DYNAMICS OF SOCIAL COMPLEXITY: COMMUNITY FORMATION BEYOND THE ORIGIN OF *POLIS* DURING THE IRON AGE, ACHAEMENID, AND HELLENISTIC PERIODS.

THE CASE OF DÜZEN TEPE, SAGALASSOS AND SOUTHWEST ANATOLIA

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Abstract

The main goal of this Ph.D. research is to study community formation and development in southwestern Anatolia (modern-day Turkey) during the Iron Age, Achaemenid and (early to mid) Hellenistic periods (8^{th} to 2^{nd} centuries BCE). The main case studies focus on the origin and development of two neighbouring, contemporaneous communities, Sagalassos and Düzen Tepe. Findings on this local scale are then scaled up to treat community formation dynamics on a sub-regional scale – corresponding to the study region of the Sagalassos Project – and the interregional scale, covering Pisidia, Lycia and Pamphylia.

The outset of the research program grew out of the realization that approaches to community development during these periods, throughout the Eastern Mediterranean, were all too often grounded in an explicitly 'Hellenocentric' framework of *polis* formation. Within such a framework, aspects of urbanization and development of extensive structures of socio-political organisation are considered mainly through a dichotomy of Hellenic versus 'indigenous' cultural identity and society. The roots of the transposition of Greek cultural modes of community development from the Aegean 'heartland' towards other parts of the Eastern Mediterranean, can be traced back, at least partially, to a 'Eurocentric' discourse stacked up against the 'East' in its own proper context. Along with this differentiation between Greek and 'other' cultural modes of living, *a priori* differences in social complexity are often presupposed. Percolating from (neo-)evolutionary approaches, a clear differentiation between so-called 'simple' and 'complex' societies is employed, with all associated implications for development of social, political and economic structures.

Despite its commonly problematic usage, the high potential of the concept of social complexity for studying community formation and development in the past is highlighted in the first chapter of this dissertation. One of the development goals of the research project was therefore to devise a framework built around a better conceptualisation of social complexity to approach aspects of multi-scalar organizational structure from foundational elements such as social interaction, practices, information processing, flows of energy and resources, and human-environment interactions.

The end goal of the research is to present a conceptual model of community formation and development, exploring several possibilities offered by a complex systems approach. The utility and validity of this framework is demonstrated through its application on the aforementioned case studies. To avoid any potential mismatches between the extensive conceptual framework and its archaeological application in archaeology, two intermediate chapters are added to discuss the analytical operationalization and narrative framing of this application. Specifically, this research focuses on in-depth material studies of pottery derived from excavations and surveys conducted at a number of selected sites. To this end, an integrative approach is employed which combines all steps in raw material selection, production, distribution and usage of these material objects in an encompassing view, and links this evaluation of material culture to wider organizational structures and societal dynamics at play in these communities at the time. This pottery dataset is then evaluated against other strands of data from the selected case studies to obtain an overall conceptualization of community formation and social complexity dynamics in Düzen Tepe and Sagalassos, the study region of the Sagalassos Project, and southwestern Anatolia.

Introduction

"The most merciful thing in the world, I think, is the inability of the human mind to correlate all its contents. We live on a placid island of ignorance in the midst of black seas of infinity, and it was not meant that we should voyage far. The sciences, each straining in its own direction, have hitherto harmed us little; but some day the piecing together of dissociated knowledge will open up such terrifying vistas of reality, and of our frightful position therein, that we shall either go mad from the revelation or flee from the deadly light into the peace and safety of a new dark age."

-The Call of Cthulhu – H.P. Lovecraft

An illuminated archaeology?

In his own, inimitable prose, H.P. Lovecraft opens his classic short story 'The Call of Cthulhu' with a chilling warning against the dangers of forbidden knowledge and the related uncovering of the position of mankind within the wider world. More specifically, it is the piecing together of seemingly dissociated and unrelated strands of knowledge, each gathered by individual sciences, which supposedly retains the potential of driving the holder of this frightful information insane. A daunting prospect but hitherto unrealized, as individual sciences are all too preoccupied with their own (little) problems to truly come together and explore the vast plains of unexplored knowledge. This projection of ultimate illumination can then only be obtained when information is able to cross borders within science, when different disciplines come together, and collaborate towards common goals. In our current age where increased specialization reigns supreme, scientific cross-overs and collaboration should indeed be considered precious lights illuminating the dark, to be coveted rather than shunned. One such profoundly interesting nexus of scientific light that has started to shine ever so brightly in recent decades, is the field of complex systems research, bringing together a disparate corpus of scientists from such disciplines as physics, mathematics, systems theory, cybernetics, biology, chemistry, as well as the social sciences, including sociology, and yes, even archaeology. The present thesis is aimed at exploring the potential of this field for archaeological research.

Whereas early adopters made some progress in archaeological applications of complex systems approaches (see for example (Bintliff 1997a; Bentley and Maschner 2003b; Chapman 2003; Redman and Kinzig 2003), the approach only recently started to fulfil its potential. Due to its strong mathematically driven underpinning, some scholars – not only in archaeology – have been hesitant to adopt the tenets of complex systems approaches. As in all scientific advances, the perceived safety of comfort zones might encourage to retreat back into the dark, rather than chase the, perhaps at first painful, illuminating light. Regardless of initial feelings one may have towards this comparatively new and unknown behemoth, I hope to demonstrate in this thesis that complex systems approaches are of the utmost interest for archaeologists seeking a suitable perspective to gather and interpret their data and recombine hitherto seemingly unrelated elements into an encompassing understanding of the past.

As archaeologists, it is our aspiration to learn about people in the past and the world they lived in. However, unlike sociologists or anthropologists, we face the major disadvantage of not being able to directly observe our objects of study for ourselves. This is especially confronting when considering elements of social life that leave no material traces. Archaeologists are limited to those activities leaving material remnants to be observed in the archaeological record, even though these only constitute a small part of the workings of past societies. With the passing of time, recollection of many events is lost and the archaeologist is left in the dark as to their effect on society. Our own peculiar beams of light may appear highly limited indeed when considering the vast areas remaining in the dark. The view of the archaeologist is therefore always limited and incomplete.

While the loss of immediate observation might be lamented, in return, the archaeologist gains something else: perspective. Instead of the act and the process itself, we see the outcomes and results as they have crystallized in the archaeological record. This offers potential to answer questions beyond the reach of anthropologists or sociologists, or indeed any other of the social sciences. In order to properly analyse the perspective offered by historical distance, however, a sound theoretical framework is needed. On the one hand, archaeology has had profound input from natural sciences such as biology, geography, ecology, geology, chemistry and physics, providing knowledge regarding the natural environment and ecological framework in which societies in the past lived and developed. On the other hand, additional theorization of the workings of society is derived from social sciences such as sociology, anthropology, ethnography, linguistics, economics, political science and governance studies. Complex systems research is therefore only one recent example within this long-standing tradition of theoretic influx in archaeology. The framework of complexity theory has been hailed as a highly promising approach suitable for integrating the famous structure-agency debate from the 1980's and 1990's as "a dynamic interaction between forces acting at the structural level to sustain overarching networks with relative stability in time and space, and inputs from discrete 'actors' within or outside of these structures (individuals, acts human or natural, intended or unintended)" (Bintliff *et al.* 2007).

It should be stated from the outset that human societies as complex systems bear no inherent equivalence to the archaeological concept of complex societies (Auban, Martin, and Barton 2013, 53). While the latter were rather equated with states and (to a lesser extent) chiefdoms, in contrast to perceived 'simple' societies – as conceptualised from the 1960's onwards within (often teleological) (neo-)evolutionary trajectories of societal development – the latter approaches societies rather as a more general class of 'open systems', requiring constant external energy input to maintain its internal structures (Cowan *et al.* 1999; Simon 1962). A society is always embedded in its natural surroundings through flows of energy, resources and waste (de Molina and Toledo 2014). The framework of social-ecological systems (SES) has increasingly started to move to the front of innovative research tracts as a nexus for studying exchanges of energy and resources between society and nature (Barton *et al.* 2012); (Berkes *et al.* 1998; Ostrom 2009; Schoon and van der Leeuw 2015). Because dynamics and concepts of complex systems can scale up across all human societies, they provide a conceptually coherent set of processes and structures that can be used to track the rise of social complexity (Adams 2001; Auban *et al.* 2013; Feinman 2012). This makes them a particularly valuable tool set for both tracking and explaining social change (Barton 2014, 321).

An important goal of this dissertation will be to construct a conceptual model of community formation in the past as part of complex systems dynamics, and outline how archaeological data can be used as a proxy to study these dynamics. The framework presented here is constructed out of the very blending of archaeological theory and practice with theoretical input from various disciplines outlined above. Clearly this means that we must be aware of the specificities of historical research when borrowing theories, concepts, methods, or tools from other disciplines. Moreover, we must consciously move to effectively bridge the epistemological gaps between different sides. Adapting to the patchy nature of the archaeological record is one, if not the most important, goal in this respect.

A toolbox of theories

Although complex systems perspectives have been around for some time now (see 1.2.1), they have not yet been able to make the transition towards the core business of our discipline. Given this continued peripheral position, an important part of this dissertation will be devoted to the construction of a suitable framework to apply approaches from complex systems research in archaeology. It should be noted, however, that it is not the intention to instigate a 'Kuhnian' shift through the development of a full-blown theoretical paradigm centred on complex systems for the field of Archaeology. It has indeed been noted that such shifts are often accompanied by overly simplified characterisation of other models in order to "reduce 'the other' to a fixed point which provides leverage against the current dynamic" (McGlade and van der Leeuw 1997, 1). This 'other' thinking can indeed be held responsible for the oftentimes heated 'processualist versus post-processualist debates'. What lied at the root of this dichotomy was the attempt to impose a single theoretical lens through which data needed to be interpreted (McGlade and van der Leeuw 1997, 3). In recent times, the plurality of theoretical approaches needed to construct interdisciplinary, integrative and synthesising research frameworks has rightfully been emphasised (Altschul *et al.* 2018). I would therefore like to argue for the usefulness of the model presented here as part of a wider toolbox approach (Bintliff 2011, 18). The idea is based on a 'Wittgensteinian' approach to research where reflexive choices need to be made from a wide variety of eclectic theories. The approach allows different theoretical frameworks and viewpoints to be integrated in a dialectic synthesis to allow analysis of various possible avenues of development in complex societies across a wide variety of variables within a multi-dimensional approach.

At this point it can be noted that I have chosen a specific set of theories from a particular background to tackle the possible multiplicity of dimensions and processes at play in a given societal configuration (*infra*). I believe these choices offered the best tools to solve the questions at hand and deal with the available data in the best possible way. Yet, different choices could have been made. I will discuss some of the roads not taken along with the evaluation of the road I *did* travel in the concluding remarks in chapter five.

To effectively integrate different sets of theories from various intellectual backgrounds in a multi-dimensional, yet coherent, theoretical discourse we must be explicit regarding the ways these theories are interconnected and contribute to the overall epistemological framework. To do so, I turn to a concept which seemingly went out of fashion in more recent years, that of 'middle range theory' (MRT). The concept was first proposed by the sociologist Robert Merton (1968). MRT are sets of theories that lie between the minor, but necessary, working hypotheses that evolve during day-to-day research, and the all-inclusive systematic efforts to develop a coherent theory that explains observed uniformities of social behaviour, social organization and social change (Merton 1968, 39). These uniformities should not be seen as a return to the fixed set of categories of social evolution. Rather, they develop out of variable selection pressures operating in probabilistic fashion onto causal factors of social organization (Sanderson 1999; Turner 2003). Particular cases of social organisation are subject to idiosyncratic combinations of such probabilistic selection pressures, emerging out of the combination of existing pathways of development with internal and external generated stimuli (Cioffi-Revilla 2005). Middle level theories can be used to uncover the relevant sets of selection pressures underlying social organisation and behaviour by guiding empirical theory, mediating between general theories that are too distant from the observed behaviour and idiosyncratic descriptions of such behaviour without further degree of generalization or wider application. This view generally stands today, as for example found in the words of Peter Hedström and Lars Udéhn, who describe middle-range theory as "a clear, precise, and simple type of theory which can be used for partially explaining a range of different phenomena, but which makes no pretence of being able to explain all social phenomena" (Hedström and Udéhn 2009, 31)

MRT was first used in archaeology by Lewis Binford (1930-2011) in the introduction to his collection of articles called *For Theory Building* (1977). Binford adapted the term as it was defined by Merton to denote a way of bridging the ever-changing behavioural dynamics of human societies in the past and the static phenomena of the archaeological record we are left with today. Here, I propose to combine the 'archaeological' approach to MRT as a way of bridging theory and data with its original 'sociological' meaning of middle-range theorizing, in order to connect, on the one hand, different sets of theories on an epistemological level, while on the other hand, confronting, investigating, and integrating the role of the actual archaeological data in each of these sets of theories. In this sense, I follow the interpretation of MRT by Norman Yoffee (2005, 186–87), stating that:

> "Levels of archaeological theory exist, if indeed they exist at all as discrete levels, as a hierarchy of propositions that afford linkage between matters of data collection (and the primary analysis of data) and the process of inference within which patterns of data are held to represent social phenomena. The levels of theory I demarcate are hierarchical only in degrees of abstraction, not

> in chronology of employment (or even in importance, which can be debated). Following Merton, the first level is the 'level of working theories that guide daily activity.' In archaeology, these activities pertain to the recovery, identification, and classification of archaeological materials…Middle-level theories are concerned with contextually appropriate explanatory frameworks…High-level theories, following Merton, are 'those all-inclusive, unified, ideal theories of behaviour, organization, and change."

The structure of theory I wish to propose in this thesis can be found in Figure 1. The upper plane of high-level theory entails the most general dimension of theory, here derived from complex systems approaches. Complex systems cover a wide range of phenomena, including the human brain, ant colonies, forests, and also human societies. In all of these, internal system dynamics can result in small or large changes in system configurations or properties.
For example, accumulation of biomass at the surface of a forest may result in the local ecosystem reaching a critical state, where even the slightest shift in balance may generate severe disruptions – as for example in a forest fire – having a major impact on system configurations and sometimes even resulting in widespread system destruction. Out of the remnants of the previous system configuration, eventually new life emerges and the system recovers to start a new phase in its lifecycle. This process is described by the so-called adaptive cycle framework developed in ecological resilience theory (Gunderson and Holling 2002; Holling 1973). More than merely applicable on ecological processes of development, destruction and regeneration, the adaptive cycle has been used as a descriptive framework for a wide range of processes related to change and stability in complex systems.

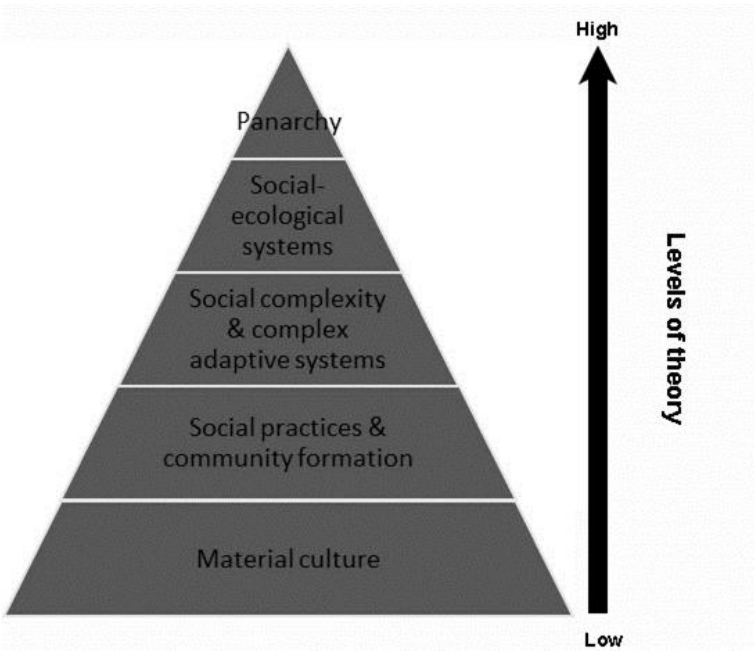

Figure 1: Different levels with increasing degree of theorization within proposed framework.

To do so however, we need to realize that, although the adaptive cycle framework *in se* does fit a wide range of system changes and dynamics, the effectiveness of its applications depends on the way this overarching theoretical framework is connected to actual empirical data. A nested structure is proposed, moving from observations of the archaeological record, through increasingly more general levels of theoretical conceptualisations. The intermediate levels of this structure then act as MRT in the theoretical framework used for this dissertation. For such an approach to be successful however, we need to clearly specify the required connections between different levels and sets of theories. How these levels are connected operationally is outlined in more detail in chapter one but an overview is already presented in Figure 2.

Levels of theory	Component	Key elements/processes	Operationalisation
LLT	Material culture	Production & consumption	Diversity measures
LLT	Social practices	Structure, agency and material	Informational material culture
MRT	Community formation	Collective action	Selection pressures
MRT	Complex adaptive systems	Flows of energy, resources and information	Mechanisms of complexity development
MRT	Social complexity	Social reactors and complexity development	Complexity as problem-solving tool
MRT	Human/environment interactions	Social-ecological systems	Social metabolism
HLT	Multi-scalar interactions and dynamics of change	Panarchy	Adaptive cycles

Figure 2: Components of theoretical framework with key elements and operationalisation (LLT= low level theory; HLT = high level theory).

This way, the theoretical input derived from other fields can be maximally exploited for archaeologically relevant purposes and cases. It is advisable to keep in mind the warning posited by Jacob Freeman and colleagues (2017, 1), who stated: "Yet, the history of theory in archaeology is littered with concepts and models that practitioners initially find useful, but then abandon because, although initially stimulating, the concepts fail to generate testable hypotheses that advance research". It is therefore essential to distinguish between a given concept and the hypotheses that it claims to solve by constructing an operationally valid framework, moving from general theory to hypothesis and interpretation.
I hope that the work presented here can contribute to the progression of our discipline regarding its overall goals of understanding the history and development of our own kind. The ambition is twofold. On the one hand, I hope to contribute to our understanding of specific avenues of community formation and development embedded in a fixed temporal and spatial framework, i.e. that of southwest Anatolia from the Iron Age to the Middle Hellenistic periods (10th to 2nd centuries BCE). On the other hand, I hope to contribute – even if only incrementally – to larger debates currently held in and beyond the academic world. I hope that through the extensive discussion of the theoretical framework and conceptual model constructed here, I can help others working on similar subjects and facing similar challenges.

Additionally, all research should at least aspire to reach beyond the sometimes constricting walls of Academia. As scientists, it is our duty to consider all possible implications of our findings – no matter how obscure or idiosyncratic they may appear to be – for the challenges we face today. Episodes of profound change have occurred throughout history, impacting social life on all scales, from local communities to large states. Social organisation commonly developed as a reaction to various internal and external stimuli and challenges. Environmental change, for example, is not only a problem of modern times, but has time and time again had its impact on the day-to-day lives of people (Barton *et al.* 2017; Caseldine and Turney 2010; Dunning *et al.* 2012; Preiser-Kapeller 2016; van der Leeuw 2005). The various ways these people organized their communities to conduct their lives and deal with challenges from a wide array of sources are still relevant today.
It is by now already a bit *blasé* to claim that knowledge of our history is the only way to avoid making the same mistakes of the past. This is at least partially too straightforward. History never repeats itself. All historical dynamics are idiosyncratic processes that always take place in a unique framework

embedded in time and space. However, as a quote sometimes attributed to Mark Twain[1] says: "History does not repeat itself but it does rhyme". The past mainly offers points of contrast and comparison to our own actions. To study the past in such a way that it is relevant for todays' society as well, we need to move beyond the exact circumstances of a given historic process. Surely, describing its emergence, development and outcomes is important. Even more important however, is to try and explain why this process emerged in the first place, and look at the wider picture of where the idiosyncratic fits the general. It should be clear by now, that this thesis aims to offer more than an analysis of a particular archaeological case study. One of its overt goals is also to contribute to the theoretical development of our discipline. That being said, it is important to remember that sometimes theory will only bring us so far. It is appropriate to remember the words of John Robb who lamented:

> "The Neolithic in Italy spans the period 6000–3500 BC… It is defined at both ends by 'transitions' of the kind archaeologists usually focus upon: the beginning of farming forms its grand entrance, the sweeping social transformations ushering in the Copper Age provides its dramatic exit. What happened in the two and a half millennia in between? Very little, apparently. The Central Mediterranean was peopled with small farming groups who lived in scattered villages and clusters of huts, relied upon a basic Old World farming economy based upon growing wheat, barley, and pulses and raising cattle, sheep, goats and pigs, and carried on a constant, low-level rhythm of ritual and trade. In traditional archaeological categories, they are usually disposed of by designating them as 'tribes', with the unspoken rider that there really is very little else to say about them until they get on with something more ambitious, such as developing hierarchies. This poses a real challenge for traditional agency theory. The archaeology does not provide us with the usual pegs to hang interpretation on – ambitious political actors, largescale ritual, craft specialists, and so on. Making pots and growing food and so on involved purposeful action, but it is quite difficult to connect them to an interpretative narrative beyond the proximate goal of making a pot or providing food. Frustratingly, the people behind this archaeological record do not provide the protagonists of our dramas of agency; they are just going about their daily lives." (Robb 2010, 508)

Robb's lamentation will resonate with many archaeologists who, sometimes to great frustration, attempt to match the observations from their data into grand theoretical frameworks or historical narratives. Major transitions such as the emergence of subsistence farming or the development of social hierarchies are indeed dramatic episodes which feature notably in our archaeological record. In general, however, people were not particularly preoccupied with the things we consider most important to support our major narratives. In the end, what people did (and do) was indeed mostly going about their daily lives and most of the evidence from our archaeological record precisely reflects this day-to-day preoccupation. Whenever we look at the bits and pieces of material remnants of the past, it therefore pays off to consider them not from any major narratives, but rather from a daily life perspective. If we are to understand why people form and maintain communities within an ever-changing environment, we must integrate local scale social interactions with their material manifestations (Thompson 2016, 314). It is argued that the bottom-up approach suggested here will be partially able to cater to these considerations, by integrating observations on material residues of social practices into a nested hierarchical structure, consisting of subsequent levels of theory, moving from community formation to dynamics of socio-economic complexity, human-environment interactions, and culminating in a multi-scalar framework of system dynamics.

Before moving on to the main text, I need to say a word on the structure of this thesis as some of the choices made for its genesis warrant an additional explanation. In accordance to a growing trend throughout Academia, it was suggested during the third year of my Ph.D. by my supervisor prof. Jeroen Poblome that I should look into the option of "doing a Ph.D. thesis on publications". While this is fairly common practice in the science departments and other faculties, the faculty of Arts did not even detail

[1] The oldest mention of the attribution goes back to John Robert Colombo's poem "A Said Poem", published in *Neo Poems* (1970). Colombo asserted that the observation attributed to Twain had been around since the 1960's but that he could not provide a source.

this option in her regulations, except for the stipulation that if parts of the thesis are already published, the Ph.D. candidate needs to clearly specify his/her own contributions in case of multiple authors (Article 18 in "Regulation Concerning The Attainment Of Doctoral Degrees At The KU Leuven, Supplemented With The Particulars Of The Faculty Of Arts").

Upon contemplation, I decided that a hybrid option would be an ideal fit for the projected thesis structure I had already devised at the time. A full publication-based structure would not be desirable or feasible given that – as I mentioned earlier – an important goal of this thesis was to construct a proper extensive theoretical framework to integrate aspects of complex systems research in archaeology. It would have been impossible to incorporate all aspects of this framework properly in a single publication. Yet, clearly a lot of potential was present to have at least part of the results of my research presented as publications. I therefore decided to apply for this option with the Ph.D. committee of the Faculty of Arts at University of Leuven. My application was granted on two conditions: 1) Indicating my personal work versus contributions by co-workers as stipulated in the regulations. This will be detailed in the introduction to chapter four. 2) The thesis should consist of a general introduction and conclusion, as well as short transitions between chapters or subchapters to grant coherence to the work as a whole and let the text adhere to the nature of a monograph.

I therefore decided to subdivide this thesis into five main parts or chapters. The first part entails the theoretical foundations upon which this work will be built – centred on community formation and social complexity as core concepts. The second chapter provides an analytical framework which allows a proper methodological operationalisation of the first chapter. The third chapter discusses the prevalent approach of the origin of *polis* narrative as a 'mirror' framework to contrast with my own research. The fourth chapter consists of a sequence of papers, either published, accepted, submitted or still in preparation. Each paper matches one specific aspect of study, and together they form the full case study presented in this thesis.

The case study part consists of a tripartite structure, first and foremost focused on the settlements of Sagalassos and Düzen Tepe (both SW Turkey), and subdivided into five components: material culture, subsistence, economy, socio-political organisation, and community formation. This locally-oriented spatial scope will be extended in the subsequent parts, first towards the surrounding area, and a second extension to encompass southwest Anatolia, covering the regions of Pisidia, Pamphylia, and Lycia. The exact structure of each part will be discussed in more detail in the introduction to chapter four. To make sure that the distinction between individual papers for the various subparts of my research findings would not result in a disparate end-result, I decided for the fifth and final part to offer a separate synthesis of all the foregoing, integrating the full range of the theoretical framework with the conclusions derived from the archaeological case studies, contrasted with the *polis* narrative. This way, the hybrid structure presented here could be concluded in a more traditional sense, offering a coherent overview of the findings and results of my Ph.D. research.

Chapter 1. Conceptual framework

"And on this rock I will build my church, and the gates of Hades will not overcome it."
-Matthew 16:18.

1.1 Social organisation and community formation

Studying the past involves finding out what people did and how they lived, and more specifically, how they did so together. While individual acts, activities and events can in principle be uncovered from the archaeological record, the majority of archaeological evidence is not readily relatable to idiosyncratic and discrete events. Yet, individual people and their actions, convictions, and intentions cannot be *a priori* discarded, if only for their major role as constituent elements in collective organisations and behaviour. Individual and collective behaviour cannot be uncritically linked, nor is this connection a mere matter of aggregation or reduction (depending on the starting point of analysis). One of the key questions of this chapter will therefore be how communities at a certain time and place originated and developed out of foundational day-to-day interactions.

Community formation entails matters of cooperation between individuals, of collective action measures to mobilize a group of people, of individual people reaching out and finding a middle ground on which they can operate in joint ventures, be these social, economic, cultural, religious or of any other nature. The reasons why people might venture into these endeavours collectively are legion and will be discussed throughout this chapter. However, it should be remembered that communicative noise, misunderstandings, unintended side-effects of actions, and bounded rationality all obscure people's intentions and strategies for interaction, resulting in a 'murky reality that is difficult to cast into a fixed set of rules and strategies.

1.1.1 Defining communities

Already in the 1950's, the sociologist George Hillery (1955) gathered 94 different definitions of community, pertaining to both urban and rural settings. The urban community in particular has received its fair share of attention (see for example the seminal work of Anderson (1959) and the recent work of Blokland (2017) for an overview). Both for urban and rural settings, the most commonly posited properties involve a certain geographic area, social interaction and common ties or 'collectivity' shared between people. One seminal definition of community by Robert MacIver states that: "Any circle of people who live together, who belong together, so that they share not this or that particular interest, but a whole set of interests wide enough and complete enough to include their lives, is a community." (MacIver 1931, 9–10). Still, this definition is not really delineating much, and MacIver immediately goes on to say that "we may designate as a community: a tribe, a village, a pioneer settlement, a city or a nation. The mark of a community is that one's life *may* be lived wholly within it." [Original emphasis].

The basic approach that will be followed here will be to consider communities as a plane upon which shared, day-to-day activities and interactions take place. According to Smejda and Baumanova (2015, 53), community is the main unit where socialization of humans takes place. It is an arena of learning and applying social skills and the reproduction of culture. Culture in this sense should be considered in its broadest sense as the 'language' of a given society or community, made up from "the meanings, symbols and interpretations of reality that are a part of everyday social life, including norms, values, beliefs, and ideas" (Hall 1980). In a related sense, the concept of 'community areas' was proposed as a theoretical notion pertinent to the model of a living community consisting of complex spatial structures delimited by the extent of communal daily practice, which can be analytically divided into single activity areas with specific functions such as residential, storage, funeral, ritual, areas of fields, pastures, hunting, fishing, craft activities (Neustupny 1986; 2010, 150-152; as quoted in Smejda and Baumanova 2015, 53). The spatial aspect of a community clearly cannot be ignored. Already in the middle of the 20th century, Hollingshead (1948, 145) identified three ways to define community: 1) as a form of group solidarity cohesion, and action around common and diverse interests; 2) as a geographic area with spatial limits; and 3) a socio-geographic structure which combines the ideas embodied in points 1 and 2. The American structuralist sociologist Talcott Parsons also explicitly mentioned a clear territorial dimension as core component, saying "a community is that collectivity, the members of which share a common territorial area as their base of operations for daily activities" (Parsons 1951, 91).

Now, instead of merely stating that community entails people living together, the reasons why people decide to live in distinct groups at delineated places in the first place need to be defined. In other words, how did communities come to be? Ever since Durkheim, communities have been considered as expressions of collective solidarity as its members enter into asymmetric assistance relations through exchange of commodities or services (Durkheim 1982). In general, this approach sees the community as the expression of an evolutionary mechanism favouring collectivity to improve the chances of survival for individual people. Lipe (1970, 86) identified the community as a minimal, territorially-based aggregate, including individuals of the two sexes and at least three generations, capable of maintaining itself through time, including opportunities for enactment of or articulation with the main social role present in the larger society, and including mechanisms for transmission from one generation to the next of the principle content of its culture.
The community as a collective unit operated at three different spheres (Kolb and Snead 1997). First, the community as a 'node of social interaction' forms an important mechanism of *social reproduction* wherein socio-political relationships between people are established and perpetuated through time. Second, communities serve as a primary focal point of subsistence labour and are principal arbiters of access to productive resources, thus controlling *subsistence production*. Finally, the community acts as a mechanism of *cultural reproduction* through a focus on self-identification by its members. This entailed the creation and maintenance of local identity, essentially rooted in subsistence practices and social reproduction, but manifest in the manipulation of boundaries both physical and symbolic. Residents of communities thus share a common sense of membership to that organization linked to residence and subsistence, in addition to whatever other social groupings they belong to. Through sharing of a common residence, members of a community are envisaged to also share a common value-system, interests, goals, and general understanding of the world (Gerritsen 2004, 144).

Building on approaches such as community areas and collective action practices, communities will be considered here from the perspective of 'communities of practice', *i.e.* when a group of people engages in a mutual relationship that binds members together into a social entity which functions as units of collective learning that are created, shared and sustained over time, thus inducing the development of communal practices (Wenger 2000). These can be highly formal and structured or informal and fluid. The main characteristic is that ways of doing and approaching things are shared to some significant extent among members. These communities can potentially be imbued with a sense of collective belonging and identity, but this need not necessarily be the case. I will focus less on this sense of communal identity, being a concept that is notably difficult to grasp and often highly contentious. Especially given the limitations of the available data sources that were employed for this research, extracting (group) identities from the limited amount of material was considered too problematic.
Having given some sense of what exactly constitutes a community, as well as some pointers as to how why these communities come to be, let us now elucidate the aspect of community formation further and discuss in more detail *how* communities emerge. The framework presented in the next part starts from social practices as focal points of societal dynamics and details how these practices are foundational for community formation and development.

1.1.2 Social practices

After this short overview of the main properties of community as a social unit, let us now take a step back and discuss in some more detail a model of how such social configurations can come to be. Any bottom-up model of community formation must start from a basic unit of social analysis and then determine how different forms of social organisation emerged out of these basic units. It can be stated axiomatically that social communities can only originate when people interact with each other. Any form of community at its most fundamental level therefore offers a platform for activities and interactions between people to take place. Essential elements that constitute a community are the people living within a certain social unit and the (social) actions they undertake, as well as social ties and interactions between them. In short, action and interaction. Yet, social organisation cannot ontologically be limited to these interactions alone. It is precisely out of the recursive interaction between individual action and structuring properties that 'social practices' can be formed, which will constitute the basis of the model of community formation presented here.

Origins of the practice approach

The ontological divide between (inter)action and organisation corresponds to a more general debate which has been front and centre in much of the social sciences, that of agency and structure. The concept of agency, at a general level, entails people's actions and intentions, as well as their knowledge of how the social world works and how to participate in it. Social structures, on the other hand, consist of a general set of social roles, rules, and norms that shape social life. Both structure and agency have held a pivotal role in conceptualisations of societies past and present. To some extent, whether an approach is agency- or structure-centred can be linked to the initial scale of analysis. Structure-centred approaches focus on the role of macro structures of social organisation and social roles in controlling, shaping, and directing the lives of people, whereas individual-centred agency approaches tend to operate on the micro scale through emphasis on the importance of social actors and individual human action and interaction between people as essential sources of social regularities that constitute a society. Both approaches can be traced back to the founding figures of sociology, with the former based on the works of Auguste Comte (1798-1857), Herbert Spencer (1820-1903) and Émile Durkheim (1858-1917), whereas the latter was built on the writings of Max Weber (1864-1920), Alfred Schütz (1899-1959), and Harold Garfinkel (1917-2011).

Agency- and structure-centred approaches are not necessarily mutually exclusive. Indeed, as I will show later on, a complex systems perspective can be used to understand as a mediator to understand both social structures and individual action (Wynne-Jones and Kohring 2007, 6). In the past, a few sociologists have famously tried to mediate between agency- and structure-centred strands of sociological theory. The critical theory of rationalization by Jurgen Habermas was a first attempt at overcoming the structure versus individual divide in sociology. Habermas (1988) tried to explain the evolution of modern society out of premodern traditional societies as a process of increasing rationalization, where institutions develop out of an appeal to rationally justifiable principles rather than traditions. Ultimately, however, it were the so-called 'theories of practice' of Pierre Bourdieu and Anthony Giddens that most effectively bridged the gap and consequently inspired many theoretical developments in the last decades.

On a general level, both approaches tried to integrate structural properties and individual action into a single conceptualization of social practice. Bourdieu's conceptualization of social practice is centred on the element of 'habitus' (Bourdieu 1977, 1986). Habitus refers to a general and unconscious set of interpretative and motivational guidelines (simply put, guidelines for ways of acting and thinking). This system is structured through objective conditions related to class position, which is defined as the whole of access to resources, social ties, rules and opportunities related to a certain position in society, such as education and an associated range of practices obtained during upbringing. Habitus can therefore be interpreted as the structuring apparatus of potential actions. This set of guidelines is obtained 'naturally' during upbringing. Even for purposive actions, the underlying rationale is therefore often subconsciously determined. The social space as a whole is not an invariant configuration but a contingent and dynamic product of history, the result of constant struggles among agents and groups of agents.

According to Bourdieu, following Weber's (1922, 1924) image of society as a range of social spheres, it is composed of autonomous and interrelated fields (political, economic, cultural, scientific, etc.). All are fields of struggles, with desired resources at stake. These fields of society are defined by a combination of horizontal functional differentiation and vertical stratification. The range of practices acquired through one's habitus is always field-specific and determined by a specific kind of capital (economic, cultural, symbolic, and social). These specific types of capital are the socially effective forms of power that structure the social space (Malaina 2014, 480). Some degree of connection between different fields exists, which means a person occupying a dominant position in one field will often also occupy a dominant position in other fields. Additionally, conversion between different kinds of capital is possible but only under strict conditions (Bourdieu 1986). However, the very access to these different kinds of capital is again determined by class position.

Like Bourdieu, a major aim of the social analysis of Giddens (1979, 1984) was to transcend the divide between agent- and structure-centred theoretical approaches in sociological thinking. Giddens was critical of micro level theorisations such as phenomenological sociology (Berger and Luckmann 1966) for failing to deal explicitly with the larger institutional structures within which micro level social processes occur, as well as of the shortcomings of macro level perspectives, including functional theory and various (neo)-Marxist perspectives whose emphasis on socioeconomic structures often fails to incorporate the role of human agency in reproducing such structures.
Giddens stated that social life consists neither of a collection of individuals, nor of a social structural order *sui generis*, but should rather be approached as a process built around social practices. Rather than conceptualizing the individual and structure as two distinct elements, he therefore proposed to view both aspects as being two sides of the same coin in a recursive loop of social dynamics. Social practices are then structured by the 'binding' of time and space to social systems. Giddens uses 'Wittgensteinian' and ethnomethodological premises stating structures are produced and reproduced in specific contexts (Reckwitz 2002). Structuration therefore entails a process involving human beings' ongoing actions as they occur through the flow of time. Social structures as a result do not exist except for being manifested in individuals' actions and interactions (Johnson 2008, 460). Structures consist specifically of rules and resources that people use in daily social life to engage in interactive practices, both constraining and enabling the total possibility space of social action. Social structures are not merely instantiated through social interactions, but also, in turn, so shape the social content of practices across time and space as to make them internal to social relations. Like Bourdieu, Giddens states that part of this embeddedness is also related to physicality, finding its constituent elements in the daily face-to-face interactions between agents.

Both with Bourdieu and Giddens, the strength of their contribution lies in understanding the importance of the dialectic relationship between individual actions, structured practices and social life. Social practices are intrinsically linked to individual action and cannot be studied solely through a structure-centred framework. However, specific actions can only be given meaningful form through the generative and structuring properties of interpretive schemes. Giddens proposed the so-called 'duality of structure' to conceptualize the role of social structures as medium of social action as well as being reproduced (and occasionally reconstituted) by those very actions. As a result of this aspect of reproduction, social relations between actors can be organized in durable patterns embedded in time and space, thus allowing the constitution of social systems.
In this view, structures are not pre-existing external elements limiting the potency of individual actions but refer to intersecting sets of rules (guidelines for actions) and resources (media for transformative capacity) acting as structuring properties of social practices, much in the same way as language is used to structure speech. Social structures must be interpreted as some sort of 'virtual order' rather than a distinct social reality, and are only actualized during processes of social practice. As a result, structures can be considered to be both enabling and constraining, rather than merely imposing external barriers to social action. This conceptualisation can also be extended to include the spatial arenas where social life takes place. More than mere settings for actions, these spaces play an active role in the structuring and routinizing of embodied practices through which the structural properties of social systems are produced, reproduced, and transformed (Lefebvre 1991).

Structural domains of social practices

Having discussed the origins of the practice-based approach, it is at this point necessary to discuss social practices as constituent elements of community formation in some more detail. I will first highlight some of its key components, before moving on to discuss the structural dimensions along which social practices are transformed into social organisation.

In its most basic definition, social practices can be considered 'a routinized type of behaviour' (Reckwitz 2002, 249). It is through immediate 'performance of doing' that a certain pattern of behaviour is actualised, but only through successive repetition these patterns of behaviour become 'encoded' over time in routinized social practices. Five key components of social practices have been distinguished: (1) interaction, (2) social agents, (3) communication, (4) social knowing and (5) coupling (Castellani and Hafferty 2009, 38). The first two components, interaction and social agents, then refer to the aspect of (social) agency, whereas numbers 3 and 4 - communication and social knowing - are subsumed under what is called 'symbolic interaction', which is related to structuring properties in social systems. Social interaction occurs when two or more people 'encounter' each other – that is, create an episode of mutual awareness – supplemented by communication (Turner 2003, 4).

Communication is considered here in a broad sense as any exchange of information, regardless of the medium, rather than verbal exchanges *per se*. I will return to this point later on as well when discussing flows of information in complex systems. Social knowing involves aligning social practices with the worlds in which humans live. The final component of 'coupling' then refers to the intersection between both agency and structure components that allow different social practices (as a whole or through one of its constituent components) to be connected, attached and merged with elements of other practices or their constituent components. The ease of coupling is testimony to the inherent plasticity of social practices as a result of the constant renewal of its structures through recursive performance. Constituent components of one kind of practice can therefore be used within and between other practices, constituting a connective structure that holds complex social arrangements, for example a community, in place (Shove *et al.* 2012).

The consistent repetition of a coupled set social practices can be considered as the most essential formative process of a society (Giddens 1984). Social systems and institutions developed out of these social practices, based on their 'degree of structuredness' and the 'deepness' of their embedment in time and space. Systems in this sense are those practices recurring over time and space. Those practices that are most deeply-layered in structure and temporal span are referred to as 'institutions'. The importance of aggregation of social phenomena through repetition can be traced back to French sociologist Gabriel Tarde (1843-1904), who conceptualised social reproduction as a sequence of imitations. Tarde's works have seen something of a resurgence due to the recent popularity of action-network theory (ANT), which builds on his conceptualisation of micro interactions as building blocks of social organisation (see *infra*). As I have mentioned earlier, community formation is not a matter of mere aggregation of a number of these constituent building blocks. Instead, the emergent properties of communities as a new level of collective social organization cannot be linearly reduced to the properties of the foundational social practices. This is precisely one of the core tenets of the complex systems approach and will be discussed in more detail later on.

The necessary iteration of social practices that binds these together into social systems takes place along three dimensions of complexity: organizational, spatial and temporal (Pickett *et al.* 2005). It is through the overlapping of these three spheres that a coherent and interconnected set of social practices, and the people involved with them, can be defined as belonging to a certain social unit such as a community. Additionally, a fourth dimension can be added, that of the material.

Let us begin with the social aspect of these settings. Encounters can be both focused, that is actively engaging its participants in mutual information exchange, or unfocused, where people maintain mutual awareness and implicit communication but do not engage with each other directly (Goffman 1972). The importance of communication as exchange of information will be considered in more detail in parts 1.2.1 and 1.2.3 when discussing the role of complex societies as information processing systems and the role of information processing in development of social organisation. For now, it suffices to say that social actions and interactions take place within certain kinds of settings that tie them together into durable social practices.

An interconnected set of social practices then constitutes a social system, to the extent that it has been argued that "social complexity theory begins with the assumption that a social system is a type of social practice" (Castellani and Hafferty 2009, 44). The nature of social ties between people will largely determine how individual actions may give rise to certain elements of social organisation by integrating individual practices to larger wholes. Different kinds of social ties or connections can be observed, both durable engagements and fluid encounters. Blokland (2017, 72–80) distinguishes four types of social ties, of which the first three can be considered enduring social ties operating in durable contexts of engagement.

The very act of entering these types of social ties generates and provides meaning to the interaction. These are: 1) transactions, or social relations with instrumentally rational orientations, often through the lens of social roles; 2) attachments, based on value of 'rationality' in the sense of purposeful relations without necessarily having specific affection with other individuals one is forming social ties with (for example in a religious congregation); 3) bonds, in the sense of social relations with affective orientations (strong personal ties with friends and/or family); and 4) interdependencies as instrumental interactions when agents do not focus on others to attribute meaning to their performances, but their performances do still connect them. Most fluid encounters fall under the latter. This does not mean that this last category of social ties is unimportant. Take for example buying goods on a market. Buyer and seller enter in a fluid and ephemeral social tie with a given social outcome (exchange of goods and/or money) but after the transaction is complete, both go their separate ways. Such individual encounters exist in and by themselves, and hardly go beyond the immediate there and then. Still, a multitude of such ephemeral interactions will result in people knowing where and when to enter such processes of exchange if they feel the need to. Social practices are therefore not only embedded in social settings, but also structured across time and space, in the case of this example through the creation of a fixed and designated space where official periodically organised markets can be held.

This brings us to those two other spheres of structuration, that of space and time. Space and time can be seen as "a primary means of structuring social encounters and so producing and reproducing social relationships" (Laurence and Wallace-Hadrill 1997, 219). All action must be located in space and occur at some point in time (Fletcher 2004, 112). Space, while possibly appearing rather simply definable, is neither straightforward nor absolute. David Harvey (1969, 1973) has argued for a tripartite ontology of space, consisting of absolute, relative, and relational space. Absolute space is a 'practical' interpretation of space as a pre-existing container providing the background for human action and interaction, existing independent of things appearing inside it. Absolute space therefore corresponds to the spatial dimensions studied in Euclidean geometry or Newtonian physics. Relative space interprets spatial dimensions as constituted out of the relations between different objects. It is therefore a space created *by* things and people, rather than an independent background for life. The difference between relative space and the third conceptualisation of space as relational might at first glance be not entirely clear. Relative space, however, is explicitly determined by the external relationalities and juxtaposition *between* different objects and people, whereas relational space is an inherent characteristic *within* individual elements themselves. It is not a quantifiable, geometrical sense of space, but rather a qualitative space created by and out of the content of things within the functional context of social practices. The importance and elusiveness of this last category has been beautifully captured in the English anthropologist Hugh Brody's (1981) book on the Beaver Indians of British Columbia , where he discusses how the actual usage of the landscape by these peoples corresponds to a wholly different spatial dimension as those captured by the standard maps customary in the modern world.

The usage of space in a variety of practices by these indigenous communities should serve as a reminder that the archaeological record offers only a limited and patchy reflection of the original richness of social life. The full spectrum of social practices in a given society will never be captured through the archaeological record alone. This is not to say that the world of social practices and their spatial dimensions are wholly invisible or intangible. The aspect of relational space can still be used to trace the structuring spatial properties of social practices. We can for example look at the works of Anthony Giddens, who explicitly drew temporal and spatial dimensions into the analysis of social practices through the concept of 'locale', defined as the temporally and spatially defined context in which social practices are manifested. On a general level both time and space are thus integral to the very nature these settings and should not only be seen as mere environments of action (Giddens 1984, 110). Spatial configurations are essential both as external context and internal structuration of social practices. This entails not merely the physical properties of space in a Euclidean sense but also its material context and how space is used for human activities and provides for the context of social life (Bryant and Jary 1997). It has indeed been noted that "understanding specific practices always involves apprehending material configurations" (Schatzki *et al.* 2001, 3) (cfr. *infra*). Locales can essentially be located within any spatial setting, a room, a house, a street corner, a town, a city, *etc*. (Giddens 1984, 110).

Through concepts such as 'locale', the settlement as a spatial container in which human action is performed, is increasingly considered to play an active role in the production and reproduction of social activities and practices (de Certeau 1988). Spatial properties and performance of social practices are combined within the concept of 'place', defined as 'lived space', ascribing meanings, identities and memories that actively shape people's daily practices and experiences (Feld and Basso 1996; Low and Lawrence-Zúñiga 2003; Meskell and Preucel 2007; Rodman 1992). Places offer spatial contexts for people to orient themselves and act within culturally constituted landscapes based on heterogeneous social knowledge and experience (Robb 2007, 9). Through the concept of place a mutually constituting relationship between settlement form and the actions and interactions of a plurality of individuals, groups, and institutions, each with their own motivations and identities can be proposed (Fisher and Creekmore 2014, 1).

Additionally, social practices are structured along temporal lines as well. Activities do not only take place at a certain place, the very act of performing them requires the investment of a specific amount of time (Carlstein 1982, 22). Given that human time is a resource with clear boundaries, decisions of performing certain actions rather than others is always associated with certain opportunity costs. Any conceptualisation of community formation as originating from social practices therefore clearly needs to incorporate a temporal dimension. To conduct social practices within a certain area, one therefore needs to take into account the time invested to traverse spatial distances. For example, when looking to exploit natural resources, even within the own immediate catchment area, people of a given community needed to assess whether certain kinds of resources were accessible in both spatial and temporal terms. The availability of a given resource within a potentially accessible spatial unit, might mean very little if it was not accessible within practical temporal parameters. Although it should be noted that such limits can still be crossed if the resource is valuable enough.

These considerations so far, mainly concern the performative micro scale of social action and interaction. One major challenge in archaeology is how to move from this immediate scale onto which social practices were performed and experienced, towards the inherently long-term scale resulting from the temporal distance created by the formation and preservation of the archaeological record until our time. One of the most frequently referred-to conceptualisations of time and temporal changes in archaeology is that of the *Annales* school, which formed the leading current of historical analysis in France between the 1930's and 1970's (Bintliff 1991, 2004, 2010b). Key figures included the co-founders of the school, Lucien Febvre (1878–1956), Henri Hauser (1866-1946) and Marc Bloch (1886–1944), but also main figures such as Fernand Braudel (1902-1985), Jacques Le Goff (1924-2014), Georges Duby (1919-1996), and Emmanuel Le Roy Ladurie. The core tenet of the *Annales* was centred on a tripartite division of temporal change and a conceptualisation of the co-evolution of time and structure. History was said to develop upon three parallel levels operating at different speeds. First, at the level of individual time, momentary actions make up the bulk of conventional political histories. These interact with processes unfolding on the second level, that of social time where social structures and institutions developed over multiple decades or even centuries. Thirdly, these are integrated in the level of geographical time (also colloquially referred to as the *longue durée*), a deep time perspective where changes are slow and often invisible. Key factors operating on the last scale include geography, climate and demography. The *Annales* historians argued that history is always the result of multiple processes operating on different temporal scales. To understand one particular event on the level of individual time, it must be contextualized in a wider framework covering temporal scales up until the *longue durée* (Bintliff 2010b, 118).

It has been noted that connecting individual events and human agency with long-term dynamics of historical and cultural evolution has been subject of a particularly extensive debate within archaeology (McGlade and van der Leeuw 1997, 3–4). Braudel's (1973, 144) claim that "the long run always wins in the end" has resulted in the *Annales* approach sometimes being considered deterministic by inducing a dichotomy between long-term environmental factors and short-term human factors. Notwithstanding the multi-scalar nature of the framework, applications frequently ended up in either a top-down reductionist approach of environmental determinism, or a culturally-centred social approach disconnected from any environmental parameters.

Despite some problems with the practical application of the framework, the *Annales* approach notably contributed to the conceptualisation of time in archaeology by redefining temporal change in terms of alternating rhythms and periodicities, as opposed to more conventional linear representations (McGlade and van der Leeuw 1997, 6). This periodic approach allows for processes operating on different scales to be analytically integrated, linking the small-scale and short-term event with macro-scale and long-term structures and landscapes. It allows for effects on one scale to act as cause on others, and the other way around, through feedback loops. The transition from micro to macro scales, not only on a temporal but also spatial and social level, is one of the core aspects of the framework presented here and in subsequent parts. In the next part, I will detail how this micro-macro transition lies at the heart of much work on social organisation, before moving on to discuss how such transitions take centre stage in the emergent phenomena of complex systems approaches. I will particularly look at the concept of hierarchically nested adaptive cycles to provide a framework for this integration between micro- and macro-scale on a social, spatial and temporal level. It should be noted that such a complexity-based approach is no new 'master narrative', but instead focuses on the interplay between small events and cascading outcomes in nonlinear interactions, defined by partial connections, fragmented temporalities and multiple mappings (McGlade and Garnsey 2006, 12). First, however, I will discuss a fourth structural domain of social practices, *i.e.* their material dimension.

Material dimension of social practices

I have so far provided some background as to the constituent elements of social practices and how these are structured along three dimensions (social, temporal and spatial). However, as archaeologists we also need to relate these social practices to the material traces they left behind.

Historically, the concept of agency is rooted in a philosophical dichotomy, building on Immanuel Kant's (1724-1802) critical philosophy (Olsen 2012, 213), contrasting humans as autonomous subjects of action, with material things, as inert objects of action (Robb 2010, 504). The British anthropologist Alfred Gell (1945-1997) argued however that agency need not necessarily pertain only to people, both individuals and groups, but objects as well can be attributed agency (Gell 1998). The main point of his argument is that in certain social settings, objects make people do things and are also culturally understood as making people do things, much in the same way other people would do. Aspects of materiality and material culture in general have a long history in archaeology, which is a discipline first and foremost centred on material objects from the past. Ever since the 19th century, culture was fundamentally conceived as an external expression of an internal mental template formed in the human mind. Material culture, as a result, came to be defined during the 19th century as the stable end-product of this externalization process (Pitt-Rivers *et al.* 1906; Tylor 1871).

From the early 20th century onwards this slowly started to change, as the externalization thesis gave way for functionalist interpretations of material culture. These works, strongly tributary to the sociological works of Durkheim, emphasized the role of material culture as 'extra-corporal limbs', i.e.

tools developed as a means of enhancing human interaction with the environment (Crawford 1921). A distinction can be made between the Anglophone and Francophone schools. The paramount representative of the Anglophone functionalist school was Gordon Childe (1892-1957), whose views on social reality in archaeological cultures were heavily influenced by the structural theories of Durkheim and Marx (Barrett 2012, 150). It was through the works of Gordon Childe that the concept of material culture became an essential part of archaeological discourse. The Francophone functionalist school, most eminently through its leading figure André Leroi-Gourhan (1911-1986), built on the ideas of Marcel Mauss (1872-1950) to provide a set of tools to study material culture (Lucas 2012, 144–45). It was only with the works of André Leroi-Gourhan that material culture was elevated to an equal ontological status to that of people, in his analytical studies on the operational sequence (*la chaîne opératoire*) (Leroi-Gourhan 1964). The concept of operational sequence remains to this day a widely used tool for analysing technology and material culture in archaeology. It explicitly puts technological practices and developments related to all successive stages of specific operations shaping material culture within a social context.

The 1960's saw the advent of a number of approaches emphasizing positivistic and empirical principles and methodologies to study and explain the structuring properties of past societies. One of the leading figures of this processual school of archaeology, Lewis Binford, proposed a system-based conceptualization of cultures consisting of a number of interconnected subsystems (Binford 2001). By integrating technological, social, and ideological elements on the same level in the system, he effectively completed the deconstruction of the externalization thesis and the primacy of the mental as source for all material culture. Binford's conceptualisation of society as a system heavily depended on the systems theory of Talcott Parsons (1977). According to that other giant of processual archaeology, David Clarke, it is customary in archaeology (but also anthropology) to separate the material and tangible manifestations of culture and classify it separately as 'material culture' as opposed to the intangible 'non-material culture' (Clarke 1968, 18). However, Clarke also immediately notes that "this division is largely conceptual and there is no basic difference between the material manifestation of abstract concepts of form and function fossilized in the attributes of artefacts and the social manifestations of similar concepts ephemerally translated into social activities. Activities are sequences of partially preconceived actions, artefacts too are similar sequences of similar solidified actions as every attribute bears witness". Every attribute on an artefact can then be considered equivalent to a fossilized action, every artefact to a solidified sequence of actions or activities, and whole assemblages of artefacts tantamount to whole patterns of behaviour. If we disregard the material or non-material implementation of the acts then we can understand artefacts as simply 'solid' behaviour (Clarke 1968, 85). Clearly, Clarke considers material culture and human action very much on the same ontological level.

The positivist model of archaeology with its structure-centred approaches came under increasing scrutiny in the 1980's, with archaeologists starting to pursue a great diversity of new approaches in a bid to better incorporate individual action into theorizations of past societies (Renfrew and Bahn 2012, 44). This large diversity of theoretical approaches has been grouped under the name of the 'post-processual' movement. Its emergence, goals, and methods can be contextualized within the larger movement of postmodernity which caused major waves throughout other disciplines as well. One of the major figures in post-processual archaeology, Ian Hodder, famously characterized the archaeological record as a 'text', whose meaning could be 'read' by the trained archaeologist (Hodder 1989). This approach was built (among others) on the works of the post-structural philosopher and linguist Jacques Derrida (1930-2004). It emphasized the inherent multi-vocal nature of symbols and signs. Material culture therefore does not necessarily come with a fixed meaning, but is in principle susceptible to change, much like words in a sentence. However, it was also recognized the material nature of artefacts acted to some degree as an anchor to constrain the in principle arbitrary nature of signification of objects. When specific symbols become *exclusively* related to specific meanings, thus negating the inherent variability in the meaning of symbols, this should be seen as an explicit act of power exercised in society (Hodder 1989, 258–60).

At the beginning of the 1990's, a wider interest for aspects of material culture outside of archaeology had started to emerge, resulting in the creation of the interdisciplinary field of material culture studies (Lucas 2012, 157–58). Showing distinct influences from Giddens' structuration theory, the material environment was no longer considered to be merely determined by society but was increasingly seen as reciprocally shaping social life in an active fashion (Appadurai 1988). Inspired by postmodern approaches, aspects of physicality and sensory qualities of material culture, based on the phenomenologist works of Martin Heidegger (1889-1976) and Maurice Merleau-Ponty (1908-1961) started to be emphasized as well. This approach defines the concept of materiality as dependent on the human engagement with things. As a result, the meaning of materiality can change according to the nature of this engagement (Thomas 2004).
Phenomenological approaches did recognize how the very nature of material things does not lie in some abstract or ideal essence of an object, but rather emerges through its relations with other elements, most notably, human beings. This allowed others to improve upon the phenomenologist approach to overcome this ontological divide between subject and object, while at the same time upholding the emphasis on the importance of relationality. To this end archaeologists have since the turn of the century increasingly turned to actor-network theory (ANT) propagated most notably by Bruno Latour, Michel Callon, and John Law (Graves-Brown 2000; Jones 2001, 176–81; Knappett and Malafouris 2008; Olsen 2012). This approach argues for the need to displace the human subject as the central focus of analysis in archaeological research if we truly are to understand the material record of the past. Latour (2007) argues that objects continually intervene in human actions, and that it is neither the object nor the person in isolation which determines a given course of events. It is rather the person-object network that is responsible for a given action. Replying to the famous NRA (National Rifle Association) slogan "Guns don't kill people, *people* kill people", Bruno Latour (1999, 176–78) asserted that it is neither the gun nor the person holding a gun that unilaterally kills another man, but rather the combined network of human and gun, including that what a gun is capable of and what humans intend to do with guns. While the argument may come across as somewhat absurd – not to mention it would probably not hold up well in court – the point to take from it is that certain actions can only take course because of the inherent roles performed by certain objects. Objects then in general exert 'an agency of how' rather than 'an agency of why' (Robb 2010, 505).

ANT can be largely considered an extension of practice-based approaches, continuing the aims to rethink the relation between people and objects in terms of human-object networks. But how to translate this conceptual approach back to the archaeological record? An internally coherent set of practices related to circumscribed contexts of production and consumption can be described through the lens of the widely-used, but generally undertheorized, concept of the archaeological assemblage (Lucas 2012, 193). The concept of assemblage in archaeology can be related to two general meanings, on the one hand, a collection of objects associated in a depositional find-context, or as a collection of objects or types found within a site or area. An assemblage in depositional sense is related to formation theories describing the genesis of the archaeological record in general, and the formation of individual archaeological contexts more specifically. An assemblage in the sense of a group of objects or types (termed typological assemblage) was already considered by Gordon Childe (Childe 1956, 31), referring to an interpretation of associated archaeological material consisting of a recurring combinations of types. The chronological implications of assemblages in the latter sense have already been commonly applied as a means of dating archaeological sequences through seriation (Lucas 2012, 195). Material assemblages are always to some extent a palimpsest, containing an aggregate of multiple events, thus creating a tension field between the temporal dynamics of societal dynamics and the deposition of their material traces in the archaeological record. Another definition of assemblage connects with the temporal dimension of assemblages stating "[an assemblage is] an open typological series containing those types which are representative for a certain phase in the chronological evolution of the pottery in a specific archaeological context" (Poblome and Degeest 1993, 149).

Lucas (2012, 196–203) proposed the concepts of 'enchainment' and 'containment' to better match theoretical conceptualisations of material assemblages to underlying formation processes of the archaeological record, both in productive and depositional sense. Specific categories of material culture (for example amphorae used for the storage and transport of a variety of goods) are grouped because of relations of similarity between these objects, with the most similar objects constituting a distinct type. However, morphological similarity in material culture is no value-neutral aspect. Material culture inherently carries the possibility for attribution of multiple meanings, potentially establishing a series of interlinked and complex webs in which social engagement and negotiation can be performed. The act of production is then the first 'web of engagement between the person, their social reality and the object' (Kohring *et al.* 2007, 102). Clarke (1968, 153) already noted that manufacture of an object directly correlates to specific sets of actions, so constituted by its maker to reflect intended patterns of performances and behaviour, integrating the artefact in other repeated actions and sequences of actions. Every object therefore embodies both a set of behaviour necessary for its fabrication, as well as another set of behaviour implied by its later usage.
DeMarrais and colleagues (1996) have pointed out, however, that material things are not neutral vessels for meaning. Rather, their intrinsic qualities condition how they can be made or acquired, used and exchanged, controlled and disposed of. In short, how meaning can be attributed. The making of a pot for example is very much dependent both on the skill and experience of the potter and the intrinsic material properties of the clay that is being used. As stated by Malafouris (2008, 34), 'the shaping of the pot becomes an act of collaboration between the potter and the mass of wet clay rapidly spinning on the wheel'. The selection of certain materials with certain properties then depends on the intentions of the potter. To make an elegant drinking cup, very fine well-levigated clays are needed, whereas for a cooking pot very different properties are needed such as the ability to withstand repeated thermal shocks, influencing the choice of clays and temper used during the production process. While these intrinsic qualities do indeed set some general constricting parameters, the precise allotment of meaning to material objects is only achieved through specific interactive contexts and relationships between people and objects. A fine drinking cup can be generally considered far more precious than a cooking vessel (especially if it were to be made from precious metals), perhaps even becoming a family heirloom of sorts. On the other hand, cooking pots have been noted for being used as vessels carrying the remains of the deceased in cremation burials, thus gaining an additional meaning and value far beyond its original use. This is no radical proposition. It is precisely this intrinsically interactive relationships between people and the world surrounding them, including material objects, which constitutes the essence of the agency approach as it is advocated in archaeology (Robb 2010, 502).

Technological knowledge and acts of production come together in the intentions and purposes of both producer and consumer, employing specific techniques and 'ways of doing', which reflect their own *habitus* and past social engagements with other people and material culture. Building on the concept of operational sequences (*chaîne* opératoire), the continued reproduction of similar material objects out of this shared understanding and material engagement can be conceived to emerge out of a memory-based iteration of a sequence of acts, techniques, and gestures (building on the French sociologist Gabriel Tarde's (1895) conceptualisation of iteration and imitation as reproductive elements of society). 'Technique' in this sense can be seen as the interaction between gestures of the artisan and the material under manipulation. The emergent *chaîne opératoire* recursively structures individual engagement with the material culture and the continued interpretation of technological knowledge within any given productive activity (Kohring *et al.* 2007, 102). If the iteration of meanings expressed through the nexus of production and consumption is sufficiently recurrent and extensive, stabilized networks of action are formed, where the interactions between interrelated sets of enchained objects and the circumscribed space in which they are embedded create socially meaningful contexts. This process strongly resembles the concept of 'place' we described earlier as it is used in social geography, where it is defined as 'lived space', ascribing meanings, identities and memories that actively shape people's daily practices and experiences to a location (Feld and Basso 1996).

If we transpose this to archaeology, analysis of the material environment as contexts for social interaction becomes essential. Rapoport's (1982, 1988, 1990, 2006) model of material environment-behaviour interaction remains even today the most comprehensive account of non-verbal communication and information transfer and is particularly compatible with a complex systems approach based on information processing and transmission, which will be applied later on. Rapoport defines his approach with three questions: (1) what characteristics of human beings influence particular characteristics of built environments? (2) What effects do built environments have on people, and under what circumstances? (3) What mechanisms link humans and the built environment? (Rapoport 2006, 59).
Rapoport distinguishes between three levels of meaning: 1) Low-level meaning focusing on mnemonic cues for identifying the uses for which certain material settings are intended, enabling users of a building, city, or space to behave and act appropriately and predictably; 2) middle-level meaning where deliberate statements about identity, status, wealth, power, and other traits are communicated through buildings and cities; 3) high-level meaning consisting of a type of symbolic representation that only exists within the context of a specific cultural and religious system (Rapoport 1982). Together, these three levels constitute the overall negotiation of meanings expressed by the built environment. This approach clearly emphasizes the recursive relationship between human action and built environment as mutually constituent components. Similarly, Ingold (2000, 195) proposed the notion of 'taskscape' as the entire ensemble of tasks, in their mutual interlocking", which "is to labour what the landscape is to land". John Robb adopted the notion of taskscape to connect human action with the material traces they leave behind, stating: "as each material trace was the result of a human project or story, the result was a landscape merging temporality and spatiality in activity, a taskscape (Robb 2007, 106–7).
It has been noted, however, that we should be aware of the convenient assumption that social actions and verbal meanings have direct causal connection to the material form environment of a community (Fletcher 2004, 115). Instead, the relationship between material behaviour and active behaviour should be carefully considered on multiple scales of analysis. First, the relationship with the small-scale spatial and temporal patterning of social life should be elucidated. Second, this should be related to the middle level of behavioural parameters of human interaction. Third, the behaviroural aspects of social life should be integrated in a view on large scale constraints of energy and resource supply, which affect the capacity of a community to replicate itself and its material context (Fletcher 2007, xviii).

Concepts of place and locale as settings for social actions can be linked to Lucas's (2012) concepts of enchainment and containment discussed earlier, to better integrate conceptualisations of materiality and material culture on distinct scales. To recapitulate, through the process of containment, interconnected (or enchained) sets of objects are structured spatially and temporally, thus creating distinct and circumscribed locations which effectively pull together sets of material linkages to constitute social practices in which these objects are to be used. If this iteration is sufficiently recurrent and extensive, stabilized networks of action are formed, where the interactions between interrelated sets of enchained objects and the circumscribed space in which they are embedded create socially meaningful contexts. When applied to communities, the archaeological site has formed the quintessential *de facto* unit of analysis in much of archaeological research (Kolb and Snead 1997). These are no new concerns, as already in the middle of the 20th century, it was wondered that "an archaeological unit ... may appear to be a rational construct in terms of the observed facts of cultural continuity and cultural relationships, but what are the chances that it corresponds in any real sense to an intelligible unit of culture-history?" (Willey and Phillips 1958, 15).
This is only one element of a more widespread realization of difficulties with finding archaeological correlates for social units across different scales. In household studies as well, it has for example been realized houses do not necessarily equal households. Household is a concept with interwoven material-spatial and social components (Fisher 2014, 205). It is traditionally seen as a minimal social unit that meets certain basic needs of its members (economic, social, and biological) and is generally distinguished from family by co-residence, or at least locality, rather than kinship (Bender 1967;

Yanagisako 1979). Current approaches instead emphasize the social interactions within and between households, seeing them not as functional units, but rather as a set of social relations enacted through practice (Hendon 2007; Meskell 1998). Household-size units, are for example, seen as typical primary constituents of a community in decision making, production and consumption, and childrearing (Johnson and Earle 2000). As a result, it must be realized that additional considerations are needed before community dynamics can be inferred from the overall material culture found at a given site. Smith (2010) for example argued that social concepts employed by archaeologists typically require two definitions—a social definition with comparative utility, and a material-culture definition that permits the identification of traces of the social concept in the archaeological record. Additionally, the goodness-of-fit between social units such as communities and archaeological correlates such as sites, also depends on the scale and complexity of the phenomenon itself, with for example, community space almost inevitably extending beyond that of the site as typically defined. A better approach would be to delineate community boundaries across organizational, spatial and temporal spheres from a coherent set of interconnected social practices as advocated here and in the following parts.

Of course, the unique and idiosyncratic aspects of human actions and intentions, and its reflections in material culture cannot be ignored. Individual engagement within a technological system, both from a production and consumption point, results in variation in material culture. In a given community, this variability can carry a range of social meanings. While variability is created through the productive side of the *chaîne opératoire*, its consolidation lies in visual recognition, or lack thereof, by others within the community (Kohring *et al.* 2007, 103). Within the social arena of a given community, a certain leeway exists for both producers and consumers to manipulate the material culture to their disposal and the meanings they carry or extend. In short, specific components of material culture are constituted by sets of similar, but not the same, objects 'enchained' together through a process of productive iteration. Through the process of containment, these enchained sets of objects are structured spatially, thus creating distinct and circumscribed locations which effectively pull together sets of material linkages to constitute social practices in which these objects are to be used. These practices are embedded in a recursive relationship between production and consumption settings, stimulating continued reproduction and innovation in material culture and social activities. Still, some room is always left for idiosyncratic negotiation of meanings deviating from prevailing social norms. In essence, different 'stakeholders' involved in all steps of the operational sequence of production and usage of material goods (most notably producers, traders, and consumers) enter a complex negotiation of meaning associated with particular objects. In this sense, material culture itself should be considered as carrying certain messages of meaning and therefore as transmitting information from one person to the next. I will return to this insight later on when I discuss David Clarke's usage of cybernetics and information theory to conceptualise the role of material culture as information transmission.

Materiality can therefore be considered an essential core concept to bridge agency, social practices and societal structures. Material things mediate and form the context for relationships between people and their surroundings, from which practices and structures of society can emerge. Any conceptualisation of human societies (both past and present) will therefore need to deal with aspects of materiality and interpretations of material culture.

1.1.3 Social organisation

In the previous part, I have discussed how action/interaction and social structures coalesce in social practices. These practices act as a core nexus for the development of social organization as they are bundled and interconnected across organizational, temporal and spatial dimensions. In this part, I will explain how and why the transition from bundled social practices towards social organisation on a community level occurs. In other words, determine how social interactions give rise to societal organisation, and conversely, how this organizational structure feeds back into face-to-face interactions, as well as the reasons behind this dialectic process. I will first discuss some modalities of micro-macro transitions in social organisation, before moving on to elucidate different approaches towards uncovering the underlying drivers of such processes.

Micro-macro transitions in social organisation

To link underlying social practices to community formation dynamics, a number of bottom-up approaches can be proposed to infer social organisation out of individual practices starting from micro-level interaction. These micro-sociological analyses conceptualise social behaviour starting from bottom-up, face-to-face interaction between human agents. One example of such micro-sociological approaches is that of Peter Blau (1918-2002), who described the emergence of macro-structures from imbalanced exchanges between people (Blau 1964). Even though large-scale associations emerge from elementary exchange processes, Blau notes that their emergent properties or characteristics sometimes seem to outweigh the dynamics of the small-scale processes of direct exchange transactions. He therefore stressed that not all aspects of society can readily be reduced to day-to-day interactions (Blau 1964).

Some properties of social exchange can be considered to be emergent features as the sum of social interaction cannot be reduced to the psychological states of individuals. Blau further argued that extended patterns of social exchange would give rise to enduring organizational forms with qualities beyond those of the individual people in the organization. This view is more in line with the tenets of complexity theory where complex systems such as human societies emerge out of simple interactions between multitudes of agents but cannot readily be reduced to the dynamics of these foundational interactions. Moreover, nonlinear connections between different system scales infer that changes on one level cannot be directly and proportionally connected to changes on other levels (see 1.2.1).

Explaining the transition from micro-level interaction towards macro-level social order was also the primary outset of the phenomenological approach, originally conceived by Alfred Schutz (1899-1959), but mainly advocated by Peter Berger (1929) and Thomas Luckmann (1927), who strongly elaborated elements of 'habitualization' and 'institutionalization' (Berger and Luckmann 1966). Habitualization constitutes the construction of a fixed pattern of actions by actors dealing with frequently re-occurring situations. Habitualized actions provide a template for these situations. For example, there may in theory be many different ways to build a wooden table, or produce a ceramic vessel, however by becoming habitualized, one set of actions is granted purposive direction and specialization. The person undertaking these actions is freed from the pressure of making conscious choices over and over again at every step of the productive process in undirected trajectories. As a result, it provides a stable background for human activity to envelop with a minimum of decision making, thus freeing up energy for conscious decision-making whenever this may be necessary.

In other words, 'the background of habitualized activity opens up a foreground for deliberation and innovation' (Berger and Luckmann 1966, 51). Institutionalization in turn occurs with reciprocal typification of habitualization among a multitude of actors. Again, a certain form of directivity is constructed, with certain types of actors undertaking certain types of activity sets. This results in the construction of distinct social roles among the multitude of actors, associated with the specific tasks and activities constituting a habitualized activity set. This typification can be codified and regulated, providing strict access guidelines to certain social roles. Institutions, in this view, are created out of and maintained by daily iterative interactions among human agents. Here the key word is 'iteration'. As certain practices are repeated in a particular way, they typified through 'signal redundancy', which counters effects of divergent replication. The more signals of a given kind are present, the smaller the impact of a rogue value (Roland Fletcher 1995, 143–44). Besides maintaining existing configurations, iterated performances may also allow for changes to develop as well, if sufficiently supported. One proposed mechanism of development, in analogy to biological evolution, is that of 'descent with modification' which describes the occurrence of change as new forms of institutional configurations develop out of older ones (Currie *et al.* 2016, 222).

Institutions can then be seen as systems of interrelated rules which prescribe particular roles and regulate social relations, thus acting as regulators of social interaction (Currie *et al.* 2016, 200).

Institutions are rarely created instantaneously but imply a sense of historicity as they are built up from a history of actions performed among a certain social group (Berger and Luckmann 1966, 52). A social group can be defined as “a collectivity in which members cooperate in an effort to realize a common enduring interest (or subset of interests), organizing themselves according to tacit or explicit codes and sanctions that regulate aspects of their conduct that they perceive as important to advancing the common interest that motivates them” (Carballo *et al.* 2014, 111–12).
As certain practices are favoured within a given community, the actions associated with it are cast in specific procedures, guidelines, and structures - in short, institutions - so as to build social organisations around the standardized outcomes of such practices. The agents participating in any given social system are thus principally responsible for the very construction of this system in the first place. As such, they could in principle still change any prevalent set of institutionalized practices at will. Yet, as time goes by, existing trajectories become increasingly eroded in historical pathways of development. Children born into an existing social system are from the onset ‘socialized’ in accordance with its prevalent norms and values. For these new generations, the social system already appears a given objective reality. In summary, the social system is first externalized out of the interactions between numerous agents, next it is objectified as a fixed set of practices is casted in an institutional framework, and finally, as it becomes increasingly perceived as an objective reality, the social system produced by these agents themselves, will in turn start to act back upon these producers (Berger and Luckmann 1966, 57).
These stages should not be seen as fixed sequences in an unyielding procedure of social organisation. Multiple lines of institutionalisation may run simultaneously, interact and mutually influence each other at any time. This process effectively results in a dialectic relationship between individual agents and society as the full assemblage of social structures and practices.

In this sense, institutions are prime elements for providing societal stability and structure. Institutions work by constructing structured avenues for taking action to deal with the phenomena they encounter. However, over time, this means they create an environment that greatly constrains their ability to change their internal set-up as existing structures prevent the creation of new avenues, even when faced with changing external stimuli. According to Parsons, institutions provide goal-oriented actors with means that are consistent with the overall value systems of society. Institutions in this functional sense can be considered a set of regulatory norms that give rise to social structure or organisation. Once established, a system of institutional norms creates an interlocking of interests that keep it in place, even if individual devotion to the underlying values starts to wane (Parsons 1990, 326).
It has moreover been observed that whereas organizations facing many different challenges within the same field initially show considerable variability, over time, they increasingly show a marked homogenization around a smaller range of organizational responses. DiMaggio and Powell (1983) have tried to explain the apparent homogenization in institutional structures and responses through the elaboration of the existing concept of isomorphism. The original definition of institutional homogenization by Hawley (1968) states that this process acts as a constraining factor that forces one unit in a given population to resemble units that face the same set of environmental conditions. DiMaggio and Powell identify three different mechanisms of what they call ‘institutional isomorphic change’: coercive, mimetic, and normative isomorphism, respectively stemming from political influence and problem of legitimacy, standard responses to uncertainty, and professionalization. These processes of interlocking interests in spite of changing circumstances and progressive homogenization of institutional structures, effectively creates pathways of development. Once a given society embarks upon one such pathway, it becomes increasingly difficult to break out of this set pattern. Sunk costs associated with continuing upon a certain pathway in face of increased external difficulties are then of primordial importance for wider processes of resilience and sustainability of this society within its environment, which will be discussed later on as a feature of adaptive cycles of socio-ecological system dynamics (see 1.2.4).

Collective action and selection pressures for social organisation

Micro-sociological analyses offer a suitable perspective on *how* micro-macro transitions occur. However, they are generally not very explicit on *why* social organisation develops. The emergence of social and political structures has been the subject of much work in fields such as political philosophy, cultural anthropology, sociology, and even theology.[2] The emergence and development of organizational structures can be related to questions as 'Why did people relinquish portions of their productive and decision-making autonomy for the economic and political arrangements that characterize complex societies?' Or 'Why did many accept that wealth and power was wielded by a few?' (Carballo *et al.* 2014, 99). In general, this pertains to matters of collective action and cooperation. Two major discourses can be discerned, following the works of French political philosopher Jean-Jacques Rousseau and his English counterpart Thomas Hobbes, respectively stressing non-coercive cooperation aimed at mutual benefit and coercive cooperation developed out of the competitiveness of human nature. Both can ultimately be seen as a solution-seeking process of groups of people looking to increase cooperation when faced with collective action problems. Cooperation can in this sense be defined as "actions that require individuals to incur some cost or risk associated with other individuals receiving a benefit", whereas collective action problems can be seen as events where "the optimal strategy from the perspective of an individual differs from the optimal strategy viewed from the perspective of a group" (Carballo *et al.* 2014, 99).

Two different kinds of collective action strategies can then be distinguished. On the one hand, common-pool resource management aims at maintaining sustainable strategies of resource exploitation (in contrast to the classic 'tragedy of the commons' driven by actors' self-interest, see Hardin 1968), such as for example herding strategies used on common grazing grounds, on the other hand, public goods systems are developed to gain mutual benefit from collectively produced resources (Blanton and Fargher 2016, 30–31). It should be noted that different cooperative interests are typically advanced through different scales (Carballo *et al.* 2014, 111). For example, Interests in biological and social reproduction are typically undertaken within a small group (a family), whereas common-pool resources seem to be more optimally exploited through the cooperation of relatively small groups of individuals, such as households, that reciprocate in agricultural tasks. Finally, the public good of collective survival is best advanced by as large a collective as is feasible.

So far, I have argued that social organisation is often induced by collective action problems requiring the development of certain forms of social organisation. However, the variety of causes and possibilities underlying these stimuli for organizational development have not yet been discussed in detail. To this end, I turn towards the American sociologist Jonathan Turner, who developed a formal approach – in his own words "to try and banish the ghost of functionalism" – centred on a number of key 'forces' operating on different scales and underlying emergence and development of social structures (Turner 2003, 6). These forces should not be regarded as static functional requisites, but rather as variable states that, depending upon their valances, exert varying degrees of selection pressures on humans to organize along certain lines. People then – successfully or not – respond to generated selection pressures to organize themselves collectively. An overview of Turner's key needs exercising selection pressures on different scales can be found in Figure 3.

[2] Illustrating the wealth of authors associated with such subjects, we can highlight one massive overview of texts discussing the nature and justification of government found in: Cahn, S. (ed.) 2015. *Political Philosophy: The Essential Texts (3rd edition)*, providing extracts from the works of: Plato, Aristotle, Cicero, Augustine, Thomas Aquinas, Niccolo Machiavelli, Thomas Hobbes, Baruch Spinoza, John Locke, Montesquieu, Jean-Jacques Rousseau, David Hume, Adam Smith, Immanuel Kant, Alexander Hamilton, James Madison, Edmund Burke, Jeremy Bentham, Alexis de Tocqueville, Georg Hegel, Karl Marx, Friedrich Engels, John Stuart Mill, Friedrich Nietzsche, Hannah Arendt, Friedrich Hayek, Isaiah Berlin, Charles Taylor, John Rawls, Michael Sandel, Robert Nozick, Michel Foucault, Jürgen Habermas, Virginia Held, Martha Nussbaum, Iris Marion Young, and Kwame Anthony Appiah.

Macro-level forces	
1. Population	Absolute number, rate of growth, composition and distribution of people
2. Production	Gathering of resources from the environment, their conversion into commodities and creation of services to facilitate gathering and conversion.
3. Distribution	Construction of infrastructures to move resources, information and people in space as well as the use of exchange systems to sustain these movements.
4. Regulation	Consolidation and centralization of power along four bases (coercion, administrative structures, manipulation of material incentives, and symbols) in order to control and coordinate a population.
5. Reproduction	Procreation of new members of a population and transmission of culture to these members as well as creation and maintenance of sociocultural systems that sustain life and social order.
Meso-level forces	
1. Segmentation	Generation of additional social units organizing activities of individuals in the pursuit of ends or goals.
2. Differentiation	Creation of new types of social units organizing activities of individuals in pursuit of ends or goals and placing them into socially constructed categories.
3. Integration	Maintenance of boundaries and ordering of relations within and between social units
Micro-level forces	
1. Emotions	Arousal of variants and combinations of fear, anger, sadness and happiness
2. Transactional needs	Activation of needs for confirmation of self, positive exchange payoffs, trust and predictability, facticity or the sense that things are as they appear, and group inclusion.
3. Symbols	Production of expectation with respect to categories of people present, nature of the situation, forms of communication, frames of inclusion and exclusion, rituals and feelings.
4. Roles	Presentation of sequences of gestures to mark a predictable course of action (role making) and the reading of gestures to understand the course of action of others (role taking)
5. Status	The placement and evaluation of individuals in positions vis-à-vis other positions and creation of expectation states for how individuals in diverse and differentially evaluated positions should behave
6. Demographic	Numbers of people co-present, their density, and movements of individuals
7. Environment	Boundaries, partitions and props of space as well as associated meeting of boundaries, partitions, and props

Figure 3: Selection pressures of social organisation (adapted after Turner 2003: 6).

Micro-level forces are generated out of direct encounters and face-to-face interaction. Its key selection pressures are emotions, transactional needs, symbols, roles, status, demographic, and environment. These micro selection pressures give rise to social groups on a meso-level. Turner distinguishes between corporate and categorical units, where the first is typified by division of labour organized to pursue certain goals, whereas the latter is formed by the social distinctions people make and use (including gender, age, class, ethnicity, etc.…). The key forces operating on this level are segmentation, differentiation and integration. Social groups on the meso-level then organise themselves through the

creation of larger sociocultural patterns and organisations through macro-level forces such as population, production, distribution, regulation and reproduction. These act as key selection pressures on what Turner terms 'the institutional core' or basic elements making up human social institutions, economy, kinship, religion, polity, law and education (Turner 2003, 3).
By approaching social organisation from probabilistically operation selection pressures, Turner' approach can indicate how different factors may relate to each other in inducing organizational development, without reverting back to reductionist mono-causal approaches. In the next part, I will show, however, that to truly grasp the probabilistic nature of these processes, this perspective should be grounded in a complex systems approach to elucidate myriad of possible selection pressures.

1.2 Social complexity and organizational structures

In the previous part, I discussed how foundational social actions and interactions form social practices, which are in turn structured along several dimensions to form patterns of social organisation. These patterns emerge out of a wide variety of possible key forces operating as probabilistic selection pressures on organizational development. In this part, I will show how such an approach to social organisation can be enhanced by integrating it in a complex systems approach. I will start with a general overview of systems thinking, and in particular its relevance for social systems, before moving on to a presentation of complex systems approaches. I will then extend the complex systems approach into three avenues: that of social complexity, the framework of complex human-environment interactions in which social systems are embedded, and a multi-scalar approach to study these interactions.

1.2.1 Systems thinking

Over the course of almost a century, the principles and aims of systems thinking have permeated in a wide range of disciplines including: planning and evaluation, education, business and management, (public) health, sociology, psychology, cognitive science, human development, agriculture, sustainability, environmental sciences, ecology, biology, physics, earth sciences, and historical sciences (Cabrera *et al.* 2008). Its fundamental concepts were developed in the early part of the 20th century in disciplines such as organismic biology, ecology, psychology and cybernetics Cabrera *et al.* 2008; Capra 1997; Hammond 2010). Systems thinking covers a wide variety of approaches, methods, and theories, and concepts used for the conceptual thinking about all aspects regarding the genesis, dynamics, and operationality of various kinds of systems (including social, biological, structural or ideal). These include total systems intervention/local systemic intervention (Flood 2001), critical systems thinking (Jackson 2001), soft systems methodology (Checkland 2000), and action theory (Parsons 1977).

One of the most influential early developments in systems thinking was general systems theory (GST), most famously developed by the Austrian biologist Ludwig von Bertalanffy (1901-1972). Bertalanffy (1968) was one of the first to note that the classical laws of thermodynamics applied to closed systems, but not to open systems such as the living systems studied in biology. As systems thinking became applied in an increasingly broad variety of scientific disciplines, definitions of what exactly constitutes a 'system' became increasingly varied and elaborated. Salmon (1978: 176) even argued that "there is not one sense of 'system' that can be captured by a single definition, or because any definition broad enough to cover all the legitimate uses of 'system' would be so vague that anything at all would count as a system". At its broadest, a system can be defined as "any set of things and the relationships between them" (Marchal 1975). While technically correct, this definition provides little practical use.[3] Systems in this sense include anything "from card catalogues to airplanes to economies" (Klir 2001). Extending this minimal definition, a system can also be considered as a set of things, interconnected in such a way that they produce their own pattern of behaviour over time (Meadows 2008).

[3] Although, according to popular TV-show *Futurama* (S02 E14) "technically correct is the best kind of correct".

The use of systems thinking as a structure-providing force in scientific thought on an ontological level, rather than a fixed set of directives, has allowed for some degree of ambiguity resulting in myriad of systems-based models (Cabrera *et al.* 2008). Many of these models highlight different approaches towards problem solving in systems thinking and often appear more or less complementary or even interchangeable to the external observer. Nevertheless, amongst the multitude of different approaches, some general similarities characteristic for the 'systems approach' can be discerned. According to Mingers and White (2010) this entails: (1) viewing the situation holistically, as opposed to a reductionist view, as a set of diverse interacting elements within an environment (2) recognising that the relationships or interactions between elements are equally or more important than the elements themselves in determining the behaviour of the system (3) recognising a hierarchy of levels of systems and the consequent ideas of properties emerging at different levels, and mutual causality both within and between levels (4) accepting, especially in social systems, that people will act in accordance with differing purposes or rationalities. These four aspects are considered essential to systems thinking as they involve the essence in the way we conceptualize and try to understand the world around us.

As such, systems thinking is part of, yet at the same time transcends, a number of system-related research approaches, including: (a) critical systems thinking (b) system dynamics (c) cybernetics (d) hierarchy theory (e) complex systems. All of these can be considered different elements under the overall umbrella of 'system sciences' as they all entail seeking knowledge of systems characterized by nonlinear dynamics, emergence, feedback relations, and complexity, albeit from different perspectives (Cabrera *et al.* 2008). As aspects of all these approaches will return at some point in the outline of this chapter, a short overview and explanation of all four is provided here. However, given its higher relative weight for the further development of this framework, I will consider the development of complexity theory and its core tenets in some more detail compared to the other three later on.
Critical systems thinking and its associated methodologies were developed out of a combination of systems thinking and critical social theories of such sociologists as Marx, Habermas and Foucault to analyse complex societal problems and determine how to solve them (Jackson 2001). Earlier approaches using systems thinking, such as operational research, systems analysis and systems engineering, were well-suited to solve easily delineated problems, but performed poorly when faced with complex problems involving people with a variety of possibly conflicting viewpoints. Critical systems thinking allowed a variety of methodologies developed in other approaches such as system dynamics, organisational cybernetics, soft systems methodology, interactive planning and critical systems heuristics to be combined in a coherent manner to promote successful intervention in complex societal problem situations.
The fundamental ideas of dynamical systems theory were developed by Jay Forrester at MIT in the 1960's out of the field of kinematics, based on a long history of classical mechanics (see (Mitchell 2009, 16–22) for a good overview of its roots going all the way back to Aristotle). Its goal was to model the dynamic behaviour of systems such as populations in cities and industrial supply chains (Forrester 1969). According to Forrester, the behaviour of such systems resulted from underlying structures of flows, delays, information and feedback relations. These resulted in patterns of growth, decay, oscillation or chaotic behaviour. System dynamics provides a set of concepts for understanding complex systems used in a wide range different applications. At heart, it entails the interplay of two feedback loops, positive or reinforcing loops that lead to continued growth or decay, and negative, counter-balancing loops that lead to stability. Both kinds of loops, and the generated patterns of behaviour, are re-occurring in all types of systems, which explains the wide range of applicability (Mingers and White 2010).
Cybernetics as a discipline was established by Wiener (1958), Ashby (1956) and others, and was mainly seen as the scientific study and mathematical modelling for an understanding of regulation and control in any system. Cybernetics studies the flow of information within abstracted systems and the way that information is used by the system as a mean of controlling itself. Today, cybernetics has a broad range

of areas of application including biocybernetics, biomedical systems, artificial intelligence, robotics, adaptive systems, large-scale socio-economic systems, man–machine systems, and systems science, all of which are based on Wiener's interdisciplinary cybernetics concepts (Mingers and White 2010).
Hierarchy theory emerged as an offshoot of general systems theory in the 1960's, most notably through the works of Herbert Simon (Simon 1962, 1973). From the very onset the discipline a cross-disciplinary perspective, combining management sciences, economics, psychology, biology, and mathematics, was applied (Wu 2013, 283). Ever since the 1980's hierarchy theory was significantly expanded, with an emphasis on biological and ecological systems, under the impulse of Timothy Allen and colleagues (Ahl and Allen 1996; Allen *et al.* 2003; Allen and Starr 2017). In its most general sense, a hierarchy simply refers to a system that is structured in layers or levels that have asymmetric relations. Hierarchies of various types are key features in innumerable domains. Its core tenets have therefore seen widespread application in many fields. I will discuss some of these elements in more detail later on, especially in part 1.2.4.
Complexity theory developed during the 1970's and 80's out of a range of disciplines – biology, chemistry, physics, mathematics, general systems theory and cybernetics. Traditionally, these 'hard' sciences worked with assuming stability, equilibrium, linear change, cyclicality, and robustness in simple models generating simple behaviour (and *vice versa*). A number of core concepts and properties of complexity were already defined by precursors such as chaos theory and catastrophe theory (Bentley 2003, 10–13). Chaos and complexity approaches emphasize instability, far-from-equilibrium, sudden change, sensitivity to initial conditions and complex behaviour emerging from simple models (Lewin 1992; Mandelbrot 1977). One of the most commonly understood meanings of 'system' generally refers to a 'complex whole of related parts' (Cabrera *et al.* 2008). The idea behind describing a system as complex (as in exhibiting complex behaviour) is that of the system as more than the mere sum of its constituent parts. One of the most crucial elements of a complex system is therefore the display of emergent properties. These properties arise when aggregates of identical elements obtain new, emergent characteristics which are not directly derived from the summation of already existing characteristics of individual constituent elements (Holland 2014b, 4). For example, H_2O molecules obtain an emergent characteristic of 'wetness' not found in the individual molecules themselves, whereas properties such as weight are always direct aggregates from constituent elements (Ball 2004). More recently, ever since the foundation of the Santa Fe Institute in 1984, applications of complexity theory have really taken off. The central theoretical nexus of the Santa Fe approach is that of complexity as a property of 'complex adaptive systems' (CAS) (Gell-Mann 1994; Holland 1995; Kauffman 1993) with a strong methodological focus on computational modelling in formal terms (Malaina 2014). I will return to complexity theory in more detail, and more specifically regarding the more recent developments and approaches under the auspices of the Santa Fe Institute, especially regarding its application in archaeology, in the next part. Before moving on, however, I will go into some more detail on aspects of systems thinking as specifically related to conceptualisations of social systems.

Social systems

Social systems refer to a particular type of system, more specifically "those comprised of humans, their various aggregate creations (groups, formal organizations, economies, social institutions *etc*.), and the relationships amongst them" (Castellani and Hafferty 2009, 58). Another definition describes a social system as "any group of people who interact long enough to create a shared set of understandings, norms, or routines to integrate action, and established patterns of dominance and resource allocation" (Westley *et al.* 2002, 107). The aspect of mutual interaction, as we will see, will prove crucial in the conceptualisation of social systems as complex systems later on. One of the first in sociology to rigorously apply systems thinking to human societies was Talcott Parsons (1977), who defined a system as "a stable set of interdependent phenomena provided with analytically established boundaries, which relates to an ever-changing external environment". A social system is defined accordingly as "a system of social interactions between reciprocally oriented actors. It consists of roles, collectivities, norms and values". As we have seen earlier, according to Parsons, the social system operated as an integrative pattern within a larger level of the general action system. Parsons' model of social systems can be considered an equilibrium-based model as tendencies towards deviance are met by the system through feedback of control mechanisms aimed at maintaining its current structures.

As argued by Spencer-Brown in his highly influential book *Laws of Form* (Spencer-Brown 1972), based on a combination of Boolean algebra with arithmetic, all systems are the result of an act of 'distinction' consisting of establishing a border between the internal system dynamics and its external environment, and an "indication" or preference for one of the two sides of this border. The act of drawing a boundary, distinguishing between system and environment, is therefore central to the very definition of a system. This is also the core element of Maturana and Varela's (1980) concept of autopoiesis. Originally developed in biology, the concept of autopoiesis can foremost be considered an ontological property of systems analysis and has its intellectual roots in cybernetics (Padgett and Powell 2012, 55). It was applied on social systems by the German sociologist Niklas Luhmann, who stated that an autopoietic approach to social systems requires a single operation that possesses connectivity as starting point for further self-reproducing development of the system (Luhmann 1995). In this view, social systems are essentially systems of communication, consisting of coupled components with operational, but not energetic closure (Haynes 2017, 10–12)
The important elements in Luhmann's social systems are therefore not people, but rather the connective process of communication that is used by the system to create its own structures- through a self-referential organizational distinction from its environment. Systems thus draw on a sense of operational closure – that is wholly containing its own operations within these boundaries – to define themselves. The role of social systems is to provide order by managing the complexity of the outside environment. Social autopoietic systems reproduce processes of meaning by making selections from the wealth of information from the outer world that faces them. Providing meaning reduces risk in experiences with other people as it generates the assurance of the intentions of the other. Through signal redundancy of similar and repeated communications, meanings gather psychological and social conviction as they simplify the process of making new selections. The operational closure of autopoietic systems then allows it to selectively appropriate (meaning) elements from the total amount of information available from the environment, thus constructing coherent social systems. While being operationally closed, the system is not isolated from its environment but is connected to it through relations of selective structural coupling that form channels of information providing stimuli to which the system reacts. In reducing environmental complexity and internally channelling information, social systems consistently develop their own internal complexity. Internal system complexity emerges mainly through the development of strategies to classify and process various types of transactions with different aspects of the environment (Johnson 2008, 482).

Parsons' action systems and Luhmann's systems theory have often been criticized for losing the individual in their rigid and deterministic systems framework (see for example (Mills 1959, 25–49)). Social systems can generally be considered as indecomposable totalities (holism), aggregates of autonomous individuals (individualism), or as systems of interrelated individuals (systemism) (Bunge 1999, 4). Most viewpoints combine to some extent a number of elements of these three different extremes, however many critiques on social systems thinking stems from a common fallacy of mistaking systemism for holism. Rather than rejecting the system concept altogether for its supposed determinism, we should rather look to properly re-integrate the individual in a systems perspective and allow it its operating space. One of the first to react against the static conceptualisation of systems by Parsons was the American sociologist Walter Buckley (1922-2006), who argued for a more dynamic type of systems, drawing from Bertalanffy's general systems theory. Buckley (1967) argued for a 'process model', as derived from the predominant view of American sociology in the early twentieth century, led by the Chicago school with key authors such as Albion Small, George Herbert Mead, Robert Park and Ernest Burgess. The process model centred on a series of events inducing processes of both system maintenance and change. As a result, social systems carry an inherent tendency to undergo continuous structural elaboration, conceptualised through the process of 'morphogenesis'. Social systems were thus considered as a complex, multifaceted, fluid interplay of widely varying degrees and intensities of association and dissociation (Buckley 1967, 18). Structural elaboration occurs as participants learn more effective ways of relating to one another and adapting to their environment (Johnson 2008, 472). Due to this tendency towards structural elaboration, social systems inherently evolve towards a more complex state. I will discuss the problems associated with such one-way conceptualisations of increasing social complexity in more detail in part 1.2.3.

Social systems in archaeology

The use of (social) systems thinking in archaeology was most famously advocated by British archaeologist David Clarke. His seminal book *Analytical Archaeology* (1968) was one of the first attempts to integrate archaeological practice and analysis into a consistent system-based theoretical framework. Clarke defines a system as "any intercommunicating network of attributes or entities forming a complex whole" (Clarke 1968, 43). Some notable observations on this definition can be made. First off, a system, is basically considered an ensemble of attributes. The emphasis on attributes, most notably in material objects, allows the identification of essential elements by differentiating 'meaning' from 'noise'. Three different types of attributes are distinguished: 1) inessential attributes which are not relevant to the study in hand and which consequently do not figure in the system as defined; 2) essential attributes, which are those essential variables that are part of the system and whose values may change as part of the changing system. They express continuity of the system; 3) key attributes, those essential attributes in the system whose successive transformation values are co-varying in some specific relationship with successive values of other similar attributes (Clarke 1968, 70).

The exact identification of relevant attributes depends on the system in question. Focusing on material culture, Clarke distinguishes different hierarchical systemic levels building on the level of the attribute. These are: artefact, artefact-type, assemblage, culture and culture group (Clarke 1968: 21). Depending on the scale of analysis, archaeological systems can be materialized as a system of attributes within a population of artefacts, a system of artefacts within a changing cultural assemblage, or a system of social attributes within a changing society and so on. None of these categories are ever fixed or unmovable as changes can be observed in the archaeological for each one of them. Clarke considers random variation, multi-linear development, invention, diffusion and cultural selection as primary mechanisms of change. This raises the question of how the archaeologist can know whether observed differences, for example changes in a specific type of pottery, are meaningful or merely the result of unintended and partially random variation? The answer lies in the identification of repetition in material attributes, suggesting the endowment of meaning. Repeated similarities or regularities are then considered systematically correlated attributes that give recognizable identity to objects of a given archaeological class. It must be noted however, that similarities, for example typological regularities may not necessarily be simple 'one to one' regularities. Instead, a polythetic attribute system is required to define membership of a given type. These regularities are then considered to follow from certain limiting conditions or constraints imposed by physical or social action. The importance of these constraints, according to Clarke, then lies in the predictive information we can get from them as they generate a greater degree of regularity.

Clarke's definition of a system also emphasizes the transfer of information among system components, which occurs whenever constraints restrict the variety of outcomes in the system. As in many other approaches in systems thinking, also outside of archaeology, this definition builds on the tenets of cybernetics and information theory, where 'messages' constitute an ordered selection from an agreed set of selected variety, which must be differentiated from disturbances that do not represent any part of the essential message and are therefore termed 'noise' (Ashby 1956, 121–60; Cherry 1957, 303–7). The role of positive feedback mechanisms, amplifying small deviations into large differences, operating on such information transfers has been especially highlighted as a factor of system development (Flannery 1968). The overall sociocultural system can be considered an elaborate behavioural information system. Within the overall sociocultural system, a number of subsystems can be discerned: social, religious, psychological, economic, and material culture (Figure 4).

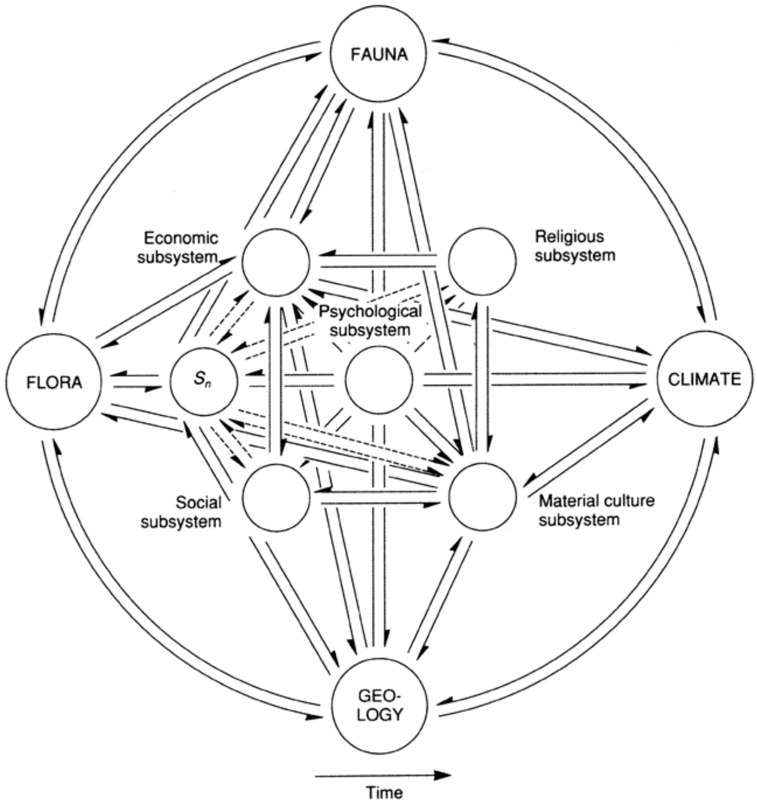

Figure 4: Model of sociocultural system and its environment in dynamic equilibrium (Clarke 1968: 134).

According to Clarke, the social subsystem is generated by a set of acquired ideas or information, which continuously reproduces itself by conscious and subconscious imprint (Clarke 1968, 105). The close similarities to Bourdieu's concept of habitus are apparent, but interestingly, the self-replicating aspect of the social subsystem is rather reminiscent of the previously discussed concept of autopoiesis. Strikingly, material culture is also considered as a separate information subsystem in its own right, consisting of patterned constellations of artefacts which outline the behaviour patterns of a sociocultural system and embody that system's technology (Clarke 1968, 129). However, Clarke also explicitly notes that every subdivision of an overall sociocultural system into component subsystems is merely an arbitrary conceptualization of different aspects of the same network. It can therefore be surmised that the same set of general postulates may be relevant in each of these arbitrary subsystems within the same system and therefore display the same set of inherent qualities. Archaeology as a discipline can therefore be expected to trace the same inherent 'behaviour' determined by the overall sociocultural system.

Clarke explicitly drew from Cherry's theory of signs (Cherry 1957) in considering material culture itself as flows of information, through concepts of 1) designata, a set of roles or activities that a particular artefact was intended for; 2) percepta, information conveyed to an observer in the act of perceiving an object or artefact; and 3) concepta, information contained in the abstract idea of an object or artefact conceived in the brain of a person or potential artificer, recalled from memory. Towards the end of his book, Clarke discusses the method of isomorphism, pertaining to borrowing, modifying and application of models from other disciplines, such as his application of the theory of signs derived from information theory and cybernetics to archaeology (Clarke 1968, 477). In this regard, he says that models and hypotheses from different disciplines often exhibit structural isomorphism's, i.e. showing unexpectedly similar theoretical constructions used as models for quite different kinds of data. He quotes MacKay (1950, 289): "Many scientific concepts in different fields have a logically equivalent structure. One can abstract from them a logical form which is quite general and takes on different peculiar meanings according to the context". Clarke himself however also issued an interesting cautionary statement which deserves to be repeated here in full:

> "It would be all too easy to take systems theory as our model for archaeological processes and the cultural entities that generate them, without isolating precisely the kind of system these entities represent. This would simply extend systems theory and its terminology as yet another vague analogy of no practical potential […] We must try and understand what kinds of system exist in archaeology, what are their roles, limits and inherent properties as systems, how are they networked by subsystems and within what setting can these systems be conceived as existing?" (Clarke 1968, 38–39).

As we have seen in this summary of Clarke's arguments, Clarke cannot be reproached for not rigorously defining his object of study, material culture, nor discussing its role within and exact relationships to the overall sociocultural system. On the contrary, Clarke's model of cultural systems remains one of the most rigorously defined and internally consistent models in archaeology to date. His contribution to the theoretical development of the archaeological discipline can therefore hardly be overstated. In the words of Plog (1975, 210) "[Clarke's *Analytical Archaeology* is] by far the most complex and thorough effort to apply general systems theory to archaeology."

Still, his work was not without flaws and others have criticized its shortcomings, as well as those of systems theory applications in archaeology in general. Most notably, the American philosopher of science Merilee Salmon (1978) discarded the applications of systems theory in archaeology. While not dismissing the potential of a systems approach altogether, she found the definition of archaeological systems to be insufficiently clear and the applications by archaeologists such as Flannery and Clarke to have limited utility. At most, the archaeologist can adopt some useful concepts such as 'feedback' and 'equilibrium', and even according to Salmon were originally derived from the fields of physics and engineering, rather than systems theory (Salmon 1978, 177).
Others have also condemned the supposed deterministic nature of the systems approach. Especially post-processual archaeologists from the 1980's onwards increasingly wondered where the people constituting these social systems were to be found. It was argued that human beings did not inhabit a specific sphere within an objective and external environment, but instead lived in an embedded world that they are able to understand and act in culturally (Ingold 2000). These approaches explicitly rejected division of the world in separate spheres such as economic, ritual *etc*. (Robb and Pauketat 2012, 10). It must be noted however, that Clarke himself already noted that every subdivision of the overall sociocultural system into component subsystems is merely an arbitrary conceptualization of different aspects of the same network.
The use of systems theory in processual archaeology tended to diffuse emphasis upon single causes and develop explanations that encompassed continuity, gradual change, and sudden transformation (Robb and Pauketat 2012, 9–10). Still, a main point of critique addressed the emphasis on studying the system through its subsystems. The criticism on the limitations of such reductionist approaches was most succinctly formulated by American physicist Philip Anderson, Nobel Prize laureate in 1977, in his seminal paper *More is Different* (1972). He writes:

> "The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe…The behaviour of large and complex aggregates of elementary particles, it turns out, is not to be understood in terms of a simple extrapolation of the properties of a few particles. Instead, at each level of complexity entirely new properties appear, and the understanding of new behaviours requires research which I think is as fundamental in its nature as any other." (Anderson 1972, 393).

The challenge ushered by Anderson, did not go unnoticed and it was increasingly realized how complex interconnections and interactions between subsystems could give rise to wholly new and unexpected behaviour, so-called emergent phenomena. It are exactly these nonlinear interactions between subsystem components and the emergent phenomena they produced that are the subject of the field of complex systems research which will be discussed in the next part.

1.2.2 Complex Systems

In the previous part I already briefly sketched the origin and development of complexity theory from the 1970's onwards. Complex systems can be generally conceptualised as 'a system whose properties are not fully explained by an understanding of its component parts' (Lewin 1992, x). The overall structure of a complex system can be found in Figure 5. The basis of any complex system consists of multitude of constituent elements which interact, often in rather simple ways (Ball 2004; Holland 1998; Mitchell 2009). These systems therefore not only consist of many elements, in order for them to be complex, these components need to be interacting with each other. This does not necessarily mean that every element communicates directly with all others in a synchronous fashion. Rather, the interactions follow network patterns with highly similar properties (Haynes 2017, 14). Out of these interactive dynamics, emergent properties arise which are not directly derived from the summation of already existing characteristics of the constituent elements (Holland 2014b, 4). In this sense, complexity theory and complex systems offer precisely the kind of solution to go beyond the limits of reductionism impinged on traditional systems thinking (Lewin 1992, ix–x), as discussed in the previous part. Examples of complex systems include ecological systems such as a forest, biological systems such as an ant colony or the human brain, artificial systems such as computer simulations or the World Wide Web, or social systems such as human societies (Mitchell 2009).

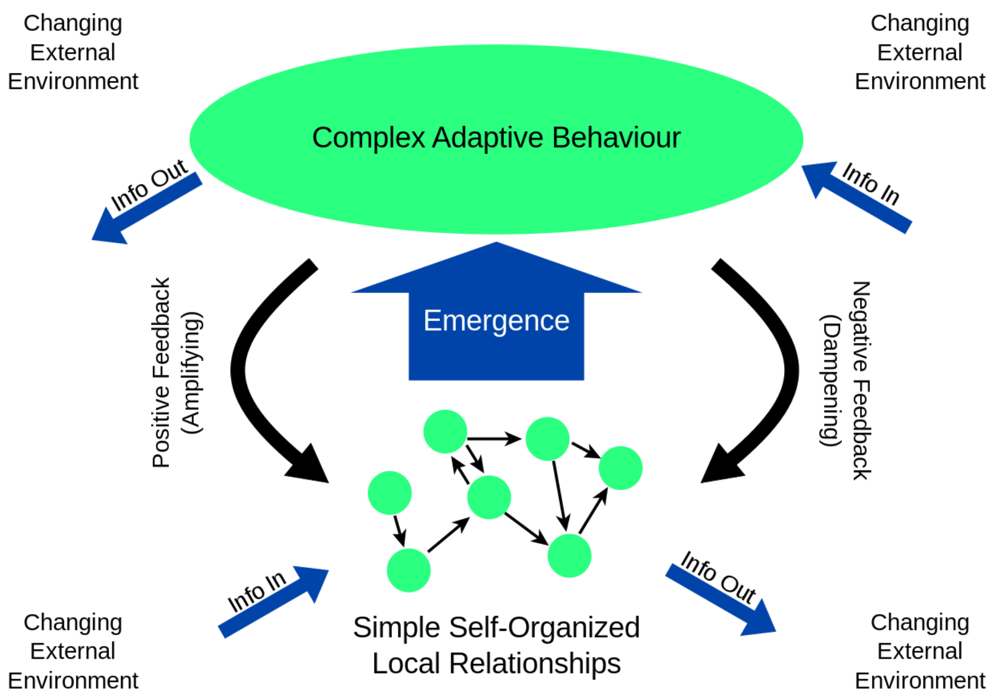

Figure 5: Basic structure of a complex system (image used under CC licence; credit to creator Acadac).

The concept of complexity has proven to be difficult to pin down, and definitions are legio. It should be noted that complexity is often used as a descriptive term, whose origins and development often remain something of a black box. It has for example been stated that "one of the hurdles in defining a theory of complexity, and with it, developing a fundamental, helpful approach is that there is no uniformity in the meaning of complexity" (Sitte 2009, 25). The term can, for example, refer to an aspect or subpart of a system, as well as the magnitude and variety of the overall system. We therefore have to be aware that different aspects of complexity can exist, sometimes simultaneously within the same system. These are different aspects or manifestations of complexity, but none of them is complexity *per se*. Correspondingly, "there is no single quantitative measure of complexity, but various aspects of it can be defined and measured" (Mayfield 2016, 58). Regardless, a number of key properties are commonly stressed: non-deterministic and non-linear behaviour, emergence and self-organization and intricate interdependencies among system components (Mitchell 2009)

One of the major goals of complexity-based approaches is to discover how movements at a small-scale translate into emergent phenomena at a larger scale, or *what* emergent properties can be expected (Bentley and Maschner 2003b, 5). As the multitude of components in complex systems interact in various dynamic ways, with variable frequency and intensity, the scale and direction of change in the higher-level structure of organisation within the system need not necessarily be proportional to the scale and direction of the constituent phenomena that trigger it (Barton 2014, 308).

Chaos/complexity, structure and contingency

In other words, connections between the multitude of basic constituent interactions and overall system behaviour are nonlinear. This means that, as feedback loops dominate complex systems, the effect becomes part of the cause of system dynamics. However, for linear cause-and-effect explanations, both need to be clearly separated. As a result, on the one hand, no linear correlation can be drawn between the size or intensity of a system input and the corresponding system outputs, and small perturbations could therefore result in major system-wide consequences (Bak 1996; Ball 2004, 227). On the other hand, even small changes in system inputs can radically alter system output, a property described as sensitivity to initial conditions.

A system is called 'chaotic' when infinitesimal changes in initial conditions lead to wholly different system dynamics and outcomes. This concept has also been described in chaos theory by Edward Lorenz (1963) as 'the butterfly effect', where one time the flaps of the wings of a butterfly on one side of the world may incrementally change air currents until it 'causes' a hurricane across the other side of the world, whereas the next, nothing of meteorological consequence happens. This 'uncertainty', has profound consequences for the ways such systems are conceptualised and studied as the unpredictability of nonlinearity magnifies any initial uncertainties in the system state. Additionally, the character of the interactions among subsystem components is generally far more decisive for the overall system behaviour rather than their inherent characteristics (Barton 2014, 308). Chaotic systems have no fixed equilibrium state but are rather characterized by multiple equilibria between which it can oscillate.

Chaotic systems are deterministic, as in governed by a fixed set of rules and undisturbed by external noise, although they are inherently unpredictable (Bentley and Maschner 2003a, 4). For a chaotic system, knowledge of past states is meaningless given that it has no bearing on the subsequent system states, even if we know the laws regulating changes in the system (Bentley and Maschner 2003a, 4). However, it has been noted that "complex systems are neither static nor chaotic. They have structure, embodied in the patterns of interactions between components" (Cilliers 2001, 140).

The difference between chaotic and complex systems was addressed in a seminal analysis by the American biologist and complex systems thinker Stuart Kauffman on random Boolean networks and NK fitness landscapes (Kauffman 1993). In his work, the number of connections (K) between constituent nodes or agents (N) of the system of interest provides the key to its nature. If we let a network of *N* agents be randomly connected to *K* others and have all agents react only to the information provided by the connected others instead of the total environment, we see that strategies of nodes connected with only one link are static or frozen, whereas a high number (depending on context but generally around four or more) of connections results in an unstable, chaotic system where favourable strategies no longer exist (Kauffman 1993; Lewin 1992, 44). The intermediate number of connections, more than one but also not too many, has been considered something of a 'Goldilocks zone' also described as the 'edge of chaos' (Packard 1988; Kauffman 1993).

These intermediate configurations have been famously described by the Danish theoretical physicist Per Bak as critical states or 'self-organized criticalities' (Bak *et al.* 1987; Bak 1996). A self-organized criticality can be defined as a quasi-steady state of a system in which small inputs accumulate until a sudden collapse, occurring at random intervals and intensities (Bak 1996). As systems move periodically into situations at the edge of chaos, change thus becomes episodic, and sometimes dramatic (Boulton *et al.* 2015). Dynamical self-organizing systems are said to constantly reorganize, releasing stress/tension to evolve towards this critical steady-state. This general system property also suggests that rapid and large-scale system changes need not necessarily be connected to major causal factors but can also result from an accumulation of bottom-up, small changes and stimuli passing a threshold value and resulting in a system-wide ‘tipping point’ (Gladwell 2000). These dynamics are therefore inherently nonlinear in nature, meaning that the scale of system-level changes are not necessarily proportional to the scale of the phenomena that trigger it. Complex systems can sometimes absorb a large amount of perturbations without any meaningful or notable changes in system configurations, whereas at other times comparatively small perturbations could result in a cascade of changes with huge consequences for the overall system state and further system dynamics. It has been noted that this approach resonates well with the evolutionary biologist Stephen Jay Gould’s theory of punctuated equilibrium (Gould 1989) which balances events and social structures in a non-linear interplay between contingencies and formal structures (Bintliff 1997a, 1999b, 2004).

The unpredictability of emergent phenomena developing out of constituent interactions has profound consequences for the ways complex systems can be analysed and understood. It has been noted that in applying chaos-complexity theoretical discourses and punctuated-equilibrium perspectives, the role of disjunction, *i.e.* changes into multiple potential pathways for a given society or landscape, is essential (Bintliff 2003, 81). These bifurcation points tend to converge into a limited number of recurrent system states with similar properties, so-called attractors. However, the crucial element is the moment of divergence between different attractor states during the initiation of the bifurcation point. The interaction between social agents – be it of a cooperative or competitive nature – can sometimes generate transformative behaviour, inducing self-reinforcing mechanisms and dynamics steering the system into a given direction (McGlade and van der Leeuw 1997, 12).
At this point, the question as to what extent contingency lies at the basis of change in human societies becomes most prominent (Bintliff 1997a, 1999b). This is not to say that complex systems are wholly unknowable and system changes happen at random. Complex systems often produce relatively simple behaviour governed by a limited set of rules (Gleick 1987, 304). Whereas the trajectory of a complex system is notoriously difficult to predict, its phase transitions can certainly be understood. Complex systems approaches therefore need to combine an understanding of system changes and phase transitions, as well as the emergence of order and structure which keep the system in a given basin of attraction. Internal system drivers and external shocks underlie both change and stability in a complex system (Bentley and Maschner 2003a, 3). I will discuss these stimuli, opportunities and challenges for social system dynamics in more detail in part 1.2.3 when outlining a model of socio-political complexity trajectories.

It should be remembered that “what is predictable, and what contingent, often depends upon the scale under consideration” (Gould 1999, xvi). Contingency and punctual equilibrium approaches relate particularly to the pace of change in a given system, balancing long-stretched periods of stability with rapid transformation phases. Such phases of discontinuity can be considered “thresholds of change where the role of human agency and/or idiosyncratic behaviours assumes paramount significance in the production and reproduction of societal structures” (McGlade and van der Leeuw 1997, 11). To understand such marked episodes of change induced by tipping points and other threshold effects, we need to apply a multiscalar perspective. I will offer a potential framework for such multiscalar approaches in part 1.2.4 through the integration of the concept of adaptive cycles. In each cycle, extended periods of stability and incremental changes within a basin of attraction alternate with rapid episodes of change and transformation. To explain these phase transitions, individual cycles need to be integrated in a nested hierarchy of scales operating on interacting spatial and temporal dimensions. This interconnectivity between scales can be discussed more specifically in terms of flows of information. Let us therefore turn towards the key role of information transmission and processing in complex systems.

Complex system as information processing systems

Complex systems' main *modus operandi* pertains to the signalling and processing of information, using and producing signals both from internal system components and external environments (Holland 2014a; Mitchell 2009, 13). Semi-permeable boundaries allow certain information to pass, whereas other gets blocked, the ensuing boundary restrictiveness determines degree of specialization within the complex system (Holland 2014a, 56). A key emergent property of complex systems is their capacity for computation and transmission of, not only material resources and energy, but also information among its components. Complex systems display a high diversity of interactions and communication between elements and are therefore highly relational and interconnected (Haynes 2017, 30). How a system develops depends very much on how the elements within it are connecting and communicating, what feedback is reinforced, and what feedback is checked and balanced. Viewing human societies through a complex systems lens entails a focus on information flow, decision-making, interactions at multiple scales of organization, feedback mechanisms, and non-linear dynamics in which individual agency generates organizational-level emergent phenomena.

The transmission of information, both intra-system between system components and inter-system between the system and its environment, makes many complex systems also *adaptable*. Two-way feedback mechanisms operate between the simple constituent behaviour and the emergent complex and collective behaviour. On the one hand, positive feedback mechanisms occur when change in one direction makes the system even more prone to keep changing in that same direction in successive system states, whereas negative feedback consists of counterbalanced change continually guiding the system towards the current equilibrium (Bentley and Maschner 2007, 245). For the subset of complex systems especially characterized by adaptive mechanisms, a distinct moniker is used, that of complex *adaptive* systems (CAS).

CAS can be defined as large networks of interacting components with no central control and simple rules of operation, exhibiting dynamic emergent collective behaviour that cannot be reduced to the sum of its individual parts, sophisticated information processing, and is responsive to its environment via learning or evolution (Holland 1995; Mitchell 2009). CAS are characterized by a collection of primitive components (for social systems generally termed agents) who initiate interactions among themselves and with their environment and out of these interactions unanticipated global properties often result (Forrest and Jones 1994). The components of CAS are organized into nested groups that can be represented as structured networks or organizational hierarchies. It then follows that, the more complex the system, the deeper the nesting of the groups of components (Barton 2014, 307). System components receive information regarding the environment and alter their behaviour in response to that information, again transmitting information regarding their current state to other components. The main difference with general systems thinking is that, in terms of structure and agency, CAS components are not merely structuring parts of the overall system, but are also capable of exerting their own agency (Barton 2014, 309). System development then results out of both internal and external challenges and stimuli.

To summarize, human societies as CAS are formed from a multitude of social interactions between individual agents. Out of these base interactions, processes of structuration take place through social practices performed across time and space (see *infra*), giving rise to emergent behaviour in the form of complex social organisation. This overall social organisation in turn exerts feedback mechanisms back onto the behaviour of constituent agents. Agents adapt their behaviour to the received information from the higher-levels of the system and their environment, including other agents and their new behaviour. As a result of these feedback mechanisms acting upon constituent social interactions, social system behaviour evolves over time. In CAS, agents' actions and choices are fundamental as the outcomes of individual decisions are not merely averaged away within the overall workings of the system (negative feedback) but may be magnified as a result of other decisions (positive feedback and increasing returns) and therefore decide the direction the system takes (Bogucki 2003, 98). For example, it has been argued by Arthur (1989) that in knowledge-based economic systems, decisions for initial investment in knowledge acquisition are rewarded with rapid accumulation of experience, stimulating functionality and efficiency of economic processes.

1.2.3 Social Complexity

In the previous parts, I already discussed the subject of complexity theory and complex systems research as an important aspect of the broader field of systems thinking. Complexity in this sense stems from its use in cybernetics and systems theory (Castellani and Hafferty 2009, 14). However, for archaeologists, 'complexity' is in the first place related to 'social complexity' (Lull and Micó 2011, 194) as a property of 'complex societies', as opposed to other, so-called 'simple' societies. The use of the term complexity, in the sense of social or political complexity, in archaeology is not the same as that of complexity theory and generally predates the development of the latter.

Socio-political complexity is commonly considered to pertain to the rise and development of social/administrative/religious/military/political hierarchies and inequality associated with societies consisting of large, dense populations, formal information systems, economic development, socio-economic specialization and urbanism (Bentley *et al.* 2007; Cowgill 2004; Feinman 2001, 2011; Turchin *et al.* 2017). It is often used to describe a trajectory of social evolution where societies are ranked in a number of discrete categories depending on a certain degree of complexity. This categorisation of complexity implied an inescapable, teleological evolution from egalitarian and small-scale societies, such as 'Bands' or 'Tribes' to increasingly socially stratified and large-scale societies such as 'Chiefdoms' and 'States'.

Complex systems, on the other hand, pertain to a general class of open systems requiring external energy input to maintain its internal structure (Cowan *et al.* 1999; Simon 1962). Complex systems research then involves studying these open systems and determine how new, complex properties emerge in nonlinear fashion from many agents interacting in simple ways. Complex systems are composed of many interacting components organized into a nested structure. On a general level, systems become more complex as additional components are integrated in an increasingly nested structure (see *infra*). Increasingly nested structures need not necessarily refer only to increasing hierarchy, as heterarchical structures may just as well contribute to increasing complexity (Blanton *et al.* 1996; Crumley 1995; Kohring and Wynne-Jones 2007).

Social complexity can be defined as "the extent of functional differentiation among social units, [which] may be vertical or horizontal; vertical complexity is hierarchical governance with a degree of concentration in decision making and power, [whereas] horizontal complexity is the differentiation of a population into various roles or subgroups." (Feinman 2012, 36). Statistical analysis on the Seshat database, integrating data on 414 societies from 30 regions around the world spanning the last 10,000 years, showed that most of the complexity indicators displayed strong correlation, meaning that variation in societies across space and time could potentially be captured by a single measure of social complexity, reflecting "a composite measure of the various roles, institutions, and technologies that enable the coordination of large numbers of people to act in a politically unified manner" (Turchin *et al.* 2017). Trends of increasing complexity have been most evidently noted in domains of: (1) agriculture (Boserup 1965; Clark and Haswell 1964; Minnis 1996; Nelson 1996; Wilkinson 1973); (2) Technology (Arthur 2015; Nelson 1996; Wilkinson 1973); (3) Competition and warfare (Carneiro 1970); and (4) Socio-political control and specialization (Carballo *et al.* 2014; Feinman 2011; Spencer 2014; Tainter 1988). Joseph Tainter (1996, 64) notes how each of these develop and increase in complexity through the combination of three mechanisms: differentiation, specialization, and integration. These mechanisms will be discussed in more detail in the analytical framework outlined in the next chapter as key factors to study complexity development.

If anything, only a weak parallel can at this point be drawn between complex systems and complex societies, as the latter often consist of more differentiated structures such as social groups, classes, specialized labour, etc. Evaluations of the emergence of new political actors, levels of organisation and hierarchical social relations are all aspects of interest for a complexity perspective, yet it does not match the full scope of a complex system (Kohler 2012, 93). It should be remembered however that no inherent equivalence exists between complex societies in an archaeological sense and the more general phenomenon of complex systems (Auban *et al.* 2013, 53). All human societies, be they classified as socially complex or simple, are intrinsically complex (social) systems in the sense of open systems requiring energy input, regardless of their size or organizational structure (Barton 2014; Miller and Page 2007). Before moving on to conciliate the complex systems approach with the use of social complexity in archaeology, I will first discuss in some more detail the development of the debate regarding the latter, pertaining to the use of (social) complexity in a framework of evolutionary trajectories of societal configurations.

Social complexity and evolution

It has been noted that many complex systems, as they adapt to external circumstances and stimuli, seem to have the irresistible, inherent tendency to become increasingly complex over time. For human societies, the conventional view has been that of a latent tendency towards greater complexity (Tainter 1996). Complexity was thus long assumed to be a desirable thing, and the logical result of surplus food, leisure time, and human creativity in past societies (Bronowski 1973; Steward 1972). In recent times, this point of view is no longer accepted and it is commonly agreed now that complexity always comes with a certain (energetic) cost and should therefore not be taken for granted. I will return to the associated costs of complexity in more detail in the next part.

In biological systems, species increase their complexity in order to increase their fitness in an ever-evolving bid to adapt to environmental changes. Such a process of bilateral evolution has been famously described as the 'Red Queen effect', where two connected species, predator and prey, must keep on adapting and evolving, not only to gain a reproductive advantage, but even to merely maintain their respective places within an ever-changing evolutional 'rat-race' (Van Valen 1973). However, notions of evolution, increasing complexity and improving fitness have also been commonly applied to complex systems outside of biology as well. For example, Spencer (1864) discussed how societies develop in analogy to biological organisms through internal dynamics inherently striving towards increasing complexity. Highly complex societies within the supposed evolutionary trajectories of societal development started to be associated with notions of 'successful' societies, outperforming their 'simpler' counterparts.

The connection between evolution and complexity can be traced back to the 18th century scholars of the Enlightenment, such as Montesquieu, Miller and Adam Smith (Chapman 2007, 13). From this time onwards, notions of successful complex societies came to be appropriated by the West and were embedded in a wider framework of 'Eurocentrism' and Western cultural superiority, among others in a bid to rationally justify Western colonial endeavours (Morris 2013, 2). This framework will be discussed in more detail in the third chapter, specifically applied on the Greek concept of *polis*.

Writings on social evolution and complexity grew increasingly prominent during the 19th century, as scholars became interested in the emergence and historical development of complex societal configurations, such as the state (Lull and Micó 2011, xiii). This resulted in the development of models of social evolution, comparing state societies to other modes of societal organization to describe how the former developed out of the latter. At the time, the workings of evolution had already been demonstrated by the English naturalist Charles Darwin (1809-1882) in his work *On the Origin of Species* (1859). It became widely accepted that organisms developed adaptations to their environment in a constant competition for resources with other species, through by a blind evolutionary process driven by natural selection. Those species best adapted to the environment often succeeded in surviving, at the expense of others. The phrase 'survival of the fittest' is often attributed to Darwin, however it was actually coined by a contemporary scholar, the English sociologist Herbert Spencer (1820-1903) in his work *Principles of Biology* (1864). Spencer is considered one of the key figures in the popular movement of 'social Darwinism' in the last part of the 19th and early 20th centuries, and put strong emphasis on biological characteristics in explaining human behaviour.

Following the biological evolutionary perspective, it was argued that continuous processes of social adaptation took place within a competitive struggle for survival in an environment of scarce resources (Johnson 2008, 493). This continued adaptation has driven societal development throughout history along a progressive trajectory towards ever-improving modes of socio-political configurations. In contrast to the random nature of ecological evolutionary processes, in social systems the tendency towards increased complexity and associated notions of successes by the survival of the fittest was rather interpreted in a teleological trajectory seen as an 'inevitable' development. As at the time of writing of these ideas at the end of the 19th century, the state was by far the most prevalent form of social organisation, scholars, within the *zeitgeist* of the 19th century, interpreted state societies as the culmination of human evolution until that point, and therefore as the best possible form of human society.

Rooted in and driven by the core tenets of empiricism as developed during the Enlightenment, scholars such as Lewis Henry Morgan, Edward Tylor and John Lubbock increasingly strove to document any such proposed trajectory with actual data from different societies (Robb and Pauketat 2012, 6). It was supposed – out of the idea of a unitary conception of human nature – that all societies developed in similar and comparable ways, and therefore passed through the same series of successive steps in a linear and teleological fashion, culminating in the State (Lull and Micó 2011, 136). This way, these proposed trajectories were thought to be applicable to all human societies throughout time and space. The American anthropologist Lewis Henry Morgan (1818-1881) used anthropological observations of 'primitive' contemporary societies to reconstruct the past stages of more advanced societies (Morgan 1877). Morgan identified three main phases: 'Savagery', 'Barbarism', and 'Civilization', whereof the first two are again divisible in three levels, 'Lower', 'Middle', and 'Upper'. Definitions of these phases and the transitions between them were based on technological advancements. For example, the manufacture of pottery vessels as the crucial technological innovation which separates Upper Savagery from Lower Barbarism or the development of a phonetic alphabet as the technological innovation marking the transition from Upper Barbarism to Civilization.

Although contributing greatly to the development of anthropology as a discipline, the evolutionary discourse of the 19th century came under scrutiny as other research paradigms became increasingly popular. In particular within the framework of German idealist philosophies, most famously propagated by Georg Hegel, unilinear evolutionary trajectories of societal development were increasingly criticized. The image of a unitary human nature was substituted with myriad of juxtaposed *cultures*. The movement of 'Historical Particularism', most generally advocated by Franz Boas (1858-1942), criticized the inappropriate methodology of the evolutionary comparative method as it relies upon ordering of synchronic data to make diachronic inferences (Sanderson 1999, 15–16). Instead Boas argued for the need for contextual study of human cultures in and by themselves and in their own worth (Lull and Micó 2011, 148). This led to the abandonment of attempts at uncovering general regularities and evolutionary trajectories of universal validity in human societies.

During the second half of the 20th century however, scholars became increasingly dissatisfied with the overt particularism in historical and anthropological research and were again looking to include comparative perspectives. A countermovement started in anthropology and archaeology where ideas from 19th century evolutionism were adapted and appropriated within a neo-evolutionary, framework. In anthropology, the works of Julian Steward (1902-1972) and Leslie White (1900-1975) are considered fundamental for this resurgence (Steward 1949; White 1949). Much like earlier evolutionism, different stages of human societies were postulated. However, the importance of technological innovations was combined with a strong emphasis on different forms of political organization. More specifically, the implementation of political hierarchies and the institutionalization of leadership in society, ranging from simple and hardly formalized types of leadership to permanent, centralized and highly regulated forms (Lull and Micó 2011, 161).

While neo-evolutionism retains a basic trajectory of successive steps, this trajectory was dissociated from explicit teleological notions of unilinear development. White (1943, 1949) considered the key concept to trace different stages of societal complexity was consumption of energy. Theoretical foundations for this key understanding were found in the first two laws of thermodynamics. It was argued that human cultures provided a notable exception to other systems bound to this fundamental law of physics as humans could postpone inevitable energy loss by harnessing technology and technological innovation to gather increasing amounts of external energy, resulting in increasingly elaborate culture systems. The argument is expressed through the formula: C = E x T (degree of cultural development equals the amount of energy times technological efficiency). A similar stance would late be propagated by Bruce Trigger, who argued that evolution in human history was driven by a directionality involving an overall tendency towards larger, more differentiated and more complexly articulated structures requiring greater *per capita* expenditure of energy for their operation (Trigger 1998, 10). Conceding to previous concerns regarding the particularity of individual societies and culture, Steward (1972) argued that not all intermediate steps within such trajectories needed necessarily be fulfilled within a similar, unchangeable trajectory, allowing more varied, multilinear trajectories of development.

Important contributions within the neo-evolutionary school were made in particular by the anthropologists Elman Service (1915-1996) and Morton Fried (1923-1986). Service proposed different steps of societal development consisting of 'bands', 'tribes', 'chiefdoms', and 'states', based on formative elements such as group size, group cohesion, form of leadership and nature of the means of subsistence (Service 1962). Fried on the other hand divided human societies in 'egalitarian', 'ranked', 'stratified', and 'state societies' based on Marxist ideas of growth of social inequality (Fried 1967). In both classifications, each of the categories functioned as a scale of reference in order to classify different societies based on modes of socio-political institutionalization. Yet, Service and Fried's step model classifications have been criticized for being difficult to match with the social reality of actual societies (for a more detailed overview see Khazanov 1985) and have been contrasted with so-called slide models of social evolution such as the agricultural development model of Ester Boserup (1965).

As they have been described up until now, these models were largely formulated on the basis of anthropological observations and defined through generalizing features of societal development. These descriptive modes of social organisation decontextualized societal development by extracting processes out of their spatial and temporal context. Archaeological critiques on these approaches led to call for 'materialization' of these concepts in the 1960's and 70's. However, the archaeologist – diligent as he may be – can never dig up institutions or socio-political organizations directly. A way had to be found to interpret the archaeological material as a reflection of institutional organization in society. It was therefore essential to identify those formative elements of material culture which could be linked to the prevalent political configuration of society and could thus be assigned explanatory value.

A prominent example of archaeological research trying to tackle this problem is found in Kent Flannery's analysis of developing socio-political complexity (Flannery 1972). His approach was based on the analysis of exchange of information and different levels of decision-making institutions within processes of administrative centralization and mechanisms of control. A connection can be made with the cybernetic approach of Henry Wright (1978, 56) who defined the state as "a society with specialized decision-making organizations that are receiving messages from many different sources, recoding these messages, supplementing them with previously stored data, making the actual decision, storing both the message and the decision, and conveying decisions back to other organizations". Degrees of socio-political complexity can therefore be studied through the number of levels within the settlement hierarchy of a given society (Wright 1969). Chiefdoms possessed one hierarchical level of decision-making to control the basic level of communities organized in villages, whereas state societies possessed two or more hierarchical levels that functioned as mechanisms of control.

In conclusion, (neo-)evolutionary approaches to societal change have long focused on transformations between different classes of society, for example from chiefdom to state. As Barton (2014, 70) remarks, this implies that a certain number of fundamental properties co-occur throughout a number of societies across time and space, which allows them to be characterised as belonging to one state or another. Additionally, it implies that such societies stay in a sufficiently stable form of equilibrium until a sudden 'jump' to another stage takes place and a society rapidly reorganizes to meet the properties and characteristics of the new stage. When approaching human societies from a complex systems perspective, however, it becomes clear that these various phenomena and properties supposedly characterizing a specific stage of development, "do not necessarily co-occur or coevolve, although their trajectories can converge to varying degrees in some cases… If there are universals in the rise of complex societies, it is more likely that they will be found in the underlying processes or algorithms that drive the evolution of complexity" (Barton 2014, 70). What exactly constitutes these underlying processes will be elucidated in the next parts. The suggested way forward will – among others – build on the works of White, Flannery and Wright, by focusing on flows of energy and information transmission and processing as essential buildings blocks of social organisation and complexity. Throughout the next part I will show that information processing constitutes the overall driver of societal development, whereas energy processing constitutes its overall constraints.

Social complexity and information transmission

From the previous part, it can be surmised that the discipline of archaeology has a long-standing tradition of incorporating aspects of social complexity in its discourses. However, these conceptualisations of social complexity are not necessarily in accordance with some of the tenets of complex systems studies. Let us now consider in some more detail the origins and development of social complexity from the view of human societies as complex social systems and discuss how both approaches can be conciliated, resulting in a better integration of a complex systems perspective in archaeological practice.

On a basic level, social complexity can be considered a specific property of social systems. But what does this mean? From a complex systems perspective, if we look at the general conceptualisation of complex systems, we see that on the macro-scale, complex behaviour emerges from micro-scale interactions between constituent components. As was already noted by the American sociologist Peter Blau, this complex, emergent social behaviour cannot be readily reduced to each of the constituent interactions (Blau 1964). For example, the multitude of interactions between myriad of animal species and plants together form an ecological system. If we transpose this structure to social systems, we can see human societies as the macro-structure of interest. The constituent components of such complex social systems, are then, in analogy with ecological species, the human individuals who act and interact with each other. Social complexity is therefore a form of complexity which derives from the multitude of social interactions between people. A recent quantitative definition of social complexity states that "complex social systems are those in which individuals frequently interact in many different contexts with many different individuals, and often repeatedly interact with many of the same individuals over time" (Freeberg *et al.* 2012, 1787). Could we then perhaps argue that the origins of increasing social complexity lie in growth of community sizes (Dubreuil 2010)?

Social scientists from several disciplines have frequently recognized the general and cross-cultural relationship between the size of human groups and their organizational complexity (a small sample of examples: Bintliff 1997a, 1997b; Blau 1977; Bodley 2002; Carneiro 1967; Dubreuil 2010; Ember 1963; Fletcher 1995; Johnson 1982; Kosse 1990). Population increase does indeed seem to be important as larger group sizes lead to exponential increases in amounts of (potential) social interactions (Figure 6), in turn giving rise to increased social complexity (Fletcher 2007). Intercultural comparative data suggest a correlation between the development of collective action measures and a tendency toward population growth and overall population size of the polity (Blanton and Fargher 2008). At the most basic level, as population size grows, the potential for social interaction increases as well. Moreover, both elements do not scale linearly as the number of possible pair-wise links between people increases faster than the increase in the number of people, with the exponent approximating $\frac{N^2}{2}$, with N being the total population size (West 2017, 317).

Complex societies are generally taken to refer to those human societies consisting of large numbers of people, many social and economic roles, and large permanent settlements (Barton 2014). But how does this supposed demographic driver of complexity development relate to the conceptualisation of human societies as complex systems? It must be cautioned that presupposing a direct, linear relationship between demographic drivers and complexity development should not be considered a sufficient explanation. While the correlation between demographic factors and social complexity has been attested, it should be remembered that variation in population sizes and the nature of socio-economic outcomes in CAS are nonlinearly connected. Population size thresholds as such are therefore a necessary but not sufficient cause for social complexity development.

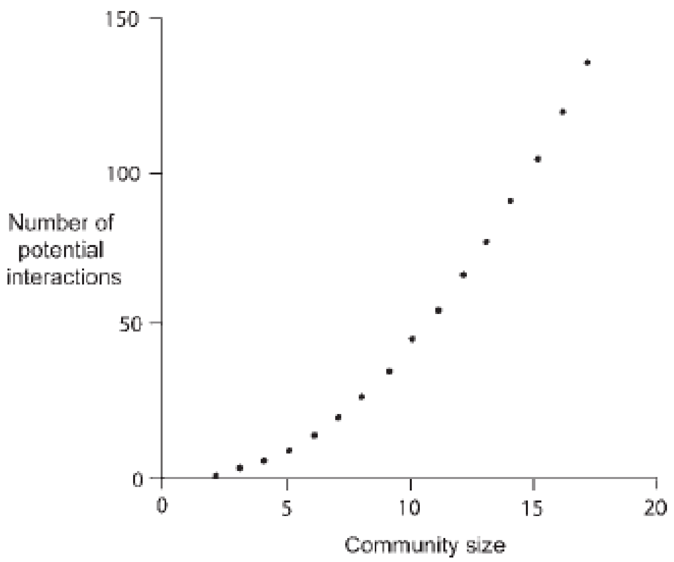

Figure 6: Relationship between number of potential interactions and community size (Feinman 2012: 39)

To provide an explanation for the observed correlation between population size and social complexity we can look at cross-cultural population thresholds, and discuss the suggested mechanisms needed for social groups to overcome them. Some classic works on group sizes include Anthony Forge's study of normative factors explaining settlement size of Neolithic cultivators in New Guinea (Forge 1972). Forge observed stabilization of villages occurring at an average population size of 150 people and explained this process as an attempt to maintain face-to-face relationships within a social group. If this threshold is surpassed, the village is likely to divide or undergo an internal horizontal sub-division into distinct social groups, each adhering to this limit, and thus maintaining small-scale community relationships within larger communities up to 400 individuals. This latter apparent constraint on population sizes at around 400-500 people was also recognized by Martin Wobst, who lined it to the minimum required population size for the practice of endogamy within the own community (Wobst 1974, 1976).

Organizational thresholds of human group sizes are thus considered to emerge through biological limitations, such as those posed by human cognition in processing and transmitting information among group members. For example, Robin Dunbar looked at the biological limits of information processing through the evolution of human brains and neocortex sizes, and also recognized the 150 people limit of social groups. Group size studies often refer to works in neurology or primate social network studies to propose these cognitive limits to group size expansion (Dunbar 1992, 1993; Hill and Dunbar 2003). Recent research in these fields has however seriously questioned the validity of inferring cognitive selection pressures from behavioural correlates of brain size on the size of social networks (de Ruiter *et al.* 2011; Powell *et al.* 2017). If we are to explain the development of organizational structures and social complexity as mechanisms of community formation, we must therefore also look beyond biological constraints.

In a seminal paper, Johnson (1982) argued that in small groups, ranging from 2 to 20 individuals, intra-group leadership – in the sense of hierarchical organization – emerges most often in groups from six individuals onwards. He relates this threshold with 'scalar stress' associated with decreasing consensus in decision making processes and decrease of effectiveness in group performance emerging at this point. Johnson then scales up his argument by stating that social groups generally surpass such small-group limits and must therefore have some kind of mechanisms allowing them to overcome scalar-communications stress problems. He then distinguishes between 'simultaneous' and 'sequential' hierarchies, defining the former as hierarchies in which system integration is achieved through the exercise of control and regulatory functions by a relatively small proportion of the population, whereas the latter is defined as an organizational structure where consensus is achieved 'sequentially' along different levels of social groups integrated within a given society (Johnson 1982, 396–403). For example, a sequential decision-making process could encompass consensus reached first within nuclear families, then in extended families, which eventually is passed on to consensuses reached on a larger group level, for example a band or tribe. By then relating intra-group sizes (for example nuclear families of up to 6 people) to the number of basal groups on any given level (for example up to 6 households within an extended family or 6 extended families within a clan), Johnson could account for observed increasing group sizes to the integration of increasingly more levels of organization, without having to discard the initial organizational limit observed in his small-group studies.
It can therefore be noted that as social groups grow, they do not simply get larger but rather self-organize to better process socially transmitted information and more effectively make decisions (Auban *et al.* 2013, 56). Developing complex organizational structures then entailed the integration of large social groups in politically and economically shaped structures (Turchin *et al.* 2015, 83). The Nobel Prize winning economist Elinor Ostrom identified a number of key conditions for cooperative groups to develop, including most notably small group size allowing for low-cost direct monitoring of behaviour and social homogeneity (Ostrom 1990, 90). However, it was noted in an analysis of 30 polities, spread across a wide temporal and spatial spectrum that development of collective action patterns strongly correlates with population growth during its formative period (Blanton and Fargher 2016, 263). While initial cooperation might be facilitated more easily out of bottom-up processes in small and homogeneous groups, collective action measures are also needed in large and heterogeneous communities or societies. For these societies, institution-building processes are needed to generate the necessary social structures to ensure cooperation and successful collective action measures. In this respect, we cannot reduce the development of social complexity to population sizes, but must also look at other aspects such as population density and patterns of social organisation.

Communities as social reactors

Besides increasing group size driven by population growth *per se* – be it from biological reproduction or social mobility – other demographic processes such as settlement nucleation, resulting in increasing population densities, need to be taken into account as well when considering the development of social organization and complexity within a community. Given higher population numbers and increased population density, a higher amount of social interactions occurs in cities compared to other areas (Southall 1973, 6). Thus, cities can be characterized as dense pockets of social interactions and information exchange. Looking at processes of community formation and urbanization through the lens of social complexity dynamics, the starting point would be an assessment of the intensity of social interaction, plotted on a spatial plane. This way, the development of the urban community can be approached as a network hub pulling in system dynamics and flows, or in other words, an attractor state for social action and interaction.
The combination of population growth with aggregation and nucleation of population resulted in a process termed 'energized crowding'. The term was first coined by the architectural historian Spiro Kostof (1999) and has come to denote a process of increased face-to-face interaction among members of a community. This process acts as the nexus between demographic drives and socioeconomic

output within a process of system development and change in human settlements and societies (Figure 7).

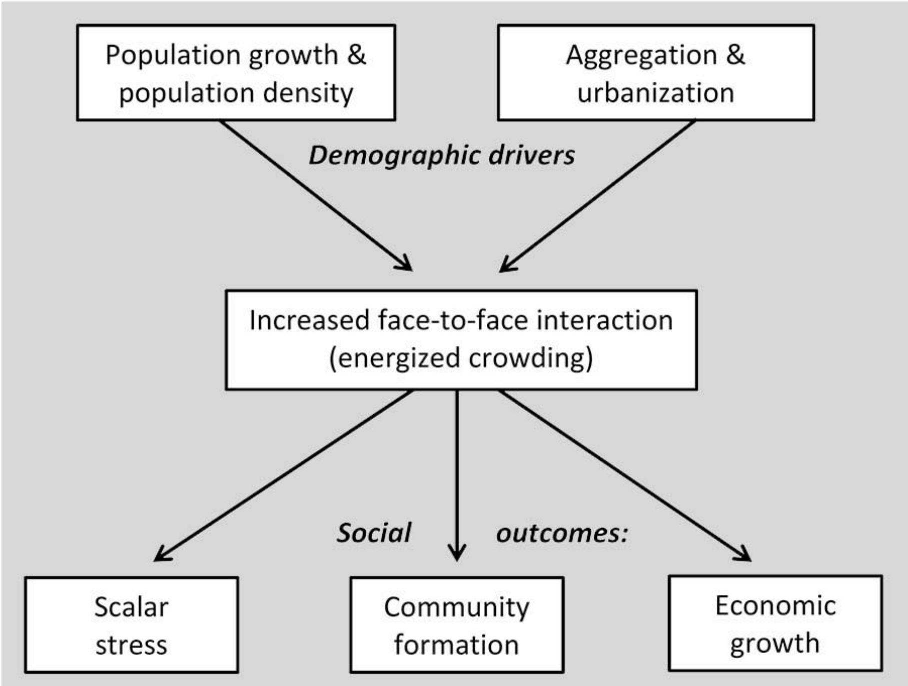

Figure 7: Model of societal development and change through energized crowding (Smith 2017, accessed from http://wideurbanworld.blogspot.be/2016/11/energized-crowding-turns-cities-into.html).

Increased social interactions following population growth and aggregation has been associated with both negative and positive outcomes respectively grouped under the header of 'scalar stress' on the one hand, and, on the other hand differentiating between social benefits as 'community formation' and economic gains as 'economic growth' (Smith 2017). The use of the concept of energized crowding is thus extended compared to others such as Johnson (1982), who considered it mainly to be the sum of consequences of decreasing consensus in decision making.

These dynamics are mostly associated with the development of cities, which are commonly considered as places characterized by pronounced divisions of labour, intensive interaction structures, and large flows of people and resources on dense infrastructure networks. Cities have been described as "the hubs of innovation, engines of wealth creation and centres of power, the magnets that attract creative individuals, and the stimulant for ideas, growth and innovation" (West 2017, 8). Urbanization has been credited as an indispensable property of societal development (Childe 1950), economic growth (Krugman 1996) and is even considered essentially preceding the formation of complex polities such as in processes of state formation (Jennings 2016). Urban communities act as the stage for increased socio-economic interactions, mechanisms and processes that drive economic growth and other processes of exponential expansion (West 2017, 213). At the same time, the negative effects of urban life have long been a dominant theme in the social sciences (Milgram 1970). For example, the rise of poverty (Teitz and Chapple 1998), crime (Glaeser and Sacerdote 1999), physical and mental health problems (Winsborough 1965) have all been linked to differing degrees of urbanization.
In recent years, the consistent recurrence of the additive effects of social interaction densities has been explored further in the booming field of scaling research (Bettencourt, Lobo, and Strumsky 2007; Bettencourt 2013; West, Brown, and Enquist 1997; West 2017). This approach builds on the structures and properties of power law distributions, where a quantity of interest *Y* is plotted against some measure *N* of the size of the system, expressed in the formula $Y = cN^b$, where c is a constant and b is a fixed exponent (Kohler 2012, 107). Power law distributions typically have no meaningful average value. Instead they consist of many small events and few bigger events, albeit more than expected in a normal

distribution. When b=1, a linear relationship occurs, whereas b<1 is considered sublinear and b>1 a superlinear relationship (Bettencourt 2013).

One of the prominent figures in this kind of scaling research is the theoretical physicist Luís Bettencourt. In a seminal paper (Bettencourt, Lobo, and Strumsky 2007) it was demonstrated that urban infrastructure scales with population in a sublinear pattern, with an approximate exponent in the range $2/3 \leq b \leq 5/6$ (therefore a maximum value of $b \approx 0.83$). This means that for every unit of growth in population, a less than proportional growth in infrastructure and services can be presupposed. This makes sense, as cities doubling in population numbers need not necessarily double its infrastructural services such as railways or sewage systems but can instead partially intensify usage of existing infrastructure. Systems growing this way therefore display marked economies of scale. A similar phenomenon has been found in the distribution of animal sizes and the associated basal metabolic rate in ecological systems, where it was observed already in the 1930's by Max Kleiber that the metabolism of smaller animals runs faster relative to their body size compared to that of larger animals (Holling 1992; Schmidt-Nielsen 1984). The apparent similarities between organisms and cities in scalar advantages expresses by conservation of energy as they increase in size, has led to the usage of 'urban metabolism' in analogy to biological metabolism (West 2017, 13). I will return to the aspect of metabolism in more detail in the next part.

Conversely, the same paper showed that the relationship between number of granted patents and population sizes of US urban areas scales superlinearly ($b \approx 1.29$), which means that as cities grow in population size, their patenting activities grow more rapidly. The phenomenon of higher than proportional (socio-economic) output compared to (capital or infrastructural) input has been commonly recognised in economics as increasing returns to scale (Krugman 1991). In urban economics, these results are described as productivity gains that result from economies of scale, the mobility of labour, knowledge spill-overs, and other effects of agglomeration economies (Krugman 1991; Storper 2010). The spatial concentration of people and firms in cities then leads to economies of scale, which pushes urban productivity even higher as knowledge and skills can be transferred among people, and from one industry to another, because of their concentration in a single spatial locality.

The central notion is that spatial proximity induces improvements in flows of information, thus creating the observed spill-overs, both on a social and economic plane. Within social reactors, flows generated by face-to-face interactions act as communication technologies (Storper and Venables 2004, 352). One type of information flow is that of learning and transfer of knowledge. As a higher concentration of people gathers, chances of having more knowledgeable agents nearby increase accordingly. One common avenue of knowledge transfer is that of imitation, for example within a vertical relationship between master and apprentice. Additionally, connections between members of the same social or economic group, for example people with the same profession such as in guilds, also foster horizontal exchange of knowledge and information flows. One modern example of extreme horizontal knowledge transfers within a single economic branch would be Silicon Valley. In such highly clustered networks, interactions can take place with higher frequency and are affected by more rapid feedback loops. By decreasing the distance between nodes within a clustered network 'lag time' in the transfer of information is reduced, as well as transportation costs for moving people and goods.

Luis Bettencourt (2013) presented a mathematical model of the workings of scaling laws in contemporary cities, based on the number of people in a settlement, average output per person, travelled distances, and probabilities of encountering other people. The model revolves around a set of basic ideas, including: 1) human settlements can be considered spatial concentrations of human interaction; 2) people arrange themselves in space so as to balance the costs of moving around with the benefits of the resulting interactions; and 3) socio-economic outputs are proportional to the total number of social interactions within the population. The resulting model was termed a 'social reactors model' to describe the additional socio-economic benefits of settlement concentration as larger communities are environments where a larger number of social interactions per unit time can be supported and sustained (Ortman et al. 2015). It was deduced that relative economies and returns to scale emerge primarily from the balancing of transport costs and interaction benefits within settlements (Bettencourt 2013; Ortman et al. 2014).

Interestingly, as the predicted scaling ratios quite closely match the empirical data from various settlement systems across the world, it can be surmised that the projected key variables of the model are indeed essential factors. Given their generality, there is no reason to presuppose that such scaling properties and economies of scale are uniquely reserved to modern cities. Some recent work has indeed seen some applications towards ancient societies and settlement systems as well (Ortman and Cofey 2015; Ortman *et al.* 2014; Smith 2017).
Additionally, these studies have shown that the common urban/non-urban dichotomy should be nuanced, and perhaps discarded altogether. Villages are generally seen as very simple places where the division of labour was limited above the household level, social interaction was structured primarily by kinship, and the built environment was relatively unorganized. From this perspective, the emergence of urban communities represents a dramatic point of innovation in history. However, it should be noted that by focusing on the central role of social interaction and associated flows of information among people within a community, the process of energized crowding described here and its consequences – be they positive or negative – can be applied both to urban and non-urban communities. Indeed, many of the aforementioned societal outcomes (both positive and negative) are not necessarily unique to urban communities but are merely intensified by urbanization processes, as they mainly involve increasing population densities and therefore induce increased social interactions. Villages and other types early polities often display the same features (Ortman and Cofey 2015) as they also undergo scalar stress, resulting for example in village fission (Alberti 2014; Bandy 2004), and develop mechanisms of community formation such as development of social hierarchy (Birch 2013), or group-integrating ritual activity (Froese *et al.* 2014). Additionally, it has been demonstrated how neighbourhoods as locus of interaction and social organization emerge, not only in cities, but also in agrarian and even hunter-gatherer sites (Smith *et al.* 2015).
This suggests that no stark divide between urban and non-urban communities should be drawn. Instead, it can be suggested to focus more on a continuum of settlement patterns rather than operating in discrete classes of settlement (Ortman and Cofey 2015). It has been argued that urban systems can be viewed as self-organizing human communications structures, which are not qualitatively different from other forms of human social organization and that differences are merely due to the need to deal with larger amounts of information flow as human problem-solving generates more knowledge, and involves more people (van der Leeuw and McGlade 1997, 334).
To conclude, cities have been considered as resulting from the interplay between a physical network of urban infrastructure and a social network of information exchange between its inhabitants (West 2017, 295). Going beyond the urban/non-urban dichotomy, however, settlement patterns should then be considered holistically as a reflection of flows of energy and resources derived from the landscape and redirect towards specific nodes, where they are invested in the built and material environment, combined with flows of information and communication embedded in both hierarchical and heterarchical social network structures. In the next part, I will discuss how information can be encapsulated in the material environment, before moving on to discuss the energetic costs of complexity development within and between communities and their natural environment.

Material networks and drivers of social complexity

It must be remembered, however, that interaction spill-overs alone still do not explain the full picture of social complexity development. If that were the case, any community with a certain number of people in close spatial proximity would indivertibly show the effects and outputs described above. Whereas the described regularities of face-to-face interaction are indeed frequently recurring and valid across different cultures throughout time and space (Ortman *et al.* 2016), the expected socio-economic outcomes and dynamics do not always develop in the same way. The question is then *why* certain communities at times embark on a process of elaborate system developments, whereas others do not.

If the explanation would be solely reduced to population dynamics and associated social interactions, markedly different scaling parameters would have been observed. In the ideal case where every member of a network or social group would interact with everyone else, the subsequent superlinear power law would have an exponent of two (West 2017, 319). However, in reality several constraints exist on the intensity and magnitude of interaction between group members. One of the reasons behind these constraints has already been noted as the constraints on human cognitive restraints on information processing, for example expressed by the limits on social group sizes posited by Robin Dunbar (Hill and Dunbar 2003). On a more basic level however, even in a concentrated urban hub, it is simply impossible for everyone to be at the same place at the same time. In addition to organizational limits (whether or not biologically induced), time and space therefore always constrain the potential amount of social interactions we can engage with.
In his recent monumental overview of the works on scaling research, the American physicist Geoffrey West (2017) argues that the increasing returns to scale of socio-economic output of cities, and their associated economies of scale in infrastructure development are inversely connected. Due to optimization processes – expressed by the fractal nature (*i.e.* scale-invariant) of both the social and physical networks shaping urban communities – they both generate an approximate 15% efficiency bonus (West 2017, 272). Thus, as the city grows, the infrastructure network that is imposed on the social network generates economies of scale which induce a concordant efficiency bonus in social interaction output and spill-overs (West 2017, 321).

Information flows are therefore not merely limited to communication between people. As we have seen in part 1.2.1, in its most basic definition, information can be considered as physical ordering. Information is therefore contained in the physical world around us, and therefore inherently deposited in the objects and structures providing the setting for human life (Hidalgo 2015). These objects allow people to communicate messages, coordinate our social and professional activities, and transmit knowledge and knowhow as the necessary 'software' that allow information processing to take place (Hidalgo 2015, xviii). Embodying information in matter requires people to push their computational capacities to the limit, often beyond what a single individual could ever achieve. Think, for example of such projects of enormous complexity such as the LHC collider in Switzerland, which requires huge amounts of knowledge and knowhow to be brought to completion. One need not only think of such recent megalomaniac projects to think of projects exceeding the individual capacities of a single individual, think for example of the many specialized and highly skilled workers needed to complete huge architectural projects, such as the Great Pyramids of Egypt or the Parthenon at Athens. Also, more mundane undertakings such as the construction of irrigation systems, building of ships or specialized artisanal production generally exceeded individual capacities of knowledge and knowhow. To fight these individual limitations, people need to collaborate and form social and economic networks that allow us to embody more knowledge and knowhow.
One crucial element to form such networks is the manufacturing and distribution of objects, helping us to increase our capacity to collectively process information (Hidalgo 2015). Obvious examples are written records such as books, inscriptions, law texts, etc. However, as we have seen, carrying information is an inherent property of every object, including everyday objects such as utensils, weapons and ceramic vessels. These objects can then be considered as the physical embodiment of information and context-specific properties that this information helps carry. The same holds true for the built environment at large. One cannot help but notice the parallels with Amos Rapoport's low level of meaning of the built environment, providing mnemonic cues of behaviour for people performing social activities within these settings (Rapoport 1982, 1988, 1990). Information is thus stored and accumulated in social and economic networks of people and objects. The nature and composition of a communities' social and economic networks is therefore of primordial importance for its subsequent development. The creation of information out of combined networks of people and objects, both on a social and economic level, has been called – somewhat poetically – the 'crystallization of imagination' (Hidalgo 2015). The underlying idea is that the complexity of the information embedded in the material framework created out of these networks is a reflection of the

complexity of the network itself, or in other words, the manifestation of the limits of its imagination. This ties back to the notion that a system develops by reacting onto stimuli received from its environment, meaning that the internal system can only become as complex as its external environment. Jeanne Arnold (1996), for example, distinguished between necessary preconditions for complexity and the consequences of complexity. The conditions for complexity are seen as the environmental and historical circumstances, or context, in which complex organization emerged, whereas consequences are defined as the intended or incidental results of increasingly complex organization. I will discuss the interaction between human systems and their natural environments in more detail in the next part.

Without the assistance of the material as a regulatory factor for information transmission, our sensory system would have much more difficulties coping with the increased demands resulting from increased social interactions. The material frame of a community has a slower replication rate and possesses more inertia than social activities, communication, and movement. It has therefore been suggested that major changes in nature and size of a community can only be sustained if a new assemblage of material aids to interaction and communication is developed (Fletcher 2007, 7). The material thus provides an integrative framework for daily life and a frame of reference for active behaviour as it carries non-verbal signals about the patterning of space and time (Fletcher 2007, 20). At the same time, material entities can also obstruct active behaviour due to the aforementioned inertia acting as barriers to signal transmission.

Social complexity and decision-making

It can by now be concluded that community formation and development of social complexity can be linked to a variety of processes such as population aggregation, social interaction, knowledge spill-overs, and the formation of social and economic networks of people and objects embodying knowledge and knowhow. The question to ask next is then *why* these people started to gather in the first place and what processes drove the development of their communities. In other words, what are the fundamental generative ‘forces’ or selection pressures of community formation, and what stimuli drove subsequent system development towards dynamics of increasing and decreasing complexity?

As a general statement, we can say that certain types of interactions must generate a set of concordant stimuli for system development.

Remembering sensitivity to initial conditions as one of the central tenets of the complex adaptive systems approach, the type of initial stimuli as generative forces driving community formation have huge impact on subsequent development, differing from one community to another. As the community develops, these ‘fundamental’ forces are enhanced along the way. Here an element of chance is inevitable. In one settlement, fortuitous presence of suitable clay beds may set the community on its way towards developing a pottery industry, whereas other communities nearby lacking such resources may become partially dependent onto this community for their needs. Of course, a community may very well have targeted the presence of suitable natural resources in the environment in the first place when choosing a location to settle. But even so, the element of chance should not be overlooked. It has been argued – based on a mathematical model of wealth distribution and population size – that inequality in the distribution of wealth is to be expected to occur by chance alone in human populations of a given size and wealth, even when prior differences among individuals are ignored (Mayhew and Schollaert 1980). Once a given community invests in certain avenues of development, it becomes increasingly difficult to break out of this set pattern. Sunk costs associated with continuing upon a set pathway because of the development of an interlocked system of interests then results in fixated pathways of development, from which a community can diverge only against great costs (see 1.2.4) (Janssen *et al.* 2003; Janssen and Scheffer 2004; van der Leeuw 2007, 215).

The principal causal factors in social development are often the material conditions of human existence, i.e., the demographic, ecological, technological, and economic forces at work in social life. It should be noted that any such causal factor operates probabilistically – following Turner’s selection pressures on human organization, see 1.1.3 – as variable states that, depending upon their valances, exert varying degrees of selection pressures on social organization (Sanderson 1999, 8–9; Turner 2003). The material conditions of human existence have such causal significance because they relate to basic human needs concerning the production of subsistence and the reproduction of human life. These selection pressures operate within societies as politically and geographically bounded systems. However, societies are never closed off to interactions with, and influences from, other societies. Development of human social systems therefore occurs both endogenously and exogenously, and neither of these can be causally privileged on *a priori* grounds. The exact delineation of processes driving development of complex societies are often strongly debated, with different theories emphasizing such factors as population growth, warfare, information management, economic specialization, and long-distance trade among others (Johnson and Earle 2000; Sanderson 1999; Turchin *et al.* 2015).

As different theories postulate different causal factors responsible for the evolution of social complexity, we must analyse which potentially explanatory variables correlate best with the observed system dynamics (Turchin *et al.* 2015, 81). To this end, we turn to an algorithmically formalized model[4] of decision-making processes proposed by Cioffi-Revilla (2005) who postulated that various driving forces, or stimuli, operate on the emergence and subsequent development of communities through a dual canonical – as in undergoing variations on a recurring theme – loop of signal detection, information-processing, and problem-solving resulting in either successful adaptation or failure of social organisation. This dual loop consists of a 'fast process' of crisis and opportunistic decision-making through collective action, which feeds a 'slow' process of socio-political development or decay. The model is designed to start from a 'blank' initial state of complete egalitarianism, to take into account the development of social complexity from pristine state development until present and even future dynamics of social organization (Cioffi-Revilla 2005, 133). The basic form of the model can be represented as: $A \leftarrow \langle (K) \wedge (C|K) \wedge (N|C) \wedge (U|N) \wedge (P|U) \wedge (S|P) \rangle$

With each symbol denoting a distinct fast-process event and the angular brackets indicating that the conjunction of events is ordered from left to right. The algorithm is represented graphically, along with the processes it represents and their potential outcomes, both for successful and unsuccessful adaptation, in Figure 8.

The model starts when a given social group (K) without any clear system of social organization and government is faced with serious situational changes or events (C). These events can be organized along a variety of lines, including both stresses and opportunities, endogenous and exogenous processes, social or physical in nature, and human or environmental induced. The nature of these situational events as stimuli of social development is purposefully left unspecified to facilitate wide applicability of the model.

Once the situational event occurs, it has to be correctly perceived by the social group and induce an understanding of the need to undertake a collective action (N). To do so, the situational event has to be correctly perceived and separated from alternative perceptions so that the right measures to counter it come to be understood by the community, as opposed to any possible alternative measures. If and only if both conditions are met (a Boolean AND operator), can collective action (U) be undertaken. For example, a community may perfectly well identify the situational event and perceive the need for collective action to be undertaken, but fail to identify the right measures to actually execute it (denoted by ~U in Figure 8). Undertaking collective action measures often involves the development of some kind of leadership within groups. To this end, potential leaders need to be available and willing to take on their new role, whereas the rest of the group needs to be convinced

[4] The PoliGen model was developed on the MASON (Multi-Agent Simulator of Networks and Neighbourhoods) platform, an open-source Java simulation toolkit developed as a collaboration between the Evolutionary Computation Laboratory and the Center for Social Complexity at George Mason University (http://cs.gmu.edu/~eclab/projects/mason/).

(either voluntarily or through coercion) to become followers by adhering their objectives and strategies to those of this potential leader.
Situational changes may or may not persist (P), resulting in either weak socio-political developments (W) or in collective action success (S). Undertaking collective action in itself does not guarantee political development or an increase in socio-political complexity. Even if successful, individual cycles of development such as have been described do not necessarily result in development of social complexity. However, when a social group or community is repeatedly successful in managing or overcoming serious situational changes, probabilistic selection pressures may occur under a specified set of conditions, yielding a long-term (slow) probabilistic accrual (or loss) of emergent socio-political complexity and development (A).

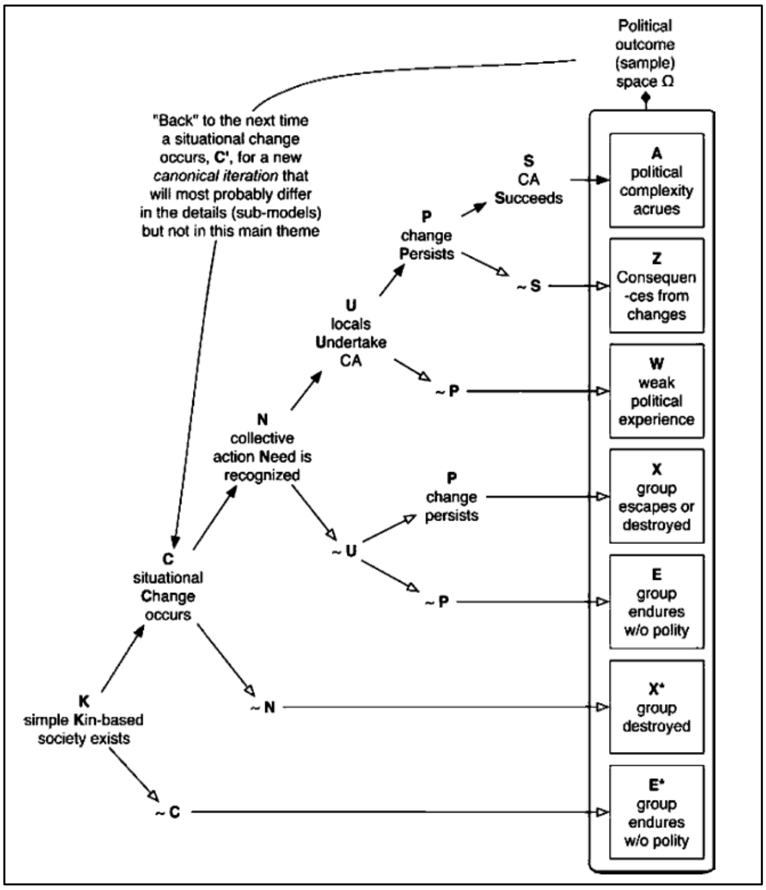

Figure 8: A canonical process of socio-political complexity development (Cioffi-Revilla 2005).

Variable pathways of development – depending on distinct situational processes – will necessarily result in different outcomes. Still, a number of general potential outcomes can be listed, including: 1) shared perception and understanding of threat or opportunity; 2) mobilization of resources for a common purpose; 3) experiential lessons about whom to trust and whom to distrust; 4) hierarchies of leaders and followers; 4) specialized assignments or division of labour; 5) protocols for sharing of information; 6) experience in coordination; 7) emergence of norms; 8) validation of social memory and capital (Cioffi-Revilla 2005, 147).

Costs of complexity

In this recursive model of socio-political development, complexity is effectively considered a 'problem-solving tool' (Tainter 1996, 2006). This corresponds to some general definitions of social development, for example by Ian Morris who provided both a minimal definition as "a measure of communities' abilities to get things done in the world" (Morris 2013, 5), and a more formal one, stating that "social development is the bundle of technological, subsistence, organizational, and cultural accomplishments

through which people feed, clothe, house and reproduce themselves, explain the world around them, resolve disputes within their communities, extend their power at the expense of other communities, and defend themselves against others‘ attempts to extend power” (Morris 2011, 144).
The various outcomes of the development of socio-political complexity can be combined to varying degrees within different modes of socio-political organization (the full state space of which is denoted with Ω in Figure 8). Depending on the situation, however, emergent leaders may choose different political policies as problem-solving strategies as different costs are associated with implementing different strategies, some being more difficult to maintain (Peregrine 2012). ‘Costs’ can then be interpreted either as requiring more individuals to be supported by the polity or, in the case of taxation, as a direct measure of costs borne by the polity. The corporate-network strategy, for example, generally displays the clearest pattern in terms of relative cost, with more corporate-oriented polities tending to have fewer levels of hierarchy, less role differentiation, fewer specialists, and fewer taxes (Demarrais *et al.* 1996; Peregrine 2012). Less costly, more stable strategies will generally survive for longer time periods than more costly and less stable ones. However, when faced with acute situational events, leaders may sometimes implement more costly and unstable strategies to contain the crisis more quickly. A leader will choose a strategy over which they have relatively strong control, and where only a handful of key supporters are needed to implement the strategy. Corporate strategies then require societal endorsement, which is a time-consuming and often difficult process, especially in the face of crisis.
Regardless of the ensuing mode of organization, with every iteration of the recursive loop, various subsequent strategies and solutions become superimposed, eventually generating a costly apparatus consisting of multiple, partially overlapping structures of administration, laws, and measures of socio-political organization, but also an intricate set of social norms and values, and various avenues of communication between people, social groups and central administration, all of which are costly to maintain. Performing every iteration of the loop, even if successful, therefore required more energy to be invested. In this sense, executing and maintain older measures of socio-political development will often induce additional stimuli or challenges for the community, requiring ever more measures to be undertaken in an ever-flowing loop of complexity development. Complexity as a problem-solving tool for both external and internal disturbance events can therefore explain what seems like a ‘natural’ tendency towards growing complexity in many social systems, whereas the infinitely more numerous potential pathways leading to failure of socio-political development and societal collapse (a potential state space associated with every subsequent step of the recursive loop) explains why only some societies ever did develop a complex socio-political configuration, whereas many more did not.

Not only can social complexity therefore be considered a costly development whose maintenance requires constant, renewed energy input in the form of expenditure of labour, money and/or time, as the process is a recursive one, there is a characteristic flow among these loops where societies generally tend to first use simple and cost-effective efforts with high returns, however, as the loop continues, solutions to maintain societal structures become more complex and costly, with ever-diminishing proportionate marginal returns upon investment (Tainter 1996). For example, exploitation of resources such as minerals, ores, and precious metals moves consistently from easily accessible, inexpensively exploited reserves to ones that are costlier to find, extract, process, and distribute as earlier sources are gradually becoming depleted. This general phenomenon of diminishing returns means that complexity always has a certain cost and recursive loops of development cannot go on forever. In a sense, every iteration of loop of socio-political development increases the possibility of failure or stasis. Episodes of developmental failure have generally been interpreted as ‘societal collapse’, which can be defined as a process of rapid simplification and loss of an established level of social, political, or economic complexity (Tainter 2006, 2016).
One of the main functions of social systems is to store exergy, among others in the form of food reserves, money, social and institutional structures, and other capital and assets. Larger and more complex societies would then require more efficient ways of buffering external and internal disturbances and thus more prosperity and higher standards of living (Muys 2013, 43). However, as a

society grows more complex, it tends to increasingly struggle with keeping up the pace due to the aforementioned diminishing returns on investment. The increased dissipation of stored exergy by social systems to increase complexity in response to disturbance events then becomes of crucial importance for understanding properties of resilience in these systems. To look at how societies generate the necessary energy to develop and maintain its external structures, apply various response strategies to environmental and social stress factors, and how some strategies result in potential system transformations and regime shifts, we must now look beyond the limits of a community/society as a bounded and autonomous unit. Societies never exist in a vacuum but operate within, and are affected by, the dynamics, cycles, and pulses of the ecological context through various feedback loops (Ostrom 2009). This interaction between social and natural systems will therefore be the main subject of the next part.

1.2.4 Human-environment interactions

In the previous part, I discussed the genesis and development of such complex social systems out of a variety of selection pressures operating within itinerated loops of signal detection, information processing, and problem-solving. I also described how stimuli generating these selection pressures can emerge both endogenously and exogenously, that is, from within the system itself or from its environment. In this part, I will shift from a focus on communities as information processing units to flows of energy and resources. Up until now, I have mainly focused on system dynamics in communities as bounded social units. However, to sustain community life, flows of energy and resources need to be redirected and invested towards the community. These flows typically originate from the natural environment. It can be noted that, to some extent, direct control over resources can be replaced with access to extensive trade networks with other communities, but full dependence on such networks is simply not feasible nor desirable for any community. We can therefore consider axiomatically that every community needs some extent of natural environment to derive the necessary energy and resources to sustain their own dynamics. At this point it is therefore essential to explicitly incorporate this wider environment into our approach.

A science of energy

It can be generally stated that not a single system or their agents and dynamics – be they social, ecological, artificial, biological, or any other in nature – could exist if not for the crucial element of energy. Everything and everyone needs energy to come into being and to keep on living. Energy can be generally defined as “the capacity for doing work” (Smil 2006, 8). The link between energy and work goes all the way back to the coining of the term (*energeia*) by the ancient Greek philosopher Aristotle (384-322 BCE), who used it to denote a form of ‘being in the world’, or rather that which support one’s being in the world (Smil 2006, 1). Energy therefore creates the conditions for (social) life, but at the same time, the limitations on exploiting and transforming energy into usable exergy also offers the ultimate boundaries for these dynamics to develop.

A genuine science of energy started really started to develop in the early 19th century, with the works of French engineer Sadi Carnot (1796-1832), who determined some of the universal principles of producing kinetic energy from heat, and German chemist Justus von Liebig (1803-1873), who was one of the founders of modern chemistry and offered a nearly correct estimation of human and animal metabolism (Smil 2006, 3–4).The works of German physician Julius Robert Mayer (1814-1878) proved that heat and work were equivalent and laid the basis for the law of conservation of energy, which states that “the amount of energy within closed, isolated system remains constant”. Extending this principle, the first law of thermodynamics stated that as energy passes in or out of the system as work or heat, the system’s internal energy changes accordingly to the law of conservation of energy. This definition was extended by Albert Einstein, who concluded that mass is a form of energy as well (described through the famous equation $E = mc^2$).

In 1865, German physicist Rudolf Clausius (1822-1888) first coined the term of entropy to measure the degree of disorder in a closed system, or more formally, the number of possible configurations a thermodynamic system can have in a specific state. Ludwig Boltzmann (1844-1906) then added a probabilistic dimension to the concept of entropy by defining it as the fraction of indistinguishable – or equivalent – arrangements of a given system compared to the total system state. High entropy then means there are many more ways in which the constituent parts of a system can be arranged without seeing macroscopic difference. Clausius also formulated the second law of thermodynamics, saying that “natural processes are accompanied by increasing entropy within the system”. In terms of probabilities, this means that as there are many more different ways for a system to be arranged in high entropy compared to low, all systems have tendency to move from low entropy to high entropy. This process entails that, in a closed system, the availability of useful energy can only decrease and therefore, overall entropy of the universe irreversibly tends to the maximum (this law lies at the basis of the projected ultimate fate of the universe: heat death).

The Russian-born (and Belgian-raised) physical chemist Ilya Prigogine, who won the Nobel Prize for Chemistry for his milestone contribution on dissipative structures theory, noted that although all birth, growth and development of organisms and systems on this planet entails the concentration and local increase of energy, this does not ultimately violate the second law of thermodynamics as the second law applies on closed systems under thermodynamic equilibrium. Although the universe as a whole may be considered as such, Prigogine demonstrated that the Earth is an out-of-equilibrium pocket of energy and information within the larger system of the universe (Prigogine 1968).

Erwin Schrödinger (2012) likewise recognised that all living systems within this world of energy and material fluxes can be considered an open system which imports external energy (mainly solar energy) to sustain its own operations and produce a lower entropy, more organized state within itself (Kay 2000; Kay and Schneider 1995). During this transformative process, part of the capacity of energy to perform work is lost. The thermodynamic concept of exergy is used to denote the maximum capacity of the energy content that can be used by the system, accounting for energy loss during transmission or transformation. It should be noted that it primarily describes the quality of energy. For example, water on top of a cliff has a high exergy content because its potential energy can be used to perform work by driving water mills or turbines, whereas if the water were to fall down freely from the cliff towards the rocks below, the same water below as a much lower exergy content, despite having the same energy content (Kay 2000, 6).

Locally, the second law may therefore be suspended (or better, temporarily halted) in pockets of high energy, whereas overall increase of entropy can never be warded off (Coveney *et al.* 1990; Prigogine 1968). Out-of-equilibrium systems – that is being not in thermodynamic equilibrium, or in other words, in a state of complete energy dissipation or full entropy – are characterized by information-rich steady-states as information emerges spontaneously through energy flows allowing matter to self-organize. Information must here be seen in its most basic definition as ‘physical ordering’, or the arrangement of particles in a specific configuration. According to Shannon’s theory of cybernetics, information is then the minimum number of bits (unit of information) needed to communicate an arrangement (Shannon 1948).

Prigogine’s dissipative structures can be defined as any system based on dissipation of energy, for example every living thing that needs energy to maintain its existence, both biological and social. As a system becomes more complicated, it slows the flow of free energy that passes through it and energy spends more time in the system. The extended duration of energy flows within the system result in the system absorbing and storing energy and use it to increase its order and structure (Bausch 2001, 30). As exergy flows are absorbed by the system, it moves increasingly away from a thermodynamic equilibrium state (that is, a state of entropy) as a larger number of organizational (or dissipative) opportunities and structures become available (Kay 2000, 6). By producing more complex components, the system itself becomes more complex, as information and orderliness increases at the expense of the energy flowing through it (Csányi 1989, 34). This information is embedded in the physical structures of any given complex system, such as the buildings of a city, but also the bodies of its inhabitants. Information therefore is 'sticky' as solid matter allows information to endure and be recombined for longer periods of time (Hidalgo 2015). As dissipative structures self-organize through energy fluctuations pushing them farther from equilibrium, informational structures become increasingly elaborated.

Energy flows in coupled human-nature systems

As with all complex systems, societies need to derive energy and resources from the environment to maintain and develop its internal structures. Social systems ‘work’ by converting external energy derived from the environment into internal exergy. Complex societal systems can generally apply four different strategies of exergy use: 1) store it to keep it available for future use; 2) use it for system maintenance; 3) for buffering; or 4) for luxury consumption, that is exergy consumption not leading to one of the former two outcomes (Muys 2013, 43). In an evolutionary perspective, the latter generally is expected to be eliminated by selection pressures in times of crisis or system disturbance. The process of appropriation and transformation of energy and resources is organized and constrained by the institutions and structures of a given society (including its technological level, see van der Leeuw 2012, and *infra*). Human societies must be considered to be inherently embedded in nature, as they affect, and are affected by, the dynamics, cycles, and pulses of their ecological environment through relationships of exchange of energy, materials, and information (de Molina and Toledo 2014, 22).

Coupled social and ecological systems already featured to some extent in the archaeological systems thinking of David Clarke (1968) and Karl Butzer (1982), as well as in sociology with Walter Buckley’s (1967) conceptualisation of social systems as adapting to their environments through input/output relations within morphogenic processes. In anthropology as well, the works of cultural ecologists have focused on the interplay between the human and environmental system (Redman 2005, 70). Prominent among them are Emilio Moran (1990), Julian Steward (1972), and Andrew Vayda (1969). In these approaches, the main focus was still mainly on the social domain, with limited attention for the wide potential variety of external stimuli and constraints, and under-theorization of the differential interlinking between social and natural systems. These system conceptualisations were also explicitly equilibrium-based, applying various homeostatic controls to remain near such an equilibrium state.
Within human-environment studies, traditional equilibrium-based ways of approaching the relations between society and nature, more specifically exploitable nature, have been expressed through the concept of carrying capacity, aimed at calculating the maximum sustainable yields per given land and often mentioned in the same breath as ‘population pressure’ (Cote and Nightingale 2012, 478). A more in-depth review of the history of carrying capacity will be provided in part Subsistence. While carrying capacity approaches have offered highly valuable contributions to our discipline, it can be noted that these approaches have difficulties in accounting for the human ability to change their environment through technological innovation or dealing with the effects of socio-cultural aspects, such as foodways and social/economic inequality (Dincauze 2000; Lemmen 2014). It has been realized in recent years that to move beyond the limitations of such equilibrium-based approaches, human-nature studies need to move toward a more fluid, dynamic, and non-equilibrium (or at least multiple equilibria) based analysis (Redman and Kinzig 2003; Schoon and van der Leeuw 2015). To do so, traditional calculations of carrying capacity need to be extended to include a holistic approach towards flows of energy and resources needed to sustain a population across all societal domains, including not only subsistence strategies, but also, for example, techno-productive systems, exchange networks, and construction works. One concept which offers a potentially suitable avenue to develop such a framework is that of social metabolism (de Molina and Toledo 2014).

Carrying capacity approaches generally relied on conceptualizations of ecological systems as static systems where biophysical dynamics tend towards stable equilibrium states, whereas change is exceptional and therefore considered as ‘noise’ that must be analytically suppressed (Holling, Gunderson, and Ludwig 2002). In the 1970’s, the field of resilience thinking emerged as a counter narrative out of dissatisfaction with these prevalent models of ecosystem dynamics (Cote and Nightingale 2012, 476–78). In a seminal paper, Holling advanced the concept of ecological resilience as the capacity of systems to absorb disturbance while retaining the same populations or state

variables, or in other words, the ability of a system to remain organized around the same set of processes, structures, and functions (Holling 1973, 14). This is a distinctly different view of resilience compared to the more traditional engineering approach, which assumes a single steady system state and defines resilience as the return time to equilibrium after a system has experienced a disturbance (Pimm 1984). Through the renewed lens of resilience thinking, the focus has shifted away from the quantitative availability of resources, and towards the scope of available response options (Cote and Nightingale 2012, 478). We could for example look at how a society dealt with spatial and temporal variability in resource availability, for example by exploiting a portfolio of resources that do not co-vary – i.e. when one is stressed, the other is not – or by combining physical and social infrastructure, such as food storage facilities and redistribution systems, to buffer resource variability (Anderies 2006, 133).
As a result of this shift in focus, human-environment relations could no longer be conceived as separate systems with diverging objectives and trajectories. The emphasis on feedback dynamics between social and ecological systems encourages the view that these cannot be conceived in isolation, but must rather be seen as inherently interconnected. In recent decades, various frameworks have been proposed to approach the synthesis of human and natural systems, with various terms and acronyms in use as well, including coupled natural human systems (CNH), coupled human and natural systems (CHANS), coupled human-earth systems (CHE), complex social ecological systems (CSES), social-ecological-technological systems (SETS) and many others (for an overview and discussion, see Binder *et al.* 2013). While different terms stress different key factors or starting point, mutual similarities are sufficiently strong for us to take abstraction of peculiarities and minor differences and refer to this general body of work through the more general term of social-ecological systems (SES).[5]

More recently, SES has been particularly advanced as the most common expression of studies on this intertwining of social and ecological dimensions of reality (Berkes *et al.* 1998; Ostrom 2009; Schoon and van der Leeuw 2015). The SES framework has been under development from the 1980s onwards, starting with the political economist Elinor Ostrom (1990) who wanted to tackle the study of common-pool resources and solve Hardin's (1968) 'Tragedy of the Commons'. She focused specifically on small-scale, community-based natural resource management and self-governance. From the 1990s onwards, Ostrom increasingly started to combine her work on common-pool resources started building upon linkages with the works of resilience scientists such as Holling, and embarked on a new approach to the study of 'complex social-ecological systems' (Ostrom 2009). The term 'social-ecological systems was first coined by Gallopin (1991) and strongly advanced by the works of Berkes and his colleagues (Berkes *et al.* 1998, 2013). This new diagnostic approach was specifically focused on identifying key variables that could affect long-term sustainability of these social-ecological systems and allow for cross-case comparisons (Schoon and van der Leeuw 2015, 170).
Key elements of a SES are the interactions between core components such as a spatially delineated resource system, resource units available within this area, the users of those resources, and the governance system regulating use of and interaction with these resources, as well as the effect of the outcomes of these interactions onto both resource units and resource users (Figure 9). Ostrom's SES approach provides a clear framework to analyse the complexity of interdependence of these sub-systems, as well as to assess the variables characterising them – such as overuse, conflict, collapse, stability, increasing returns – through patterns of interactions and outcomes within an integrated system structure (Ostrom 2009)
A SES can therefore be considered an internally coherent bio- and geo-physical unit associated with social actors and institutions though structures of resource appropriation and governance. The weakness of the framework is then that it *a priori* focuses on a delineated resource system with concordant governance system, for example a designated wildlife protection park or coastal fisheries (Ostrom 2009, 420). When applying the SES framework to societies as a whole – especially in the past

[5] For this decision I follow the "*Best practices for Integrating Social Sciences into Social Ecological Systems Science*" report of 2015 by the National Science foundation (https://iris.ucl.ac.uk/iris/publication/1098391/1).

– we must extend the framework to include a more fluent interaction between society and nature, driving dynamics of change and development within a systemic context. For coupled social-natural systems such as communities with a dependent hinterland, clear-cut delineations of resource systems and concordant governance systems are not easily made, moreover, the extent of this area may vary strongly through time. To apply this approach in archaeology therefore needs to allow for the inclusion of potential mismatches between delineated resource systems and concordant governance structures.

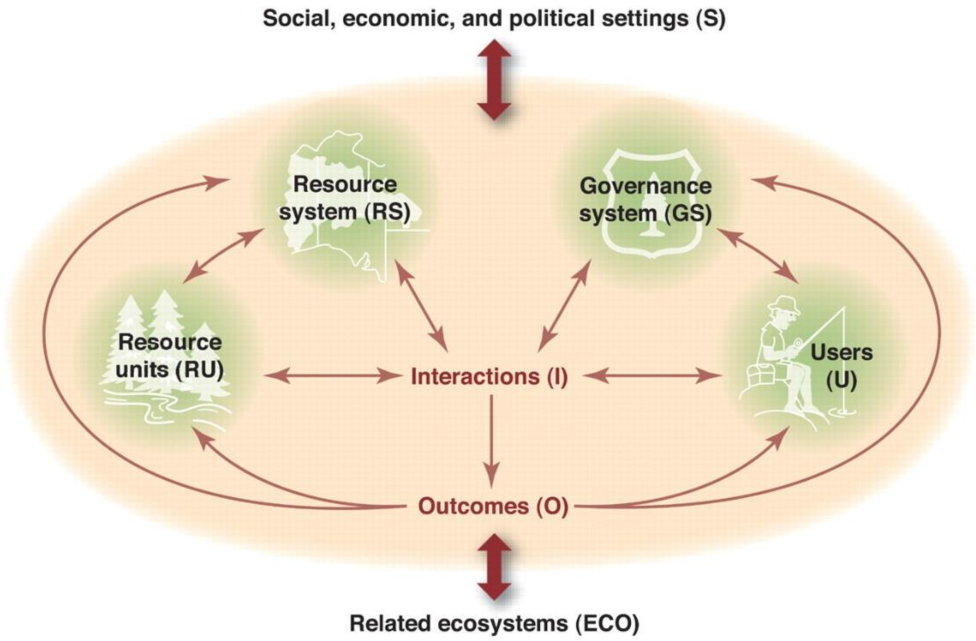

Figure 9: Core components for analysing a social-ecological system (SES) (Ostrom 2009).

A given area may at different points in time be firmly connected to community A, whereas in other times it may be linked to community B, and sometimes it may not be firmly connected to either one but rather loosely coupled with both, or none at all. If we are to understand the various dynamics between societies and their environment in the past, our models must incorporate such ambiguity and temporal changes. This way, spatial developments are constituted socially through the interaction between nature and society (Poblome 2015, 100). This approach therefore helps to advance the conceptualisation of space as a social construct reproduced through contained social practices rather than delineated geographical units.

I will advocate here the use of two principal concepts to extend the SES framework towards possible solutions for these problems and thus advance their use in archaeology: social metabolism and the adaptive cycle. Both have developed out of the field of resilience-based ecology described here, and hold enormous potential to trace, describe, analyse, and understand flows of energy and resources between society and nature, both in the present and in the past.

In a recent paper, Filatova and colleagues (2016, 335) ushered four major challenges for exploring SES approaches and regime shifts: 1) sources of regime shifts; 2) feedbacks between social and environmental systems in coupled SES; 3) conceptualising complexity aspects; 4) regime shift identification. I argue that to a certain extent, all four aspects are at least discussed and hopefully also slightly improved upon in the course of the present thesis. The first aspect of regime shift sources has already been discussed from the social perspective through those fundamental forces acting as selection pressures for social organisation and the framework of canonical socio-political complexity development. For the second, I wish to put forward the concept of social metabolism, which will be discussed in the following part, as a suitable framework to describe socio-environment feedback mechanisms through the flows of energy and resources going between both system components. For the third, I will argue that the concept of the adaptive cycle offers a highly suitable framework for aligning resilience theory with aspects of complex systems by describing the various spatial and institutional changes and developments within wider system dynamics characterized by nonlinear effects and threshold values. Finally, to identify regime shifts, interlinked adaptive cycles within the panarchy framework offers a highly suitable approach to analyse the necessary multi-scalar dynamics across time and space. This also ties in with Ostrom's (2009) appeal for more explicitly interscalar analyses in resilience theory.

Flows of energy and resources: social metabolism

Ever since the 1990's, the concept of social metabolism has exploded onto the field of socioenvironmental studies, as a suitable perspective to determine, trace, quantify, analyse and interpret these multiple relationships of exchange in energy and materials. It was generally defined as "the particular form in which societies establish and maintain their material input from, and output to, nature and as the way they organize the exchange of matter and energy with their natural environment" (Fischer-Kowalski and Haberl 1997). It has been used both as a theoretical framework for explaining socioenvironmental change and as a set of methodological tools to analyse specific flows of biophysical behaviour (Weisz 2007).

Although it became increasingly prominent in the 1990's, the concept itself can be traced back to the 19th century, when it was used for comparisons of different, yet structurally similar, systems. One of the first to apply the metaphor of metabolism to social systems, in analogy to living organisms, was Karl Marx (1818-1883) who used it to describe the metabolic flows of material commodities and interactions between society and nature (As discussed in Schmidt 1971). Energy flows were only later on incorporated by the Ukrainian medic and philosopher Sergei Podolinsky (1850–1891) who studied the energy return to input in a framework of reproduction of the social system (Alier and Naredo 1982). During most of the twentieth century the concept of metabolism was mainly applied within the fields of biology and ecology (Wolman 1965; Ayres and Kneese 1969; Meadows *et al.* 1972).

The application of the concept of metabolism on social systems has been argued for based on the human species' capabilities for communication and cooperation (Fischer-Kowalski 1997, 124). Collective organisation is of crucial importance for human survival and reproduction. A communal group's collective metabolism then minimally equals the sum of the metabolisms of its individual members, in addition to the extra energy requirements of maintaining social organisation. Metabolic analyses of social collectives at first were mainly preoccupied with assessment of energy flows. The American anthropologist Leslie White for example considered energy capture as an important driver of social evolution and used measures of appropriation and harnessing of energy flows to classify societies' level of evolution, represented mathematically as the product of the amount of per capita energy times the efficiency of conversion determined by level of technology ($C = E \times T$) (White 1949, 366).

It was only towards the end of the twentieth century that metabolism was reintroduced as a useful way of analysing material flows in social systems as well, and it has been front and centre of many contributions to social and ecological resilience thinking ever since (Baccini and Brunner 1991; Ayres and Simonis 1994; Fischer-Kowalski and Haberl 1993; Fischer-Kowalski 1997). Broadly defined, social metabolism entails the entirety of biophysical analysis of exchanges in matter and energy between society and nature. Three types of material and energy flows can be distinguished – input flows, inner flows, and output flows – subdivided in five functions: appropriation, circulation, transformation, consumption and excretion (Figure 10). These metabolic functions can operate on two distinct levels: an individual or biological, and collective or social.

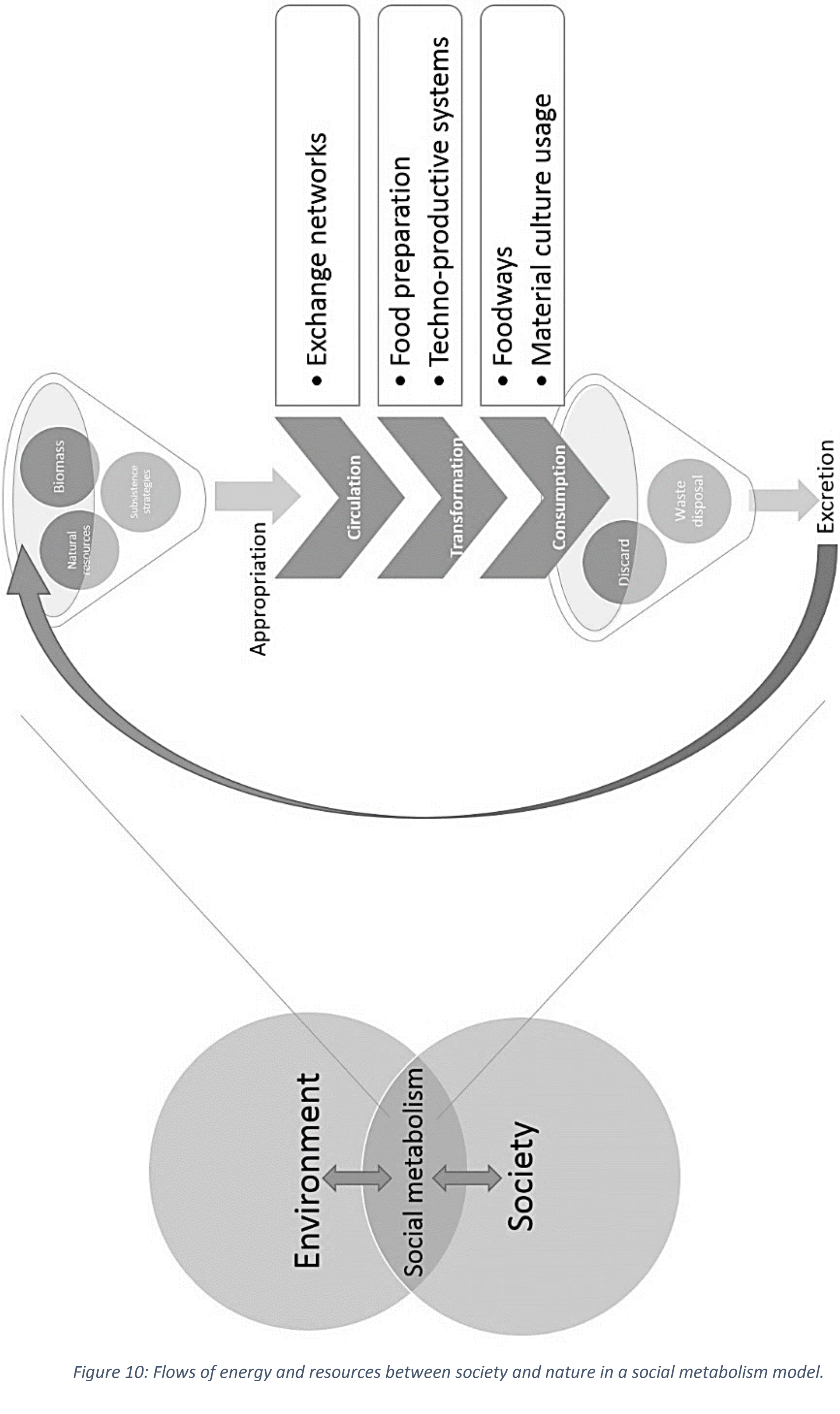

Figure 10: Flows of energy and resources between society and nature in a social metabolism model.

For example, appropriation processes at the individual level consist of human beings extracting oxygen, water, and biomass from nature in order to survive. Everything we do ultimately requires energy, even sitting still our bodies expend energy to keep its metabolism going, performing functions such as breathing, maintaining body heat, pumping blood, etc. without any conscious thought needed. Energy comes in a variety of forms, most commonly as (but not limited to) heat (thermal energy), motion (kinetic energy), light (electromagnetic energy), and chemical energy (Smil 2006, 10). The latter is mainly contained in biomass (plants, animals and people) and fossil fuels and represents a massive source of energy for human societies exploited throughout history.
At the social level, a collective unit of individuals connected through certain social relations (for example a family, company, or community) also extract matter and energy from nature to ensure maintenance and reproduction (de Molina and Toledo 2014, 60). All forms of societal development, fundamentally require energy capture and exploitation to fuel its operations. In any living system, increased complexity therefore carries a metabolic cost (Tainter 2016, 35). This is in clear contrast with progressivist views of social evolution who consider increasing complexity to be an inherent and unavertable property of human societies (Bronowski 1973; Childe 1950; Diamond 2005; Morris 2011, 2013). These approaches argue that mechanisms of complexity development operate upon the potential derived from storage of energy surpluses in a given society. One classic example discusses the possibilities offered by technological innovations such as the development of agriculture, allowing people to store food surpluses and endow the necessary free time to allow the emergence of 'civilization' (Childe 1950). These approaches therefore consider surplus energy to precede and facilitate development of complex social configurations. However, it has been noted that surplus energy within a complex system is generally quickly dissipated and that human societies therefore rarely had surplus energy to be exploited (Tainter 2011a, 90; 2016, 35). Increasing complexity therefore does not always lead to greater energy flow within the system, as greater complexity also results in more costly economic and administrative structures (Tainter 2006).
Due to the process of diminishing returns on investment, societies are increasingly put under strain unless new sources of energy are found. Those few exceptional events in human history where innovations in exploitation of new energy sources with enormous potential occurred, were of such primordial importance that they are colloquially denoted with terms such as the 'Agricultural Revolution' or 'Industrial Revolution'. In short, for most of human history these approaches simply do not suffice. In the view of complexity as a problem-solving tool presented earlier, any available energy would be quickly tied up with and exploited by new measures of collective action. Inexpensive energy exploitation measures generate increasing complexity at first, but through a combination of generated problems associated with these exploitative measures (for example waste production) and diminishing returns on investment setting in, solutions need to be developed to deal with these problems, intensifying energy capture but again increasing complexity. This recursive dynamic has been termed the energy-complexity spiral (Tainter 2016, 35). In this view, the 'progressivist' order is reversed, and complexity development precedes measures that increase energy availability. Complexity development therefore induces energy exploitation, but can then only be sustained on the condition that energy is effectively made available. This view aligns with the realization that energy availability sets the constraints for the development of social complexity and organisation.

The distinction between the level of the individual and the collective level of energy appropriation can be extended towards all subsequent phases of the metabolic process. The division between individual and collective metabolism corresponds to a distinction made by the American biophysicist Alfred Lotka (1956), between endosomatic use of energy in nutrition (bio-metabolism) and the exosomatic use of energy by tools (techno-metabolism). It has been argued that the flow of endosomatic metabolism remains fairly constant in time and is directly related to population size, whereas exosomatic metabolism is more variable and depends on the amount of technological capital present in society (Giampietro *et al.* 2011, 187). Because of these more or less stable endosomatic energetic needs, we can calculate subsistence costs through the use of basic tables of general caloric needs of a community based on calculations of population size.

For exosomatic metabolic needs, on the other hand, a contextualized analysis of socially determined practices will be needed, as the ways human beings are organized in society will determine the way in which they affect, transform, and appropriate nature, which in turn conditions the way in which societies are configured (de Molina and Toledo 2014, 60). To this end, we must look at the specific ways that exploitation of resources, habitation, burial, artisanal activities and worship was organized in a given society. As endosomatic energy needs per capita generally remain stable, the development of social organisation can then only take place through the expansion of socio-metabolism beyond the addition of the bio-metabolisms of all its members, or in other words, through an expansion of exosomatic energy dissipation. In this way, the exo/endosomatic energy ratio has been used as an indicator of the level of material complexity of societies (Giampietro 2003).

Depending on the scale of analysis and the level of exosomatic energy expenditure, different modes of metabolism can be identified, including rural, urban, agrarian, industrial, regional, national and global metabolism (For an overview of key publications, see de Molina and Toledo 2014, 5). To conclude this part, I would like to shortly highlight in particular the aspect of urban metabolism as a major avenue of energy exploitation and transformation. The social metabolism associated with urban life has resulted in an enormous increase of energy expenditure associated with the basic biological metabolic rate. Whereas we only derive on average 2000 food calories per day, or about 100 watts, per capita energy expenditure related to food provision in modern cities of our Western society can reach up to 11,000 watts (West 2017, 373). Naturally, the difference is not primarily related to increased food consumption *per se*, but mainly to production, transportation, distribution, and marketing exerted by a far more extensive supply chain moving goods from farms to stores and beyond, up until the customer. Although modern supply chains in industrialized societies greatly exceed those of the past, it illustrate the remarkable impact of urbanization.

Similarly, intensification of processes such as economic production and construction works always need to be sustained by increased energy expenditures. The availability and processing efficiency of energy therefore constitutes the most basic of constraints on the development of social organisation. It is only within the parameters set by the flows of energy and resources between society and nature that the former can develop. It is out of the configurations of these flows that stable societal configurations can emerge. In the next part, I will turn to the adaptive cycle framework to describe and explain such patterns of change and stability in socio-ecological systems.

Change and stability in socio-ecological systems: adaptive cycles

In the 1970's, a seminal paper by C.S. Holling (1973) heralded the rise of the field of resilience thinking as a counter narrative out of dissatisfaction with prevalent equilibrium-based models of ecosystem dynamics. Holling defined ecological resilience as the capacity of systems to absorb disturbance while retaining the same populations or state variables, or in other words, the ability of a system to remain organized around the same set of processes, structures, and functions (Holling 1973, 14). The concept of resilience has proven to be a popular one in archaeology, especially in recent years as archaeologists increasingly sought to position themselves within debates wider contemporary relevance regarding sustainable development and long-term dynamics within coupled human-environment systems and various potential societal response options to environmental challenges (among others: Barton *et al.* 2017; Bicho *et al.* 2017; Blanton 2010; Bradtmöller *et al.* 2017; Cote and Nightingale 2012; Davidson 2010; Faulseit 2016; Gronenborn *et al.* 2014, 2017; Marston 2015; Peregrine 2017; Redman 2005; Redman and Kinzig 2003; van der Leeuw and Redman 2002).

One of the debates where resilience thinking has especially provided rich contributions to archaeology is that of phases of dramatic societal transformation, traditionally gathered under the moniker of societal collapse. In a recent volume edited by Ronald Faulseit (2016), various contributors seek to reassess traditional conceptualisations of collapse, instead focusing on alternative terms such as societal transformation to denote the full extent of possible outcomes of transitionary phases (including collapse, reorganization, revitalisation…). Collapse is then specifically defined as a rapid (over a few generations) decline in socio-political complexity or the demise of a particular political system (Faulseit 2016, 5). Resilience on the other hand, is considered more difficult to define as it is often vaguely conceptualized by characterizing the vulnerability of a particular unit and its ability to adapt to, cope with, or transform when facing both acute and chronic stresses (Faulseit 2016, 6; Keck and Sakdapolrak 2013).

Adjustments to stimuli and challenges (both internal and external) can be performed through either mitigation or adaption. The former refers to actions that reduce exposure to changes, for example, through regulation, location, or technological shifts, whereas the latter refers to the adjustments that populations take in response to current or predicted change (Nelson *et al.* 2007, 397). Two distinct characterizations of resilience in archaeology can be identified, both related to range of possibilities associated with societal transformation: 1) the ability to maintain, or quickly restore, in the face of a challenge, conditions considered highly desirable (Cowgill 2012, 304); 2) maintenance of cultural aspects, such as worldview, kinship, and language, in civilizations that experience a decline in socio-political complexity (McAnany and Yoffee 2012). It has been noted that resilience is fundamentally about "the capacity of an institution to adjust to perturbations . . . [It is not about] stability around a single state, but rather the possibility of multiple socioecological states that maintain the primary functional relationships of the socioecological system" (Redman *et al.* 2007, 118)
Conceptualisations of complex systems in resilience theory have focused on such core components as functional diversity in building resilience to perturbations (Folke 2006; Nelson *et al.* 2011; Ostrom 2005; Walker *et al.* 2006) and connectivity (Kidder *et al.* 2016; Stiner and Kuhn 2006). Diversity is commonly seen as an important source of response options of a socio-ecological system as it helps to absorb disturbances and re-organize system structures after stress events. Others however, have in turn warned against the detrimental effects of diversity for socioecological resilience (Levin 1999). Resilience theorists often claim social diversity plays the same stabilising role in social systems, however it has been noted that trade-offs exist in costs and benefits, as high social diversity might for example impede mobilization of large amounts of people for a common cause and therefore detract from capacity for collective action (Anderies 2006).

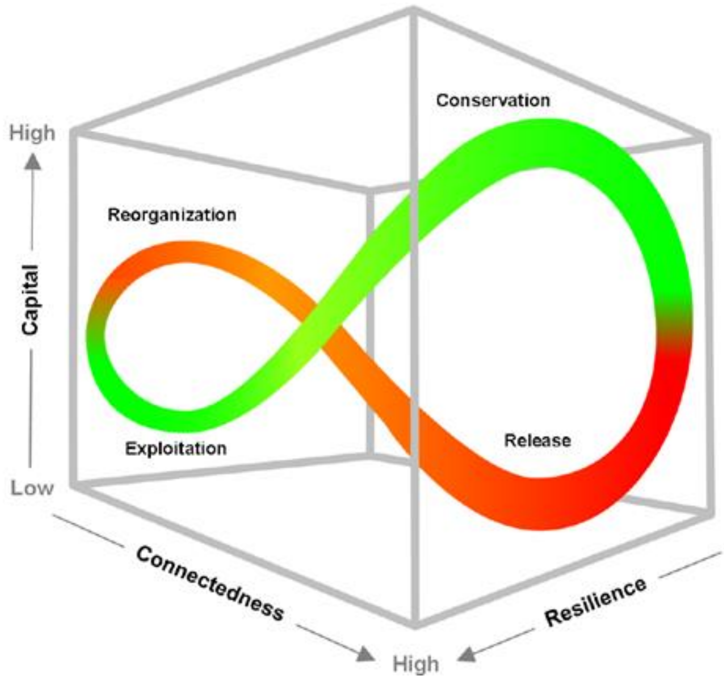

Figure 11: Adaptive cycle (Holling and Gunderson 2002: 41).

The key methodological and conceptual linchpin of resilience theory is the adaptive cycle (Figure 11) (Berkes *et al.* 2003; Gunderson and Holling 2002; Iannone 2013; Redman 2005; Redman *et al.* 2007; Walker *et al.* 2006). This framework can be considered a wholly different level of SES conceptualisations compared to social metabolism. Whereas the latter offers a specific gateway into

the workings and dynamics of a given metabolic unit, the former provides a wide and large scale integrative framework to describe change and dynamics in complex systems. The potential of the framework for archaeological research has gradually gained recognition and adaptive cycles have in recent years seen a number of archaeological applications (among others: (Aimers and Iannone 2013; Daems and Poblome 2016; Gronenborn *et al.* 2014; Nelson *et al.* 2006; Charles Redman and Kinzig 2003; Thompson and Turck 2009; Weiberg 2012; Widlok et al. 2012; Zimmermann 2012), including even a dedicated thematic volume in *Quaternary International* (Grimm *et al.* 2017). One of the contributions in this volume provides an excellent overview of applications of resilience theory and adaptive cycles in archaeology (Bradtmöller *et al.* 2017).
The adaptive cycle framework was mainly developed in the works of Lance Gunderson and C.S. Holling (Gunderson and Holling 2002) to trace general patterns of ecosystem development. Combining research strands of economics, ecology, institutional theory, and complex systems theory, the adaptive cycle aims to describe and explain processes of transformational change in human and natural systems. The framework is based on conceptualisations of the dialectic between shifting and stable human-environment interactions among multiple scales resulting in discontinuous structures exhibiting flexible and adaptive behaviour (Holling *et al.* 2002). It advances a number of key properties regarding dynamics of change in human-environment systems.

First, it must be realized change is neither continuous nor chaotic, rather it is episodic, consisting of periods of slow accumulation of capital and structures punctuated by sudden releases and reorganization (Holling and Gunderson 2002, 26). The link with Stephen Gould's concept of punctuated equilibrium (Gould 1999) has been noted earlier (see 1.2.1). However, it should be noted that part of the criticism levelled at the adaptive cycle has precisely focused on its seemingly superficial parallelism with other models. It has been argued that because of the general nature of the dynamics it can potentially describe and its tendency for oversimplification of complex system dynamics, the framework is rendered no more useful than a mere metaphor for system change (Gotts 2007).
It should be noted however that a similar criticism has been levelled against the perceived determinism of general system theory (Hodder and Hutson 2003), neglecting the role of human agency (Plunkett *et al.* 2013). On the other hand, conceptual flexibility can just as well be an asset for any model or concept if applied with sufficient rigour (Weiberg 2012). It can moreover be countered that not all systems and system dynamics fit within the adaptive cycle model (for an overview see Cumming and Collier 2005). Still, the criticism is not entirely unwarranted, especially given that Holling and Gunderson themselves conceded that at least for its general initialization, the framework functions more as a metaphor to help interpret events and their causes and consider the cycle in and by itself to be too general to be viewed as a testable hypothesis (Holling and Gunderson 2002, 49). They do however suggest that it can be highly valuable as an overarching classificatory framework to trace dynamics of change in coupled socio-ecological systems and use these to develop more specific questions and hypotheses. This way, the adaptive cycle can be advanced at least partially beyond mere metaphorical uses to actually uncover and explain underlying mechanisms at play in system development
Secondly, processes of change operate at different rates, spanning several orders of magnitude, both on a spatial and temporal level. However, while theoretically spanning a continuum of resolution scales, these processes generally tend to cluster around a few dominant frequencies (Holling and Gunderson 2002, 26). This is the rationale behind the frequent tripartite division in micro-meso-macro scale, but is in the context of the panarchy considered as 'lumpiness' (Holling *et al.* 2002, 77–98). While real-life processes need not necessarily follow this classification, with more fine-grained dynamics operating between different scales, they do offer a useful construct to analyse various processes of change in system dynamics. What is important, however, is to find adequate mechanisms to connect individual scales into a coherent multi-scalar framework. The adaptive cycle work explicitly conceptualises such intra-scalar connections by integrating individual cycles into an overarching framework called a panarchy. In this multi-scalar framework, episodic changes are caused by nonlinear interactions between small, fast and large slow cycles and variables. The extension towards the multi-scalar framework of panarchy will be expanded in the next part.

The adaptive cycle describes changes in three dimensions or parameters: 1) potential for change, determining the range of possible options of system development though accumulated capital; 2) degree of system connectedness between internal variables and processes, reflecting degree of flexibility or rigidity of system controls; and 3) system resilience, measuring vulnerability to unexpected disturbance events (Holling and Gunderson 2002, 32–33). All three dimensions move simultaneously through four phases: exploitation (r), conservation (K), release (Ω), and reorganization (α). The symbols for these phase names may at first come across as a bit strange, but there is a logic to it. The release and reorganization phases are respectively denoted by α (alpha) and Ω (omega), naturally representing the first and last letter of the Greek alphabet. The alpha and omega of a process thus represents its beginning and end. The r and K phase symbols are derived from the naming conventions for the logistic equation, with r representing the instantaneous initial rate of growth and K the sustained plateau of the curve. In ecology, these terms are used to denote r-strategists and K-strategists, where the form denotes those explorative species quickly occupying a certain ecological niche through extensive dispersal, rapid growth and high reproduction rates. K-strategists tend to have slower growth rates and lower reproduction rates.
Likewise, the r-phase of exploitation entails a rapid phase of development characterised by low connectivity between system components, high resilience, and quick initial accumulation of potential – here used in the sense of capital, resources, knowledge, social networks of cooperation, leadership and social trust – all available for the system to shift into new state phases or initiate new dynamics. In short, the construction of new niches for (social and biological) populations to originate and develop. Associated processes include rapid movement into uninhabited or sparsely populated landscapes, population growth, and development of new technologies and food acquisition strategies (van der Leeuw 2007, 215). An example of an r-phase situation may be the development of a new economic niche resulting in novel opportunities – take for example the development of internet-based companies after the development of the world wide web – where initially a high number of start-up firms competed to gain part of the market share. As competitive processes played out, the number of competitors winded down until a stable configuration with a small number of strong companies was formed (that is, the start of the K-phase, see *infra*). The r-phase can be considered to be highly resilient because of the abundance of available resources, high level of diversity, flexibility and connectivity, resulting in a robust system configuration in the face of perturbations (Aimers and Iannone 2013, 23–24; Holling and Gunderson 2002; Walker *et al.* 2006).

As the r-phase develops into K, system dynamics slow down and start to conserve existing properties rather than explore new avenues of development. Potential continues to accumulate, albeit more slowly and tightly bound to existing structures rather than being freely available for innovation and system development. The shift from r to K strategists therefore entails a shift from adaptation to external variability towards control of variability where increased efficiency is sought by minimizing costs and streamlining operations (Holling and Gunderson 2002, 44). K-phase systems therefore exhibit less room for innovation and entrepreneurship. Internal system components become increasingly interconnected as they become increasingly mutually dependent within self-organized clusters of relationships, sometimes resulting in extremely high levels of integration or hypercoherence, where an increasingly smaller number of key productive strategies start to solely depend on one another, resulting in intensification of production strategies. It is at this phase that the recursive, problem-solving loop of socio-political complexity highlighted earlier takes place. Within the K-phase there is therefore also increasing specialization, efficiency, and process optimization resulting in increasingly more narrow avenues of development where these strategies may generate a multiplier effect induced by increasing returns to scale (Arthur 1989, 2009; Krugman 1991). These are for example key processes in the generation and accumulation of production surpluses needed for complex societies to store capital and resources as buffer for future perturbations. However, because of these strategies of intensification, there are fewer resources in play, and most resources tend to get 'locked up' over time, meaning they are more tightly controlled and more expensive, for example because of material accumulation by developing elite control mechanisms (Aimers and Iannone 2013, 23–24; Davidson 2010, 1139). In other words, the cost of 'getting things done' simply grows higher over time (Walker *et al.* 2006, 87). Efficiency and optimizing behaviour, although theoretically desirable, can therefore be problematic in practice because in being efficient – as in optimizing their behaviour – people, communities, societies, and other organizations often eliminate redundancies and emphasize a specific range of values and interests, resulting in a more homogenous system in terms of functions and response diversity, which can result in a dramatic decline in flexibility and hence resilience (Aimers and Iannone 2013, 23–24; Hegmon *et al.* 2008; Walker *et al.* 2006, 7–8). This tension field actually ties back to two contrasting aspects of stability, one focusing on maintaining *efficiency* of function – also called engineering resilience – whereas the other entails maintaining *existence* of function – or ecosystem resilience (Holling and Gunderson 2002, 28).

A study of network resilience in socio-ecological system has shown that no simple relation between connectivity and resilience could be observed (Janssen *et al.* 2006). In general, however, it can be stated that as the system becomes increasingly interconnected, more and more energy and resources go into maintaining existing structures (functional resilience). As was noted earlier, measures to exploit energy and resources from the environment to maintain the structural integrity of complex societies are subjected to diminishing returns on investment, therefore requiring putting in more energy over time to get the same return output (Tainter 1988, 194–99). As a result, overall efficiency resilience of the system continuously decreases in order to maintain functional integrity. This suggests that resilience within a system is never infinite, but rather some sort of trade-off exists between maintenance of efficiency and maintenance of function. In analogy to ecological resilience, the concept of social resilience has been defined as "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change" (Adger 2000, 347). Strategies of social groups trying to cope with disturbance events have been elucidated earlier in the discussion on canonical loops of complexity development in the previous part. However, as has become clear by now, the gradual development of socio-political complexity may indeed provide short-term solutions, but need not necessarily be effective on the long term as increasingly elaborate structures require ever more maintenance and rob the system of the necessary flexibility to deal with new challenges.

Rigidity is often considered to be characterized by low heterogeneity and high connectivity between system elements (Carpenter and Brock 2008). However, high connectivity could also have benefits of decreasing response time of the system to certain disturbance events by mobilizing a high number of agents for collective action, such as for example when dealing with famine or flood events. High connectivity therefore does not inherently result in a more rigid system as it allows information to flow more freely within the system (Kidder *et al.* 2016, 75). Highly connected system components do, however, allow disturbances to propagate throughout the entire system, whereas a less connected system might have contained certain disturbances in particular system components. This suggests that the trade-off in efficiency and function maintenance in complex coupled socio-environmental systems is tightly related to trade-offs in diversity and connectivity.

Ultimately, these processes of increased interlocking of system components lead into a pathway of development where a system finds it increasingly difficult to break out of a set pattern because of associated sunk costs, which refer to a situation in which agents 'put more ... effort into continuing with existing investments rather than exploring new ones', resulting in a tendency to undermine innovation (Janssen *et al.* 2003; Janssen and Scheffer 2004; van der Leeuw 2007, 215; Walker *et al.* 2006, 87). This tendency, often unintentionally, may therefore actually result in the inverse of resilience and lead to what has been called a 'rigidity trap' (Hegmon *et al.* 2008). As agents within a system have locked themselves into a certain way of doing things, the system itself begins to exhibit a 'path dependency'(Kidder *et al.* 2016, 75; van der Leeuw 2007, 215). It thus becomes brittle in the face of perturbations. Path-dependent development of a system of institutional norms has also been described by Parsons as an interlocked system of interests keeping existing structures in place, even if individual devotion to the underlying values starts to wane (Parsons 1990). This process has also been linked to gradual development of institutional mismatches or maladaptation (Currie *et al.* 2016).

At some point, the system may become too rigid to be able to deal with an unexpected disturbance event, either internally or externally induced – think of the canonical loop of complexity development described earlier – and the potential bounded with the interconnected system components is suddenly released and becomes lost from the disbanding organizational structure as the system moves into the Ω-phase. This event of slow accumulation leading up to an event of rapid destruction has also been called a tipping point (Gladwell 2000), creative destruction (Schumpeter 1942) or critical transition (Scheffer *et al.* 2012), describing phases of system transformation, both through incremental changes moving towards threshold values such as in the canonical loop of complexity development as well as through major disturbance events leading to system collapse (Aimers and Iannone 2013, 26–27). This type of system shifts has been commonly recognized in the archaeological record, including changes in subsistence systems (Rosen and Rivera-Collazo 2012), settlement patterns (Allcock 2017; Nelson *et al.* 2006), territorial abandonment (Nelson et al. 2011), and social organisation (Allcock 2017; Nelson *et al.* 2006).

Without the continued existence of a strong structural framework, the system moves into a period of strong innovation in the reorganization phase (α). In this phase, connectivity is at its lowest point, allowing surviving but uncoupled system components to be re-used in novel combinations induced by the remaining system potential of the previous cycle. Interestingly, this matches Prigogine's observations that even in complex systems which are running down to simpler forms of dispersed low levels of activity, a concentration of remaining energy into focal points can create new elaborate phenomena. As such pockets of energy and information remain available, the system reorganizes itself and a new cycle develops. In this sense, sudden events traditionally associated with full societal collapse can in fact often indeed be considered more accurately as societal transformation (Faulseit 2016; Schwartz and Nichols 2006). This phase is commonly associated with increased system diversity, population migration, innovation and rapid restructuring and can be generally subsumed under the moniker of a regime shift (Filatova *et al.* 2016).

This new system may resemble its predecessor as uncoupled system components become rearranged in a system configuration strongly resembling the previous cycle, i.e. be in the same 'basin of attraction', or it may have fundamentally new functional characteristics in a system that has multiple stable states. The latter is increasingly probable as the system gets near to the so-called 'edge of chaos' 1.2.1) where sensitivity to initial conditions is more likely to cause even slight differences in system dynamics or components to develop into widely divergent system configurations (Bintliff 1997a, 1999b; Gould 1999; Mandelbrot 1977).

As a whole, the adaptive cycle consists of a 'front loop', from r to K, with slow and incremental growth and accumulation of potential (resources, capital, knowledge), and a 'back loop', from Ω to α, of rapid reorganization and renewal. Each part of the cycle thus results in one of two important elements of complex systems dynamics: the maximization of production and accumulation, and maximization of innovation (Holling and Gunderson 2002, 47). The three properties of change – potential, connectedness and resilience – respectively set the limits to potential system development, degree of system control, and system vulnerability to disturbance events that exceed that control. It is important to stress, however, that not all systems need necessarily pass through the various phases of the cycle in the exact same order (Aimers and Iannone 2013, 26–27). In some cases, an r-phase (exploitation) may jump directly into a period of reorganization, for example if a given socio-ecological system cannot sustain existing levels of development or an unexpected situational event induces an impact of such a magnitude that the existing system structures cannot cope with it (i.e. a societal collapse event). In other instances, an α-phase may stimulate additional reorganization rather as the system is unable to settle on a new suitable configuration. Systems in a K-phase may also shift directly into an α-phase, thus avoiding an Ω-phase release, for example, a sudden shift to a democratic government from a totalitarian regime.

To effectively apply the adaptive cycle framework in the present framework, it is essential to consider what exactly such a cycle actually represent from a social complexity point of view. It has been noted that adaptive cycle studies are "confronted with similar challenges related to how to parameterize key variables and/or to establish a reliable age and stage model for the SES so that it can profitably be studied from an AC [adaptive cycle] perspective" (Bradtmöller *et al.* 2017, 4). In one of the earliest applications in archaeology, Charles Redman and Ann Kinzig (2003) indicated that the nature of the adaptive cycle depends on the scale of interest. For example, they consider whether every societal reorganization represents an entire cycle by itself, or whether such transformations actually represent specific phase transitions.
The solution they offer however, can hardly be considered satisfactory. In their case study on centralization and fragmentation of governmental structures in Mesopotamia, Redman and Kinzig argue whether the period between 3500 and 2000 BCE, spanning five major historical phases, consisted of one protracted cycle, or whether the individual phases and corresponding dynasties within this period each constitute their own cycle. Both proposals are too limited and disposes of all the strong points of the panarchy as a framework for societal dynamics operating on various scales across temporal, spatial, and organizational dimensions, as they are reduced to one single dynamic of change. Yet, equating archaeological periods with stages in an isolated adaptive cycle appears the most frequent approach in various archaeological applications (Allcock 2017; Nelson *et al.* 2006; Peters and Zimmermann 2017; Rosen and Rivera-Collazo 2012; Weiberg 2012). Applied this way, the adaptive cycle indeed hardly transcends the level of a metaphor for change as it becomes bereft of all potential for describing and explaining multi-scalar dynamics. What we need instead is to describe patterns of development along a variety of domains, including economic, social, political, and environmental, within separate adaptive cycles operating on different scales, and then integrate each of these patterns into a wider panarchy framework, indicating relevant connections between different scales, dimensions and domains.
When constructing an adaptive cycle framework within an archaeological case study, it is essential to consider the challenging task of defining archaeologically valid parameters of connectedness and potential. Connectedness has, for example, been defined as the intensity of subsistence and exploitation strategies, mobility, and social organisation, whereas potential has been considered as 'the potential for innovation' (Rosen and Rivera-Collazo 2012). Other definitions focus on connectedness as the level of vertical and horizontal social differentiation (Peters and Zimmermann 2017), or consider the element of 'integration' to be crucial (Hegmon *et al.* 2008). I will return to this point in the next chapter when discussing key drivers of system development.

It has been suggested that to study dynamics of change social and ecological systems, only 3-5 key variables should be used for analysis as to not overcomplicate the analysis, *i.e.* the so-called 'rule of hand' (Yorque *et al.* 2002; Walker *et al.* 2006). In their recent overview of resilience theory applications in archaeology, Marcel Bradtmöller and his colleagues (2017, 5) identified four main proxies and related attributes are most commonly used to conceptualise/classify complexity within past SES: subsistence, demography, social organisation, and technological innovation. Each of these can be studied through a number of attributes. For subsistence, for example, agricultural intensity (Weiberg 2012), diversity and abundance of resources (Allcock 2017; Nelson *et al.* 2006, 2011; Rosen and Rivera-Collazo 2012), food storage (Allcock 2017; Nelson *et al.* 2006), subsistence specialization (Marston 2015; Solich and Bradtmöller 2017), variability in subsistence systems (Bicho et al. 2017; Gronenborn *et al.* 2017), and trading and redistributive networks (Dunning *et al.* 2012; Sheets 2012) can all be studied. Demographic trends can be studied through population size (Stiner and Kuhn 2006), rate of population growth (Allcock 2017; Marston 2015), and limiting threshold populations (Gronenborn *et al.* 2017; Sheets 2012; Weiberg 2012). Social organisation includes forms of social control (Allcock 2017; Dunning *et al.* 2012; Nelson *et al.* 2011; Weiberg 2012), social interaction networks (Cooper 2012), and social mobility (Zimmermann 2012; Peters and Zimmermann 2017). Technological innovation is used less frequently as a proxy for adaptive cycle development, but if used, the rate of innovation is often equated with potential for system development as characteristic for the reorganisation or conservation domains (Thompson and Turck 2009; Rosen and Rivera-Collazo 2012). It should be noted that the methodologies for measuring many of these attributes are often heterogenous and still being debated (Bradtmöller *et al.* 2017, 10). This thesis should therefore not be seen as a definitive answer, but rather as an additional voice in the debate. The structure of the upcoming case study will follow similar overall lines of inquiry, starting with patterns of development along a limited number of key domains – subsistence and resource exploitation, production and exchange, and social organization – that are to be integrated into a synthesising multi-scalar and multi-dimensional framework of community formation and development in southwest Anatolia from the Archaic period until Hellenistic times. To successfully attain such level of synthesis and integration, it is essential to elucidate where connective mechanisms operate between various scales, domains and dimensions. One key conceptual unit to approach such multi-scalar analysis in resilience theory has been a nested hierarchy of adaptive cycles, called the panarchy.

Panarchy as multi-scalar model of socio-environmental dynamics

One of the core questions that needs to be asked for all scientific research, is what are the appropriate scales of observations we must use to approach processes and structures that constitute the object of study? It must be noted that hardly ever one isolated scale of analysis provides a sufficient explanation, as either the effects of many processes in complex systems inherently unfold across various scales, or its properties and dynamics are influenced by processes on higher and/or lower scales. This refers to the 'triadic' structure as a key property of hierarchically-ordered scales, which states that three adjacent hierarchical levels need to be considered for both a parsimonious and sufficient description of the behaviour of the middle level (Salthe 1985; Wu 2013).

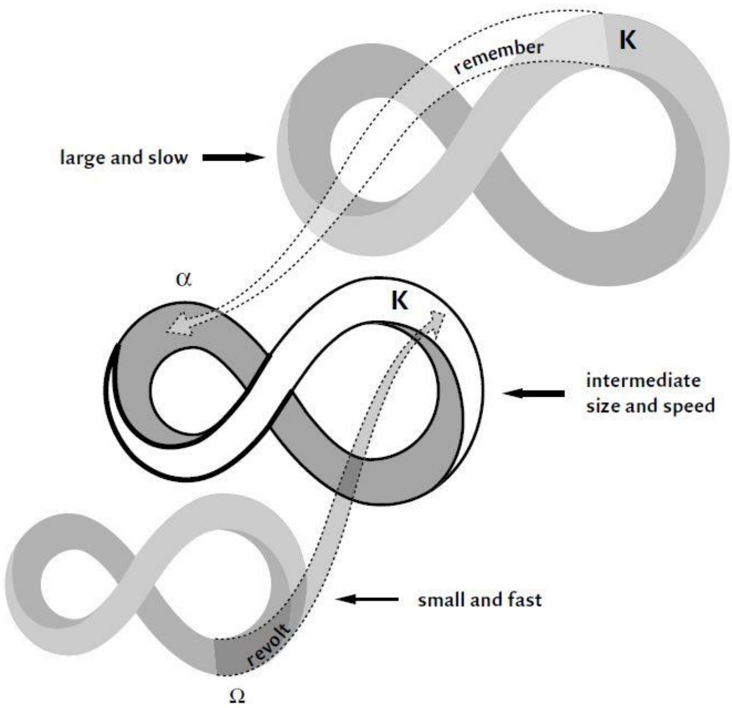

Figure 12: A panarchy of nested adaptive cycles (Gunderson and Holling 2002).

As we have seen, individual adaptive cycles correspond to one particular scale with its own logic and operating at a characteristic periodicity and spatial scale. However, such cycles never operate in isolation. Individual cycles are integrated in two ways, basically corresponding to hierarchical and heterarchical structures. On the one hand through the so-called *panarchy*, a nested hierarchy of semi-autonomous levels, not necessarily subjected to strict top-down sequences of authoritative control (Holling, Gunderson, and Ludwig 2002, 72; Simon 1973) (Figure 12). On the other hand, cycles of comparable size on a similar level can be interconnected across different panarchies. Cycles in a panarchy are not ranked in a continuous distribution, but rather clustered together in 'lumps' of distinct relationships in space and time (Holling *et al.* 2002, 77). The system dynamics described by the adaptive cycle and panarchy framework inherently move at an uneven speed. We already discussed how within individual cycles system flows move in a slow 'front' loop from r to K, and rapidly in the back loop towards Ω, α, and back to r. On the other hand, individual cycles inherently move at different speeds, with small and fast cycles integrated in a single panarchy. In particular, cycles that operate at small scales generally move quickly, whereas those at the top of the nested hierarchy move more slowly (Holling *et al.* 2002).

It has been argued that distribution discontinuities can arise endogenously in dynamic systems in the presence of dynamic instabilities in the system (Rosser 2011). In the adaptive cycle framework, these instabilities are then caused through the interactions between 'small and fast' and 'large and slow' cycles and variables leading to fluctuations in system dynamics. Larger cycles can provide the inertia and stability that permit lower scale cycles to pass through release and reorganization while maintaining similar functions, i.e., staying within the same basin of attraction, thus allowing adaptive cycles at one level to be repeated in the same or similar cycles of system configuration through the process of 'memory'. The role of memory is strongest when the higher-level cycle is in the conservation phase. Conversely, coordinated release at small and fast scales may, in cascading fashion, trigger release at larger scale cycles, especially if these are at that time in the K phase characterised by low resilience, a process called 'revolt', precipitating potential shifts into new basins of attraction at large scales through a phase of creative destruction (Walker *et al.* 2006). The term 'revolt' is therefore used to describe change originating at smaller scales, that moves across scales to broader spatial scales or longer temporal scales. They can occur either because lower-level cycles are synchronized, and thus all enter a back loop at the same time, or because they are tightly interconnected, so that a back-loop transition in one cycle triggers such a transition in the other cycles. Collapses in one cycle may stimulate changes in other adaptive cycles, both larger and smaller in size, such as increased mechanisms exploitation (through immigration and a resulting larger labour force), conservation (the adoption of more productive and/or sustainable agricultural practices), or reorganization (transformations aimed at making the system more resilient) (Aimers and Iannone 2013, 26–27).
In this sense, it should be remembered that a phenomenon that is considered to be a phase trajectory at one scale of analysis may be considered a 'state flip' at another, for example when an overarching socio-political unit collapses or is superseded this need not necessarily impact life in individual communities in a significant way. To assess to what extent a state flip occurred rather than a major perturbation within a consistent phase trajectory, it may prove useful to look at whether the unit of analysis has maintained the structures, controls, and members that are considered essential to its identity, and on what intersection between temporal, spatial and organizational scales these changes developed. To this end, relevant scales of analysis should be identified, as well as the connections between them.

As we have seen, the multi-scalar structure of complex systems grows 'organically' out of the foundational interactions of its constituent components (see 1.2.1). Because of this bottom-up genesis of the typically nested organizational structure of complex systems, interactions among components within one of the nested groups tend to be more frequent and stronger than interactions between groups at any level in the nested hierarchy (Barton 2014, 308). For example, in a biological system, cells of the heart interact more directly with other heart cells than they do with lung cells, even though both are part of the cardiovascular system. Likewise, social units such as households within a specific community share stronger social ties and interact more frequently with other households within the community than with those of another community, even if both are part of the same overall socio-political system. Units that make up the nested hierarchies of CAS, can often continue to function even when linkages to other units are broken. For example, if the larger socio-political system of our two communities, say the Achaemenid empire, were to disintegrate and lose its political ties of connectivity holding these communities together, community life itself may continue pretty much unaffected. This property of stronger connectivity between same-kind units and the ability of units to operate semi-independently of other units in a nested hierarchy is a property of CAS called 'near decomposability' (Auban *et al.* 2013, 54; Allen 2009; Barton 2014, 308; Simon 1962, 1973; Wu 2013). This near-decomposable characteristic of complex systems also profoundly affects the disaggregation of the system, following in general a similar, but reversed, order to its genesis, where the highest-level groups become independent systems, disassociated from others.

Within a socio-ecological system, human and environmental components are interlocked in mutually reinforcing ways, although they each operate on a characteristic spatial scale with specific temporal periodicities. In a seminal contribution, Sander van der Leeuw and James McGlade (1997) proposed a model of urban development, starting from an axiomatic dynamic of rural village communities embedded in a natural landscape, which can prove useful at this point. The human component of such a system generally consists of few superimposed rhythms, whereas the environmental component consists of a complexly integrated spectrum of biological and ecological rhythms (van der Leeuw and McGlade 1997, 338–39). The faster dynamics of social units have thus been embedded in and locked on to slower environmental dynamics. This is not to say that the environment should be reduced to an inert background stage for social dynamics to envelop. However, one of the most prominent differences between human and environmental systems is that the former consists of (potentially) knowledgeable agents who can coordinate and adapt their behaviour according to flows of information and communication with other people. Social agents are self-reflective and goal-oriented, and able to make decisions to move the system towards a desired state (Redman 2005, 74). As a result, they are able to act and react with a markedly higher speed compared to the natural environment, which operates with a seasonal periodicity and therefore acts as a stabiliser for social dynamics.
Different social configurations also operate on distinct speeds, which will markedly determine the frequency and intensity of human-environment interactions, as well as the very nature of the social dimension itself. I already discussed in the previous part how dynamics of innovation, creativity and socio-economic development intensify superlinearly as settlements grown due to the increase of social interactions per capita and economies of scale in infrastructure. It has even been shown how positive feedback mechanisms induced by increased stimuli associated with modern city life resulted in a marked increase in the "pace of life" in these centres as diseases spread faster, businesses emerge and perish more often, commercial transactions take place faster, and even walking speed in the streets increases (West 2017, 326–27). Therefore, once the system sets of in a given direction associated with the initiation of urbanization processes, positive feedback mechanisms will intensify these initial stimuli even further, thus inducing a certain pathway of development ending up in an urban-based basin of attraction.
'Faster' social configurations therefore induce more frequent and intense impulses resulting in ever-growing feedback dynamics. One important consequence is that such communities often pose a far greater strain on their natural environment. It has in this sense been argued that village communities are generally very efficient in their usage of (mostly local) energy and information flows (van der Leeuw and McGlade 1997, 338–39). Additionally, it was stated that in such communities, decision-makers are few and of limited diversity, and therefore often relatively slow to adapt. This need not necessarily pose a problem as long as society and environment remained in (dynamic) equilibrium within a given basin of attraction. As soon as – for whatever stimuli, challenges or opportunities – a phase transition was induced, however, their relatively slower response times would result in the community being less well adapted to their environment This non-linear coupling between environmental and human dynamics can induce a series of phase transitions as new periodicities and rhythms become superimposed and the system passes a series of bifurcation points related to the emergence and subsequent development of urban systems (van der Leeuw and McGlade 1997, 339).

These emergent processes induced by feedback mechanisms from social interaction and information transmission thus results in the development of settlement patterns combining settlements of varying sizes connected in hierarchical and heterarchical structures. It has been observed that people do not organize themselves in a continuous settlement size distribution, but rather in a limited series of favoured sizes with clear discontinuities in between these categories (Johnson 1977). These discontinuities can then be considered thresholds between dynamic levels of adaptive cycles or, in other words, basins of attraction reflecting the scales of opportunity available in a given system to which a certain unit may respond (Garmestani, Allen, and Gunderson 2009). In the case of settlement patterns, one obvious example might be clusters of similar types of settlements, with primary cities at the top, followed by secondary cities, villages, and hamlets on the bottom of the size distribution. However, it is one thing to map out different clusters within a given distribution, it is something else to also explain why these clusters emerge, upon which scales of opportunity they react, which pulling forces act as selections states for the different basins of attraction, and what the thresholds are that result in the emergence of distribution gaps. To explain these scalar differences, we must combine explanations from all three dimensions of structuration (spatial, temporal, organizational) across various relevant societal domains as differential concentrations of population across a landscape reflects the differing levels of comparative advantages in economic, political and social properties of each site (Adger 2000, 352).

The transposition of the adaptive cycle and panarchy framework from ecology and resilience thinking into archaeology is not straightforward. It has for example been cautioned that:

> "Although animal body mass and the functions a species provides appear to incorporate many of the most critical elements of system structuring and system resilience, it is unknown what archaeological variables reflect the core processes and functions present in human social systems, and whether the archaeological material culture available to researchers, such as pottery styles, sufficiently represents the key scaling processes structuring human societies." (Sundstrom *et al.* 2014, 6936).

Still, the framework holds a lot of potential to initiate better conceptualisations of multi-scalar interactions in archaeological analyses. The theoretical framework outlined so far has tried to trace the outlines towards taking an additional step in this direction by offering a more thorough integration of more traditional archaeological approaches to dynamics of community formation on the one hand, and complex systems thinking and dynamics of social complexity embedded in coupled socio-ecological systems on the other.

The adaptive cycle and panarchy offer a suitable high-level framework where various strands of theory can be coherently integrated to describe and understand processes, structures, and variables operating at discrete ranges of scale. The application of the notion of panarchy and its nested set of adaptive cycles possess the potential to further the necessary multi-evolutionary and multi-trajectory approach advocated here, by providing a suitable epistemological framing tool to assess variable development within different domains of society as well as link these developments to the natural environment and overall socio-cultural matrix of a given society. It has been noted that the adaptive cycle model offers a useful heuristic for understanding well established archaeological patterns, however, this is only a first step to apply resilience theory to archaeological questions (Freeman *et al.* 2017, 85). In the next chapter I will outline how this conceptual framework can be operationalised in archaeological analyses.

Chapter 2. Analytical framework

““Analysis is the art of creation through destruction.”
-P.S. Baber, Cassie Draws the Universe.

2.1 Introduction

In the previous chapter, I discussed a series of theoretical approaches which form the basis for a conceptual model of community formation and development of social complexity. In this chapter, I will present the outlines of a suitable analytical framework to operationalise this conceptual framework in preparation for the case studies of chapter four. The aim of this chapter is to bridge the chasm which sometimes looms between theory and data, especially given the very extensive framework detailed in the previous chapter. The case studies of chapter four cover four major domains (material culture, subsistence, economy and socio-political organization), focusing on the dynamic between two contemporaneous communities, Düzen Tepe and Sagalassos. This focused case study will then be extended, first to include material culture and community formation dynamics on a sub-regional scale (corresponding to the study region of the Sagalassos Project) and, second, to include community formation on an interregional scale including the regions of Pisidia, Lycia and Pamphylia in southwestern Anatolia.

The genesis of this research project and its initial goals followed the logic of the state of knowledge in the Sagalassos Project at the time. Although significant effort has been spent on long-term diachronic dynamics and settlements patterns within the study region as a whole, many of the works by the Project up until that point had focused on the city centre of Sagalassos itself, and more specifically on those periods in which the settlement reached a more elevated status among the sites in the study region, *i.e.* the Roman imperial and Early Byzantine times, and accordingly produced some of the most visible elements of its archaeological record such as its urban fabric and mass production of pottery. A logical starting point was therefore to look beyond this most obvious scope and focus on the preceding periods in the development of Sagalassos. The central question at this point therefore became: how did the community develop from its moment of origin up until the early Roman imperial period? It had already been established that the oldest traces of material culture indicating habitation at Sagalassos could be dated to the late Achaemenid-early Hellenistic period (5th to 3rd centuries BCE) (Poblome *et al.* 2013). As a result, the period of interest was from late Achaemenid to Hellenistic times (more or less from the late 5th to 1st centuries BCE).

A corollary of this choice, however, was that far less data was available compared to that of some other periods, most notably the Roman imperial period. For example, almost no structural remains have been encountered of this earliest habitation phase, whereas the oldest material pertained to a body of pottery material encountered as residual material in excavated contexts or as surface material collected during urban surveys. To deal with the general problem of paucity of data, a strategy needed to be devised to maximise the amount of information derivable from what was available. This resulted first and foremost in a detailed analysis of the available pottery material.

As the actual outlines of the project started to take shape, extensions to the original research question were added. In the first place, the core case study needed to include a comparison with the nearby site of Düzen Tepe. The pottery material of this site greatly resembled that of the oldest material of Sagalassos and was therefore considered to have originated at roughly the same time. However, in contrast to the latter, Düzen Tepe was abandoned at some point during the 2nd century BCE, thus providing far more information on these early phases of community formation and development. To maximise the comparative potential with Sagalassos, it was decided to focus on the type of data both sites had most in common, *i.e.* pottery. As a considerable amount of this material had already been studied petrographically and geochemically in the Ph.D. dissertation of Dennis Braekmans (2010), but less so typologically, functionally and chronologically, it was decided to focus in the first place on an encompassing macroscopic analysis of this material.

It was soon realized that to properly interpret the origin of social life at Düzen Tepe and Sagalassos, these communities needed to be embedded in their proper spatial and temporal context. This entailed a necessary extension of the case study to include the surrounding study region, as well as the addition of the preceding Iron Age period. Again, a focused line of comparison with the core case study of

Sagalassos and Düzen Tepe was needed, centred on the pottery material collected from a selected number of sites throughout the study region. The analytic core of this research thus clearly revolves on the macroscopic study of pottery material of a number of settlements within the study region of the Sagalassos Project. In conducting the case studies, the data from the core pottery analysis was compared and integrated with other available datasets (see 2.3). The aim of this part is to show how we can use this pottery material to study the dynamics of community formation and complexity dynamics described in the previous chapter, or, simply put, how to move from sherds to complexity. To do so, let us start with discussing the characteristics of the main datasets and the various methodological steps of the core analysis performed on them.

2.2 Pottery analysis

Datasets

The pottery studied in this dissertation can be generally subdivided in three major datasets: (1) Sagalassos (2) Düzen Tepe (3) the study region. For each of these locations, a body of material was collected, marked and documented to allow further analysis. The number of available sherds, and method of collection was highly dependent on the location and the nature of the archaeological research conducted there in the past (see Figure 13).

Sherd counts	*Sagalassos*	*Düzen Tepe*	*Study region*
Excavation	546	1878	0
Survey	750	0	435
Total	1296	1878	435

Figure 13: Counts of selected diagnostic sherds in datasets.

While the site of Sagalassos has been subject of over three decades of extensive interdisciplinary research campaigns, comparatively little material remains of its earliest habitation phases have been preserved. The little available material has been collected either as residual material in excavations or as surface material from urban surveys. To compose this dataset, I re-examined contexts from excavations conducted throughout the history of the Sagalassos Project that had been noted for containing comparatively large amounts of material suspected to be 'Pre-Roman'. Although a large variety of material far beyond this chronological bracket was typically denoted with that label during the preliminary material processing, this approach did yield significant amounts of material suitable to be included for further analysis.

The selected areas were spread over a large extent of the later, Roman settlement (see Figure 29), with several locations in the monumental centre (Upper Agora, Odeion, and Bouleuterion), as well as the eastern parts of town (Late Hellenistic Fountain-House and Site F in the later Eastern Suburbium) (Figure 14). It is hard to assess the spatial extent of this area given the patchy evidence. Moreover, we have no indication for the intensity and density of land use within any supposed area due to superposition of the later phases of town. As a general indication, however, we can state that material from the Achaemenid and Hellenistic periods (including from urban surveys, see *infra*) was spread across an area of about 22-25 hectares. Given that the first goal of this analysis was to compose a fabric/type classification (see next part), I focused mainly only the diagnostic pottery material, excluding most body sherds and small fragments. In total, 546 diagnostic sherds from the Achaemenid and Hellenistic period were selected and included for further analysis, of which a majority was collected from control excavations conducted at the Upper Agora. This was the only dataset which could be considered to be a coherent assemblage of pottery material (for more on this, see 2.2 and 4.2.1.3).

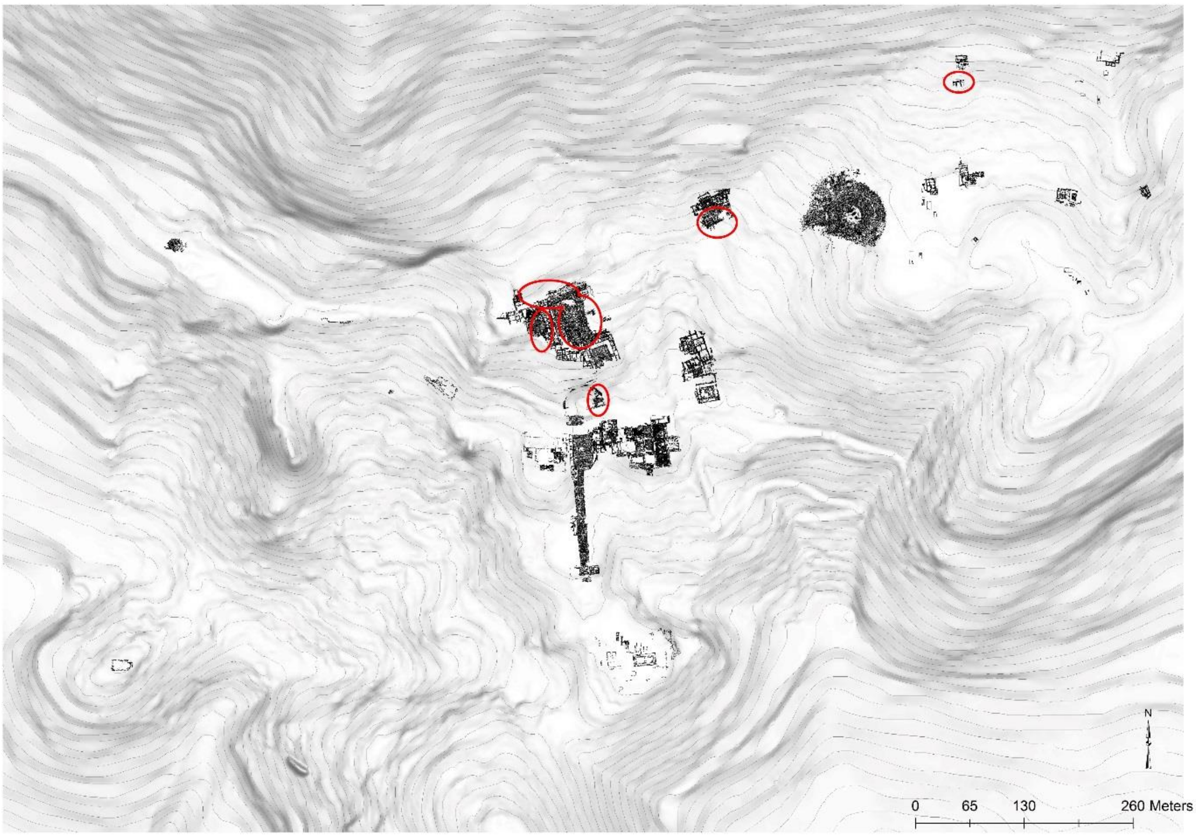

Figure 14: Locations of excavations used for diagnostic material selection.

Additionally, I perused through all of the material collected during the urban surveys, which covered the monumental centre and eastern residential quarters of the later Roman imperial town. Out of a total of 410 sectors (of varying sizes depending on the survey year, either 10x10, 20x20 or 50x50 meters) 148 sectors provided clear indications of Achaemenid and/or Hellenistic pottery material, ranging between 1 and 62 sherds (Figure 15). An initial selection of 750 sherds was prepared, out of which 186 diagnostic sherds were fully documented in a fabric/type classification. This may seem like a substantial number, and, indeed, it is a sufficient sample size to allow drawing certain conclusions. However, this number should still be put into context as, throughout the 5 field campaigns of urban surveys needed to cover the site, over 30,000 sherds were collected. While fairly substantial amounts of material could be recollected, with a sufficient spatial coverage across the full survey extent, it still only pertained to a minor part of the full diachronic dataset.

Throughout the study region of the Sagalassos Project, Düzen Tepe was the only site (besides Sagalasso) which has been studied through interdisciplinary research campaigns that also included archaeological excavations, for a period between 2005 and 2011 (see Figure 31). For Düzen Tepe, I decided not to include the material gathered during the archaeological surveys because of the heavy weathering these sherds had been subjected to. Instead, I looked at the material collected in three of the major excavations, more specifically the Bakery, Courtyard Building and Kiln Area excavation (see part 4.1). As these three yielded by far the most material of all the excavations conducted at Düzen Tepe, and moreover were considered to cover several functional contexts, this selection was considered to have the best change of yielding the most representative sample.

Out of these excavations, I selected 163 contexts identified during excavations as occupational or post-occupational contexts or containing interesting features, thus disregarding topsoil or erosional layers. Contexts from various rooms were selected to ensure sufficient coverage of the full extent of an individual building. Locations of selected contexts within these three excavations can be found in Figures 16-18 (denoted with black circles). In total, 1878 sherds were selected and documented in a fabric/type classification (or one of both) if possible (see next part).

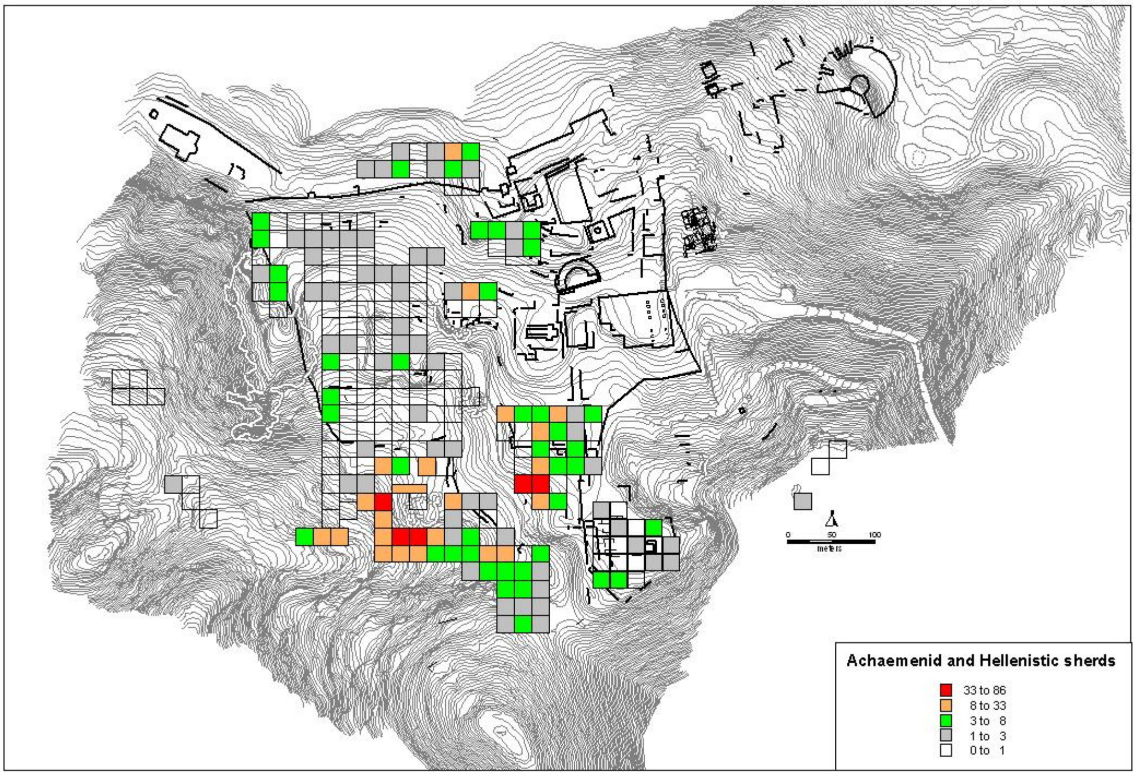

Figure 15: Find spots Achaemenid and Hellenistic pottery in urban survey (map created by Femke Martens).

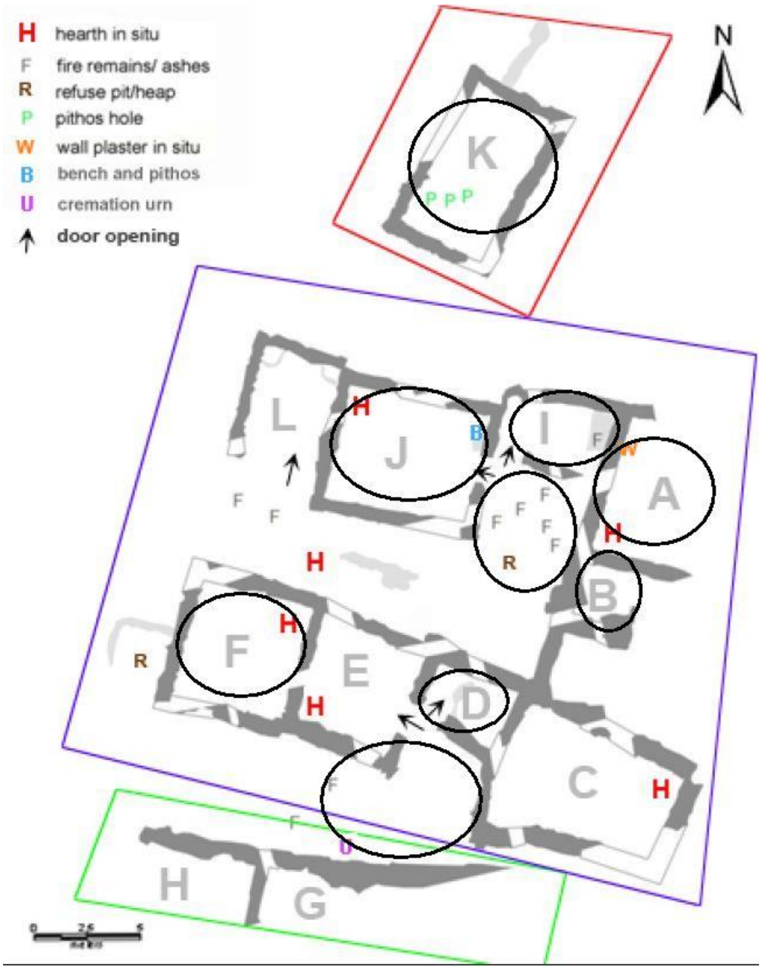

Figure 16: Plan of the Courtyard Building excavation at Düzen Tepe, with indication of context selection.

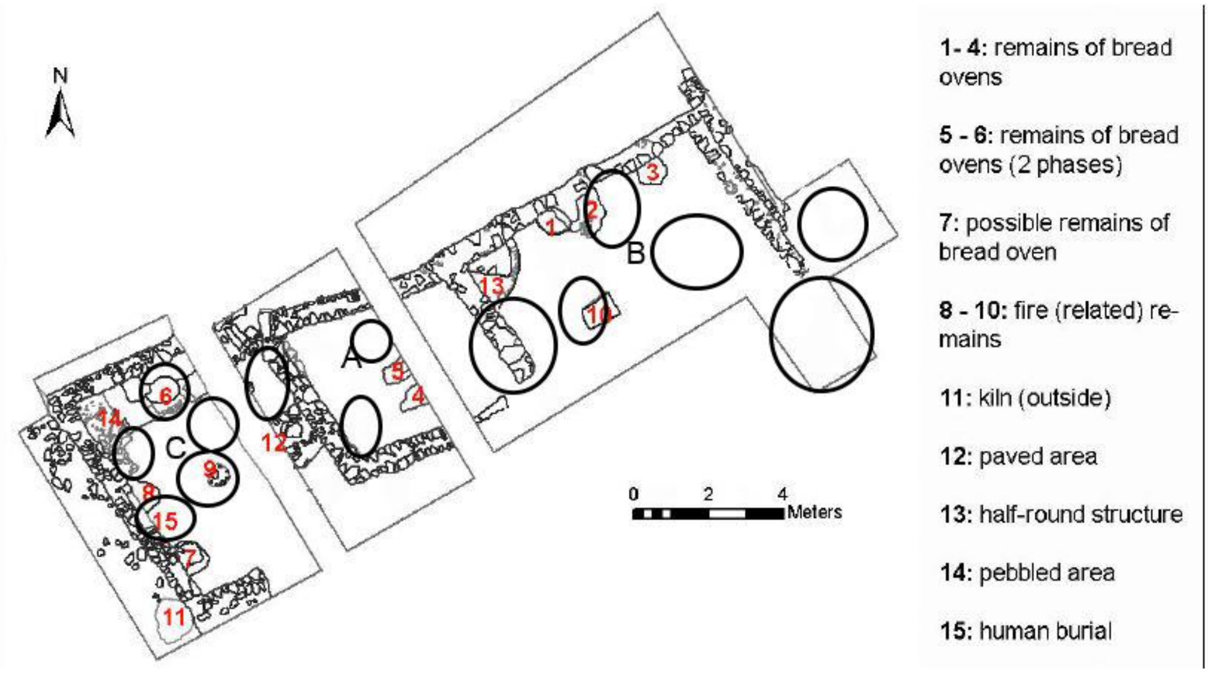

Figure 17: Plan of Bakery excavation with indication of context locations (black circles).

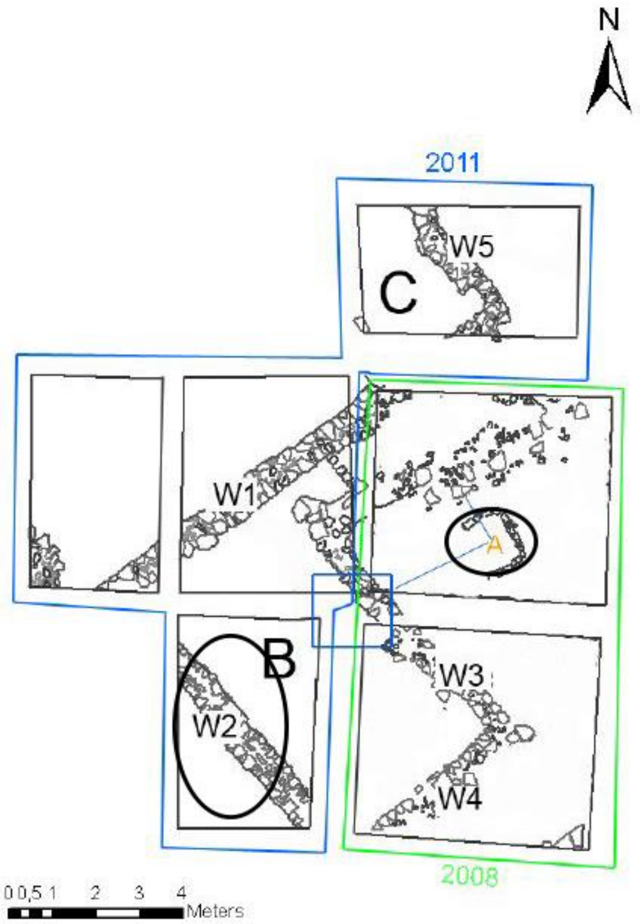

Figure 18: Plan of Kiln Area excavation with indication of context locations (black circles).

Elsewhere in the study region of the Sagalassos Project, no excavations have been conducted. Instead, our information is derived from interdisciplinary survey campaigns. Archaeological material has been collected through both extensive and intensive surveys, depending on the year of the campaign. In 2014, much of the material from contexts and sites visited and studied up until that time were re-examined by prof. Jeroen Poblome and dr. Eva Kaptijn to provide an overall chronological impression of diachronic settlement patterns in the area. This study was used as the basis for the selection of relevant sites that were most likely to yield significant amounts of material for the period from Iron Age to Hellenistic times. Out of 40 potentially relevant sites, 25 were selected for further data collection, comprising about 350 sectors. Of course, here the difference between intensive and extensive surveys strongly skewed the amount of identified contexts, as well as the amount of collected material, and therefore also the final selection of the dataset.

The majority of the material eventually included in the dataset was selected from ten sites (see blue dots on Figure 19): Belören (Keraia), Bereket, Çatal Pınar, Düver Ada, Hisar, Aykırıkça, Kayış Kale, Kepez Kalesi, Kökez Kale, and Seydiköy. Of these ten, six (Bereket, Çatal Pınar, Hisar, Aykırıkça, Kayış Kale, Kökez Kale) were studied through intensive surveys, whereas four (Belören, Düver Ada, Kepez Kalesi, Seydiköy) were studied only through extensive surveys. In total, 435 diagnostic sherds were selected and documented in a fabric/type classification insofar possible. However, it was soon realized that for the study region this could not be done on a level of detail comparable to the classification of the Düzen Tepe material, or the Hellenistic pottery of Sagalassos. In the next part, I will explain in more detail the different steps of the methodology I used to study these datasets, as well as some of the limitations that were encountered along the way.

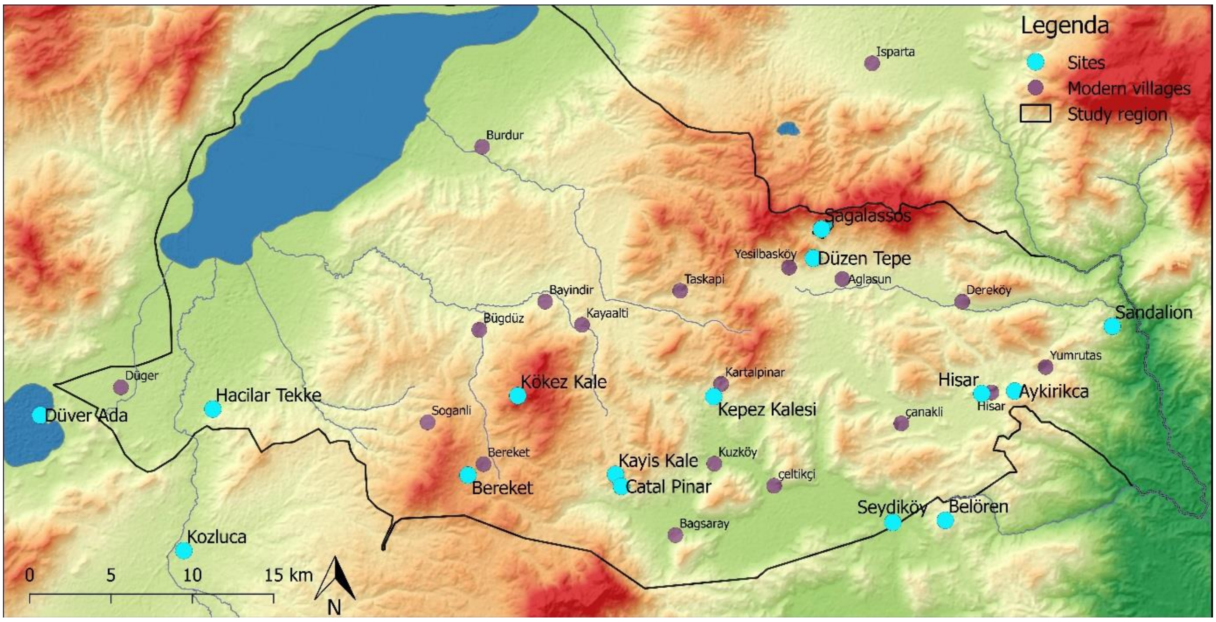

Figure 19: Sites in study region.

Methodology

In the previous part, I discussed the sample size and provenance of the main datasets used for this research. In this part, I will provide some more detail as to the objectives in studying these datasets, and the various steps of the analysis and methodological procedures that were used.

The initial objectives of the pottery analyses were twofold. First, to compose a ware classification – based on fabric and type properties, see *infra* – of the 'pre-Roman' material of Sagalassos and Düzen Tepe, *i.e.* from the Achaemenid and Hellenistic periods. This classification moreover needed to be transposable to other sites in the study region, as well as allow extension to include the Iron Age material which was found in this area, but not at Düzen Tepe or Sagalassos. However, a *sec* presentation of the pottery material and its classification was not the end-goal of this research project. For the second objective, this information therefore needed to be integrated in a view on the societal context in which it was produced and used. More specifically, the goal was to examine how this material related to the overall societal complexity of different communities within the selected case studies. Although it has been stated that "economic specialization is a generally accepted concomitant of social complexity" (Rice 1981, 219), it should be elucidated how this connection is made. To this end, material culture needs to be assessed as a proxy for social, economic and political patterns of behaviour and complexity dynamics.

The crucial point to make this transition 'from sherd to complexity' is to start from the material dimension of social practices, highlighted in part 1.1.2. Much, albeit not all, human behaviour contains an inherent material component, essentially making use of tangible objects and/or being performed in material environments. Even though the actual performance of social practices and behaviour in the past is inherently lost to us, its material dimensions can be preserved in the archaeological record and therefore studied by archaeologists.

In the conceptual framework outlined in the previous chapter, I elaborated on a conceptualisation of complex social systems as configurations of social organisation developing through communication and information transmission between groups of people. To briefly recapitulate the elements related to material culture in particular, I especially noted the works of David Clarke, who considered material culture as an essential part of the socio-cultural system because of it functionality as an information transmission system (Clarke 1968, 129). More specifically, he extensively argued for connecting attributes of material culture on various levels – from variation in artefact dimensions linked to individual acts of making and production processes, up until variability in whole material assemblages – with social activities and patterns of behaviour (Clarke 1968, 85).

The material environment operates both as a facilitator and constrictor of social interaction (Fletcher 2007, xix). On the one hand, it acts as a fundamental regulator, initiating and guiding information transmission within a community, on the other hand, it poses a constraint on the total range of potential interactions taking place within a given context (Rapoport 1988). This can be linked to Gavin Lucas' (2012) concepts of 'enchainment' and 'containment', connecting different elements of material culture assemblages with their effective usage at certain times in certain places, thus allowing distinct contextualized material culture usage to be created through spatial and temporal structuration. At this point, having established the link between material culture and social practices, we can thus connect techno-productive systems to overall dynamics and degrees of societal organisation as well. Material culture can then be considered a reflection of the complexity of overall societal communication mechanisms and interaction structures, as the complexity of information embedded in the material framework of a society is a reflection of the complexity of the network itself, or in other words, the manifestation of its organizational limits (Hidalgo 2015).

In short, the material environment – consisting of structures and objects – can markedly impact avenues of communication and information transmission among people within and between communities. This impact can be the result of conscious actions and considerations by the very same actors responsible for forming the material assemblage, or they can be wholly unintended consequences derived from subsequent usage and information processing associated with this material. The built environment in particular can have enduring effects long after the period of initial establishment, due to the relatively high 'inertia' imposed by the high costs associated with its alteration or removal (Fletcher 2007, 6). Due to the recursive relationship between material and social aspects of communities, the former may acquire a range of different, possibly even contradictory, meanings.

This brief sketch traces the outlines of the framework for the pottery analyses conducted here. It is important to note, however, that we should clearly distinguish between information *about* material culture and information transmitted *from* these objects. It should for example be argued whether differences in object dimensions are socially or functionally meaningful. In practice, however, it is not always easy to distinguish individual traits of variability *and* connect these with meaningful social and/or functional properties.

To effectively link the pottery material in our datasets to the information conveyed by patterns of production and usage of these artefacts, we need to ensure that the methodology applied here, pieces out attribute information from the level of the individual artefact up until the overall assessment of the techno-productive system of these societies at large. This information then needs to be integrated in a conceptualisation of the two-way flow of information between producers and users of the material environment. To assess every step of the design, development and usage of material objects, I start from the classical framework of operational sequences (*chaîne opératoire*) developed by the French archaeologist and anthropologist André Leroi-Gourhan (1964).

The framework of operational sequences considers all sequential procedural steps and actions geared towards both production, distribution and usage of a certain object. An operational sequence can be defined as "a series of operations which brings a raw material from a natural state to a manufactured state" (Cresswell 1976, 6). In this sense, the framework explicitly embeds the production of material objects within a societal functional context, even though these need not necessarily overlap with the intended functional contexts associated with the production process. It was noted that all actions within the operational sequence, although not necessarily all conscious and intended, are performed within a mental template, and therefore purposeful in nature (Lemonnier 1992, 26). The framework is therefore highly compatible with the overall approach of this work to link material culture to overall dynamics of social complexity.

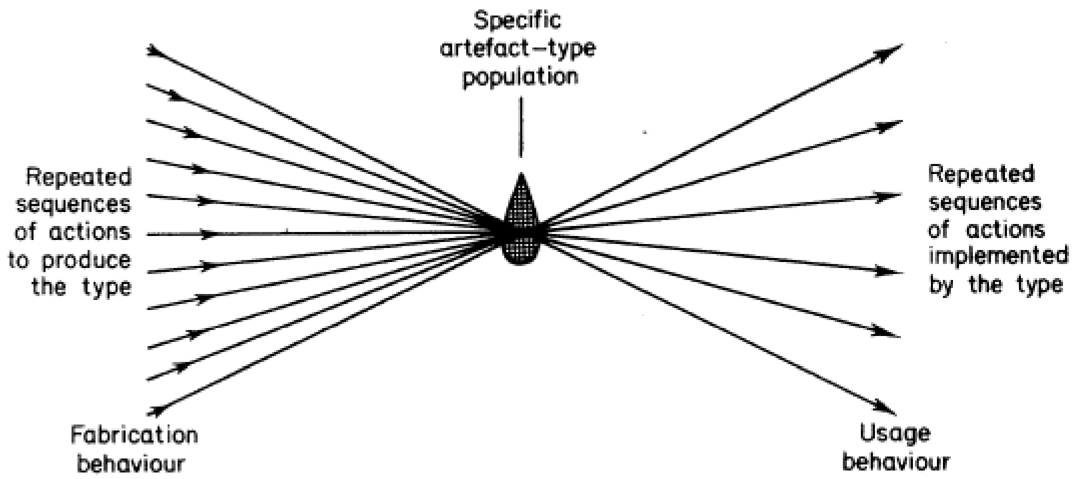

Figure 20: Objects as nexus of production and usage strategies of communication (Clarke 1968, 153).

Throughout the process of producing and using material culture, information is transmitted in two ways. One is in a techno-productive sense, entailing techniques and practices of raw material selection, preparation, forming and finishing of objects which is transmitted through channels of individual and collective learning (Roux 2016, 102). By honing their technical skills, producers become increasingly better at expressing the second flow of information, which is the one of communication expressed by means of the artefact itself. Through the combination of both flows of information, a 'way of doing' is created in which the material environment becomes an inherent part of the establishment of communities of practice (see 1.1.1). The duality of flows of information in a techno-productive and communicative sense is expressed in Figure 20. The material object is thus conceptualised as the nexus between both flows of information, crystallizing certain techno-productive strategies into solid form, which then provides wholly new projections of information through its actual usage, possibly but not necessarily converging with the messages intended by the producers.
Discussion of the techno-productive component of the operational sequences of pottery involves two levels of description (Roux 2016, 105). The first entails the main successive steps in the sequence of transforming raw materials into a finished product: collecting and preparing raw materials, mixing clay paste, forming the vessel body, surface preparation and treatment, decoration, drying and firing. The

second level then describes the operational procedures in each of these steps. It is the latter level which allows different degrees of variability through cultural, environmental and functional factors such as resource availability, technological infrastructure, production choices, knowledge and expertise. This variability can then be used to transmit and alter information flows through social communication. Capturing this variability in our analyses will therefore constitute an important factor to link material culture and complexity dynamics. I will discuss this connection in more detail in part 2.4.

For now, I will focus on the praxis of macroscopic analysis of the techno-productive component of material culture. To maximise comparative potential, I chose to adhere to the best practices within the Sagalassos Project, as established for the Sagalassos Red Slip Ware (SRSW) production from Roman imperial times (Poblome 1999). As a matter of policy in the Sagalassos Project, classifying and processing of pottery fragments is based in essence on fabric and morphological properties. Any classification of the Achaemenid and Hellenistic material of Düzen Tepe and Sagalassos, or any other archaeological period or site in the region for that matter, clearly needed to focus on the same major elements to ensure the highest possible degree of uniformity and systematisation of information. These procedures are aimed to uncover as much information as possible regarding ways of doing in communities of practices, technical skills and socio-cultural choices imbued in the material.
First, clay pastes or fabrics are defined through macroscopic analysis, essentially following David Peacock's system of fabric characterisation (Peacock 1977a). The key properties used for fabric identification are colour, hardness, texture, characteristics of the break, inclusions, and surface treatment. Preliminary macroscopic fabric classifications are, if possible, backed up and refined following a program of chemical and petrographic analyses, as well as raw materials provenancing (Braekmans 2010; Braekmans *et al.* 2017; Neyt *et al.* 2012).
Wherever possible, morphological attributes are added to fabric properties to classify sherds in a typological categorisation built on a nominal scale of measurement. Distinct classes of objects are described through a consistent patterning of a polythetic set of attributes (Hill and Evans 1972, 233). In this classification, three taxonomic levels are distinguished: type group, type and type-variant. These attributes can include elements such as wall thickness, diameter, height, shape, composition, *etc.* The resulting typology is arbitrary, in the sense that any other logic of classification and grouping of attributes could in principle have been followed.

Following this method of classification used for the SRSW, a pre-arranged system is developed, classifying material according to the principles of non-dimensional taxonomy. This means that not all attributes are equivalent and can therefore not be assigned equal weight. The latter would, for example, be the case in paradigmatic classifications or systematics of grouping following no pre-arranged abstract template. This is a common approach for statistical methods such as cluster analysis (Dunnell 1971). Ideally, a classification system would take into account all potential attributes, which can be used for determining classification boundaries. In practice this is often impossible, especially for the archaeological record because of the fragmentary nature of our data. Moreover, in theory an endless array of attributes could potentially be identified, albeit not all of equal importance. It was, for example, suggested by David Clarke that a tripartite ranking could be used to differentiate between key, essential and inessential attributes (Clarke 1968, 71). However, even if no such *a priori* ranking is used, in practice certain attributes will still tend to be assigned greater weight. One of the problems encountered specifically for the selected material of the datasets under discussion here, pertains to the high degree of fragmentation, which impeded determination of vessel form and function to a large degree. As such, several types identified in the typologies of Achaemenid and Hellenistic material were by necessity defined on the basis of a limited amount of attributes related to rim shape. In the absence of better preserved material, this caveat seems difficult to remedy at this point. As a result, however, even for better preserved types where part or all of the vessel shape was retrieved, rim-related attributes received hierarchical precedence over others to maintain internal coherence.

Based on these principles, a pottery typology was constructed, with type codes following or complementing those of the SRSW classification. As full typological continuity cannot be expected throughout different time periods, this approach resulted in certain discontinuities in numbering within type groups, especially when comparing different time period. In exchange, however, significant added benefits were gained for typological and diachronic comparison, allowing maximum highlighting of continuity and discontinuity in material culture whenever possible.

However, classifications are merely a first step in the basic procedure of data structuration and can never be the end-goal (Rice 1987, 275). As mentioned earlier, the second objective of my analyses was to examine how this material could be interpreted as proxy for social, economic and political patterns of behaviour and complexity dynamics. To do so, however, we do not only need a logical classification, we also need to establish whether or not the material in our datasets corresponds to coherent patterns of behaviour, and therefore whether they can be identified as actual assemblages, and, if not, how we can still use this data for general interpretations of the societal context of their production and usage. An assemblage has been defined as 'an open typological series containing those types which are representative for a certain phase in the chronological evolution of the pottery in a specific archaeological context' (Poblome and Degeest 1993, 149). Our argument therefore needs to demonstrate that the material presented here has both contextual and chronological coherence.

It can immediately be noted, however, that the highly different types of contexts from which the material was selected, as well as the highly varying site formation processes associated with them, seem to exclude the identification of coherent assemblage in most cases. For Düzen Tepe, material has been selected from three spatially and functionally differentiated contexts, including a bakery, a pottery production site and a domestic building. Moreover, it is unclear how site formation processes influenced the formation of these contexts. In particular, the distinction between occupational and post-occupational layers is contested, especially since we have no idea how and why the latter developed, even though they commonly contain far more material compared to occupational contexts. Finally, the pottery material of Düzen Tepe can be placed in a comparatively large chronological bracket, spanning the 5th to 2nd centuries BCE. In sum, neither contextual nor chronological coherence can be assumed for this dataset, and consequently, the identification of a single assemblage is hard to retain. Still, I will show in part 4.2.1.4 that a certain degree of coherence in-between the different excavation contexts can be found.
For the study region, in the absence of stratified excavation material, only surface material has been collected through archaeological surveys. Reconstructing coherent assemblages from survey material is notoriously difficult given the multitude of site formation and erosion processes influencing the surface. Moreover, those sites only studied through extensive surveys can *a priori* be excluded given the high degree of uncertainty regarding the internal coherence of this material and collection biases. Even for systematically organized intensive prospection, the potential biases are too large
Finally, for Sagalassos, the dataset comprises of three major parts. For the survey material, again strong caution should be applied in associating functional or chronological coherence to such material, which *a priori* constitutes a material palimpsest (Lucas 2012). Additionally, the residual material selected from contexts all over the site can obviously not be considered a proper assemblage in its own right. The only body of material which can safely be considered to constitute an actual assemblage is the pottery material collected from recent control excavations conducted at the Upper Agora. This material can be associated with the construction of the first phase of the public square in the second century BCE, and is therefore an important data source regarding the initial phase of urbanization at Sagalassos. A more detailed argumentation as to the identification of this material as an assemblage will be offered in part 4.2.1.3, whereas its implications for this marked transformation phase at Sagalassos will be discussed throughout chapter four.

For the other material in the datasets, no strict interpretations on properties of the overall level can therefore be made. This can be solved, however, by focusing on properties of individual sherds and aggregating this information onto the overall group level. Particularly, variability in individual vessel dimensions will be used as a starting point for such an interpretative aggregation. The methodological component of this approach will be discussed in more detail in part 2.4, whereas its application will be outlined in part 4.2.1.4.

2.3 Comparative datasets

While much of the work presented here is based on the macroscopic pottery analyses outlined in the previous part and in 4.2.1, other data sources have been used as well. At this point, differences in data availability between different sites and time periods needed to be taken into account.
In Figure 21, an overview can be found of available datasets that could be used to complement/compare the macroscopic pottery analysis (displayed on line 1) in order to present a better conceptualisation of community formation and complexity dynamics in the various case studies.

Data	*Sagalassos*	*Düzen Tepe*	*Study region*	*Iron Age*	*Achaemenid period*	*Hellenistic period*
Macroscopic pottery analyses	x	x	x	x	x	x
Petrographic pottery analyses	x	x	x	x	x	x
Resource provenancing	x	x	x	x	x	x
Archaeobotanical remains	x	x			x	x
Faunal remains	x	x			x	x
Population estimates		x			x	x
GIS analyses	x	x	x	x	x	x
Architectural remains	x	x			x	x
Textual sources	x		x			x
Chemical analysis		x			x	x
Production infrastructure	x	x			x	x
Distribution patterns	x	x	x	x	x	x
Geophysical survey	x	x			x	x

Figure 21: Overview of available data sources.

Looking at the table, it becomes immediately clear that comparatively less data sources were available for the study region and the Iron Age. This partially influenced the eventual choice to focus more strongly on the Sagalassos-Düzen Tepe dynamic.
First off, to offer an encompassing view on the properties of pottery production and usage, macroscopic analyses needed to be supplemented with petrographic and chemical analyses as well. Fortunately, these were readily available for the material of Düzen Tepe and Sagalassos, as well as the study region through the works of dr. Dennis Braekmans (Braekmans 2010; Braekmans *et al.* 2011, 2017). Macroscopic and petrographic data have been combined in several of the papers on material culture in part 4.2.1 as well as 4.3 to trace material provenance, strategies of raw material exploitation, and patterns of distribution from Iron Age to Hellenistic times throughout the study region.
Second, in order to properly contextualise patterns of production and material culture usage for the various communities in the case studies, I wanted to sketch the overall socio-environmental parameters in which they operated. At this point, it became clear that the necessary data sources for relevant historical periods were only available for Düzen Tepe. It was therefore decided to use Düzen Tepe as a case study and calculate the total spatial area needed to sustain the population of this settlement. To this end, geophysical and archaeological survey data were used to establish a series of population estimates, archaeobotanical and faunal remains were used to reconstruct diet and prevalent foodways at the settlement. These were then combined to determine the amount of land needed to grow these crops or herd these animals, or in short, the amount of land needed for subsistence practices at Düzen Tepe. The method of calculation is explained in more detail in part 4.2.2. However, the results of these calculations then needed to be related to the actual spatial extent available to the community.

Determining areas associated with settlements at specific points in time is a notoriously difficult undertaking. In the absence of clear textual sources or boundary markers, polity boundaries are commonly assumed to fall on physiographic features, such as rivers or mountains (Stoner 2012). However, towards the east of Düzen Tepe, such a natural boundary was not present, moreover, the proximity of Sagalassos could potentially be a problematic factor. At this point, it was decided to integrate patterns of material culture distribution in our analysis. Having established the differences in distinct properties of pottery production at Düzen Tepe and Sagalassos, we could differentiate between pottery from both sites as it was collected from several locations in the valley during the Suburban Survey project. It was moreover noted that material from Düzen Tepe and Sagalassos were never encountered in the same survey sector. This suggested that we could assume some sort of spatial differentiation between the presence of people associated with one or the other community. It is not claimed that the presence of pottery sherds can be considered unequivocal proof of fixed territorial claims and/or social, political and economic relations. However, it is suggested that pottery material can be tentatively used as indicators for the material expression of communities of practice, resulting in spatially differentiated presence of people from one particular community and not the other at specific locations (Carlstein 1982).

Having thus established a pilot case for the overall subsistence requirements for the population of a relatively small-scale community such as Düzen Tepe, as well as a potential outline as to the spatial extent available to sustain these needs, we can turn attention towards discussing societal dynamics of community formation and complexity trajectories at the site, as well as compare these with the data from Sagalassos.
I decided to focus on two major themes: socio-economic complexity and socio-political organisation, following focus on the dual conceptualisation of material culture as informational entities with a techno-productive and communicative aspect. The former element could be used to extend the argument towards socio-economic complexity, whereas the latter could be used to elucidate socio-political organisation and complexity. The assumptions, reasoning and methodological implications of this approach will be discussed in the next part.

2.4 Social complexity

A rich body of literature exists on approximating and measuring complexity, however, so far it has remained an elusive concept and constructing an encompassing and useful measure of complexity has proven to be extremely difficult (Page 2010, 27). Likewise, little consensus has been found on reliable indicators or approximations of social complexity. In part 1.2.3, I discussed social complexity as a property of social systems, capturing *inter alia* social differentiation, hierarchical and heterarchical organizational structures, and political integration. A more fruitful interpretation, however, was offered by Joseph Tainter (1996, 64) who suggested a stripped-down approach by focusing on three general mechanisms of complexity development: differentiation, specialization, and integration. If we are considering *mechanisms* of complexity, one can wonder what exactly these mechanisms are operating on. Instead of trying to define specific elements, we can again strip down our approach and focus on general causal factors for development. This approach is pursued in more detail in part 4.2.3 but we can already detail the background and general outlines here. Next, I will turn to the aspect of causal factors to elucidate how these mechanisms can be related to the system changes observed in the data, as discussed in the case studies of chapter four. Causal factors and mechanisms of complexity are then tied back into the conceptualisation of material culture as an element of informational systems to structure avenues of communication, collective action and social organisation. As with the previous chapter, I conclude this part with some considerations regarding human-environment interactions and how these will be approached in the case studies.

Relative complexity

As a starting point, a particularly interesting approach can be highlighted, considering a 'subjective' or relative measure of complexity (Efatmaneshnik and Ryan 2016). In this sense, degree of complexity development always depends on the available frames of reference, starting from a 'reference simplicity'. A given society can only be considered 'complex' compared to another society, which may in turn be considered 'simple', of course without endowing any moral connotations to any such labels. The equation is as follows: $K(S) = F(\mu(S) \cdot D(SR))$.
The subjective measure of system complexity K is then a function of input μ (size of the minimal description in a given context) and D (distance function). Complexity can in this sense be considered some sort of 'distance' or amount of system change compared to an initial input value. However, not every change necessarily constitutes the development of complexity.
We already detailed how growing complexity can come about when a given society tries to develop solutions to challenges and opportunities. On a socio-political level, these solutions generally consist of additional rules, laws procedures, institutions and conventions guiding social life. On a more abstract level, however, Douglas Price (1981), for example, defined complexity as 'that which is made up of many, elaborately interrelated parts'. Likewise, many other definitions have focused on the inclusion of more parts, or more differentiation between parts. Specifically for human systems, complexity development has also been defined as an increasing degree of structural differentiation and levels of integration (Allen *et. al.* 2003, 61-62). A number of key elements can be seen to return, which can be linked to different types of complexity.
Renate Sitte (2009) defined five fundamental types of complexity: functional, topological, structural, algorithmic, and architectural. I will focus specifically on the first three, as both architectural and algorithmic complexity have seen few applications beyond very specific fields and are of limited use in the present context. Functional complexity pertains to a differentiation between single or multifunctional components. Topological complexity refers to aspects such as connectivity, relation, number of relations, and direction of relations. Structural complexity involves elements of dimensionality, networks, hierarchy, and levels depth/breadth. For descriptive ease, I will subsume the different aspects of each of these types of complexity under a common denominator, which will form the core components of the upcoming complexity approximation, respectively: diversity, connectivity, and dimensionality. These reflect Jonathan Turner's meso level forces acting as selective pressures on development of human social organization, respectively differentiation, integration and segmentation (Turner 2003, 6) and also generally correspond to Joseph Tainter's complexity mechanisms.
Diversity and connectivity in particular are then the key mechanisms which will generate the 'distance' in complexity development. Diversity can be further differentiated in three aspects, operating on different scales: variation within a given type (pertaining to measurements and dimensions such as height, width, weight, etc.), diversity of types and kinds (the most commonly considered element of diversity, most closely related to Sitte's functional diversity), and diversity of composition (population/assemblage variability) (Page 2007). Connections between components is what makes the overall system truly complex, as it allows the necessary interactions generating emergent behaviour (Fernandez *et al.* 2014). Finally, 'dimensionality' refers to the constituting ordering of diverse, interconnected components within the system, structured both vertically and horizontally.

Returning to the conceptualisation of complexity as a function of a given input value and a distance measure, it can now be posited that this distance is generated by the interplay between differentiation in dimensional organization and growing connectivity between differentiated components in a structured whole. Joseph Tainter, for example, based on Blau's (1970) consideration of organizational differentiation, offered various definitions of complexity as "differentiation in social, political and/or economic structure combined with organisation that integrates diverse structural parts into a whole" (Tainter 2000) or (cultural) complexity as "differentiation in structure and variation in organization" (Tainter 2016, 33). The combination is essential, as structural differentiation alone does not necessarily equal complexity. Structural elements (for example social roles and institutions) should be constrained through interconnected organizational structures. It is this connected organization which gives a system coherence. I will now discuss these three mechanisms – diversity, dimensionality, and connectivity – in some more detail given their importance in the case studies of chapter four, especially in the discussion of socio-economic complexity in part 4.2.3.

Diversity

Diversity as a property of human societies has been considered mainly from an evolutionary perspective. Early approaches to construct diversity measures were developed mainly for comparison of evolutionary perspectives on cultural change, and therefore strongly borrowed input from earlier advances made in ecology to quantify biodiversity (Bobrowsky and Ball 1989). Kenneth Bausch (2001, 98) differentiated three fundamental tenets of 'differentiation theory': 1) differentiation is the master trend of societal evolution; 2) it is directed by societal needs; 3) it increases adaptation, generality and inclusivity of a society. Diversity is thus an essential element of conceptualising changes within a system over time (Sahlins 1976). It has even been suggested that social, political, and economic diversity are all inherently covered by the single term of 'complexity' (Chapman 2003; Page 2007; Gronenborn *et al.* 2014, 2017).

It should be noted however that in some ways, societies we might think of as most complex – for example our modern nation-states – are actually less differentiated than premodern archaic states, with their complicated webs of estates, orders and ranks (Gellner 1983). Instead, *dedifferentiation* has been argued for as the hallmark of the rise of homogeneous citizen communities (Tilly 1984, 46-50). I have of course no intention of returning to conceptualising evolutionary trajectories of human societies, yet, I argue that diversity can prove a useful concept if properly operationalised. How can we now approach the operationalisation of the aspect of diversity?

As we have seen, several levels of diversity can be distinguished. In its most general sense, however, most people will consider diversity as pertaining to the distribution of quantities over distinct classes (Jones and Leonard 1989, 2). Diversity measures have commonly been used to capture this dimension of type diversity when comparing pottery assemblages (see various contributions in Leonard and Jones 1989). However, as we have seen in one of the previous parts, only one set of material in our datasets can safely be assumed to constitute a coherent assemblage, the others being a compilation or amalgam of various contexts. I therefore decided not to apply a diversity measure in the traditional sense to compare for example the pottery of Düzen Tepe with that of Sagalassos, given the overly strong biases in both datasets. Instead, in part 4.2.1.4, I provide a statistical comparison of the variance in attributes of the Düzen Tepe material compared with that of Sagalassos. The aim of this analysis is therefore to study the degree variation within a given type. More specifically, I compare attributes that could – despite the high degree of fragmentation of the material – be consistently recorded for most sherds: wall thickness and diameter. Given the overly strong divergence in genesis of the material record and compilation of the datasets, focusing on diversity of object attributes is considered to be more likely to result in meaningful results compared to the diversity of the full assemblages.

Different degrees of variability can be associated with a number of underlying factors such as imperfect processes of replication, lack of skill, conscious variation, number of producers involved, lack of strong control over production sequences or, conversely, strong quality control aimed at standardized production output, or even completely random events such as the potter having a bad day or being distracted (Rice 1981, 1989; van der Leeuw 1977). Concordantly, artefact diversity can be indicative for a variety of behaviour patterns as well, not only related to pottery production but usage as well. For example, access to resources for manufacture can be socially or economically determined, status variables that relate to access to finished goods may influence distribution patterns, differing functions or activities involving pottery at different sites may skew typological assemblages, and changes in usage over time may influence overall distribution of diversity within the assemblage (Rice 1989: 111).

Connectivity

As discussed earlier, (cultural) complexity is considered to be determined by differentiation in structure and variation in organization (Tainter 2011b). However, structural differentiation alone does not necessarily equal complexity. The behaviour of components must be integrated in order to function as a system. Structural organization limits and channels behaviour, granting a dimension of behavioural predictability predictable and internal system coherence. Complexity thus occurs when different components become connected, start to interact and generate novel information which determines further system dynamics. What makes complex systems truly 'tick' are therefore the connections between people and other constituent components of social systems, such as social groups and institutions.
The connections between subcomponents of a complex system are 'informational' by nature. I already extensively discussed the emergent property of complex systems as information transmission and processing units, allowing – besides energy and material – information to be spread among system components. The key mechanisms of these flows of information are social interaction and communication, as well as the informational component of the material environment of a given society. Connectivity in this sense can be said to have a strong multiplier effect in system dynamics, a core aspect of the functionality of urban communities as social reactors, as highlighted earlier (see 1.2.3).

Connectivity between system components was also discussed already as a key property of the adaptive cycle in part 1.2.4. Specifically in the transition from the r to K phase, internal system components become increasingly interconnected, sometimes resulting in extremely high levels of integration or hypercoherence, where an increasingly smaller number of key productive strategies start to become strongly interdependent. Processes of increasing specialization, efficiency, and process optimization are therefore characteristic for this transition phase, generating a multiplier effect induced by intensification processes yielding increasing returns to scale (Arthur 1990, 2009; Krugman 1991).
The generative role of connectivity should, however, not be automatically assumed. One the one hand, there is not necessarily a linear relationship between an increase in connectivity with increase in diversity, resulting in a direct increase in complexity. An essential element of connectedness is also the intensity of its linkages, for example when performing exploitation strategies (Rosen and Rivera-Collazo 2012). Additionally, connectivity of 'what-to-what', or the various ways subcomponents become interconnected, are equally important as the mere fact that connectivity increases or decreases (Scheffer *et al.* 2012). Peters and Zimmerman (2017), for example, define connectedness as the level of vertical and horizontal social differentiation, however, this last conceptualisation rather relates to the third mechanism proposed here: dimensionality, or the various ways in which complex systems are structured.

Dimensionality

The property of dimensionality captures the degree of hierarchical and heterarchical organizational structure. Complex systems consist of integrated heterarchical components organized into nested groups that can be represented as structured networks within organizational hierarchies (Barton 2014, 307). The development of hierarchical structure is often advantageous as its streamlines flows of information and communication, however this does not necessarily mean that hierarchy guarantees efficiency and stability (Wu 2013, 287-299). When a hierarchical system is too deep (too many levels) and too rigid (too strong top-down controls), its performance may suffer because of low efficiency and low adaptability. In general, the deeper the vertical nesting of various horizontal groups of components, the more complex the system, regardless of its efficiency. Key elements here are networks of components, hierarchy/heterarchy or levels of depth/breadth. Dimensionality as a concept therefore reflects the structural properties of a complex system as an interconnected diversity of subcomponent functionalities and structures. It entails the combination of a vertical and horizontal dimension. The structural properties of a complex system will determine to a large part its flows and dynamics as interactions among components within a nested group tend to be more frequent and intensive than interactions between groups at other levels within the hierarchy. These stronger links between coherent groups allow certain groups to operate semi-independently of their connections to other groups within a nested hierarchy, a property called 'near decomposability'. This property can strongly affect the way complex systems originate, develop and disaggregate.

Systems displaying increased levels of dimensionality, for example through the development of hierarchies, are often subjected to feedback mechanisms induced by processes operating at different speeds, as elucidated in more detail in part 1.2.4. In part 4.2.4, I will argue how some of the properties associated with the urban transformation phase at Sagalassos can be related to the development of an additional hierarchical level of social organization and decision-making beyond the household as main locus of social life, thus acting on a wholly different scale and speed of operation.

Techno-productive complexity in material culture

The three mechanisms of complexity development discussed here, in and by themselves can explain *how* a certain process envelops. However, they do not necessarily explain *why* this development occurs. To do so, the element of causal factors of system development can be incorporated in the approach (Gerring 2012, 198-199). These should not be seen as a reduction to a single causal connection, but rather as part of a multi-causal perspective on system dynamics. Causal factors of complexity development can be linked to Jonathan Turner's (2003) macro-level forces stimulating social organizational development highlighted in part 1.1.3. These forces are: demography, economic production, distribution, regulation and (biological) reproduction. In the case studies of chapter four, all of these will be discussed, with the exception of reproduction as this is less visible in the archaeological record. More specifically, demography will be discussed in 4.2.2, production and distribution in 4.2.3, and regulation in 4.2.4.

Given the focus on material culture in this research, I focus at this point in particular on the material dimension of complexity development. As I have argued up until this point, this material dimension can be used as proxy for overall dynamics of social complexity as well. When applying the framework of complexity mechanisms on material culture, we need to consider how to conceptualise the parameters of change upon which these mechanisms can operate, or, in other words, what the relevant elements are within the causal factor of production.

At this point, we can turn towards literature on modes of material culture production structure our argument and provide a systematic contextualization for the findings of the macroscopic pottery analyses outlined earlier. In general, two approaches have found widespread application in archaeology (Peacock 1982; van der Leeuw 1977), which can be largely boiled down to four categories as most prevalent organizational structures of material culture production: 1) household production, 2) household industry, 3) individual workshop industry, and 4) nucleated workshops. Each of these are qualified according to a set of traits (Figure 22).

Traits	**Mode of production**			
	Household production	*Household industry*	*Individual workshops*	*Nucleated workshops*
Raw material procurement	Immediate availability	Immediate availability	Targeted selection	Targeted and specialized
Labour investment	Low	Low	Moderate	High
Capital investment	Low	Low	High	High
Scale of production	Self-sufficiency	Subsistence production	Limited market exchange	Full market exchange
Specialization	Low	Low	Moderate	High
Standardization	Low	Low	Moderate	High

Figure 22: Modes of production according to qualified set of traits (after Rice 1987).

It should be noted that the exact identification and delineation of specific modes of production in any of the case studies is *not* the point here. These categories are oftentimes presented as an evolutionary sequence broken down into fixed steps along an invariant trajectory, however, it has been noted that any such divisions are purely artificial (Rice 1981, 222). Instead, they will help to structure the argument and generate hypotheses to allow us to focus on developments in relevant parameters for material complexity trajectories. Rather than focusing on the vertical connections of Figure 22 through invariant modes of production, I therefore propose to work on a horizontal axis and look for development in each of these traits through the complexity mechanisms outlined earlier.
For each (qualitative) parameter of comparison, an evaluation is given for the systems under comparison, for example Düzen Tepe and Sagalassos. Next the intensity of development, *i.e*. the distance needed to get from the reference value to the comparison value, is approximated. In part 4.2.3, I apply this framework by attaching a fixed numerical valuation to all nominal evaluations (see Torvinen *et al.* 2016 for a similar methodological procedure), using a fuzzy set of numerical values ranging between 0 and 1. This approach can be used to clarify how different processes compare to one another through the internally consistent use of a measurement indicator.
This way, an approximation of the intensity of system dynamics can provide an indication for the degree of potential generated by each causal factor for inducing further system complexity. By comparing intensities of development, we can determine which elements of the socio-economic systems at both communities contributed most to overall system complexity. The purpose of this preliminary measure would be to elucidate claims of what constitutes the development of social complexity by forcing us to carefully consider the parameters used to evaluate it and to provide an explicit approximation of the proclaimed developments in each of these parameters.

The intensity of a given process is only a first step towards approximating socio-economic complexity development. To elucidate the underlying drivers of this process, a formalized approach is suggested, based on a model of input information (I), causal factors (X), mechanisms of complexity development (M), and (socio-economic) system output (Y). The resultant *Y* can then feature as part of novel *I*, operating in a recursive loop of system dynamics. Due to the non-linear nature of complex system dynamics, multiple causal factors and mechanisms can interact and co-evolve simultaneously, rendering any interpretation of the resultant system output probabilistic in nature (Ragin 2014, 24-25). This can be represented as: $Y \leftarrow \langle (X) \wedge (X|I) \wedge (M|X) \rangle$.
The angular brackets indicate that the conjunction of events is ordered from left to right. *X* can be considered as an element of a given system state developed out of a combination of *I* from prior system outcomes and external stimuli. Information is then evaluated according to a rule set derived from internalised practical knowledge and socialized behaviour in causal factor *X*, and transformed into a new system response *Y* through a mechanism *M*.

The traits listed in Figure 22 can be considered part of a (non-exhaustive) set of parameters that can be used to trace material complexity within socio-economic systems through the integration of the aforementioned mechanisms. Other elements which will be considered in more detail in the case studies are, for example, supply and demand and institutionalization.
Diversity in resource selection, for example, can be interpreted within the context of differing degrees of knowledge on the availability of sources within the environment and the potters' recognition of the suitability of these sources. The effective usage of suitable sources is then dependent on subsequent resource selection for production, possibly limited due to restricted access to resources. The latter also has an effect on diversity in attribute systems of the pottery, along with possible standardization practices in production activities. Here, the relation between diversification and integration, versus specialization and standardization needs to be considered.
Specialization generally occurs in three ways: 1) spatial specialization, as the expression of diversification in specific activities that form part of the same overall integrated practice sequence, for example spatial differentiation in performing the various steps of the operational sequence; 2) resource specialization, as a selection policy aimed towards specific production purposes and greater

efficiency of resource exploitation (Rice 1989, 110; Solich and Bradtmöller 2017, 112); 3) producer specialization, referring to the integration of individual and collective learning mechanisms through a specialized allocation of labour (in the form of time, skill and training) invested in producing goods for primary livelihood, often related to increased division of labour. Generally, when we consider specialization, it is the latter sense which comes to mind. Production specialization has also been defined as "*the investment of labour and capital toward the production of a particular good or service, in that a person produces more of that commodity, and less of others, than he or she consumes*" (Alchian and Allen 1969, 204).

Specialized production thus results in the production of surpluses (generally of one or a few specific goods) specifically geared towards exchange. Successful specialization will allow these higher return rates due to the accumulation of knowledge in an area of expertise and the associated improvement of skills or techniques. Increased production skills and knowledge are often expressed through increased standardization of material culture, which can be defined as "*the relative degree of homogeneity or reduction in variability in the characteristics of an artefact, or the process of achieving that relative homogeneity*" (Blackman *et al.* 1993, 61). Standardization can therefore be considered a by-product of specialization, induced by the routinization of repeated, itinerative[6] actions inducing economies of practice and resulting in increasingly similar production output and reduction of variation (Sinopoli 1988, 582).

Standardization and specialization can occur in two ways. First, through top-down structures when units on higher socio-political scales intervene and invest capital/energy to take control over certain subsystems and redirect its operations towards a specific outcome. Secondly, bottom-up processes can lead to standardization occurring within a given operational framework, either through 'organic' convergences or conscious decisions made by independent agents. For production systems this would, for example, entail convergences in properties of production output induced by the artisans themselves. Whether these measures are taken out of considerations for work flow efficiency, cost effectiveness, customer preferences or other reasons, is *in se* not relevant at this point and should be determined on individual case level.

To do so, the underlying mechanisms of the observed system dynamics need to be uncovered. Standardization and specialization can, for example, be considered symptomatic of intra-system connectivity. This means that systems with high dimensionality in subsystem components (here production units) become increasingly interconnected, either horizontally through self-organizing properties due to *inter pares* connectivity, or vertically through hierarchically connecting structures of control. The multiplier effects of these connections then result in economies of scale and increasing returns on investment.

The rate of variability and standardization in material culture can therefore be considered good indicators for the degree of specialization in a techno-productive system. Here, macroscopic pottery analyses can provide the necessary data to elucidate these processes. This includes elements such as fabric-type specialization, standardization of composition and appearance of objects, or inversely, the variability in vessel dimensions. Additionally, a statistical comparison of the variance in attributes of the Düzen Tepe material compared with that of Sagalassos performed in part 4.2.1.4 will capture part of this dynamic as well. The degree of specialization in material production can thus be considered through the reduction of variability as more efforts are spent towards a more limited number of strategies.

However, variability and standardization in material culture are not only the result of processes of specialization related to techno-productive factors. It can also be generated by the communicative dimension of material culture highlighted earlier as producers may express different intentions and goals in varying ways through their production output. In Figure 23, an overview of major factors

[6] As in the repetition of similar but not fully the same actions. 'Itinerative action' is a concept defined by French sociologists Gilles Deleuze and Felix Guattari, see Deleuze and Guattari 2004.

affecting ceramic variability is presented. These include not only techno-productive components, but also elements related to information transmission such as cultural conditioning, choices and identities (Lamban *et al.* 2014). It is clear that we should be careful to consider what exactly is measured by diversity/variability and standardization regarding production and usage of pottery.

	STANDARDIZATION	VARIATION
Production system	- Availability of raw materials - Specialization - Large scale of production, routinization, need for efficiency and cost effectiveness - Use of tools and measurement aids	- Difficulties in obtaining raw materials, or high variability in raw materials - Non-specialized production - Production at domestic scale, or at low demand
Cultural conditioning	- Few cultural models - Regulations and norms - Mimetic learning (in a family or a workshop) - Skilled craftsmen	- Many cultural models - Mistakes, inability to reproduce models - Unskilled craftsmen
Conscious choice	- Traditionalism in style and technique - Need to communicate affiliation - Practical considerations	- Preferences of craftsmen and consumers/users - Need to communicate distinction
Identity mechanism	**The 'other' as an insider** (or member of the specific group)	**The 'other' as an outsider** (not a member of the specific group or someone excluded from that group)

Figure 23: Major factors affecting ceramic variability (Lamban et al. 2014).

To this end, we again need to focus on the earlier conceptualisation of the communicative aspect of material culture as an information transmission system. I will discuss the usage of material culture as part of a 'solidified' communication network to structure socio-political organisation in the next part.

Communicative complexity in socio-political organisation

It has been suggested that diversity in material culture can be directly linked to its functionality as an information transmitter by stressing its role as regulator in managing information processing problems (Kohler *et al.* 2004; Nelson *et al*. 2011). Homogeneity (i.e. low diversity) in material culture is then linked to overall strategies of social conformity as a social consensus tool, a trait often associated with increases in group size, density, or scale (Johnson 1982; Kohler *et al.* 2004).

Two major modes of consensus-seeking strategies can be discerned, either originating from the presence and role of (formal or informal) centralised institutions, for example authority, leadership, broadcasting (i.e. one-to-many distributors of information), incentives for collective coordination, closed information feedback loops (Baronchelli 2017, 2). When centralised institutions do not exist in a given society, consensus comes either from the interaction between agents or from some predefined individual behaviour. This 'spontaneous' emergence of consensus is then produced by self-interested individuals who are not intentionally aiming to collective coordination. Its main mechanisms are: communication, (social) punishment of deviants, positive payoff externalities (i.e. pathways of development where once certain norms are established they persist), and conformity bias. Low material diversity is then characteristic for the second mode of consensus strategies, inducing conformist behaviour, also known as biased conformist transmission referring to the tendency of people to copy or imitate ideas or behaviours of the majority of the group, thus facilitating intragroup cooperation as a way to reduce scalar stress in consensual decision making by establishing a degree of social cohesiveness (Hodder 1979; Johnson 1982). In other terms, social conformity can be considered as a form of institutional structure that reduces transaction costs (cfr. North 1990).

In their study on the Mimbres archaeological region in southwest New Mexico, Nelson and colleagues (2011) found that in some contexts, low levels of diversity and high population density preceded dramatic social, economic, political, and demographic transformations. They therefore suggested a trade-off between the costs and benefits of diversity in the context of regulating population densities, either as an intentional strategy or an emergent circumstance. In resilience theory, however, it is pointed out that diversity is essential for absorbing disturbance and helping with regeneration and reorganization following a disturbance event (Folke 2006). Social conformity may thus simultaneously constitute a loss of resilience by lessening the capacity of the system to respond in varied ways (Nelson *et al.* 2011). The reduction of diversity therefore increases short-term robustness by improving group cohesiveness and contribute to decision making and the capacity for collective action, at the expense of limiting the range of available response options to disturbance events, thus eroding resilience and increase long-term vulnerability.

In part 4.2.1.4, I present a statistical analysis of the variance in attributes from pottery of Düzen Tepe and Sagalassos. The results of this analysis can be used to consider differences in strategies of communication between both sets of material. To elucidate our view further, the information from the pottery analysis is complemented with a description of the architectural remains from both sites to provide a more comprehensive evaluation on the full material environment guiding and structuring flows of information and communication. This way, it can be demonstrated how both sites developed markedly different locales for social life and collective action measures to unfold.

Socio-environmental complexity

In the conceptual framework of chapter 1, I extensively discussed the importance of incorporating human-environment interactions when studying community formation and social organisation. The availability and expenditure of energy and resources underlie all societal dynamics and are therefore a *condition sine qua non* for social organisation. Making things is one way to expend energy through labour and usage of resources. Choices regarding organizational structures of labour are therefore highly indicative of the overall opportunities and limits of a given society. In the previous parts of this chapter, I already provided some analytical tools and approaches to use archaeological data in order to elucidate some of these dynamics of social organisation and complexity development.

Among others, I highlighted the link between elements of specialization, standardization and variability with socio-economic complexity. On a more general level, we can consider any process of specialization (economic or otherwise) to entail the investment of labour and resources (in any given process) towards generating an increased output (of any given nature) beyond personal consumption (for any given purpose). As such, processes of specialization generate capital which can be used to sustain further system dynamics, creating a positive feedback loop. This process can be captured through the framework of the adaptive cycle.

At this point, I will not attempt to integrate the adaptive cycle framework on the same formal basis as in the previous part. I will explain the reasoning behind this choice further in the final chapter. I do want to argue, however, that the framework can prove valuable as a descriptive framework that can be used to generate general hypotheses on system dynamics which can be compared to empirical data. For example, as a single adaptive cycle moves from r into K, overall system capital should increase due to increased specialization and intensification of system dynamics. It should be noted however, that certain pay-offs between subcomponents of capital may exist. For example, natural capital is often exploited more intensively to sustain increased expenditure in physical capital. The integration of the adaptive cycle as a framework for human-environment interactions is able to capture these different aspects of capital (human, physical, environmental).

In another example, it has been suggested that system growth in the K-phase is often characterized by increasing investment in a limited number of strategies and hypercoherence (Nelson *et al.* 2006, 411). As such, an inverse correlation between connectivity and resilience exists as too many high-performance connections may constrain the potential response options and make the system ‘brittle’ or less resilient in the face of perturbations (Redman and Kinzig 2003, 4). By tracing specialization in strategies of subsistence and production, as well as the connections between different system components, we can try to assess whether a certain social system was straining the limits of its natural environment. For example, the impact of the development of Sagalassos into an urban hub can be considered in this respect.

Chapter 3. Narrative framework: The origin of *polis*

“Books are not made to be believed, but to be subjected to inquiry. When we consider a book, we mustn't ask ourselves what it says but what it means.”
-Umberto Eco, The Name of the Rose.

3.1 Introduction

In the previous chapters, I outlined a suitable theoretical and methodological framework to describe, approximate, and interpret dynamics of community development and social complexity. In the following chapter, I will apply this framework to a selected case study, centred mainly on the origin and development of Sagalassos and Düzen Tepe (SW Anatolia). It should be noted that, traditionally, dynamics of (increasing) social complexity and (urban) community formation in Anatolia, especially during the Hellenistic period, are often discussed in the framework of *polis* formation. This chapter will specifically deal with the background of this *polis* narrative, where it came from and what it entails for an Anatolian context.

The *polis* narrative can be expressed in a variety of ways. The increasing attestations of social complexity may for example be considered to be directly derived from contacts with Greek or allied people moving into these lands, mainly colonists or veterans from armies of the Hellenistic kings (Cohen 1978). Cultural developments in so-called 'indigenous' communities are in this sense ascribed to some sort of Hellenocentric *aemulatio* influencing local tastes, preferences and styles, for example expressed through the construction of Greek-styled monumental buildings or material culture oriented towards Aegean examples. In sum, local communities that model their social, political and economic structures to Greek examples. I will discuss in more detail how this standard image does not necessarily return in our observations on the archaeological record of Anatolia (see chapter four). Yet, this view is pervasive in much historical and archaeological works. It is for example expressed through the widespread usage of the word *polis* to denote local settlements and communities. It is commonly applied to an enormous amount of settlements, spread throughout the Mediterranean world, mainly from Archaic (800-500 BCE) until Hellenistic times (323-31 BCE) (Hansen 2006a; Hansen and Nielsen 2004). About 164 *poleis* were identified for the southern (16) and western (148) parts of Anatolia, albeit mainly on the coastal areas (Hansen and Nielsen 2004). It was stated that "there were no *poleis* in the interior of Asia Minor before the end of the fourth century BCE" (Mitchell 2017,16).

But what does the concept of the *polis* in an Anatolian context actually mean? Is it effectively related to the appropriation of Greek cultural elements? It can be questioned to what extent this connection is actually valid. Why would communities in Anatolia necessarily turn to Greek culture as a hallmark to be emulated? Was it merely a matter of preferences and style? Or could there have been political motives at play as well? Especially for the Hellenistic period, it has been suggested that adopting Greek culture could have been a means of political advancement in relationship with the different Hellenistic kings (Ma 1999). Was the adoption of Greek culture in Anatolia then merely a 'façade', as prerequisite to be taken seriously on the socio-political playing field of that time? Yet, the presumed dissemination of Greek culture in Anatolia, for example through the foundation of Greek colonies, occurred long before the Hellenistic period as well (Cohen 1978).

As will be demonstrated in the case studies in chapter four, the direct cultural influences of the Aegean on local material culture production and urban development should rather be played down in favour of other potential orientations of influence. Likewise, Stephen Mitchell (2017) recently downplayed the impact of Greek culture in the Anatolian world. Yet, the idea of a paramount Greek model of community formation, settlement layout and material culture preferences has been quite pervasive in scholarly works. Why is that? I will argue that part of the reason can be found in the Eurocentric discourse, built on an older Hellenocentric sense of cultural superiority, present (implicitly and explicitly) in much of Western academic works. Rather than sweeping the Hellenic connection aside as irrelevant for local Anatolian community dynamics, it was opted to present a Greek model of community formation and complexity development, centred on the Aegean heartland of Greek civilization, and use this as a contrasting model to compare with and contextualize the case studies of chapter four.

A different question would be to what extent the concept of *polis* should continue to be necessarily linked with a Greek connotation. Maybe the concept can be salvaged as a descriptive term for certain trends in social, political and economic dynamics rather than having an explicit interpretive function as denoting a Greek cultural phenomenon. This chapter will present an in-depth discussion of the word and concept of *polis*, so commonly used to denote urban settlements in Anatolia as well, and its various meanings. *Polis* is a convoluted term. Between 1993 and 2003, the Copenhagen Polis Centre, founded by Mogens Herman Hansen at Copenhagen University, conducted a sweeping survey based on a number of pre-defined criteria in a bid to provide an empirical basis for identifying settlements as *poleis*. The resulting monumental inventory (Hansen and Nielsen 2004) identified up to 1500 *poleis* in Archaic and Classical times throughout the eastern Mediterranean. I will discuss the specific criteria that were used in the next part. However, the question can already be raised here, as by Hansen's (2006a) own admission, whether such an enormous amount of settlements can truly be covered by a single moniker, disregarding essential elements of variability in community organization and operation. To understand the role of the concept of *polis* in our understanding of ancient society, we must not only take into account the conceptions of *poleis* by the Greeks themselves, but also how the concept has been defined and used in modern research. It will be argued that the widespread identification of the *polis* through time and space is for a large part a direct result of a convolution of the concept of *polis* with aspects of urbanization and state.

After presenting an overview of the debate regarding the concept of *polis,* I then move on to a discussion of the development of the Eurocentric discourse that has engrained much of its research context, before discussing how the concept can still be used in modern academic research by focusing specifically on its two main aspects, as an urban community and a socio-political unit. Any overview presented in this chapter will by necessity be summarizing a far larger debate, using particular aspects in particular places at particular points in time as evidence for a general Greek model of community formation. Nothing like the archetypical Greek *polis* ever existed, yet due to constraints in time and space, the narrative will unavoidably be presented as such, losing valuable nuance and detail along the way. Discussing the Greek *polis* as a model of community formation in its own right, however, would have required a Ph.D. dissertation on its own, and more, allowing for more than a lifetime of study. The overview presented here should therefore be seen rather as a rough sketch of some major lines of development, which can be used later on by means of comparison with the case studies presented in the next chapter.

3.2 The concept of *polis*

Scholarly debate regarding the concept of polis originated during the 19th century. The Swiss Jacob Burckhardt (1818-1897) is generally considered the first to introduce the concept of *polis* in the study of ancient history (Vlassopoulos 2007, 45-7). He was soon followed by the Frenchman Numa Denis Fustel de Coulanges (1830-1889), who likewise discussed the Greek city and society through the lens of *polis* formation. Ever since, the concept of polis has remained in the vanguard of scholarly debate regarding ancient Greece. Its critics have pointed out the lack of a clear definition of the term due to a poor understanding of its uses in ancient sources, as well as an insufficient delineation of its meaning in modern scholarly debate (Gawantka 1985).

The word *'polis'* has been linked etymologically with the Old Indian *púr*, Lithuanian *pilìs*, and Latvian *pils*, all signifying a stronghold (Hoffmann 1950, 239). The oldest use of the word *polis* may already have been used to denote fortified sites on Crete in the 10th century BCE (Nowicki 1992). Throughout Archaic, Classical, Hellenistic, and Roman times, the word *polis* is mentioned frequently in texts and inscriptions. In 1993, Mogens Herman Hansen started the Copenhagen Polis Centre (CPC) to try and uncover the precise meaning(s) of the term in these sources. Specifically, all attestations of the term in Archaic and Classical sources were collected and analysed. CPC (Hansen 1996, 25-36) has highlighted four different uses of the word *polis*: 1) When used synonymously with *acropolis*, the term denotes a stronghold and/or a small hill-top settlement. The word is only used sporadically in this sense in Archaic sources and disappears altogether in later periods; 2) When used synonymously with *astu*, it denotes a nucleated settlement; 3) When used synonymously with *ge* or *chora* the term denotes a territory in the sense of a combination of town and hinterland. However, in this sense the word is used in fewer than two per cent of all occurrences; 4) when used in the sense of *koinonia* or *plethos politon* the term denotes a political community.

The overview provided by Sakellariou (1989) also distinguishes four usages of the word *polis* in ancient texts identified by CPC. The original, yet infrequently occurring, meaning of the word *polis* as citadel is here also supplemented with the denotation of a settlement as physical entity. Interestingly, he does not mention the use to denote a territory, but rather distinguishes between the *polis* as a specific form of state, and *polis* as a community of citizens in general. I will discuss the connection between *polis* and state in one of the next parts of this chapter. For now, it suffices to conclude that these four categories can be reduced to two main usages of the word: that of a physical setting and a political community. Often, both are meant simultaneously as nucleated settlements usually acted as political centres of a community in ancient Greece (Hansen 1998; Vlassopoulos 2007, 81). Moreover, out of both options, the use of *polis* as a political community is favoured, as concluded by the CPC:

> "In archaic and classical sources the term *polis* used in the sense of 'town' to denote a named urban centre is not applied to any urban centre but only to a town which was also the political centre of a *polis*. Thus, the term *polis* has two different *meanings*, town and state, but even when it is used in the sense of town, its reference, its denotation seems almost invariably to be what the Greeks called *polis* in the sense of a *koinonia politon politeias* and what we call a city-state." (Hansen 1996, 33).

At the very end of this definition, Hansen mentions the interesting concept of city-state, a common modern translation for *polis* as it refers simultaneously to both these crucial aspects, that of a physical settlement and political community. By the latter, Hansen means a self-governing and autonomous social, economic and political entity, consisting of an associated town and territory (Hansen 2006a, 33). After determining the main usage of the word *polis* as a political community, CPC tried to see which communities fit the bill by conducting an overall inventory of all Greek *poleis* that existed during Archaic and Classical times (Hansen and Nielsen 2004).

To conclusively prove the existence of political structures, it was necessary to look at the written evidence in particular. A first category of *poleis* was identified, consisting of those settlements explicitly denoted as such in ancient Greek sources. The second group consisted of those communities subsumed under the heading of *poleis* by ancient authors but only alongside a number of other communities. Given the fragmentary record of our knowledge of ancient authors and sources, it was considered most likely that not every mention of *poleis* in antiquity has survived and is known. Two more categories were therefore added, consisting both of settlements not explicitly mentioned as *poleis*, but known for one or more activities or traits characteristically associated with *poleis* in ancient Greek sources.

Textual analysis of the sources generated a list of traits, covering about 33 associated activities and attributes. These traits were used in a polythetic way. Whereas the ideal conception of *polis* would be characterized and identified by all of these traits, specific instances can be said to fit the general category by matching only a number of characteristics, rather than necessarily combining all of them. The list includes: Tribal affiliation, federal membership, alliance membership, league membership, party to a treaty, subject of synoikism or comparable processes (metoikism, dioikism, refoundation, *sympoliteia*, etc.), attestation of exiles, military matters, envoys, *proxenia*, naturalization, *theorodokoi*, civic subdivision, constitution type, public enactments, manifestations of legal systems, officials, assembly, public architecture, acropolis, walls, urbanisation, mint, control of land ownership, taxation, free non-citizens, cults, calendar, communal oracle consultation, participation/victors in games, communal dedications, colonizer, colonized, and foundation myth (Hansen and Nielsen 2004). The difference between both categories is mainly the certainty with which a given settlement could be considered a *polis* based on the attestation of one or more of these traits.

The aim of CPC was to compose an inventory of all Greek *poleis* in Archaic and Classical times. However, to use the traits listed above for identifying those settlements not explicitly named *poleis* in ancient sources, it must be noted that, individually, many of these traits could be associated with a wide range of socio-political configurations, not necessarily limited to the *polis*. Generic traits such as urbanisation, public architecture, cults, calendar, mint, *etc*. can by themselves hardly be used specifically as *polis* identifiers. Is it then implied that the specificity of this Greek context is to be found in one or more polythetic combinations of the listed traits? Yet, no indication is given that any specific combination(s) should be considered typical for *poleis,* whereas others should not. Nor could that have been the case as the list is indeed said to *a priori* consist of traits associated with *poleis*. Any combination of traits must therefore in principle be considered possible to identify a *polis*. This leaves us with tension between the generic nature of the individual traits and the overall aim of identifying specifically *Greek* communities. If identification is not possible through the listed traits *per se*, it could only be made possible through the context of these features. This list can therefore only effectively differentiate *poleis* from other modes of community organization within specific temporal and spatial parameters. While the CPC methodology can indeed be considered suitable for its aims within the Aegean heartland of ancient Greece, beyond these limits its effectiveness is lessened. The question then becomes not 'what is the *polis*?' but rather 'what is Greek?'.

A well-known passage from Aristoteles (384-322), defines the Greeks compared to other peoples in Europe and Asia as both spirited and intelligent (Aristoteles, *Pol.* VII, 1327B). Is the concept of *polis* then best used as an inseparably associated trait of Greek culture? An attestation of their intelligent and spirited nature if you will? Yet, other Greek authors, such as Herodotos (*c.* 480-420), Thucydides (*c.* 460-400) and Xenophon (*c.* 430-355), all use the word *polis* to describe barbarian (used in the sense of non-Greek) settlements as well (more specifically: Herodotos does so 47 times, Thucydides 7 times and Xenophon 21 times). Ancient Greek sources therefore did not *a priori* use the term *polis* as an inherently Greek concept that by its very definition differentiated them from other cultures. However, if this is the case and the element of 'Greekness' is no pre-set condition to talk about *poleis*, what use is left for the concept? Once the list of traits outlined above is dissociated from their specific context, many of these elements become part of a range of phenomena associated with two very general processes: urbanization and state formation, as will be discussed later on. Devoid of its denoting value, '*polis*' would then only be a label for any highly institutionalized urban centre. Some have indeed issued a call to consider the *polis* in this way as a general political community in order to incorporate a degree of variability not *a priori* limited solely to a single mode of socio-political configuration (Vlassopoulos 2007, 82). However, given the common usage of the term within a specifically Greek context, first the range of associated meanings and biases carried by the moniker 'Greek' must be considered.

3.3 The Greek *polis* in a Eurocentric discourse

In recent decades, the inherent biases at play in academic research on ancient Greek society and culture have increasingly been called out (Bernal 1987; Held 1997; Vlassopoulos 2007). It has been noted how the view of Greece as the cradle of Western civilization is built on an implicit Eurocentric framework, which projects key elements of modern society such as the city and the state onto ancient times, as well as imbues Greek culture with notions of cultural superiority, resulting in the undervaluation or neglect of possible external influences on the genesis and development of this culture.

In this part, I will discuss first the ways 'the Greek' identified themselves – insofar a single voice can be said to have existed – in contrast with other people (3.3.1). Next, it will be shown how these views were appropriated in later times to construct a narrative of Greek cultural superiority (3.2) and how this narrative has impacted on modern scholarly works (3.3.3 and 3.3.4).

3.3.1 Ancient Greek ethnocentrism

It has been stressed how Greek communities consisted of mainly of small, nucleated settlements housing a distinct political community, distinguishing themselves from other, comparable communities. However, a sense of cultural unity remained. In Herodotos, for example, the Athenians answered the Spartans who implored them not to accept the offer for a treaty proposed by a Persian envoy:

> “For there are many great reasons why we should not do this, even if we so desired; first and foremost, the burning and destruction of the adornments and temples of our gods, whom we are constrained to avenge to the utmost rather than make pacts with the perpetrator of these things, and next the kinship of all Greeks in blood and speech, and the shrines of gods and the sacrifices that we have in common, and the likeness of our way of life, to all of which it would not befit the Athenians to be false.” (Herodotos VIII, 144).

The common elements said here to connect all Greeks are: descent, language, religion, and a distinct way of life. A quote found in the writings of Diogenes Laertius, a third century CE Roman biographer, but attributed to Socrates, can serve as illustration of the Greeks distinguishing themselves from non-Greeks, called barbarians (*barbaroi*)*:*

> *Hermippos in his Lives refers to Thales the story which is told by some of Socrates, namely, that he used to say there were three blessings for which he was grateful to Fortune: "first, that I was born a human being and not one of the beasts; next, that I was born a man and not a woman; thirdly, a Greek and not a barbarian."* (Diogenes Laertius I, 33).

According to the geographer Strabo (XIV,2:28), the Greek word *barbaroi* was originally an onomatopoeia used to denote people who spoke an unintelligible language, either their own or Greek with a very thick accent. Recent studies have also made the link with the Persian word *barabara*, meaning ‘he who carries a load’ and suggested the Greek word *barbaroi* was initially used to denote those people paying taxes to the Persian king (Kim 2013). It is argued the idea of the *barbaros* as the non-Greek originated at the end of 6th century BCE when the Greeks in Ionia increasingly came to blows with the Persian king and would come to define themselves explicitly as not being subjugated to the Persians, and therefore as non-taxpayers.

It is hard to determine when the idea of a distinct Greek people, characterized by a common descent, common language, and common culture, originated but it was at any rate already firmly established by the fifth century BCE. Herodotos (I,56), for example, already explicitly uses the word *ethnos* to denote a common group, separating Greeks from other people. However, some claim the Greeks’ common cause against the Trojans, as well as the use of communal monikers such as ‘Hellenes’ and ‘Hellas’ in the Homeric poems, already indicate some sense of Greek unity, which must therefore have existed when these texts started to circulate in written form, supposedly from the eighth century BCE onwards (Coleman 1997, 177). Early Greek colonies provide a particular case where Greek groups of settlers strongly distinguished themselves from other populations. The joint foundation of the *Hellenion* sanctuary by Ionian, Dorian and Aiolan groups in Egyptian Naucratis, attributed to the reign of pharaoh Amasis (Herodotos II,178:2) somewhere at the beginning of the sixth century BCE, indicates colonies at this time already participated in expressing a common Greek identity.
The contrast between Greeks and non-Greeks was also closely related to a dichotomy between Europe and Asia with ancient Greek geographers (as for example in the *Periodos ges* written by Hecataios, who lived from *c.* 550 to 476 BCE). This should not be interpreted as a precursor to some sense of a ‘unified European civilization’, as other peoples in Europe were very much considered barbarians and inferior to the Greeks as well (Coleman 1997, 188-9). Still, the word *barbaroi* was only used occasionally for foreigners before the Persian invasions of Greece in 490 and 480-79 BCE. The historiographer Herodotos regarded the Persian wars as a continuation of earlier (mythical) conflicts between Europe and Asia such as the stories of the abductions of Io, Europa and Medea and the Trojan

war (Herodotos I,1-5). Around 500 BCE the Greek philosopher Heracleitos (fr. 107) already used the word in a pejorative sense to denote an irrational person (Coleman 1997, 178). After the Persian wars, the existing Greek/*barbaroi* polarization was extended more generally as more negative attitudes towards non-Greeks started to emerge (Cartledge 1993; Coleman 1997; Hall 1989, 1997) and initial linguistic distinctions developed into deeper political and cultural prejudice (Held 1997, 257). The development of such an 'us *vs*. them' dichotomy is considered one of the most effective enhancements of group identity and unity by inciting common actions against the external 'Other' (Cartledge 1993, 8-17). At this time, the Athenians are considered to have 'invented the barbarian' (Hall 1989) in antithesis to themselves as embodiment of the grand Greek culture. As expressed by the Athenian orator Isocrates (436-338 BCE):

> "And so far has our city distanced the rest of mankind in thought and in speech that her pupils have become the teachers of the rest of the world; and she has brought it about that the name Hellenes suggests no longer a race but an intelligence, and that the title Hellenes is applied rather to those who share our culture than to those who share a common blood." (Isocrates, *Panagyricus*, 50).

This is but one example of ancient Greek authors arguing for the superiority of the Greeks (and in this case specifically the Athenians) *versus* the inferiority of barbarians (Other examples include: Hippocrates, *On airs, waters, places*: XVI, 23; Euripides, *Iphigenia in Aulis*: lines 1400-1401; Plato, *Laws*: III,693; and the passage of Aristoteles quoted above, *Politics:* 1327B 23-34). The Greek's idea of superiority of their own cultural heritage was a persisting notion that would become appropriated in later times as well.

3.3.2 Appropriation of Greek cultural superiority

Greece under Roman rule has been famously described in Susan Alcock's book *Graecia capta* (1993). The title is based on one of the epistles of Horace: "*Graecia capta ferum victorem et artis intulit agrestic Latio*…" [Greece, the captive, took her savage victor captive, and brought the arts into rustic Latium] (Horace, *Epistles* 2.1.156). In these words, the traditional view of Greece as original developer of civilization and major source of cultural learning for the Romans comes to the fore. However, the capture of Greece also represented a paradox for Graecophile Romans: how to explain Greek cultural superiority, yet, at the same time, their political subjugation to Roman domination? Greece's decline was explained mainly through internal factors – moral decadence, internal disarray, spiritual inertia – resulting in the inevitable conquest by the Romans. The Greek practice of naked wrestling in public for example was linked to moral degeneration by the second century Roman biographer Plutarchos (*Roman Questions 273)*. The second century CE Roman orator Lucianus in his *Anacharsis* used Socratic dialogue to likewise criticise Greek customs such as public wrestling at the gymnasium, but also visiting the theatre and participating in a symposium. The Roman orator Cicero warned against the dangers of decadent Greek culture Greek in his preface to the *Tusculan Disputations* (Cic. *Tusc*. Praef) and argued for the superiority of Roman *mores* (values and norms).
Of course, one can wonder why these authors found it necessary to argue against the perceived dangers of Greek culture. Adopting a Greek way of life was indeed not something of the past but, on the contrary, something many Romans of high standing actively and explicitly strived for. One example can be found in the figure of Favorinus of Arelate (modern-day Arles, France) living in the first and second centuries CE, who is quoted in Philostratos' *Lives of the Sophists*:

> "If someone who is not a Lucanian, but a Roman, not one of the plebs, but of the equestrian order, and who has imitated not only the language, but the thinking and way of life and dress of the Greeks, and who has done so with such conspicuous mastery as to have no rival either among the Romans before him or the Greeks of his own day…because though a Roman he has become perfectly Hellenic." (Philostratos, *Lives of the Sophists*, 25-6).

The process of 'Hellenization' appearing in these words is reminiscent of Bourdieu's concept of *habitus* (Wallace-Hadrill 2008, 6). Greek identity is obtained by continued and repeated actions, enacting Greek behaviour. The instrument of this process is 'High Culture' education in literature, music and arts, subsumed within the Greek concept of *paideia*. This important concept allowed non-Greeks to obtain a Greek identity through cultural learning, not only including Greek language but an entire way of life. Through the concept of *paideia*, the Romans also adopted a sense of ethnocentrism based on culture. They also adopted both the geographical term 'Europe' and the word 'barbarian' to refer to those beyond the boundaries of their empire (Sherwin-White 1967). Their assessment of these people as barbarians was in part based on the (perceived) lack of urban communities as the Romans explicitly associated civilization with urban life, denoted with the term *urbanitas* (Wallace-Hadrill 1991, 247). The concept of *paideia* however also entailed civilization was not unreachable or only available to a closed off group as it allowed for the possibility of civilized barbarians eventually participating fully in the commonwealth of the Roman Empire.

In later times, the image of Greece as fountainhead of a European civilization was firmly established during the enlightenment in the eighteenth century and the rise of nationalism in the nineteenth century. Philosophers and scientists of the enlightenment put paramount value on reason and knowledge as highest authority (Bauman 1987, 36). To their mind, the Greeks above all embodied these values, considering them to be the fathers of civilization (Gay 1966). The French philosopher and writer Denis Diderot (1713-1784) for example hailed Thales as the founder of the scientific method. Voltaire (1698-1778) went even further and proclaimed the arts, music, poetry, eloquence, history and philosophy all had come from the Greeks (*Essay sur les mœurs* 1756). Turgot (1727-1781) also stressed the ground-breaking political achievements of the Greeks, claiming the liberty achieved through the development of democracy aided in establishing the most balanced society (*A Philosophical Review of the Successive Advances of the Human Mind* and *On Universal History* 1750).
The prominent position of such sentiments in French intellectual circles contributed greatly to the creation of the social climate leading up to the French Revolution in 1789, and the values and norms expressed thereafter. It was even hoped that the *tabula rasa* of the Revolution would allow the creation of a new society, returning to the roots of Ancient Greece. Specifically, fourth century Athens as the cradle of democracy was to be emulated (Held 1997). Not only in France were such sentiments expressed. The famous German art historian and archaeologist Johann Winckelmann (1717-1768) proposed that the only way to become great was by imitating the Ancients and their Art (*Reflections on the Imitation of Greek Works in Painting and Sculpture* 1986 [1765]).

The creation of a sense of European civilization during the Enlightenment was consciously and elaborately built on classical foundations derived from ancient Greece and, to a lesser extent, Rome (Rowlands 1988, 46-8). Like its classical precursors, it would incorporate an explicitly ethnocentric view. As the Greeks differentiated themselves from non-Greeks, so would the Western European civilization distinguish itself sharply from 'Oriental' cultures. The Turkish invasion of the 16th century, culminating in the siege of Vienna in 1552, had already anchored a view of Asian threat to civilization in European eyes (de Rougemont 1966, 88-91). The enlightenment movement would act upon such sentiments by contrasting the superiority of ancient Greece's democratic society based on a rational way of life, with the theocratic nature of Eastern societies. The East was claimed to be ruled by tyrants, stimulating a clinging to religious superstition, which impeded the development of rationality in these societies. As a result, individual freedom, both on an intellectual and political level, could never be attained. Somewhat later, the German philosopher Georg Hegel (1770-1831) wrote:

> The Greeks…lived in that happy middle sphere of self-consciousness and subjective freedom and substantive ethical life. They did not persist, on the one hand, in the unfree Oriental unity, which is necessarily bound up with religious and political despotism…" (Hegel (1910) [1835] *Philosophy of the Fine Arts*, 181-182)

As European travellers increasingly gained access to Greece to view the remains of that ancient civilization for themselves, some noted the discrepancy between the ancients and their present-day descendants. A common explanation for the perceived degeneracy of the contemporary Greek population was their subjection to Eastern theocratic states, first under the Byzantines, and later under the Ottomans (Voltaire and Montesquieu among others, see Augustinos 1994 for a more elaborate discussion). The emphasis on rationalization of the Enlightenment was continued and elaborated to include rationalization and standardization of production processes during the Industrial Revolution at the beginning of the nineteenth century. Nationalist-inspired ideas of classical Greek identity developed during the nineteenth century deepened the divide between Greek and Eastern identities even more, in the words of Ulrich von Wilamowitz-Moellendorff:

> "The peoples and states of the Semites and the Egyptians which had been decaying for centuries and which, in spite of the antiquity of their culture, were unable to contribute anything to the Hellenes other than a few manual skills, costumes, and implements of bad taste, antiquated ornaments, repulsive fetishes for even more repulsive fake divinities" (1884 *Homerische Untersuchungen*).

This schism between appreciations of Greek and Eastern identities would come to have significant repercussions in the way academic research was conducted.

3.3.3 Eurocentrism in studies of Hellenistic culture

Eurocentrism distinguished itself as a grander version of any particular form of ethnocentricity bound to time and place in earlier times through a pretension to transcend local values and aiming to be deployed as a universal standard of values and norms (Held 1997, 257-262). Within the framework of 19th century cultural evolutionism, such pretences were imbued with teleological connotations linked to the advancement of morality imbued in the evolution from simple to complex societies. Usage of these terms in essence implies normative conceptualisations of inferior and superior. (Shanks and Tilly 1987, 163). This means modern Western societies were seen as the pinnacle of human development inherently possessing greater morality, and thus considered 'better'. The meta-narrative of simple to complex then serves as an ideology favouring a modernizing ethos and the primacy of the West (Rowlands 1995, 36). This association has a direct impact on in historical writing as well:

> "The schemes of 'explanation' in evolutionary theories easily slip into ideologies of self-justification or assert the priorities of the West in relation to other cultures whose primary importance is precisely to act as offsets for our contemporary 'civilization'. Genuine difference and radical incompatibility of social forms become relegated in terms of schemes which permit the evaluation of social life and the celebration of one social form *vis a vis* others. This 'knowledge' is a political act, a form of power. Societies become classified in an evaluative hierarchy judged implicitly or explicitly by their degree of deviation from ours." (Shanks and Tilley 1987, 164).

Modern (Western) society was therefore seen as morally and culturally superior to other cultures in general, and 'the East' in particular. One particularly remarkable denunciation of this discourse can be found in Martin Bernal's (1987) work "*Black Athena*. *The Afroasiatic Roots of Classical Civilization*". It must be noted his claims are generally repudiated by the academic community, although some have praised his radically different stance on historical research. A particularly famous and influential study of Edward Saïd (1978) argued how cultural representations of the East in Western works of art, literature and scholarly work are often based on patronizing perceptions of Eastern inferiority and moral degeneration, and therefore inherently geared towards perpetuating Western dominance over the East. These biases remain present in modern scholarly work as well, where Greece is still often seen as the cradle of western society and Civilization. To illustrate:

> "It seems incredible that in what seems a moment in time, in a tiny corner of Europe, occupied by less than five million landsmen and islanders endowed with scanty natural resources, there should have been created a culture, a commerce, a social order and a polity…renowned beyond all others as the most original and brilliant." (Callander 1961).

> "In studying the society and conditions of Archaic Greece, we study also the conditions of our own emergence as a civilized society and as civilized individuals in the Western world." (Osborne 1996).

This focus on ancient Greek culture comes at the expense of acknowledgement of external influences. This can be illustrated with an example from scholarly works on the Hellenistic period and culture in the Eastern Mediterranean. The concept of a 'Hellenistic culture' is associated with a chronological era termed the 'Hellenistic period' starting off with the death of Alexander the Great (356-323 BCE). The concept of a Hellenistic culture has, under the influence of German historian Johann Gustav Droysen's (1808-1884) *Geschichte des Hellenismus* (1836), been commonly represented as a mixture (*Verschmelzung)* of Western (Greek) and Eastern (Persian) cultural influences.

It was argued that Alexander, after the conquest of the Persian empire, had advocated a policy of multiracial government, where Greeks, Macedonians and Persians would blend together to form a single ruling elite. One way to stimulate such a blend was through actively encouraging and rewarding interracial marriages (Arrianos 7.4.4). Some have interpreted these policies as being borne out of a sense of universal brotherhood of men (Tarn 1948) possibly inspired by Zeno's Stoic philosophies. Others have however proposed his policies of interracial marriage, as well as the adoption of oriental regalia, should rather be interpreted as mechanisms for strengthening the loyalty of his Eastern subjects (Badian 1958). Droysen's works have been criticized for being strongly based on European colonial thinking (Canfora 1987) and carrying an implicit teleological view on history as a cultural preparation for the arrival of Christianity under the influence of Hegelian Protestantism (Momigliano 1955). It has been demonstrated that his idea of a 'bastardised' form of Greek language, originating in Hellenistic times out of a fusion between Eastern and Western influences, was grafted on Barthold Niebuhr's (1776-1831) comparison between Creole languages spoken in French Haiti and San Domingo, and Greek language in Egypt and the Orient. The characterisation of social and cultural transformations during the Hellenistic period as a fusion between East and West has since been criticized (Wallace-Hadrill 2008, 22).

Even if the idea of a 'fusion' of Eastern and Western elements in Hellenistic times can be questioned, interaction between Greek and Eastern peoples did increase as the different Hellenistic dynasties competed over the control over the different remnants of Alexander's empire (Rotroff 1997b). Both the ancient Greek heartland of the Aegean and the lands in the Eastern Mediterranean were now drawn into the same political-military arena. At this point, much academic research has fallen short as hardly ever both sides of the interaction between Greek and Eastern practices are studied. The standard view in much historical research is that of the Eastern peoples inevitably drawn to a superior Hellenistic culture. They adopted Greek as their official language, used Greek-styled names, and participated in Greek practices, such as attending the gymnasium and the theatre. The Hellenistic kingdoms are represented as dominated by a Macedonian elite, closed-off from outside influences. The German historian Christian Habicht (1958) for example calculated that only 2.5 percent of non-Greeks held a position of authority in the Seleucid kingdom. However, the statistical relevance of his sample has been questioned as it has been observed his conclusions were based on a sample of 250 names spanning three centuries (Sherwin-White 1987, 6).

Large amounts of archaeological data collected during nineteenth and twentieth centuries archaeological excavation in the Near East could have provided a more nuanced view. However, in practice, many archaeologists focused almost exclusively on the impact of Greek influences on local material culture (Kuhrt and Sherwin-White 1987). Within this Hellenocentric framework, many scholars undervalue or ignore Eastern cultural elements and assume somewhat axiomatically Greek culture was spread over local communities during the Hellenistic period (see for example Walbank 1981 *The Hellenistic World*). Architectural studies commonly focus on buildings or monuments in Greek fashion, for example the Pergamene Altar, whereas contemporaneous buildings in non-Greek traditions are left for Near Eastern or Egyptian archaeology. One example is the temple of Horus at Edfu (Cauville 1984). A notable exception where both Greek and non-Greek elements and the interaction between both in art and architecture are examined is provided by Malcolm Colledge (in Kuhrt and Sherwin-White 1987). Interdisciplinary collaboration, for example between Assyriologists and Classical archaeologists, however remains rare, resulting in a clear divide between Greek and non-Greek in academic research.

Still, exceptions do exist as some scholars explicitly try to fill this gap through collaboration across disciplines, stressing the continued importance of indigenous people and their practices in both everyday life and the administration of the Hellenistic kingdoms (Samuel 1983; Davies 1984; Kuhrt and Sherwin-White 1987). Sherwin-White (1987) for example argued how the adoption of Greek as official language in the Seleucid kingdom should by no means be interpreted as the deathblow for other languages. It has been attested the Seleucids allowed the continued use of languages such as Aramaic in official matters, for example in legal documents (Dougherty, in Rostovtzeff 1932; Postgate 1976). A bilingual (Greek/Aramaic) inscription, possibly a milestone, was found at the Iranian site of Pasargadae in a layer with a *terminus post quem* of 280 BCE. The Greek text was dated to the early third century BCE on a stylistic base. At Behistun in Media, a relief sculpture ordered by a Seleucid viceroy was found, depicting a reclining Heracles. The inscription included a date (June 148 BCE) and at the bottom of the stele, the beginning of an abstract of the Greek text in Aramaic was found. Epigraphical data also provided evidence for the inclusion of non-Greeks in structures of administration, especially on a provincial level, as indicated by a decree from Amyzon in Caria (dated to 321 BCE) attesting the elevation of the Iranian Bagadates to key position of warden (*neokoros*) of the sanctuary of Artemis through the personal intervention of the governor Caria (Robert and Robert 1983, no. 1).
Despite these exemplary works, many hiatuses remain. In Anatolian studies for example, all too often archaeologists assume a political or cultural vacuum when no clear Hellenistic/Greek elements can be observed. One example of this approach is the strikingly common failure to recognise the importance of Achaemenid traditions and institutions in Anatolia (Kuhrt and Sherwin-White 1987, x), especially in the southern and western parts. This does not only pertain to studies of historical phases in Achaemenid times, but also the influence and legacy of Achaemenid practices in social, political, cultural, and economic structures active during the rule of the different Hellenistic successor dynasties. Many studies of the spread of the *polis* during Hellenistic times can be viewed in this context.

Given the idea of Greek culture as the cradle of Western society, the ancient Greek past is characterized in part by the projection of elements out of modern Western societies upon communities in antiquity. Under the influence of Enlightenment thinkers as John Locke (1632-1704), Jean-Jacques Rousseau (1712-1778) and Georg Hegel (1770-1831), the evident rationality behind the State as ideal form of socio-political organisation was stressed. (Lull and Mico 2011, xii-xiii). Likewise, because of the pivotal place of the modern city in our Western society, the concept of the urban environment was projected onto the past, leading to a strong emphasis on what was perceived as the urban environment of Greek society. This dual projection is exemplified by the dual translation of *polis* as 'city-state'. In the next part, I will discuss in some more detail the debate regarding the Greek *polis* as a city-state as well as the common comparisons made with the prevalent modern version of state, the nation state.

3.3.4 City-state *versus* nation state

Modern interpretations of the *polis* as a socio-political unit are expressed through its most common translation, that of a city-state. While being a relatively small unit centred on a core urban settlement, its association with elements of state is often stressed. However, the debate regarding the nature of the Greek *polis* is still ongoing. Whereas the majority of scholars consider the *polis* a prime form of an (early) state (Snodgras 1977; Sakkellariou 1989; Runciman 1990; Morris 1991; Hansen 1998, 2006; Low 2007), others do not (Berent 2000, 2004, 2006; van der Vliet 2005, 2008, 2011). In intercultural comparisons of early state formation, the *polis* is only rarely discussed. It does not feature for example among the famous 21 case-studies of early states compiled by Claessen and Skalnik (1978). This is because the Greek *polis*, is commonly considered to be a very specific kind of societal organisation: a city-state.
A comparative study of city-state cultures throughout the world was initiated in the wake of the wider program for constructing an inventory of Greek city-states by the Copenhagen Polis Project. Besides the Greek *poleis*, other noted examples of city-state cultures include Mesopotamia during the fourth

and third millennia BCE, northern Syria during the neo-Hittite period (1200-700 BCE), Lycia during the early Achaemenid period (540-360 BCE), the Benizaa region in Mesoamerica during the Post-Classical period (800-1500) and 12th century Italy (Hansen 2000, 2002). In a definition of the city-state Hansen states that:

> "*A city state is a highly institutionalized and highly centralised micro-state consisting of one town (often walled) with its immediate hinterland and settled with a stratified population, of whom some are citizens, some foreigners and, sometimes, slaves. Its territory is mostly so small that the urban centre can be reached in a day's walk or less, and the politically privileged part of its population is so small that it does in fact constitute a face-to-face society. The population is ethnically affiliated with the population of neighbouring city-states, but political identity is focused on the city-state itself and based on differentiation from other city-states. A significantly large faction of the population is settled in the town, the others are settled in the hinterland, either dispersed in farmsteads or nucleated in villages, or both. The urban economy implies specialisation of function and division of labour to such an extent that the population has to satisfy a significant part of their daily needs by purchase in the city's market. The city-state is a self-governing by not necessarily independent political unit.*" (Hansen 2000, 17-19)

Individual city-states are generally part of a wider 'city-state culture', defined by Hansen (2000, 16-17) through a polythetic description of characteristics, including: 1) Located in a well-defined geographical region that is inhabited by people who speak the same language and share a common culture; 2) Characterised by political subdivisions into a large number of small political communities of a common type; 3) Interaction between city-states can be conducted both over land or sea; 4) City-states can emerge either through endogenous processes of growth as urbanisation during a period of demographic and economic upsurge, exogenously as colonial foundations, or out of disintegration of an urbanised macro-state; 5) considerable variation in size between city-states exist, but none is so powerful that it can conquer the others permanently and transform the region into one political unit; 6) War between city-states is endemic, but at the same time there is always considerably economic, religious and cultural interaction; 7) In times of peace, city-states interact politically by having close diplomatic relations, by concluding alliances, and by forming leagues or federations, often of a hegemonic type; 8) Attempts to create larger political units, often leads to small city-states being swallowed up by larger counterparts, but more often it results in the formation hegemonic leagues or federations; 9) When, occasionally, one city-state succeeds in long-term conquest of all the others, the city-state structure usually persists so that the result is a large capital in control of an empire made up of dependent city-states; 10) City-states are not necessarily peer polities but can be hierarchically organised systems of polities , of which some are hegemonic, some independent, and some dependencies; 11) Dependent city-states are self-governing communities, but as regards foreign policy or defence they have either restricted independence or no independence at all; 12) In some city-state cultures a central aspect is the distinction between insiders (citizens) and outsiders (free foreigners and sometimes slaves); 13) A city-state culture ceases to exist either by the (temporary) disappearance of the urban centres or by being conquered by a neighbouring power; 14) City-state cultures often appear in neighbouring regions.

This is not the time or place to discuss each of these features in great detail. Yet, it is clear from the properties listed above that the concept of a city-state can arguably be considered the most pronounced coupling of political and urban systems (Smith 2003, 16), as both systems are projected upon the same entity on a limited spatial scale. Still, reality did not always match this characterisation. It has been noted, for example, that many Greek *poleis* were distinctly non-urban in character. While the emergence of the *polis* is often studied through a fixed checklist of architectural elements, literary references and archaeological research alike give evidence of a number of settlements considered *poleis* who did not yield any significant architectural structures. Such as for example the settlement of Chorsiai in Central Greece which is explicitly called a *polis*, yet could have housed at most 500 people (Bintliff *et al*. 2007, 56-7). Already around 600 BCE the Greek poet Alkaios (fr. 426) mentions a polis not just as a town but also as a political community whereas most contemporary settlements, especially in mainland Greece, would not have matched all the expected attributes of a polis as physical setting of the community. This observation prompted Kirsten's (1956) to propose a conceptualisation of the Greek *polis* as a *'Dorfstaat'*. Development of urban features should therefore be separated from political aspects of *polis* formation, as both processes did not always transpire in parallel (Whitley 2004, 166; Osborne and Cunliffe 2007, 2).

When looking at the political aspects of the *polis* as a form of state, one approach has been to compare its features with that of its most prevalent modern equivalent, the nation state (Hansen 1998). As a starting point for this comparison, definitions of state provided in the field of constitutional law, specifically in international law, can be used. The state as a person of international law was codified in 1933 during the Seventh International Conference of American States in Montevideo. The resulting treaty, the "Montevideo Convention on Rights and Duties of States"[7], can be used as a starting point for our discussion, with a definition of the state as it is perceived now in the context of modern society. In the first article the nation-state is described as follows: "The state as a person of international law should possess the following qualifications: a) a permanent population b) a defined territory c) government d) capacity to enter into relations with other states." The first three attributes of people, territory, and government constitute the basic elements of the nation-state.
These attributes of a state expressed in the Montevideo Convention can be compared to a definition of the *polis* offered by Aristoteles, for many historians still the benchmark for Greek political thought, who states: "*The polis is a community of citizens with regard to a constitution*" (*Pol.* 1276b.1). Strikingly, Aristoteles here mentions two of the key elements of the modern conception of state: people and government. The omission of the aspect of territory is not altogether surprising given that – at least in his theoretical writings –the concept of *polis* need not be in essence bounded by fixed geographical boundaries. The territorial aspect of a *polis* is in his view only determined as the location of residence of the community. As the community moves in space, so does the *polis* (Hansen 1998, 53). It should be noted that this seeming disregard of geographical factors relates in the first place to an idealized concept of *polis* and should not uncritically be extended to the policies of actual *poleis*, which were very adamant in protecting their borders or obtaining new lands, as can be attested by the countless boundary conflicts between *poleis* (Rawlings 2007). Human beings are inherently territorial animals, after all (Sack 1983).
In these discussions, Herodotos' (VIII,61:2) description of the Athenians leaving Athens for Salamis to escape the approaching Persian army is often quoted as an example to argue for the opposite. The continued existence of Athens as a *polis* community for the duration of the Athenian exile during the Persian occupation of Attica is then used to stress the importance of the citizen body as the main component of a polis rather than the settlement itself and its associated territory. However, it should be noted in the very same passage, the Korinthian general Adeimantos tried to silence the Athenian Themistokles by doubting his right to speak as he was now *apolis*. This shows that also in the minds of the Greek, the physical environment of the community was an important factor in constituting a polis and that loss of settlement and territory was at least enough of a reason to cause debate over the continued existence of the *polis* community. The occasional use of the word *polis* to denote a territory as a combination of town and hinterland mentioned in a previous part should also remind us that territory was indeed an important aspect of the *polis*, at least in real-life politics if not in the writings of Aristoteles (although it has been noted how the aspect of territoriality does feature in other parts of his works when talking about elements of *polis*, see Hansen 1998, 53). An example of the use of *polis* in a territorial sense can be found in Herodotos (VII,58:2) who relays how the army of the Persian king Xerxes in 480 marched through a *polis* called Agore.

Of the two factors that were listed by Aristoteles, the central importance of the people is also telling through the Greek habit of identifying individual *poleis* as its collected inhabitants, for example 'the

[7] (http://www.cfr.org/sovereignty/montevideo-convention-rights-duties-states/p15897; Accessed on 26/10/2016).

Athenians' *(Ἀθῆναιοι)* as denominator for the *polis* Athens. *Polis* identity is thus expressed through membership of a communal group. This was not an inclusive group membership, as this denominator pertains to matters of citizenship and membership of the political community, which still excluded women, children, slaves, and foreigners.
The other element listed by Aristoteles, *i.e.* government or constitution, is also the most abstract of the key elements of state. In its broadest sense, it designates the entirety of the political structure of a community, which includes all institutions of law-making and law-enforcing (Hansen 1998, 64). Regarding structures of power, commonly differentiated modes of political organization in ancient Greek sources were monarchy, oligarchy, and democracy (Rhodes 2007). One oft-quoted description of this tripartite political organisation can be found in a passage from Herodotos (III,80-82). In the so-called 'constitutional debate' he staged three Persian nobles, each offering their view on what can be considered the best form of political organisation. Distinction between these three modes can be made on the basis of participation to structures of power and authority. In a monarchical structure, authority and decision-making power is concentrated in the hands of a single person. In an oligarchical constitution, the community is controlled by a small group of authoritative persons, with membership to a ruling group organized on a number of possible restrictive lines, including age, and social, economic, or religious capital. In a democratic constitution membership to political structures of decision-making is extended to include a larger, albeit not fully inclusive, group.

So far, I have only discussed three out of four elements in the Montevideo definition of the nation-state. The fourth element covered the capacity of a state to enter into relations with other states. When applied to the Greek constellation, this fourth element refers to the nature of inter-*poleis* relationships and the concept of *autonomia*, often equated with our modern concept of autonomy (Ostwald 1982, 1986). The modern notion of autonomy can be applied to a range of contexts such as the sovereignty of states, as well as the self-government by constituent states, regions, and communities. The Greek term of *autonomia* however explicitly means 'to live under one's own laws' and refers exclusively to the own constitutional context of individual Greek settlements. When describing the autonomous nature of Greek *poleis,* sometimes a modern notion of autonomy in the sense of a sovereign entity is used rather than the Greek sense of adhering to the laws of the community proper. Here a conflict arises between the ancient and modern notion of autonomy relating to the element of independency.
In the modern sense, Greek communities can only have been autonomous if they also were independent. Yet it has been extensively argued that most *poleis*, even in the Classical period, were dependencies (Hansen 1998, 79). Many *poleis* were engaged in overarching structures such as alliances, leagues, and federations. Whereas philosophers such as Plato and Aristoteles had much to say about the structure of the *polis*, these overarching relations between *poleis* are barely mentioned (Hansen 1998, 77; Morgan 2003). Yet, *autonomia* still features frequently in decrees and treaties found in inscriptions all over the Greek world. Consequently, it still is considered by many modern historians to be an essential aspect of the *polis*, especially during the Archaic and Classical periods (Hansen 1998, 78-9; Low 2007, 2).
This temporal restriction is applied because it is often presupposed that Greek communities were completely dependent of another entity from the Hellenistic period onwards, most notably the Hellenistic monarchs, and thereby losing their autonomy completely (Lonis 2003, 8-10). Consequently, some authors claim that the true Greek *poleis* ceased to exist at the end of the Classical period when they were integrated in the Graeco-Macedonian empire of Philippus II (382-336) and his son Alexander the Great (356-323) (Cawkwell 1996). However, if the end of the *polis* can indeed be claimed because of the loss of independence at the moment of the integration of these Greek communities in the Hellenistic kingdoms, how then should *poleis* that had already lost (part of) their autonomy during the Archaic and Classical period be interpreted? Examples include those *poleis* on the west coast of Asia Minor under the rule of the Persian kings, as well as *poleis* entering into an alliance (*symmacheia*) and thus transferring parts of its autonomy and decision-making authority towards overarching federations or leagues, for example those part of the Delian League headed by Athens in the fourth century. Can

these not be considered to be 'true' *poleis* either? To enter into such an alliance could be a decision made for a variety of reasons, political, religious, or military, and should therefore not automatically be equated with a full loss of autonomy.

However, regardless of this valid call for nuance, one cannot but conclude that joining federations required its members to give up at least part of its autonomy, even if to varying degrees. If then *autonomia* is interpreted in a modern sense as total political independence, every member of a number of leagues and federations in Greek history can no longer be considered a *polis*. However, to do so would result in the elimination of a majority of the communities now easily considered *poleis* throughout different periods of time. It could be tempting to simply dismiss the notion of *autonomia* as a key aspect of the *polis*, yet, the term is used in abundance in inscriptions found throughout the Greek world. Some scholars have attempted to avoid this apparent contradiction by separating concept and reality of the *polis* by stating that in its idealized concept the Greek *polis* was always an autonomous political entity but that juridical and factual sovereignty are to be considered separately (Lonis 2003, 8). The aspect of autonomy is then relegated to an ideal property to be pursued by these communities. However, it can be wondered what value the concept of *polis* has if it can just be separated from the actual communities involved whenever we see fit?

It is therefore necessary to correctly contextualize the use of the concept *autonomia*. It would seem that this concept was only developed during the fifth century BCE, in answer to the growing Persian threat, several centuries after the first *poleis* had emerged (Hansen and Nielsen 2004, 19). Looking closely at the use of the concept, it becomes clear that *autonomia* was most commonly used within the context of inter-*poleis* relationships and as such does not refer to a state of total political independence (Hansen 1998, 80). A distinction can therefore be made between internal and external *autonomia*. A *polis* could engage in an alliance with other *poleis* or participate in a league or federation and thus transfer a major part of its external decision-making to a federal level without direct infringement of its authority in internal affairs. In this sense, it maintained the monopoly of political institutions of control within the territory to which its own laws applied (Runciman 1990, 348). The concept of *autonomeia* was therefore mainly applied to political independence in external relationships, which appears to never have been part of the essentialities of the *polis*.

In the previous parts, I have tried to provide some context as to the embedment of the *polis* – both as a distinct socio-political entity in the past and as a research concept in the present – in a wider Hellenocentric and Eurocentric discourse, which has to varying degrees, impacted our assessment of the phenomenon. This need not necessarily mean that explicit comparisons such as those described in this last part, where I contrasted the Greek *polis* as a socio-political unit with modern-day phenomena such as the nation state, must be condemned. Comparative views often allow an informative contrasting image by which both sides can be further elucidated. This will be the intention for later parts of this thesis as well, comparing the concept of *polis* with the archaeological realities of SW Anatolia. To do so however, it is essential to provide a more in-depth overview of the historical development of the polis in the Aegean, focusing on the combination of archaeological remains with relevant models of socio-political development.

3.4. Complex polities in ancient Greece

The origin of *polis* in the Aegean was projected furthest back in time by the French archaeologist Henri van Effenterre (1985), who asserted that the *polis* as a socio-political phenomenon originated already in the Bronze Age (around the turn of the second millennium BCE) and existed throughout the period along the great palaces which characterized the period. However, his thesis has found little resonance in the rest of the academic world. Most other scholars who favour a Mycenaean connection for the rise of the *polis* rather argue for an origin out of surviving social units after the collapse of Mycenaean society, somewhere during the tenth or ninth centuries BCE (Maddoli 1970; Thomas 1981). It has been observed that some of the earliest *poleis* emerged in areas previously under direct control of the

Mycenaean palaces (Snodgrass 1980, 44), for example Argos, Athens and Corinth, prompting the suggestion of the roots of the *polis* to be situated in the broken fragments of Late Bronze Age centralized bureaucracies. In one hypothesis, it is argued that the collapse of Mycenaean society mostly pertained to the upper levels of Mycenaean social organization, yet, local echelons of society, who functioned semi-autonomously, continued to exist and would provide the basis for the later development of the *polis* (Donlan 1989, 1997).

A major element causing discord in the scholarly field is our still limited knowledge of the period following the collapse of Mycenaean society (around 1200 BCE), the so-called 'Greek Dark Ages' (1100-800 BCE). The name was coined in the 1970's and stems from a comparison with the medieval period (AD 500-1400), supposedly a period of darkness and backwardness following the Greek and Roman civilization. Similarly, The Greek Dark Ages were seen as a period of darkness following the collapse of the Mycenaean civilization (Snodgrass 1971). Lately, this view has come under scrutiny and more and more signs of light have broken through this darkness (Cartledge 2009, 25-8). Therefore, to avoid needless negative connotation to what is basically no more than a convention of periodization I will use the term Early Iron Age to denote this period of 1100-800. As some theories have situated the origin of the *polis* in the aftermath of the Mycenaean collapse, we will start our overview with the EIA.

3.4.1 Early Iron Age (1200-800 BCE)

The traditional narrative of the Early Iron Age (EIA) tells of massive population movements coupled with a widespread phase of destruction in all major centres throughout the Aegean and many other parts of the Mediterranean East around 1200 BCE, often attributed to the so-called 'Sea Peoples'. This major system collapse resulted in a break-up of the Mycenaean world into isolated regional entities (Sandars 1978; Davies 1997, 25; Oren 2000; Morris 2005a; Kourrou 2009, 112; Bintliff 2012, 209-10). The image of the Greek Dark Ages following the collapse of Mycenaean society stems in part from a major drop in archaeological finds for this period compared to the preceding Mycenaean period as well as the subsequent Archaic period (800-500). Many key elements of Mycenaean society, such as social differentiation, monumental architecture, artisanal skills and craft specialization, long-distance trade, and the palace as a redistributive centre all but completely disappeared (Morris 2006). This has led some to consider a strict disconnection between the Mycenaean period and later developments. As such, the EIA is sometimes considered something of a 'blank sheet' which would allow to completely dissociate later social developments from any Mycenaean precursors (Bintliff 1994, 212).

Yet, at the same time this view can also be nuanced. Whereas signs of destruction or abandonment have indeed been widely attested, many centres were quickly re-occupied, showing strong signs of societal resilience, albeit at the same time expressing a new form of societal organization. No longer centred on the great palaces of the Mycenaean period and the associated administrative apparatus, these communities nonetheless show indications of social stratification and a rich material culture, as appears from the 'princely' burial at Lefkandi on Euboia and a host of other finds, among others at Ialysos on Rhodes, Perati in Attica, and Emborio on Chios (Osborne 1996, 19-21). Continued habitation has also been attested at a number of sites through the southern Argolid Survey Project and the Berbati-Limnes Survey (Lantzas 2012, 22-23), although absolute settlement numbers seem to have declined (Lantzas 2016, 465).

Massive population decline following the Mycenaean collapse was mainly proposed based on the limited number of graves datable to EIA, compared to the more extensive finds of the preceding Mycenaean period (Snodgrass 1977, 1980). It has been noted however that problems with sampling and identification in early survey projects might have resulted in systematic discarding, misidentification, and subsequent undervaluation of EIA remains (Bintliff 2012). For some time, the only EIA remains identified were from known Mycenaean settlements with continued habitation. The perceived lack of other EIA settlements resulted in the argument that the EIA countryside was virtually abandoned due to population decline and the nucleation of population in this limited number of surviving towns, interpreted as 'refuge cities' such as Knossos, Karphi, Athens, and Argos. This has led some to interpret the system dynamics of this period as related to dynamics of gradual repopulation of a vacated landscape starting from these surviving refuge cities. However, even if absolute settlement counts may have declined, this need not necessarily be seen as a direct indication of population decline, but may be symptomatic of processes of settlement nucleation just as well (Lantzas 2016, 465). Moreover, it has been argued that this decline in burial numbers should not be directly correlated with a decline in population numbers but should rather be interpreted as the result of changing social habits which included a widespread shift from inhumation to cremation and a preference for individual rather than multiple burials (Morgan 2009, 44-5), possibly indicative of a more general shift towards individualising ideologies (Lantzas 2016, 468). More recent survey projects have also taken earlier sampling pitfalls into account and have been increasingly identifying EIA sites (Bintliff 2012, 213).

In recent decades, a perspective of more gradual processes taking place during the EIA is favoured, arguing for the longevity of developments between the 12th and 5th centuries BCE (de Polignac 1995; Foxhall 1995; Morris 2006; Hall 2013). In this view, certain aspects of social complexity are seen to persist, such as for example the continued existence of nucleated communities with complex social stratifications, whereas other innovations were gradually added, driving societal development throughout EIA. The traditional narrative of complete social collapse and a subsequent Dark Age following the demise of the Mycenaean states, has for a large part been replaced with one of social resilience and transformation of organizational structures following major perturbations (Lantzas 2016). This phase of 'creative destruction', combining innovation with recombinations of existing elements to construct a novel trajectory of social organization can be associated with the reorganization phase (α) of the adaptive cycle framework highlighted in chapter one. The decline and demise of overarching socio-political units while dynamics on smaller scales continue within a new framework of operation is a clear sign of the property of near-decomposability of complex adaptive systems as highlighted in chapter one.

Changes in socio-political structures following the collapse of the palatial societies of the Mycenaean period greatly influenced form and organization of EIA settlements. Whereas many LBA centres on Crete and some on the mainland, such as Argos, Midea, Mycenae, and Tiryns, would continue to be inhabited during the EIA, they no longer functioned as palatial centres. At Midea and Tiryns, specific areas with administrative, production, and cult functions were renovated already soon after the destruction phase of 1200 BCE. Yet, it has been argued that new functionalities associated with these structures, for example based on the removal of communal hearths, took place within a new ideological framework to support new socio-economic practices, privileging the individual and domestic unit over larger, corporate groups (Lantzas 2016).

Most known EIA settlements were located closely to potential subsistence sources (Kourrou 2009, 109). These include small villages close to cultivated areas, such as Nichoria in Messenia, settlements in mountainous terrain with direct access to pastures such as Vitsa in Zagori, or on high ground overlooking the sea, such as Emporio on Chios. A notable phenomenon was the foundation of new settlements during the Ionian colonization of the eastern Aegean and the west coast of Asia Minor, such as Samis, Ephesos, Miletos, and Old Smyrna. Unsurprisingly, these were mainly coastal settlements with easily accessible and well-sheltered harbours. Many of these settlements would develop into major centres during Archaic and Classical times, leading to the postulation of a number of theories linking colonization to processes of *polis* formation. I will return to this point later.

In the past, studies of EIA settlements focused on the excavation of Classical sites with evidence of EIA habitation, such as Athens, Argos, Thebes and Knossos. These sites have been interpreted as 'refuge sites' where the Mycenaean population survived the collapse of their civilization and from which they repopulated the surrounding regions (Snodgrass 1980; Bintliff 2012, 214). While this theory would support the idea of continued social stratification in EIA society, a simple diffusion model of stratified society spreading from these refuge sites does not seem to match the available data, showing a small, yet consistently present amount of EIA finds dispersed throughout the landscape (Bintliff 2012, 214). Besides such refuge sites, a second category of settlements has generally been identified, consisting of discontinuously occupied, nucleated settlements of rather small size. It has been argued that the *polis* in an urban sense can be traced back to these settlements as these can be considered 'urban centres' in the sense of "foci of settlement, more densely settled than the surrounding countryside and serving as centres for administration and economic exchange" (Hall 2013, 10). A number of these settlements, such as Zagora on Andros and Lefkandi have been found to have existed during the ninth and part of the eighth century, only to completely disappear before the seventh century. For this reason, they have also been identified as 'failed *poleis*' who lost the competition for resources and consequently ceased to exist. I will return to later to suggest an alternative explanation.

In general, two main settlement types have been recognized, one consisting of dispersed domestic dwellings with little to no relation to each other and different orientations, sometimes with a stand-out communal building such as the ones found in Lefkandi or Nichoria (Snodgrass 1980; Morris 1991; Lang 2005; Bintliff 2014). The other was a more 'town' like setup with clusters of unplanned hamlets each with its own cemeteries. The best-known examples of this last type include Athens, Argos, Corinth, and Knossos. EIA cemeteries were mostly located right outside the settlement along a roadside leading towards the settlement, quite similar to later periods of time. Whenever comparison between the layout of settlement and cemetery was possible, it was noted that dispersed clusters of habitation units in settlements were matched in the cemeteries with similarly associated graves gathered in clusters, possibly reflecting prevalent modes of societal organisation (Kourrou 2009, 121). At Zagora on Andros distinct hamlets within the town have been linked to different (kin) groups within the community, each with their own chieftain who were part of a competitive oligarchy governing the community as a whole (Snodgrass 1991; Morris 1991).

Structures potentially identifiable as communal buildings were found at a number of settlements, most famously at Lefkandi and can be considered attestations of a form of social stratification which provides one of the most visible argument against the historical trope of the Dark Age and the perceived absence of societal complexity of EIA society. Because of this apparent contradiction and the location of these settlements at what is often perceived as the very periphery of the later Greek world, these settlements have been interpreted as continuations out of Mycenaean society, albeit not functioning as a palatial centre (Kourrou 2009, 109-12). The monumental building (45x10m) found at Lefkandi on Euboia, was built with mudbrick walls on stone foundations and an exterior peristyle of wooden posts (Osborne 1996, 41-7). The building was dated to the tenth century BCE. In the centre of the room a tomb was found with the cremated remains of a man, as well as the inhumated remains of a woman. Many rich burial gifts were found, including metal weapons, vessels and jewellery, as well as the skeletons of four horses. Among the burial gifts found here and in other graves were several items imported from the East, indicating long-distance trade networks still persisted in the EIA, albeit on a more limited scale. The location of the settlement itself remains unknown but the lay-out of the cemetery, consisting of closely associated yet clearly distinct clusters, might suggest a similar internal differentiation in clusters of houses for the site itself as well as has been observed at Zagora (Snodgrass 1991; Morris 1991).

This type of communal buildings indicates the existence of some form of community organization and perhaps social stratification during the EIA. To discover how this (stratified) society and associated socio-political structures emerged, I will turn to the model of *polis* formation formulated by John Bintliff for the region of Boeotia (Bintliff 1982, 1997a, 1997b, 1999a, 2000b, 2007, 2012). This model of regional settlement formation driven by fusion/fission dynamics is based on archaeological material gathered during survey campaigns conducted in the region since 1978, as well as comparative data from anthropological studies. The model starts with a settlement pattern consisting mainly of small villages widely dispersed throughout the landscape following the collapse of Mycenaean society. Interestingly, it appears new settlements already arise long before existing settlements used their catchment area to the full degree. This suggests some kind of social cause rather than an economic one for the progressive multiplication of settlements throughout the landscape.

While hardly any evidence survives which would allow us to reconstruct the exact dynamics at play in EIA Greece, anthropological research has suggested small communities are constantly driven by the contradiction between attraction and repulsion of population due to, respectively, the urge for new blood to avoid interbreeding and the socio-biological limits of face-to-face societies (Forge 1972; Bintliff 2000b, 26; see also the model-based exploration by Griffin 2011). In face-to-face societies, every individual can have a personal relationship of some form with all other member of community. It would appear social as well as biological limitations result in an upper limit of 150-200 people for this kind of communities. When this threshold is crossed, communities tend to fission to retain this face-to-face societal structure. However, at the same time communities this size were too small to be sustainable and needed constant exogamy to avoid inbreeding. The minimum community size to ensure communities were sustainable without the constant need for exogamy was about 400-500 people.

It is suggested that the space between the dispersed villages at our model's starting point was gradually filled up through fission dynamics aimed at maintaining a face-to-face society in EIA communities, resulting in a pattern of a large number of small villages. The model also allows for the occasional larger settlements, who broke through the limitations imposed by face-to-face societies and strived for reaching a sustainable population level without the need for exogamy. Such decisions could have been in part driven by notions of landownership and attempts at keeping control over the surrounding lands within the community. Upon reaching this threshold these communities required to create additional integrative mechanisms to sustain social organization on this level. These mechanisms could either be hierarchical or heterarchical. The former consisted of the creation of a ruling-class elite, possibly consisting of a single dominating household or a council of seniors from a number of different households. The latter consisted most commonly out of a subdivision of the settlement into semi-autonomous neighbourhoods of which each remained within the face-to-face boundary and the formation of social institutions to link these semi-autonomous units into a whole (Bintliff 2013, 112).

It has been proposed that EIA communities were possibly controlled by an individual chieftain (*basileus*). However, it is hard to determine whether power was hereditary or won through economic or military means (Whitley 1991; Morgan 2009). The partial restoration of the *megaron* at the previous palaces of Tiryns and Midea might point towards the re-use of Myceneaean seats of power as location for these new rulers (Morgan 2009, 43). The appropriation of parts of the material environment of power from the preceding Mycenaean period could have served as a mechanism of legitimation of new rulers.

In other communities, indications have been found pointing rather towards rule by a minority elite. It has been suggested that individual hamlets within a single settlement such as Zagora on Andros each had their own chief, while the settlement as a whole was controlled through a competitive oligarchy (Snodgrass 1991; Morris 1991). It has been argued that this can be interpreted as the establishment of a new social framework in the Early Iron Age, led either by an individual leader or groups of elite families supported by a middle class, possibly some sort of yeoman retinue, who controlled a body of dependent peasantry (Morris 2005a). These groups might be tied to the authority of the chief through elaborate feasting events. This proposal could provide an alternative explanation for the observed discontinuous occupation of settlements during the ninth and eighth century. A previous hypothesis interpreted these settlements as failed *poleis* not able to compete with other polities. An alternative reading might identify these settlements as the material expression of the connection between local communities and a powerful chief. When this chief died, the inherently person-bound form of control over local communities might disperse, leading to another chief leading the local community towards a different location of settlement thus resulting in the discontinuous occupation observed in such settlements as Zagora and Lefkandi (Nevett 2010, 41; Bintliff 2012, 220). The small number of larger settlements would have an advantage over smaller ones during any ensuing competition for resources, an example of the 'rich-get-richer effect' (Barabasi and Albert 1999).

Crossing the aforementioned population threshold led to the development of a so-called 'corporate community', which is defined as a specific form of village organization centred on a village council controlling disposal of land, animals, and labour, whose members are largely adult male landowners requiring a certain property qualification (Bintliff 1999a, 533). These communities are already characterised by clear elements of organised town life and socio-political structures (Bintliff *et al*. 2007, 60, 2014, 265). It is striking how the emergence of these socio-political structures did not develop in parallel with an urban transformation within the settlements. This observation has prompted the historical geographer Ernst Kirsten (1956) to identify the average Greek *polis* as a 'Dorfstaat' or village-state, rather than a city-state. This usage of the term village-state should not be confused with Maisel's (2010) village-state, which is a territorial state and explicitly contrasted with a city-state because the majority of its population lived in villages dispersed across the territory as opposed to in a single central settlement, as was the case with the Greek city-states.

We should be careful to label these early corporate communities already as *poleis* but the proposal has merit in its disconnection of state formation on a socio-political level with an urban transformation of the material environment. Following this approach, the emphasis on the monumentalization of Greek settlements as a diagnostic feature of *polis* formation, can be shifted towards the use of urban features as a possible, but not essential, consequence of processes of socio-political development leading towards the development of the *polis*. It can be questioned whether or not the urban centres emerging during the EIA can already be identified as *poleis* in a political sense. However, it is no coincidence that self-conscious political communities were to come to identify themselves as residents of such existing urban centres (Hall 2013, 10). However, these developments probably crystallized only after the EIA during the eighth century BCE. Let us now therefore take a look at the upcoming Archaic period (800-500).

3.4.2 The Archaic Period (800-500 BCE)

Traditional narratives of Greek history have described the EIA following the Mycenaean collapse as a 'dark age' lasting until the beginning of the eighth century, when suddenly 'new light' emerges. While this view has for a large point been reconsidered to incorporate a more gradual perspective, it cannot be denied that at some point during the eighth century BCE, an intensification of ongoing system dynamics occurred which would kick-start the ongoing development of social complexity. Notable developments at this time are the adoption of the Phoenician alphabet, the rise of urban communities, increasing trade contacts beyond the Aegean and re-emergence of certain artistic skills and technologies (Osborne and Cunliffe 1996; Fisher and Van Wees 1998; Lonis 2003; Morris 2006; Hansen 2006a; Bintliff 2012; Hall 2013).

It has been argued that throughout EIA, social tension had gradually risen in many Greek communities, as a result of the establishment of the new social framework described earlier, inducing a number of potential response options, including intensification, extensification, or reorganization of social processes and organisation (Morris 2005a, 4; 2009, 67). One example of the former could be intensification of agricultural production, resulting in increasing labour inputs per hectare of land. Processes of extensification often relate to population displacement, either internally by filling up unoccupied land within the borders of the own polity, or externally by taking lands from neighbours, for example the conquest of Messenia by Sparta around 720 BCE (Morris 2009, 68). Additionally, a form of long-distance extensification existed, through the foundation of new sites as colonies in more distant locations. Finally, processes of reorganization could be of a highly variable nature, including a stronger social solidification of a sense of citizenship, more equal redistribution of land, and improving property rights.

It is within this framework that the developments noted earlier, as well as the emergence of the *polis* as an urban and socio-political unit should be situated. While it was already noted how some scholars have associated the origin of *polis* already with the EIA or even Mycenaean period, ever since Victor Ehrenberg's seminal paper on the rise of the *polis* (Ehrenberg 1937) its origins have been commonly dated back to the eighth century. Hansen and Nielsen (2004, 17) considered the earliest written attestations for poleis as city-states to have been derived from the *poleis* of Thasos, Sparta and Cretan

Dreros, where they have been dated to the mid seventh century BCE, yet the archaeological record shows marked changes that reach back farther than the epigraphic evidence.
It has been suggested that the shift from a warm dry sub-Boreal climate phase towards a cooler, wetter sub-Atlantic phase during the ninth and eighth centuries BCE, providing increased and more dependable annual rainfall to allow for increased agricultural production and higher crop yields, could potentially have been a major factor of social complexity development at this time (Bradley 1999, 15; Fagan 2004, 196-202; Morris 2006, 83). As a result of these more favourable climatic circumstances, a marked population growth is said to have occurred, which would have been a major basic causative factor for changing system dynamics in this period (Snodgrass 1980; Morris 2005a, 2006).
It has been argued that a Mediterranean-wide process of population growth led to an intensification of system dynamics observed in the eighth century (Morris 2005b, 3, 2006). Although regional variation existed, at many places in the Aegean the number and size of settlements can indeed be seen to increase, for example expressed through the replacement of prevalent single-room houses by multiple-room house complexes (Crielaard 2009, 361). On the other hand, we should be careful with reading too much into the available archaeological remains. It was already mentioned how the lack of burial finds during the EIA was thought to be linked to massive depopulation of the land. It can therefore not be excluded that interpretations of such waves of population decline and growth are at least partially exaggerated because of preservation of the archaeological record (or lack thereof).
At first sight, the increasing number of settlements in this period observed during archaeological surveys could indeed be logically connected to an increase in population numbers, even if taking into account some degree of exaggeration of such dynamics (Scheidel 2003). If it can indeed be argued that population numbers were increasing during the transition towards and throughout the Archaic period, by no means should this necessarily be seen as a demographic explosion fuelling continued social innovations. If population growth occurred, it was more likely gradual, yet significant evolution over the course of a few centuries (de Polignac 1995; Foxhall 1995; Whitley 2004). The sudden increase of graves in the eighth century, often cited as proof for this population growth, should not be directly linked to changes in population numbers but perhaps rather as changing social praxes of burial. It has for example been argued that the sharp increase in child burials at Athens from the eighth century onwards could rather be explained by the development of an increasingly inclusive society, opening up burial areas previously restricted to the wealthy to a larger segment of society, including both less wealthy adults and children (Osborne 1996, 78-88).

Even if we suppose a more gradual nature for underlying demographic processes, rather than a sudden growth, increased settlement nucleation (Hall 2013, 9) caused the dispersed settlement pattern of the EIA to be filled up and transformed into a landscape with regularly spaced settlements controlling on average a core area of 2-3km radius (Bintliff 2000b). The regular spacing of the developing settlement pattern emerged due to the 'gravitational pull' of anthropologically observed limitations in walking distances of half an hour from the central settlement towards the furthest edges of the territory. These towns can be termed '*proto-poleis*' and were competing with each other for resources and prestige (Bintliff 2000b, 28). At some point, conflicts would have arisen between adjacent polities when no intermediate land was left to allow further expansion. Overcoming this conflict does not necessarily imply violent conflict as tensions between different polities might be solved through a number of strategies, including direct conquest, intimidation, alliances, religious legitimization, marriage *etc*. Not much is known of the exact nature and development of these conflicts, but it is argued these processes were driven by the establishment of a class-based society where a warrior elite exercised control over society and derived its authority and prestige from frequent, institutionalized conflicts with adjacent polities (Bintliff *et al.* 2007, 59).
Increased internal social conflicts due to changing system dynamics would have resulted in a significant shift in the nature of structures of power where emphasis is increasingly placed on the prestige of a fixed office itself, regardless of the individual holding this position (Hall 2013, 12). This process ultimately resulted in the transformation of EIA societies through the institutionalization of socio-political power structures. Whereas at first, a single individual or limited group of individuals could

hold undivided power over different (economic, political, social, military) domains, power became increasingly divided with the constitution of different offices, limited to specific spheres, held by different people and limited in time. However, this process took place over the course of several centuries and at the start of the Archaic period, elite control over local communities was still firmly in place. Luxury imports such as those derived from trade net-works with the Levant as described earlier, were used for the purpose of elite self-definition and establishing status and prestige. Oriental wealth as attestations of cultural resources were used to distinguish a morally and culturally superior elite class, claiming social and political authority (Riva 2007, 206-7).
These resources were tapped in a constant process of competitive interaction among elites to gain prestige and status. Due to mutual suspicion of excessive ambition among the members of the elite, a number of control mechanisms were developed for exercising public offices. These mechanisms include standardization of procedures for election, regulations for terms of offices and transfer of power after tenure. van der Vliet (2011, 125) suggests three possible tasks to be conducted in these early offices: ritual and cultic tasks within the community religion, conflict solving and regulation of judicial procedures, and imposition of fines on transgressors. A law text found in the sanctuary of Apollo Delphinios at Dreros on Crete (Fornara 11), possibly dated to the mid seventh century BCE, provides one of the earliest attestations of institutionalized political structures in Archaic age Greece (Hansen and Nielsen 2004, 17; Meiggs and Lewis 1989, no. 2.1-2). Here is already mentioned a fixed magistrate with jurisdictive authority, the *kosmos*, who was prohibited from having a second term of office within ten years (Koerner 1993, 90; *Nomina* I.81). This implies of course that the term of office in itself was limited in time. A similar text, dated to 450 BCE, was found at Gortyn as well (Koerner 1993, 121; *Nomina* I.82). The Greek word *kosmos* is associated with a sense of bringing order in disorder. It is interesting to note this connotation was associated with public offices as well.

The attestations of law decrees and lawgivers in the Archaic period has led some to identify a trend towards increasing 'legalization'. These new laws partially confirmed old social norms, as well as partially transformed them (Schmitz 2004). However, this never entailed a systematic regulation of social life, with only those areas potentially causing problems for the community becoming extensively regulated (Gehrke 2009, 396-404). The establishment of different offices in distinct spheres of society allowed more people to participate in the governing structures of the community, but this did not mean just about anybody was qualified to assume all offices. To be selected from the body of citizens for a specific office also entailed one to be a recognized member of it. For starters, one had to be male, as women were excluded from participating in structures of government and decision-making. Female membership of the community was more important in an indirect way as rules of citizenship were built on descent, with either one or two parents having to have been acknowledged members of the community (McAuley 2013, 180).
At first, holding major offices was probably still restricted to a narrow elite class recruited mainly on the basis of birth, but property qualifications also became increasingly important (Hall 2013, 14). The governing elite at this time had grown into a class of landowners, gradually accruing new capital and farmland. A growing number of the lower classes came to be economically dependent on these landowners to ensure their survival, consequently stronger economic control was accompanied with stronger political control over the community (Donlan 1997, 44). The rich landowner elite retained their control over community by guarding access to offices and institutions through these property qualifications. Towards the end of the Archaic Age, a bifurcation point was reached in the development of socio-political structures. In both pathways signs of the weakening of aristocratic control over their communities in favour of a stronger middle-class can be found. The first pathway continued an evolution based on heterarchical processes of societal development and the flexibility of social roles by grouping a number of different social classes through the allocation of political and legal rights to an increasingly larger segment of society and to varying degrees also towards parts of the lower classes, thus resulting in a strong middle-class of politically active citizens. The origin of this process has been linked to military reforms – although others have levelled criticism, see Krentz (2007) for an overview – involving the development of hoplite warfare at the end of the eighth or beginning of the

seventh centuries (Snodgrass 1993; Lonis 2003, 16-7; van Wees 2004, 47-52; Pitsoulis 2011). The equal responsibility of every individual soldier in holding the line during hoplite warfare was then taken to be analogous to their equal status in the political configuration of their communities at the time. It is unclear however whether these reforms were indeed causative for this development or rather a consequence of other social processes, involving rising wealth, increased long-distance exchanges, and population growth which started in the eighth century and led to internal pressures and struggles within the upper classes of society (Bintliff 2012, 212). At any rate, it must be noted this was a gradual process developing throughout the Archaic age and probably the Classical period as well. In Athens, for example, the highest office of archon was opened up to the third of the four census classes – the *Zeugitai* –only in 457 BCE ([Arist.] *Ath. Pol.* 26.2). Even then, serious property restrictions were still in place as membership of the *Zeugitai* required meeting a production threshold of 200 *medimnoi* (± 8000 kg of wheat or 6500 kg of barley), which required approximately 9 hectares of land (van Wees 2004, 55-57), whereas the average landholding in the Classical period has been estimated at around 5 hectares (Hall 2013, 14).

In the second pathway, after initial developments towards the creation of a communal identity, this evolution is frozen through hierarchical processes aimed at retaining prevalent structures of power and governance within a strict hierarchy, emphasizing the superior position of a small elite group in conjunction with a more restricted citizen class common to Thessaly and Dorian groups which were supported by a large body of subsidiary classes of serfs. Evidence for this conclusion is sometimes seen in the redirection of the presence of prestigious objects from rich burials towards temple offerings (Bintliff 2014, 266-267). The outcome of these system dynamics driving social development led to a number of the Greek communities in the Classical period becoming oligarchic *poleis*, where serfs were replaced by slaves or paid labour from the poor classes, while others retained a form of serfdom (Thessaly, Sparta-Messenia, and much of Crete) or excluded their free lower class from full citizenship. These two distinct pathways of development are commonly illustrated through two of the best-known poleis, democratic Athens and oligarchic Sparta.

However, despite being the best-known Greek communities, Athens and Sparta were not necessarily representative for the majority of Greek communities. Most communities cannot readily be considered through an oversimplified dichotomy 'aristocratic' (or oligarchic) – 'democratic'. Instead, these should rather be considered within a continuum of configurations between these two extremes. The labels 'aristocratic' and 'democratic' should therefore only be used to provide some direction as to which tail within the range the denoted community can be considered to belong. It should be noted however, while many Greek communities of the democratic type did indeed allocate political rights to a more extensive part of their population, many inhabitants of these settlements were still excluded, such as women, children, slaves, and foreigners. It is therefore more fitting to denote these communities as 'moderately-democratic' rather than democratic in the modern sense, still, for practical ease the descriptive label 'democratic' will continued to be used here.

In terms of office-holding one could describe this duality by stating that in oligarchic or aristocratic communities, power over the citizen community was located in the hands of an exclusive group, providing all magistrates and filling all offices, whereas in democratic communities, this pattern was inverted, with decisions made by a popular assembly and the election of magistrates charged with executing these decisions (McAuley 2013, 179-80).

In both aristocratic and democratic type communities, the council (*boule*) was an important component of government. Aristocratic councils tended to be smaller in number and grafted on more permanent structures, whereas democratic councils were generally larger with rotating membership (Wallace 2013, 191). Convening councils are attested already in Homer, for example when Achilles called the assembly of the leaders of the Achaians (*Iliad* 19.40-277). Mostly such gatherings occurred *ad hoc* to address specific problems. From the seventh century BCE onwards, many communities increasingly started to formalize their governmental structures, providing a template for gathering times, procedures, and membership of councils (Wallace 2013, 192). Councils could gather more easily

and frequently compared to a full popular assembly, allowing them to act faster upon certain incentives. As a result, a wide variety of responsibilities could be directed towards the prerogatives of the council, including executive, administrative and judicial functions. However, the exact extent of power of the council in the decision-making process varied from community to community. Whibley's (1896) seminal study '*Greek Oligarchies, Their Character and Organisations*', still considered standard today, of Greek oligarchies concluded that the council '*was the sovereign power in the [oligarchic] state as the [popular] assembly was in the democracy*'. Likewise, Ehrenberg (1969, 52) remarks that in aristocratic and oligarchic societies, decision-making power rested with the council. The more recent survey of Greek *poleis* by the Copenhagen polis Project even stated: '*if major decisions are left to a general assembly, it is an indication of democracy, whereas major decisions made by a boule or by magistrates point to an oligarchy*' (Hansen and Nielsen 2004, 83).
One of the oldest written constitutions known to us is Sparta's 'Great Rhetra', fixing the number of members of the council of elders (*gerousia*) at 28 persons, aged over 60, serving for life and chosen from Sparta's leading families (Plut. *Lyk.* 5-6; Arist. *Pol*. 1270b24-25, 1306a16-19). The Spartan council had the sole right of imposing death sentences, exiles or stripping of citizen rights and its members were immune for prosecution. However, others have nuanced the sovereign power of the council. It has for example been argued that at least in Sparta's foreign policy, major decisions were taken in full assembly (Andrewes 1966, 7). Others have pointed out the claim of sovereign power of the council in Greek oligarchies is based at least in part on biased readings of the ancient sources and cannot be backed up by the ancient authors or the epigraphic record (Wallace 2013).
The growing importance of a broad middle-class in Greek communities was not in all instances a smooth development but could lead to social conflict within the community as well. Two possible responses arise, a first involved the appointment of a supreme 'lawgiver' to resolve the dispute. This could be an influential individual from within the community but at times someone external was selected to bring an impartial and unprejudiced solution to the dispute by drafting a formal constitution. Another possible response involved the rise of a tyrant who took advantage of rivalling sub-groups within the community to seize power. Both responses can also occur consecutively, the most famous example being sixth century Athens. At the beginning of the sixth century the Athenians appointed Solon as lawgiver to provide a formal constitution, however, internal social conflicts persisted and consequently the Peisistratid dynasty seized power around 561 BCE and ruled as tyrants over Athens for almost half of the century. At the end of the sixth century (507 BCE) a new lawgiver was appointed, Kleisthenes, whose constitutional reforms would form the basis of the Classical Athenian system.

In terms of settlement patterns, a minority of increasingly powerful proto-poleis started to absorb other polities, thus enlarging themselves towards a new threshold with a 5-6 km radius extent of the territory, or one-hour walking distance (Bintliff 1999a). These polities established new structures of control over the landscape, resulting in either the merging of these competing polities to form a joined settlement – a process called *synoikismos* – or resulted into the integration of one settlement within the structures of control of the other settlement as a dependent village or town. The described evolution of the settlement pattern during the Archaic period with a multitude of villages and occasional small towns transforming into a regularly spaced landscape of towns with dependent villages and hamlets, was accompanied by marked transformations of the architectural outlook of these settlements.
A first aspect to discuss is the monumentalization of these settlements. Development of monumental urban architecture might at first sight be explained on a basic level as a manifestation of prosperity in society. Although some correlation exists between wealth and establishment of monumental architecture, as a causative factor this explanation is insufficient to truly understand how and why this development occurred as monumentalization is not determined by wealth per se, but rather by priorities of expenditure (Hedrick 2013, 388). The construction of these structures provided an answer to specific societal needs and functions, inherently linked to a specific context of social interactions at

the time of their emergence. However, this does not necessarily entail the meaning of these structures was fixed and inherently linked to specific roles and interpretations at its time of construction.
Over time, societies change, and through the dialectic relationship between a community and its physical environment, the meaning, function, and means of physical construction of these architectural structures changed as well. The most archaeologically notable process is the 'petrification' of public architecture. Buildings in stone were much more resilient and thus longer-lasting than the previously prevailing wooden and/or mud-brick structures. Not only do monumental stone buildings convey a different message both to the members of the community, as well as to other communities, the longevity of these buildings leaves more room for possible shifts in meaning attributed to these structures by future generations of the community.

The earliest clear archaeological attestations of monumental public architecture in Greek communities can be found in the Greek colonies abroad rather than on the mainland itself. The Greeks spread throughout the Mediterranean by founding colonies during every single period of Greek antiquity starting from the late 11th - 10th century BCE. However, during the eighth century these processes intensified with an increase in numbers of new Greek foundations throughout the eastern Mediterranean, as well as the start of new developments in older foundations (Tsetskhladze 2006, XXIII). The process of Greek colonization of the eastern Mediterranean is sometimes explained as a strategy to deal with massive population growth and subsequent stress on the levels of subsistence of local communities. This would at first sight corroborate well with observations of a gradually filled-up landscape during the EIA which would mean the only possible subsequent reaction of Greek communities to population growth through processes of extensification was to transport parts of the population elsewhere. It should be noted however that colonization started long before the landscape of mainland Greece was filled up. Moreover, I have already mentioned population growth at this time was more likely to be a gradual process rather than a population explosion. This means explanations must be found elsewhere.
The great success of Greek colonization was possibly in part also driven by the increasing importance of trade with these lands. During the EIA, the peripheral position of the Aegean within Eastern trade networks resulted in the limited import of highly prestigious elite objects, although contacts between the Greek mainland and Cyprus have been attested through exchange of metals and pottery (Osborne 1996, 24-8). It can be argued however that these objects, mainly found in burials such as at Lefkandi, should be interpreted as 'antiques' imported through networks of diplomatic gift exchange rather than the result of commercial trade networks (Bintliff 2012, 255).
Trade contacts with the East notably increased already during the ninth century BCE, but sharply intensified from the second half of the eighth century BCE onwards, resulting also in a sharp increase of Orientalizing decorative influences in Aegean material culture, most notably from Egypt and the Near East (Morris 2007). The trade networks established at this time have been argued to be part of a common pan-Mediterranean *koine* (Riva 2007, 203). Mainly luxury items were imported from the East, including jewellery, gold and silver vessels, faience, statuettes and personal ornaments, but the most common trade goods were bronze objects (Snodgrass 1989). These trade networks were clearly aimed largely at the wealthier segments of Greek society. Of course, it can be argued to what extent we are really dealing with one unified network or rather with a multitude of interconnected smaller networks. It has been argued that these external trade contacts with the more advanced state societies of the East, played a significant role in the economic and cultural development of Greek society (Bintliff 2012; Morris 2006). The emergence of the *polis* as a new form of complex community organization in the Aegean during the Archaic period was in this view part of a Mediterranean-wide shift in system dynamics leading to the emergence of such complex polities (Horden and Purcell 2000). An external source of influence for the development of complex social configurations in the Aegean should therefore be taken into account:

> "New forms of social complexity often derive from a foreign source and from external models of organizing social and economic relationships… internationalism in the form of sea-borne long-

> distance trade and mercantile activities drove significant social change and heavily influenced pre-existing structural templates of social complexity. In these cases, connectedness and interdependency rather than autonomy and autarky provide the social conditions for the regeneration of complexity. Emerging from this complex interplay of societies and economies is the development of a political landscape of multiple self-organized, competing polities rather than a monolithic imperial presence." (Kolata 2006, 219).

When taking a closer look at these external sources stimulating the development of social complexity in Greece, the Phoenicians in particular should be discussed. Phoenician colonization of Cyprus started already around 820 BCE with the foundation of Kition but would greatly intensify during the eighth century BCE. At this time, Phoenicians settled across the entire Mediterranean, providing trade links between hitherto less connected parts of the region, including the Aegean. However, the Greeks themselves became increasingly mobile as well, moving both people through colonization and goods through trade (Osborne 1996, 105). Trade contacts between the Aegean and the Levant became common during the eighth century. Perhaps the most important development at this time was the adoption and adaption of the Phoenician alphabet by the Greeks. As far as we know, this constituted the first regaining of scribal literacy in the Aegean since the destruction of the Mycenaean palaces and their administration around 1200 BCE. The interaction was not one-sided as Greek pottery has been found at a number of coastal and inland sites in the Levant, including Al Mina, Tyre and Tell Tainat (Osborne 1996, 112-3).

A number of authors have argued that dynamics of colonization, not only in the East but towards the west as well (especially in Sicily and Magna Graecia), contributed in a decisive manner towards the emergence of the *polis* (For an overview, see Sakellariou 1989, 336-9; Di Vita 1996; Osborne 1996; Tsetskhladze 2008, 2009). One example is Megara Hyblaea in Sicily, where a clear separation between private and public space is clear already in the very beginning of the foundation of the settlement in the eighth century (de Polignac 2007, 45), although others have argued for the construction of a formal agora here only in the second half of the seventh century (Gras *et al*. 2004).

Of course, in a genuine chicken-or-egg fashion, the question remains whether the preconceived planning of urban space observed in these settlements indeed actively contributed towards the development of a new concept of Greek community formation with new urban features and political institutions, or if the planned lay-out of these colonies was merely one of the first, and better recognizable attestations of an already developed sense of organizing communities. Regardless, these colonies provide some of the earliest known evidence for those architectural features which were to become diagnostic characteristics of the Greek *polis*, such as the *agora* as a formalized public space (Morgan and Coulton 1997, 107). One of the best recognizable elements of architectural transformations is the construction of fortification structures. The earliest attestations of city walls in the Aegean were again found outside the Greek mainland. Examples constructed already during the ninth, and especially eighth century BCE were found in Magna Graecia, on the Cycladic islands (Siphnos, Andros, Chios, Amorgos and Donousa), and the west coast of Asia Minor (Smyrna and Iasos) (Crielaard 2009, 363). However, towards the end of the Archaic period fortifications are virtually omnipresent, barring a few exceptions, most notably Sparta.

While the earliest attestations of the common repertoire of public architecture were found in the Greek colonies outside of the Greek mainland, it was mainly from the sixth century onwards clear architectural programs aimed at constructing a monumental city centre started to emerge on mainland Greece as well (Bintliff 2012, 261). Greek communities became centred on a central open space (*agora*) which became a formalized space for social, commercial, religious, and political contacts within the settlement. Among the architectural repertoire of public buildings sometimes (but not always) centred on this space were the town hall (*prytaneion*), assembly hall (*bouleuterion*), theatre, gymnasium, covered walkways (*stoa*), baths, market buildings and temples. The sense of permanence conveyed by these public buildings and their construction in close association with the agora as the very heart of the settlement can be interpreted as a clear message both from and towards the own community. This has been interpreted as a shift away from the domestic house as the constituent unit of society towards the focus on the role of the polis as a collective unit in which all citizens were encouraged to participate in this new sense of identity by performing their civic duties (Bintliff *et al.* 2007, 60). The development of a civic identity promoted elaborate investment in these symbolic monuments to serve as conspicuous markers for this newfound identity both towards members of the own *polis* community as towards outsiders

Some of the earliest examples of *agorae* on the Greek mainland were found in Dreros, Argos and Athens (Hall 2013, 13). The development of this public repertoire is most commonly considered testimony of the extended development of the *polis*, however, it should be noted that the existence of an agora as location for local assemblies has also been attested in several Attic demes (Morgan and Coulton 1997, 107). While at first sight this might disconnect the *agora* as a formalized focal point for political structures from the polis level, the extraordinary size of Attica and the subsequent functioning of Athens as an extensive territorial unit when compared to the average polis might have resulted in an idiosyncratic development of the Attic demes as places for localized socio-political structures. Other sixth century attestations of public buildings are the *bouleuterion* at Olympia and the Royal Stoa at Athens (Hedrick 2013, 393). The importance of the *prytaneion,* where the executive committee of the city presided, appears to have been considered an important feature in Greek communities as its symbolic centre where the city hearth was kept. Their existence has been attested in about 90 literary and epigraphic texts, however, archaeologically, only three examples have been identified with a certain degree of certainty, at Delos, Lato and Olympia (Hedrick 2013, 393).

A persisting notion of a single *agora* as the exclusive civic and economic centre of a settlement has remained prevalent in spatial analyses of Greek communities for a long time, neglecting the possibility for a multiplicity of public spaces, possibly centred around cult places as well (de Polignac 2007, 55). It has been suggested instead that the transition from elite-controlled shrines and cult-places during the EIA towards monumental temple buildings also formed a major aspect of the development of *polis*. This involved complementing kin-based membership groups with membership of a civic community based on an image of common descent (Hall 1997; Blok 2013, 165). An important element in creating group identity was the group's unique relationship with one or more deities, laying the foundation for the development of specific civic cults (de Polignac 1995; Blok 2013, 164-7). Communities gathered around temples and other cult places by participating in common rites and rituals fostering intra-community cooperation. From the eighth century onwards, this process intensified with the construction of increasingly monumental temples. The most impressive examples were the so-called *hekatompedon* (hundred-feet) temples, as for example constructed in Samos.

The spread of this monumental temple architecture throughout Greece, has been explained through the workings of peer-polity interaction, when competition between different polities resulted in the construction of exceedingly large and impressive monumental structures (Bintliff 2012, 258). The earliest instances of monumental sanctuaries however were not located within the settlement itself but rather in the surrounding territory (*chora*). Besides functioning as cult locations for religious practices, it has therefore been argued that, besides their role in constructing a shared identity for *polis* inhabitants through religious practices, these structures also performed other integrative functions within the societal framework of the community (Snodgrass 1980; Bintliff 2012, 240), perhaps linked to the marking of territorial boundaries (de Polignac 1995). A particularly telling feature which shows the importance of Greek temples as integrative institutions in local communities, also in later periods, is the displaying of inscriptions with legal codes or *polis* decisions on the temple walls to enforce religious sanctioning, such as for example found in Priene in Asia Minor (I. Priene 14/OGIS 11; I. Priene 15/OGIS 12).

It might be suggested that the *proto-poleis* merging to form *poleis* in John Bintliff's model of community formation might already have developed some sort of idiosyncratic communal identity prior to the fusion process. Upon the incorporation of these polities in larger entities, different identities needed to be symbolically integrated in an overarching framework of cultural identity oriented at the new *polis* polity. An important strategy for the implementation of an overarching identity throughout the newly acquired territory was by establishing a number of rural sanctuaries

(Bintliff 2012, 243; de Polignac 1995). These geographic locations could be linked together in religious practices involving processions from the settlement towards the countryside. This resulted in the internal affirmation of a common religious practice on these lands as well as the external claim towards other polities on all the land marked by these sanctuaries.

3.4.3 The Classical Period (500-323 BCE)

The fusion-fission dynamics driving settlement development in John Bintliff's proposed model of *polis* formation, appears to have topped off at some point during the Classical period. This resulted in a characteristic pattern of communities of limited size, generally between 10-30 ha (Bintliff 2006, 17), except for a handful of notable exceptions, see *infra*. Why indeed is ancient Greece commonly described as a patchwork of small city-states and did it take a 'foreign' power in the form of the Macedonian kingdom to unite these polities into a single territorial state? Part of the answer can be found in the territorial dynamics between these settlement and their immediate hinterland.

The majority of *poleis* mainly depended on agriculture to provide for their sustenance, although it has been argued that husbandry is too often neglected as a mechanism of subsistence and social development in ancient Greece (Derks 1995). Still, with the majority of population living at the central settlement, this meant that many of those people cultivating lands in the surrounding territory had to move every day from the settlement to the countryside to work the fields and back. This put a major constraint on the extent of the territory controlled by a single *polis*. In his inventory of Greek *poleis*, Hansen states 60% of all Greek communities in the Aegean controlled a territory with a 5-6km radius, while 80% never exceeded an 8km radius (Hansen 2006b; Hansen and Nielsen 2004). The 5-6km limit coincides with a maximum one hour walk from the settlement towards the edge of the territory. The gravitational pull of limits set by walking distances provided a strong selection pressure towards small, nucleated settlements.

However, it has not yet been explained why this major constraint on territorial expansion of Greek *poleis* was maintained, thus halting many ongoing fusion/fission dynamics. The answer may lie in the development of an ideology of citizenship with an extended middle-class gaining political and juridical rights. The importance of performing all associated activities of this citizenship for the continued existence of the community required these citizens to reside in the central settlement. However, these citizens also needed to control a fixed minimum amount of land if they were to retain their political rights. When these citizens needed permanent residence in the settlement, a large number of small-scale agriculturalists therefore needed to move out every day to work their lands and be able to return on the same day, resulting in the observed 5-6km radius limit on territorial expansion of these communities (Bintliff *et al*. 2007; 60, 2012, 217). Together, these elements held the existing system within its current basin of attraction, impeding the development of a strong elite class or single ruler which might have directed existing flows of energy and resources towards territorial expansion.

Exceptions to the general image of the polis as a small nucleated settlement are the so-called '*megalopoleis'* such as Athens and Thebes with territories up to and exceeding a 15km radius. Athens is the most notable one because of the incorporation of all of Attica in its structures of government. The settlement pattern of Attica was based on numerous rural demes centred on a secondary settlement dependent on the main city of Athens. Throughout the rural landscape, unlike in other areas of the Greek mainland, mainly extensive estate-centres are found instead of large number of small farms. This phenomenon is likely linked to the dominant economic activity of Attica, namely large-scale olive oil production which was unsustainable for small family farms (Bintliff 2010, 26). This peculiar image of a local dominance of large estates with a high investment in cash crops can probably be explained through the direct link with the role of Athens as a major hub of maritime trade. It has also been suggested the great constraints in domestic architecture on conspicuous signs of wealth and power in the city of Athens, as a consequence of the dominant ethos of citizen equality following the creation of an extreme democratic regime in Athens, did not apply to properties in the rural areas, which would provide an additional explanation for the odd predominance of fairly large and elaborate estates in the countryside.

During the Classical period the settlement pattern established at the end of the Archaic age was largely consolidated. Intensive archaeological surveys throughout mainland Greece have suggested approximately 70-80% of the population lived in towns (Bintliff 2006, 16), either in the central settlement or in dependent towns. Still, this left a sizeable portion of population[8] to have lived on the countryside (*chora*). One must only think back to one of the four primary meanings of the word *polis*, that of a combination of town and hinterland, to see that both were inseparably connected.
As a result, it is not always clear where to draw the line between 'urban' and 'non-urban' or 'rural'. Along the edges of cities, both ancient and modern, a clear-cut perimeter is not always readily found. Urban sprawl and development of giant suburbs impede straightforward delineations even in the best-documented modern cities. For settlements in antiquity, even when fortification walls surrounded a settlement, such a distinction can be equally problematic. It has been argued perhaps a stark and fixed delineation between the urban settlement and its hinterland has never been clear, nor should it necessarily be desirable (Smith 2003, 4).
When looking beyond the mere physical dimension of settlement occupation density, different criteria used to define what constitutes a city will provide different effective boundaries for the spread of a given city. For example, economic structures will link areas in a different way than social boundaries would. Economic structures would intrinsically link areas of resource procurement, such as for example clay beds or forests used to obtain respectively clay and fuel for pottery production, with areas of production such as pottery quarters, often located in the periphery of the settled area, and areas of distribution such as markets, typically situated on or around the central *agora*. On the other hand, let us consider for example the social dimension of urban life of a member of the town elite, which would typically (with some sense of simplification) revolve around the dual-attractors of *domus-agora*, i.e. the private household and public political arena. When considering the city from the first point of view, at least the suburban potters' quarters would be an essential part of the make-up of the city, whereas in the latter case it would be of little direct consequence. A fixed divide between urban and rural has therefore not only become unfeasible, it wouldn't even make a lot of sense to uphold in the first place. 'Urban' and 'rural' are two intricately linked parts of the same system, two sides of the same coin as it were. They encompass different elements of both the social and ecological systems that interact to produce and sustain community development. Both must be considered together within the same socio-ecological system. It is within this perspective any analysis of settlement and territory must be undertaken.

Regional variation does exist, but for example in Boeotia and the southwest Argolid, settlement numbers on all scales reach their highest point antiquity during the Classical period (Jameson *et al*.1994; Bintliff 2000a, 140). Many major settlements reached about twice the size of their Roman successors and Classical Greek ceramics are found *en masse* throughout the landscape in regional survey projects (Jameson *et al*. 1994; Bintliff 2005, 137-40). Population growth resulted in an increase in size and/or density of settlements through, respectively, an organic growth out of a single core or the infilling of open spaces that existed because of the dispersed location of habitation in the former constituent units of the settlement (Bintliff 2010, 24).
The rural population has been encountered during archaeological surveys through the identification of increasing numbers of structures on the countryside, predominantly 'family farms'. The most basic ones were two-roomed structures with a yard. These structures sometimes occurred in clusters and can be interpreted as farms owned by peasants or agricultural tenants. Such structures are a recurring element in many different regions. It has been doubted whether these farms were permanently inhabited or seasonally occupied in agriculture peak times but it would appear at least a large part of these structures show sufficient elements of continued domestic use to argue for permanent

[8] 20-30% according to my impressive math skills.

habitation with only a minority used periodically (Bintliff 2012, 270). The large number of such farms found throughout most regions of the Greek mainland could possibly be explained by the short period of occupation of each individual unit, perhaps connected to generational shifts in location (Bintliff 2006, 16). Some structures however are notably larger than basic farm units with clusters of rooms placed around a courtyard, sometimes accompanied with impressive tower structures (*pyrgos*). These might be interpreted as seasonal country houses owned by richer land owners (Bintliff 2012, 305).
Most rural sites therefore consisted of farms and hamlets, with a prevalence of small estate-centres. This image is corroborated by finds from other survey projects in the southern mainland and the islands**.** In Boeotia 15 major Classical period settlements were identified (Bintliff 2010, 120). Dependent on these central places were a high number of secondary rural sites. The settlement pattern of Thespiae, one of these central places in Boeotia, in Classical times consisted of a tripartite radial pattern surrounding the city core, which formed the focus of sustained occupation and shows the highest surface find density. Beyond the core, a site halo has been observed, consisting of pottery sherds with a lower level of surface find density compared to the core and associated with a first semi-urban, semi-rural band of cemeteries. Further away, a second belt of large estates or hamlets can be observed, whereas on the outermost edges, sometimes a thinner carpet of sherds could be found, related to a secondary impact zone of the core site, consisting of a number of small farms (Bintliff and Snodgrass 2007, 132). Depending on the size of the site core these two outer zones could range from a few tens of meters for farm sites to several kilometres for large settlements (Bintliff 2014, 5).

Analysis of the archaeological record showed an abundance of tableware and limited evidence for food processing or storage vessels, suggesting many of these rural sites also had an important residential function, next to a productive or agricultural role. It has been suggested the intensive exploitation of the countryside during the Classical period resulted in the formation of a subsidiary settlement network, composed of regularly spaced villages and hamlets with their own satellite farms because of the increasing difficulties in daily commuting to and from the city. One example was the large village, or perhaps even a small town, of Askra located 7.5km from Thespiae, which exploited the surrounding Valley of the Muses (Bintliff and Snodgrass 2007, 136).
In many different regions, a number of villages can be found across the countryside, who were dependent on the central settlement and acted as secondary or tertiary foci for the dispersed rural farms in the local settlement hierarchy. These smaller towns or villages were especially important in local structures of control of *poleis* who extended their control over a larger territory by continuing to integrate adjacent polities into structures of control and transform themselves into some sort of territorial states with territorial radii of up to and exceeding 15km. For Boeotia, the prime example is Thebes, which grew into a *megalopolis* extending over 300 ha during the Classical period. A comparable image of regularly dispersed normal *poleis* and an occasional larger territorial *polis* is recognized in different areas throughout Greece. Examples include Thessaly, and the Argolid, where the southwest Argolid Survey identified a similar pattern of a series of small settlements, at the very least proto-*poleis* but possibly already *poleis*, who merged into two territorial *poleis*.

Besides the organic growth of existing settlements, the continued foundations of new settlements can be seen. Many of these new foundations are characterized by regular town lay-outs built around regular units of house blocks, which are often referred to as ‘Hippodamian’ town plans. However, this concept of city planning was merely an elaboration of existing town lay-outs developed in the fifth century BCE (Tsetskhladze 2009, 145). One of the few known locations where the architect Hippodamos worked was the new port of Athens, Piraeus (Hoepfner 2009, 170). The best-known case of a clearly planned settlement with a regular architectural lay-out, however, was Olynthos, located on the Chalkidiki peninsula in northern Greece. The occupation of the settlement on the so-called South Hill ranges back to 1000 BCE, however, in the last quarter of the fifth century the settlement expanded greatly, possibly because of a population influx from neighbouring settlements during a process of *synoikismos*. Due to this strong population growth, an entirely new segment of the settlement was carefully planned and constructed on the North Hill. This part of town was only

occupied for little more than half of a century as Olynthos was besieged, captured, and destroyed by the Macedonian king Philippos II (359-336) in 348. During excavations, over 100 houses have been (partially) uncovered and of those, 50 ground plans have been completely reconstructed, making Olynthos the biggest known sample of domestic architecture throughout the Greek world. As might be expected, the older parts of the settlement are placed dispersed on and around the South Hill due to organic growth, while the new parts on the North Hill were built through two rows of equal-sized blocks of houses (Nevett 2001, 55; Hoepfner 2009, 174).
As for public architecture, the standard repertoire that emerged at the end of the Archaic period continued to be of importance throughout the Classical period. One difference observed at many places, is the construction of permanent, customary built meeting places, providing a new location for popular assembly rather than convening on the agora as was customary before (Hedrick 2013, 391). The most famous example being the Athenian Pnyx, built during the first half of the fifth century on a slope at some distance from the *agora* to serve as venue for political meetings of the citizen assembly. Regional variation in the composition of this architectural repertoire mainly exists in the northern part of the Greek mainland and on Crete. These communities were led by kings or an aristocratic council with a less important position reserved for the civic assembly. Nevertheless, these communities also featured an *agora* on a prominent location closely associated with the major civic temple, but supplemented by other public buildings linked mainly to the storage, preparation and consumption of food (*andreion* or *syssitia*) by the gathered male population in daily rituals of communal dining to which each household contributed ten percent of its agricultural production (Bintliff 2012, 261, 303; 2014, 267).

I have described how the institutionalization of political structures during the eighth century led to the formation of a number of governing bodies and offices. Regarding further development of these political structures, most information is available regarding the constitutions of Sparta and, especially, Athens. While the constitution of the average *polis* can in part be discerned out of more fragmentary evidence, for example from epigraphical sources, for the most part they remain quite obscure. But to what extent can all *poleis* be supposed to have had a similarly extensive administrative apparatus? Classical Athens was probably in many ways an exceptional case because of the need to administer the Athenian empire. It can for example be suggested that a certain extent of multiplication and fragmentation of administrative offices, coordinated by the *boule* must have existed (Pownall 2013, 291). We should therefore be wary of extrapolating our Athenian sources on structures of government to an understanding of the workings of *poleis* in general.
In Athens, the selection of magistrates could be done in a number of different ways, depending on the specific governmental structures of the community. Some magistrates were elected by lot, such as for example the *metronomoi* charged with enforcing standards of weights and measures during market exchanges ([Arist.] *Ath. Pol.* 50.1-54.3). Appointing magistrates by drawing lots gives every citizen eligible for office an equal chance to be selected. Such a system was devised to avoid the creation of different factions within the citizen body and prevented personal popularity or bribery to influence selection mechanisms (McAuley 2013, 181). However, not every magistrate was selected by lot, and for some offices experience, skills and popularity did indeed become important factors. The ten supreme magistrates at Athens, the *strategoi*, for example, were elected every year by the popular assembly. Voting could occur through raising hands, casting stones, or by raising one's voice in favour of a certain candidate with the loudest appraisal deciding who gains the office. The latter procedure was for example used when selecting the members (*gerontes*) of the *gerousia* of Sparta (Plut. *Lyk.* 26.1-3).

Again, variation between different pathways of development existed, best exemplified in our knowledge the constitution of Sparta on the one hand and Athens on the other. Yet, it is to be questioned how much of this standard image can be projected onto the wider realm of other respectively aristocratic and democratic communities. By definition, *poleis* of the aristocratic type included less participants in their structures of power. Decision-making mechanisms were therefore initiated which transcended the power of a more extensive middle-class. The most common of such mechanisms was the council of elders (*gerousia*). Besides, the *gerousia*, consisting of 28 members chosen from Spartan men aged over 60, the institution of 2 dynastic kings with little actual power but high social prestige, as well as the 5 ephors, officials with political, judicial and military functions have been attested. These institutions all in some way curtailed the power of the civic assembly. The combination of monarchic, oligarchic and democratic elements has led to the common assertion Sparta had a 'mixed constitution' (Strauss 2013, 27). Despite the shift of political domination towards less accessible institutions instead of the assembly of male citizens, this civic class did hold a privileged position in these societies. In Sparta, a clear trend towards a stark delineation between lower classes and citizens to provide support of the Spartan citizen class (*homoioi*) has been observed somewhere during eighth century, when northern Laconia was annexed and local communities were forced into a relationship of dependency (*periokoi*) towards the Spartan citizens (Hall 2013, 17). These communities retained their internal autonomy but were forced to support Spartan military actions. This process towards the formation of structures of control aimed at supporting a Spartan citizen class was extended towards the end of the eighth century when first southern Laconia, and next Messenia were annexed and its residents were enslaved as helots, in practice they were among other things forced to contribute a significant share of their agricultural production towards the support of Spartan community

In democratic *poleis* the aristocracy lost its dominant position in favour of an extended middle class, or in an alternative view, some members of the aristocracy tried to maintain their position or extend their power by temporarily appealing to heterarchical socio-political structures (Small 2009). The breach of the aristocratic power base is mainly attested, as usual, for Athens with descriptions of the reforms of Cleisthenes, who was a member of the elite himself (thus prompting the suggestion the reform towards democratic structures was part of a deliberate power strategy). Around 510 BCE Cleisthenes' reforms meant the abolishment of the traditional tribal structure based on the four property classes established by Solon in which the lowest class could take part in civic assemblies or courts but could not take office as a magistrate. The new system of 10 tribes was established in such a way it unified all the markedly different parts of Attica to enhance the feeling of a united citizen class (Lonis 2003). In 461 Pericles completed the democratic reforms initiated by Cleisthenes by greatly advancing the *ecclesia* over the *boule* in governing power and limiting the importance of the aristocratic council (*areopagus*) to a purely ceremonial role (Parker 2004, 35).

Within democratic structures of power, the dominant citizen class was differentiated through heterarchical decision-making structures, leading to the establishment of a democratically chosen council of government (*boulè*). Interestingly, in Athens, this *boulè* consisted of 500 people and according to the model presented here this number of people would often lead to the formation of additional mechanisms differentiation, and indeed, out of these 500, a group of 50 people (the *prutaneis*) were selected on a monthly basis to deal with the day-to-day government (Bintliff 2010, 33-35). The population of Athens (and of entire Attica by extension as this fell under the same political structures as the settlement itself) greatly exceeded that of the average Greek community. Similarly extended differentiated structures should therefore not be *a priori* assumed for other *poleis* as well. Nevertheless, the differentiated structures of governance installed in democratic poleis resulted in the need for a massive investment of time (and resources) for citizens to participate in them. This development may only have been possible if the citizen class delegated a major part of their productive and commercial activities towards a large class of resident non-citizens (*metoikoi*) as well as rely in part on slave labour. In this sense, the democratic *polis* was quite similar to the aristocratic *polis*. Therefore, the formation of a privileged class, regardless of individual trajectories of oligarchy or democracy, was only ever possible by exploiting a number of other societal groups to provide support.

The concept of citizenship as a prerequisite for political participation is crucial in understanding the workings of socio-political dynamics of Greek communities. The right of citizenship was generally shielded from external influx by being restricted to the male, legitimate offspring of citizen fathers. In Athens, from 451 BCE onwards citizenship was being restricted even further through the implementation of an additional requirement to have a citizen mother as well (Strauss 2013, 23). The central role of a citizen middle-class (of varying size) bestowed with significant political and judicial rights in both trajectories of Greek societal development has prompted the suggestion to replace the common translation of *polis* as city-state with 'citizen-state' (Runciman 1990, 348; Morris 1991, 26; Hansen 1993, 2006a; Van Der Vliet 2005, 2008; Bintliff 2012; Strauss 2013). The concept of citizenship can both entail membership of a given community, as well as add a legal-political element of rights and duties associated with this membership (Blok 2013, 161). These two elements did not always coincide and could show considerable variability. Not all citizens for example were eligible to run for public office. Citizenship however extended beyond a mere political dimension as membership of the local community was also defined through an explicit link to religious practices (Blok 2013, 164).

3.4.4 The Hellenistic Period (323-31 BCE)

One of the major episodes of disruptive change occurring at the transition from the Classical to Hellenistic period is of course the incorporation of the Greek cities in the structures of the Hellenistic kingdoms. The conquests of Philip II (382-336 BCE) – continued to unprecedented heights by his son Alexander the Great (356-323 BCE) – provided a marked period of upheaval in many parts of the eastern Mediterranean. From this time onwards, the Greek world was incorporated in a huge realm stretching into the eastern Mediterranean, even reaching as far as the borders of India. After Alexander's death, his generals assumed control over different parts of his empire, founding a number of hereditary imperial dynasties. Some have interpreted the loss of independence following the battle of Chaironeia (338 BCE) and the subsequent conquests, incorporating the Greek communities within structures of empire, as the final end of the *polis* (Cawkwell 1996). Others, who rather stressed the longevity and continued existence of the *polis*, argued along two lines. Some have argued for discarding the aspect of autonomy (*autonomia*) as one of the key defining characteristics of the *polis* altogether. Others argued for the continued independence of these communities during Hellenistic times, at least in a legal sense if not *de facto* in a political sense, stating individual *poleis* can formally only be considered independent allies of the different Hellenistic kings (Heuss 1937). Several attestations can be found in the epigraphic record of cities claiming to have received freedom by the king (Ma 1999). The crucial aspect is of course the act of *receiving* freedom by the king. It was already argued by Bickerman (1938) that most cities in the Seleucid kingdom were clearly subordinated to royal power and freedom was only granted after formal surrender to the king's authority, and could therefore be revoked at all times.

Ultimately, this resulted in a major shift in the functions of the *polis* as it had now lost, for the most part, its freedom to run its external affairs. At this point, *poleis* were embedded in larger-scale socio-political units driven by conquest-based expansive politics, or empires, composed of a diversity of localized communities, polities and ethnic groups (Strootman 2013, 39). Whereas some scholars refer to these entities rather as Hellenistic 'kingdoms', this definition can clearly be applied perfectly. I will therefore use both terms interchangeably throughout this text. The Hellenistic empires have essentially been described as "*military organizations interested primarily in collecting tribute and gaining access to the resources needed to sustain their martial capabilities, and reluctant to become directly involved in the government of subject cities and territories*" (Strootman 2013, 39).

Some of the core activities of these empires comprised of war making, conspicuous consumption of goods in ostentatious practices of the display of power, and gift giving (Ma 2013, 338). These were only ever possible because of the incorporation of local communities in structures of administration, control, and extraction of resources. The Hellenistic kingdoms in general did not impose new administrative controls within individual communities but chose to co-opt local institutions and facilities. The Hellenistic kings in effect preferred to seek the goodwill of local communities rather than impose authority and force obedience (Wiemer 2013, 62). As a result, many communities retained most of their internal self-government as long as the royal agenda was continued to be supported (Ma 1999, 151). Stephen Mitchell (2017, 28) considered political strategies for maintaining internal autonomy to be the major driver behind the adoption of Hellenocentric elements in the indigenous communities of Anatolia, more so than any direct cultural impact. More specifically, the adoption of democratic structures of citizen participation, as an intermediate stage of dissemination of political organisation grafted on the Greek *polis* model, was seen as a key means of establishing and maintaining internal autonomy by connecting the establishment of legal authority with full assembly of the civic council and people (Errington 1995; Mitchell 2017).

The model of social interactions between the king and dependent peoples as devised by Bicerkman (1938) and extended by Ma (1999), stressed the vibrant reciprocal dynamic between local communities, actively in pursuit of advantages for the own community, and the royal administration, through flows of capital and resources moving towards central government in the form of taxation or the other way round in the form of stimuli for local development. Measures of taxation were intrinsically part of the surrender-and-grant model of interaction between kings and cities. Structures of empire therefore did not just consist of a one-way extraction of resources from local communities towards the central governmental apparatus as these very same epigraphical sources often tell of the benefits bestowed by the different Hellenistic dynasts upon local communities.
The willingness of these communities to participate in the structures of empire is commonly seen as a major driving force behind the assimilation of Greek material culture within local structures (Wiemer 2013, 54). Within these formalized structures of interaction, personal relationships between someone from the local community, mainly from the elite, and members of the royal court played a crucial part in obtaining favours from the Hellenistic kings. The competition between local communities to receive royal benefits therefore resulted in a process of 'aristocratization' of these Greek communities and local aristocrats often boasted about using these relationships for the benefit of the community through inscriptions made public somewhere within the settlement. Interactions with central government added a whole new institutional level to local structures of government, yet, for the local government of these communities themselves it can be argued a lot stayed very much the same with a continuation of existing structures well into the Hellenistic period.
Plenty of attestations exist in the epigraphical record of local communities requesting and receiving favours from the royal administration. Favours could be requested and obtained either directly from the king and his royal court or from the provincial magistrates depending on the nature of the request. One of the most well-known figures of provincial administration in the Seleucid kingdom was Zeuxis, governor of Asia Minor, who features prominently as benefactor in the epigraphic record of the cities under his rule (for an overview see Ma 1999, 123-130). Antiochos III gifted grain to Priene and Herakleia, granted cash to Herakleia, subsidized the expenses for maintaining infrastructure such as the water-conduit at Herakleia, and provided financial aid for the reconstruction of Sardis and Iasos after earthquakes badly damaged buildings such as the gymnasion and the *bouleuterion* (For an overview of royal euergetism see Bringmann 1993, 1995). It is argued the benefits obtained through this interaction stimulated other communities to present themselves as *poleis* as well, especially in Asia Minor (Wiemer 2013, 54). This shift in representation in part contributed to the frequent application of the moniker of *polis* onto many settlements of the Hellenistic period throughout the eastern Mediterranean (Ma 1999; Bauer 2011; Stavrianopoulou 2013; LaBuff 2016). Still, we should be careful in generalizing this process, especially when lacking literary evidence. I will return to this point extensively throughout this thesis, especially when discussing the evaluation of the proposed case-study on community formation dynamics throughout southwest Anatolia.

Although city and king generally interacted through a reciprocal dialogue, the king of course retained the absolute power to purposefully intervene in local affairs if he so desired. One striking strategy employed by the Hellenistic kings comprised of the merging of existing neighbouring settlements through *synoikismos*. Such interventions in the local settlement configuration could be executed for a number of reasons, but were part of wider administrative reorganizations to extend and solidify structures of political and economic control over certain areas. It has for example been argued that the fragmentation of state control and flat hierarchies of power form a considerably greater threshold for inter-regional trade compared to distance and transportation costs. Administrative reorganizations of newly acquired regions during the Hellenistic period might partially be interpreted within a larger strategy of active optimization of existing socio-political structures. It has for example also been suggested that the extensive city founding program of the Seleucids was primarily aimed at intensifying ongoing patterns of economic activity (Aperghis 2004).

One of the most direct methods of intervention in local settlement systems by the Hellenistic dynasts was no doubt the founding of new cities which could markedly alter configurations of economic, social, and political structures (Aylward 2005, 37; Cohen 1978; Owens 2009, 183). Of the different Hellenistic dynasties, the Seleucids were no doubt the most active builders of cities with over sixty known city foundations. Seleucid policies of colonisation and city foundation as part of wider socio-political and economic policies will be discussed more extensively in chapter four. New city foundations also frequently acted as instruments for the self-promotion of Hellenistic kings. Royal foundations were for example often given dynastic names such as Apamea, Seleukeia, Antiochia, Stratonikeia, *etc*., in honour of the founding dynasty.

City foundations were commonly equipped with the standard architectural repertoire of Greek communities, such as a gymnasium, *stoa*, temples, market building, theatre, *bouleuterion*, *prytaneion*, *etc*. As indicated earlier, existing cities were also increasingly accommodated with the full extent of these public architectural structures, sometimes with royal financial aid. Of these structures, the gymnasium in particular obtained a crucial role within Hellenistic communities as a location for physical and intellectual development which was to become a symbol for Greek culture in general. As such, it became part of the very architectural core of these settlements as it became often closely associated with the *agora*. Likewise, the *stoa* grew considerably in importance during the transition towards the Hellenistic period. Allowing a number of different shapes because of its simplicity in plan, its multifunctional nature soon led it to become a symbol of Greek urban life in new city foundations, especially in Asia Minor, as it was increasingly used as a delineation of the agora and other public spaces or as a link between different public buildings (Owens 2009, 186). City foundations are therefore sometimes interpreted as prime mechanisms for the spread of Greek culture over previously non-Greek regions. As a result, the *polis* system in Hellenistic times is considered sometimes more as a cultural phenomenon (Murray 2000, 238). It constitutes a settlement pattern within multi-ethnic kingdoms, imposed by a dominant Graeco-Macedonian elite upon native populations, who were excluded from participation in its central institutions. In this view, the chief function of the polis was to sustain a universalised and homogeneous Hellenic culture for a Greek minority, within a plurality of native cultures, who would find throughout the Hellenistic world the same institutions, language, and buildings. In a previous part I already discussed some of the shortcomings of this view, more particularly as related to a Eurocentric discourse on Greek cultural influences.

3.5 Conclusions: Relevance of *polis* formation for southwest Anatolia?

When talking about the historical development of Greek communities or *poleis*, the starting point must be to examine what exactly the concept of *polis* entails. I started this chapter with some question marks regarding the validity of the concept of *polis* to denote the enormous variability in Greek communities, as well as for its use as an analytical tool in further academic research. The CPC concluded the word *polis* was mainly used in ancient sources to denote a physical settlement or political community, often including both meanings simultaneously. Every *polis* was centred on a town and, conversely, every town called *polis* was considered the centre of political community (Hansen 2000: 172). Specifically, the *polis* is commonly interpreted *qua* town as a city and *qua* political community as a form of state (Hansen 1998). It was also noted that the list of characteristics of the *polis* generated by the CPC could in essence be associated with a wider range of socio-political configurations, not necessarily limited to the *polis*. Indeed, in some works the CPC discusses the specificities of the Greek *polis* as one particular example of a wider range of city-state cultures (Hansen

2000). The term *polis per se* therefore only has intrinsic value to differentiate *poleis* from other modes of community organization within the specific temporal and spatial parameters of the Greek Aegean. Outside of these limits, its effectiveness is strongly weakened.
Yet, the concept of *polis* is commonly applied beyond the Aegean in historical and archaeological writings. A partial explanation can be offered by the Eurocentric discourse in which origin of *polis* and associated Greek/Hellenistic culture was embedded. As a result, the concept of *polis* was imbued with projections of elements from modern Western society. Its main meaning as a nucleated settlement and a political unit saw it associated, respectively, with aspects of urbanisation and state formation. While the usefulness of the concept of *polis* has lessened due to this association, depriving it of classificatory value, it can still be used as a descriptive framework to describe a model of community formation. However, devoid of this classificatory value, the term *polis* would then function as a label for a highly institutionalized urban centre.
I have presented some rough outlines of a historical overview of the development of such centres in ancient Greece from EIA to Hellenistic times. The traditional narrative of EIA Greece tells of massive population movements coupled with a widespread phase of destruction in all major centres throughout the Aegean and many other parts of the Mediterranean East around 1200 BCE. Lately, this view has been nuanced. Instead, aspects of societal resilience and transformation have been stressed, consisting of a transition phase of creative destruction resulting in novel forms of social organization, developed through a combination of innovation with recombination of existing elements. The demise of the large Mycenaean states, along with continued habitation and transformation of social life at many local centres is indicative of a reorganization phase, made possible by the characteristic property of near-decomposability in complex adaptive systems.

I have drawn heavily from John Bintliff's model of *polis* formation in Boeotia, driven by fusion/fission dynamics. This model posits a classificatory system consisting of *proto-polis*, *polis*, and *megalopolis* as societal categories based on inter-culturally valid attractor states and cognitive selection pressures for social organisation. The model starts from a dispersed settlement pattern during the EIA. Driven by processes of settlement nucleation and population growth, this landscape was gradually filled up and transformed into a landscape with regularly spaced *proto-poleis* controlling on average a core area of 2-3km radius. The regular spacing of this settlement pattern emerged due to the 'gravitational pull' of anthropologically observed limitations in walking distances of half an hour from the central settlement towards the furthest edges of the territory. These limits on walking distances provided strong selection pressures towards small, nucleated settlements that kept local communities in their existing basin of attraction, effectively operating as attractor states.
These settlement consisted of corporate communities, which already showed characteristics of town life and attributes of socio-political structures, even though these developments did not run in parallel with an urban transformation of these settlements. The limited sizes of these corporate communities was explained through fusion/fission dynamics induced by cognitive limits on information processing and social group sizes. To overcome these limits, mechanisms of social organisation and hierarchies needed to develop, resulting in communities with a certain basic socio-political structure. At this point, the system entered into an exploitation phase (r) where different (ecological, social and economic) niches started to be filled up, as these small-scale communities started to spread out, resulting in a full exploitation pattern of the landscape.

At some point during the eighth century BCE, ongoing system dynamics started to intensify, leading to new forms of material culture and monumental architecture, the emergence of new forms of social organization, socio-political structures and institutions, all developed to sustain a new mode of community organization centred on the *polis*. In terms of settlement patterns, a minority of *proto-poleis* started to absorb other polities, thus enlarging themselves towards a new threshold with a 5-6 km radius extent of the territory, or one-hour walking distance. After these system transformations, the system started to move towards the conservation (K) phase, as increased connectivity and processes of intensification and specialization in increasingly more narrow avenues of development,

generated a multiplier effect with increasing returns to scale. Because of these strategies of intensification, most resources tend to get 'locked up' over time, for example by developing elite control mechanisms. Imports of prestige objects, for example, were increasingly tapped in a constant process of competitive interaction among elites to gain prestige and status. Due to mutual suspicion of excessive ambition among the members of the elite, a number of control mechanisms were developed for exercising public offices. These mechanisms include standardization of procedures for election, regulations for terms of offices and transfer of power after tenure. One important process was the increased differentiation in power structures through the development of fixed offices limited to specific spheres of society and limited in time. The transformative period from the eighth century BCE onwards saw a marked stimulation of capital/potential geared towards development of stronger communal structures of government.
During the Classical period, the fusion-fission processes driving system dynamics seem to have topped of, resulting in a stabilized settlement pattern of nucleated settlements of a generally limited size, between 10-30 ha, that can be considered the typical Greek *polis* configuration. The stabilization and consolidation of this social, political and economic landscape matches the full transition into a K-phase of conservation. At this point, the system exploits its full available potential as subcomponents become increasingly interconnected and more energy and resources go into maintaining existing structures. This development induces a resilience trade-off where the increased efficiency of the system also entails increased rigidity, hampering the system's ability to overcome disturbance events. Such events can either be externally imposed or internally developed. In this case, the conquest of Greece by Philipp II and his son Alexander would integrate the *poleis* of the Greek mainland into a far larger socio-political system, oriented towards the Near East, inducing a wholly new adaptive cycle of system development.

It would require a research project on its own to examine the various ways this impacted local community configurations in Greece. I will not discuss these processes in any more detail here. Instead, the time has come to move towards the presentation of the case studies in chapter four. How can the historical narrative of *polis* development in Greece now be used in a comparative view to study settlement formation in southwest Anatolia? First, special care should be taken not to relapse in any unwarranted aspects of 'Eurocentrism', implicitly providing a favoured bias towards elements of Greek culture, at the expense of other, most notably 'Eastern' influences. To this end, it must be considered how local communities operated within a certain framework of orientation and integrated external influences within local preferences to generate their own idiosyncratic socio-cultural framework. It is therefore essential to view community formation as an encompassing process, consisting of a combination of idiosyncratic developments influenced by initial local circumstances and certain structural constraints formed by a number valid formative 'attractor states' which are selected through the imposition of selection pressures onto the own cultural framework. This approach allows for more variability to be incorporated in views of community formation as it focuses on the coalescence of local particularities and formative dynamics resulting in particular socio-political configurations. The *polis* model can be used as a comparative framework to elucidate and explain possible selection pressures underlying community formation and development in southwest Anatolia. This approach goes beyond the mere model of adoption or resistance of Greek culture, and focuses instead on a comparison of fundamental driving forces and selection pressures of social organization and community formation.

Chapter 4: Case studies

"*Because of the self-confidence with which he had spoken, no one could tell whether what he said was very clever or very stupid*."
-Leo Tolstoy, War and Peace.

4.1 Introduction

Chapter Structure

As explained in the general introduction, this part of the thesis is partially built on a series of papers, as per approval of the Doctoral School Humanities and Faculty of Arts of the KU Leuven. I considered this approach to best match the format and goals of my research project. However, this *modus operandi* also runs the risk of ending up in a disparate structure. In general, I have tried to maintain the coherent nature of a traditional thesis text by streamlining the flow between different parts. This entails introductory parts in-between papers, explaining its purpose and genesis, as well as removing duplicate parts where possible. However, at some points compromises had to be found. As every paper followed its own format logic, it was, for example, decided to retain the numbering of figures and tables within individual papers, which will therefore restart from 1 in every paper.

Part	Topic	Paper
1. Düzen Tepe and Sagalassos	1. Material culture	Daems D., Braekmans D., Poblome J. (2017) Late Achaemenid and Early Hellenistic Pisidian Material Culture from Düzen Tepe. *HEROM* 6(1): 11-47.
		Daems D., Poblome J. (2017) The Pottery of Achaemenid Sagalassos: an overview. *HEROM* 6(1): 49-62.
		D. Daems, M. van der Enden, P. Talloen, J. Poblome (In review) The mid Hellenistic Pottery Repertoire made at Sagalassos, SW Anatolia. *IARPHP Conference Proceedings Lyon*, 2015.
		Monsieur P., Daems D., Poblome J. (2017) Hellenistic and Italic amphorae from Sagalassos. *HEROM* 6(1): 97-118.
	2. Subsistence	S. Cleymans, D. Daems, and N. Broothaerts (In preparation) Sustaining People. Reassessing carrying capacity through the socio-ecological metabolism of Düzen Tepe (SW Turkey).
	3. Economy	Daems, D. (Accepted) Social complexity and complexity economics. Studying socio-economic systems in the past. *Collection Latomus*. Conference Proceedings of *"Complexity: A New Framework To Interpret Ancient Economic Proxy Data",* Sagalassos, September 2015.
	4. Socio-political organization	Daems, D. (In review) Living together. Models of settlement configuration and social organisation at Sagalassos and Düzen Tepe.
	5. A model of community formation	Daems, D. and J. Poblome (2016) Adaptive cycles in communities and landscapes. The case of Sagalassos and Düzen Tepe during the Classical/Hellenistic period, *Archaeological Review Cambridge* 31(2): 91-107.
2. Sub-regional scale	Material culture and community formation	Daems, D. and J. Poblome (In preparation) Material culture and community formation in the area of Sagalassos from Iron Age to Hellenistic times.
3. SW Anatolia	Community formation	Daems, D. and P. Talloen (In preparation) Moving in together. Synoikismos and modes of community development through push/pull dynamics in SW Anatolia.

Figure 24: Structure of chapter four with indication of papers used for each part.

The structure of the chapter follows a major tripartite structure on the first level, differentiating between the core case study of Sagalassos and Düzen Tepe, followed by two extended case studies, covering respectively the sub-regional scale corresponding to the study region of the Sagalassos Project and an interregional scale covering Pisidia, Lycia and Pamphylia in southwestern Anatolia. The first case study is then again subdivided in several thematic parts: material culture, subsistence, socio-economic organisation, and socio-political organisation. The last three parts each correspond with a single paper, whereas the first part of material culture is more extensive and consists of four distinct papers and a comparative synthesis, as this part constitutes the bulk of the analyses for this research. This case study is concluded with a synthesis part, corresponding to one of my first major papers – published in the *Archaeological Review of Cambridge* – where I first attempted to apply parts of my theoretical framework – more specifically the use of adaptive cycles – onto my main case study. Several of the elements highlighted at that point will be reprised in the final chapter where I will present a synthesis of the research findings and implications, extending on arguments initiated earlier.
In some of these papers, elements of the theoretical framework are summarized insofar they are not specifically elaborated for the specific paper compared to the general framework offered in chapter one. This is most relevant for the last two papers, which contain the case studies extending the frame of analysis up until southwest Anatolia. To avoid overly strong repetition, the description of the relevant community development contextualized in these papers is largely omitted as this is discussed in sufficient detail earlier in the chapter.
Before each paper, I detail the genesis, date and (if applicable) journal of publication, as well as a description of work division in case of co-authors with listing and explanation of my own contributions. Finally, a transitionary part was written where necessary as well. Specifically, part 4.2.1.4 offers a comparative view of the material culture discussed in parts 1 to 4, which is not discussed elsewhere, yet deserves a more in-depth treatment.

Environmental and geographical setting

As archaeologists, we not only look at people in the past and the stuff they left behind. To truly understand how these people lived and how their societies worked, we must also look at the natural environment that surrounded them. Sagalassos was situated in the ancient region of Pisidia, named after its inhabitants, the Pisidians, an ethnic group descendent from the Indo-European Luwians, who first enter the historical sources in the early 5th century BCE as part of Xerxes' (518-465) army (Herodotos *Histories* VII.76). The ancient region of Pisidia corresponds with the present-day Lake District in the Turkish provinces of Burdur, Isparta and Antalya. Being part of the western Taurus, mountainous terrain, forested hills, valleys with river streams and large plains and lakes are typical features of the Pisidian landscape. The area of Sagalassos is part of the frontal area of the Lycian nappe complex on the western limb of the Isparta Angle. It is composed mainly of limestone, along with flysch, ophiolites and radiolarite deposits (Paulissen *et al.* 1993).
In recent times, the region is characterized by an (oro)Mediterranean climate, typified by long cold winters with pronounced precipitation and short but dry and hot summers (Bakker *et al*. 2012, 250; Kaniewski *et al*. 2007a, 2202; Poesen *et al*. 1995, 342-343; van Zeist *et al.* 1975). Natural vegetation in these climatic circumstances consists of evergreen needle-leaved forests resistant to cold (*Cedrus libani, Pinus nigra* and *Abies cilicica*) above 1200m a.s.l., and mixed evergreen forests *(Pinus brutia*, *Quercus coccifera, Juniperus excelsa/oxycedrus*, and various deciduous oak trees: *Q. cerris, Q. infectoria* and *Q. ithaburensis*) in the zone up to 1200m a.s.l. (Paulissen *et al.* 1993, 233; Vermoere *et al.* 2002b, 570). Most of the natural vegetation has disappeared around Sagalassos in modern times due to deforestation and degradation of the landscape, and was replaced by a dominant cover of low shrubs and herbs, with some juniper trees still left on the hill slopes. In recent decades however, the Turkish ministry for Forestry has initiated an extensive programme towards reforestation of many slopes in the area.

The Beyşehir Occupation phase (BOP) – generally dated from 3500 to 1300 BP, with start and end dates differing from site to site – induced warmer and more humid circumstances (Bottema and Woldring 1995; Vermoere *et al*. 2000, 2002a,b; Vermoere 2004; Kaniewski *et al*. 2007a, 2007b; Bakker *et al*. 2012, 2013). These new conditions favoured agricultural and arboriculture production at higher altitudes, characterized by the increased appearance of cultivated trees such as *Olea europaea, Juglans regia, Fraxinus ornus, Castanea sativa* and *Vitis vinifera*, indicating potential agricultural practices and therefore human impact (Bottema and Woldring, 1984; Kaniewski *et al*. 2007, 2214-2215; Vermoere *et al*. 2002a,b, 2003). The occurrence of the BOP is indicated in all records from the territory of Sagalassos, however, the timing of the onset of the phase differs between locations, with estimates ranging from *c*. 1000–800 BCE to the start of the Hellenistic period (334 BCE) (Bakker *et al.* 2012). Palaeoenvironmental research from the Gravgaz valley, combining sedimentological and palynological data, indicated the onset of BOP to occur between *c*. 2280 BP and *c*. 2270 BP, with a most likely calibrated start date between Cal 400 and 210 (Vermoere *et al.* 2002b, 581), signifying the start of an arboricultural phase with notable deforestation leading to significant erosion processes on the surrounding hill slopes (Van Loo 2017).
The start of the BOP for Bereket is estimated at 280 BCE, largely contemporaneous with Gravgaz (Bakker *et al.* 2012, 255). It is interesting to note that the BOP is preceded in the Gravgaz and Çanaklı cores by a phase which also indicates human activity, although these anthropogenic influences are less easily detectable. The human influences in this pollen-assemblage zone can be interpreted as a kind of 'disturbance' in the landscape (Vermoere *et al.* 2002b, 581). A study combining palynological and, where available, charcoal and non-pollen palynomorph data, obtained from the Ağlasun, Gravgaz, and Bereket valleys indicated that the start of the BOP as calculated for the Ağlasun valley is contemporaneous with this first increase in anthropogenic activities in the Gravgaz marsh, most notably with a distinct deforestation event estimated to have occurred between *c.* 800–500 BCE (Bakker *et al.* 2012, 254). While the estimates of the start and end times of the BO-Phase must be treated with caution, the differences between the estimates for the Ağlasun valley on the one hand, and Bereket and Gravgaz on the other, are significant enough that it can likely be posited that the BOP started earlier in the Ağlasun valley (Bakker *et al.* 2012, 258). This warm period of the BOP ended between *c*. 450 and 650 CE (Kaniewski *et al*. 2007a, 2007b; Bakker *et al*. 2012, 2013; De Cupere *et al*. 2017b, 12) and, as such, lies outside of the chronological framework of this thesis and will not be considered further.

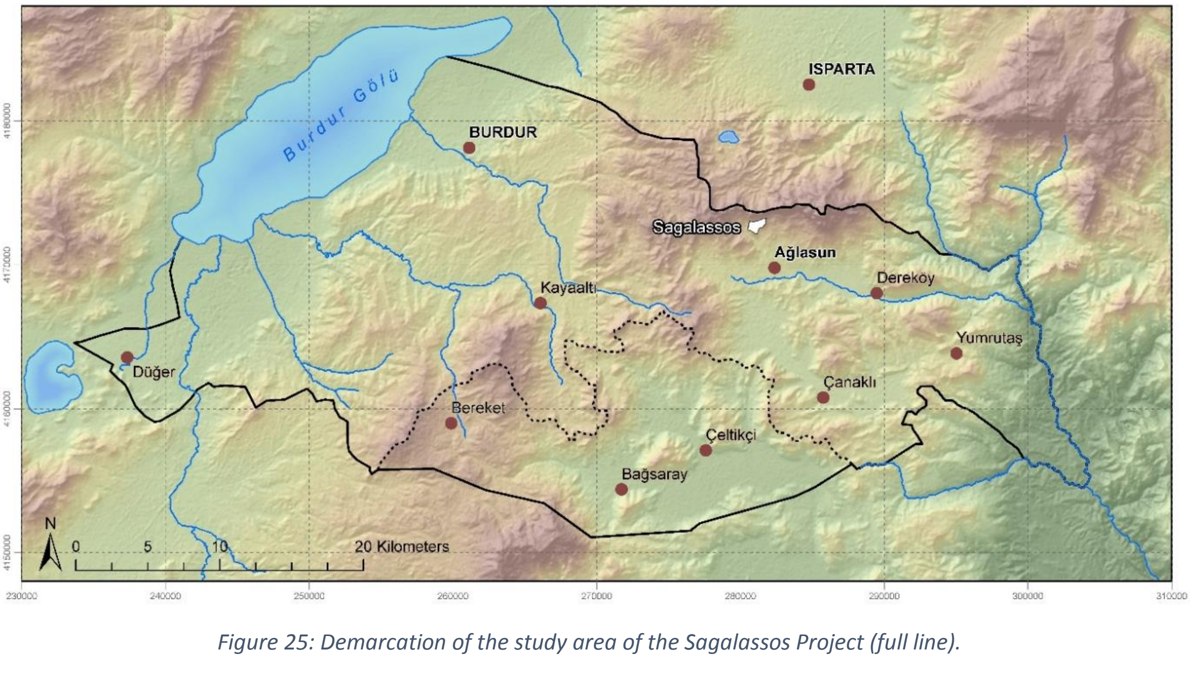

Figure 25: Demarcation of the study area of the Sagalassos Project (full line).

A variety of ecological niches existed within the landscape that offered both opportunities and constraints to the development of human communities. I will discuss how these environmental circumstances can be linked with the archaeological record through human-environment interactions in more detail in chapter four. The present-day study region of the Sagalassos Project roughly corresponds to the political territory of Sagalassos in Roman imperial times (Waelkens *et al.* 1997), covering about 1200 km² and extended from Lake Burdur in the west to the Aksu Çayı (the ancient Kestros river) in the east. Its northern boundary runs over the mountain ridge above the site, whereas to the south it extended to include the plains of Bereket, Bağsaray, Çeltikçi, Çanaklı, and Hisarköy.
The research area of the Sagalassos Project consists of a patchwork of (semi-)closed basins surrounded by steep limestone slopes, rolling landscapes with moderate slopes, as well as wider, flat valley bottoms alternating with steep, incised, narrow river channels (Verstraeten *et al.* 2017). The western part of the territory can be subdivided in three major zones (from east to west), the limestone mountain range of Mt. Beşparmak, the Burdur Badlands, and the fertile Burdur plain (Waelkens *et al.* 2000, 26-28). The first zone consists mainly of the same sequence of mountain ridges and river valleys prominent in the eastern part, most notably the Bereket basin and the Büğdüz river valley system. The intermediate Badlands zone consisted mainly of Neogene marls, with a desert-like appearance except for a green corridor formed by the Büğdüz river (Waelkens *et al.* 2000, 104). Almost no signs of settlement have been found in this area.
By contrast, the fertile plain located next to Lake Burdur would have been highly suitable for agricultural purposes. This area was part of a series of plains forming a natural thoroughfare from the south/southeast of Lake Burdur towards the Lysis river, connecting the Pamphylian coast with the Anatolian plateau further inland. Already in the Achaemenid period a road was built along this thoroughfare to make the connection between the Pamphylian ports and the satrapal capital of Kelainai (modern-day Dinar), at *c*. 50km north of Sagalassos. This route was likely already used by Alexander in 333 BCE on his march to Gordion (Arrian *Anabasis* I, 27; Waelkens *et al.* 2000, 22). In Roman imperial times, this connection was ensured through the construction of the *Via Sebaste* (6 BCE), which became the main route for movement of goods and people through the region and passed at the eastern side of Lake Burdur, through the territory of Sagalassos, to connect the coast with the Augustan colonies located inland (Talloen In Press).

The eastern part of the area covers a series of valley systems, interspersed with steep mountain ranges. The original catchment of Sagalassos during its initial phases of community formation in late Achaemenid and early Hellenistic times, was located in the central parts of the Ağlasun valley. Parts of the Ağlasun valley were intensively surveyed between 1999 and 2006 in the Suburban Survey programme coordinated by dr. Hannelore Vanhaverbeke. These surveys indicated that human occupation in the form of small hamlets and rural farms originated throughout the Ağlasun valley during late Achaemenid-early Hellenistic times. Even in this early period, fabric association indicated a close connection between the valley and the early community at Sagalassos, suggesting that this area constituted its primary catchment from the very beginning. Interestingly, material from the middle Hellenistic period is only sparsely attested, perhaps suggesting processes of settlement nucleation towards Sagalassos.
The western part of the Ağlasun river catchment is known as the Başköy valley, situated at an altitude between 1100 and 1200m a.s.l. and centred on the modern village of Yeşilbaşköy, which is, located about 10km southwest from Sagalassos. The valley has a luscious vegetation, which was the reason why the village changed its name from Başköy ('the main village') to Yeşilbaşköy ('the green main village'). Between the 5th and 2nd centuries BCE, the valley was primarily oriented towards the village at Düzen Tepe, located on a plateau on the fringes northeast of the valley. Towards the very western edge of the valley, an archaeological site was found at Körüstan, where material was collected dating back to the Early Iron Age. Only a limited amount of material was found so it remains unclear whether this location was actually occupied at the time.
A recent intensive survey programme coordinated by dr. Ralf Vandam has focused on the Dereköy-Hisar valley in the eastern parts of the Ağlasun river catchment about 7km southeast of Sagalassos.

From an ecological and environmental point of view, this hilly area is agriculturally less productive, with more erosion, thin soil cover, and more limited permanent fresh water sources, but richer in other resources such as forests and grazing land (Vandam *et al.* 2017, 318). Still, traces of human activities can be found in these so-called 'marginal landscapes', with the main earliest phases datable to the Upper Final/Epipalaeolithic period, and even some Middle Palaeolithic (120,000-45,000 BCE) attestations (Vandam *et al.* 2017, 324-326). An Iron Age hill-top settlement was identified at Aykırıça. The site of Hisar, located *c.* 1.2 km west of Hisarköy, 1100-1050 m a.s.l. and overlooking the valley of Çanaklı to the west, provided the main focus of settlement in this area in Achaemenid and Early Hellenistic times.

About 8km south of Sagalassos, on the other side of the Ağlasun çayı, the valley transitions into the Çanaklı valley. Little intensive archaeological surveys have been conducted in this part of the landscape. However, a reconnaissance survey conducted in 2004 to assess the potential for future survey works indicated that the valley itself was practically devoid of archaeological finds, most likely because of the considerable sediment deposits covering the ancient soil levels (Vanhaverbeke *et al.* 2006, 184). Traces of human activity in the pollen record arrive rather late compared to the surrounding valleys, with the introduction of olive cultivation in Early Hellenistic times (Vanhaverbeke 2003, 48). The valley is better known for its clays derived from detrital lake sediments in its northwestern parts, which were of the highest quality of the entire region. These clays were used extensively and systematically in Roman imperial times for the tableware production of Sagalassos Red Slip Ware, but were already in use for the production of the higher-end spectrum of finer tableware in Hellenistic times (Ottenburgs *et al*. 1993; Poblome *et al*. 2002), as well as part of the common ware production at both Sagalassos and Düzen Tepe (Braekmans *et al.* 2017, 16).
The basin of Bereket (meaning 'abundance', possibly referring to the fertility of the land or abundance of water) is located in the southwestern part of the territory, and was subjected to intensive archaeological surveys in 2008, coordinated by dr. Hannelore Vanhaverbeke. The valley bottom lies at an altitude of 1410-1440m a.s.l., making it the highest intramontane valley within the territory. In ancient times, the presence of springs in combination with poor soil drainage resulted in the development of a marshy area. In recent times, the marsh has been drained and transformed into farmland. As a result of its mountainous location, it was quite isolated with regard to the surrounding valley systems. Already in the 19th century, the discovery of an inscription just outside the modern village of Bereket resulted in its identification as the Roman village (*komè*) of Moatra, probably located on the lower hill slopes south of the modern settlement (Ramsay 1895, 338; Waelkens *et al.* 2000, 54). Two possible routes used for traffic in and out of the Bereket basin to and from Sagalassos have been suggested (Kaptijn *et al.* 2013, 76). The first option runs from Bereket to the north along the river, then turns east towards Kayaaltı, crosses the pass further to the east, and enters the Ağlasun valley from the west. The second option departs from the east of the Bereket basin in the direction of Bağsaray and descending into the valley of Çeltikçi, then turning north towards the Ağlasun valley. Both options – respectively 37 and 40km in length – are relatively long and difficult, although the second option seems to be the most logical one given that it passes several settlements *en route* (Kaptijn *et al.* 2013, 76). The valley appears to have been integrated into the territory of Sagalassos rather late. The Hellenistic material collected from the site of Bereket appears to have been distinctly different from that of contemporary Sagalassos, suggesting different spheres of interaction (see 4.3). Even for the Roman imperial period, when Sagalassos Red Slip Ware products flooded most settlements in the area, a distinct component of the pottery assemblage is derived from other, as yet unknown production centres (Kaptijn *et al.* 2013, 80-81).
The valleys of Çeltikçi and Bağsaray towards the south (840m a.s.l.) were likely of the most productive agricultural areas in the wider landscape. The earliest traces of occupation were found at a late Chalcolithic site 3km east of Çebis Köyü. During the Iron Age and Achaemenid period, the main site in the area was located at Seydiköy. In Hellenistic times, the area was centred around Belören (ancient Keraia), which was an independent polity in the Early and Middle Hellenistic period, located on the Sivri Tepe, overlooking the valley of Çeltikçi to its west. However, under the reign of emperor Augustus

it lost its autonomy and was reduced to the status of a village dependent on the colony at Kremna (Waelkens *et al.* 1997, 54-55). It was only at this time that the valleys of Çeltikçi and Bağsaray were added to the territory of Sagalassos (dotted line on Figure 25), when the lands previously belonging to Keraia were divided between Sagalassos and Kremna.

Historical setting

Throughout its history, Anatolia has been a melting pot of various cultural influences thanks to its geographical location as an important thoroughfare for human movement between Europe and Asia. Providing a full overview of this history would take us too far in the present context. I will focus here on sketching the broad outlines of the chronological framework of the periods relevant for this thesis, *i.e.* the Iron Age, Achaemenid and Hellenistic periods.

At the beginning of the first millennium BCE, after the fall of the Hittite empire, much of the broader political spectrum in Central Anatolia was dominated by Phrygian rule (1000-600 BCE). By the late 9th century, the Phrygians had established an organized state configuration covering most of Central Anatolia and centred on Gordion. The capital was fortified with an elaborate citadel. However, around 800 BCE it was destroyed for reasons unknown and a new citadel was built. In the late 8th century BCE, Phrygia was at the height of its power. Several Iron Age rock-cut tombs and tumulus burials were found around Gordion containing impressively rich grave goods including the typical grey burnished and painted buff wares found throughout central and southwestern Anatolia (Henrickson 1993).

In the 7th century BCE, Phrygia was conquered by their western neighbours, the Lydians (690-547 BCE) based at Sardis, which has provided most indications for its material culture. One of the most famous of the older Lydian kings was Gyges, the first king of the Mermnad dynasty, who overthrew the last Heraclid, presumably around 680 BCE. Lydian material culture displayed many cultural influences, including local western Anatolian wares such as the Phrygian burnished and painted wares, along with late and Sub-Mycenaean and Attic Proto-geometric wares prevalent in the 10th to 8th centuries BCE (Roosevelt 2009, 22). Between the beginning of the 7th century and middle of the 6th century BCE, the Lydians are considered to have ruled over a territorial state covering large parts of central and western Anatolia.

Perhaps most famous of all, the last Lydian king Kroisos (595-547 BCE) ruled over these lands in the mid-6th century, waging frequent war against the Greek communities on the west coast, including Miletos, Ephesos, and Sidene (Herodotos 1.26-28). Under his rule, the Lydians at Sardis have been famously credited to have been the first to start minting coins (Ramage and Craddock 2000). In the late 550's Kroisos famously crossed the river Halys to wage war on the Persians, where shortly before the ruling Median dynasty was overthrown by Cyrus I (?-580 BCE), the Achaemenid king, only to find his campaign failing with disastrous results.

Following the failed attempt at expansion, in 546 BCE, the Lydian state was in turn conquered by the Persians. The Persians were one of many groups of Iranian peoples, arriving in Iran around 1500 BCE (Waters 2014, 19). The Persians first appear in the written sources in the 9th century BCE in the records of the Assyrian king Shalmaneser III (reigned 858-824 BCE). Cyrus I presumably appears in the records of later Assyrian kings, paying tribute to Ashurbanipal (668-627 BCE) and his successors. After the fall of the Assyrian empire, the Persian empire gradually gained a more prominent position in the political arena of the time.

The grandson of Cyrus I, Cyrus II the Great (c. 600-530 BCE) greatly expanded the Persian realm by conquering the neighbouring Medes centred on their capital Ecbatana around 550 BCE, and by the aforementioned conquest of Lydia in 546 BCE, followed by the subjugation of the Greek cities in Ionia. Towards the eastern side of the Persian empire, Cyrus waged war in Eastern Iran, Central Asia and Babylonia, extending the empire considerably. Under the reign of Darius I (550-486 BCE), the Achaemenid empire reached its largest extent, ranging from Anatolia over Egypt, Western and Central Asia into northern India (Figure 26). In 498 BCE, the Greek cities in Ionia on the Anatolian west coast revolted, with support from Athens. After the revolt was suppressed, Darius set his sights on the Greek mainland, but Persian attempts to conquer Greece were thwarted twice, first under Darius himself in 490 BCE and also in 479 BCE under the command of his son and successor Xerxes I (518-465 BCE). The Pisidians are first mentioned in historical sources in the early 5th century BCE as part of Xerxes' army (Herodotos *Histories* 7.76). After the assassination of Xerxes in 465 BCE, hostilities with the Greek city-states repeatedly flared up again, driven by the Delian League, whose official purpose was to unite the Greeks in a continued struggle against the Persian threat. The Achaemenids, however, never embarked on a full-scale military operation in the west, preferring to act through diplomacy to pit different Greek factions against each other. This shift in policy was likely induced by military concerns on their other borders, including unrest in the Levant.

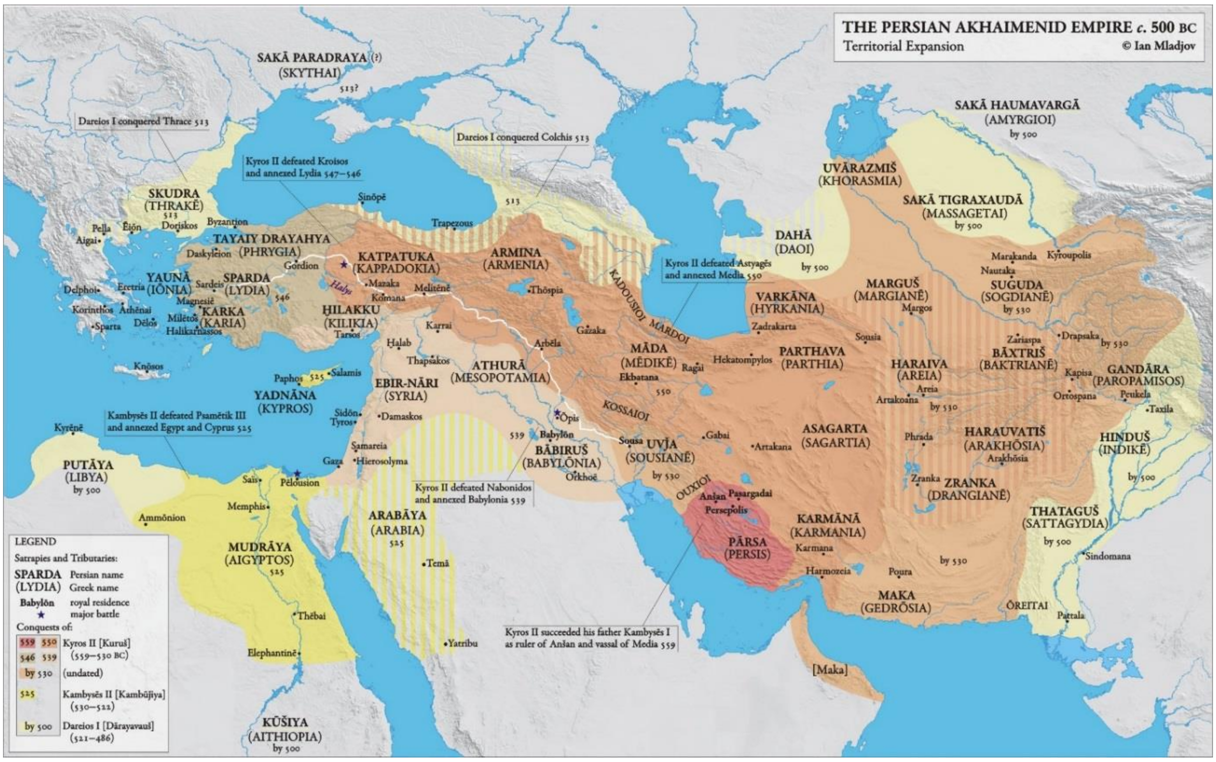

Figure 26: The Achaemenid empire around 500 BCE (© Ian Mladjov, reproduced with permission).

Under the rule of Artaxerxes II (445/435-358 BCE), the Pisidians are mentioned in conjunction with a revolt against the Achaemenid king led by his younger brother Cyrus (Xenophon, *Anabasis* I,2.1). The warlike nature of the Pisidians as being a "*menace to peace and security"* is already stressed by ancient authors (Arrian *Anabasis Alexandri* I,27−28; Polybius V,72-77), but clearly they are not the only people to be considered as such. The interpretation of the Pisidians as a "warlike and unruly people" has been commonly endorsed in recent scholarly works as well (Bracke 1993, 16; Cook 1983; Coulton 2012, 63; Jones 1971; Laufer 2010 Vanhaverbeke *et al.* 2010; Vyncke 2013). Achaemenid presence and socio-cultural influence in Anatolia, in general, is often not recognised, commonly explained through the supposed *laissez-faire* attitude of the Achaemenid administration (see 4.4), leaving some authors to believe that the tolerant Persian rule hardly had an enduring effect on a local and regional level, especially in remote areas such as Pisidia (Vanhaverbeke 2003, 105-106).

In the 360's the so-called Great Satraps' Revolt caused major upheaval in Anatolia. The revolting satrapies are supposed to have included Phrygia, Caria, Mysia and Lydia, covering large parts of central and western Anatolia, although the sources are not always clear and seem to contradict who was on whose side (Waters 2014, 191-192). Despite causing some initial trouble for the king Artaxerxes II, the rebellion was eventually subdued. The reign of the last Achaemenid king Darius III (*c.* 380-330 BCE) was marked by a period of unrest and treachery on the highest level of the empire. However, nothing indicated that the mighty Achaemenid empire would soon reach a dramatic end.

In 334 BCE, the Macedonian king Alexander III (later named the Great, 356-323 BCE), following earlier military probes by his father Philip II (382-336 BCE), embarked on an ambitious campaign against the Achaemenid empire. Upon landing on the Anatolian mainland, Alexander first met the Persian forces at the Granicus river near Troy in 334 BCE, gaining victory against the Persian satrap of Phrygia. After the battle, Alexander could move through Anatolia, unchecked by central resistance, moving against one satrapy after the other, subduing cities along his way. He concluded treaties with several cities along the Lycian and Pamphylian coasts, including Xanthos, Patara, Perge, Aspendos and Side, and unified Lycia and Pamphylia in a single satrapy. He then marched onwards to the Pisidian highlands, trying (and failing) to capture Termessos, which withstood him due to its great strategic location.
In the accounts of these conquests by the Roman historian Arrian (*c.* 86-160 CE), Sagalassos is mentioned for the first time in historical sources (Arrian 1.28). It was accounted how Alexander, after moving on from Termessos in 333 BCE, took Sagalassos by storm after breaking the local resistance on a hill in front of the city. However, the settlement at the time, as far as the archaeological record shows, was probably no more than a village, hardly worth the trouble of a siege. Afterwards, Alexander captured the Phrygian satrap residence at Kelainai, and installed Antigonos Monophthalmos (382-301) as satrap of Greater Phrygia. He then went to Gordion and moved further east into central Anatolia, towards the eastern parts of the Achaemenid empire. As a result of Alexander's conquest, Pisidia and other areas in inland Anatolia are considered to have become part of the Hellenistic world. In the next year, Alexander met the main forces of the Achaemenids, led by Darius himself at Issos in southeast Anatolia, and again achieved victory. After a final decisive victory in the battle of Gaugamela near the Tigris river in 331 BCE, Alexander conquered all of the Persian possessions, up to the river Ganghes in north India.

After Alexander’s death in 323 BCE, with no clear successor having been appointed, a devastating war broke loose between a series of potential successors, the *Diadochi*, each claiming control over various parts of the empire. During this struggle, most of southwest Anatolia, including Pisidia, was ruled by a series of successive dynasties, respectively by Antigonos Monophthalmos (333-301 BCE), Lysimachos (301-281 BCE), the Seleucids (281-189 BCE), and the Attalids (180-129 BCE). Antigonos, appointed satrap of Phrygia by Alexander, was given control over Asia in the agreement at Triparadeisos in 321 BCE which repartitioned the empire of Alexander among the Diadochi. His ambitions were soon used against him, however, as he clashed with Seleukos (358-281 BCE), the satrap of Babylonia, who had gained support from the other Diadochi. In 301 BCE, the combined forces of Seleukos and Lysimachos (301-281 BCE) defeated Antigonos, who died on the battlefield, and his lands were divided among the two victors.
Seleukos and Lysimachos soon were at odds with each other as well, and in 281 BCE, Seleukos gained a decisive victory at the battle of Koroupedion, establishing his dominance in Asia and Anatolia, nearly succeeding in reuniting most of the empire. However, his victory was short-lived as he was assassinated soon after, plunging the Hellenistic world in renewed turmoil. Sardis became the administrative centre of the western part of the extensive Seleucid kingdom, but the Seleucid hold over Anatolia did not go unchallenged and soon started to crumble as various local dynasts attempted to assert their independence. Additionally, Celtic tribes, the Galatians, - after ravaging mainland Greece and famously sacking Delphi – invaded Central Anatolia in 278 BCE and founded a separate Galatian polity. In the middle of the 3rd century BCE, the satrapy of Cappadocia became an independent kingdom, while the rulers of Pergamon increasingly started to assert themselves as important players in the Anatolian game of power. The Ptolemies of Egypt continued to threaten Seleucid control in Anatolia, especially on the southern coastal area by retaining a series of footholds. After losing large parts of their kingdom to local dynasts, such as in Parthia, Bactria, Galatia, Bithynia, Pontos and Cappadocia, Antiochos III (241-187 BCE) managed to temporarily restore Seleucid power over Anatolia and the Seleucid kingdom knew its greatest expansion under his reign between 222 and 187 BCE.

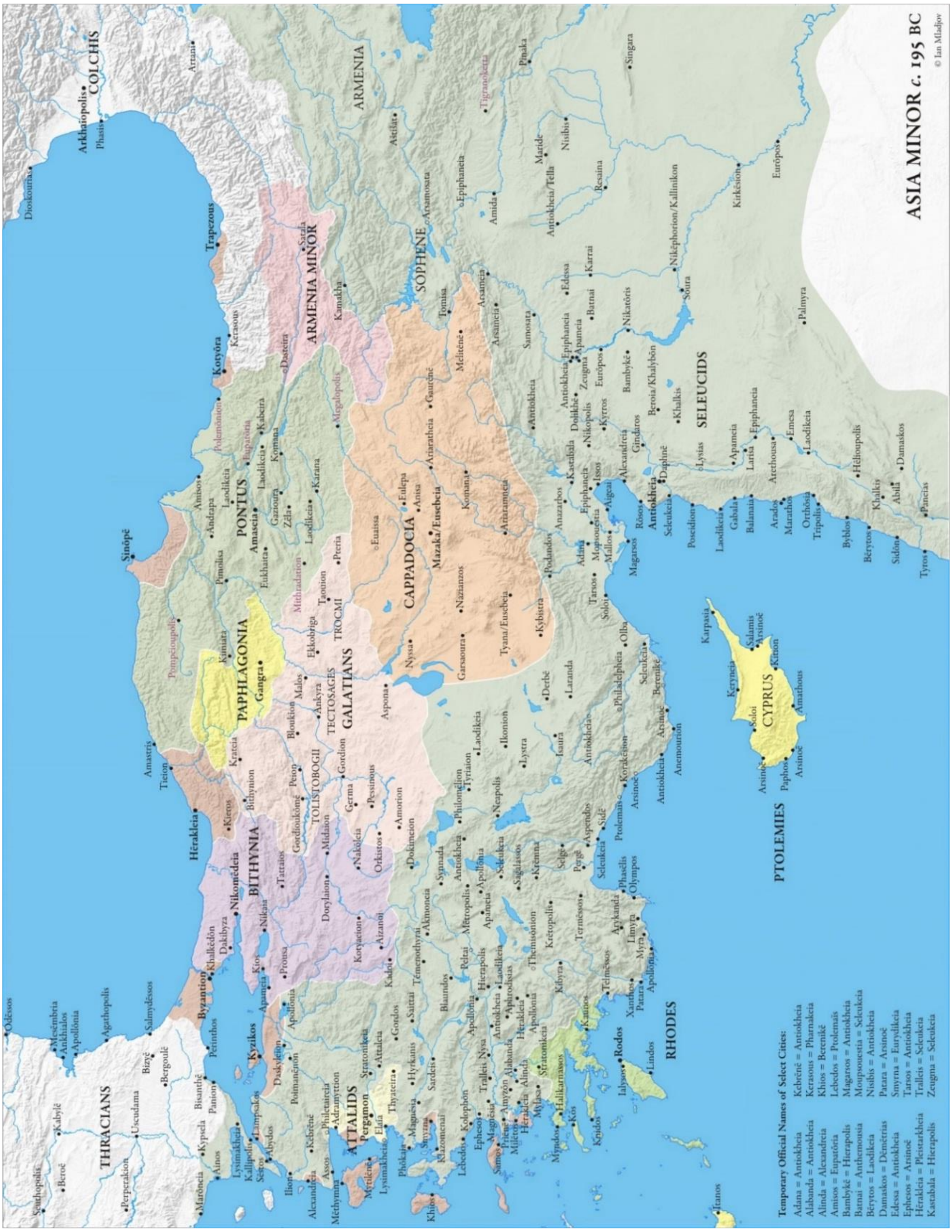

Figure 27: The Hellenistic kingdoms in Anatolia around 195 BCE (© Ian Mladjov, reproduced with permission).

The Seleucids were especially noted for their city foundations and other interventions in local configurations of power and settlement patterns throughout their empire (Aperghis 2004; Cohen 1978). However, the impact of the incorporation of inland Anatolia in the Hellenistic kingdoms has been debated. Some have argued that Pisidia remained a 'backward' area prior to the reign of Augustus, hardly touched by Greek culture and democratic institutions (von Aulock 1977, 13-15). Others have instead argued for a rapid, endogenously driven Hellenization as expressed in the use of Greek as the official language, municipal institutions and in material culture (Bracke 1993; Kosmetatou and Waelkens 1997; Mitchell 1991, 1999; Waelkens 2002; Waelkens and Vandeput 2007).
The expansion policies of Antiochos III alarmed his rivals, and a coalition between Egypt, Rhodes, Pergamon and the Romans fought and defeated Antiochos III at the battle of Magnesia in 189 BCE. After the battle, the victorious Romans send a military expedition led by consul Gnaeus Manlius Vulso, officially to deal with the troublesome Galatians. He also passed through Pisidia, and extracted heavy fines from Termessos and Sagalassos, the latter because it was claimed the city did not respect proper form by neglecting to greet the consul at the borders of their territory. After the treaty of Kelainai/Apamea following the battle of Magnesia, large parts of western and southern Anatolia, including parts of Lydia, Phrygia, Lycaonia, and Pisidia, became part of the Attalid kingdom. It was suggested that the Attalids founded a series of fortresses in southwest Anatolia, in a bid to protect their newly found possessions (Aydal et al. 1997, 163-172; Mitchell 1995; Vandorpe 2000; Waelkens *et al.* 1997, 81). The foundation of Attaleia (Antalya) by Attalos II (220-138 BCE) between 159 and 150 likewise reflected Attalid policies to protect their interests in the region.
After the death of Attalos III in 133 BCE, the Attalid possessions in Anatolia were officially bequeathed to the Romans. In 129 BCE Rome took control over the Attalid kingdom and incorporated most of it into the *provincia Asia*. However, they did not immediately assert their dominance in Anatolia and mainly contented themselves with tax collection, until the wars against Mithridates VI of Pontos (135-63 BCE) during the first half of the 1st century BCE. The Romans finally managed to defeat Mithridates and the Cilician pirates ravaging the area with support by the Galatians. This resulted in a reorganisation of western Anatolia into provinces and client kingdoms in 63 BCE. As a result, Amyntas of Galatia was allowed to take control over Pisidia in 39 BCE. After his death in 25 BCE, Pisidia was incorporated in newly created the Roman province of Galatia by the Roman emperor Augustus. With the transition of power back into the hands of the Romans, a new chapter in the history of Anatolia started. As this period is no longer part of the chronological framework of this thesis, I will not discuss the continued historical setting in any more detail.

Sagalassos

The main case study of this work pertains to the archaeological sites of Sagalassos and Düzen Tepe, both located in southwest Anatolia, modern day Turkey (Figure 28). The area of Sagalassos has drawn scholarly interest at least since the 19th century, *inter alia* through the travels of Arundell, Hamilton, de Tchihatcheff and others. Their accounts drew in early historians such as Duchesne, Collignon, Ramsay, Lanckoronski and many others. Lanckoronski's volume *Die Städte Pamphyliens und Pisidiens* (1892) was remarkable in that it provided the only systematic survey covering most parts of Pisidia at this time. Throughout the twentieth century, the area of Sagalassos would repeatedly be the subject of topographical and epigraphical surveys (for an overview, Waelkens *et al.* 1997, 2000).
In the 1980's a new phase of research started at the site with works of the Pisidia Survey Project, directed by prof. Stephen Mitchell. Sagalassos was investigated between 1985 and 1989 (Mitchell and Waelkens 1989). In 1989, prof. Marc Waelkens conducted a rescue excavation directed by the Museum of Burdur, and in 1990 officially became the first excavation director appointed by the Turkish authorities, running excavations funded by the Belgian National Fund for Scientific Research and the University of Leuven. This marked the beginning of the Sagalassos Archaeological Research Project, since 2014 directed by prof. Jeroen Poblome, conducting interdisciplinary research at Sagalassos and the surrounding research area ever since.

Figure 28: Map of Anatolia.

The archaeological site is located on the southern flanks of the Ağlasun Dağları, at an altitude of *c.* 1400-1600m a.sl. (Paulissen *et al.* 1993, 229). The geological substrate consists of an undulated platform composed of limestone and ophiolite at the outer front of the Lycian sheet. The hilly topography downslope consists of autochthonous flysch deposits (Degryse *et al*. 2008, 19-21; Waelkens and Degryse 2003, 15-18). The superposition of the permeable limestone to the ophiolite and flysch aquiclude results in a permanent water table at 1,350-1,750 m a.s.l. feeding several permanent springs along the mountain range (Paulissen *et al*. 1993, 231; Waelkens *et al*. 1999, 699). Water was therefore abundantly present at Sagalassos. These springs feed the Ağlasun Çayı, a permanent river tributary to the Aksu river (ancient Kestros), which filled the Ağlasun and Yeşilbaşköy valleys with alluvial deposits or fluvisols (Waelkens *et al*. 2003, 35-37; Waelkens *et al*. 1999, 699; Donners *et al*. 2000, 742). Additionally, in Roman imperial times a 24km long aqueduct was built to bring in more fresh water from the main source across the Akdağ mountain to the town centre (Waelkens 2016). Other natural resources were also present at the site or its immediate vicinity. Local stone outcrops were used for various urban monuments built from Hellenistic times onwards (Degryse 2007). The site can be reached from the lower Ağlasun valley from its southern and eastern sides. At the northern side, it is shielded by a mountain ridge, which is accessible to and from the Isparta plain on the other side through a pass, located at an altitude of *c*. 1730 m, guarded by fortifications.
Good quality clays suitable for pottery production could be exploited in and around the site from weathered flysch, limestone and ophiolite bedrock outcrops (Neyt *et al.* 2012). The earliest habitation attested at Sagalassos (from late 5th century BCE onwards) was likely attracted by the potential of the site regarding clay quarrying and agriculture, two major sets of activities for the community. Clay quarries were for example attested at Sagalassos in the central depression to the east of the city centre, in what in Roman times would become the Eastern Suburbium (Figure 29). Here, core-drills provided evidence of a *palaeosol* horizon which developed naturally on top of a clay quarry phase that could be dated to the period between 370-200 BCE (Vermoere *et al.* 2001). This *terminus ante quem*

for the quarrying activities suggested these clays were already in use during the first phases of habitation at the site in late Achaemenid and early Hellenistic times.
Additionally, control excavations conducted on the Upper Agora confirmed that an anomaly – previously noted through geophysical research by the team from the University of Ljubljana coordinated by dr. Branko Mušič - was actually a series of large pits, resulting from clay quarrying activities conducted before the construction of a public square at this location (Talloen and Poblome 2016). Pottery associated with the fill of the quarry in order to accommodate the construction of the original public square at this location was dated to around 200 BCE. Although it cannot be conclusively proven that these specific quarries were necessarily exploited for pottery production, it does seem plausible that at least part of the clay raw materials were used by potters, as ceramics attributed to this group seem to represent the main type of production of common wares and buff wares in the area during Late Achaemenid and Early Hellenistic times (Braekmans *et al.* 2017).

Some of the oldest material found at the site pertains to a body of surface material collected mainly from the southwestern part of the settlement during the Urban Survey programme coordinated by dr. Femke Martens, as well as a small amount of sherds found as residual material in younger deposits, most notably at the Upper Agora, and in the eastern parts of the settlement, in the area around the Neon Library and a single, small stratigraphically associated body of material as part of a foundation deposit of a terrace wall at Site F in the later Eastern Suburbium. The latter could be dated to the late 4^{th} - 3^{rd} centuries BCE. Interestingly, although few indications are known to us regarding the organisation of communal life at this time, the preparation of this area in the form of terrace wall construction would have required at least some level of communal organisation, and thus of a form of community (Poblome *et al.* 2013b). The construction of this terrace wall indicates that natural slopes of the area were levelled, which would allow better exploitation of the soil, possibly in function of horti- and agricultural activities, and in later periods also for artisanal activities.
Unfortunately, not much is known of this oldest phase of habitation at Sagalassos. While the settlement would likely have been modest on all accounts, most material traces have been covered and/or destroyed by later occupation phases. Our evidence grows from the 3rd century BCE onwards, when Sagalassos transformed into an urban settlement organized around a political community which started to express itself through a formalised agora and associated core of monumental buildings (Poblome *et al.* 2013b; Talloen and Poblome 2016; Vandorpe 2000). The various properties and attestations of this development will be discussed extensively throughout this chapter, but a short overview can already be presented here.

The construction of a first public square at the end of the 3rd – early 2nd centuries BCE, constituted the start of this urbanization process (Talloen and Poblome 2016). Over the course of the next century, the surroundings of the square were gradually filled up, following a common trend in the lay-out of Hellenistic agorae towards all-round framing (Sielhorst 2015).
The oldest structural remains surrounding the agora pertain to a wall found at south side of the agora, dated to the second half of the 3rd century BCE. To construct the agora, first the aforementioned clay quarries needed to be filled up. The fill layers of these quarries could be dated to around 200 BCE, providing a *terminus post quem* for the construction of an agora of about 35 by 25 meter, which consisted at this time merely of beaten earth rather than stone slabs. The latter were only added in the early Roman imperial period. At the eastern edge of the square, a sizeable market building was constructed about a generation later. This two-story *stoa*-like rectangular structure consisted of several rooms below and behind the façade which could be used for storing and exchanging goods. Around the middle of the 2nd century BCE a monumental terrace building – the function of which remains unclear following thorough Byzantine reorganisations – was built towards the northeast of the square, together with the street in front of it.

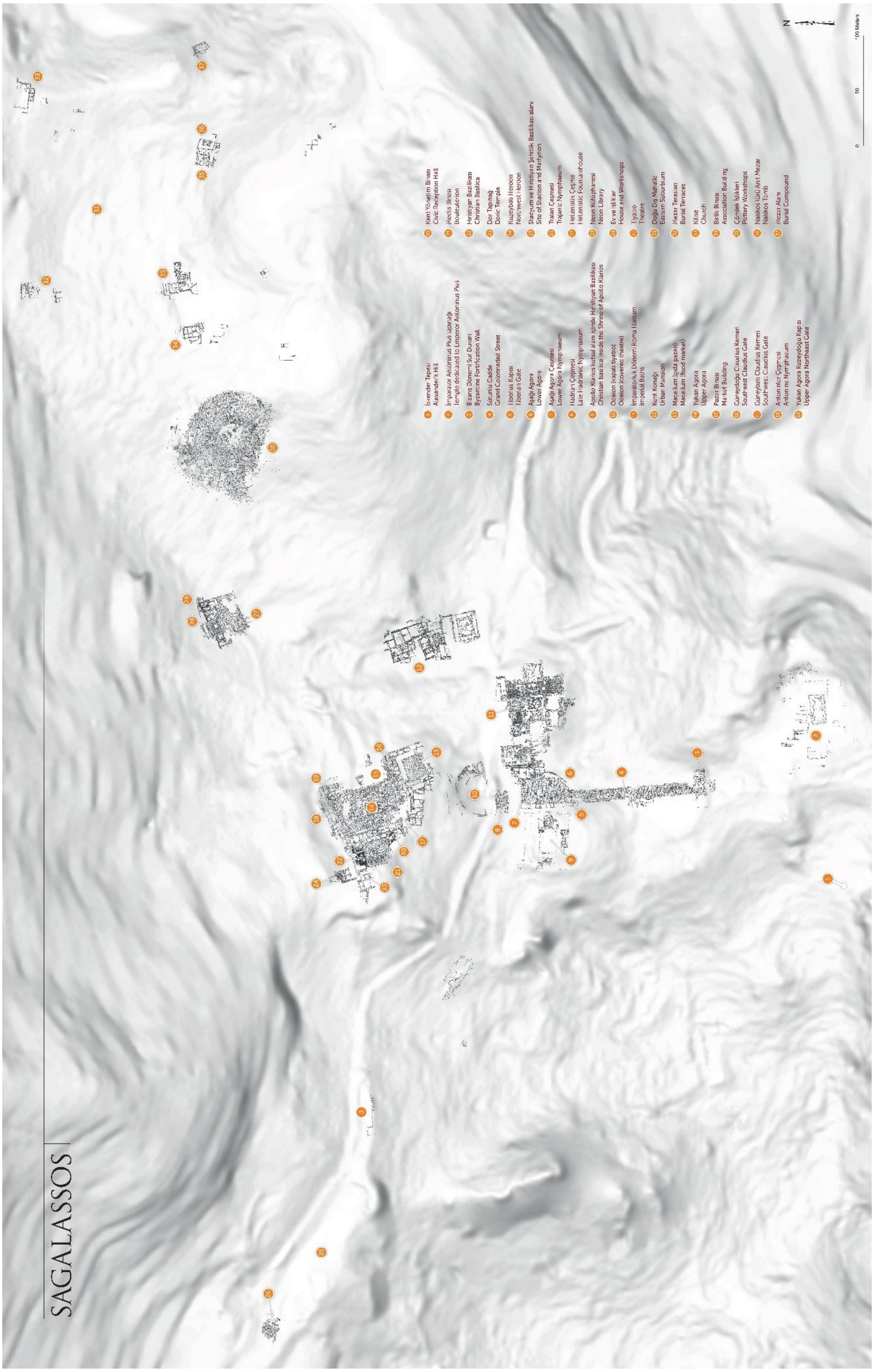

Figure 29: Map of Sagalassos with excavated and visible structures.

In addition to the monumental centre and production facilities in the south, it was suggested that the oldest residential quarter was located in the western part of town, based on the higher amounts of Hellenistic material in surface finds collected during the city surveys conducted in this area. A couple of contemporary deposits were also discovered at Site LE, to the east of the later Neon Library, dating between 225 and 75 BCE (Uleners and Poblome 2016). At different sides of the settlement, extensive, spatially dedicated necropoleis were laid out, of which the southern one is considered as the oldest, dating back to at least the 2nd century BCE (Köse 2005b, 19-22). Additionally, Hellenistic cremation burials and burial monuments were attested in the eastern part of town as well, in what is called the Eastern *proasteion* (Claeys 2016).

It was suggested that the fortress guarding the pass over the mountain ridge – located at an altitude of 1885m a.s.l. overlooking the site from the north – was constructed in the Early Hellenistic period, based on the construction technique used for the walls. It was therefore considered to be contemporary with the very development of a political community, as indicated by an inscription found at the Upper Agora, considered to be late 4th or 3rd century in date (with the latter being more likely). The inscription mentioned a civil strife, when part of the population occupied the *akra* (fortress) indicating that a fortress would already have been present at this time (Vandorpe 2000, 2007). The inscription also mentions *dikastai* or rotating public officials, referring to an older law, and thus suggesting the existence of an earlier legal and governmental system (Bracke, 1993, 22-23), even though this would predate the oldest attestations of monumental public architecture at the site. Interestingly, however, the oldest material found in recent test soundings conducted at the fortress can be dated to the late Hellenistic period (2nd-1st century BCE), with no discernible indications for earlier occupation at the site (Talloen, Accepted). Although this suggested data would fit the timing and course of the overall process of urbanization observed at Sagalassos, it does seem to be at odds with the Early Hellenistic date suggested by the inscription.
The establishment of a civic community was also attested by a series of coins struck by Sagalassos from the end of the 3rd century BCE onwards (Van Heesch and Stroobants 2015). One of the oldest examples was a silver tetradrachm showing the head of Herakles with the lion skin on the obverse, while on the reverse Zeus was depicted seated on a throne with an eagle and a staff, and the lettering of *ALEXANDROU*, indicating that this was a copy of the typical silver coins minted by Alexander the Great or by his successors, and *SAGA*, denoting the origin of the coin. This practice is attested in many different cities, not only in Pisidia but also the surrounding regions of Lycia and Pamphylia.

During excavations conducted in the *cavea* of the Odeon, the remains of a badly damaged (pottery) kiln were discovered, predating the construction of the concert hall. Material found in deposits retrieved from inside of the dismantled kiln could be dated to the end of the 3rd century BCE. Geophysical research in the area revealed a series of magnetic anomalies, possibly also related to kilns or other production activities. It was therefore suggested that this might indicate the location of a separate production quarter in Hellenistic times.
The remains of a circuit wall surrounding the monumental centre, but not the full settlement, can still be traced today. Due to the construction technique that was used, the wall was originally dated to the 3rd century BCE. Excavations at the extant northwestern section of the fortifications determined that this part of the circuit wall was constructed by the end of the 2nd century BCE. Towards the south, a part of the wall that was suspected to be a gate from Roman imperial times, flanking the southern colonnaded street, was excavated. Underneath the later course, two ashlar walls were found in a slightly different orientation, suggesting the existence of a previous fortification system. The foundation trench yielded only a handful of pottery sherds, two of which were Hellenistic black glazed sherds dating to the 4th to 2nd centuries BCE. Whether or not any chronological difference existed between the construction of the northern and southern part of the fortification wall remains unclear, however, we can state that the circuit would only have been fully completed towards the end of the 2nd century BCE, which marked the conclusion of the first phase of urban development at Sagalassos.

Several explanations have been sought for the development of Sagalassos on a local and regional level, including its advantageous setting for exploitation of water and raw materials and the available space for economic activities (Poblome *et al.* 2013a, 2013b). Several of these factors will be discussed extensively throughout this chapter, and a synthesising view will be offered in the concluding chapter four. Regardless, at the end of the Hellenistic period, Sagalassos had established itself as a sizeable regional centre drawing in energy and resources from a politically controlled area stretching from Lake Burdur in the west to the Aksu river in the east, bordering the flanks of the Beşparmak mountain range in the south and the Akdağ mountain range in the north (Waelkens and Poblome 1997). The development of Sagalassos in Hellenistic times constituted the onset of a pathway of development continuing well into Roman imperial times, when it gradually gained the position of prime city in Pisidia. These phases of development of Sagalassos will not be discussed in this work. Instead, I will focus on the earlier parts of the trajectory of development, the period before and during its rise to prominence, when Sagalassos had to share the spotlight with a second settlement nearby, Düzen Tepe.

Düzen Tepe

Düzen Tepe – a Turkish toponym meaning 'flat hill' – is located approximately 1,8km from Sagalassos. The site was first discovered during extensive territorial surveys conducted in 1994, resulting in the collection of undiagnostic pottery and the identification of pre-Roman structures in dry rubble (Waelkens *et al.* 1997, 43–44, 50, 52). It was in preparation of the intensive suburban survey campaign of 2005 that the full extent of structures visible at the surface was noticed on Quickbird-2 satellite images (© 2003 Digital Globe). The site is located on two wide promontories (1400-1450m a.s.l.), forming a plateau overlooking the Ağlasun valley and valley of Yeşilbaşköy. The plateau was shielded on the northern side by the slopes of Zencirli Tepe (1,782m) and with steep slopes towards the surrounding valleys on the west, south, and northeastern sides (see Figure 30). Only at the east, a comparatively more gradual slope clear of vegetation (at least in modern times) provided relatively easy access to the plateau. Geological research by prof. Patrick Degryse and dr. Bert Neyt indicated that both the Zencirli Tepe and the plateau consist of subhorizontal homogeneous beige limestone, a bioclastic wackestone with a Late Miocene date forming the top unit of the Lycean nappes. This limestone overlies an ophiolitic mélange of the Lycean nappes and is bordered by flysch deposits consisting of purple-brown sandstone and shale.

The sizeable amount of surface remains, along with the promising natural location of the site prompted a full archaeological survey conducted in 2005 and 2006, coordinated by dr. Hannelore Vanhaverbeke, supplemented with a topographical and geophysical survey (using GPR and magnetometry) programme conducted in 2006 and 2007, coordinated by Sabri Aydal and Hannelore Vanhaverbeke. Surface remains were documented on both promontories, covering an area of almost 75ha (Vanhaverbeke *et al.* 2010, 108). The site can be reached by a winding track along its western side, leaving from the modern village of Yeşilbaşköy. Additionally, two partially rock-cut pathways were discovered on the western and eastern side of the promontory. The one on the west gives way for the modern track at some point, whereas the eastern one descends along the slopes of mount Zencirli towards the Ağlasun valley – supported at certain points by dry rubble walls – but is lost right before making the connection with the valley floor due to modern quarry activities. The slope and limited width of these pathways (up until about 1m) suggests that these were not suited for use by carts or wagons, suggesting that entry to the site mainly took place on foot or with pack animals. If any other tracks led from the valley towards the site, these have not yet been discovered.

The location of Düzen Tepe within its natural and geographical background, offered a number of advantages to establish a settlement. The location on the plateau, overlooking the surrounding valleys and surrounded on all sides by protective natural features would have offered a strategic location for the local community. A number of natural resources were also present at the site. An abundance of limestone outcrops and field stones found across the plateau which were easily collectible and used for construction activities. Clay sources suitable for pottery and building activities were available at the site or in the immediate vicinity (Braekmans *et al.* 2017). Local placer deposits may have been exploited as a source for magnetite ore utilized for iron production (Vyncke *et al.* 2014).

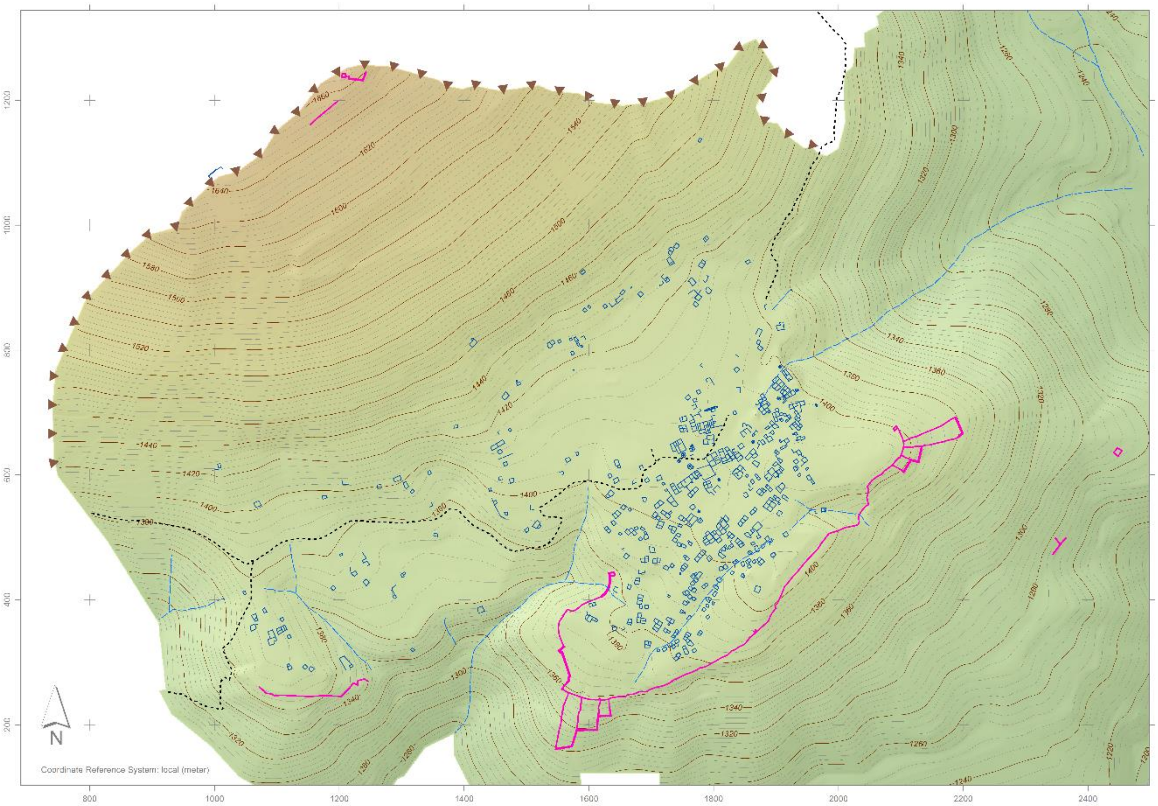

Figure 30: Settlement plan of Düzen Tepe. Fortifications indicated in purple (© Sagalassos Project).

The outlines of the settlement lay-out were traced through a combination of remote sensing, and geophysical, topographical and archaeological surveys coordinated by dr. Hannelore Vanhaverbeke and dr. Veronique De Laet. The remote sensing survey included analysis of Quickbird satellite images and VHRS imagery to identify any possible surface remains covered by vegetation, as well as subsoil archaeological remains (De Laet *et al.* 2009). Structures were identified throughout the plateau, across an area of almost 75ha. The walled area within the fortifications entails just over 60ha, but with a clear settlement nucleus of about 13ha. It should be noted, however, that modern agricultural practices north of the eastern promontory and the outcropping bedrock on the western promontory hindered mapping the entire settlement. It is particularly striking how the unoccupied area in the reconstructed settlement plan matches with the extent of the current agricultural fields on the plateau when overlaying the plan with the topographical map in Google Earth, whereas right at the edge of the lower slopes of mount Zencirli, where the slopes make agriculture less evident, ancient structures suddenly appear again. It can therefore be suggested that this area must have been at least to some extent covered with structures as well, before modern agriculture removed most of the surface and *in situ* remains.

The settlement is characterised by a seemingly (at least to the modern observer's eyes) unstructured lay-out, although many buildings seem to follow a NE/SW orientation. This need not necessarily be the result of town planning but could, for example, also be related to adaptation to climatological conditions such as prevalent directions of wind or sun (Vyncke and Waelkens 2015, 163). Most buildings visible at the surface consist of two or three rooms, although both smaller and larger structures occur frequently. In general, three building types seem to occur, one-room structures, longitudinal buildings consisting of several rooms in a row, and multi-room buildings (Vyncke and Waelkens 2015, 163). It was hypothesized that more complex multi-room structures represent developed forms evolved out of simpler building types (Vyncke 2013, 98).

While excavations at a domestic structure did indeed provide indications for a sequential development with different phases adding additional rooms to the overall structure, it remains hard to determine to what extent this can be extrapolated to the entire settlement. On the combined settlement plan, about 280 distinct structures could be identified. However, it should be remembered that a considerable part of the settlement is likely lost to us. Based only on these survey results it is virtually impossible to make further distinctions, either on a functional or chronological level. Moreover, the outlines of structures identified through these surveys do not always match those found in the actual excavations, for example in the case of the Courtyard Building (see *infra*). Based on magnetic survey results, a number of potential circulation patterns in the form of irregular streets and open spaces were suggested. However, in the absence of clear delineations or pavement, these claims are hard to substantiate.

An extensive fortification wall consisting of dry rubble, unworked breccia boulders, was constructed along the edges of the promontory, covering the western and southern sides of the settlement. At the western promontory, a 200m tract covers the southern side. While it was suggested that this structure supposedly covered the "slopes [that] are relatively easy to scale" (Vanhaverbeke *et al.* 2010, 113), upon personal investigation I found these parts to be rather difficult to climb, even compared to the other sides, not in the least because of the extensive thorny shrubbery vegetation and irregular rock fall currently present. To what extent these would have been present in the past is difficult to determine. The functionality of this part of the fortification is difficult to assess. It only covers part of the southern slope, leaving considerable space on either side unmarked which appear no more or less difficult to scale than the parts directly underneath it. Moreover, the pathway running directly to the west of the wall cannot be properly defended, although it is possible that parts of the wall have been destroyed in recent times to create the current access way.

The fortification wall covering the south side of the eastern promontory extends over 1,2km, and is possibly furnished with a watchtower at either side, along with a series of perpendicular jutting walls that likely had a strategic defensive purpose. I was unable to confirm the existence of a supposed wall trajectory and structure on top of Zencirli Tepe, which was interpreted as a Hellenistic watchtower by Loots and colleagues (2000, 606).

Given the rich results of the preliminary surveys, test soundings were undertaken in 2006, first under the supervision of the Museum of Burdur, but soon extended under the excavation permit of prof. Marc Waelkens from 2007 onwards. Five trenches were opened in 2006, the location of which was chosen in areas with the densest occurrence of buildings, or at structures that seemed to deviate (both in size or complexity) from the average structures. The aim of these trenches was to gain an insight regarding the material culture and living conditions of the people inhabiting the site, as well as to define the chronology of occupation by stratigraphical evidence. Unfortunately, these first soundings hardly yielded any archaeological information (Vanhaverbeke *et al.* 2010, 110).

In a next phase of archaeological research at the site – coordinated by dr. Kym Vyncke and dr. Hannelore Vanhaverbeke – a series of excavations were executed (see Figure 31), one at a domestic structure (Courtyard Building), a production workshop (Kiln Area), a building with communal facilities (Bakery), a presumed communal building (Big Building), the fortification wall (Fortification), as well as a number of smaller test soundings. Of these, especially the first three constituted the major research programmes of archaeological research at Düzen Tepe between 2008 and 2011. The latter offered only limited amounts of material.

Most structures at Düzen Tepe were found to be constructed with stone foundations and socles of small to medium-sized local fieldstones, forming the basis for walls made of perishable materials. It was suggested that these consisted of a wattle-and-daub structure with a thatched or flat roof made from organic materials such as straw or reeds (Vanhaverbeke 2013, 115). It should be noted however that this interpretation is based on a fairly limited amount of chaff or reed impressions in chunks of burnt clay. Most preserved chunks of clay did not show any such traces, and it can be questioned to what extent this technique would have actually been used or widespread at Düzen Tepe. Mudbrick as an alternative view on wall construction could be suggested, with the preserved clay fragments deriving from floors or ceilings.

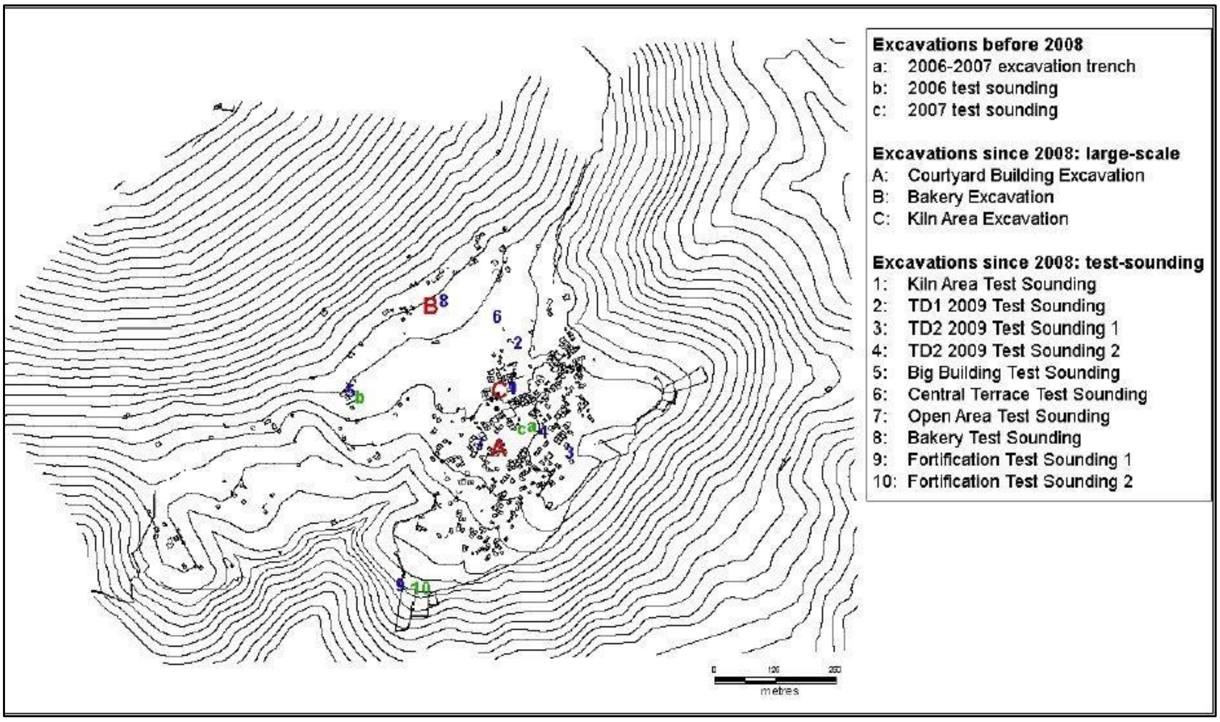

Figure 31: Map of Düzen Tepe with indication of the location of excavations (Vyncke 2013, 101).

In the majority of excavations at Düzen Tepe, magnetite particles were observed, along with a considerable amount of metal production waste and metal objects. Petrographic and X-ray fluorescence analysis of production waste and magnetite ore sample suggested that, even though no direct link could be made between the individual steps of the iron production chain (ore, production waste and objects), separate links between several parts of the chain could be established, suggesting that local magnetite sources were exploited and used in local metallurgy production processes (Vyncke *et al.* 2014). Geomagnetic surveys indicated the existence of distinct magnetic anomalies characteristic of ancient artisanal activities, such as kilns (Vanhaverbeke *et al*. 2010, 114). Geochemical analysis (coordinated by prof. Patrick Degryse) of approximately 100 soil samples from across the site also shows strong anomalies of *Cu*, *Pb* and *As* traces in the vicinity of these anomalies, providing indications for ancient pollution, and could more specifically indicate metalworking activities, for example ore smelting. Interestingly, the observed preparatory steps of the production process could not be linked to the actual metal objects found at the site. We therefore have no indication for the full production process of metal objects at Düzen Tepe.

The pottery at Düzen Tepe is characterised by badly preserved, thin and dull mottled slips, in contrast with the preceding Iron Age painted pottery or later the Roman red slipped pottery, which was generally characterised by thick and fat slips. This pottery can therefore be placed in the general chronological bracket between the 5th and 2nd centuries BCE, due to the accordance with the tradition of so-called colour-coated wares identified throughout the eastern Mediterranean (Hayes 19991). Typological comparisons have indicated a close affiliation with the 4th and 3rd centuries BCE (Daems *et al.* 2017; Poblome *et al.* 2013b). The large majority of pottery material found at the site can be assigned to this chronological bracket, suggesting that this corresponds to the main phase of occupation of the town. Only few securely datable glass fragments were found at Düzen Tepe, including some fragments of core-formed blue glass with white and yellow opaque decoration, closely resembling dr. Veerle Lauwers' (2008) types of *aryballoi* (VG-CF-001 to 003) dated to the 4th and 3rd centuries BCE (Vyncke 2013, 219). Additionally, a number of samples (collected from pig bones and macro-botanical remains) were taken to conduct AMS dating. Although outliers in both directions can be discerned, these samples generally correspond to the range suggested by the pottery material (Figure 32). Finally, a handful of silver coins was found at the site, which offer some chronological indication for occupation, and fit the suggested time bracket as well (Figure 33).

Context	Radiocarbon dating	2 Sigma calibration
SA-2006-TD-00046	2050 ± 40 BP	360-280 BCE and 260-60 BCE
SA-2006-TD-00143	2250 ± 40 BP	510-380 BCE
SA-2007-TD-00066	2050 ± 40 BP	360-280 BCE and 260-60 BCE
SA-2007-TD-00022	2120 ± 40 BP	390-170 BCE
SA-2007-TD-00012	2120 ± 40 BP	390-180 BCE
SA-2008-TD2-00166	2140 ± 40 BP	380-170 BCE
SA-2008-TD2-00196	2040 ± 40 BP	200 BCE - 10 AD
SA-2008-TD2-00225	2120 ± 40 BP	370 - 100 BCE
SA-2011-TD2-00067	2190 ± 40 BP	390 - 200 BCE

Figure 32: AMS radiocarbon dates from Düzen Tepe (Beta Analytic Inc. Miami), calibration Oxcal 4.1 (Vyncke 2013).

N°	Identification	Material	Obverse-Reverse	Origin	Dating	Value
1	2009-Y-00001-00001	Silver	Athena - Medusa with protrud-ing tongue	Selge	ca 350-300 BC	obole
2	2009-TD1-00067-00089	Bronze	Laureate head of Apollo - Forepart of bull rushing right	Magnesia	ca 330-280 BC	
3	2009-TD2-00004-00006	Silver	Athena - Medusa	Selge	ca 350-300 BC	obole
4	2009-TD1-00067-00091	Silver	Head of Heracles, wearing lion skin - Bow and inscription	Erythraea	3^{rd} century BC	drachm
5	2010-TD2-00017-00024	Bronze	Head of Alexander the Great - Inscription	Unknown	Late 4^{th} century BC	

Figure 33: Overview of the description and dating of coins found at Düzen Tepe (Vyncke 2013, 218).

So far, I have not yet talked about the major excavations conducted at the site – the Big Building, Courtyard Building, Kiln Area, and Bakery – in any detail as these will be discussed extensively at different points throughout this chapter. For now, it suffices to say that it has been concluded that both the architecture and material culture found at Düzen Tepe seemed to “reflect contemporary Pisidian styles” and were considered a nice fit for the general chronological timeframe of late Achaemenid and early Hellenistic times (Vanhaverbeke *et al.* 2010). The site was interpreted as a “proto-urban” settlement, spanning a substantial settled area and controlling a potentially extensive territory, but lacking any of the clear signs of hierarchical socio-political organisation typical for the *polis* paradigm considered prevalent for Anatolia at the time (Vanhaverbeke *et al.* 2010). Throughout this chapter, I will provide several indications that this image should likely be changed. Systematic occupation of the site seems to end in the course of the 2nd century BCE (Vanhaverbeke et al. 2010; Braekmans et al. 2011; Vyncke et al. 2011; Poblome et al. 2013a, 2013b). Largely simultaneously, however, starting from the 3rd century BCE onwards, Sagalassos, developed into an important urban centre on a local and regional scale. Explaining this process was one of the defining objectives at the onset of this Ph.D. research. The properties and idiosyncrasies of this development will be described and contextualized throughout the rest of this chapter, when I will also move towards a first level of interpretation. The final synthesis of the data collection and analysis conducted in this chapter, as well as the general conclusions, will be presented in the final chapter four of this thesis.

4.2 Community formation at Düzen Tepe and Sagalassos

4.2.1 Material culture

The research conducted in light of this Ph.D. thesis predominantly focused on macroscopic analysis of the pottery found at the archaeological sites of Düzen Tepe and Sagalassos. Specifically, the intention of this fellowship was to study the earliest phases of habitation at Sagalassos. The oldest coherent body of material found at the site consisted of a relatively limited number of pottery sherds, located mainly in the southwestern part of the settlement, found during the urban surveys conducted between 1999 and 2005 under the coordination of dr. Femke Martens. Unfortunately, virtually no architectural remains have so far been found that could be associated with these sherds. However, the similarities between these sherds and those of neighbouring Düzen Tepe was quickly noted (Poblome *et al.* 2013). For Düzen Tepe, a general date of occupation between the 5th and 2nd centuries had been suggested (Vanhaverbeke *et al.* 2010). Yet, no in-depth analysis of either body of material had yet been undertaken. One of the primary goals was therefore to take a thorough look at this material and consider its typological and fabric properties. These findings are presented in this part through a number of papers, respectively covering the late Achaemenid and Hellenistic pottery of Düzen Tepe, the late Achaemenid pottery of Sagalassos, the mid Hellenistic pottery of Sagalassos, and the Hellenistic amphora material found at Sagalassos. At the end, I conclude this part by comparing some of the elements of the pottery material of both settlements, as well as highlighting some general trends throughout both time periods discussed here.

4.2.1.1 Late Achaemenid and Early Hellenistic Pisidian material culture from Düzen Tepe (SW Anatolia)

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(1) University of Leuven, (2) Cranfield University.

This paper was published in the first volume of the 2017 edition of Herom: Journal on Hellenistic and Roman Material Culture. It presents the results of material studies conducted in 2015 and 2016 on the pottery material from the site of Düzen Tepe. It lays the foundation for further studies on late Achaemenid and Early Hellenistic times (5th – 2nd centuries BCE) by presenting the first classification – within the framework of the Sagalassos Project – of the material culture associated with this period based on fabric and morphological properties. Two co-authors were involved with this paper. First, dr. Dennis Braekmans who studied the fabric classification of Düzen Tepe in his Ph.D. thesis, resulting in two publications (Braekmans 2011, 2017). Dr. Braekmans was not involved at any stage of the writing process, however, was considered for co-authorship given the extensive use of his (published) results. Second, prof. Jeroen Poblome provided the framework to conduct the necessary study of the material. This pertained not only to the logistical circumstances of access to the depots of the Sagalassos Project as participant of the yearly excavations, but also providing the necessary intellectual and methodological support to ensure these studies could build on established best practices within the Sagalassos Project. Additionally, prof. Poblome contributed in the search for parallels through the extensive literature collected both by him personally and by the Project. Although the text was completely written by myself, prof. Poblome's feedback and critique during the writing process, both on content and grammar, proved invaluable for the eventual end-result.

Introduction

Much archaeological work revolves around trying to understand how societies in the past came into being, developed, and often also declined and disappeared from the surface of the earth. Unfortunately, we can no longer witness the workings of these past societies directly. We can, however, study and interpret the material remains they have left us. Naturally, as far as material culture is concerned, many different types of material were used, such as bone, wood, and textile, but most of these are very susceptible to the decay of time, whereas (precious) metals were often re-used in new smelting processes. In general, pottery was widely used for a variety of purposes and breaks relatively easy when dropped. Although certain kinds of pottery sometimes show indications of repair, it was not considered altogether precious as a medium for people to refrain from discarding after its usefulness had expired. The remaining sherds, with varying degrees of fragmentation, are not entirely immune to exposure to the elements, but are on average highly resilient to the wear and tear of time. For many societies, especially those of historic times, this combination of ubiquity and durability has resulted in pottery being by far the most abundant form of material culture left for us to study (perhaps likewise, future archaeologists might turn to the ever-presence of plastics to study societies from the 20th and 21st centuries). In this paper, we present an overview of the pottery found at Düzen Tepe. The dataset used for this analysis was compiled with material collected from three major excavations conducted at the site, the Courtyard Building, Bakery and Kiln Area. A more detailed description of the dataset can be found in part 2.2.

Methodology

In light of the strategic role ceramological investigations have played in the research agenda of the Sagalassos Project, the operational methodological framework has been designed in order to be able to classify each fragment, and not to ignore anything. The classifying and processing of pottery fragments is based – essentially – on fabric and shape. As a matter of policy, this approach permeates the classification procedures applied to any distinctive archaeological period in the history of the region, ensuring the highest possible degree of uniformity and systematisation of information. These procedures reflect not only our level of knowledge, but also past persons' and communities' technical skills, socio-cultural choices, ways of doing things, preferences and expressions, economic relations with and integration within frameworks of any size, and so forth.

A clay paste or fabric we define through the observation of combined macroscopic properties, whereby we maintain David Peacock's system of fabric characterisation.[9] Our preliminary macroscopic fabric classification is backed up and refined following a programme of chemical and mineralogical fingerprinting, as well as raw materials provenancing.[10] As far as shapes are concerned, the systematics of the applied classification operate on the nominal scale of measurement. As such, the resulting typology is arbitrary, in the sense that any other logic of classification could have been followed. From the outset, however, it was our intention to develop and work within a pre-arranged system, classifying material according to the principles of non-dimensional taxonomy, in contrast to paradigmatic ones for instance, nor with a classification system based on the systematics of grouping following no pre-arranged abstract template.

For each studied locus, generic functionality, typology and quantified information of the pottery is registered. The Functional Level is subdivided into four subheadings: General Functional Category, Functional Category, Specific Functional Category and Object. This tiered hierarchy works from a more general presumed function to the more specific. Secondly, type/variants are usually created based on the presence of certain morphological, decorative or sometimes technical characteristics. Thirdly, count and weight allow for a full count and weight quantification – of rims (R), bases (B), body sherds (BS) and handles (H) respectively. The typology constructed here follows the example of the well-established typology of the Roman imperial production of Sagalassos Red Slip Ware (SRSW) in

[9] Peacock 1977a.

[10] Braekmans 2010; Braekmans *et al*. 2017.

describing a number of distinct types through a polythetic set of attributes.[11] These attributes are linked to fabric and morphology as main parameters for typological classification. The envisaged typology needs to reflect the strategies employed by producers and choices made by consumers. It must therefore combine a typological description of the end-products with the identification of used fabrics. Each type code contains a letter denoting its respective typological group, including: cups (A), bowls (B), dishes (C), plates (D), containers (F), *pithoi* (G), jugs/jars (H), and cooking vessels (Q).
Next, a number is added to differentiate specific forms within the different type groups, (arbitrarily) starting with 100, so for example A100 for a basic cup form. Different types are then allocated different numbers, rising with 10 for each new type, so A110, A120, and so forth. For any consistently recorded variant of a specific type, a new number is allocated rising with 1, so for the A100 type variants are denoted with A101, A102, and so. The code numbers used for the different types have been selected to comply where possible with the existing SRSW typology. We therefore adopted existing numbering whenever typological continuity could be observed, and allocated new numbers succeeding the existing SRSW numbers whenever new types were identified. As full typological continuity can of course not be expected throughout different time periods, this resulted in certain discontinuities in numbering within type groups. In exchange, however, we gain a significant increase in potential for typological comparison over different chronological periods, which allows maximum highlighting of continuity and discontinuity in material culture whenever possible.

Fabric	Fabric no.	Percentage
black core	4	NA
LT1	227	28.0
LT2	228	12.4
LT3	229	11.4
cookware	230	22.5
LT4	232	3.9
metamorphic ware	233	0.1
grog ware	234	0.2
micaceous fabric	235	0.4
grey ware	236	3.4
buff ware	237	6.4
black-glazed tableware	238	0.1
orange-red tableware	239	4.4
red tableware	240	5.0
Hellenistic tableware	241	0.4
white ware	242	0.2
red lustrous wheelmade ware	243	NA
grey buff ware	244	NA
dense grey ware	245	0.7
gritty orange-red ware	246	NA

Table 1: List of fabrics with code number and relative occurrence based on a total of 26,813 sherds (Braekmans 2010).[12]

Full typological description also includes fabric identifications, with distinct fabrics denoted with a unique code number preceding the type codes. Previous petrographic and geochemical analysis identified a number of pottery fabrics for the late Achaemenid and early Hellenistic period at Düzen

[11] Poblome 1999.
[12] Percentages not always available; fabric 4 was not noted separately; fabric 243 was not encountered at Düzen Tepe proper; fabrics 237 and 244 were counted together; fabric 246 was added afterwards.

Tepe and Sagalassos, providing fabric numbers starting from the number 200 (TABLE 1).[13] In conclusion, a full identification of an Achaemenid bowl (A120) produced in the local buff tableware fabric (no. 237) would therefore be in the form of '237A120'. This system of numbering fits with established practice at Sagalassos following the SRSW typology and allows quick classification and identification during material studies

The productive landscape: Raw materials selection

It has been argued that both Sagalassos and Düzen Tepe were largely self-sustaining communities in late Achaemenid and Early Hellenistic times, who relied heavily on the local landscape in the immediate surroundings of the settlements for their most basic functions and provisions (see 4.2.2 and 4.2.5). The production of pottery was in this period likewise oriented on a local productive landscape, with raw material derived mainly from nearby sources and distribution of the end-products limited to the settlement and the immediate hinterland. Petrographic analysis of the pottery found throughout the wider territory[14] of Sagalassos and Düzen Tepe has identified thirteen overall petrographic groups, related, besides one distinctly non-regional source group, to four regional ceramic production groups based on both common petrology and clay chemistry: A) Burdur basin groups, B) detrital clay groups from the Çanaklı and Ağlasun basin, C) a mixed flysch–limestone group, and D) an ophiolitic–volcanic group.[15]

The clays derived from the Burdur area were only sparsely encountered at Düzen Tepe, with only 8 diagnostic pieces identified, mainly related to a bowl functionality, as well as two jars. The detrital clays were derived from the northwestern parts of the nearby Çanaklı valley (located at a distance of 4-5 km from Düzen Tepe). These clays were used systematically in Roman imperial times for the tableware production of SRSW, but were already in use for the production of the higher-end spectrum of finer tableware in Hellenistic times[16], as well as part of the common ware production at both Sagalassos and Düzen Tepe[17]. The flysch-limestone group was produced with clays derived from weathered ophiolite found on the flanks of the mountain ranges around the Ağlasun and Çeltikçi valleys.[18]

Clay quarrying was for example attested at Sagalassos in the central depression to the east of the city centre, in what in Roman times would become the Eastern Suburbium. Here, core-drills provided evidence of a *palaeosol* horizon developed on top of a clay quarry phase that could be dated to the period between 370-200 BCE.[19] This *terminus ante quem* for the quarrying activities suggested these clays were already in use in late Achaemenid and early Hellenistic times. Additionally, control excavations conducted at the Upper Agora confirmed that an anomaly previously noticed through geophysical research was actually a large pit, resulting from clay quarrying activities before the construction of a public square at this location.[20] Although it cannot be conclusively proven that these specific quarries were necessarily exploited for pottery production, it does seem plausible that at least part of the clay raw materials were used by potters, as ceramics attributed to this group seem to represent the main type of production of common wares and buff wares in the region during late Achaemenid and early Hellenistic times. Finally, pottery related to the ophiolitic-volcanic group seem to be associated with the entire range of common wares found at Düzen Tepe. It can be suggested that specifically the illite-rich clays from the immediate vicinity of the settlement proper were used to produce the ceramics associated with this group.[21] Both storage and cooking ware functionalities

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[13] As proposed by Dennis Braekmans (2010, pp. 103-122). The choice to start from 200 was made to allow sufficient space for later additions of fabrics from other time periods.
[14] I.e. the research area of the current Sagalassos Archaeological Research Project, more or less coinciding with the territory controlled by Sagalassos in Roman imperial times.
[15] Braekmans *et al.* 2017.
[16] Poblome *et al*. 2002; Poblome 2016.
[17] Braekmans *et al.* 2017, p. 16.
[18] Neyt *et al.* 2012.
[19] Vermoere *et al*. 2001.
[20] Talloen and Poblome 2016.
[21] Neyt *et al.* 2012, p. 1301-2; Braekmans *et al.* 2017, p. 17.

appear to have been especially associated with this group, while, strikingly, no tableware seems to have been produced using these clays.
The fabrics listed here were first described by Dennis Braekmans within the framework of his Ph.D. dissertation on the petrographic and geochemical analysis of pottery found at Sagalassos, Düzen Tepe and the wider study region. Here, we follow both the macroscopic fabric classification, description and numbering proposed by Braekmans.[22] A full list of the fabrics encountered at Düzen Tepe, along with corresponding fabric numbers and relative occurrence, can be found in TABLE 1. It must be noted that a number of the listed fabrics was only encountered very rarely, whereas others did not yield any diagnostic fragments so far. We limit our fabric descriptions to those relatively frequently encountered in the diagnostic material of Düzen Tepe.

Fabrics (FIG. 1)

Common ware

A first major fabric group within the ceramic material of Düzen Tepe are a number of common wares characterised by the mutual presence of lime particles used as temper for production purposes. These 'lime-tempered' (LT) common wares cannot always be clearly distinguished from one another in macroscopic analysis. A certain degree of overlap between the fabrics within this group can therefore not be excluded. The LT1 fabric (227) is fully oxidized with a light red to reddish brown colour (5YR 6/6 – 5/8 dark to light red). Sherds belonging to this fabric generally have medium to extensive pores, a rough texture and hackly fracture. Inclusions consist mainly of limestone (+), biotite (+), feldspars (+), calcite (++), chert (-), grog (-), pyroxene and amphibole (--) particles. Inclusions are unevenly distributed and can be up to 2 mm in size. No traces of surface treatment have been observed, apart from partial to full smoothening.
Besides fabric 227, three additional variants of lime-tempered fabrics have been identified. All four share for a large part the same characteristics; observed differences can be mainly related to overall colour and composition of inclusions. The LT2 fabric (228) is slightly less oxidized compared to LT1 and can be most clearly distinguished by its overall lighter brown colour. Additionally, it differs from LT1 in compositional respect in containing more chert (-), lime (+), and volcanic (possible basalt or andesite) (++) inclusions. A third variant of the lime-tempered fabrics of Düzen Tepe (229) is generally fully oxidized as well, although a considerable number of sherds in this fabric has a characteristic large grey core while still retaining oxidized margins. The fabric is compositionally characterized by a higher amount of lime (++), quartz (+) and some pyroxenes (-), and occasionally also grog and reddish chert. It was noted that this fabric was more extensively represented in vessels with storage and or jug functionalities[23], however, some bowls made in this fabric were identified as well (SEE FIGURE 14 AT THE END). Finally, the fourth variant, termed 'orange limestone-tempered' fabric (232) is in overall composition quite similar to LT1 but can be distinguished by the abundant amount of limestone inclusions, sometimes up to 3 mm in size. Other inclusions are quartz (+), feldspar (+), grog (-) and some volcanic rock (basalt) fragments (--). Sherds in this fabric also appear to systematically show a more intense orange colour (7.5YR 6/8 yellowish red). This fabric was applied most frequently in large storage vessels, although again a number of bowls were identified as well. A rare variation of this fabric consistently has a 1/3 reduced core, with both interior and exterior retaining the characteristic orange colour and a fully similar composition compared to their fully oxidized counterparts. All four lime-tempered fabrics derive from the same local sources but have variations in composition that seem to weakly correlate with functional differences, for example the greater range and number of inclusions used in the manufacture of storage vessels.

[22] Braekmans 2010; Braekmans *et al.* 2017.
[23] Braekmans 2010, p. 108.

Figure 1: Pottery fabrics at Düzen Tepe.

Cookware

In Braekmans' original classification, two types of cookware were subsumed along with the four lime-tempered wares under the general heading of common wares. As the cookware fragments of Düzen Tepe were distinguishable from the other fabrics in being highly and consistently enriched in volcanic material and/or mica minerals[24], and showed virtually no limestone inclusions, we decided to separate these two groups. However, as the original numbering sequence was retained, the cookware in TABLE 1 can still be found among the lime-tempered common wares. Moreover, originally a distinction was made between cookware I and cookware II, respectively fabrics 230 and 231, with the only distinction being an apparently systematic blackening observed in type II. As it was unclear whether this blackening was due to a systematic uneven production sequence or rather the result of secondary firing and as both types have the same compositional systematics of inclusions, we decided to group both types together into a single cookware fabric (230). This fabric was characterized by a light brown to red brown matrix (10R 5/8 Red) and a highly gritty overall feel and texture. Inclusions comprise high amounts of volcanic rock (basalt and andesites) fragments (++), quartz (++), biotite (++), pyroxenes and amphiboles (+), feldspars (+), as well as some olivine (--), iron oxides (--), calcite (--), and chert (--). Inclusion sizes can range up to 2 mm, with an irregular, cracked pattern of elongated pores observable as well.

Additionally, a second major cookware fabric that is found in the wider region of Düzen Tepe and Sagalassos can be found at Düzen Tepe as well: the gritty black core ware (originally fabric number 4, here denoted with 250). As the original fabric number suggests, this fabric was not part of Braekmans' classification, but was already identified earlier when a diachronic provenance study of cookware and storage/transport vessels from late Achaemenid to Middle Byzantine times identified this distinctive black fabric as a precursor of the later, Roman imperial fabric 4 by proving these were part of the same production context.[25] Although small differences between different time periods could possibly be accounted for by small shifts in exploited clay bodies, in general this production seems to have derived from clays in and around the central part of the Ağlasun valley. This fabric is characterized by a black/grey or dark brown colour in the break with the outer margins either black or oxidized towards

[24] Braekmans *et al.* 2017, p. 5.

[25] Neyt *et al*. 2012.

a light brown hue (5 YR 7/10). The surface is generally quite rough but can occasionally be smoothened extensively. Texture can be very dense and range from a quite fine-grained to rough matrix. Break is rough to hackly and very rough. An abundant amount of inclusions can be observed, sometimes up to 2 mm and mostly poorly to very poorly sorted. These include quartz (++), calcite (++), grog (+), volcanic inclusions (+), mica (-) clay pellets (-), and pyroxenes and amphibole (-) minerals.

Tableware

The most typical form of tableware encountered in large amounts at Düzen Tepe is a fully oxidized buff tableware (237), named after its systematic buff colouring (7.5YR 6/6). This fine fabric is systematically very powdery with mainly a few small calcite and feldspar inclusions less than 1 mm in size present. Other, less frequently attested inclusions are small quartz and grog particles. Typically, the fabric has many small, rounded micropores, with occasionally larger pores present as well. Traces of a dull reddish to brown mottled slip can be found on many but not all fragments, although the powdery nature of the fabric would have intensified weathering of this slip. Based on the cleaning of detailed 'windows' on the sherds in the Sagalassos conservation laboratory, we presume that most fragments originally had the mottled slip characteristic for this period.

The widespread occurrence of a fully black slipped ware is a common feature in Hellenistic pottery, especially in the Aegean parts of the Greek world, and is commonly considered to have originated in Athens during the Classical period.[26] It has, however, been suggested that several production centres in Anatolia started to develop their own tableware repertoire, notably including a local production of black-glazed pottery, somewhere during the 3rd century BCE.[27] Likewise, at Düzen Tepe we find, albeit in very limited quantities, some attestations of a black-glazed pottery fabric (238), determined to have been locally produced through geochemical analysis. This fabric was characterized by a soft feel and smooth texture and break. These sherds are fully oxidized and beige/buff coloured, making them difficult to differentiate from the more common buff wares safe for the characteristically distinct dark brown to black semi-lustrous slip (7.5YR 3/0). Save for this slip, the main difference with the buff tableware is the slightly more reddish colour (7.5YR 6/6 reddish yellow) and the higher amount of micropores in the break. The only inclusions visible are sparse feldspar inclusions of less than 1 mm. As this type of fabric, like the buff tableware, is highly susceptible to weathering, it is hard to quantify the amount of black-slipped pottery at Düzen Tepe. Still, it can be suspected that these vessels constituted the very upper-end of ceramic tableware at Düzen Tepe and would probably have occurred only in limited amounts.

A third typically soft, smooth and highly powdery tableware fabric with a highly homogeneous texture found at Düzen Tepe is the orange-red tableware (239). All sherds belonging to this fabric are fully oxidized, showing a distinctly bright orange colour. Few inclusions are visible, mainly some quartz, calcite and feldspar. The fabric is not uncommon at Düzen Tepe but because of its high susceptibility to weathering, few diagnostic pieces have been identified.

Finally, a fine type of tableware constituting the main component of the Hellenistic tableware identified at Sagalassos, was also identified sporadically at Düzen Tepe. This Hellenistic tableware (241) can be seen as the predecessor of the production of SRSW in Roman imperial times, using the same Çanaklı-based clays discussed earlier. Fragments in this fabric are predominantly oxidized, ranging from reddish yellow to brown (7.5YR 5/4 brown; 5YR 6/6 reddish yellow), although some reduced grey-coloured fragments occur as well. This well-levigated fabric is typically very fine and highly microporous with a very smooth feel and texture. Overall, very few inclusions can be observed, mainly small calcite particles, as well as occasionally some mica and volcanic inclusions. Several kinds of dull mottled slip were applied, fitting within the category of so-called 'colour-coated' slips, ranging from reddish and grey-brown to orange.

[26] Rotroff 1997a.

[27] For example, in Ephesos: see Mitsopoulos-Leon 1991, pp. 32-3.

Typology

With the most common fabrics described, the typology of the ceramics of Düzen Tepe can be introduced. To recapitulate, all types receive a distinct type number, starting with a letter denoting the typological group (A for cups, B for bowls, C for dishes, F for containers, G for *pithoi*, Q for cooking vessels). An overview of the different type-codes, as well as the number of diagnostic sherds[28] assigned to each type, can be found in TABLE 2.

A120									
97									
B140	B150	B170	B230						
31	16	78	4						
C120	C121	C170	C171	C172	C280	C290			
48	5	7	11	9	1	9			
F120	F150	F151							
3	12	1							
G100	G110	G120							
12	13	8							
H100	H101	H110	H102/122	H111	H130	H140	H160	H170	H250
22	15	26	4	38	9	8	5	1	1
Q200	Q210	Q220							
71	40	5							

TABLE 2: Number of diagnostic rim sherds per type (Total amount 610[29]).

Düzen Tepe						
		fine wares (/6)	common wares (/6)	cookware (/3)	storage (/1)	import (/2)
tableware	cups	4	1	0	0	1
	bowls	4	5	1	0	1
	dishes	6	5	1	0	0
serving	jars/jugs	6	5	2	0	1
	containers	3	4	0	0	1
storage	pithoi	0	5	0	1	0
kitchen wares	cooking	0	1	3	0	0

TABLE 3: Comparison of typological groups and fabric groups (colour coding equals min-max value as red to green range).

One of the most characteristic properties of the ceramic material at Düzen Tepe is the limited degree of fabric specialisation. It is remarkable how different fabrics cover large parts of the full typological spectrum, with only a few exceptions of specialized production, such as storage and cookware fabrics (TABLE 3). In this table, a comparison between type groups and fabric groups is presented.[30] For every fabric group we counted whether a given type group occurs or not. The higher the numbers, the more extensively a given fabric is used throughout the full typological spectrum, and, *vice versa*, the more a given type group occurs throughout the full fabric range. If we look at the jar/jug group for example, we see that jars/jugs occur in all of the 6 fine tableware fabrics, and 5 out of 6 common wares, whereas they were identified in only 1 of 3 cookware fabrics. Reading the table the other way round, we see that the common wares cover the full typological spectrum of pottery, whereas the highly idiosyncratic

[28] Mostly diagnostic rim sherds, except for the A120 where the characteristic S-carination in the wall allows clear identification as well.

[29] Diagnostics selected from excavated contexts interpreted as occupational and post-occupational layers of a multi-room housing unit (Courtyard Building), a suspected potter's workshop (Kiln Area) and a bakery; see Vanhaverbeke *et al*. 2010.

[30] Summarized, for full table see enclosed Figure 14.

large storage fabric only occurs in – what's in a name? – in large storage vessels. As far as the description of the individual types of this typology is concerned, as with the fabrics, we focus on the typical components constituting the most important elements of the pottery assemblage. At the end, we provide a short description of a few more peculiar, yet noteworthy, elements.

Cups (A)

So far, the only form of drinking cup found at Düzen Tepe is the so-called 'Achaemenid bowl' (A120), FIG. 2. This handle-less bowl/cup has a convex-concave wall profile, forming a characteristic S-shape. The lower part of the body is sharply carinated. The upper part of the wall is flaring and culminates in an out-turned rim with simple lip. Two different forms can be discerned, one with a straight flaring rim, the other with a curved rim. The form is the result of skeuomorphism of metal prototypes and descends from a long line of drinking cups reaching all the way back to the early first millennium BCE.[31] It would go on to become a highly popular shape spread from the Persian heartland from sites such as Persepolis[32] and Pasargadae[33], throughout large parts of the Persian/Achaemenid empire, including Anatolia in the period following the Persian conquest. Achaemenid bowls have been found at the satrapal capital of Phrygia, Daskyleion[34], Karaçallı and Perge[35] from southern Pamphylia, although at Perge they occured most frequently in Hellenistic contexts from the *bothros* at the acropolis. More inland, only a handful examples are known from Gordion[36], however they are commonly attested at the nearby settlement of Hacımusalar Höyük[37]. Other inland locations include Sardis[38], Kale Tepe[39], and Seyitömer Höyük[40]. At Kelainai[41], the Achaemenid capital of Greater Phrygia and royal residence during the Persian period, the Achaemenid bowl constitutes the predominant class of drinking vessels, with several hundreds of sherds identified in surveys conducted from 2008 to 2011.[42] Two major types have been observed: a *'phiale*-shaped' shallow bowl with horizontally fluted wall and a deep, conical bowl tapering towards the base. Achaemenid bowls are also known from late Classical contexts (4th century BCE) at Palaepaphos on Cyprus.[43]

Recent material studies of pottery from Düzen Tepe identified 97 possible fragments of Achaemenid bowls out of a total of 610 diagnostic sherds, roughly 16% of the total dataset that could be linked to a minimum number of 35 distinct bowls. In most cases, Achaemenid bowls at Düzen Tepe are recognized by the S-shaped carination which forms a relatively robust part of the vessel and is therefore often still preserved. For this reason, the number of identified Achaemenid bowls might be somewhat skewed. Most examples encountered at Düzen Tepe appear to match the more shallow-bodied type of Achaemenid bowls from Kelainai[44], however, smaller and deeper specimens have been registered as well. For the few examples of which sufficient part of the rim was preserved, reconstructed full rim diameters ranged between 12 and 24 cm, with an average of 18 cm. If we were to follow Dusinberre's[45] suggestion that earlier, Achaemenid examples often have a shallow body and wider diameter (average of 14 cm) compared to their later, Hellenistic counterparts (average of 11

[31] Dusinberre 2003, p. 177.
[32] Schmidt 1957, Plate 72, no. 1.
[33] Stronach 1978, pp. 242-243 no. 13.
[34] Dusinberre 2003, p. 194.
[35] Çokay-Kepçe and Recke 2007, pp. 94-95.
[36] Stewart 2010, Fig. 26A.
[37] Toteva 2007, pp. 115, 120, pl. 17.
[38] Dusinberre 1999, pp. 78-79 and 82 no. 10.
[39] Hürmüzlü et al. 2009, Fig. 10.
[40] Coşkun 2011, Fig. I-III.
[41] Summerer et al. 2011, Pl. 3, no. 26a-b.
[42] Lungu 2016, p. 455.
[43] Maier and Wartburg 1998
[44] Lungu 2016, p. 464, Fig. 14.
[45] Dusinberre 2003, pp. 185-6.

cm), then we could ascribe the examples found at Düzen Tepe to this first group. However, it must be noted we do not possess a clear enough stratigraphical sequence allowing seriation of deposits and material to substantiate any such claim.

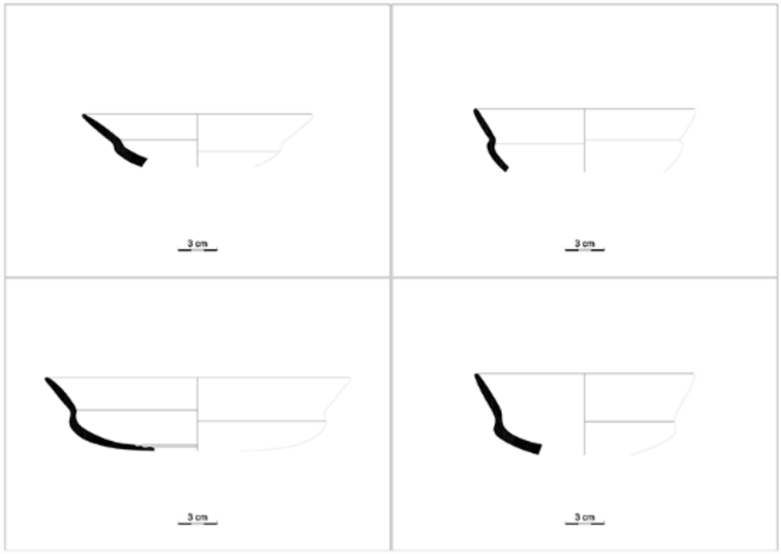


Figure 2: Cups.

The majority of the attested fragments consisted of locally produced tableware fabrics, mainly buff wares (237), as well as occasionally the Hellenistic tableware fabric (241) and a handful of fragments in the orange-red tableware (239). Interestingly, one fragment was produced in one of the lime-tempered common wares (227). Finally, a few small fragments were found in a fine fabric, imported from a more distant, hitherto unknown source.

Bowls (B)

Next to the Achaemenid bowls, tableware at Düzen Tepe consists of a fairly limited number of rather simple forms of bowls and dishes. Bowls are typically defined as vessels with a height varying from one-third of the maximum diameter of the vessel up to the maximum diameter, whereas dishes are defined as having a height of more than one-fifth, but less than one-third of its maximum diameter.[46] It must be noted that a strict delineation between both groups is difficult because of the high degree of fragmentation of the material, making it hazardous to accurately reconstruct vessel dimensions, as well as due to high intra-type variation in sizes and dimensions. For example, types B170 and C170, despite being generally classifiable as bowl and dish respectively, can still show considerable overlap in sizes and dimensions. At this point, it must be taken into account that different types within our classification represent fixed points within a varied and fluctuating spectrum of shapes.

First, a type of plain upturned rim bowls can be identified with a characteristic flattened top (B140**,** FIG. 3A). Sometimes the flattened top is slightly outward facing, resulting in a soft S-curve (resembling variant C171). A frequently recurring (but not omnipresent) element is the carination occurring in the upper half of the vessel wall, leading these to be described as 'ledge rim bowls or dishes' such as at Gordion[47], where they occurred from the 3rd century BCE onwards. Parallels are also known in the Hellenistic slipped wares of Xanthos found in the West Area[48] and the sanctuary of Leto[49]. At Pasargedae[50], comparable vessels were found in contexts dated to 4th and 3rd centuries BCE. At Düzen Tepe, type B140 is produced both in finer tableware fabrics (237 and 244), as well as a range of

[46] Rice 1987, p. 216.
[47] Stewart 2010, Fig. 197, no. 27-30.
[48] Yener-Marksteiner 2007, Abb. 10: no. 5-7, p. 95.
[49] Lemaître 2007, Fig. 7: no. 2-4, p. 123.
[50] Stronach 1978, Fig. 107, no. 1-2 + Fig. 112, no. 4.

common wares (227-228-229-230-236). Additionally, a handful of sherds were found made from a fine grey fabric that can be linked to the general Burdur area (245).

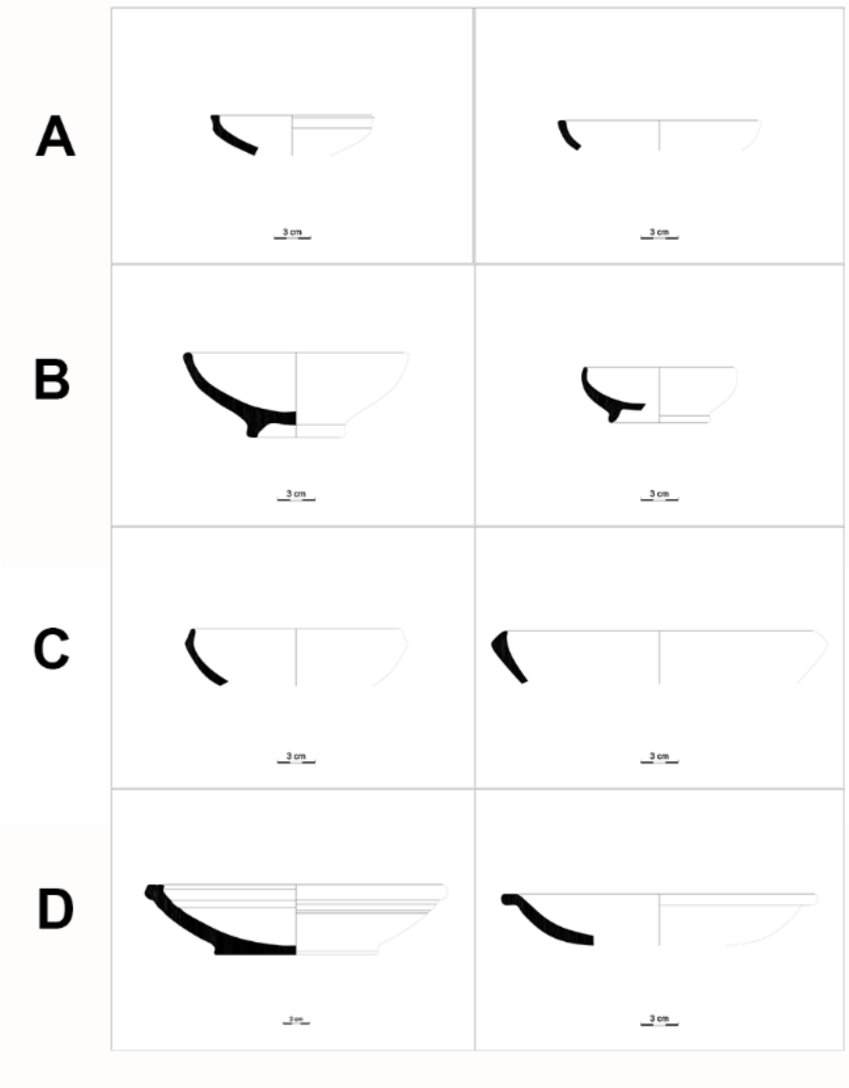


Figure 3: Bowls.

Next, a type of plain upturned rim bowls (B150, FIG. 3B) has a distinctly rounded rim, rather than the flattened top of the B140. Moreover, these vessels never show the carination found in some of the B140 examples. These generally shallow bowls with simple rims can be considered a basic type of bowls and, as a result, occur on many different sites, throughout different periods. Listing parallels is therefore superfluous in this case, although we note the similarities with the 'simple upright bowls' identified at Gordion.[51] At Düzen Tepe, these bowls were produced both in finer tableware fabrics (237, 239 and 244) and common wares (228-236).

One of the most frequently represented types found at Düzen Tepe (about 13% of the total amount of diagnostic material) is the so-called *echinus* bowl (B170, FIG. 3C): a generally small and rather shallow, simple type of bowl on a ring foot base, with the maximum diameter commonly near the upper quarter of the wall and in principle characterised by a highly distinct incurving rim. Still, it must be noted that for Düzen Tepe a clear distinction between types B150 and B170 cannot always be made, as a certain range can be observed on the angle of the rim, going from straight up to strongly incurving. Sometimes the curved rim becomes thickened and more pronounced, resulting in a fat 'comma-shaped' lip. The most frequent fabrics used in Düzen Tepe for production of this type are the full set of lime-tempered

[51] Stewart 2010, Fig. 26C & D.

wares (227-228-229-232), the buff tableware (237), Hellenistic tableware (241), as well as a number of imported bowls from the general Burdur area (245). Incurving rim bowls became widely popular in Anatolia by the end of the 4th and 3rd centuries BCE.[52] Similarities can be especially noted with material from Sardis[53], Ephesos[54], Pergamon[55], Troy[56], Gordion[57], Patara[58], Xanthos[59], as well as on Paphos[60], Palaepaphos[61], and Salamine[62] on Cyprus, Jebel Khalid in North Syria[63], and Pasargadae[64] in Iran.
A distinct, but relatively rare type is the bowl/dish with an outward protruding rim that is flattened at the top (B230, FIG. 3D). The flattened protruding part is also distinctly thickened, resulting in a heavy, 'squared' appearance. Examples produced in both common ware (229) and fine ware (237) have been found at Düzen Tepe.

Dishes (C)
The first type of dishes found at Düzen Tepe is a form of shallow dish with a plain upturned rim (C120, FIG. 4A). Due to high degree of fragmentation of the material it is not always easy to distinguish between plain rim bowls or dishes (type B150 or C120) and a high degree of overlap between both types is presupposed. The fabric range of both types appears largely similar, except that type C120 is encountered in all variants of the LT fabric range, whereas B150 in only one. A few examples were identified as a variant (C121, FIG. 4B), with the upturned rim flattened at the outside and sloping towards the top of the lip.
The C170 bowls/dishes (FIG. 4C) are characterised by a convex in-turning wall profile and a thickened rim rounded at the exterior. Sometimes the wall is slightly narrowed right underneath the top of the rim. This is the result of a conscious act during the shaping of the vessel when the potter grasped the upper lip between his/her fingers and stretched the clay upward to form the rounded rim. Some fragments additionally have a small groove right underneath the rounded rim. Comparable shapes have been found at Xanthos.[65] At Alexandria[66], examples were identified within the Rhodian tradition of colour-coated wares, termed as "*skyphos* with accoladed handles". Although no indications have been found of such handles at Düzen Tepe, the overall idea of these vessels is quite similar. This production fitted within a wider south Anatolian form of *skyphos* production where the rim rounded at the outside was also folded inwards, thus restricting the vessel mouth. An earlier parallel from Palaepaphos on Cyprus was dated to late Classical times[67], becoming more widespread towards the end of the 2nd century BCE. The shape is also encountered in Cypriot Sigillata, form P22a at Paphos.[68] However, this shape would only appear in Sagalassos in the material found underneath the Roman Odeon, dated to the 1st century BCE.[69] At Düzen Tepe, the rounded rim is not folded inwards, thus leaving the maximum diameter of the vessel at the top. This tradition appears to be 'eastern', as comparable vessels can be found already from the late Iron Age in eastern Anatolia in the Upper Tigris

[52] Rotroff 1997a, p. 161; Dusinberre 1999, p. 95; Çokay-Kepçe 2007, p. 93.
[53] Rotroff and Oliver 2003, Plate 7-8: no. 32-47; 2.
[54] Mitsopoulos-Leon 1991, Tafel 1: A1-5 + Tafel A4-A8.
[55] Schäfer 1968, Tafel 4, no. C13-19.
[56] Berlin 2002, Plate 13, no. 70-76.
[57] Stewart 2010, Fig. 93A + fig. 97B-C.
[58] Işin 2007, fig. 5-6.
[59] Lemaître 2007, fig. 8.7.
[60] Hayes 1991, Figure XIV.
[61] Maier and Wartburg 1998
[62] Diederichs 1980, Pl. 7, no. 65-74.
[63] Jackson and Tidmarsh 2011, pp. 12-14.
[64] Stronach 1978, pp. 248-249 no. 5-16.
[65] Yener-Marksteiner 2007, Abb. 10: 8-9.
[66] Élaigne 2012, fig. 46, no. 6039/2 and 4479/5.
[67] Maier 1967, fig. 5a-b: form IV.
[68] Hayes 1991, figs. XIX, LXI, pp. 21-2.
[69] van der Enden 2014.

Valley[70], as well as during the Achaemenid period at Altıntepe and Cimin Tepe II[71]. At Jebel Khalid in North Syria, the shape occurs during the 3rd century BCE and is thought to represent an eastern ceramic tradition as well.[72] Interestingly, type C170 is so far only encountered in the finer tableware range (237-238-239-242) and not in one of the common wares.

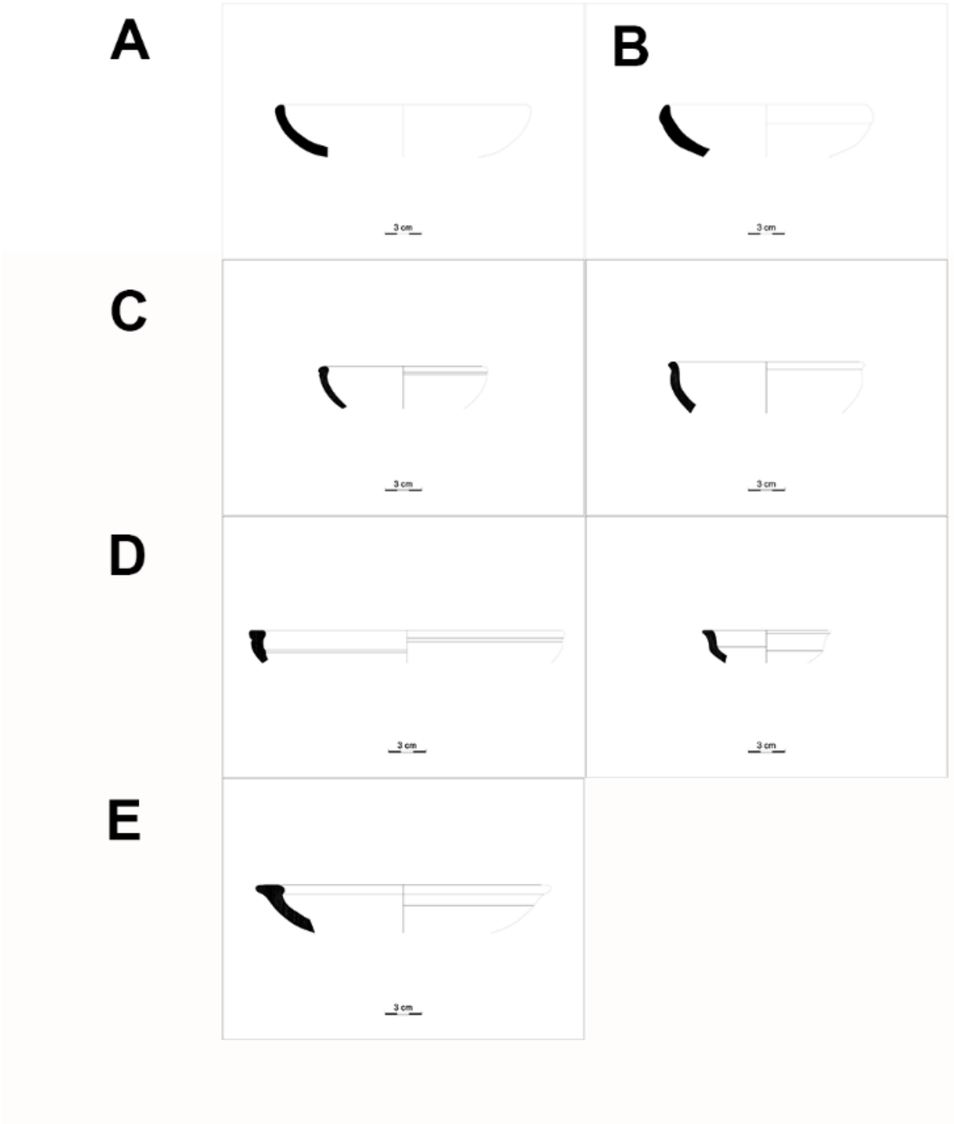


Figure 4: Dishes.

A similar shaping technique can be observed with variant C171 (FIG. 4D) where instead of a rounded rim, the top of the lip is flattened, resulting in a slightly outward facing flat rim. Parallels are again found at Xanthos[73], but also in Troy[74], Gordion[75], and in the Upper Tigris Valley[76]and Pasargedae[77]. A second variant on this shape (C172, FIG. 4E) can be found in a small number of sherds where the flattened lip of C171 is not only extended outwards but inwards as well. Parallels can again be found

[70] Matney 2010, Fig. 3.
[71] Summers 1993, Fig. 9, no. 4.
[72] Jackson and Tidmarsh 2011, pp. 19-20.
[73] Yener-Marksteiner 2007, Abb. 10: 10-11.
[74] Berlin 2002, Plate 11: no. 56.
[75] Stewart 2010, Fig. 93E.
[76] Matney 2010, Fig. 3.
[77] Stronach 1978, Fig. 107, 4.

at Troy.[78] Interestingly, as at Düzen Tepe we find the shape of the C172 rim both in fine concave bowls, as well in some larger vessels possibly basins.[79] As with C170, both C171 and C172 have so far only been encountered in finer tableware fabrics (11-237-239).

Containters (F)

A small number of open containers were identified at Düzen Tepe. Two basic simple types can be distinguished: one with a straight wall and flattened rim slightly projecting at the inside (F120) and one with the wall profile varying from straight to slightly convex, with a prominent projecting rim (F150). The few fragments identified as F120 (FIG. 5A) were all produced in lime-tempered common wares (228-229). F150 (FIG. 5B), on the other hand, was not only produced in the common ware group as well (227-228-229) but was additionally identified in a couple of finer tableware fabrics (237-239-244). One fragment could potentially be linked to clays derived from the Burdur area (245). A comparable object to type F150 was found during survey campaigns at Kale Tepe[80], a nearby settlement in northern Pisidia, thought to have been highly comparable to Düzen Tepe and inhabited during the Iron Age and Achaemenid period.[81]

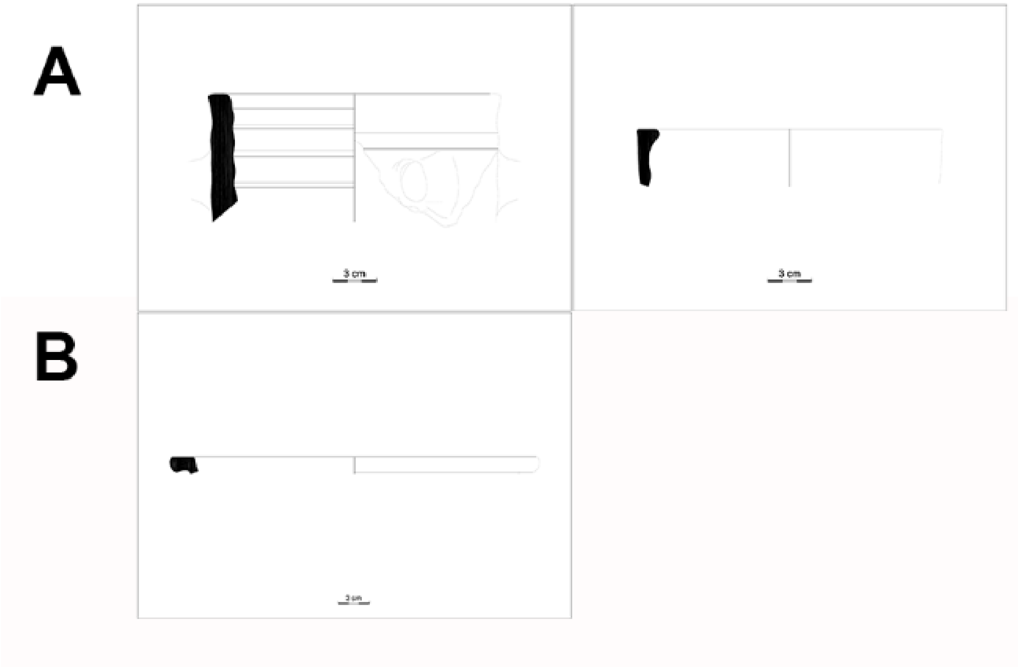


Figure 5: Containers.

Pithoi (G)

Large storage vessels with closed orifices, commonly termed *pithoi*, are frequently identified at Düzen Tepe. Here, three types are differentiated (FIG. 6 A-C): vessels with basic everted rims that can sometimes be thickened and rounded (G100), vessels with outward-turned and flattened rim, and vessels with outward-turned and flattened rim that is thickened, sometimes into a triangular shape (G120). These *pithoi* conform to generic, widespread shapes. Unfortunately, little effort is made to adequately publish these storage vessels. Close parallels for both types G110 and G120 can be found at Gordion.[82] For these large storage vessels at Düzen Tepe, a dual production line can be observed. On the one hand, a certain amount of vessels is made in a rough version of the lime-tempered common wares (most prominently 232, but also 227, 228, 229) enriched with mica particles. On the other hand,

[78] Berlin 2002, Plate 14, no. 84.
[79] Berlin 2002, no. 128.
[80] Hürmüzlü *et al.* 2009, Fig. 10.
[81] Personal communication between Bilge Hürmüzlü and Jeroen Poblome.
[82] Stewart 2010, for G110: Fig. 153, no. 189, 192, and 193 + for G120: Fig. 153, no.191.

a different production line can be observed, characterised by a reduced amount of lime inclusions and increased amounts of grog, oxidized iron particles, volcanic inclusions and chert. So far, this fabric could not yet be conclusively linked to one of the provenance groups described earlier, although a link with the mixed flysch–limestone group derived from the central Ağlasun valley might be tentatively suggested, based on composition of inclusions. Additional analyses are needed to confirm this suggestion and for this reason this fabric has not yet been attributed a fabric code. For now, this fabric is merely denoted as 'large storage fabric'. Many fragments have traces of black pitch on the surface, possible added to waterproof these vessels to allow carrying (semi-)liquid contents.

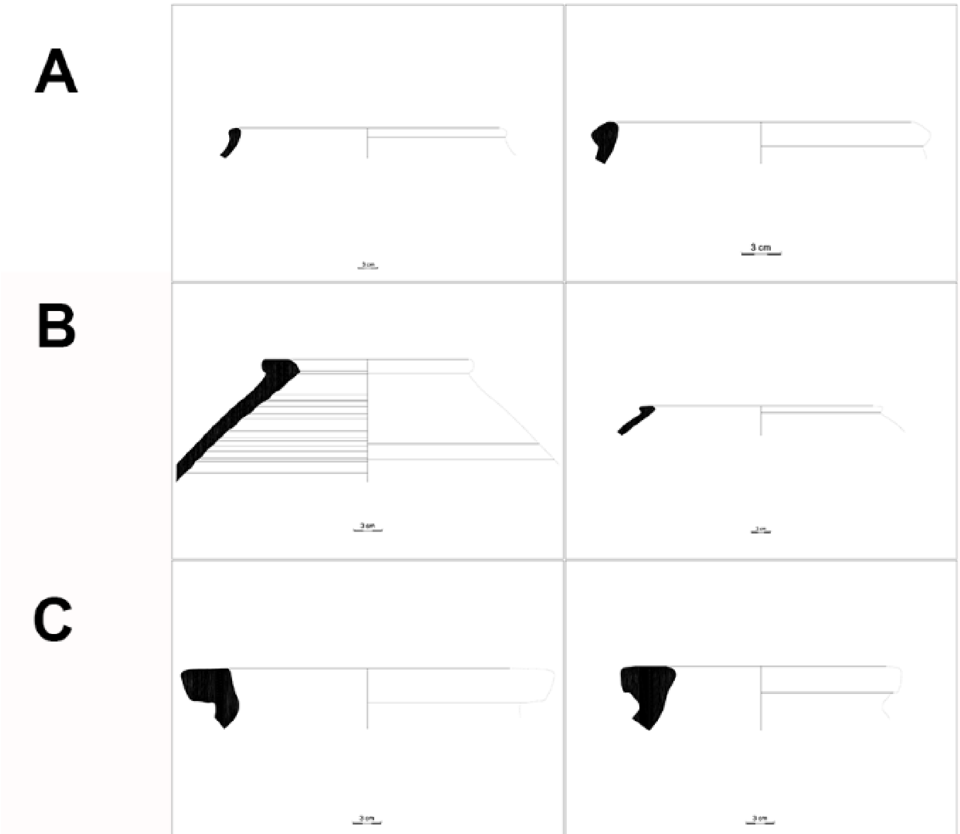


Figure 6: Pithoi.

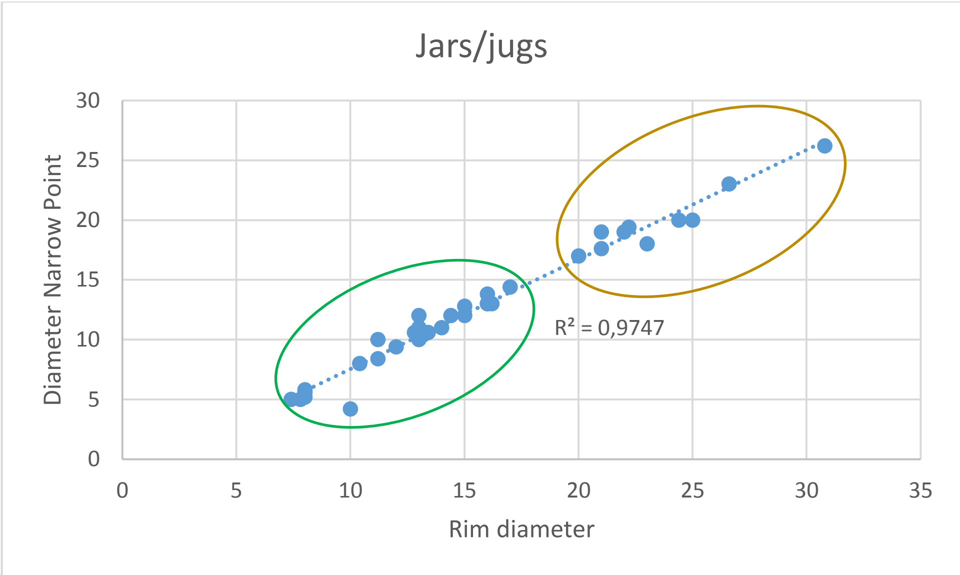
Jars/jugs (H)

As jars and jugs can have distinct functionalities associated with storage or serving beverages, these normally receive a different letter code – in the SRSW classification this is I for jugs and H for jars.[83] The most obvious diagnostic feature being the presence of a spout. Unfortunately, due to high fragility, spouts are only very rarely encountered in the pottery of Düzen Tepe. The only indications being a handful of cloverleaf-shaped jug spouts, from so-called trefoil jugs, which are generally preserved without any further indication for rim diameter, or vessel shape and size. As we have no conclusive evidence for the existence of jugs safe for this handful of trefoils, it was therefore decided not to allocate a distinct letter code to jugs, not even the trefoils, but rather to subsume them all under the same category (H) and use the description jars/jugs. Suspected functional difference are expressed through a different type number. When plotting measurements of the rim diameter at the orifice of the vessel against the diameter of the neck at its narrowest point, two distinct groups were observed (GRAPH 1).

Unsurprisingly, both parameters are highly correlated. A first group could be distinguished with a maximum diameter of 15 cm at the narrowest point of the neck. While we have no way of confirming the actual use of these vessels, we would like to suggest that the restriction of the diameter of the

[83] Degeest 2000.

neck could indicate the storage or serving of relatively valuable contents, for example wine, compared to the more unrestricted second group with neck diameters over 15 and up to 25 cm, possibly containing less precious contents such as water for serving or grain and pulses for (short-term) storage. In both groups, two general types could be discerned, resulting in four basic types (FIG. 7A-D). Small jars/jugs with straight neck/wall profile could be divided in a group with plain out-turned rims (H100), and in some cases with considerably thickened out-turned rim (H101). Likewise, the large diameter group was divided in plain (H101) and thickened (H111) out-turned rim jars/jugs. Combined, these four types occur throughout virtually the entire fabric spectrum, including all lime-tempered wares (227, 228, 229, 232), other common wares (236), tableware (11, 237, 238, 239, 242) and even a couple of sherds in cookware fabrics (230, 246). At Kilisi Tepe[84] comparable material has been found as residual Hellenistic material in later deposits. For these vessels, rim diameters ranged up to 12 cm, allowing the comparison with the smaller H100/110 group.



GRAPH 1: Comparison between rim diameters and diameter of most narrow point for jars/jugs.

As mentioned earlier, only a handful of trefoil spouts could be identified at Düzen Tepe. As with the basic jug/jar shapes we left room for identification of small and large trefoils by allocating two variant codes (respectively H102 and H112). However, so far only one specimen was found with its full profile preserved to allow attribution specifically to the H112 group (FIG. 8A). The limited amount of examples, however, forces us to consider both variants together as H102/112. As with type A120, this shape resulted from skeuomorphism of metal prototypes, such as those found at Pasargadae[85], or stone as in Persepolis[86]. Examples in pottery have been found at Tarsos[87], Gordion[88], and Ephesos[89]. At Düzen Tepe, these jugs were made from both lime-tempered common wares (227-229) and buff tableware (237), as well as one peculiar fragment in a dense and fine grey fabric with traces of a thin black finish or slip both at the in and outside. This sherd was initially attributed to the Burdur group, but could possibly be imported from elsewhere.

[84] Nevett and Jackson 2007, fig. 412, no. 997-998-1001.
[85] Stronach 1978, Fig. 113, no. 9.
[86] Schmidt 1957, Pl. 71, no. 6-7.
[87] Goldman 1950, Fig. 123, 92.
[88] Stewart 2010, Fig. 13, D + Fig. 25, C.
[89] Mitsopoulos-Leon 1991, Tafel 54, B 114-115.

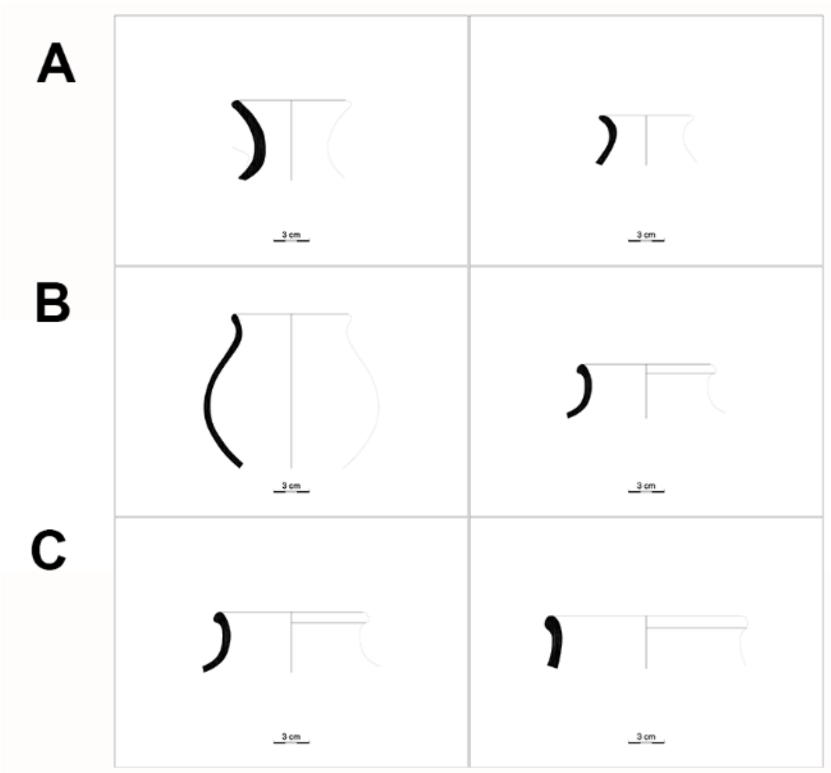


Figure 7: Jars/Jugs.

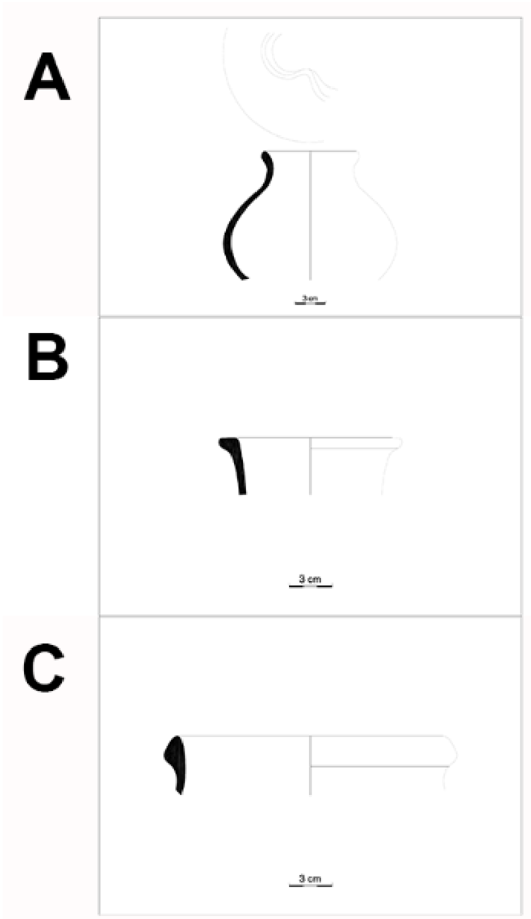


Figure 8: Jars/Jugs.

Next to the more common basic types of jars/jugs, a few rarely occurring types have been identified as well. Out of these, two will be described here. First, a type of jar characterised by a simple outward folding of the upper part of the vessel wall, resulting in the forming of a flattened projecting rim jar/jug (H130, FIG. 8B). This type was produced in the full spectrum of lime-tempered fabrics (227-228-229-232) as well as the buff tableware (237). Second, a few examples of jars/jugs with almond shaped rims (H140, FIG. 8C) were attested as well, albeit rarely. In comparison, at Sagalassos this shape would become one of the most prominent features of the late Hellenistic pottery assemblage, recurring in common ware, cookware, and tableware fabrics.[90]

Cooking pots (Q)

Cooking pots are quite common at Düzen Tepe and represent about 19% of the total studied diagnostic material. A typical cooking pot in Düzen Tepe has an ellipsoid-shaped body, with larger specimens tending towards a globular shape and the smaller ones often showing an S-curved profile. The collar is generally slightly out-turned, but is often absent or very short. A distinction is made between simple out-turned rims, sometimes thickened (Q200, FIG. 9A) and rims that were smoothened and flattened, thus creating a defined band at the outside (Q210, FIG. 9B). Next to the highly distinct volcanic-biotite based cookware (230), and gritty black core fabric (250), a third fabric (246) can be systematically related to our two main types of cooking shapes (but especially Q210). However, this gritty orange-red fabric was most likely not suited to deal with the thermic shock of heating and can probably be linked to some sort of short-term storage functionality.

The concept of a cooking pot is specifically functionally oriented and rather conservative by nature as it reflects basic food preparation and consumption practices and habits.[91] This resulted in only minor variations in details such as handles, base or rim, with little changes to overall shape or dimensions.[92] This makes it more difficult to trace similar morphological traditions. The cooking pots of Gordion[93] from middle Hellenistic times (before 200 BCE) do however, show similarities with the cooking pots found at Düzen Tepe. A morphological parallel of type Q200 can be found at Salamine[94], dated to 150-50 BCE.

Most cookware sherds belong to closed vessels of type Q200 or Q210. Some rare but notable exceptions occur. First, a handful of clearly open vessels have been identified (Q220, FIG. 9C). These large dishes characteristically have a heavy incurved rim as well as a carination right underneath the curve. It has been suggested that such a wall shape allowed large lids to be placed on the vessels. However, it remains unclear whether this type was at any point part of cooking practices and should therefore be considered a casserole or not. It should be noted that no clear fire clouding or burn marks were noted on the outside of the vessel. Perhaps it can be suggested that these dishes were used to help prepare foodstuffs in the kitchen. Comparable material has again been found at Gordion[95]. Finally, a few fragments have been found of cooking pots with fairly restricted openings and a strong carination of the rim, forming a convex shoulder profile and flaring ledged rim (Q250, FIG. 9D). This flaring rim could be either everted slightly upwards or more strongly flaring outwards, creating an everted S-profile. This type of cooking vessel would become more prominent in the pottery of Sagalassos from 200 BCE onwards. Comparable material has been found at Salamine[96] on Cyprus and in Knidos[97], where it was dated to the period between late 3rd century and third quarter of the 2nd century BCE.

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[90] Daems *et al*, in preparation.
[91] Cleymans *et al*, this issue.
[92] Stewart 2010, p. 167.
[93] Stewart 2010, fig. 92 F, 96 A, 101 C, 115 A,189-191 and 215-217.
[94] Diederichs 1980, Pl. 5: 55-58.
[95] Stewart 2010, Fig. 173, nr. 201
[96] Diederichs 1980, Pl. 5, nr. 59
[97] Kögler 2010, Abb. 13, nr. D.84 + Abb. 23, nr. E.168-169

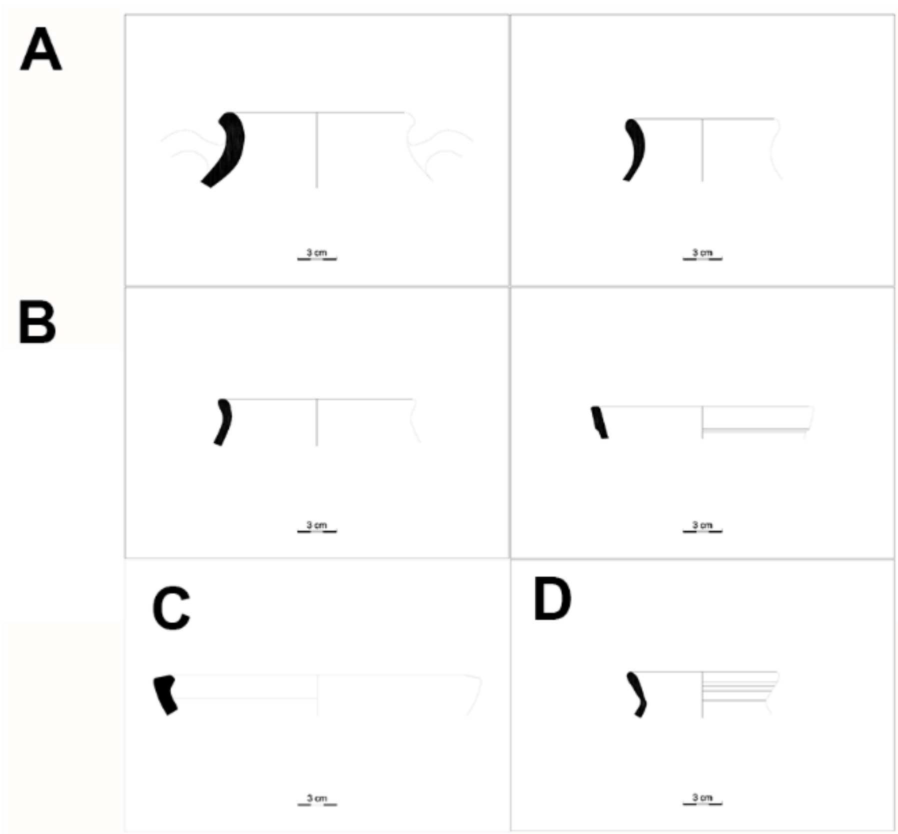

Figure 9: Cooking vessels.

Other (FIG. 10)

- Brazier (U100)

A few fragments have been found that can be considered as a brazier or portable hearth. These half-open, horseshoe-shaped objects could be moved by one or two handles, either a vertical one at the middle, or horizontal ones on each of the sides, to be placed outside or inside houses to provide heat or be used for cooking. Cooking pots were placed on top of the brazier, leaving space on the half-open side to replenish fuel. Interestingly, these objects were not produced in a cookware fabric that was specifically aimed at dealing with absorbing thermic shock, but rather in one of the lime-tempered common wares (232).

- *Mortar* (E200)

A kind of large, heavy open dishes with spout at the rim is identified as a mortar, used as a utilitarian vessel in the kitchen to prepare food, such as mixing ingredients or mashing grains to pulp that could be poured into another receptacle through the spout. This example was made in the cookware fabric of Düzen Tepe (230) but clearly smoothened at the surface.

- Krater/basin

A few examples have been found of large open receptacles with a wide flat rim and heavy, downturned handles. These vessels can be identified as some kind of basin. Examples have been found both in one of the lime-tempered common wares (227) as well as one in a very fine fabric produced with Çanaklı clays, highly similar to the clays used for the later production of SRSW at Sagalassos. Especially for the latter specimen, a function as krater to be used as tableware, perhaps for mixing or serving wine can be tentatively suggested.

- Lid (J200/210)

A number of small lids has been identified, generally divisible in two types: flat lids with a rounded and thickened outside border (J200) and domed lids ending in a knob handle (J210). Examples have been found both in buff tableware (237) and cookware (230) fabrics.

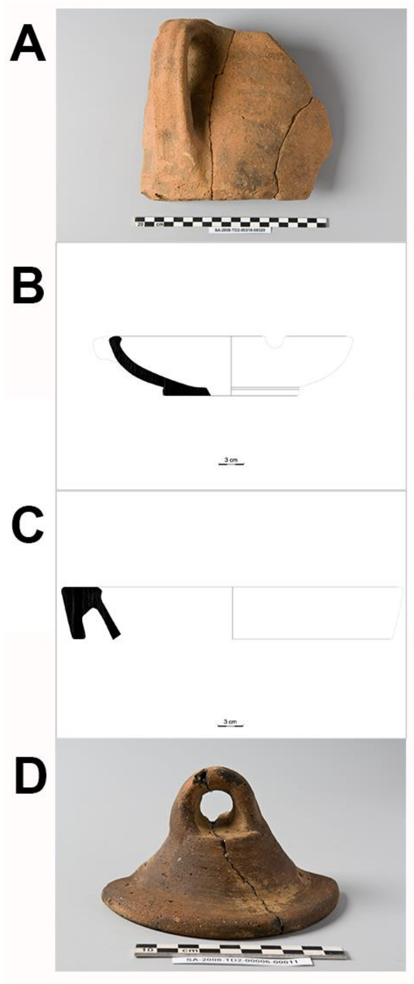

Figure 10: Other pottery.

1. *Handles & bases*

Due to high fragmentation of the material it is difficult to conclusively link certain types of handles or bases with certain types of vessels. Some indications can be found in the few vessels with better preserved profiles and rims with attached handles and bases. Our only conclusively attested type of cup, the A120 Achaemenid bowls, are generally considered to be handle-less vessels. Achaemenid bowls characteristically have either a flat or a so-called *omphalos* base. Only one such example of the latter has been identified (FIG. 11).

Regarding tableware, handles and bases can therefore be most firmly linked to the bowl/dish component of the material. Bowl/dish bases range from small ring bases with rounded underside to larger standing foot bases with flattened underside. In the common wares, a similar range can be observed, supplemented with both flat bases and so-called 'raised flat bases' or disc bases (FIG. 12). Both categories also occur in the cooking vessels, although raised bases clearly occur more frequently. Flat bases are found elsewhere in Achaemenid Sardis[98] and in Gordion during middle Hellenistic times[99]. Raised bases also appear in a sounding at Xanthos[100] dated to the early 5th century BCE, in the Hellenistic material of Salamine on Cyprus[101], as well as in a 4th century context in Troy[102], where these are called 'jug foot bases' attested in a local production line of jars. Düzen Tepe therefore appears to

[98] Dusinberre 1999, pp. 94-95.

[99] Stewart 2010, fig. 92 F, 96 A, 101 C, 115 A,189-191 and 215-217.

[100] Yener-Marksteiner 2007, pp. 97-98 and Abb. 11, 12.

[101] Diederichs 1980, Pl. 5, no. 55-58.

[102] Berlin 2002, Plate 19, no. 117-123.

be firmly embedded in a broader Anatolian tradition. By way of contrast, the Greek mainland and the Levant[103] preponderantly used round base cooking pots.

Figure 11: Omphalos base from Achaemenid bowl.

Handles for tableware fabrics are generally rather small and rounded. Both circular horizontal and ellipsoidal vertical handles are commonly attested. Occasionally, a larger flat strap handle has been identified as well. A similar range of handle shapes can be observed in the common wares as well, although here the strap handles appear more frequently (FIG. 13). These can probably be linked to a storage functionality associated with the larger jar component of the material. In cookware as well, handles consist mostly of strap handles, sometimes ribbed, placed on the shoulder and connected to the collar. Rounded handles only appear sporadically on some of the smaller cooking vessels. Both one-handled and two-handled cooking pots are attested.

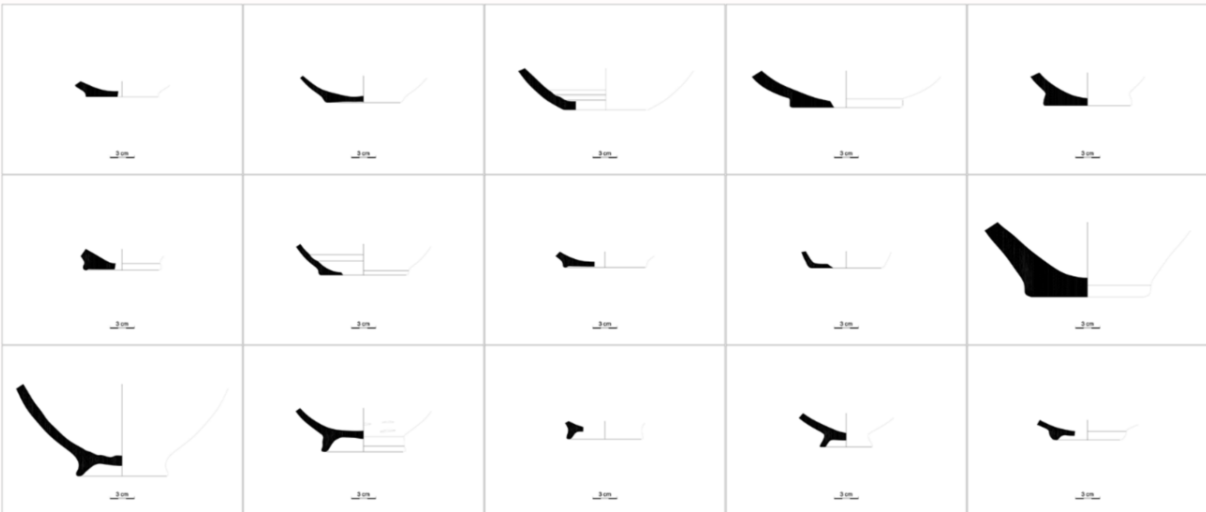

Figure 12: Bases.

[103] Rotroff 2006a, fig. 71-81; Edwards 1975, plate 27-28; Hayes 1991, fig. XXVIII-XXXVI; Jackson and Tidmarsh 2011, fig. 81-83.

Figure 13: Handles.

Discussion: framing pottery

The main aim of this paper so far has been to present an overview of the major components of the pottery found at Düzen Tepe. Can we now conclude the descriptive work with providing some context for the nature of this material culture against a wider perspective?

A first observation is that save for Achaemenid bowls, no repertoire of drinking cups was conclusively attested. There is no evidence for any *kantharoi, skyphoi, mastoids,* or two-handled cups that are all frequently attested in the Aegean world.[104] The bowls and dishes found at Düzen Tepe are mostly of simple forms, with shallow bodies and simple, functionally inspired rims. No indications were found for so-called 'saltcellars', identified frequently at Troy for example.[105] Compared to other Anatolian sites such as Troy, Ephesos, Sardis and Kilise Tepe, a markedly different tradition of cookware is attested, with little evidence for thin-walled vessels with everted rims typical for such types as *chytra* and *lopas* pots. Instead, we must turn to the area of central and southern Anatolia, with sites such as Gordion, Xanthos, as well as Salamine on Cyprus, to find comparable material.

Not a single amphora fragment was identified at Düzen Tepe, suggesting the settlement did not participate in this type of long-distance exchange networks. Other notable absentees of Greek-style pottery are *choes* and *olpe*, with only one or two tentatively identified kraters found as well. One body sherd could possibly be attributed to a *lagynos*, but here as well identification remains highly tentative. As far as decoration is concerned we find, if any, only highly rudimentary decorative elements such as a few dots and stripes. No attestations of, for instance, the characteristic West Slope decoration were found on any of the sherds studied at Düzen Tepe. Many sherds were heavily affected by post-depositional weathering conditions, leaving only limited traces of slips or other surface treatments. Where traces have remained, the pottery of Düzen Tepe appears to be furnished with dull, mottled slips characteristic for the tradition of so-called colour-coated vessels.[106]

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[104] Rotroff 1997a.
[105] Berlin 2002.
[106] Hayes 1991.

All in all, the impression of the pottery from Düzen Tepe is one of relatively simplicity and tradition. All steps of the production process, ranging from raw material selection, over forming practices to the firing of the vessels, were professionally organised and conducted by a knowledgeable artisan, but primarily aimed at fulfilling its functional purposes as was suitable for the village community proper.[107] No indications have been found that the pottery of Düzen Tepe was directed towards a wider market[108], suggesting this local production was first and foremost aimed at supplying the own community. This need not imply that production took place in an isolated vacuum, independent of outside developments.

Clearly, this pottery was embedded in larger trends of production preferences and styles. It is particularly noticeable, however, that this framework was not geared towards the Greek world, as little similarities could be found with the material from the Greek mainland, the Cyclades or the Anatolian West Coast. Instead, production was grafted upon an Anatolian template, with particular coherence found in material culture of central and southern Anatolia. Where certain 'Atticizing' elements do occur, such as for example the typical black-glazed tableware production, besides a limited number of imports, the community rather turned towards a local interpretation of the features as they started to produce their own black-glazed ware.[109] This development as well was part of a wider Anatolian phenomenon, as was for example also noted at Ephesos, Sardis and Tarsos. Even where more 'eastern' influences are sometimes supposed as with the introduction of the Achaemenid bowls in Anatolia, for instance, it has been argued this development should be viewed within a central and southern Anatolian context of local/regional interpretations of more general Persian fashions.[110] In this respect, it is interesting to note that the distribution of Achaemenid bowls in eastern Anatolia appears far more uneven and sparse.[111]

Most comparative material indicates that the production of the material presented here can be traced back to the end of the 4th and (especially) 3rd centuries BCE. This neatly fits the preliminary identified chronological window of 5th to 2nd centuries BCE. While a restricted part of the material might place the outer ends of the period of habitation of the settlement towards either end of this range, the majority of the pottery at Düzen Tepe can be most convincingly related to habitation during the 4th and 3rd centuries BCE.

[107] Braekmans 2010, pp. 286-299.
[108] Braekmans et al. 2017, p. 18.
[109] Braekmans 2010, p. 290.
[110] Lungu 2016.
[111] Summers 1993, p. 88.

	250	230	246	227	228	229	232	234	236	241	237	238	239	242	244	245	Import	Storage
A120	0	0	0	1	0	0	0	0	0	1	1	0	1	0	1	0	1	0
B140	0	1	0	1	1	1	0	0	1	0	1	0	0	0	1	1	0	0
B150	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	0	0
B170	0	0	0	1	1	1	1	0	1	1	1	0	1	0	1	1	0	0
B230	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
C120	1	0	0	1	1	1	1	0	1	0	1	0	1	0	1	0	0	0
C121	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
C170	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0
C171	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0
C172	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
F120	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
F150	0	0	0	1	1	1	0	0	0	0	1	0	1	0	1	1	0	0
G100	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1
G110	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1
G120	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1
H100	0	0	0	1	1	1	1	0	0	1	1	1	1	0	1	0	0	0
H101	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0
H110	0	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0
H111	0	0	0	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0
H102/112	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0
H130	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0
H140	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0
Q200	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Q210	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Q220	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Q250	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Q251	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 14: Presence/absence types per fabric.

4.2.1.2 The pottery of late Achaemenid Sagalassos: an overview

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This paper was published in the first volume of the 2017 edition of Herom: Journal on Hellenistic and Roman Material Culture. It presents the results of material studies conducted in 2016 on the Achaemenid pottery material from Sagalassos. While the goals of the material studies conducted in that year were to study, on the one hand the pottery material from Düzen Tepe, and on the other hand, the Hellenistic material of Sagalassos. The small amount of sherds presented in this paper were discovered to be associable with the preceding, Achaemenid occupation phase at Sagalassos, thus offering proof of the oldest substantial phase of habitation at the site. As such, it was considered important enough to consider a separate publication, but still in association with the contemporary material of Düzen Tepe in the Herom volume. Prof. Jeroen Poblome was included as co-author for providing the framework of analysis for these sherds, as well as helping with the identification of diagnostic features of the Achaemenid material. The text was completely written by myself, but improved by feedback provided by prof. Poblome during the writing process

Introduction

A long history of archaeological research by the Sagalassos Archaeological Research Project has resulted in significant understanding of the Roman imperial to early Byzantine phases of urban development at Sagalassos[112]. Unfortunately, due to stratigraphical superposition and oftentimes large-scale and invasive building operations during the main phases of urban development, original and/or earlier structures, layers and archaeological material have remained largely beyond reach in the extant archaeological record. As a result, the early phases of the development of the original settlement at Sagalassos can never be explored systematically. In recent years, the project has executed a concerted research programme, combining targeted archaeological excavations with intensive material studies of the excavated pottery, in an explicit attempt to improve our understanding of the origin and initial development of Sagalassos, based on what little the archaeology of the site has on offer[113].

In this paper, some of the results of the recent material studies will be discussed. Most of the time it is quite difficult to differentiate between late Achaemenid and early Hellenistic (5th to 3rd centuries BCE) material. As a result, both periods are generally grouped together during material studies.[114] The aim of this paper is to present a small body of material that can be considered the oldest pottery sherds known from the archaeological site of Sagalassos proper, unequivocally ascribed to the late Achaemenid period (late 5th – 4th centuries BCE) based on properties of fabric and typology. This material was found associated with excavated contexts from the later, Roman town, as well as forming part of surface materials found during intensive city survey (CS) campaigns, mainly from the southwestern parts of town (FIG. 1)[115]. The wider historical and archaeological implications of the presence of this material will not be considered here.

[112] Jacobs and Waelkens 2013.
[113] Talloen and Poblome 2016.
[114] A total of 722 of such sherds has been identified from both surveys and excavations.
[115] For the intensive urban survey, see Martens 2005.

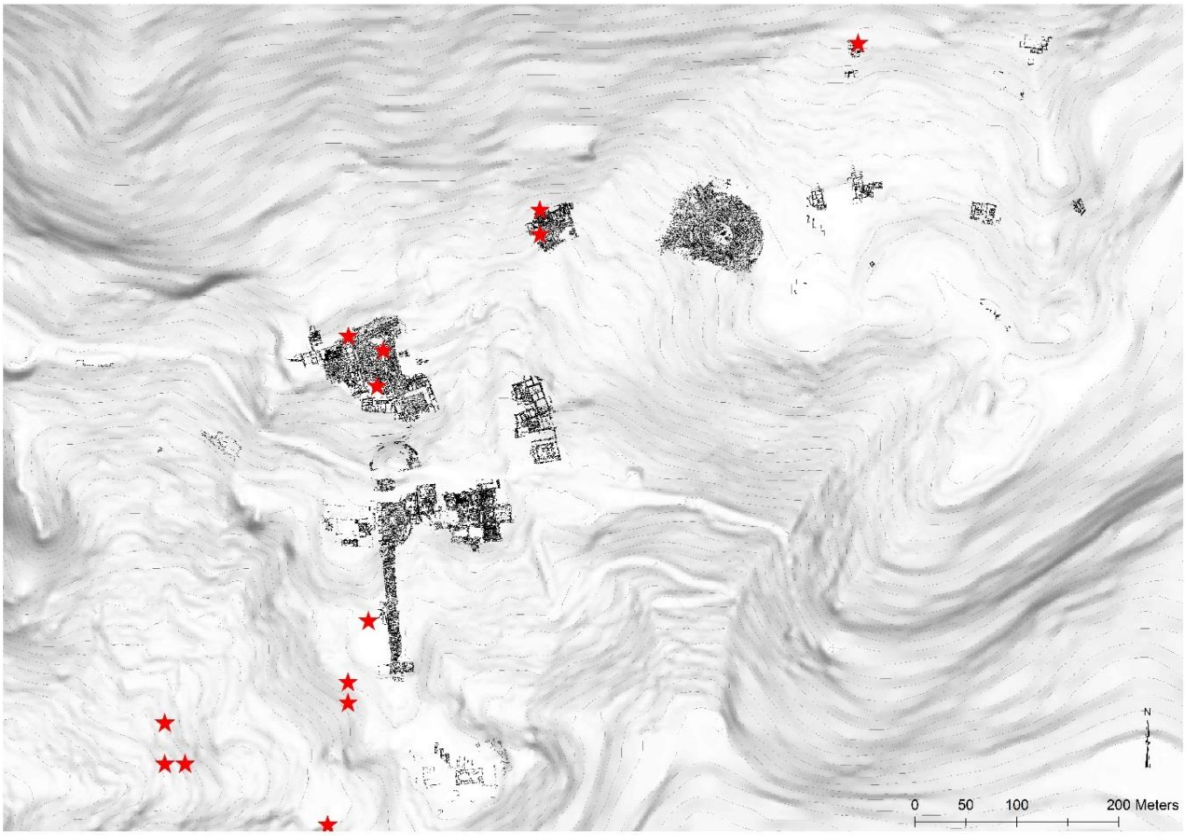

Figure 1: Find locations of relevant contexts within the urban area of ancient Sagalassos.

Presenting pottery

An overview of the material under scrutiny can be found in TABLE 1. Insofar as it is possible, we used type codes from the late Achaemenid-early Hellenistic pottery typology, recently constructed for the nearby settlement of Düzen Tepe (for the full typology, see 4.2.1.1).
It must be noted that the full typological spectrum as reconstructed for the pottery studied at Düzen Tepe is not present in this dataset. Clearly, jars (sherds 1-3-4-5-7-8-9-10-14-17-21-22-23) and cooking vessels (sherds 2-11-13-18-20) feature most prominently. Tableware is only exceptionally present (sherds 12 and 19). Two reasons can be suggested. First, tableware from this period is not easily distinguishable from comparable material from slightly later, due to similar diachronic practices of raw material usage from local sources. This is of course most relevant for material collected at the surface during survey campaigns, where an effective multi-chronic palimpsest emerges at the surface and no stratigraphic arguments can be applied. Secondly, for the excavated material, the very nature of the contexts wherein this material was found might *a priori* be less likely to include tableware. We will return to this point later on.

A characteristic element of the pottery found at Sagalassos throughout its long-term history is the prominence of pottery production at the site itself.[116] Likewise, most of the fabrics (FIG. 2) used for the material presented here were produced with locally procured materials. First off, a range of fabrics was identified that can generally be considered variations within the same range of common wares, produced with locally procured clay raw materials. These fabrics are denoted with fabric numbers 12 – 13 – 14. The main macroscopic diagnostic feature pertains to the general colour of sherds, both at the surface and core, however other differences can be noted as well. Fabric 12 especially, is comparably easily identified due to its bright orange colour and overall more fine-grained texture. Sharp distinctions between fabrics 13 and 14 are somewhat more difficult to make, with the former

[116] Neyt *et al*. 2012; Braekmans *et al*. 2016.

showing a lighter shade of brown, whereas the latter entails a darker brown/greyish, sometimes up to shades of black colour. Fabric 14 also generally has more frequent inclusions. All three fabrics are quite soft and can be scratched by a fingernail, although harder ones do occur occasionally. The feel is rough to harsh, with an irregular and rough texture of the break. A moderate to abundant amount of medium to very coarse inclusions is present, generally poorly sorted. The most common inclusions are calcite (++), grog (++), quartz (+), feldspar (+), mica (+), lime (-), oxidized iron particles (-) and volcanic particles (-). Few indications of surface treatment can be observed, although occasionally traces of smoothening and/or dull finish can be observed.

Figure 2: Achaemenid pottery fabrics at Sagalassos.

This range of common ware fabrics was encountered in sherds 1-4, 7-10, 14-17 and 22. Additionally, the fabric of sherd 23 looks very similar to some of the identified common wares (especially fabric 12) but seems altogether more rough and brittle with more and larger inclusions, as well as more elongated cracks and voids both on the surface and in the break. Perhaps this fragment can be seen as a slightly less well produced example of the same common ware range. As far as we can tell, functionally this fabric range covers mainly simple large jars with thickened everted rims (H111) and cooking vessels (Q200) with similarly thickened rims and large strap handles (FIG. 3). Two exceptions are sherd 1, which is a closed storage vessel or *pithos* with a flattened outward protruding rim (G110), and sherd 16, which is an open bowl with an out-turned, rounded and flattened rim (C171).
Strikingly, in the latter case the forming technique is similar to its typological successors in Hellenistic times, when the upper part of the wall is stretched and flattened by the potter, resulting in a slightly thinned wall right underneath the rim. However, this example is considerably larger and thicker than most of its Hellenistic counterparts, resembling a heavier kind of dish encountered commonly in the region during the Archaic period.

	Locus	Context	Periodization context	Fabric	Type
1	SA-2002-CS-00078-1	Sector 26	Achaemenid + Roman	13	G110
2	SA-2004-CS-00051	Sector 27	Achaemenid + Hellenistic + Roman	12	Q250
3	SA-2004-CS-00090	Sector 40	Achaemenid + Hellenistic + Roman + Mid-Byzantine	13	Flat base jar
4	SA-2004-CS-00111	Sector 45	Achaemenid + Hellenistic + Roman + Post-Byzantine	13	Handle jar
5	SA-2004-CS-00111	Sector 45	Achaemenid + Hellenistic + Roman + Post-Byzantine	Common ware	H170
6	SA-2005-CS-00094-1	Sector 32	Achaemenid + Roman	Common ware	Flat wall/slab fragment with rounded knob
7	SA-2005-CS-00086	Sector 28	Achaemenid + Hellenistic + Roman + Mid-Byzantine	12	Jar with thickened rim flattened at outside and slight groove
8	SA-2005-CS-00086	Sector 28	Achaemenid + Hellenistic + Roman + Mid-Byzantine	12	Handle jar
9	SA-2005-CS-00086	Sector 28	Achaemenid + Hellenistic + Roman + Mid-Byzantine	12	Handle jar
10	SA-2005-CS-00086	Sector 28	Achaemenid + Hellenistic + Roman + Mid-Byzantine	12	Handle jar
11	SA-2005-CS-00102	Sector 30	Achaemenid + Roman	4	Handle cooking pot
12	SA-1992-UA-00070	Upper Agora: topsoil sector IX	Topsoil	Fine fabric	High standing ring
13	SA-2014-UA-00056-00052	Upper Agora: fill of water channel works	1st century CE + residual Achaemenid	Cookware	Q230
14	SA-2014-UA-00056-00052	Upper Agora: fill of water channel works	1st century CE + residual Achaemenid	14	Handle jar
15	SA-2014-UA-00056-00052	Upper Agora: fill of water channel works	1st century CE + residual Achaemenid	12	Base jar
16	SA-2014-UA-00070-00071	Upper Agora: construction trench honorific monument	2nd century BCE + residual Achaemenid	12	C172
17	SA-2010-UAN-00045-00041	Upper Agora North: cultural fill in street substrate	1st century CE + residual Hellenistic and Achaemenid	13	Handle jar
18	SA-2011-F-00056-00067	Site F: foundation trench terrace wall	Achaemenid + early Hellenistic	Cookware	Q200
19	SA-2011-F-00056-00067	Site F: foundation trench terrace wall	Achaemenid + early Hellenistic	237	A120
20	SA-2011-F-00056-00067	Site F: foundation trench terrace wall	Achaemenid + early Hellenistic	4	Q200
21	SA-2011-F-00081-00098	Site F: foundation trench terrace wall	Hellenistic + residual Achaemenid	Common ware	Handle jar
22	SA 1996-N-54.2	Site N: underneath steps south of Library	Roman + residual Achaemenid	12	H111
23	SA-1994-L-00167	Site L: back wall Library sector LVII-LIX	(late) Hellenistic + residual Achaemenid	Common ware	H111

Table 1: Overview of diagnostic Achaemenid pottery sherds at Sagalassos.

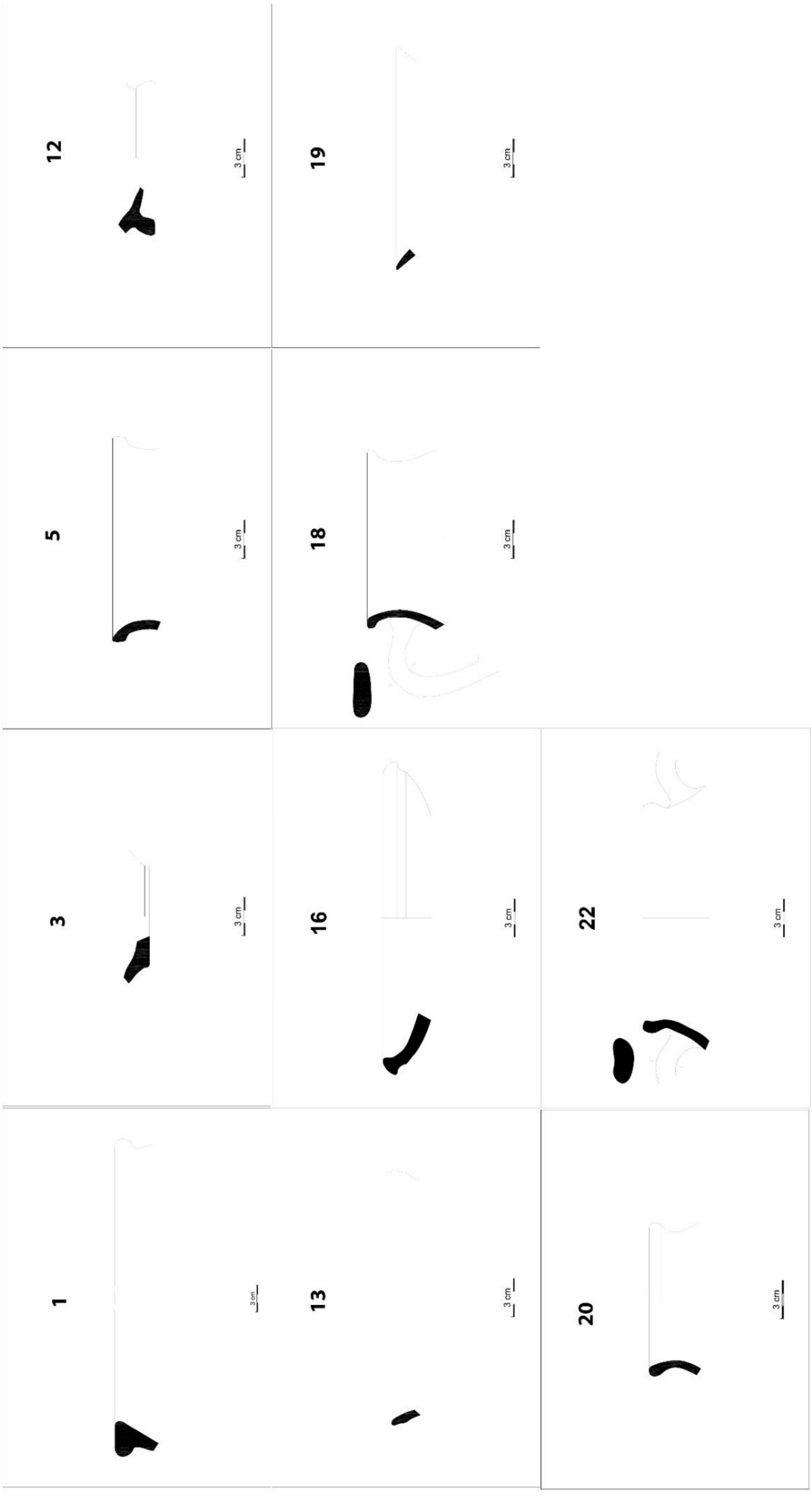

Figure 3: Profile drawings of diagnostic material.

Figure 4: Overview of some of the discussed material.

A gritty black core ware (fabric 4) was identified during a diachronic provenance study of cookware and storage/transport vessels from Achaemenid to Middle Byzantine times. This distinctive fabric can be considered as a precursor to the later, Roman imperial fabric 4, as it was proven that these were part of the same production context, with clays derived from the central part of the Ağlasun valley.[117] This fabric is characterized by a black/grey or dark brown colour in the break with the outer margins either black or oxidized towards a more light brown hue (5 YR 7/10). The surface is generally quite rough but can occasionally be smoothed extensively. Its texture can be very dense and range from a quite fine-grained to rough matrix. The break is rough to hackly and very rough. An abundant amount of inclusions can be observed, sometimes up to 2 mm and mostly poorly to very poorly sorted. These include quartz (++), calcite (++), grog (+), volcanic inclusions (+), mica (-) clay pellets (-), and pyroxenes and amphibole (-) minerals. In the sherds presented here it can be found in a rough horizontal attachment handle, possibly linked to some kind of storage vessel or cooking vessel (sherd 11) and in a rim fragment of a cooking pot found at Site F (sherd 20).

One fragment (sherd 19) of an Achaemenid bowl was found made from a buff tableware (fabric 237). This was a fully oxidized tableware, named after its systematic buff colouring (7.5YR 6/6). At Sagalassos, this fabric also appears in a paler shade of grey to buff colour. This fine fabric is somewhat powdery with mainly a few small calcite and feldspar inclusions less than 1 mm in size. Other, less frequently attested inclusions are small quartz and grog particles. Typically, the fabric has many small, rounded micro-pores, with occasionally larger pores present as well. Finally, four sherds are included the fabric of which could not be conclusively identified. Possibly, these were imported from an external, hitherto unknown source, however this cannot be conclusively proven at this point.

A final word regarding fabrics is reserved for perhaps one of the most crucial aspects of most of the pottery under scrutiny here, the slip. John Hayes[118] was a pioneer in describing the so-called colour-coated wares, a Hellenistic tradition of pottery characterised by a typical dull, semi-lustrous and mottled slip of variable colours, ranging from light brown to orange and reddish brown hues. For

[117] Neyt *et al*. 2012.
[118] Hayes 1991, pp. 23-31.

Sagalassos these kind of slips have been observed in a body of material related to the initial phase of urbanization dated to around 200 BCE[119], as well as in a number of contexts with Hellenistic material dating to the 2nd and 1st centuries BCE[120]. Interestingly, most of the sherds under scrutiny with traces of surface slips (sherds 1-10 and 17-21) do not adhere to this Hellenistic practice, but are instead situated within an earlier, pre-Hellenistic tradition of fat, sticky brown to reddish brown slips. Similar slips have for example also been found at the nearby late Achaemenid-early Hellenistic settlement of Düzen Tepe (FIG. 5).
The material presented here can therefore be described as (late) Achaemenid pottery. This is not to say we suppose that a distinct Persian/Achaemenid identity should be deduced from this material. On the contrary, it has been argued that the locally produced material culture at this time should rather be seen as distinctly and consciously geared towards an Anatolian template of material culture production and consumption.[121] A similar reasoning can be applied to this material. We therefore merely refer here to a chronological framework, to be situated, possibly, from the late 5th century BCE onwards, but mainly from early in the next century.

Figure 5: Pre-Hellenistic slip tradition at Sagalassos and Düzen Tepe.

Framing pottery

Two main groups of archaeological contexts can be discerned – resulting from survey and excavation activities. The individual intensive survey grids where relevant material was collected will not be considered in too much detail here as these generally determine palimpsest or collated chronological conditions on the material. Therefore, in the fourth column of TABLE 1 we listed the general periodization of the survey material found in that specific grid, rather than providing a specific chronological bracket as with the excavation material.
The general location of the relevant survey sectors requires some comment, however. The city survey programme of Sagalassos, coordinated by Femke Martens, was conducted between 1999 and 2005 with the general aim of trying to understand the overall urban development of Sagalassos, complementary to the specific localized image provided by the different excavations across the

[119] Talloen and Poblome 2016.
[120] Poblome *et al.* 2013, pp. 128-30.
[121] Daems *et al.* 2017

archaeological site.[122] After some initial methodological try-outs, a system of 20x20 m grids with walker distance of 2 m was applied across the entire occupied area of the Roman/Byzantine town alongside the monumental city centre (FIG. 7). The oldest material found during the city survey appeared fairly clustered towards the southwestern area of the later, Roman imperial settlement. Several reasons can be suggested to explain this observation. For example, the degree of intensity of later habitation could have been lower in this general area, resulting in less disruptive processes perturbing older material remains. Another possibility is that this strongly sloping area was subject to more erosion processes, especially upon the collapse of the original terraces, removing the younger layer and revealing older deposits of material.[123] While the effects of such processes cannot be entirely disregarded, we should still wonder why this significant effect is only observable in this southwestern area, and not in other, equally strong sloping areas of the former settlement. Most likely, the answer lies, as it so often does, somewhere in the middle, with less intensive post-deposition disturbances and certain erosive processes in a less monumentalized part of the site, resulting in a higher probability of older material remains to be found at the surface. Still, such probabilities can only manifest themselves if the material was there in the first place. So, although later occupation phases have destroyed virtually all architectural remains of the earliest phases of settlement, it can be suggested on the basis of the intensive urban survey results, that (one of) the oldest core(s) of habitation might have been situated in this general area of Sagalassos.

However, this is not the full picture. Although the survey material seems clearly clustered within the southwestern area, the excavation material tells a somewhat different story. As we generally have no *in situ* pottery from the late Achaemenid period, most sherds were encountered as residual material in younger deposits. Interestingly, these contexts were found widely distributed throughout the general area covered by the later phases of the town. This includes finds on and around the (later) Upper Agora in the city centre, to the south and north of the later Neon Library in the eastern parts of town, as well as at Site F in what would become the Eastern necropolis.

The contexts from the Upper Agora and Site F are particularly interesting. Control excavations were laid at the Upper Agora, *inter alia* to uncover the nature of a large anomaly identified during previous geophysical research by a team from the University of Ljubljana coordinated by Branko Mušič.[124] The anomaly in fact turned out to result from a large clay quarry. Pottery associated with the fill of the quarry in order to accommodate the construction of the original public square at this location was dated to around 200 BCE. The sherds datable to the Achaemenid period discussed here were found as residual material in this fill. Clay quarrying during this early period was also attested at the later Eastern Suburbium of Sagalassos.[125]

Core drills at the central depression of the Eastern Suburbium indicated the presence of a palaeosol layer, which had developed on top of a quarrying phase and that could be dated to 370-200 BCE[126], providing a *terminus ante quem* for the quarrying activities. The development of the palaeosol was linked to soil accumulation due to deforestation of the higher slopes. Clearing the area of its cover vegetation might be related to preparation of these lands for agricultural production. This suggestion is supported by the evidence from a series of terrace walls excavated in 2011 at Site F.[127] In the fill of the trench supporting one of these terrace walls, some of the oldest *in situ* stratigraphical contexts at the site were found, associated with sherds 18-21 of the material presented here. This wall was probably constructed to allow the area to be cultivated in order to supply the early community.[128] We can conclude that both agriculture and clay quarrying were important activities for the original

[122] Martens 2005; Martens *et al*. 2012.
[123] Martens *et al*. 2008, pp. 130-133; personal communication with Femke Martens.
[124] Talloen and Poblome 2016.
[125] Degryse et al. 2003.
[126] Vermoere et al. 2003.
[127] Claeys 2016.
[128] Claeys 2016, pp. 76-7.

community at Sagalassos during late Achaemenid times. The very nature of these contexts related to agriculture and clay quarrying could possibly have had implications for the nature of the material culture associated with these, in which the representation of fine tableware is perhaps somewhat less likely.

Conclusions

In this paper, we presented a small body of pottery, which can be unequivocally linked to the earliest phase of occupation and community organisation at the archaeological site of Sagalassos. Based on arguments related to typological and fabric features, this material can be securely placed in a pre-Hellenistic tradition and is to be situated during late Achaemenid times (late 5th - 4th centuries BCE), mainly based on comparable material at the nearby site of Düzen Tepe. The interpretation of the pottery presented here is one of a largely utilitarian, generic functional nature. We mainly encounter storage vessels, *i.e.* jars and a *pithos*, and cooking pots, with only few attestations of tablewares.
We have noted however that the very nature of the contexts in which the material was found, might *a priori* bias our sample against the wide representation of such tableware vessels. The limited amounts of available material do not allow any grand conclusions to be drawn from these observations. Still, it is interesting to note that for whatever reason, be it habitation, agriculture, or resource exploitation, a relatively large area was already connected and frequented, even at this early stage of site and/or community development, ranging from the outer southwestern point of the later settlement up to the eastern outskirts of town in the later Eastern Suburbium. We assume that this area was not nearly as densely occupied and intensively used when compared to later, Hellenistic and especially Roman imperial times. However, it is clear that even in the later Achaemenid period the local community made effective use of the space (and natural water sources?) that was available to them in order to sustain a range of activities and community dynamics.

4.2.1.3 The mid Hellenistic Pottery Repertoire made at Sagalassos, SW Anatolia

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This publication grew out of a paper presented at the 2nd Conference of the International Association for Research on Pottery of the Hellenistic Period (IARPotHP), held at Lyon in November 2015. The paper discusses the mid Hellenistic pottery material found at Sagalassos, mainly derived from a series of recent test soundings at the Upper Agora which provided the first cohesive pottery assemblage datable to the period at Sagalassos. Unfortunately, due to the absence of some key presented papers, the conference proceedings have not yet been published, although the editor has ensured me through e-mail correspondence in October 2018 that the review process had been initiated in and "should be completed soon". Co-authors included in this paper are, first, dr. Mark van der Enden, who performed the initial material studies on the Hellenistic pottery and constructed a first preliminary typology. I then used this preliminary study to refine the pottery classification and adhere it to prevalent best practices within the Sagalassos Project, as well as incorporate macroscopic fabric analyses, resulting in the classification as it is presented here. Second, dr. Peter Talloen was the site supervisor of the test soundings at the Upper Agora which provided the main component of the material that is presented. His first-hand knowledge of the stratigraphy of the excavation provided the essential foundation for the discussion of the relative chronology of the excavated contexts, allowing me to provide a substantiated base to argue that the material belongs to a cohesive material assemblage. Finally, prof. Jeroen Poblome again provided the essential intellectual and logistical environment to conduct the necessary material studies, as well as aided the search for parallels through his extensive library. The text has been largely written by myself, however, dr. Talloen provided some outlines for paragraphs describing the stratigraphic contexts of Upper Agora.

Introduction

The main purpose of this paper is to present and discuss the pottery associated with the genesis of an urban fabric at Sagalassos, more specifically hailing from the construction of its first public square preserved below the southeastern and eastern section of the later, enlarged Roman imperial Upper Agora (Figure 1)[129]. The Upper Agora of Sagalassos has been the object of archaeological investigation since 1993[130], continuing into recent years with a number of control excavations in 2014 and 2015. The construction of the public square has been dated the beginning of the 2nd century BCE and appears to constitute the start of the urbanisation process at Sagalassos[131]. It served as the heart of the community, where all central functions were represented and thus constituted the spatial core for the original phase of monumental urbanisation[132]. At the eastern edge of the square, a sizeable market building was constructed. This *stoa*-like structure with rooms for storage and workshops, and space for social and economic exchange, located below and behind the colonnades, is an example of a public monument inspired by Hellenic prototypes to appear in the Pisidian urban centres from the 2nd century BCE onwards[133]. Around the middle of the 2nd century BCE, a monumental terrace building, of which the function remains unclear for now, was erected to the northeast of the square. At the same time, elsewhere at the site, on the slope to the south of the Upper Agora, a Hellenistic potters' quarter was

[129] Talloen - Poblome 2016
[130] Waelkens *et al*. 1995. For an initial synoptic understanding of early community developments at Sagalassos, see Waelkens 2004.
[131] Talloen – Poblome 2016
[132] Hölscher 2012
[133] Köse 2005a

identified, suggesting the genesis of a significant production infrastructure[134]. Excavations at the extant northwestern section of the urban fortifications determined this part to have originated by the end of the 2nd century BCE, by which time the inhabitants of Sagalassos were also being buried in extensive, spatially dedicated necropoleis surrounding the urban area[135]. In sum, the 2nd century BCE saw Sagalassos transform into an urban community or polis.

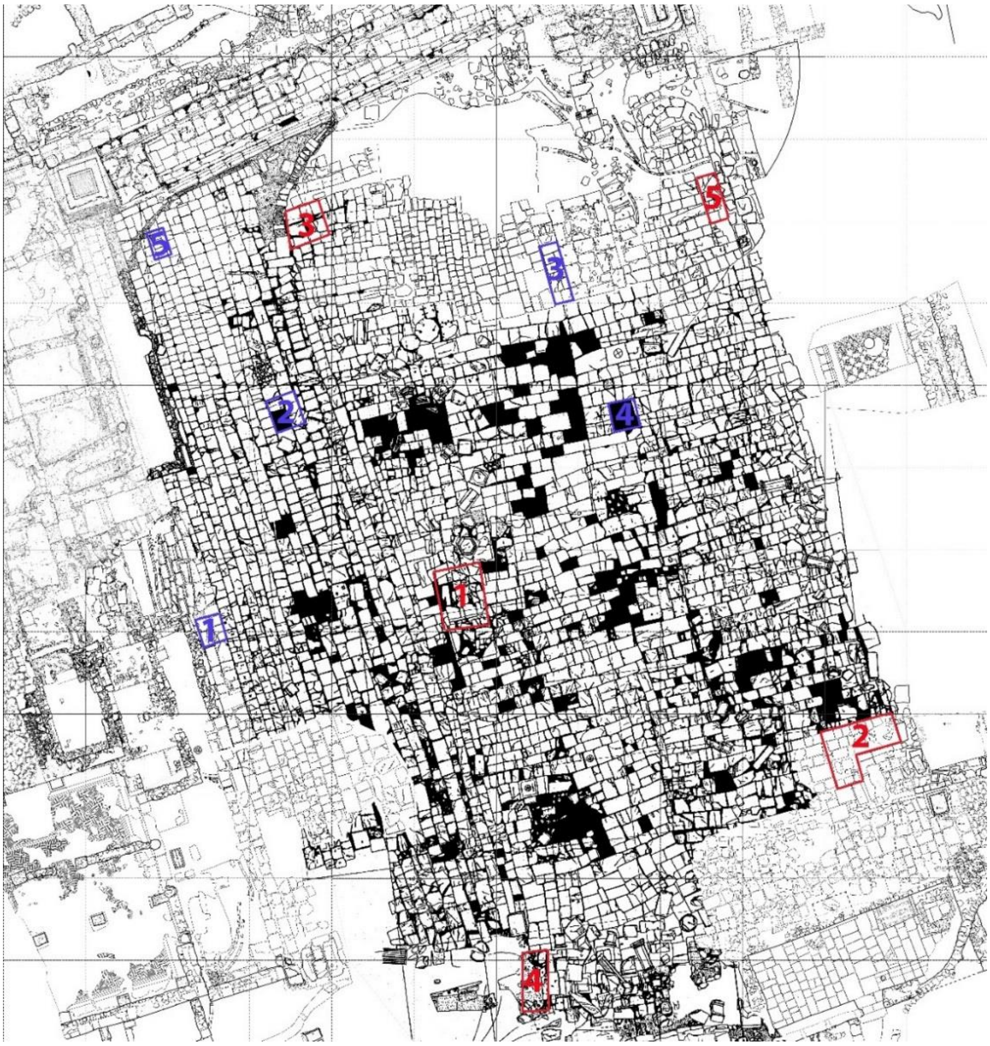

Figure 1: Masterplan of Upper Agora with indication of the control excavations in 2014 (blue) and 2015 (red) (Talloen and Poblome 2016).

Along with architectural developments, a number of profound changes in material culture were pushed along as well. It has been suggested that these changes were partly made possible in the context of a more elaborated production infrastructure and rode the wave of the urbanisation as well as the territorial expansion of Sagalassos (see 4.2.5). Recent excavations at the Upper Agora[136] have now for the first time provided a sufficiently extensive body of pottery to study the material culture associated with this phase of urban genesis in more detail. Our intentions are twofold: besides typological presentation, we will try to better contextualize this material both chronologically, to improve our understanding of urban genesis at Sagalassos, as well as spatially, by comparing this material to parallels found elsewhere.

[134] Poblome *et al.* 2013
[135] Köse 2005b
[136] Talloen – Poblome 2016

Pottery classification

The classifying and processing of pottery fragments at Sagalassos is essentially based on both fabric and shape[137]. A system of type codes is used to maximize classification potency. Type codes always start with a fabric identifier. Previous petrographic analysis identified a number of pottery fabrics for late Achaemenid and early Hellenistic times, attributing fabric numbers starting from the number 200[138]. Where possible, these fabric numbers have been retained. Fabric codes are supplemented with letters denoting general functional group: cups (A), bowls (B), dishes (C), containers (F), jars (H), and cooking vessels (Q). Finally, a number is added to differentiate specific forms within the different type groups, starting with 100, and rising with 10 for each new type, so A110, A120 *etc*. For any consistently recorded variant of a specific type, a new number is allocated rising with 1, so for type A100, variants are denoted with A101, A102 and so on. The full identification of a hemispherical cup made in the standard Hellenistic tableware fabric is for example '11A131'. Code numbers used for the Hellenistic material have been selected to comply where possible with the existing late Achaemenid/early Hellenistic typology[139] on the one hand, and the Sagalassos Red Slip Ware (SRSW)[140] typology on the other. Whenever typological continuity could be observed, we adopted existing numbering of either the chronologically preceding or subsequent typology, or, ideally, both. New numbers succeeding the existing Achaemenid/Hellenistic or Roman imperial series were attributed whenever new types were identified.

Fabrics

Tablewares

The main component of the Hellenistic tableware identified at Sagalassos, consists of a very fine fabric (fabric 11) which can be seen as the precursor of the local production of SRSW (fabric 1) in Roman imperial times[141]. Fragments in this fabric are predominantly fully oxidized, ranging from reddish yellow to brown (7.5YR 5/4 brown; 5YR 6/6 reddish yellow), although some reduced grey-coloured fragments occur as well. This well-levigated fabric is typically very fine and highly microporous with a very smooth feel and texture. Overall, very few inclusions can be observed, mainly small calcite particles, as well as occasionally some mica and volcanic inclusions. Pottery made in this fabric is usually slipped orange, brownish red or black, generally thin and dull or watery in appearance. These slips fit within the category of so-called 'colour-coated' slips, first identified by John Hayes and placed in a general chronological bracket between the 5th and 2nd centuries BCE[142].

Petrographic analysis conducted by the *Center for Archaeological Sciences* (University of Leuven), on some late Hellenistic sherds indicated two provenance areas for the clay raw materials of this fabric[143]. On the one hand, greenish detrital clays, originally accumulated as part of a sequence of lake deposits, were used, derived from the northwestern parts of the nearby Çanaklı valley (located at 7-8 km from Sagalassos)[144]. On the other hand, clay beds derived from a flysch-limestone weathering horizon of the bedrock found at numerous places on the flanks of the mountain ranges around the Ağlasun valley

137 For a more extended exposition on the praxis of pottery studies at Sagalassos, see Poblome - Bes (In Press).
138 Braekmans 2010
139 Daems *et al.* 2017
140 Poblome 1999
141 Poblome *et al.* 2002; Degryse - Poblome 2008; Within the Sagalassos Project this Hellenistic precursor to the Roman fabric 1 has traditionally been denoted with number 11, continuing on existing fabric numbers from Roman imperial times. To comply with fabric classification of late Achaemenid and Hellenistic times, Dennis Braekmans (2010) attributed number 241 to this fabric. In a recent publication (Daems *et al.* 2017) we continued the use of the number 241 as it provided the best fit with the chronological framework of that paper. However, as we discuss here the period for which it was originally conceived, we revert back to the use of number 11.
142 Hayes 1991
143 Poblome *et al.* 2002; Neyt *et al.* 2012; Braekmans *et al.* 2016
144 Poblome *et al.* 2002

were used as well[145]. Clay quarrying was, for example, attested at Sagalassos in the central depression to the east of the city centre, in what in Roman times would become the Eastern Suburbium. Here, core-drills provided evidence of a palaeosol horizon developed on top of a clay quarry phase that could be dated to somewhere between 370-200 BCE[146]. This *terminus ante quem* for the quarrying activities suggests that these clays were already in use from late Achaemenid and early Hellenistic times onwards. Although petrographic analysis indicated two distinct provenances, only a single fabric number is allotted, as differences between both are difficult to observe macroscopically.
A small amount of sherds can be linked to a local tradition of powdery 'buff' coloured wares (fabric 237) which can be traced back to late Achaemenid times. This fabric constitutes the main element of the tableware pottery at nearby Düzen Tepe, but is only sparsely encountered at Sagalassos. We will therefore not discuss this fabric in further detail here. The occurrence of a fully black slipped ware is a common feature in Hellenistic pottery, especially in the Aegean core area of Greek culture, and is commonly considered to have originated in Athens during the Classical period[147]. It has, however, been suggested that several production centres in Anatolia started to develop their own tableware repertoire, notably including a local production of black-glazed pottery, somewhere during the 3rd century BCE[148]. Likewise, we have found some evidence of a local production of pottery in a black-glazed fabric (238), albeit in very limited quantities.

Coarse wares

In general, we can differentiate between three fabrics (numbers 247-248-249) within the same general range of coarse wares. Again, these consist mainly of clays from the flysch-limestone group derived from weathered ophiolitic mélange found on the flanks of the mountain ranges at and around the settlement[149]. Fabric 247 is characterized by a bright orange colour whereas 248 and 249 are respectively lighter brown and greyish brown/black in colour. As this general tripartite division is encountered in local pottery throughout different historical periods, it was considered meaningful enough to justify creating separate fabric numbers. These fabrics generally have a relatively fine-grained to medium rough texture, with a slightly rough feel. A moderate amount of poorly sorted inclusions and small to medium pores can be discerned. The main inclusions are calcite (++); grog (++); quartz (+); feldspar (+); mica (+); oxidized iron particles (-); volcanic particles (-). Slip or other surface treatments other than some smoothening is generally absent, save for a few pieces with traces of a dull brown slip or wash.
Another coarse ware fabric is a notable 'gritty black core ware' (fabric 250). This fabric was identified as part of a diachronic provenance study of cookware and storage/transport vessels from late Achaemenid to middle Byzantine times[150]. Petrographic analysis has shown this typically black-coloured fabric to be part of the same production context, and therefore a precursor, of the later, Roman imperial fabric 4, using clays from the central part of the Ağlasun valley system[151]. Fabric 250 is characterized by a black/grey or dark brown colour in the break with the outer margins either black or oxidized towards a light brown hue (5 YR 7/10). The surface is generally quite rough but can occasionally be smoothened extensively. Texture can be very dense and range from a quite fine-grained to rough matrix. The break is rough to hackly and very rough. An abundant amount of inclusions can be observed, sometimes up to 2 mm and mostly poorly to very poorly sorted. These include quartz (++), calcite (++), grog (+), volcanic inclusions (+), mica (-) clay pellets (-), and pyroxenes and amphibole (-) minerals.

[145] Neyt *et al.* 2012; Braekmans *et al*. 2016
[146] Vermoere *et al*. 2001
[147] Rotroff 1997a
[148] For an Ephesian example, see Mitsopoulos-Leon 1991, 32-3
[149] Neyt *et al*. 2012
[150] Neyt *et al.* 2012
[151] Neyt *et al.* 2012

Types

Typologies at Sagalassos are in principle based on a four-tiered functional classification, consisting of general functional category / functional category / specific functional category / object, supplemented with a type code containing information on fabric, functional group, and type/variant. The full typology of the material discussed here can be found in Figure 2. For each particular functional category, a number of distinct types have been identified, including 5 different types and variants of cups, 3 bowls, 6 dishes, 2 containers, 9 kinds jars/jugs and 2 types of cooking vessels. Different types within the same functional category could perhaps have been linked to different specific functions in day-to-day activities. Different types of bowls have for example been linked to differences in eating practices, with incurving rim bowls said to be ideally suited for eating wet foodstuffs, whereas plain upturned rim bowls were rather suited for consumption of dry foods[152]. To what extent differentiated functionalities can be associated with every type/variant identified here remains an open question. Out of the full typology, the most prominent types will be discussed in more detail (see Figure 3)[153].

Cups

The first element of this typology (Figure 4) is the so-called Achaemenid bowl (*11A120 and 237A120)*, a bowl/cup shape with a convex-concave wall profile. The lower part of the body is sharply carinated. The upper part of the wall is flaring and culminates in an out-turned rim with simple lip. The form is the result of skeuomorphism of metal prototypes and can be traced back to the Persian heartland, at sites such as Persepolis[154] and Pasargadae[155]. It would go on to become highly popular throughout large parts of the Persian empire, including Anatolia, and would remain in use until the 2nd century BCE. At Perge, these drinking cups occur frequently in the Hellenistic *bothros* on the acropolis[156]. Elsewhere, they are attested at Sardis[157] and Gordion[158], although here only a handful examples are known, dated to the late Achaemenid period (5th – 4th centuries BCE). At Kelainai[159], the former Achaemenid capital of Greater Phrygia and presumed royal residence during the Persian period, the Achaemenid bowl is strongly represented in the material gathered in archaeological surveys[160]. Finally, Achaemenid bowls are also found at Paphos on Cyprus[161].

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152 Stewart 2010, 178

153 Note however that for some types counts displayed in table 2 also contain a number of variants grouped together. The counts of C170 therefore also include its variants C171 and C172, and F150 also includes F151.

154 Schmidt 1957, Plate 72, nr. 1

155 Stronach 1978, 242-243 nr. 13

156 Çokay-Kepçe - Recke 2007, 94-95

157 Dusinberre 1999, fig. 78-79 and 82 nr. 10

158 Stewart 2010, fig. 22-23 A, 26 A

159 Summerer *et al.* 2011, Pl. 3 nr. 26 a-b

160 Lungu 2016, 455

161 Hayes 1991, fig. I-II

General Functional Category	Functional Category	Specific functional category	Object	Functional Group	Type - Variant
Household Implements	Tablewares	Consumption	Achaemenid bowl	A	120
Household Implements	Tablewares	Consumption	mastoid cup	A	130
Household Implements	Tablewares	Consumption	hemispherical cup	A	131
Household Implements	Tablewares	Consumption	flaring rim cup with rounded inside	A	180
Household Implements	Tablewares	Consumption	mouldmade bowl	A	200
Household Implements	Tablewares	Consumption	plain upturned rim bowl	B	150
Household Implements	Tablewares	Consumption	incurving rim bowl	B	170
Household Implements	Tablewares	Consumption	rolled incurving rim bowl	B	270
Household Implements	Tablewares	Consumption	dish with rounded outside rim	C	170
Household Implements	Tablewares	Consumption	dish with flattened and protruding rim	C	171
Household Implements	Tablewares	Consumption	dish with flattened rim protruding both inward and out	C	172
Household Implements	Tablewares	Consumption	rolled rim plate	C	270
Household Implements	Tablewares	Consumption	saucer with projecting rim	C	280
Household Implements	Tablewares	Consumption	inwards turned rim plate	C	290
Household Implements	Tablewares	Serving	container with flattened rim	F	120
Household Implements	Tablewares	Serving	container with outward protruding rim (lekanè)	F	150
Household Implements	Tablewares	Serving	undercut lekane	F	151
Household Implements	Tablewares	Serving	plain rim jar	H	100
Household Implements	Tablewares	Serving	thickened rim jar	H	110
Household Implements	Tablewares	Serving	almond rim jar	H	140
Household Implements	Tablewares	Serving	blocked rim jar	H	170
Household Implements	Kitchenwares	Storage	ledged jar	H	260
(Personal) care	Cosmetic	Storage	unguentarium	I	200
Household Implements	Tablewares	Serving	flat lid/tray	J	200
Household Implements	Kitchenwares	Cooking	cooking pot with plain rounded rim	Q	200
Household Implements	Kitchenwares	Cooking	cooking pot with flattened outside rim	Q	210

Figure 2: Typology of the mid Hellenistic material from Sagalassos.

Types	Count	Percentages
A120	18	6,62
A130	37	13,60
A131	8	2,94
A180	1	0,37
A200	4	1,47
B150	15	5,51
B170	36	13,24
B270	25	9,19
C170	11	4,04
C270	1	0,37
C280	4	1,47
C290	4	1,47
F120	1	0,37
F150	35	12,87
H100	7	2,57
H140	25	9,19
H170	4	1,47
H260	6	2,21
I200	6	2,21
J200	4	1,47
Q200	2	0,74
Q210	18	6,62
Total	**272**	**100**

Figure 3: Type counts.

Next, the mastoid cup *(11A130 and 237A130)* is characterised by a flaring wall and out-turned lip. The degree of flaring of the wall varies. Its shape is again the result of skeuomorphism, imitating glass and metal counterparts[162]. Interior or exterior grooving just below the rim is characteristic but not omnipresent. The mastoid cup was a very popular shape across the eastern Mediterranean, with parallels identified *inter alia* at Halikarnassos[163], Knidos[164] and Ephesos[165] in Anatolia, Paphos[166] on Cyprus, and Corinth[167]. They appear in Athens during the first quarter of the 2nd century[168].
A variant of the mastoid cup, the hemispherical cup *(11A131)* has a slightly convex wall, in contrast with the straight flaring wall of the *mastos*. In addition, the lip is slightly out-turned and rounded off. Parallels have been identified from the middle Hellenistic period (200 BCE) at Gordion[169], Knidos[170] and Athens[171]. Finally, a cup shape with mould-made exterior decoration (*11A200*) was also identified. So-called mould-made bowls are considered one of the most widespread types of drinking cups in Hellenistic times, but are only rarely encountered at Sagalassos. Their emergence at Athens has been dated to 220 BCE[172].

[162] Rotroff 1997a, 12.
[163] Vaag – Nørskov - Lund 2002, plate 8 nr. B11
[164] Kögler 2010, abb.56 kn65
[165] Ladstätter 2003, Tafel 8 K73, Tafel 9 K92; Gassner 1997, Tafel 21 nr. 277, Tafel 72 nrs. H14-15
[166] Hayes 1991, fig. XLIV 35, XLVII 28
[167] Edwards 1975, plate 17 nr.532
[168] Rotroff 1997a, 110; fig. 20 cat. 328-331, figure 21 cat. 341 & 347, figure 96 cat. 1582
[169] Stewart 2010, fig. 93 K, fig. 97 K
[170] Kögler 2010, abb. 2 nr. b15-18, abb.10 nr. d.37, abb.14 nr. d.115., abb. 22 nr. e.131-133
[171] Rotroff 1997a, fig. 22 cat. 358, 362, 366
[172] Rotroff 2006a

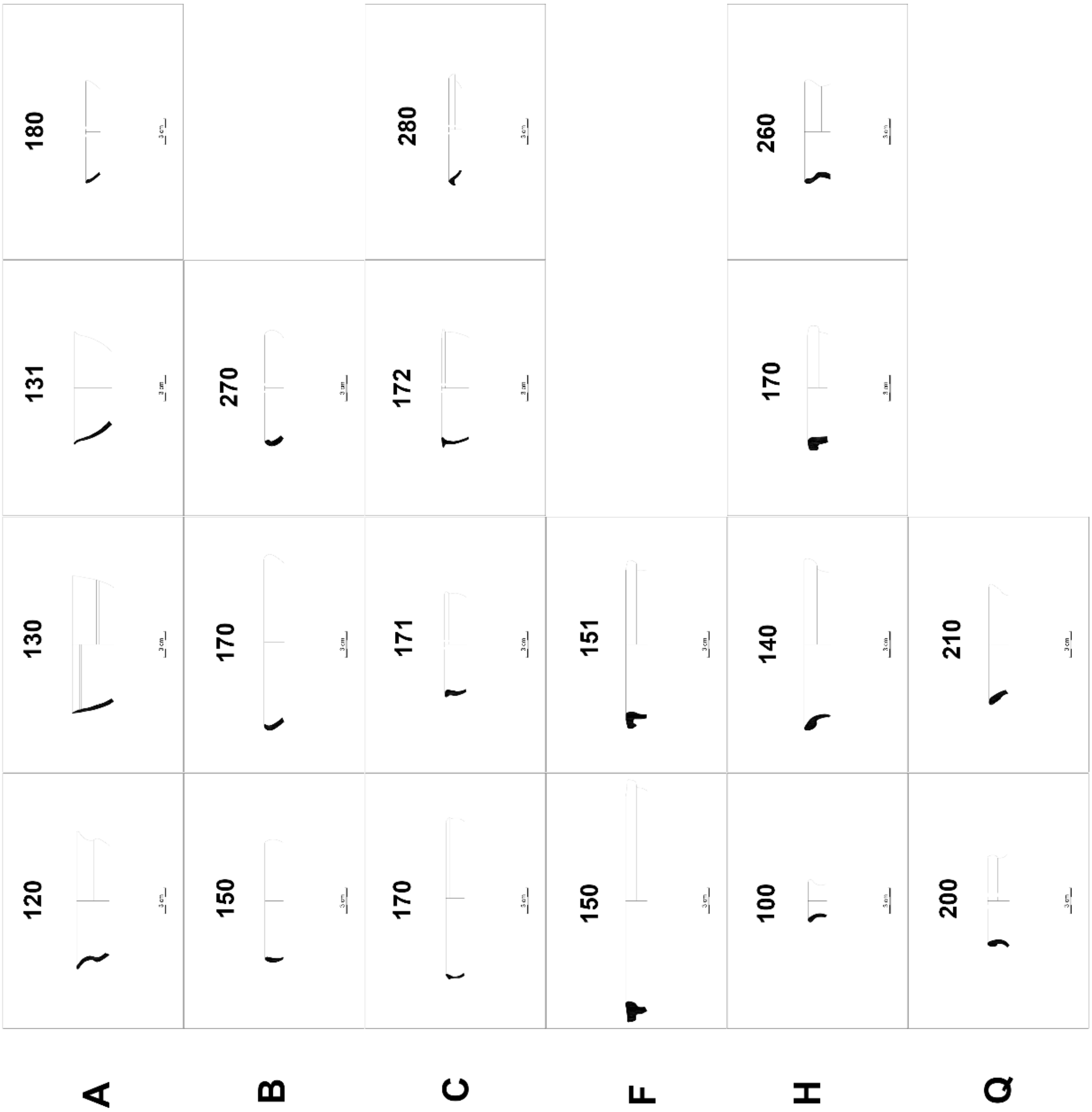

Figure 4: The main types of the mid Hellenistic pottery of Sagalassos.

Bowls

A frequently occurring type are bowls with plain upturned and rounded rims *(11B150)*. Some examples have a slight groove on the inside beneath the rim. Due to the generic nature of the shape, many parallels can be found, including at Gordion[173], where these were dated to the 4th and 3rd centuries BCE, as well as at Knidos[174], Halikarnassos[175], and Ephesos[176] elsewhere in Anatolia. At Antioch on the

[173] Stewart 2010, fig. 193 nrs. 25-29
[174] Kögler 2010, abb.1 nr. ac.3, abb. 9 nr. d.22-23
[175] Vaag – Nørskov - Lund 2002, plate 9 nr. B36
[176] Ladstätter 2003, Tafel 2 nr. K13; Gassner 1997, Tafel 44 nr. 534-535

Orontes in North Syria they were identified as indigenous 'non-Hellenic' shapes, dated to the 4th century BCE[177]. On Cyprus, parallels have also been found at Paphos[178].
Another frequently attested type are rim bowls with characteristic incurving rim (*11B170)*, sometimes thickened into a fat 'comma' shape. This typical bowl was found throughout the eastern Mediterranean during the Hellenistic period, commonly attested in Anatolia from the 3rd century BCE onwards. Examples have been noted in Anatolia among others at Ilion[179], Knidos[180], Ephesos[181], Sardis[182], Patara[183], and Gordion[184]. In North Syria parallels have been found in Antioch on the Orontes, dated to the second half of the early Hellenistic period (late 3rd to early 2nd centuries BCE)[185]. On Cyprus these were attested at Salamine[186] and Paphos[187], as well as in Corinth[188] and Athens[189] on mainland Greece.
Bowls with an overall similar shape as B170, but with characteristic rolled band formed on the inside of the incurving rim (*11B270*) have been frequently observed as well. These have been found at Paphos[190] and Gordion[191] where they were dated to the middle Hellenistic period (200 BCE).

Dishes
A type of open recipients of bowl/dish shape has a convex in-turning wall profile and a rim which is rounded on the exterior *(11C170*). Sometimes the vessel wall is slightly narrowed underneath the top of the rim. Bowls with out-rolled rims are one of the most frequent occurring types in the material from the Orontes valley in North Syria, where they are found both in Hellenic contexts dated to the 4th century and early Hellenistic contexts from the late 4th to early 2nd centuries BCE[192]. Everted rim bowls also occur at Ilion in contexts dated to the (second half of) 3rd century BCE[193]. A parallel shape is attested at Pergamon and dated to *c*. 250 BCE)[194]. Bowls with a similar shape are also attested at Paphos[195] and Sardis[196], where these were tentatively dated to the 4th century.
A variant of the C170 bowls/dishes has been noted, with a similar forming technique but instead of a rounded exterior, the top of the rim was flattened, resulting in an outward protruding lip (*11C171*). Parallels are found at Xanthos[197], Troy[198], and Paphos[199]. A similar type of projecting rim bowl at Gordion[200] was dated to the middle Hellenistic period (200 BCE), whereas at Sardis[201], a tentative date of 4th century BCE was suggested. Another variant on C170 and similar to C171 has been identified but

[177] Waagé 1948, plate 1 nr. H16-20
[178] Hayes 1991, Figure XIV nr. 9, 5
[179] Berlin 1999, pl. 4 nr. 112
[180] Kögler 2010, abb. 1 nr. Aa.8-9, abb. 12 nr. D.69
[181] Ladstätter 2003, Tafel 8 nr. K79; Gassner 1997, Tafel 71 nr. H
[182] Rotroff – Oliver 2003, Pl. 7-8
[183] Isin 2007, fig. 5-6
[184] Stewart 2010, fig. 218, fig. 219 nr. 256. 257, fig. 220, fig. 228
[185] Waagé 1948, plate II nrs. 76a-k
[186] Diederichs 1980, pl. 7 nrs. 65-74
[187] Hayes 1991, fig. XIV nrs. 10 & 13, fig. XLIV nr. 9
[188] Edwards 1975, plate 2 nr. 30
[189] Rotroff 1997a, fig. 63
[190] Hayes 1991, fig. XIV nrs. 14 & 18
[191] Stewart 2010, fig. 218 nrs.230-232-235, fig. 220 nr. 262
[192] Waagé 1948, pl. 1 nrs. H9-12, pl. 2 nrs. 41a & f
[193] Berlin 1999, pl. 4 nrs. 11 & 199
[194] De Luca 1968 pl. 39 nr. 80
[195] Hayes 1991, fig. XLII nr. 38
[196] Rotroff – Oliver 2003, Pl. 10 nr. 53
[197] Yener-Marksteiner 2007, Abb. 10: 10-11
[198] Berlin 2002, Plate 11: no. 56
[199] Hayes 1991, fig. LXI nr. 21, fig. LXVI nr. 26
[200] Stewart 2010, Fig. 93E
[201] Rotroff – Oliver 2003, Pl. 10 nrs. 51-52

with a flattened rim protruding both inwards and outwards (*11C172*). A single parallel can again be found at Troy.[202]
Finally, some sherds of a saucer with flaring or slightly convex wall profile and downturned projecting rim *(11C280*) were identified. The downturned rim resembles the popular tradition of fishplates widely encountered throughout the Hellenistic world, however, no indications have been found for the typical central depression traditionally associated with this type of material. Parallels are found in the out-turned rim dishes of Knidos[203] and Antioch on-the-Orontes, where it is dated to the late 4th century BCE[204]. The shape also features in local pottery production at Ephesos from the 3rd century BCE onwards[205].

Containers

The most prominent type of open containers identified at Sagalassos are characterized by a prominent outward protruding rim (*11F150*) with a wall profile that varies from straight to slightly convex. This type adheres to a tradition of so-called *lekanè* shapes that return frequently in the Greek world during the Hellenistic period. Parallels have, for example, been noted in the lekanè form 2 of Athens[206] and at Corinth[207]. The strong projecting rim is considered a 3rd century BCE feature in the case of Athens[208]. A variant to the regular F150 is characterized by a typical undercut projecting rim (*11F151*).

Jars/jugs

The basic components of the jug/jar ensemble at Sagalassos consists of simple forms characterised by a straight or slightly everted neck profile and plain rim commonly turning slightly outwards to facilitate pouring. A variant with thickened and rounded rims are also commonly attested. For this basic group, four distinct type codes are reserved[209] (*11H100/101/110/111*), respectively denoting small plain rim jars, small thickened rim jars, large plain rim jars and large thickened rim jars. For the material under scrutiny here, however, we do not have sufficient indications to explicitly differentiate between these four types. Therefore, we decided to group these basic jars under one common header (*11H100*) serving the quantification of the material. A parallel to this basic jar shape has been identified in the material of Ilion dated to the end of the 3rd century BCE[210].
Additionally, some more elaborate jar types have been identified as well. A first is characterised by a concave neck profile and slightly out-turned almond shaped rim, sometimes somewhat flattened at the outside rather than rounded (*11H140*, *247H240, 248H240 and 249H240*). Parallels for this type are attested at Halikarnassos[211], Ephesos[212], and Gordion[213]. The latter are dated to the middle Hellenistic period (200 BCE). Additionally, at Gordion they are identified specifically as cooking pots rather than jars. Based on the fabric in which these objects occurred at Sagalassos we are rather inclined to subscribe these to a (short-term) storage or serving function, but some uses for cooking or other food preparation practices cannot be excluded. For future cases where such a distinction might be made more clearly, a separate type code is reserved (*Q240*).
Some fragments have been found belonging to a jar type with straight neck profile and blocked rim (*11H170 and 247H170)*. Similarities can be pointed out with two large globular jugs with everted rim

202 Berlin 2002, Plate 14, no. 84
203 Kögler 2010, abb. 9 nr. d.28
204 Waagé 1948, plate I nr. H9
205 Mitsopoulos-Leon 1991, tafel 6 nrs. A21-22
206 Rotroff 2006a, fig. 42 cat, 252
207 Edwards 1948, plate 33 nr. 709
208 Rotroff 1997a, 167-168
209 Following the example of the late Achaemenid and early Hellenistic typology, see Daems *et al.* 2017.
210 Berlin 1999, pl. 7 nr. 95
211 Vaag – Nørskov - Lund 2002, plate 17 nr. G26
212 Gassner 1997, tafel 3 nr. 48, tafel 24 nr. 310
213 Stewart 2010, fig. 215 nr. 203

from Ilion[214], where they are dated to the second half of the 4th - early 3rd centuries BCE[215]. Finally, a jar type has been noted with convex shoulder profile and either straight carination of the rim or slightly everted S-profile, resulting in a 'collared' neck with a flaring ledged rim (*249H260)*. Again, fabric properties rather suggest a general jar/jug functionality, however the shape itself occurs in cooking vessels as well, for example at Knidos[216] where they are dated between the late 3rd and third quarter of the 2nd centuries BCE. In such future cases where a cooking functionality can be more unequivocally attributed, a separate code number *(Q250)* is reserved.

Cooking pots

The shape of cooking pots is typically considered to be rather conservative because of a combination of factors favouring the retention of existing practices. These include technological challenges regarding heat retention and thermal shock resistance, existing cooking technologies, practices of food preparation, diet and foodways. As a result, cooking pots are generally rather difficult to date. Unfortunately, the material under consideration here is too fragmented to allow reconstruction of the full profile of cooking vessels. Based on the shape of the rim, we can make a distinction between two different types of cooking vessels. One with simple out-turned rims, that were sometimes thickened and rounded (*250Q200*), and a second one with rims that were smoothened and flattened at the exterior, thus creating a defined band along the rim (*250Q210*). Interestingly, a similar distinction has been made for the pottery material from nearby Düzen Tepe, where cooking pots typically have an ellipsoid-shaped body, with larger specimens tending towards a globular shape and the smaller ones often showing an S-curved profile. However, whereas at Düzen Q200 predominated and Q210 featured only marginally, these proportions were reversed at Sagalassos. For Q200, parallels have been noted at Ephesos[217], Gordion[218], Salamine[219] and Athens[220], whereas the Q210 type occurs at Athens[221], Ephesos[222] and Gordion[223].

Discussion

In the previous part we presented the main elements of the typology of mid Hellenistic pottery at Sagalassos. A first question in discussing this material should be whether this can be considered a coherent assemblage or not? An assemblage has been defined as 'an open typological series containing those types which are representative for a certain phase in the chronological evolution of the pottery in a specific archaeological context'[224]. Our argument therefore needs to demonstrate that the material presented here has both internal and chronological coherence.

This discussion pertains to a total of 272 rim sherds, found in 27 loci, derived from 4 trenches spread over the agora. Because of this discrepant provenance, internal coherence across these contexts cannot *a priori* be considered a given. If we take a closer look, however, at the proportions between the types, both considering the overall total as well as the individual loci, we observe a markedly consistent distribution. In the total count (see Figure 3), the most common types (each taking up more than 5% of the total assemblage) are respectively A130, B170, F150, H140, B270, Q210 and A120.

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[214] Although the material found at Sagalassos is too fragmented to allow full profile reconstruction, as a result, the full body shape of these jars/jugs is currently still unclear. Nevertheless, similarities can be suggested based on the rim and the straight neck profile. Interestingly, these examples at Ilion have the same slightly sloping standing rings flattened at the bottom which frequently occur in the material of Sagalassos as well.

[215] Berlin 1999, pl. 6 nrs. 25-26-28-29-30-52

[216] Kögler 2010, abb. 13 nr. d.84, abb. 23, tafel 14 nr. e.168-169

[217] Gassner 1997, tafel 23 nr. 301, tafel 24 nrs. 309, 312

[218] Stewart 2010, fig. 191 nr. 15, fig. 216 nr. 212

[219] Diederichs 1980, plate 5 nrs. 55-59

[220] Rotroff 2006a, fig. 71 cat. 559

[221] Rotroff 2006a, fig. 72 cat. 567

[222] Gassner 1997, tafel 24 nr. 310

[223] Stewart 2010, fig. 215 nr. 206-207, fig. 216 nrs. 209, 211

[224] Poblome – Degeest 1993, 149

	Total	**15-UA-24-22**	**15-UA-58-62**	**15-UA-67-67**	**15-UA-71-77**	**15-UA-77-79**	**15-UA-80-89**	**15-UA-82-84**	**15-UA-90-97**	**15-UA-99-100**
A120	**16**	2	4	0	0	4	2	0	1	3
A130	**28**	0	4	1	4	13	5	0	0	1
A131	**5**	2	0	1	1	1	0	0	0	0
A180	**0**	0	0	0	0	0	0	0	0	0
A200	**4**	0	2	0	1	1	0	0	0	0
B150	**10**	0	0	1	3	1	2	2	1	0
B170	**28**	0	4	5	2	7	2	4	2	2
B270	**24**	0	5	3	7	4	2	1	1	1
C170	**10**	3	2	0	2	0	2	0	1	0
C270	**1**	0	1	0	0	0	0	0	0	0
C280	**2**	0	0	0	1	0	0	1	0	0
C290	**2**	1	0	0	0	1	0	0	0	0
F120	**1**	0	0	1	0	0	0	0	0	0
F150	**30**	4	4	2	8	8	4	0	0	0
H100	**7**	1	0	1	1	1	2	0	0	1
H140	**24**	2	2	1	5	8	2	2	1	1
H170	**3**	2	0	0	1	0	0	0	0	0
H260	**5**	1	0	0	2	2	0	0	0	0
I200	**4**	0	1	0	2	1	0	0	0	0
J200	**3**	0	0	0	1	1	1	0	0	0
Q200	**1**	0	0	0	0	0	0	0	1	0
Q210	**16**	0	0	1	1	0	4	4	3	3

Figure 5: Type counts for major excavation loci.

Interestingly, the combination of these types covers the full spectrum of the typology presented here, including drinking cups, bowls for food consumption, open containers for serving and/or storage, jars for serving and cooking vessels. If we look at individual contexts, limiting ourselves to only those contexts yielding the most diagnostic material[225], we notice that generally the same types dominating the overall assemblage consistently return most frequently in every context (see Figure 5). We can therefore conclude that these contexts show sufficient internal coherence to be at this point tentatively considered part of an assemblage.

Can we, in the next step, assess the chronological properties of these different loci? At this point, we will combine information on their relative stratigraphic order with a suggested chronological framework, based on comparison with pottery materials from other archaeological contexts at Sagalassos itself, as well as with external parallels.
First, it must be reiterated that the contexts under consideration are all part of a sequence of operations in function of the construction of the public square. Trench 4 of the 2014 control excavations touched upon the origins of activities in this area when an anomaly (25m long, 5m wide and more than 1m deep) previously discovered in the geophysical plan of the square, was identified as a large quarry dug into the ophiolithic clay, possibly to supply both local pottery production and provide building material for the mudbrick architecture. The filling of the pit marked the beginning of the initial construction phase of the agora. Contemporary loci have also been identified in Trench 2 of the 2015 excavations, where a first walking level, consisting of beaten earth and some small stones, was laid out, suggesting that the genesis of the square in this area can be dated to this period[226]. Very few diagnostic material was found in these oldest loci. Still, based on general fabric properties, it can be considered within the same general bracket as the main collection under consideration here. Throughout the subsequent sequence of construction activities, the pottery material associated with the original foundation of the square was mixed in with younger material, which was then interpreted as a *terminus post quem* for these subsequent interventions. To approach the chronology of this original foundation, we must therefore work our way downwards in the stratigraphy, starting with the youngest phase.
The square reached its final form in early Roman imperial times. It underwent a serious reworking at the beginning of our era, when, among others, *c*. 12 m high honorific columns carrying statues of local noblemen were erected in the four corners of the square[227]. Thus, the agora, previously a meeting place of the popular assembly, assumed a new socio-political role as a display case for the elite. Sometime afterwards, during the second quarter of the 1st century CE, the square was paved over, receiving a surface of limestone slabs which still remains in place today[228]. Trench 3 of the 2014 excavation season was laid out to the east of the foundation of a dismantled honorific monument, subsequently dated to the late 1st century CE.
Underneath the early Roman imperial level, an older substrate of a walking level was identified, consisting of a layer of beaten earth with small stones. The associated pottery material consisted mainly of, besides a few intrusive sherds of Roman pottery, late Hellenistic material (1st century BCE) with typical black and brown mottled slips. During the late 1st century BCE, the square had already been enlarged towards the west and north, as at several other locations comparable substrates of walking levels were found. The spread of these walking levels, as well as the positioning of adjacent buildings dated to the Hellenistic period, suggest a roughly 40m long (north-south) and 25m wide (east-west) open area during the 2nd and 1st centuries BCE[229]. These and subsequent operations and interventions at the square resulted in a fairly thorough reworking of some of the older contexts.

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[225] More specifically, nine contexts are considered, each providing at least 12 identified rim sherds.
[226] Talloen – Poblome 2016, 117
[227] Vandeput 1997
[228] Talloen - Poblome 2016, 132-133
[229] Talloen - Poblome 2016, 120-121

Underneath the late Hellenistic walking level in Trench 3, a layer was found with markedly less intrusive Roman material. Based on both shapes and fabrics, the majority of this pottery predated the late Hellenistic material, with, for example, no traces found of shapes characteristic for that period such as ovoid cups, fishplates, upturned rim dishes, and a typical form of bowls with thickened exterior rim whose maximum diameter is situated at 1/3 of the wall, rather than at the top of the rim opening as with the C170 presented here[230]. The latter type can be linked to a south Anatolian, Cypriot and Levantine tradition of *skyphoi*, dated to the end of the 2nd and 1st centuries BCE[231]. Most likely, the pottery found in this layer predated this period. Even in the limited quantities of diagnostic material found in this layer, already a significant typological range was covered, including cooking vessels (Q210), bowls (B150, B170) and drinking cups (A120, A130).
A number of contexts providing a larger amount of diagnostic material, was found in Trench 2 of the 2015 campaign, laid out in the southeastern corner of the agora, at the north and west side of the southeast honorific column. Underneath the pavement from early Roman imperial times, a series of levelling deposits were constructed to raise the level of the southeastern zone of the agora. Some intrusive early Roman imperial sherds were found, indicating that these deposits had been reworked during this period. The reworking occurred as part of the construction of the honorific monument in the southeast corner of the agora[232]. These deposits included a single bronze coin minted at Sagalassos (AE, Sagalassos, obv. head of Zeus/ rev. two confronted goats) dating to the late Hellenistic – early Roman imperial period. Clearly these deposits were subjected to disturbances and few clear chronological conclusions can be drawn here. However, despite the presence of some later intrusive material from late Hellenistic and early Roman imperial times, the bulk of the pottery derived from these loci again appears to predate this period. Some of these contexts even provided the highest amount of diagnostics for the pottery material discussed here, which we have tentatively associated with the older phases of the genesis of the agora. A summary of the diagnostic pieces in some of these layers can be found in Figure 5[233]. The internal coherence of the material associated with the recurrent stratigraphic sequence observed in different test soundings across the agora again confirms our initial assumptions to consider this material as a coherent assemblage.

Can we now try to situate this material in a firmer chronological framework? First off, it is important to note that comparable material was found elsewhere at Sagalassos. Underneath the Roman Odeon, excavations conducted by Bart De Graeve in 2007 revealed a badly preserved pottery kiln[234]. The combustion chamber of the kiln was only partially preserved, however, inside the chamber three different fill layers could be identified. The kiln was already out of operation and partially dismantled before the deposition of these fill layers, therefore no direct relationship can be presupposed between the material found in these loci and the functioning of the kiln itself[235]. The two upper layers contained Hellenistic pottery material mixed with Roman imperial pottery dated to the end of the 1st century BCE and first half of the 1st century CE. The pottery found in the lowest layer was dated to the end of the 3rd and the (first half of the) 2nd century BCE.
Interestingly, both individual shapes and the typological range encountered in the latter of these loci show clear similarities with the material from Upper Agora discussed here (Figure 6). Regarding the presence of cups, the common representation of fragments of mastoid cups (A130) can be noted, which can be considered the main type of drinking cup at mid Hellenistic Sagalassos, while both hemispherical cups (A131) and Achaemenid cups (A120) were identified as well. The most prevalent types of bowls were the incurving rim (B170) and plain upturned rim (B150) types. As in the Upper Agora material, small shallow dishes with downturned rims (C280) were only sporadically attested,

[230] van der Enden *et al.* 2014
[231] Élaigne 2012, fig. 46 nrs. 6039/2 – 4479/5
[232] Talloen - Poblome 2016, 120-121
[233] Save for the first column, all contexts listed in table 3 are part of these levelling deposits.
[234] Poblome *et al.* 2013
[235] Poblome *et al.* 2013, 176

with no indications for the central depression associated with well-known fishplate types[236]. Open containers with horizontally projecting rim (F150) were also identified, as were jugs/jars with almond shaped rims (H140).

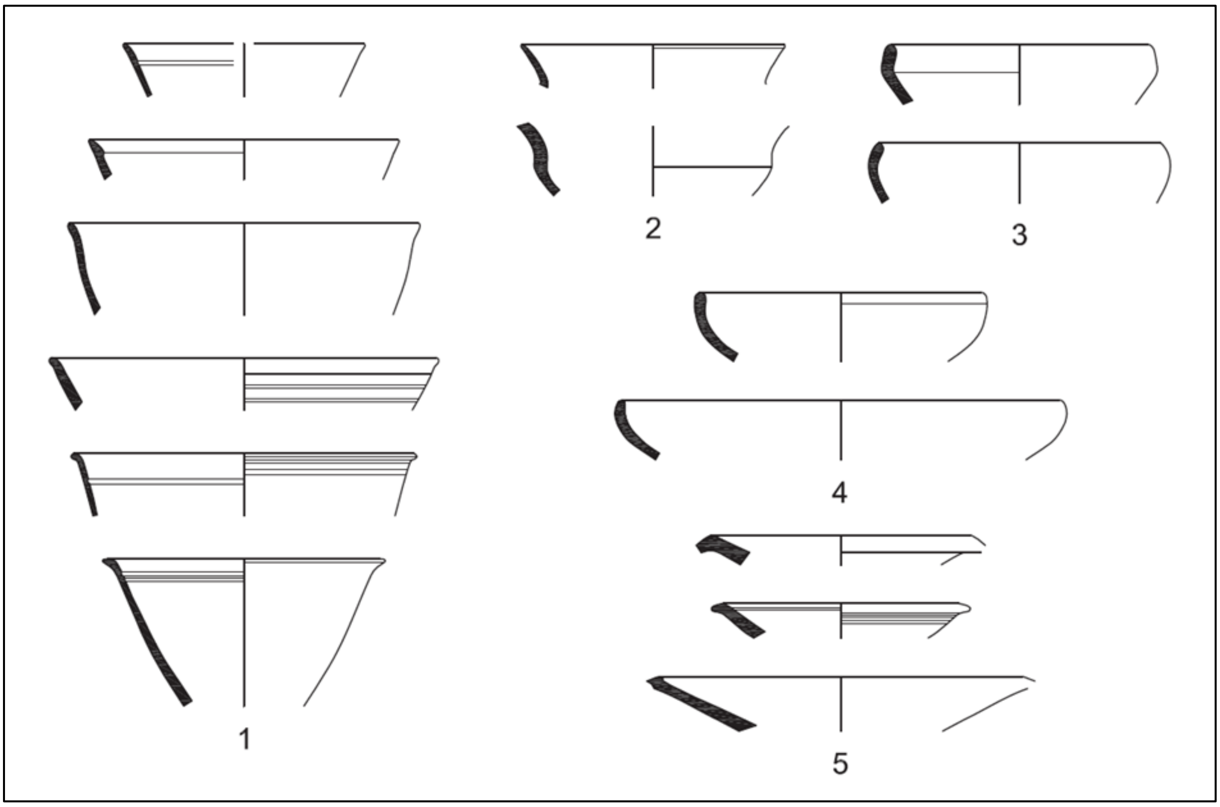

Figure 6. A selection of the ceramic assemblage encountered underneath the Odeon: mastoid cups (1); Achaemenid bowls (2), echinus bowls (3), plain upturned rim bowls (4) and downturned rim plates (5).

When comparing this assemblage to external material parallels, it is striking how a significant part seems to consist of a number of types (A120, B150, B170, C170, and Q200) that also feature prominently in the pottery material from nearby Düzen Tepe, where it has been generally dated to the 4th and 3rd centuries BCE. Additionally, these are complemented with a number of types (A130-A131-A200-B270-F150-H140-H260) dated to the middle Hellenistic period (late 3rd and early 2nd centuries BCE). The most precise external chronological indications based on cross-dating are derived from Athens, where the emergence of the mastoid cup is dated to the first quarter of the 2nd century[237], and the mould-made bowl even very specifically to 220 BCE[238]. The production of mould-made bowls is said to have been initiated in Asia Minor workshops by the end of the 3rd century BCE[239]. It is not unthinkable - but ultimately unprovable - that Sagalassos, while not necessarily in the vanguard, reacted unto these developments fairly rapidly and adapted its local pottery production accordingly to these external stimuli, already at the beginning of the 2nd century BCE. Based on this external chronological framework, we would therefore like to suggest that the assemblage under consideration here indeed confirms the initial date suggested for the Odeion material and can be generally placed within a chronological bracket between the late 3rd and the first half of the 2nd centuries BCE. Both internal and external parameters therefore stress the chronological coherence of the material under scrutiny here. We can therefore now strongly confirm our initial interpretation of this material as a coherent assemblage.

[236] Poblome *et al.* 2013, 183
[237] Rotroff 1997a, 110
[238] Rotroff 2006b
[239] Rotroff – Oliver 2003, 92

In the original presentation of the pottery material found in the pottery kiln underneath the Odeion, we wondered to what extent this typological repertoire was representative for the full pottery assemblage in use at mid Hellenistic Sagalassos. Whereas no overly strong conclusions were drawn then because of the limited amount of available material, considering the remarkable coherence of the assemblages across different loci, contexts and excavation sites we can now propose that the types presented in the Odeion paper and here did indeed constitute the major component of the mid Hellenistic pottery assemblage at Sagalassos. Admittedly, the search for parallel material has not been conducted in an exhaustive manner. Instead, we specifically focused on a number of key publications covering sites in the Aegean, Anatolia and the Levant, also depending on publication status of comparative material. In this respect, we cannot but note that, unfortunately, such a comparative exercise is *a priori* limited because of the fragmentary coverage of published material. One of the major aims of this paper has therefore been to help fill up this void with a systematic presentation of the mid Hellenistic pottery assemblage produced at Sagalassos.

4.2.1.4 Hellenistic and Italic amphorae from Sagalassos

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This paper was published in the first volume of the 2017 edition of Herom: Journal on Hellenistic and Roman Material Culture. It entails the presentation of a small, but interesting, set of amphorae, the oldest to have been attested at Sagalassos. First author dr. Patrick Monsieur identified the amphora fragments and wrote the presentation and short discussion of the material. The more in-depth interpretation of the meaning of the first attestation of these fragments in light of the development of Sagalassos as an urban hub, was written by myself. Third author prof. Jeroen Poblome assisted in the material studies of dr. Monsieur and provided valuable feedback during the writing process.

Introduction

The aim of this paper is to present an overview of a number of middle/late Hellenistic (*c*. 200-25 BCE) and early Roman imperial (25 BCE – 100 CE) amphora fragments found at the archaeological site of Sagalassos, located in ancient Pisidia in southwest Anatolia. The importance of material culture has long been acknowledged for tracing trade and exchange in the past[240], amphorae particularly have been regarded as ideal proxies for reconstructing contacts between sites within socio-economic networks, because of their intrinsic functionality as transport vessels of agricultural produce.[241] The pivotal importance of amphorae implies their extensive study, resulting in an, at times, a very detailed description of aspects of fabric, form, chronology, content, provenance and distribution.
Establishing the provenance of amphorae found at a given site has great potential to show patterns of connectivity and trade. Counting sherds and/or defining the minimum number of individual vessels or estimated vessel equivalents can be indicative of the intensity of contact.[242] However, we should be careful using amphora fragments to automatically assume direct trading contacts between settlements or assess the respective weights of trade routes.[243] At any rate, such studies are most effective when the spatial and temporal dimensions of the material are contextually linked, requiring the material to derive from securely datable archaeological deposits. Additionally, the attested material culture needs to be embedded in a conceptual approach of ancient socio-economic systematics, to make things speak.

Unfortunately, for the material discussed in this paper such arguments are difficult to construct. The town of Sagalassos reached its largest extent during Roman imperial times and continued to be inhabited into the middle Byzantine period. These later occupation phases have covered and/or destroyed much of the archaeology related to the late Achaemenid origins of the community and its original phase of urbanisation in middle Hellenistic times. As a result, the material presented here was in most cases not found *in situ*, making any attempts at linking aspects of connectivity to a secure chronological dimension through these amphorae impossible. Of the studied fragments, three were found during archaeological surveying campaigns within the Ağlasun valley, which Sagalassos overlooks, while the others were found during excavations at the site proper. Of the latter, two were found in a topsoil layer, five in erosional layers, two in late antique fill layers, one in a 4th century CE occupation layer, one in a foundation trench of a building constructed in the second half of the 1st century CE, and two in foundation trenches linked to construction works in the first half of the 1st century CE. As even the fragments from the oldest stratigraphic deposits consisted of reworked material brought in during construction works related to the early Roman imperial period, little to no direct chronological information can be derived from this material. The only chronological framework

[240] Peacock 1977a.
[241] Peacock and Williams 1986; Lawall 1998, p. 76. For an historical overview, see Garlan 1983.
[242] Fulford 1977; Orton 1975; 2009.
[243] Lawall 2005, pp. 190-194; Panagou 2016, pp. 209-210.

that we can rely on is external, relating to periods of circulation of specific types of amphorae, obtained from other sites. This allows setting the brackets for the Sagalassos fragments to between middle Hellenistic and early Roman imperial times, ranging from *c*. 200 BCE to 100 CE.
Even though our material comes with clear limits, we considered its presentation to hold some importance. The listing of amphora finds from non-coastal regions in the ancient world has relevance for understanding past realities of circulation of goods, as well as approaching socio-economic patterns of these past worlds. At Sagalassos, a lot of attention has so far been dedicated to its local pottery production, allowing the presented material to instigate some reflection on wider aspects of urban life. Specifically, (part of) the material can be related to the initial stages of urbanisation, which is an area of growth in studying the history of the region of Pisidia.

Presenting the material

The amount of fragments of Hellenistic and Italic amphorae from Sagalassos is at present very limited.[244] All were found in locations other than their original contexts. In general, the archaeological harvest at Sagalassos is related mostly to the Roman imperial, late antique and Byzantine periods in line with the archaeological opportunities offered by the extant urban framework. It should therefore come as no surprise that the discussed amphora fragments are small, resulting from the long object history, starting as imported amphorae in periods before the main archaeology of the site and finishing as sherds in residual positions in scattered deposits. Nevertheless, the identification of the origin of the amphorae and the broad external chronological framework based on typology and fabric provide a first glance at the relations of an inland, mountainous site in Asia Minor with some well-known agricultural production centres and regions on the Aegean and Tyrrhenian coasts. All of the amphorae originally carried wine.

Rhodian Hellenistic amphorae

1. SA-2002-DA2-94 (Fig. 1)

Rim fragment with small part neck and traces of handle, preserved height 4.5 cm, preserved length 7 cm. Exterior light beige with traces pale slip, core beige to brown, well levigated fabric with nearly no inclusions visible, hard fired.

Figure 1: Rim fragment of Rhodian amphora.

2. SA-2003-SS-134

Lower part vertical handle fragment, preserved height 7.5 cm, diameter 3.5 cm. Exterior beige, core light brown to light red, well levigated fabric with fine white inclusions, one notable red brown inclusion, hard fired.

3. SA-2003-LA2-80 (Fig. 2)

Upper part vertical handle fragment, broken at the bend towards horizontal part, split off lengthwise, preserved height 5.5 cm. Light brown, well levigated fabric with fine colourless, grey and dark inclusions, hard fired. Two other Rhodian fragments, a small shoulder fragment with print of handle attachment and a small wall fragment could form part of the same amphora.

[244] The fieldwork leading to this paper was carried out in the 2009 Sagalassos season. Dr. Philip Bes kindly prepared the initial selection of the amphora material.

Figure 2: Wall fragment of Rhodian amphora.

4. SA-1996-B-197

Bottom with beginning of peg toe, interior slightly twisted clay pellet, preserved height 6 cm. Exterior light brown, core red pink, well levigated fabric with fine white and red brown inclusions, badly eroded and decomposing.

5. SA-2003-SS-107 (Fig. 3)

Fragment lower wall, maximum length preserved 6.5 cm. Exterior light brown, traces pale slip, core light red, well levigated fabric with fine white and dark inclusions, hard fired.

Figure 3: Wall fragment of Rhodian amphora.

The output of wine and amphorae on Rhodes in the Hellenistic period was very considerable.[245] The top shaped Rhodian amphora with its fine rounded handles was easily recognisable, then as now. These containers were widely distributed throughout the Mediterranean and Levant. Although production started already around 300 BCE, the massive output from Rhodes is best situated between *c*. 250-80 BCE with a peak in the 2nd century BCE. Both handles of the Rhodian amphorae were systematically stamped with the respective names of the eponym officials and the producers providing invaluable dating clues.[246] Unfortunately, no stamped handles have been discovered at Sagalassos so far. The First Mithridatic War most probably led to a serious decline of production which ended with the capture of Rhodes in 43 BCE by Cassius. Production was resumed from Augustan times onwards and Rhodian amphorae of a more slender form with typical horned handles were successfully distributed throughout the empire during the 1st century CE. As far as is known, no fragments of this Roman imperial version turned up at Sagalassos, although production centres in the *peraia* of Rhodos on mainland Asia Minor are well attested and considered prolific.[247]

***Knidian Hellenistic amphora*?**

6. SA-2000-TSW2-13

Middle to lower wall fragment, rather coarse fabric, irregular break, dark brown matrix with lots of small white, dark, red brown and colourless inclusions. Some letters of a graffito *post cocturam* preserved:]Ι Π (height 1.5 cm) followed at a distance of 1.5 cm by the smaller letters ΥΛ(?) (height 0.5 cm).

Knidian wine and amphora production became important around the end of the 4th and the early 3rd centuries BCE.[248] Typical morphological features were the egg shaped body, the slender tall strap handles and the ringed toe. From the final decades of the 3rd century BCE on, stamping on the handles

[245] Grace and Savvatianou-Petropoulakou 1970, pp. 289-316; Empereur and Hesnard 1987, pp. 18-20; Withbread 1995, pp. 53-67.

[246] Grace 1953; Finkielsztejn 2001.

[247] Hesnard 1986; Empereur and Picon 1986, pp. 116-117; 1989, pp. 224-225; Peacock 1977b, pp. 266-270.

[248] Grace and Savvatianou-Petropoulakou 1970, pp. 317-354; Empereur and Hesnard 1987, pp. 20-21; Withbread 1995, pp. 68-80; Koehler and Wallace Matheson 2004, pp. 163-169.

became regular. As much as the Rhodian stamps, the Knidian ones are invaluable tools for dating. No Knidian stamps were found in Sagalassos. A wide variety of fabrics is considered to point to a large number of production sites, as also indicated by the stamps. Hellenistic Knidian amphorae circulated widely in the Cyclades, Athens and mainland Greece. An appreciable production continued in Roman imperial times.

Koan Hellenistic amphorae and imitations from the Asia Minor coast

7. SA-2000-TSW2-13 (Fig. 4)

Upper vertical part of the two tubes of a double barrelled handle, broken at the bow to the horizontal part, preserved height 8 cm, diameter 2.6 cm. Fairly levigated fabric, exterior greenish beige, core beige, some red brown, black and colourless inclusions, medium-hard fired. Almost certainly original from Kos.

Figure 4: Handle fragment of Koan amphora.

8. SA-2008-MAC-0084-00136 (Fig. 5)

Upper horizontal part of a double barrelled handle, width 4.8 cm, preserved length 5.5 cm. Beige slip, core brown, fabric with white and dark inclusions, scaly at break, hard fired. Probably Koan imitation from a centre on the Asia Minor coast.

Figure 5: Handle fragment of Koan imitation amphora.

9. SA-2006-DA-47-88

Wall fragment, preserved length 11 cm. Light greenish slip, core and interior red brown, fabric with colourless and brown inclusions, a fair quantity of white inclusions, sandy but medium-hard fired. Probably Koan imitation from a centre on the Asia Minor coast.

10. SA.2002-DA2-111 (Fig. 6)

Fragment shoulder with handle attachment, preserved length 8 cm, rounded to quadrangular section handle of 2.8 x 3.3cm. Greenish grey exterior, core light brown to pink brown, fabric with red-brown and some white inclusions, medium-hard fired. Imitation of a Rhodian example from Kos or Asia Minor coast?

Figure 6: Shoulder fragment of Koan imitation amphora.

Wine and amphorae from Kos manifested themselves in the course of the 3rd century

BCE.[249] Initially, different types with strap and rounded handles existed, but in the end the double barrelled handles became typical, as well as the thin wall of the body. The slender types of the 2nd and 1st centuries BCE were much imitated, with fabrics macroscopically hard to distinguish. Petrological analysis and surveys on production sites proved this type to be made on different coastal sites such as at Myndos and even in the *peraia* of Knidos.[250] Kos remained a prolific centre in Roman imperial times with an important distribution. Some fragments of this later production were also found in Sagalassos. In the 1st century CE, the Koan amphora type became one of the most imitated wine containers in the empire.

Chian Hellenistic amphora and lagynos

11. SA-1996-B-192 (Fig. 7)

Fragment shoulder broken at the carination to the lower wall, preserved length 3.5 cm. White slip on surface with red brown core and interior, well levigated fabric with nearly no inclusions visible apart some fine white particles, hard fired.

Figure 7: Wall fragment of Chian amphora.

12. SA-1999-LA-127 (Fig. 8)

Fragment shoulder most probably from a lagynos, preserved length 7.5 cm. White slip on surface with red brow core and interior, slightly laminated, well levigated fabric with nearly no inclusions visible, some white and red brown particles, hard fired.

Figure 8: Shoulder fragment of Chian lagynos.

The production of wine amphorae on Chios was impressive in Archaic and Classical times. In the second half of the 4th century BCE, a new amphora type was designed with a long neck, rounded handles and a triangular shaped body ending in a massive toe.[251] In the course of the 3rd century BCE, Chios probably lowered its mass production and focused more on quality wine, which is supposedly reflected in a substantial decrease of amphora and lagynoi output for export. The production of this amphora type continued into Augustan-Tiberian times.

Italic Republican amphorae from the Tyrrhenian coast

13. SA-2008-MAC-0084-00136 (Fig. 9)

Fragment upper vertical part of a handle with break on the carination to the horizontal part, preserved height 12 cm. Exterior light pink red, core dark pink red, coarse fabric with much inclusions, especially black, red brown and colourless particles, medium-hard fired.

[249] Grace and Savvatianou-Petropoulakou 1970, pp. 363-365; Empereur and Hesnard 1987, pp. 22-23; Withbread 1995, pp. 81-106.

[250] Hesnard 1986; Empereur and Picon 1986, pp. 109-112; Empereur and Picon 1989, pp. 225-226; Empereur and Hesnard 1987, p. 13; Monsieur and De Paepe 2002, pp. 163-166.

[251] Grace and Savvatianou-Petropoulakou 1970, pp. 359-363; Empereur and Hesnard 1987, pp. 21-22; Monsieur 1990; Withbread 1995, pp. 134-153.

Figure 9: Handle fragment of Tyrrhenian amphora.

14. SA-2001-DA1-136 (Fig. 10)

Wall fragment, length preserved 3.5 cm. Pink red coarse fabric with much inclusions, especially black sparkling particles, medium-hard fired.

Figure 10: Wall fragment of Tyrrhenian amphora.

15. SA-2001-DA2-111

Chip of a wall fragment, length preserved, 3.5 cm. Brown red coarse fabric with much inclusions dominated by black particles, some white.

16. SA-2002-SS-83 (Fig. 11)

Wall fragment, preserved length 5.8 cm. Pink red coarse fabric with core of grey and red brown layers, fair amount of inclusions, red brown particles as abundant as black.

Figure 11: Wall fragment of Tyrrhenian amphora.

The fabrics of these Italic amphora fragments leave no doubt as to the location of the production sites on the Tyrrhenian coast. All sherds point to a volcanic environment, most probably Campania known as a major wine and amphora production region.[252] One diagnostic handle can be identified safely as a late Graeco-Italic or an early Dressel 1 type, dated to 150-50 BCE. The thickness of the three wall fragments indicates that these belonged to amphorae, although Campanian table and cooking wares were also distributed in the Eastern Mediterranean. Our fragments, however, can be assigned to a specific amphora type, with implications for the chronology. The sherds formed part of the more slender versions of the Graeco-Italic types (2nd century BCE), the sturdy Dressel 1 types (1st century BCE) or the Dressel 2-4 types with their double barrelled handles in imitation of Koan prototypes (1st century CE).

[252] Hesnard *et al*. 1989; Ricq de Boüard *et al*. 1989; Peacock and Williams 1986, pp. 84-92 and 105-106; Tchernia 1986, pp. 42-100; Maza 1988; Monsieur and De Paepe 2002, pp. 166-169; Olmer 2003.

Discussing the amphorae

Although out of context and reduced to rough external chronological indicators, we tend to read in the examples collected at Sagalassos that these did not appear before the original phase of urbanisation of this settlement, from around *c*. 200 BCE onwards[253] (Table 1). Apart from a presumed demographic concentration within the newly constructed urban framework, this phase also saw the origin of an extensive territory administratively linked to the new town. The newly found momentum of development was also translated into the initiation of a new line of pottery tableware production, mostly in line with Anatolian models.[254]

	Type	Origin	Chronology	Fragment	Context/Locus
1	Hellenistic type	Rhodos	250-50 BCE	rim	SA-2002-DA2-94
2	Hellenistic type	Rhodos	250-50 BCE	handle	SA-2003-SS-134
3	Hellenistic type	Rhodos	250-50 BCE	handle	SA-2003-LA2-80
4	Hellenistic type	Rhodos	250-50 BCE	bottom	SA-1996-B-197
5	Hellenistic type	Rhodos	250-50 BCE	wall	SA-2003-SS-107
6	Hellenistic type	Knidos?	200 BCE- 50 CE	wall	SA-2000-TSW2-13
7	Dressel 5 Hellenistic	Kos or imitation	200-50 BCE	handle	SA-2000-TSW2-13
8	Dressel 5 Hellenistic	Kos or imitation	200-50 BCE	handle	SA-2008-MAC-0084-00136
9	Dressel 5 Hellenistic	Kos or imitation	200-50 BCE	wall	SA-2006-DA-47-88
10	Imitation Rhodian Hell.?	Kos or imitation	200-50 BCE	shoulder	SA-2002-DA2-111
11	Hellenistic type	Chios	200BCE - 25 CE	shoulder	SA-1996-B-192
12	Lagynos	Chios	200-50 BCE	shoulder	SA-1999-LA-127
13	Greco-Italic or Dressel 1	Campania	150-50 BCE	handle	SA-2008-MAC-0084-00136
14	Gr-It or Dr 1 or Dr 2-4	Campania	150BCE - 100 CE	wall	SA-2001-DA1-136
15	Gr-It or Dr 1 or Dr 2-4	Campania	150 BCE - 100 CE	wall	SA-2001-DA2-111
16	Gr-It or Dr 1 or Dr 2-4	Campania	150 BCE - 100 CE	wall	SA-2002-SS-83

Table 1. Overview of Hellenistic and Italic amphorae found at Sagalassos.

On the other hand, we should avoid coming to far-reaching historical conclusions based on this limited amount of material, from secondary and scattered deposits. Moreover, research on contemporary amphora material, especially at inland Anatolian sites or sites along the south coast of the peninsula, is not yet encompassing enough to gauge and compare importance of types and patterns.

Sites such as Gordion, Pessinous and Xanthos[255] also did not reveal large quantities of Hellenistic and Italic amphorae, although Gordion seems a case on its own regarding the import of Rhodian amphorae. The pre-Hellenistic period yielded a certain amount and diversity of Pontic, Aegean and Levantine amphorae, possibly due to the position of Gordion on or near the Persian Royal Road. In the wake of arrangements of the Galatian settlement around 260 BCE, imported amphorae seem to become rare. This is contrasted with a group of 34 Rhodian amphora stamps discovered in the context of the so-

[253] Talloen and Poblome 2016.
[254] Poblome *et al*. 2013a; 2013b; van der Enden *et al*. 2014.
[255] Lawall 2008; 2010; Monsieur 2001; Monsieur and De Paepe 2002; Lemaître 2015.

called SET house. These formed a chronologically homogenous group of the first decade of the 2nd century BCE. Mark Lawall proposed in a very convincing way a link with the base that the Roman commander Manlius Vulso set up at Gordion in 189 BCE, upon the abandonment of the city by the Galatians. The clustering of Rhodian amphorae in this case seems to reflect supply of the Roman army rather than market dependent exchange or trade. As impressive amounts of Rhodian amphorae otherwise came to light in Ionia and Pergamon[256], military logistics of supply could tap into the supply to these markets.

Although both Pessinous[257] and Sagalassos were confronted with the expedition of Manlius Vulso, the available evidence at both sites is too scant and hazy to consider explaining the presence of Rhodian amphorae at both sites in this way. Moreover, a clear chronological framework is lacking. No stamps were found at these sites and the amphora fragments were too small to extract dating clues from their typology. Rhodian Hellenistic amphorae were produced and exported successfully during a window of 150 years[258], of which there is ample proof on some Asia Minor coastal sites. At Perge[259], the excavations at the acropolis yielded 12 legible Rhodian stamps with a chronology between *c*. 234-146 BCE (Table 2). On the southeastern Cilician coast, at Kinet Höyük[260], probably ancient Issos, some 30 Rhodian stamps were evenly spread in a longer chronological range, i.e. between 250-100/80 BCE. Strangely enough, although not situated far from the coast, we should remark that Xanthos revealed only a small amount of Rhodian amphorae.[261] We cannot propose a detailed scenario as to why and how, but the presence of Rhodian Hellenistic amphorae at newly urbanising Sagalassos can perhaps be seen in the context of the relative proximity of Rhodos, its massive wine and amphora production and the generally successful distribution of the latter in these parts of the ancient world.

	Period	**Date**	**Eponym**	**Manufacturer**	**Month**	**Device**
1	IIa-b	*c*. 233-220+		Σοτεριδας		
2		*c*. 233-220+		Δαμονικος	Αρταμιτιος	
3		*c*. 219-210+		Μεντορ	Βαδρομιος	
4	II?	*c*. 234-199?		Μενανδρος I		
5	IIIa	*c*. 194	Σοστρατος			head Helios
6	IIIc	*c*. 177-175	Καλλικρατες II		Πεταγειτνιος	
7		*c*. 176-174	Δαμοκλες II		Πεταγειτνιος	
8	IIc-IIIe	*c*. 199-167/165+		Δαμοκρατες I		rose
9	IIIe	*c*. 165-163	Αρχιλαιδας		Αρταμιτιος	
10	IIIb-IVa	*c*. 186-153+		Μαρσψας	Καρνειος	
11	IVa	*c*. 154-153	Γοργον		Καρνειος	
12	IVa-b	*c*. 160-146+		Ηιπποκρατες		rose
13	III-IV	*c*. 194-146		Ηερακλειτοσ I or II?		

Table 2. Legible Rhodian amphora handles found on the acropolis of Perge.[262]

[256] See the famous Pergamon Deposit with more than 900 Rhodian amphora handles found on the Burgberg and dated to c. 198-161 BCE: Börker and Burow 1998.
[257] The Rhodian amphorae of Pessinous are not yet published. Some 10 fragments were identified.
[258] Rhodian wine production and export culminated between c. 190-150 BCE: Lund 2011, pp. 287-289.
[259] Laube 2003.
[260] Monsieur and Poblome, in press.
[261] Lemaître 2015, p. 12: amongst them there is one illegible stamp.
[262] Arrangement after Laube 2003, pp. 133-134. For the chronology of the manufacturers the upper dates of a combination with eponyms were chosen.

Sagalassos also yielded some other typical Hellenistic wine amphorae from Chios, Kos, several unknown production centres on the Asia Minor coast, and perhaps Knidos. These types occurred in small quantities at the inland site of Pessinous as well, but not anymore at Gordion as upon its abandonment in 189 BCE there was only an important resettlement phase by the end of the 1st century CE.[263] There is also a remarkable paucity of Hellenistic amphorae in Xanthos.[264] The nearly complete absence of Knidian amphorae at Sagalassos is not necessarily surprising. Whatever the reasons may be, Knidian amphorae did not occur regularly along the western and southern coasts of Asia Minor, nor in the Levant.[265] In contrast, the presence of Knidian amphorae is massive in Athens, the Cyclades and somewhat less at Alexandria.[266] It seems as if the markets of Asia Minor were mostly reserved for Rhodian wine.

What could have been expected in Hellenistic Sagalassos are Pamphylian amphorae. Perhaps these went unnoticed. These vessels were rather well represented on the acropolis of Perge.[267]

The evidence on activities of Italic and Roman merchants within Anatolia and on the south coast of Asia Minor is not very abundant and the nature unclear. Considering the current state of the art, amphorae do not qualify as telling tracers even though these do occur in a certain variety on different sites. Nevertheless, it is difficult to grasp their importance because there is no quantified data available.[268] We mostly rely on the publication of isolated finds of Italic amphorae, which, in a fragmented condition, can be difficult to recognise.[269] At Sagalassos only Campanian amphorae were identified and, with the exception of a handle of a Graeco-Italic or an early Dressel 1A type, their poorly preserved state does not allow assignation with certainty to a specific typology. Strikingly, no other Tyrrhenian or Adriatic productions were represented. This is in contrast with the typological variety attested in wrecks or of finds on land elsewhere. Central Adriatic wine amphorae of the Lamboglia 2 and Dressel 6A types are known from Pessinous, Kinet Höyük, Tarsos and some underwater locations.[270] A geographically related group, carrying another commodity, the Apulian and Brindisian oil amphorae were attested in Pessinous, Patara, Xanthos, Kinet Höyük and Tarsos.[271] Finally, there are different types of Tyrrhenian origin: the wine amphorae Dressel 1A and B and Dressel 2-4 (Pessinous, Patara and Xanthos[272]) and those for fish-based products, the Dressel 1C and Dressel 21-22 (Xanthos and Museum of Anamur[273]). The oldest imports of Italic amphorae in the Eastern Mediterranean were Central Adriatic Graeco-Italic types. Six complete examples were found in the fill of a man-hole within the South Stoa at Corinth, containing materials of the 146 BCE destruction.[274] To be sure, the import of Italic amphorae in Greece and Asia Minor needs to be considered partly in the light of Roman colonialism and military expeditions, such as the Mithridatic wars and the wars of Pompeius against the Cilician pirates.

[263] Monsieur 2001; Monsieur and De Paepe 2002; Lawall 2008, p. 164.
[264] Lemaître 2015, p. 10.
[265] E.g. at Kinet Höyük where only some fragments were probably identified; even in Pergamon these are poorly represented: Börker and Burow 1998, pp. 56-58 and 110-112.
[266] Koehler and Wallace Matheson 2004.
[267] Grace 1973; Laube 2003, pp. 132-135.
[268] Lund 2000, p. 89; Lemaître 2015, p. 3.
[269] Lemaître 2015, p. 24.
[270] Pessinous: unpublished, at least 8 fragments were identified. Kinet Höyük: Monsieur and Poblome, in press. Tarsos: Jones 1950, n° 1050, fig. 169 and 177. Underwater finds: Museum of Bodrum: Oğuz Alpözen 1975, p. 21, n° 1 and p. 28, n° 1; Museum of Anamur: Zoroğlu *et al*. 2008, p. 48, n° 34-37.
[271] Pessinous: unpublished, at least 2 fragments. Patara: Dündar: 2013; Lemaître 2015, p. 19. Xanthos: Lemaître 2015, p. 18. Kinet Höyük: Monsieur and Poblome, in press. Tarsos: Jones 1950, fig. 143, A.
[272] Pessinous: Monsieur 2001; Monsieur and De Paepe 2002. Xanthos: Lemaître 2015, pp. 13-16 and 18; Patara: Dündar 2013; Lemaître 2015, p. 19.
[273] Lemaître 2015, pp. 4-5, 16, 18; Zoroğlu et al. 2008, p. 48, n° 39.
[274] Romano 1994, pp. 86-88, n° 63-68.

First interpretations and conclusions

With little to no information preserved regarding the original contexts of these fragments, can we still use this material to understand aspects of local community development within a larger framework? The material under scrutiny in this paper represents the oldest examples of amphora encountered at Sagalassos, with the beginning of their circulation situated between 200 and 150 BCE. Interestingly, amphorae were all but absent from the material record at the nearby late Achaemenid to early Hellenistic site of Düzen Tepe. Radiocarbon dating and palynological studies, combined with evidence from ceramological studies, have indicated that Düzen Tepe was inhabited from the 5th century onwards, until its abandonment somewhere during the 2nd century BCE, with the main occupation of the settlement probably situated during the 4th and 3rd centuries BCE.[275] This places the arrival of amphorae at Sagalassos near the end date of the occupation period of Düzen Tepe, or even outside of this time period altogether when the maximal end-date of the circulation period – 50 BCE for the Hellenistic amphorae and 79 CE for the early Roman imperial pieces – is estimated. This leaves ample room for these objects to have reached Sagalassos only after Düzen Tepe was already abandoned. As a result, the absence of amphorae at Düzen Tepe can be attributed to chronological differences. However, it can be argued that the main underlying explanation goes deeper and is related to differences in socio-cultural frameworks.

The absence of amphorae at Düzen Tepe and contemporary Sagalassos cannot be attributed to a supposed isolation of local communities from wider system dynamics. Although Düzen Tepe was characterized by a predominantly locally-oriented socio-economic system, it clearly had no problem familiarizing itself with wider developments to provide a template for local artisanal production where possible/wanted, nor to supplement local production with import whenever the former was not possible, sufficient or desired.[276] Could the observed Anatolia-oriented template of material culture perhaps be symptomatic of the community not having access to Aegean/Mediterranean trade patterns that would have allowed amphorae to reach the site? As amphorae did reach the later, middle Hellenistic community at Sagalassos, while a similar Anatolia-oriented template was still observed for its material culture, connectivity cannot have been the only factor. Did the people of Düzen Tepe perhaps have no need for importing amphorae and their contents because of sufficient local production? Archaeobotanical and palynological research indicated local olive and grape cultivation and processing taking place at Düzen Tepe or in the immediate vicinity of the site, suggesting local production of oils and wine must have existed, insofar as vine cultivation can be directly linked to wine making.[277] But also at Hellenistic Sagalassos we have the same indications for local grape or olive production, suggesting local production did not prevent the import of other wines.
Interestingly, the proposed outer date of circulation of these amphorae and the demise of Düzen Tepe roughly coincided with the initial phase of development of the urban fabric of Sagalassos and its associated material culture.[278] Are these (quasi) simultaneous developments happening coincidentally? Or can we suspect these processes to be in some way interconnected? We should not necessarily interpret practices and the processes behind them to be directly causally connected, but perhaps rather to be symptomatic of larger developments shaping social, economic, cultural and political configurations and developments at this time.

Even in Moses Finley's minimalist assessment of the ancient economy, individual households as basic economic units were never completely self-sufficient, despite the 'ideology of autarky'.[279] Diversification in household production therefore already required a certain amount of production

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[275] Vanhaverbeke *et al*. 2010.
[276] Daems and Poblome 2016
[277] Bakker *et al*. 2012, pp. 253-259; Vermoere 2004, pp. 133 and 136-139; De Cupere *et al*. 2017b; Cleymans *et al*., this issue.
[278] van der Enden *et al*. 2014; Poblome *et al*. 2013b.
[279] Harris and Lewis 2016, pp. 5 and 25-28.

beyond its own needs, generating inter-household exchange to obtain goods necessary for the average household to perform all its functions. Such inter-household reciprocity provided the necessary economic base for family-based social organization and can be subsumed under the moniker of 'domestic economy'.[280] In such a system, local grape and olive production was sufficient to fulfil basic local needs, leaving no incentive to participate in trade systems connected with the Aegean, let alone Campania, which could have resulted in the import of amphorae. Yet, amphorae, more or less by definition, were geared towards long-distance markets based on the exchange of production surpluses.[281]

In the post-Finley era it has been commonly asserted that the ancient economy went beyond the limitations of the domestic economy model.[282] Keeping things simple and putting aside the role of individual entrepreneurship, most other economic incentives beyond the level of the household can be subsumed under the marker of 'political economy'. On this level, household production was connected to the outside world through the emergent nexus of the community as a local socio-political unit. Although these three scales (in a simplified model consisting of household, community, and outside world) could in theory interact freely with each other, certain lines of structuration guided much of this intra-scalar communication along fixed pathways. However, such pathways do not merely offer constraints but also act as a catalyst for further system dynamics to emerge and develop. Therefore, we should like to suggest that the appearance of amphorae at Sagalassos can be seen as a material trace of a wider transition phase, moving from the primordial roles and activities of households to those of the community as a whole. In this respect, the attestation of amphorae at Sagalassos from middle Hellenistic times onwards can be regarded as symptomatic of wider developments crystallizing as urbanisation at work.

[280] Ault 2007
[281] Lawall 2016, p. 263.
[282] Hopkins 1983; Mattingly and Salmon 2001; Harris and Lewis 2016.

4.2.1.5 Material culture comparison

The following subsection is the only part of this chapter that is not currently geared up towards publication. Its main purpose is to deepen the comparative perspective hinted at, but not explicitly followed through, in the previous parts of this section. It will also offer some additional support for some of the arguments used throughout the remainder of this chapter regarding variability and diversity in material culture. The results presented here will likely be at some point taken into consideration for publication as part of a diachronic comparison of material culture production processes and technology in the study region of the Sagalassos Project. The analyses were conducted in collaboration with Danai Kafetzaki (Master's student in Statistics) who currently works for the Sagalassos Project on the recalibration of the pottery templates through statistical analyses.

In the previous parts, I have presented a series of papers pertaining to the Achaemenid to early Hellenistic material culture of Düzen Tepe, the Achaemenid period material from Sagalassos, the mid Hellenistic pottery assemblage from the Upper Agora of Sagalassos, and the oldest indications of amphorae imports at Sagalassos. Besides differences and idiosyncrasies inherent to chronologically differentiated material, it can also be wondered to what extent similarities and continuities between these different bodies of material existed. To this end, I will here compare the pottery between different elements of the sample from individual site, as well as compare different sites with each other.

Whereas in the previous papers, I focused on the detail of the material, in the remainder of this chapter I will move from this basic description and analysis towards a first interpretation as to the meaning of this material in its relevant societal context. I will therefore first provide some indications that the identified assemblages are sufficiently coherent to allow the premise of using this material as an indicator for the nature of the overall societal matrix. Next, it should be noted that some of the arguments presented in several papers throughout this chapter are built on the assumption of a concurring overall socio-political matrix underlying the material culture of Sagalassos and Düzen Tepe in late Achaemenid and early Hellenistic times, and a marked divergent development at Sagalassos from middle Hellenistic times onwards. In the second part of this subsection, I therefore wish to present a more extensive reasoning for these claims, which will then be used as argumentation in subsequent sections.

Düzen Tepe

For Düzen Tepe, the main component of material studies was built on diagnostics selected from the pottery found during three major excavations: the Bakery, Courtyard Building (CYB) and the Kiln Area (KA). For each of these sites, a distinct functional interpretation has been assumed, based on the identified archaeological features. These interpretations are, respectively, a communal food preparation facility, a house, and a production workshop. It should not axiomatically be assumed, however, that the material collected these sites can be used in a single comparison to represent *the* material culture of Düzen Tepe. In Tables 1 and 2, I compare the fabric and type group proportions in diagnostics collected from each of these excavations.

Düzen Tepe	Common wares	Tablewares	Cookware	Storage	Import	Total
Bakery	48	65	19	3	1	146
CYB	122	170	85	7	7	391
KA	44	33	11	1	0	89

Table 1A: Sherd counts per fabric group across the mentioned excavations at Düzen Tepe.

Düzen Tepe	Common wares	Tablewares	Cookware	Storage	Import
Bakery	32.9%	44.5%	13%	2%	0.7%
CYB	31.2%	43.5%	21.7%	1.8%	1.8%
KA	49.4%	37.1%	12.4%	1.1%	0%

Table 1B: Fabric proportions across the mentioned excavations at Düzen Tepe.

Düzen Tepe	Cups	Bowls	Dishes	Containers	Storage	Jars	Cooking	Total
Bakery	35	33	15	0	12	30	16	141
CYB	49	82	63	13	18	73	81	379
KA	13	14	12	3	3	23	20	88

Table 2A: Sherd counts per type group across the mentioned excavations at Düzen Tepe.

Düzen Tepe	Cups	Bowls	Dishes	Containers	Storage	Jars	Cooking
Bakery	24.8%	23.4%	10.6%	0%	8.5%	21.3%	11.4%
CYB	12.9%	21.6%	16.6%	3.4%	4.8%	19.3%	21.4%
KA	14.8%	15.9%	13.6%	3.4%	3.4%	26.4%	22.7%

Table 2B: Type group proportions across the mentioned excavations at Düzen Tepe.

Some divergences can be noted. Common wares cover almost half of the material gathered from the Kiln Area, whereas for the Bakery and Courtyard Building the proportions are closer to 1/3. Given the flexible usage of such common ware vessels, it is difficult to draw conclusions from this observation. Tablewares, by comparison, cover a smaller part of the material from the Kiln Area, although in this case the difference is less pronounced. Perhaps, this could be expected from a context that is considered to be part of a production facility rather than domestic usage, but since the output of the workshop is unknown we should not make too much of this observation. Cookware is most present in the Courtyard Building, consistent with its interpretation as a domestic unit, which would have been a logical context for cooking activities. Still, they are significantly present in the other two excavations as well. As expected, the amount of imports is generally low and even completely absent at the Kiln Area.

Regarding type groups, it is interesting to note that cups (*i.e.* Achaemenid bowls) cover almost twice as much of the material collected from the Bakery compared to the Kiln Area and the Courtyard Building. Especially for the latter, the relative low amount of cups can be considered surprising, although in absolute numbers, cups are still most attested at the Courtyard Building in the three excavations. Interestingly, no diagnostics of storage vessels have been noted for the Bakery excavation. Given the interpretation of this site as a communal food preparation facility, this can be considered slightly surprising. However, this observation should be nuanced as during material studies, fragments of storage vessels were noted in the Bakery material. However, as these pertained mainly body sherds and no rims, these were not taken into account for the tables. The proportion of (storage) jars seems rather even across the different contexts, which is a likely testimony to the multifunctional usage of these vessels. Finally, cookware is attested most in the Courtyard Building, in absolute numbers far exceeding those of the other excavations, but proportionally almost equal to that of the Kiln Area. In absolute numbers, the latter is largely equal to that of the Bakery.

A full contextual analysis would take use too far in the present context, and has already been undertaken for Düzen Tepe, in the Ph.D. dissertation of dr. Kim Vyncke (2013). The results of that research, supported by the limited comparison presented here, suggest that the picture of material culture usage was not as straightforward as we might *a priori* assume. Different activities would likely have been performed in different contexts, depending on circumstances, rather than having fixed and circumscribed spaces for specific activities. Still, this does not mean that the general functional interpretations associated with each of these excavations should be negated. The integration of other strands of archaeological evidence – which will be discussed throughout the different parts of the remainder of this chapter – such as the ovens at the Bakery, the kiln at the Kiln Area, and the traces of various domestic activities at the Courtyard Building should be taken into account as well.

Sagalassos

The paper on the middle Hellenistic material of Sagalassos was built on two components of pottery material. On the one hand, a cohesive material assemblage derived from the recent control excavations at the Upper Agora, on the other hand, the compiling of disparate fragments of Hellenistic material from a variety of excavations across town. The latter includes the remains of the Hellenistic kiln and associated material underneath the Odeon, excavations at a retaining wall to the north side of the Upper Agora, control excavations at the Eastern Residential Quarter, burials and nearby terrace wall at Site F in the Eastern Suburbium, and excavations at the late Hellenistic fountain-house east of the monumental centre.

Naturally, when comparing and combining these two components for analysis, the question arises to what extent the second body of material is actually cohesive enough to allow proper contextualization. It was already observed that the selected sherds individually fit the framework of the Upper Agora material on a typological and fabric basis. In Tables 3 and 4, I compare the reoccurrence of individual type groups among and across the different fabric groups.

Sagalassos (w/o UA)		cookware	common wares	fine wares	import	storage
Tableware	cups	0	1	4	1	0
	bowls	0	0	3	0	0
	dishes	0	0	2	0	0
Serving	Jars/jugs	0	2	3	0	0
	Open	0	1	2	1	0
Kitchenwares	cooking vessels	2	3	0	0	0
	preparation/storage	0	1	2	0	0
Storage	Storage vessel	0	0	0	0	0
Cosmetics	Unguentarium	0	0	2	0	0

Table 3: Fabric/Type group proportions for Sagalassos w/o UA (colour coding equals min-max as red to green range).

Sagalassos UA		cookwares	common wares	fine wares	import	storage
Tableware	cups	0	0	4	1	0
	bowls	0	1	2	0	0
	dishes	0	0	3	0	0
Serving	Jars/jugs	1	2	2	1	0
	Open	0	0	2	0	0
Kitchenwares	cooking vessel	2	2	0	0	0
	Preparation/ storage	0	1	1	0	0
Storage	Storage vessel	0	0	0	0	0
Cosmetics	Unguntaria	0	0	1	0	0

Table 4: Fabric/Type group proportions for UA material of Sagalassos (colour coding equals min-max as red to green range).

When comparing these two tables we see largely the same picture, with perhaps a more extensive distribution of common wares across the various type groups. This suggests that, although the Upper Agora material represents a far more extensive sample compared to the more fragmentary collection of material compiled from the other sites, overall, the material of both components is sufficiently cohesive to allow it to be combined and compared as was done in part 4.2.1.3.

Typological comparison

In Table 5, a comparison of the presence/absence and counts of the different types observed for Düzen Tepe and Sagalassos is presented. For Düzen Tepe, this pertains to the combined counts of the Courtyard Building, Bakery and Kiln Area excavation, whereas for Sagalassos we combined material from excavations at the Upper Agora, Upper Agora North, the Odeon, the late Hellenistic Nymphaeum, and Site F in the Eastern Suburbium.

TYPE CODE	DÜZEN TEPE	SAGALASSOS	DÜZEN TEPE (%)	SAGALASSOS (%)
A120	97	29	15,8%	6,9%
A130	0	55	0,0%	13,1%
A131	0	14	0,0%	3,3%
A180	0	1	0,0%	0,2%
A200	0	5	0,0%	1,2%
B140	31	0	5,1%	0,0%
B150	16	35	2,6%	8,4%
B170	78	45	12,7%	10,7%
B230	4	0	0,7%	0,0%
B270	0	25	0,0%	6.0%
C120	53	0	8,6%	0,0%
C170	7	16	1,1%	3,8%
C171	11	4	1,8%	1.0%
C172	9	0	1,5%	0,0%
C260	0	4	0,0%	1.0%
C270	0	1	0,0%	0,2%
C280	1	36	0,2%	8,6%
C290	9	7	1,5%	1,7%
F120	3	3	0,5%	0,7%
F150	12	43	2.0%	10,3%
F151	1	7	0,2%	1,7%
G100	12	0	2.0%	0,0%
G110	13	0	2,1%	0,0%
G120	8	0	1,3%	0,0%
H100	22	8	3,6%	1,9%
H101	15	3	2,4%	0,7%
H102	3	1	0,5%	0,2%
H110	26	2	4,2%	0,5%
H111	38	1	6,2%	0,2%
H112	2	2	0,3%	0,5%
H130	9	2	1,5%	0,5%
H140	8	29	1,3%	6,9%
H150	1	1	0,2%	0,2%
H160	5	0	0,8%	0,0%
H170	1	5	0,2%	1,2%
H240	0	2	0,0%	0,5%
H260	0	6	0,0%	1,4%
Q200	71	5	11,6%	1,2%
Q210	40	19	6,5%	4,5%
Q220	7	0	1,1%	0,0%
Q240	0	2	0,0%	0,5%
Q250	1	1	0,2%	0,2%
TOTAL	*614*	*419*	*100%*	*100%*

Table 5: Type counts for Düzen Tepe and Sagalassos.

In general, we see an increase in typological diversity at Sagalassos compared to Düzen Tepe. This is exemplified most pronounced in the cup types, extending from a single type – the Achaemenid bowl – to four different types and one type variant. The same trend can be seen in the entire functional spectrum. In total 42 types are identified, of which 32 in Düzen Tepe, and 33 at Sagalassos. However, I already remarked on the absence of storage vessels, possibly due to the nature of the particular contexts used for this comparison, while they are clearly attested in the Hellenistic material from sites elsewhere in the study area. The material of the study area will be discussed in more detail later on in this chapter (see 4.3). However, it can already be mentioned hear that in the type counts of this material, we find an additional 8 types of this typology present in the study area that are not attested at Sagalassos, bringing the combined total for Hellenistic times up to 41 types. Unfortunately, less comparative material dated to the late Achaemenid and early Hellenistic material is available in the study area to allow a similar exercise for the Düzen Tepe material.

Interestingly, of the most extensively attested types (arbitrarily placed at taking up at least 3% of the total dataset), only the echinus bowl (B170), Achaemenid bowl (A120) and banded rim cooking pot (Q210) occur in significant quantities on both sites. For the other parts of the functional spectrum, notable shifts occur. For the cups, the increase in importance of the mastoid cup (A130) in Hellenistic times can be noted. In the bowls, a shift from flat rimmed carinated bowls (B140) to plain rim bowls (B150) is most prominent. Interestingly, dishes do not feature frequently in the material of Sagalassos, except for the rolled rim dishes, whose sizes quite often approach those of bowls. Open containers with protruding rim (F150) only become popular in Hellenistic times and appear to be one of the most distinguishable elements with diagnostic chronological value. The predominant series of simple rim jars, either plain (H100/101) or thickened (H110/H111), observed at Düzen Tepe seems to disappear, in favour of a more prominent presence of almond rim jars (H140), again a chronological indicator.

Statistical comparison

In the previous part, I provided some indications that the pottery sherds used to interpret the material culture of Sagalassos and Düzen Tepe against its overall socio-cultural background constitutes a sufficiently coherent body of material to allow a comparison to be made. In this part, I wish to present some additional statistical analyses to show how certain trends and divergences can be observed within the two assemblages. The explanations behind these observations will be presented throughout the remainder of this chapter.

Specifically, I have measured two properties - vessel diameter and wall thickness – for the diagnostics from Düzen Tepe and the Upper Agora material from Sagalassos, which were documented through illustrations during past material studies campaigns. I have used the same type codes as are standard for pottery studies in the Sagalassos Project, as presented in part 4.2.1.1. Not for every sherd could one or both of these observations be recorded, due to differing sizes and preservation. In Table 6, the number of observations for diameter and wall thickness (WT) of Düzen Tepe (TD) and the Upper Agora (UA) are listed. It should be noted that no storage vessels (G) were identified in the Upper Agora material and were therefore excluded from the comparison.

Observations	**A**	**B**	**C**	**F**	**G**	**H**	**Q**
Diameter TD	10	60	49	6	13	89	39
WT TD	14	61	52	7	12	95	40
Diameter UA	19	22	6	13	NA	24	5
WT UA	27	34	15	13	NA	36	9

Table 6: Number of observations for each of the variables.

A summary table including the mean, median, minimum, maximum and variance value of these observations can be found in Table 7, as well as in the box plots of Figure 1.

Some preliminary observations can be made at this point. It appears that comparable diameter sizes can be observed at both sites, although the Düzen Tepe vessels tend to be larger, except for the open containers and cooking pots. It should be noted, however, that only a handful of examples of the first group were attested at Düzen Tepe. Additionally, the calculation for the cooking vessels can be expected to be skewed due to the incorporation of the almost complete cooking pots (n=8) used as cremation vessels found at Site F in Sagalassos. The Hellenistic material apparently also tends to be more thin-walled. It can be suggested that more specialized production and technological control – partially allowed by the usage of finer clays – can be considered responsible for these observations. When looking at the variability within the different type groups, it appears that only for the cups and containers the variance of the Sagalassos material appears larger than that of Düzen Tepe. The former can possibly be explained by the more diversified typological spectrum observed at Sagalassos for the cups, whereas the limited observations of containers at Düzen Tepe make drawing conclusions for this group highly tentative. In all other categories the material from Düzen Tepe appears to display more variability in vessel dimensions. Finally, when looking at the boxplots in Figure 1, it can be observed that the wall thickness measurements of the Sagalassos material is highly skewed to the left regarding functional categories A, B, and H, only moderately in C, and highly right skewed in F. To ensure the validity of these preliminary observations, however, it was decided to test whether the observed variance in this sample was statistically significant.

Diameter Düzen Tepe and Sagalassos (in cm)							
Functional Category	**A**	**B**	**C**	**F**	**G**	**H**	**Q**
Mean	15.5	18.4	18.5	20.7	24	16.4	13.7
	13.3	15.1	15.2	24.3	NA	14	17.6
Median	16	17.6	18.6	19	20.5	16	13
	12.6	14.3	15.3	25	NA	14.7	19
Minimum	11	10	9.8	18	7	6.4	8.2
	3.5	8.2	12.4	13	NA	4.4	12.6
Maximum	20.4	41	31	29	42	35	22
	22.6	22.6	18	38	NA	26	19.4
Variance	10	38.5	20	17.9	106.4	28.9	11
	19.9	14.2	5.3	61.7	NA	25.4	8.2
Wall Thickness Düzen Tepe and Sagalassos (in cm)							
Mean	0.5	0.7	0.7	0.9	1.1	0.8	0.6
	0.3	0.4	0.4	0.5	NA	0.6	0.5
Median	0.6	0.7	0.6	0.9	1	0.7	0.6
	0.3	0.4	0.4	0.6	NA	0.5	0.5
Minimum	0.4	0.4	0.4	0..7	0.6	0.4	0.3
	0.2	0.3	0.3	0.4	NA	0.4	0.3
Maximum	0.6	1.3	1.5	1.2	2	1.7	1.4
	0.5	0.7	0.7	0.7	NA	0.9	0.8
Variance	0.01	0.04	0.04	0.03	0.16	0.06	0.06
	0.01	0.01	0.01	0.01	NA	0.01	0.02

Table 7: Summary statistics Düzen Tepe (up) / Sagalassos (down).

For the calculations, the open-source statistical program R was used, version 3.4.3. Specifically, the package *ggplot2* was used for rendering the plots, and packages *stats* and *lawstat* were used to perform the statistical tests. The R script used for analysis will be made available. Before moving to the hypothesis testing, the observations had to be checked for normality. To check whether the observations were normally distributed, the Shapiro Wilk test was used. The results indicate that the observations are not normally distributed (p-value < 0.001 for all tests) and therefore a non-parametric test should be used.

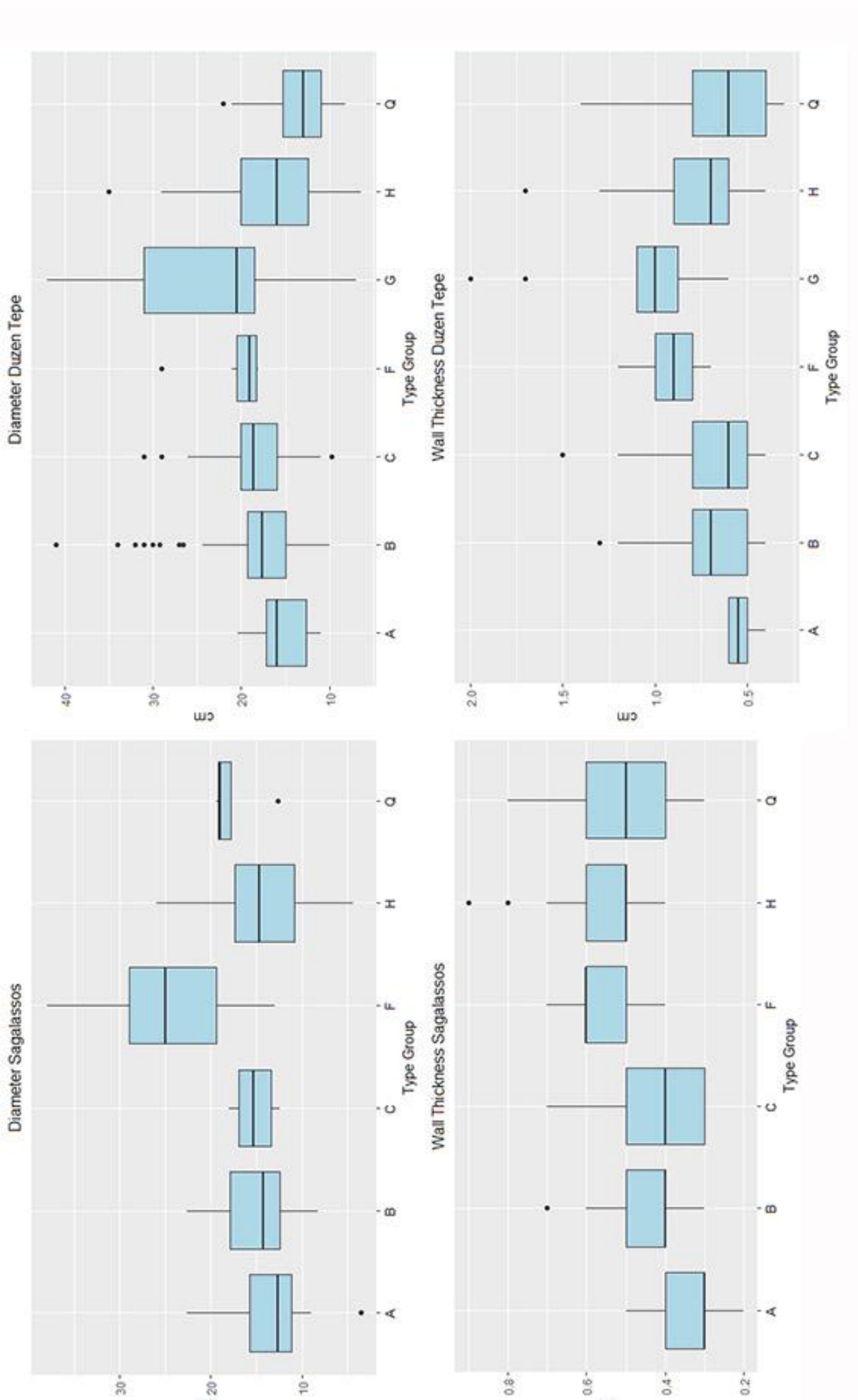

Figure 1: Box plots of observations in diameter and wall thickness per type group at Düzen Tepe and Sagalassos.

To assure the robustness of our findings, several tests were used (with confidence level of 0.95). Specifically, the robust Brown-Forsythe test was used, which measures the spread of the group median (Brown and Forsythe 1974). Alternative tests that were used are the Levene test, measuring the spread of the mean, and the robust Levene test, which uses user-specified 10% trimmed observations (Levene 1960). The Brown-Forsythe test is preferred since it uses the median, which is more robust when dealing with non-normally distributed data. The null hypothesis for the statistical tests is that the variances between the dimensions (diameter and wall thickness) of the pottery vessels collected from Sagalassos and Düzen Tepe are equal. The alternative hypothesis is two-sided, *i.e.* that the variances are not equal. The results (Table 8) indicated that for the diameter measurements the null hypothesis cannot be rejected, and therefore the diameters of the vessels collected from Düzen Tepe and those of Sagalassos are overall not significantly different (p-value = 0.213). For the wall thickness the null hypothesis was rejected (p-value < 0.001), meaning that a significant difference was observed between the vessels of Düzen Tepe and Sagalassos.

P-values of Düzen Tepe and Sagalassos		
Test	**Diameter**	**Wall Thickness**
Robust Brown-Forsythe	0.2125	<0.001***
Levene	0.1055	<0.001***
Robust Levene	0.1659	<0.001***
Significance codes: 0 *** 0.001 ** 0.01 * 0.05 . 0.1 1		

Table 8: P-values comparing Düzen Tepe and Sagalassos.

However, it was considered that by taking the overall distribution, we would combine various types of pottery whose dimensions are in principle unrelated. It was therefore necessary to differentiate the datasets into smaller components to perform more detailed analysis. It was decided to perform the tests on the level of type groups, as a sufficient number of observations are needed to perform the test without essential loss in the power, prohibiting a subdivision onto the level of the type/variant. First, the observations per type group were checked for normality before performing further tests (Table 9).

P-values Düzen Tepe and Sagalassos		
Functional category	**Diameter**	**Wall thickness**
A	0.619	0.002**
	0.472	0.004**
B	<0.001***	<0.001***
	0.773	0.003**
C	0.214	<0.001***
	0.443	0.008**
F	0.006**	0.471
	0,84	0.069.
G	0.674	0.031*
	NA	NA
H	0.041*	<0.001***
	0.780	<0.001***
Q	0.054.	0.005**
	0.015*	0.701
Significance codes: 0 *** 0.001 ** 0.01 * 0.05 . 0.1 1		

Table 9: P-values per functional category.

The tests indicated that for the diameter observations, type groups A and C are normally distributed and that therefore an F-test should be used to test the equality of variances between these datasets.

B, F, G and Q are non-normally distributed, and thus a Brown-Forsythe test should be used. For the wall thickness observations, only type group F was found to be normally distributed, requiring the use of an F-test, whereas all others were non-normally distributed, requiring a Brown-Forsythe test to be performed. Again, the null hypothesis for the subsequent statistical tests (Table 10) is that the variances between the dimensions (diameter and wall thickness) of the pottery vessels collected from Sagalassos and Düzen Tepe are not significantly different. The alternative hypothesis therefore being that they are not equal.

P-values Düzen Tepe and Sagalassos		
Functional category	**Diameter**	**Wall thickness**
A	0.293	0.348
B	0.634	0.01**
C	0.138	0.226
F	0.185	0.04*
G	NA	NA
H	0.721	<0.001***
Q	0.181	0.145
Significance codes: 0 *** 0.001 ** 0.01 * 0.05 . 0.1 1		

Table 10: P-values comparing pottery dimensions of Düzen Tepe and Sagalassos per functional category.

While performing the material studies to generate the data upon which these tests are based, it was considered that the material of Düzen Tepe seemingly displayed a higher variability in dimension sizes compared to that of Sagalassos. The summary statistics provided in table 7 seemed to confirm this idea by indicating that the variance of diameter dimensions in the material of Düzen Tepe generally appears to be higher than those of Sagalassos. Further tests have now indicated that, for diameter, no significant difference in variances between the observations of the two sites could be identified. For wall thickness, sufficient evidence was provided for functional category F to reject the null hypothesis of equal variance, while for B and H we can strongly reject that the variances are equal. For the others, we cannot reject that the variances are equal.

The results of these tests are not straightforward to interpret in light of convergences or differences in the underlying logic of either production or consumer choices associated with this material culture in both communities. However, sufficient indications have been provided to state that different choices were indeed made. Given the clearly macroscopically identifiable differences in pottery fabrics of Düzen Tepe and Sagalassos, these can most likely be linked to differences in production processes as part of distinct communities of practice.

It can be suggested that the inconclusive results of the analysis of diameter sizes could indicate that no markedly different functionalities or consumer choices should be associated with the difference of vessel dimensions. More likely, these were exercised on the morphological level of the different types rather than individual vessel sizes. The difference in wall thickness, however, could point towards significant improvements associated with the technological production process. The use of finer clays, better preparation of the paste, and perhaps also higher skills associated with specialized production would likely have allowed potters at Sagalassos to produce finer, thin-walled vessels compared to their Düzen Tepe counterparts. The higher amount of outliers observed in the box plots of Düzen Tepe (Figure 1) can likely be seen in the same respect. The results of these tests will be integrated in a more extensive argument regarding degrees of production specialization throughout the next parts of this chapter.

4.2.2 Subsistence

This paper is currently in preparation and pertains to the first calculations and analysis of the carrying capacity of Düzen Tepe (as well as offering a short comparison with Sagalassos). The draft presented here was mainly written by drs. Sam Cleymans and myself, with some contributions in the calculations of the more advanced modelling efforts through probability density functions by third author dr. Nils Broothaerts from the department of Geography. First author drs. Sam Cleymans performed most of the basic calculations of the carrying capacity of the hinterland, and wrote the short historical overview of its applications in the scholarly debate, its problems and opportunities, methodology and preliminary results. These were supplemented with some calculations by third author dr. Nils Broothaerts, who also provided the graphs. My own contribution focused mainly on extending the traditional carrying capacity approach presented in these parts by integrating the concept of social metabolism and its potential for archaeological applications. The discussion and conclusions were written in full mutual consultation by myself and drs. Sam Cleymans. The paper will be submitted to "Journal of Archaeological Research".

Sustaining People. Reassessing carrying capacity through the socio-ecological metabolism of Düzen Tepe (SW Turkey).

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Introduction

Population pressure has long been considered informative for the study of the economy, social complexity, environmental sustainability of populations in the past, *etc*. by a wide variety of scholars, demographers, economists, geographers, historians and archaeologists alike. Theoretical works on this and related concepts such as carrying capacity and sustainability go back more than two centuries. Yet, practical applications are often cumbersome due to the large amount of data and the complex interaction of factors. Moreover, archaeologists and historians have to rely on partial and fragmented sources in an incomplete record. Consequently, methodologies to calculate carrying capacity in the past often tend towards the simplistic.

This paper wishes to propose a new method to estimate the amount of people an area can sustain for past populations. To do so, we wish to extend traditional approaches to calculating carrying capacity, as well as incorporate this methodological tool into an innovative theoretical framework of social metabolism. The newly devised method will be tested on Achaemenid to early Hellenistic (5th to 2nd century BCE) Düzen Tepe, an archaeological site in the ancient region of Pisidia (SW Turkey).

Carrying capacity, a short history

The '*principles of population*' by Thomas Robert Malthus (1766-1834)[283] easily come to mind when considering concepts such as population pressure and carrying capacity. The works of Malthus, however, never mentioned the term carrying capacity[284]. In fact, the term was first used – in the same sense as it is still applied today – by the Scottish botanist George Thomson (1848-1933) on the effects of the introduction of rabbits in New Zealand on the stock carrying capacity[285]. From then on, carrying capacity was understood as '*the maximum population of a given organism that a particular environment can sustain*'[286]. Following its first use in 1886, this concept was further developed, originally to measure rangeland productivity: how many animals can graze on a given area of grassland

[283] Malthus 1798.
[284] Sayre 2008: 121.
[285] Thomson 1886: 428.
[286] Definition of carrying capacity in *Oxford dictionary of ecology* (Allaby 2010: 67).

without degrading the land[287]? From the publication on '*Game Management*' by the American ecologist Aldo Leopold (1887-1948) in the 1930's onwards, carrying capacity was applied on wildlife management too[288]. Leopold scrutinized how the population of Kaibab deer evolved after hunting and grazing were banned and natural predators such as the wolf were exterminated in the Grand Canyon Game Preserve. Leopold plodded himself further to the concept of carrying capacity and became the first scholar to apply it onto human populations, claiming that in societies, just as in nature, there are self-regulating mechanisms to prevent population overshoot: e.g., warfare[289]. William Allan, in turn, was the first to calculate agricultural carrying capacity for a human population, more specifically for the British colony of Rhodesia (Zambia)[290]. After this initial development, two divergent trajectories can be discerned: the further theorization in the fields of ecology and demography, and the application in anthropology and archaeology.

The first scholar theorizing carrying capacity – and not just applying it as a calculation method – was the American biologist Eugene Odum in his book '*Fundamentals of ecology*'[291]. Drawing on the work of Pierre-François Verhulst, Raymond Pearl, Alfred Lotka and Vico Volterra[292], Odum regarded population growth as a logistic equation, resulting in a sigmoid curve showing the population numbers over time. The asymptote which limits population growth can be regarded as the carrying capacity: a natural population will grow until it reaches its limits, being its saturation level (denoted as *K*)[293]. The growth-curve is formulated as: $\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right)$.
With N being the population size, r the growth rate and K the carrying capacity. Odum claimed that, although *K* could never be observed empirically in the field, it can be deduced from the growth curve of a population. This implies that each time carrying capacity rises or decreases, the population will react as a new sigmoid.
Some theoretical problems, however, have been raised. Levins' paradox showed that if *r* is negative and $N > K$, then unbound growth can take place[294]. Similarly, Ginzburg's paradox described that if additional mortality is added to the equation (μN), the model still reaches *K* although this contradicts with the idea of unchanging equilibrium[295]. These two problems were resolved by new formulae presented by the mathematician Jean-Pierre Gabriel *et al.*[296]. Following this new equation, the mathematician Chan Hui[297] came forth with a new problem: if 3000 protozoan *Paramecium bursaria* are placed in a 0.5 ml Petri dish and one is added, they all die. The carrying capacity of the protozoan in the Petri dish being 3000, the real population following natural growth levels of around 290 individuals[298]. Therefore, Hui proposed to redefine carrying capacity as the maximum load of an environment (the 3000 protozoa) and to denote the amount of natural stagnation as population equilibrium (the 290 protozoa). All these adjustments and models, however, are mostly theoretical and only occur in ideal situations which are exclusively observed in laboratory-environments[299]. For this paper, a more practical attitude is required.

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287 For an overview: Sayre and Fernandez-Gimenez 2003.
288 Leopold 1933.
289 Leopold 1941 [1991].
290 Allan 1949.
291 Odum 1953.
292 Verhulst 1838; Pearl 1924; Lotka 1925; Volterra 1928.
293 Odum 1953: 122-123.
294 Hutchinson 1978.
295 Ginzburg 1992.
296 Gabriel *et al*. 2005.
297 Hui 2006.
298 Based on experiments by Vandermeer (1969).
299 A critique by Levins 1966; Sayre 2008: 131-132 and many others.

In demography, mainly under the influence of (neo-)Malthusian thought, the concept of carrying capacity was adopted shortly after World War II, continuing in use today and often predicting apocalyptic futures[300]. These negativist stances are recently criticized, mostly for being grounded in theories and methods that were never empirically tested[301]. Other, less fatalistic scholars have stressed the interplay of carrying capacity with other aspects of past societies, such as economic, social and political organization, technology, connectivity, territoriality, health, quality of life, sustainability, resilience *etc*.[302] Under the influence of the New Archaeology, the concept became a hot topic in the archaeological debate in the 1970's and '80's[303]. Scholars adopted the theoretical framework and methodologies from ecology and demography, of which they soon noticed that these were not necessarily applicable to archaeological case studies[304]. To top things of, Brian Hayden stated that '*the practical problems involved in measuring and using "carrying capacity" have proven the concept to be deficient in theory, unrealistic in implementation, and impossible to measure*'[305].

Problems and opportunities

Over the past two centuries, many historians and archaeologists have endeavoured to calculate the carrying capacity of human populations in the past. Over the years, two very basic calculation methods were adopted: one starting from average grain yields per year per person or household[306], the other from a fixed area needed to sustain an average-sized household[307]. While the first method is based on ecological formulae that assume energy caption needs via a fixed and (overly) simplified diet, the second remains mute on the parameters used to calculate the required area. Moreover, both calculations were developed for specific historical contexts, meaning that the applied constant values cannot necessarily be transposed to other situations.
Consequently, alternative models have been developed, such as Hayden's *Resource Over-Exploitation* (ROE) rate[308], or the quite elaborate model proposed by Ezra Zubrow, which he tested on Hay Hollow Valley in the Navajo-Apache County[309]. More recently, a more detailed calculation of the carrying capacity of the Roman army in the western Lower Rhine delta included measures of food, timber and fuel, and was based on an extensive database consisting of archaeological, palaeo-ecological and geomorphological data[310]. Yet, this study assumed a diet of exclusively cereals (67.5%) and beef (22.5%), complemented with other foods (10%) which were not accounted for. Although this model is grounded in data, still a large amount of assumptions is being made.

The problems with archaeological models designed to calculate carrying capacity can be summarized in three points. First, the methods from ecology are difficult to transpose to archaeological cases. Ecological models are bound to fully natural conditions, while humans have the ability of changing the environment through technological innovation, and of creating of their own ecological niches. Moreover, social-cultural aspects, such as foodways and social-economic inequality, have an effect on carrying capacity too[311]. Second, the quality of the archaeological record does not often allow for direct reconstructions or exact numbers on population sizes, food consumption, material resources, land ownership *etc*. Consequently, many assumptions and oversimplifications need to be made in order to come to a result. Finally, most archaeological methods only count in foods (or exclusively grains), while

[300] E.g. Vogt 1948; Meadows *et al*. 1972; Tainter 1988; Hubbert 1993; Ehrlich and Ehrlich 2004.
[301] Persson 2010: 44-49; Friedrichs 2014.
[302] E.g. Boserup 1965; 1981; 1996; Arrow *et al*. 1995; Richerson and Boyd 1997; Fischer-Kowalski *et al*. 2016.
[303] E.g. Hayden 1975; Zubrow 1975; Hassan 1981: 161-175.
[304] Criticized by Street 1969; Brush 1975; Little and Morren 1976.
[305] Hayden 1975: 11.
[306] E.g. Beloch 1886; Holm 1965; Engels 1990.
[307] E.g. De Angelis 2000; Bintliff 2002b.
[308] Hayden 1975.
[309] Zubrow 1975.
[310] van Dinter *et al*. 2014.
[311] Dincauze 2000: 462; Lemmen 2014.

resources for construction and artisanal production, fuel for heating, water sources and space for housing, burial, worship *etc*. are excluded from the equation, while, clearly, these areas cannot be used for agricultural production. Furthermore, when considering agriculture, the single land type taken into account are arable fields, while forests for timber, and mountainous areas for shepherding and quarrying are not considered.

An archaeological model for calculating carrying capacity can therefore only succeed if the following evidence is available: 1) a reconstruction of the diet of the studied society, 2) information on the production output and required raw materials, 3) accurate estimates for the local population, 4) the spatial outline of the primary catchment area, 5) environmental parameters influencing agricultural yields, and 6) the available technologies influencing agricultural and artisanal productivity. Additionally, to effectively trace the implications of the calculated carrying capacity for a given society or population, the method needs to be integrated into a proper framework, which offers a holistic approach to flows of energy and resources needed to sustain a population across all societal domains. This includes not only subsistence strategies, but also, for example, techno-productive systems, exchange networks, and construction works. We believe that the concept of social metabolism has the inherent potential required to offer such a framework.

As our main case study, we selected the late Achaemenid/early Hellenistic occupation phases at Düzen Tepe, with a (limited) extension towards the nearby site of Sagalassos. Both sites have been studied by the Sagalassos Archaeological Research Project, which pursued from the very beginning an interdisciplinary perspective[312], resulting in important archaeological, bioarchaeological, geomorphological and palaeo-ecological datasets. Recently, papers on the foodways of the inhabitants of Düzen Tepe[313], and the pottery[314] and metal[315] production at both sites were published. Especially for Düzen Tepe, the necessary data are now available to not only make a reconstruction of the carrying capacity, but also incorporate these calculations in a new framework centred on social metabolism. The calculations presented here will therefore be mainly focused on Düzen Tepe, but where possible, we have tried to extend the case study towards the early phases of habitation at Sagalassos as well.

Opening up theoretical avenues: social metabolism

The emphasis on the concept of carrying capacity and calculation of maximum sustainable yields per given land unit is part of a more conventional tradition of human-environment analysis. These approaches relied on conceptualizations of ecological systems as static systems where biophysical dynamics tend towards stable equilibrium states, whereas change is exceptional and therefore considered as 'noise' that must be analytically suppressed[316]. In the 1970's, resilience thinking emerged as a counter narrative out of dissatisfaction with these prevalent models of ecosystem dynamics[317]. In this tradition, ecological resilience is understood as the capacity of systems to absorb disturbance while retaining the same populations or state variables, or in other words, the ability of a system to remain organized around the same set of processes, structures, and functions[318]. This is a distinctly different view of resilience compared to the more traditional engineering approach to resilience. The latter assumes a single steady system state and defines resilience as the return time to equilibrium after a system has experienced a disturbance[319].

Through the new lens of resilience thinking, the focus has shifted away from the quantitative availability of resources towards the scope of available response options. As a result, human-

[312] Degryse 2013; Van Neer and De Cupere 2013; Verstraeten 2013.
[313] Cleymans *et al*. 2017; De Cupere *et al*. 2017a; Fuller *et al*. 2012.
[314] Braekmans *et al.* 2017 ; Daems *et al.* 2017.
[315] Vyncke *et al.* 2014; Eekelers *et al.* 2016.
[316] Gunderson & Holling 2001.
[317] Cote and Nightingale 2012 : 478.
[318] Holling 1973 : 14.
[319] Pimm 1984.

environment relations can no longer be conceived as separate systems with diverging objectives and trajectories. The emphasis on feedback dynamics between social and ecological systems encourages the view that these cannot be conceived in isolation, but must rather be seen as inherently interconnected. This intertwining of social and ecological dimensions has found a common expression in the concept of social-ecological systems (SES).[320] Human societies must be considered inherently embedded in nature, as they affect, and are affected by, the dynamics, cycles, and pulses of their ecological environment through relationships of exchange of energy, materials, and information[321].

Ever since the 1990's, the concept of social metabolism has exploded onto the field of socio-environmental studies, as a suitable perspective to determine, trace, quantify, analyse and interpret these multiple relationships of exchange in energy and materials. It was generally defined by Marina Fischer-Kowalski and Helmut Haberl (1997) as the particular form in which societies establish and maintain their material input from, and output to, nature, as well as the way they organize the exchange of matter and energy with their natural environment[322]. It has been used both as a theoretical framework for explaining socio-environmental change and as a set of methodological tools to analyse specific flows of biophysical behaviour[323].
Although it became increasingly prominent in the 1990's, the concept itself can be traced back to the 19th century, when it was used for comparisons of different, yet structurally similar, systems. One of the first to apply the metaphor of metabolism to social systems, in analogy to living organisms, was Karl Marx (1818-1883) who used it to describe the metabolic flows of material commodities and interactions between society and nature[324]. Energy flows were only incorporated later on. The Ukrainian medic and philosopher Sergei Podolinsky (1850–1891) was the first to look at the energy return to energy input in a framework of reproduction of the social system[325].

During most of the twentieth century, the concept of metabolism was mainly applied within the fields of biology and ecology[326]. The transition in applications of the concept of metabolism from organisms and ecosystems to social systems has been argued for based on the human species' capabilities for communication and cooperation, which goes beyond that of any other known species[327]. Collective actions are therefore of crucial importance for human survival and reproduction. A communal group's collective metabolism minimally equals the sum of the metabolisms of its individual members. Metabolic analyses of social collectives at first were mainly preoccupied with assessment of energy flows. The American anthropologist Leslie White for example considered energy capture as an important driver of social evolution and used measures of appropriation and harnessing of energy flows to classify societies' level of evolution, represented mathematically as the product of the amount of per capita energy times the efficiency of conversion determined by level of technology ($C = E \times T$)[328].
It was only towards the end of the twentieth century that metabolism was reintroduced as a useful way of analysing material flows in social systems as well, and it has been front and centre of many contributions to social and ecological resilience thinking ever since[329]. Throughout the long history of the concept, numerous different modes of metabolism have been identified, including rural, urban, agrarian, industrial, regional, national and global metabolism[330].

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[320] Berkes and Folke 1998.
[321] de Molina and Toledo 2014: 22.
[322] Fischer-Kowalski and Haberl 1997: 62.
[323] Weisz 2007.
[324] As discussed in Schmidt 1971.
[325] Alier and Naredo 1982.
[326] Wolman 1965; Ayres and Kneese 1969; Meadows *et al.* 1972.
[327] Fischer-Kowalski 1997: 124.
[328] White 1949: 366.
[329] Baccini and Brunner 1991; Ayres and Simonis 1994; Fischer-Kowalski and Haberl 1993; Fischer-Kowalski 1997.
[330] For an overview of key publications, see de Molina and Toledo 2014: 5.

These widely divergent modes show that the concept both transcends narrow scientific divisions and is widely adjustable to specific cases. Broadly defined, social metabolism entails the entirety of biophysical analysis of exchanges in matter and energy between society and nature. Three types of material and energy flows can be distinguished – input flows, inner flows, and output flows – subdivided in five functions: appropriation, circulation, transformation, consumption and excretion.

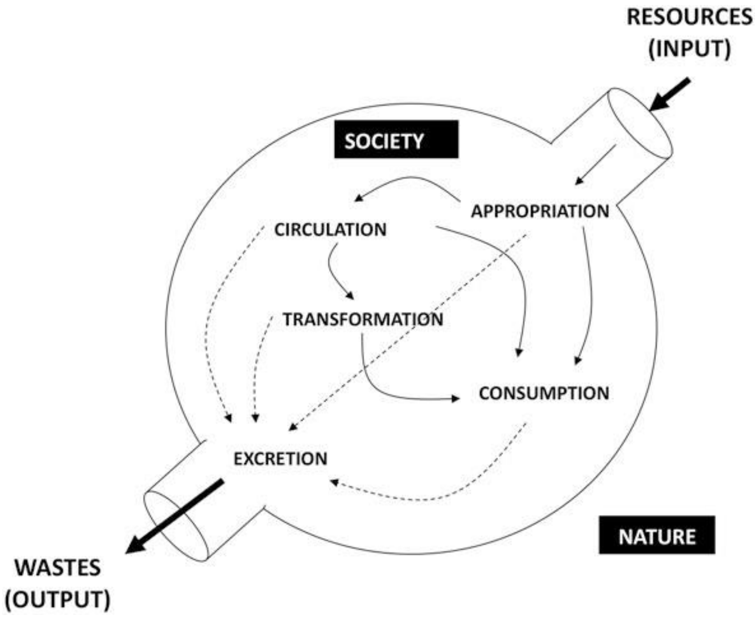

Figure 1: Processes of social metabolism (de Molina and Toledo 2014).

These metabolic functions can operate at two distinct levels: individual or biological, and collective or social. For example, appropriation processes at the individual level consist of human beings extracting oxygen, water, and biomass from nature in order to survive. At the social level, a collective unit of individuals connected through certain social relations (for example a family, workshop, or community) also extracts matter and energy from nature to ensure maintenance and reproduction[331].
A similar distinction between the level of the individual and the social collective can be extended towards all subsequent phases of the metabolic process as well (see *infra*). The division between individual and collective metabolism corresponds to a distinction made by the American biophysicist Alfred Lotka[332], between endosomatic use of energy in nutrition (bio-metabolism) and the exosomatic use of energy by tools (techno-metabolism). It has been argued that the flow of endosomatic metabolism remains fairly constant in time and is directly related to population size, whereas exosomatic metabolism is more variable and depends on the amount of technological capital present in society[333]. Because of these more or less stable endosomatic energetic needs, we can calculate subsistence costs using basic tables of general caloric needs of a community based on calculations of population size.

For exosomatic metabolic needs, on the other hand, a contextualized analysis of socially determined practices is needed, as the ways human beings are organized in society determine the way in which they affect, transform, and appropriate nature, which in turn conditions the way in which societies are configured[334]. To this end, we must look at the specific ways that exploitation of resources, habitation, burial, artisanal activities and worship was organized in a given society. As endosomatic energy needs per capita generally remain stable, the development of social organisation can only take place through the expansion of socio-metabolism beyond the addition of the bio-metabolisms of all its members, or

[331] de Molina and Toledo 2014: 60.
[332] Lotka 1956.
[333] Giampietro *et al.* 2012: 187.
[334] de Molina and Toledo 2014: 60.

in other words, through an expansion of exosomatic energy dissipation. This way, the exo/endosomatic energy ratio has been used as an indicator of the level of material complexity of societies[335].

Our proposed method of calculating carrying capacity presented in the next part is, first and foremost, aimed at calculating the caloric needs for Düzen Tepe, thus covering the endosomatic energy needs of the community in order to determine whether the surrounding lands were sufficient to sustain the population. This will provide the necessary preliminary base to undertake a full metabolic analysis of the settlement of Düzen Tepe. For now, we are still laying the foundations for integrating the interdisciplinary research team needed to undertake such a total metabolic analysis. We hope to present this additional work soon in a follow-up study.[336]

The method

In contrast to previous studies that calculated the population that could be sustained from a given area, this paper starts from an estimate of the local population to calculate what area is needed to sustain these people. Here, we have based ourselves on a method proposed by R. W. Dennell[337] to reconstruct prehistoric nutrition, and the calculations of the carrying capacity along the Roman *limes* by Marieke van Dinter *et al.*[338]. Dennell did not test his method, but presented the variables required to examine the nutrition of prehistoric people, such as population estimates, demographic information and a reconstruction of the diet. In turn, van Dinter *et al*. applied a model using less variables aimed at calculating the carrying capacity. The model presented in this paper is grounded on five main components: 1) population estimates, 2) caloric needs, 3) diet reconstruction, 4) land yields and 5) landscape reconstruction.

The amount of people living at Düzen Tepe influenced the amount of foods needed, and thus directly alters the population pressure. The yearly energy requirements for a single person is based on sex, age, weight and physical activity level[339]. The caloric requirements relate directly with the amount of foods that are consumed. The zooarchaeological and archaeobotanical materials[340] as well as the diet reconstruction based on stable carbon and nitrogen isotopes[341] make it possible to reconstruct the foodstuffs which were consumed in this settlement. Of these foods, their relative share in the diet, as well as their energy content serve as important evidence to determine the amounts that are needed to reach the total energy requirements: to meet a certain amount of calories, one would have to eat a much smaller amount if exclusively bacon was consumed than with a diet only consisting of lettuce. Each of the components of the diet, both the animal and vegetal products, ask for a certain surface area of a specific landscape type (i.e. an ecological niche) to meet the required caloric values. The availability of certain technologies and the chosen agricultural strategies play a significant part too. Finally, the environmental needs of each of the food products will be taken into consideration: a cow has very different requirements than lentils for example. These can be compared with the available environmental niches in the surroundings of the archaeological site of Düzen Tepe.

After having analysed each of the components separately, these will be combined in a general equation which allows to calculate the required space and landscape types to sustain the population:

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[335] Giampietro 2003.

[336] An interdisciplinary research team (SuRP+) consisting of archaeologists, historical demographers, geographers, and environmental scientists has already been composed within the framework of an IdeaLab grant by the Academic Foundation of the University of Leuven. Preliminary initiatives for collaboration have been initiated.

[337] Dennell 1979.

[338] van Dinter *et al*. 2014.

[339] James and Schofield 1990.

[340] Cleymans *et al*. 2017; De Cupere *et al*. 2017a.

[341] Fuller *et al*. 2012.

$$A = \sum_{x=1}^{n} \left(\frac{1}{m_x \cdot E_x \cdot Y_x} \right) \cdot (EN \cdot N)$$

A_x: Area needed to sustain a population (ha)
m_x: The relative mass of a specific food
E_x: The caloric value of a specific food (kCal/kg)
Y_x: Product's yield (kg/ha)
EN: Energy need of a single person per year (kCal/person)
N: The number of people residing in the study area

This formula thus expresses that for each archaeologically documented food the required area can be deducted from the variables listed above. A total measure for the land needed to sustain the population, can be obtained via the sum of all separate areas needed to produce a sufficient amount of a single food.

Results

Population estimates (*N*)

The number of people residing at Düzen Tepe is calculated by using the so-called 'shotgun method 2.0'[342]. This method is loosely based on the shotgun-method by Mogens Herman Hansen[343], who proposed to apply a broad variety of formulae to estimate the amount of Greeks living in all *poleis* throughout the Aegean world. He argued that the final outcome should be the full range of all estimates. In the method applied in this paper, we did not choose the full range as the result, but rather take into consideration the distribution of all estimates, meaning that the population number is presented as the range with the highest probability.
To this end, a variety of formulae to estimate the population of Düzen Tepe is applied. Elaborate evaluations of these techniques can be found elsewhere[344]. In general, these formulae rely on the built-up area of the settlement, house counts and the floor area of these dwellings. These basic data are available for Düzen Tepe thanks to the multi-disciplinary surveys executed by the Sagalassos Project[345], which resulted in a detailed map of the site. The built-up area was measured as covering at least 12.8 ha. However, modern agricultural practices north of the eastern promontory and the outcropping bedrock on the western promontory hindered mapping the entire settlement. Consequently, the numbers given here might result in an underestimation of the population size.
One formula[346] bases itself on the area within the fortification walls, which has been measured as 61.3 ha, which is far more than the urban or built-up area. Such larger areas are not uncommon in late Achaemenid and early Hellenistic Anatolia for a variety of reasons: e.g. considering settlement growth, rough terrain which does not allow for the enclosure of an acropolis, or the extension of the walls to incorporate a harbour[347]. For the house count, we based ourselves on the geophysical survey. However, geophysics seldom allow the determination of the function of an edifice. Therefore, almost all separate buildings were regarded as houses, resulting in a total of 283 units. For 30 of them, the floor area was measured. This measure makes it possible to calibrate the number of people living in one edifice, as it is assumed that a larger dwelling can house larger families than smaller dwellings[348].

[342] Cleymans 2018.
[343] Hansen 2006b.
[344] Hollingsworth 1969; Hassan 1978, 1981; Schacht 1981; Willigan and Lynch 1982; Zorn 1994; Chamberlain 2006; Wilson 2011; Drennan *et al*. 2015; Cleymans 2018.
[345] Vanhaverbeke *et al*. 2010: 106-110; Vyncke 2013.
[346] Russell 1958: 68.
[347] Wycherley 1962.
[348] Naroll 1962.

Basic data	Formula	Lower limit	Upper limit	Reference
Area	Walled area x population density	613	3.065	Russell 1958, 68
Area	Urban area x population density	1.280	1.920	Russell 1958, 68
Area	Urban area x percentage of residential area x population density	960	1.613	Bintliff 1997b, 235; Hansen 2006b,61
Area	Urban area x population density for an unplanned city	512	768	Price 2011, 23
Area	Residential area x population density	1.000	1.280	Engels 1990, 82
Area	Area = a x population^b	366	1.448	Wiessner 1974, 343-350
Floor Area	Housing units x (average size/surface per person)	268	1.072	Naroll 1962
Houses	(Housing units/area) x residential area x sum(perc. Housetype x household size(linear))/2	746	1.140	Cleymans 2018
Houses	(Housing units/area) x residential area x sum(perc. Housetype x household size(logaritmic))/2	764	1.274	Cleymans 2018
Houses	(Housing units/area) x residential area x sum(perc. Housetype x household size(linear))/8	186	284	Cleymans 2018
Houses	(Housing units/area) x residential area x sum(perc. Housetype x household size(logaritmic))/8	192	318	Cleymans 2018

Table 1: Estimates of population size of Düzen Tepe.

The application of the formulae resulted in eleven population estimates, as presented in table 1. the mean of all estimates lies on 958 inhabitant with a standard deviation of 504. Supposing a Gaussian distribution, a 68.2% change exists that the population of Düzen Tepe was between 454 (µ - 1s) and 1461 (µ + 1s) individuals (Figure 2).

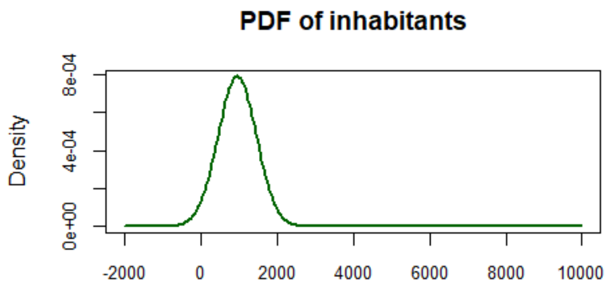

Figure 2: Probability density function (PDF) of inhabitants of Düzen Tepe (x-axis), based on the estimates shown in Table 1.

Energy needs (*EN*)

Calculating the energy needs of a person on a daily basis can be quite cumbersome as the metabolism is influenced by a broad variety of external and internal factors. Those influencing the caloric needs most are age, sex, body weight and physical activity of an individual[349]. Indeed, age is an important factor because the growth of infants, children and adolescents requires a raised caloric intake compared to that of adults and elderly people. As a genetic factor, sex influences the basal metabolism as well: men require an average higher energy need than women. Furthermore, the basal metabolic rate (BRM) is influenced by the body mass of an individual, as it counts for the nutrition needed to sustain normal body function (and weight) in absolute rest for long periods of time. Finally, the more active a person's lifestyle, the more energy the body consumes. Other aspects not taken into account are those which are not archaeologically measurable, such as genetic heredity – some people have a faster metabolism – and disease – raising the body's energy consumption to fight the illness – as well as those factors which can be considered to be negligible, such as the effect of climate which can be easily minimized by adjustments in housing and clothing.

[349] James and Schofield 1990; Eveleth and Tanner 1990; Bogin 2001.

The United Nations Food and Agricultural Organization (FAO) composed a series of age and sex specific formulae for the calculation of the daily energy needs of a person based on body weight and the Physical Activity Level (PAL)[350]. For the input data some assumptions need to be made. First, when covering the population as a whole, it is safe to assume an equal presence of men and women. When it comes to age, we decided to use the formulae for adults (18-30 years old) for two reasons: the raised energy need per kilogram for sub-adults compensates for the elevated body weight of adults, and furthermore, the skeletal assemblage of Düzen Tepe does not allow for a reconstruction of the demographic structure of the society as it consists so far of only two *in situ* burials.
The PAL is to be understood as a factor with which the BMR is multiplied to obtain the Total Energy Expenditure (TEE) based on the lifestyle of a person. Here, we chose a '*vigorous or vigorously active lifestyle*' for men (PAL: 2.2) and an '*active or moderately active lifestyle*' for women (PAL: 1.8). The former encompasses people which have to walk long distances over rugged terrains, carrying heavy loads as well as non-mechanized agricultural workers, while the latter covers the lifestyles of skilled workers (e.g. masons, potters etc.) and rural villagers participating in agricultural activities, or collecting fuelwood, water and foods[351]. The estimates of the body weight are based on Frank Siegmund (2011), who estimated the mean body weight for males at 71.7 ± 6.4 kg and for females at 59.0 ± 5.5 kg. Siegmund's study was based on regression formulas to transfer osteometrics to body mass, and made use of a sample of 512 individuals from medieval cemeteries (5^{th}-15^{th} century AD) in Switzerland. Given the similar lifeways and environmental conditions of the individuals in the Suisse sample and the inhabitants of Düzen Tepe, we decided on adopting these figures.
Based on the FAO-formulae for men and women between 18 and 30 years old, the energy needs can be calculated as:

$$\text{men: } EN = PAL \cdot (15{,}057 \cdot weight + 692.2)$$
$$\text{women: } EN = PAL \cdot (14{,}818 \cdot weight + 486.6$$

Using this formula, a male inhabitant of Düzen Tepe required an energy need of 3897 ± 212 kcal per day. A female inhabitant required 2449 ± 146 kcal per day. On a yearly basis, this equalises an energy need for males of 1,422,745 ± 77,381 kcal, and for females of 894,086 ± 53,545 kcal. For a population consisting of 50% men and 50% women (adults) this is an energy need of 3174 ± 258 kcal per day, and 1,158,416 ± 94 100 kcal per year.

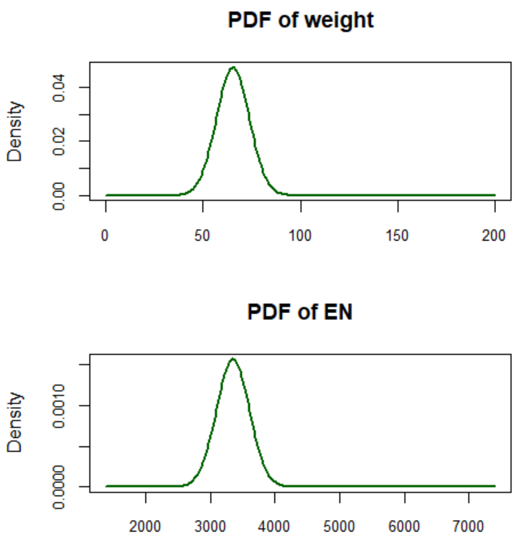

Figure 3: Probability density function of 'weight (kg)' (on x-axis) on upper graph and 'Energy Need (kcal per person per year)' (on x-axis) on lower graph for a population consisting of 50% men and 50% women (adults).

350 FAO 2001.
351 *Ibidem*, 38-39.

Diet reconstruction

The study of zooarchaeological and archaeobotanical remains at the site already provided excellent indications on the foods consumed at Düzen Tepe. An assessment of the foodways and diet indicated which choices – often cultural – were made related to the use of environmental resources. Indeed, of all available and potential foods in the surroundings of a settlement (i.e. menus), only a limited amount is regarded culturally as edible and thus effectively consumed (i.e. diet)[352]. Yet, the relative amounts of animal bones and charred plant remains inform us only partially on the share of each of these foods in the energy input for the people of Düzen Tepe. Therefore, the animal and plant products will be discussed separately.

Animal products

The study of the faunal remains at Düzen Tepe was executed by Beatrice De Cupere *et al.*[353], showing that the majority of the more than 20,000 identified skeletal fragments can be interpreted as consumption refuse belonging to domesticates. As the share of (shell)fish, game mammals and fowl was <1%, these are not regarded as a significant element in daily food consumption and therefore excluded from the calculations. Of the domesticates the most abundant taxa were sheep/goat (72%), cattle (19%) and pig (9%). Sheep and goat were present in almost equal amounts, respectively 51% and 49%. Slaughter patterns (based on their age at death) indicated that both cattle and sheep/goat were kept for their milk/wool mainly, and only secondarily for their meat[354]. Considering the relative milk yield of each of these animals, 60% of all milk was provided by cattle, while sheep (14%) and goat (26%) had a lesser share[355]. The same is true for the meat produce. For Roman Imperial Sagalassos, the meat yield per animal was calculated based on their average slaughter age and withers height[356] by applying the calibration curves by Jean-Dennis Vigne[357]. As the slaughter ages at Düzen Tepe are quite similar to those of Roman Imperial Sagalassos, these same figures will be applied[358]. This results in a highest share of meat yield for cattle (75%), and far lower numbers for sheep (9%), goat (9%) and pig (7%).

In contrast to milk yield, meat produce is not presented in kg/year, but as kg/animal. Therefore, to make numbers comparable, meat yield should be divided by the average slaughter age. For pigs, this age has been established in a detailed study of changes in pig husbandry from late Achaemenid/early Hellenistic times at Düzen Tepe until the Middle Byzantine period at Sagalassos[359]. At Düzen Tepe, peaks in age at death can be found at the ages of 2-4 months and between 2 and 3 years. While the remains of young piglets have been interpreted as natural deaths, the older pigs are regarded as butchered for their meat. The mandibula wear stages (MWS) of the *ovicaprids* indicated that the majority was over 4 years old[360]. Finally, the skeletal material of cattle did not allow for a detailed reconstruction of slaughter patterns, but both young and adult individuals were observed in the faunal assemblage[361]. This indicated that female animals were primarily reared for their milk, while the majority of the bulls were killed for their meat at a young age. Consequently, the yearly meat yields are often far lower than those of milk (see Table 2). Assuming the consumption of all meat and dairy products for each animal, the yearly weight percentage of dairy compared to the total of animal products ranged between 60 and 87%.

[352] Higman 2011: 3; Reitz and Wing 1999: 239.
[353] De Cupere *et al*. 2017a. Updated by Cleymans *et al*. 2017.
[354] *Ibidem*; De Cupere *et al*. 2017b: 11.
[355] Cleymans *et al*. 2017; calculated based on the numbers published by John Robb 2007: 138: 350 kg/year of milk for cattle, 45 kg/year for sheep and 77kg/year for goat.
[356] De Cupere 2001: 145-146.
[357] Vigne 1991.
[358] 250 kg of meat for cattle, 16 kg for sheep/goat and 48 kg for pig (De Cupere 2001: table 44).
[359] Frémondeau *et al*. 2017.
[360] De Cupere *et al*. 2017a.
[361] *Ibidem*.

Product			Meat yield (kg/animal)	Age (year)		Yield (kg/year)	
				Min	Max	Min	Max
Meat	Sheep/goat	Mutton	16	3	5	3	5
		Goat	16	3	5	3	5
	Pig	Pork	48	1	3	16	48
	Cattle	Beef	250	1	5	50	250

Product			Milk yield (kg/year)
Dairy	Milk	Goat milk	77
		Sheep milk	45
		Cow milk	350

Product	Weight%	
	Min	Max
Dairy	87%	60%
Meat	13%	40%

Table 2: Food yield of domestic animals.

The relative caloric value of each of the animal products can now be obtained. The energy contents are based on the USDA Nutrient Data Laboratory[362]. As presented in Table 3, the foods with the largest share in nutritional provision were cow milk and beef, followed by goat milk. Indeed, dairy was more important than meat in the diet.

Product	mx (Relative mass)		Caloric value (kcal/kg)	
	Min	Max	Min	Max
Mutton	1,2%	1,4%	1690	3720
Goat	1,1%	1,3%	1090	1430
Pork	1,4%	3,1%	1340	3760
Beef	9,5%	33,7%	1120	3720
Goat milk	22,2%	15,4%	680	700
Sheep milk	12,4%	8,7%	1060	1100
Cow milk	52,1%	36,3%	610	640
Total	**100,0%**	**100,0%**		

Table 3: Caloric value of animal products.

Plant products

The same exercise can be performed for plant products, based on 515 identified charred archaeobotanical remains[363]. Given the sometimes very small number of finds for some foods, not all will be added to the equation. Fig, olive and *rubus*, for example, were represented by a single element only, and of drupes only two stone fragments are recovered. Also, the three seeds of the *Lallemantia iberica*, known as a source of vegetal oil[364], are not considered. Included in the analysis are grains (68%), pulses (20%) and grapes (11%). Of the grains, 2% of the remains belonged to emmer, while most elements were attributed to barley (38%) and wheat (60%). The pulses were represented by lentils (6%), peas (16%) and bitter vetch (78%). In contrast to the animal products which are presented as weight percentage, these percentages denote the share in individual botanical elements. As a single grape weighs more than a single wheat grain, the shares need to be calibrated following their mass per grain (kg/gr)[365].

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362 https://ndb.nal.usda.gov/ndb/search/list.

363 Presented in De Cupere *et al*. 2017b; Cleymans *et al*. 2017.

364 Jones and Valamoti 2005.

365 The numbers are derived from note AG1420 by the department of agriculture in the state of Victoria (Australia); http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/estimating-crop-

For grapes, both the archaeobotanical and ceramological evidence indicated that the majority of grape yield was meant for the production of wine[366]. Yet, since not the entire grape is used for this production and the must mostly ended up as fertilizer or fuel[367], part of the grape is not consumed. On average, one ton of grapes results in 570 litres of wine[368]. Consequently, only 36% of the mass of a single grape ends up in wine as end product and thus gets consumed. The results of the weight percentage of all vegetal foods can be found in Table 4, showing that the grapes represent the largest share, followed by wheat and barley. Here, it should be noted that grape remains might be overrepresented as they are interpreted as being must, used as fuel and thus considered purposefully thrown into the fire, increasing their preservation potential.

Product		Share		Total share	Weight per grain (kg/gr)	Consumed percentage	m_x (Relative mass)	Caloric value (kcal/kg)
Grain	Emmer	68%	2%	2%	0,000034	100%	1%	3620
	Barley		38%	26%	0,000042	100%	13%	3495
	Wheat		60%	41%	0,000034	100%	16%	3440
Pulses	Lentil	20%	6%	1%	0,000040	100%	1%	2370
	Pea		16%	3%	0,000200	100%	8%	2350
Fruits	Grape	11%	100%	11%	0,001333	36%	61%	750

Table 4: Agricultural products consumption.

For the energy content of these foods the caloric values by the USDA Nutrient Data Laboratory are used[369]. Table 4 shows that the grains provided *c*. 60% of the energy from plant products, while pulses and grape each satisfied resp. *c*. 14 and 26% of the caloric needs.

Stable isotope analysis

So far, plant and animal products have been discussed separately. Since these were not eaten in equal amounts, the share of both in contemporary diet needs to be scrutinized too. Stable isotope analysis results ($\delta^{13}C$ and $\delta^{15}N$)[370] provide relevant information. A study on the consumption pattern of Neanderthals, for instance, partly succeeded in quantifying the contribution of animal and plant proteins to the diet[371]. Unfortunately, the data on diet reconstruction for Düzen Tepe do not allow for a similar outcome, but provide other meaningful evidence.

Although scholarly tradition often claims that meat consumption was quite rare in antiquity[372], stable isotope analysis ($\delta^{13}C$: -19.4‰ ± 0.4‰; $\delta^{15}N$: -9.7‰ ± 0.7‰) executed on four human bone samples from Düzen Tepe indicated that animal products were eaten on a regular basis[373]. Therefore, we decided to use a relatively broad range for the share of animal products in the daily diet: 15-35%. This weight percentage corresponds to the contribution of animal products in diets of rural populations in the Eastern Mediterranean from the 1960's until today[374]. When taking the energy content of all foods into account (Table 5), animal products represented between 6.6 and 27.7% of caloric intake, while vegetal foods had a share of 72.3-93.4%. Meat products provided 3.1-26.9% of daily energy requirements, dairy 3.5-27.7%, grains 32.7-49.5%, pulses 10.9-20.9%, and wine and grapes 16.3-21.4%.

yields-a-brief-guide. The average weight of a single grape (1.8g) is found in Jackson (2003), but as most grapes contain one to two pips (Creasy and Creasy 2009), this mass needed to be divided by 1.5.

366 Cleymans *et al*. 2017; De Cupere *et al*. 2017b: 11.

367 Margaritis and Jones 2006.

368 Vine *et al*. 2012.

369 https://ndb.nal.usda.gov/ndb/search/list.

370 Fuller *et al*. 2012.

371 Bocherens 2009.

372 E.g.: Garnsey 1999: 16-17; Moreno 2007 : 18-19; Von Reden 2007 : 394-396; Ekroth 2007: 249-272.

373 Fuller *et al*. 2012: 160-165.

374 Data by FAOSTAT (http://www.fao.org/faostat/en/#data/FBS).

Yields, technologies and agricultural strategies

Animal products

Previously the proportion of animals kept at or in the environs of Düzen Tepe has been discussed. Here, we will look into the area a single cow, sheep, goat and pig needs. Before doing so, a better understanding of how these animals were kept is required, as conditions are different when these domesticates are fed in an enclosure, or whether transhumance was practiced in the mountain range north of the settlement (Ağlasun Dağları)[375]. A first indication on strategies in animal husbandry can be found in the stable isotope analysis executed by Benjamin Füller *et al.*[376]. Of the domestic animals, the mean of their stable nitrogen and carbon isotope signatures ($\delta^{13}C$ and $\delta^{15}N$) plot very close together. This indicates that either the '*animals were herded and allowed to graze in the same general area or kept in enclosures and fed a nearly identical diet during this period*'[377]. This is further corroborated by the raised $\delta^{15}N$ value in these domesticates.

Although it is not clear what the exact underlying cause is, two hypotheses were proposed: the animals were either grazing in arid or saline environments, or they were kept in enclosed areas where their own manure would increase the $\delta^{15}N$ value[378]. As the environs of Düzen Tepe cannot be considered as saline and arid[379], the second hypothesis is more plausible. Moreover, in a diachronic study on pig husbandry changes in Düzen Tepe and Sagalassos, Delphine Frémondeau *et al*. argue for '*the local raising of pigs by Düzen Tepe dwellers*', based on the mortality patterns[380]. Altogether, it seems that domestic animals were reared together in corals, stables or other enclosed spaces where the animals were fed with quite similar feed. The bitter vetch, which was quite common at Düzen Tepe, might have primarily served as fodder, as untreated bitter vetch is poisonous for humans, while it is not for animals[381].

There are several reasons to opt for rearing and feeding domestic animals close together. First, Düzen Tepe can be classified as a self-sustaining community in several respects[382], including its animal management[383]. This means that the investment to manage separate herds for each domesticate would be too high in man-hours compared to its economic and nutritional returns. Second, as the mortality patterns indicate, sheep, goat and cattle were primarily reared for their secondary products: wool and milk[384]. When regular milking is performed (once or twice a day) it is easiest to keep the animals close to hand[385]. Third, if the area is calculated that is needed to allow all Düzen Tepe cows graze, this would result in estimated amounts of grass lands ranging between 700 and 3,000 ha[386]. Even the lowest number would mean that most of the available space in the nearby valley system would be used as grass land for cattle. To place this in perspective, in the UK there are 20 million hectares of agricultural area of which 6 million are used as grass land for cows[387]. Indeed, animals take a lot of space if their feeding strategy is exclusively based on grazing and browsing.

How much space is needed per animal to keep them in a closed space is the next question. The problem is that we have no evidence on the type of enclosure or stable used, forcing us to rely on modern-day analogies. In pig pens and sties the most cost-efficient area per pig in modern farming is 1.9 m² plus

[375] As is still practiced today with sheep and goat herds (Beuls *et al*. 2000; 2001).
[376] Füller *et al*. 2012.
[377] *Ibidem*: 160.
[378] *Ibidem*; Schwarcz *et al*. 1999; Commisso and Nelson 2004: 1174.
[379] Bakker *et al*. 2012: 258-259.
[380] Frémondeau *et al.* 2017: 43.
[381] Zohary *et al*. 2012: 92; Megaloudi 2006: 55.
[382] Daems and Poblome 2016: 96.
[383] De Cupere *et al*. 2017b: 11; Frémondeau *et al.* 2017: 43.
[384] De Cupere *et al*. 2017a.
[385] Phillips 2001: 91.
[386] As grazing area a surface of 1 ha per cow per month is used (Robb 2007: 138).
[387] Phillips 2001: 91.

an additional 0.3 m² of free space per pig[388]. Indeed, pigs need separate functional spaces for eating, drinking and dunging. As the same free functional space can be used by several animals, the farmer has an advantage by keeping more pigs in his pen: the amount of free space diminishes as the amount of pigs in the pen raises. This means that above 20 pigs per pen, 10-15% more animals can be added[389]. When translating these numbers to Düzen Tepe, it is safe to assume that the space requirements lay somewhere between the modern standards and more spacious areas of maybe even 100 m² per animal, which is still a massive space reduction to the 0.1 ha per animal per month for free ranging pigs[390]. For sheep and goat an average indoor surface of 1.5 m² is required according to modern standards[391]. Again, larger living spaces can be assumed as indicated by some anthropological cases of smallholder systems where a family holds 5-20 goats/sheep on a small area of up to 3 ha[392]. This again is a downsize in required space for free grazing or browsing small ruminants[393]. Especially for cattle the difference between cow grazing on grassland and one fed in a cow house is enormous. While the former is estimated of requiring 1 ha of pasture per animal per month[394], the latter only takes up 7.5-9 m² of bedded and hard-standing area[395]. This surface is without the milking area and possible loafing areas which slightly raise space requirements. The following table summarizes these surface requirements per animal.

Animal	Land Need (ha/animal)	
	Min	Max
Sheep	0,00015	0,01
Goat	0,00015	0,01
Pig	0,00022	0,01
Cattle	0,00075	0,01

Table 5: Land needs of domestic animals.

Plant products

Calculating the space required for crops is more straightforward as these yields are often expressed as the amount of kilograms per ha. Nevertheless, there is no such thing as universal yields for any given crop. These yields are very much dependant on soil type and quality, climate, water management, manuring and farming strategies[396]. Recently, Maarten Van Loo *et al*. calculated diachronically changing yields of barley within the Gravgaz basin[397], close to Düzen Tepe. These numbers, calculated via a complex model using variables such as soil thickness, soil erosion processes, ground water, precipitation, topography, land cover and temperature, provide a locally grounded parallel which is safe to apply on the Düzen Tepe case. For other crops, yield figures from similar environments will be applied. Just as for livestock, crop cultivation strategies need to be determined first. Based on identified weeds in the available archaeobotanical record, winter cereal cultivation is assumed[398]. Moreover, the high proportion and diversity of pulses in combination with wheat and barley points to a rotational system where legumes and cereal crops are planted alternatingly to maintain soil fertility[399].

[388] McGlone and Pond 2003: 201-205; Curtis *et al*. 1989.
[389] McGlone and Pond 2003: 203.
[390] Robb 2007: 138.
[391] Andersen and Bøe 2007: 90; Toussaint 1997: 161.
[392] Summerized by Purohit 1982.
[393] 0.1 ha per animal per month (Robb 2007: 138).
[394] Robb 2007: 138.
[395] Phillips 2001: 174-185.
[396] e.g. Abrahamsen and Hansen 2000; Stockle *et al*. 1994; Loss and Siddique 1994: 232-236.
[397] Van Loo *et al*. 2017.
[398] De Cupere *et al*. 2017b: 11.
[399] *Ibidem*.

Starting with grain, the one variety with the largest nutritional share in the diet of the people of Düzen Tepe is wheat. Several experimental studies in Spain – in a Mediterranean climate – can serve as a parallel for Düzen Tepe. The first study was conducted in Andalusia (SW Spain)[400], where production is based on traditional, rainfed tillage in a semi-arid environment. This resulted in a yield of 2,517 kg of wheat per ha. In the Ebro valley, the effect of the soil's N-content on the yield and quality of wheat on irrigated fields was studied[401]. Yields under different environmental and N-fertilized factors ranged between 2,422 and 5,730 kg per ha. Finally, research focussing on several climatic factors such as temperature and rainfall throughout Spain yielded 2,490-3,200 kg of wheat per ha in rainfed systems[402]. In modern-day Turkey, average wheat yield ranged between 909 and 2,429 kg/ha between 1961 and 2014[403].
As for the plateau of Düzen Tepe no clear indications for irrigation have been found, only the figures from rainfed systems will be taken in consideration. For barley, we can rely on data provided by the study of Maarten Van Loo *et al.*, which resulted in a yield of between 1,110 and 2,500 kg/ha, depending on soil thickness and topographical unit in the landscape (hillslopes, valley bottoms…)[404]. These values are very similar to the average barley yields in Turkey from 1961 onwards[405]. For emmer yields, less studies are available, especially for areas similar to that of Düzen Tepe. Yet, comparable results can be assumed as for wheat since both plants are very similar in characteristics. This assumption is corroborated by a study in Central Italy on emmer produce, showing average yields between 1,500 and 2,400 kg/ha depending on the soil's N-content[406].

When it comes to pulses, a study from the Mediterranean climatic zone in Southwest Australia focussed on the yield of several species which were grown in rotation with grain[407], as was presumably the case at Düzen Tepe. Moreover, the paper makes a distinction between rainfed and irrigation regimes, of which we will only adopt the figures of the former. Experiments in this study resulted in a yield of between 220 and 1,250 kg/ha for lentils and 1,040-2,790 kg/ha for peas[408]. Compared to modern Turkey, the numbers for peas are similar, while for lentil the Australian figures are quite low[409]. For bitter vetch, two experimental studies in the Mediterranean provide an indication on agricultural output. The first study was conducted in Northwest Syria on 25 bitter vetch accessions. Grain weights, from the harvest of one hectare ranged between 1,285 and 1,959 kg with a mean yield of 1,719 kg/ha[410]. Second, in a cool Mediterranean climate in Southwestern Australia, experiments on vetch cultivation resulted in a seed yield of 26 to 1,979 kg/ha. As these numbers are highly varying, the average of 997 kg/ha[411] serves as a more useful figure. Grape yields are usually expressed as the weight of grape berries per vine. Therefore, this berry yield can be multiplied with the average amount of vines per hectare. A Spanish study in a wine producing region in Catalonia resulted in a range of 1.48-5.66 kg/vine with an average of 3.4 to 3.8 kg/vine[412]. In general, the spacing between vines around the world ranges between 1x1.1 to 3x3 meters. This comes down to a density of 1,100-9,000 plants per hectare[413]. This means that a single hectare could produce a total of 3,000 to more than 20,000 kg of grapes per year. Here, we favour the lower parts of the figure range as these correspond more with

[400] Murillo *et al*. 2004.
[401] Abad *et al*. 2004.
[402] Del Moral *et al*. 2003.
[403] Data by FAOSTAT (http://www.fao.org/faostat/en/#data/FBS).
[404] Van Loo *et al*. 2017: 498.
[405] Data by FAOSTAT (http://www.fao.org/faostat/en/#data/FBS).
[406] Marino *et al*. 2009.
[407] Thomson *et al*. 1997.
[408] *Ibidem* 181-182.
[409] Data by FAOSTAT (http://www.fao.org/faostat/en/#data/FBS).
[410] Larbi *et al*. 2011: 280.
[411] Siddique *et al*. 1999.
[412] Serrano *et al.* 2012.
[413] Creasy and Creasy 2009: 85.

the grape yields in Turkey during the 1960's to 80's[414]. Viticulture has become much more productive in the last decades due to technological and scientific improvements.

The yields listed above are summarized in Table 6. Because animal products are presented as the land needs for a single animal – instead of the amount of animals per surface area – plant product numbers will be presented in the same way.

Product	Yield (kg/ha)	
	Min	Max
Emmer	1500	2400
Barley	1110	2500
Wheat	1000	3000
Lentil	220	1250
Pea	1040	2790
Bitter vetch	1000	2000
Vine grape	2500	5000

Table 6: Yields and land needs of cultivated plants.

Area needed to sustain a population

The area needed to sustain the population at Düzen Tepe was calculated for four scenarios:

1. Low share of animals (15%) and low yields, resulted in an area of 272 ± 145 ha to sustain the population (Figure 4).
2. High share of animals (35%) and low yields, resulted in an area of 166 ± 88 ha to sustain the population (Figure 5).
3. A third scenario, with a low share of animals (15%) and high yields, resulted in an area of 44 ± 23 ha to sustain the population (Figure 6).
4. A fourth scenario, with a high share of animals (35%) and high yields, resulted in an area of 22 ± 12 ha to sustain the population (Figure 7).

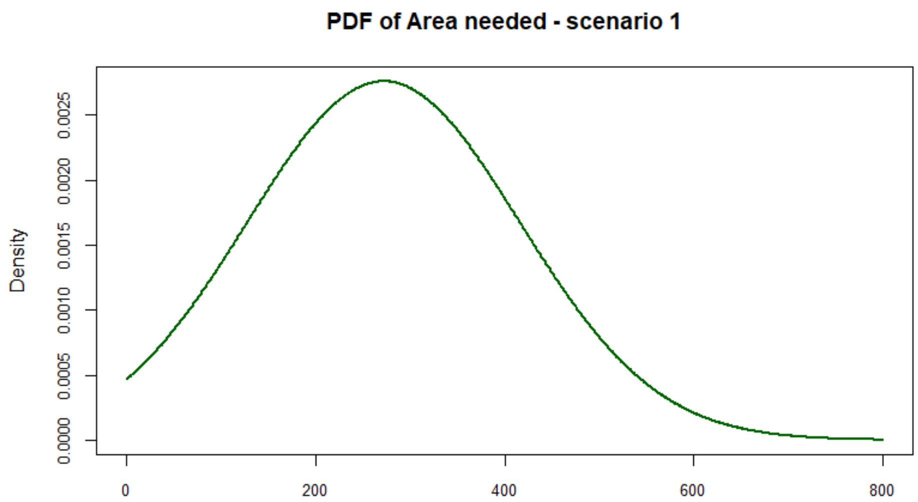

Figure 4: Probability density function of the area needed to sustain a population (area on x-axis), in a scenario with a low share of animals (15%) and low yields.

[414] Data by FAOSTAT (http://www.fao.org/faostat/en/#data/FBS).

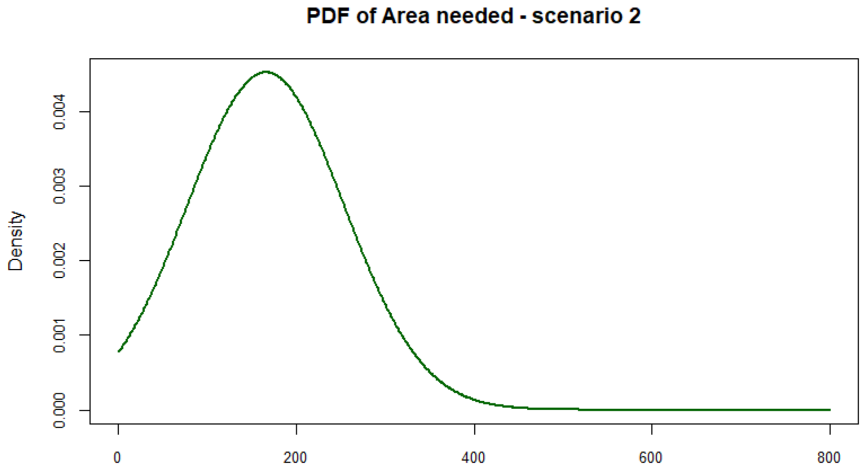

Figure 5: Probability density function of the area needed to sustain a population (area on x-axis), in a scenario with a high share of animals (35%) and low yields.

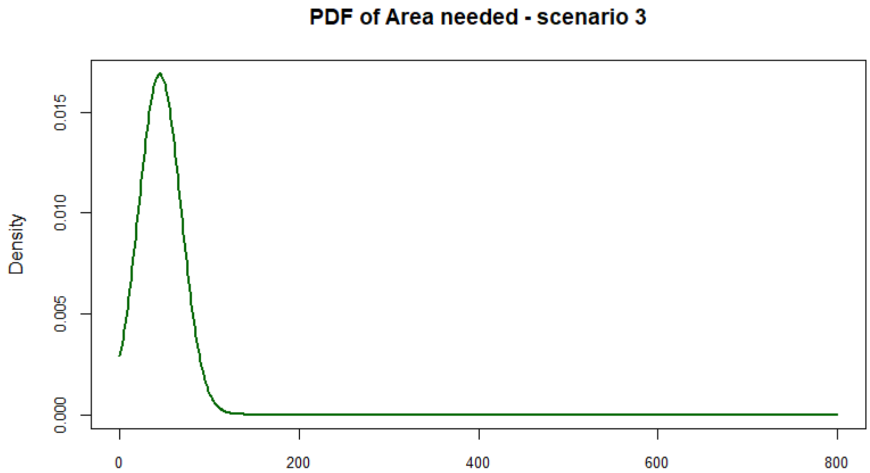

Figure 6: Probability density function of the area needed to sustain a population (area on x-axis), in a scenario with a low share of animals (15%) and high yields.

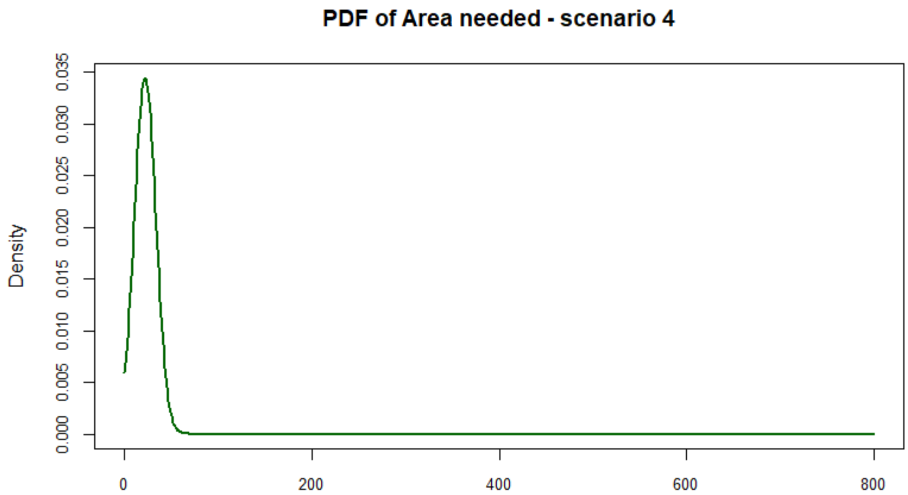

Figure 7: Probability density function of the area needed to sustain a population (area on x-axis), in a scenario with a high share of animals (35%) and high yields.

As can be gathered from the different scenarios modelled here, a relatively low amount of land would have been needed to feed the population of Düzen Tepe. For reasons outlined above, the first scenario (low share of animals (15%) and low yields) requiring an area of 272 ± 145ha can be considered the most realistic one, and, moreover, required the highest amount of land out of all four scenarios. The

maximum value of 417ha can therefore at this point safely be used as a benchmark for our further argumentation. When translating the first scenario required land to the area needed to sustain a single person, 0.1-0.9 ha is required. For an average household of five, this comes down to an area of 0.4-4.6 ha.
The next step should then be to consider the amount of land available to the community. It should be noted that not all land types are intrinsically suitable for food production. When comparing the amount of available and required land, this factor should be taken into account. The vegetal products in the diet at Düzen Tepe require quite similar soil and climatic characteristics, as these are suitable to grow in Mediterranean environments. In general, fertile valley bottoms are ideal for the production of the crops consumed at Düzen Tepe. Yet, some specific choices seem to have been made towards plants that are suitable to be grown on poorer soils, such as the bitter vetch[415]. The nearby Ağlasun and Yeşilbaşköy Valleys are both known as very fertile areas in recent times and can certainly have been used for crop growing[416]. According to Hartwin Brandt, *c*. 70% of all valley bottoms in the Pisidian Lake District are suitable for agriculture, which can be used as a buffer for our calculations[417].

Discussion

We now have a good idea of population numbers at Düzen Tepe, as well as the required endosomatic caloric needs to sustain this population. We also estimated that an area within a maximum range of up to 417ha was needed to provide for the necessary subsistence to sustain the population. Questions to be answered next are whether the community had access to such an amount of land, and, if not, how the community would have dealt with potential shortages. Additionally, we will explore the consequences of these results for each of the metabolic processes (appropriation, circulation, transformation, consumption and excretion), and look into the possible exosomatic needs of the population.

Land availability

First, let us take a look at the amount of land potentially available to the community at Düzen Tepe. It is generally rather difficult to trace territorial boundaries, especially in the absence of written sources or artefacts such as boundary stones. Territorial boundaries are therefore often axiomatically assumed to coincide with natural boundaries in the landscape, such as rivers or mountain ridges[418]. The validity of this approach should be considered on a case-by-case basis. In this case, likely natural boundaries representing maximal territorial extensions for Düzen Tepe can be suggested for the northern, eastern and southern sides (Figure 8). However, for the western side this is more problematic due to the presence of Sagalassos, a contemporaneous settlement located at 2km distance from Düzen Tepe. We already mentioned that from the little available evidence it was concluded that both Düzen Tepe and Sagalassos likely consisted of a comparable social configuration and complexity, within a village-like community framework. Such village communities are generally not considered to form explicit spatial projections of authority and control over a bounded area, which would have resulted in the development of territorial claims that are demarcated by well-defined socio-political boundaries (Robb 2007).
In the absence of clear indications for socio-politically defined boundaries, let us therefore start from the delineation of a basic area upon which a community could rely to obtain the energy and resources needed to sustain itself[419]. Specifically, we can look at catchment areas and settlement chambers. The latter was developed specifically for small agro-pastoral settlements in the German tradition of 19th-century historical geography (*Siedlungskammer*), to denote a small geographical area with sufficient

[415] Zohary *et al*. 2012: 92.
[416] Waelkens *et al*. 2003:53; Bakker *et al*. 2012: 249-266; Vermoere 2004.
[417] Brandt 1992: 10.
[418] Stoner 2012.
[419] Vita-Finzi and Higgs 1970.

resources to sustain a flourishing community[420]. Both concepts ultimately postulated a given area suitable for exploitation to sustain a community. The difference being, that catchment area starts from an observed settlement location and outwardly projects a fixed spatial extent determined by walking-time limits. Settlement chambers, on the other hand, presupposes 'logical' pockets of available space in the landscape able to sustain a community, the extent of which is subject to changes in time due to climatological circumstances and locational requirements, wherein a single prime community (possibly along with a series of dependent satellite sites) emerges and develops. One example of such a settlement chamber was identified by John Bintliff in the Valley of the Muses in Boeotia (Greece), consisting of a fertile valley surrounded by mountains on three sides[421].

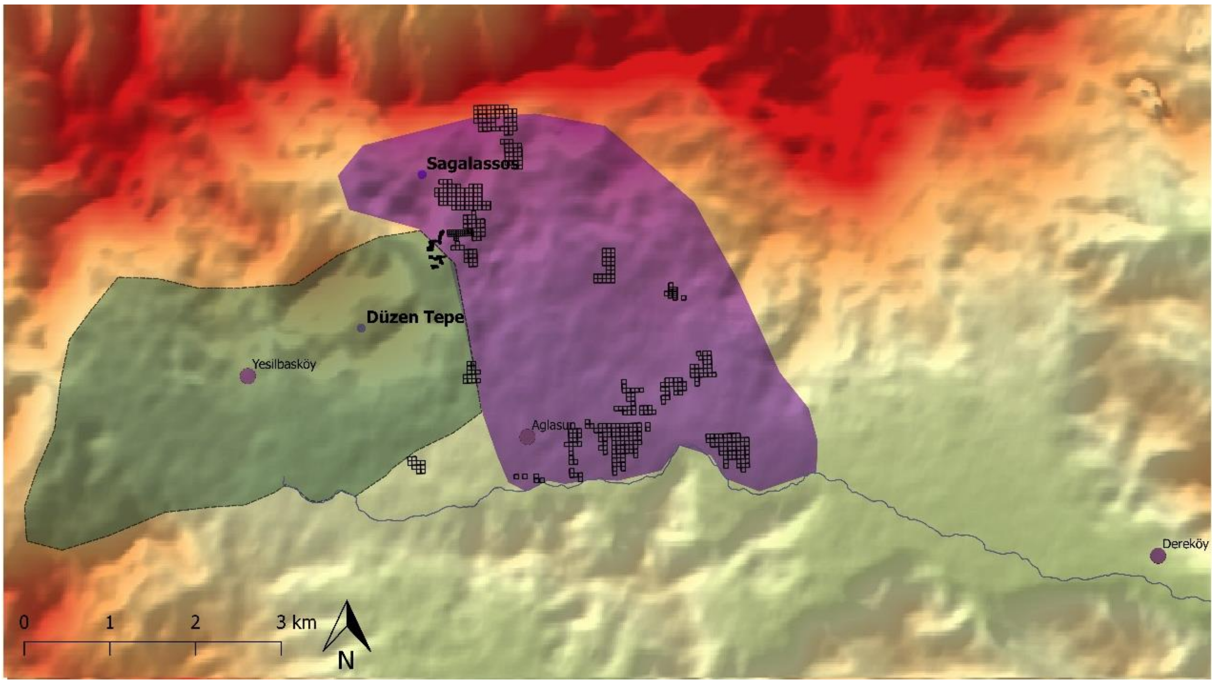

Figure 8: Location of Düzen Tepe and Sagalassos with tentative indication of their settlement chambers.

One recent GIS analysis was undertaken for an area reachable in a one-way, three-hour walking trip[422]. It was found that a comparably large area could be covered, including not only the central parts of the Ağlasun Valley but even the nearby Yeşilbaşköy, Çanaklı, and Dereköy valley systems. This limit clearly overstates the possible boundaries of Sagalassos in this period as it discards any possible living space for Düzen Tepe, given the assumption of absence of any hierarchical relationships. Other studies of catchment areas rather start from an hour or even half an hour walking distances for comparatively small communities, as for example for the Classical Greek *poleis* in Boeotia[423]. In this case, it takes about an hour at a brisk walking pace to reach the Ağlasun valley starting from Sagalassos in modern times. For Düzen Tepe, access from the plateau towards the surrounding valleys is most convenient from the pathway towards the western valley of Yeşilbaşköy, whereas only a comparatively difficult trail leads from the eastern side towards the Ağlasun valley. Still, it means that both valleys are in principle reachable within the hour. Therefore, our initial hypothesis is that Düzen Tepe and Sagalassos were primarily oriented on different valley systems, respectively the Yeşilbaşköy and the central part of the Ağlasun valleys.

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[420] Bintliff 2009: 107.
[421] Bintliff 1996.
[422] Calculated for the upward trajectory from the lower valleys towards Sagalassos to match the most difficult route, personal communication with dr. Eva Kaptijn.
[423] Bintliff 1999, 2009

Given the general topography of the area, consisting of different valley systems delineated by mountain ridges, it would be more suitable to approach this matter from the concept of settlement chambers if both communities were indeed primarily oriented towards different valley systems. As indicated, topographical and natural boundaries to a potential settlement chamber for Düzen Tepe can be tentatively posited for the northern (mountain ridge), eastern (mountain ridge) and southern (Ağlasun river) sides, whereas for Sagalassos, its northern and southern edges are also quite clearly defined, respectively through mountain ridges and the Ağlasun river. We hardly consider these topographical features to have necessarily posed impregnable or insurmountable barriers, but they do impede more easy access to and use of the further lying lands. These features therefore offer a logical starting point to posit the maximal potential extent of subsistence hinterlands for Düzen Tepe and Sagalassos.

As stated, one boundary remains relatively problematic between Düzen Tepe and Sagalassos. One way to clarify this situation can be to look at the distribution of pottery associated with both communities. Given that settlement chambers cover zones that would have contained sufficient energetic potential to sustain the basic subsistence needs of their respective communities, these areas effectively act as spatial containers for most relevant social practices of a given community.[424] Spatial distributions of material culture associated with these practices could provide some indication as to which areas are more strongly connected to one community over the other. Naturally, this dynamic and fluent delineation is prone to change and not easily pinned down at best. However, it can provide some initial indication.
Looking at the distribution of pottery finds dated to the late Achaemenid and early Hellenistic periods (5th to 3rd centuries BCE) on Figure 9**,** it becomes clear that most attestations within the Ağlasun valley were identified as fabrics related to production at early Sagalassos (blue), with only occasional attestations of material in fabrics related to local production at Düzen Tepe (red).

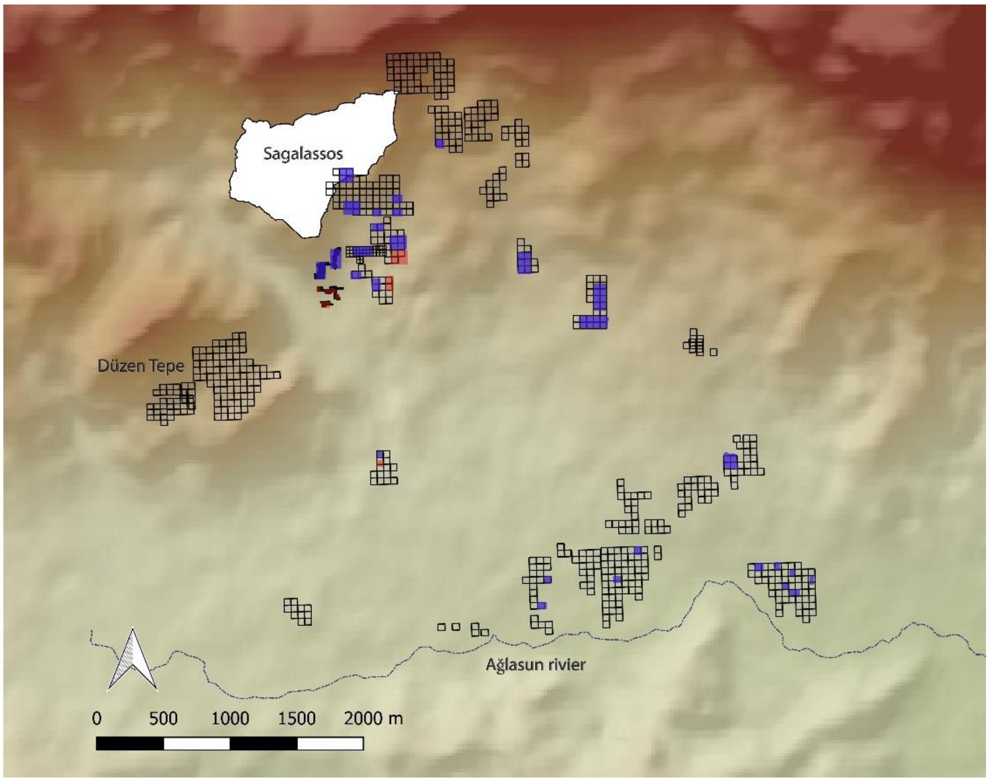

Figure 9: Findspots of Düzen Tepe fabrics (red) and Sagalassos fabrics (blue) in the Suburban survey of the Ağlasun valley.

[424] Giddens 1984; Low and Lawrence-Zúñiga 2003; Rodman 1992.

This clearly indicates that even in its earlier phases, Sagalassos was already extensively present in these parts of the Ağlasun valley, strengthening our interpretation of this valley as the most logical area feeding energy and resources into the settlement. Attestations of Düzen Tepe material occurred mainly in the area where a small pathway winded down from the plateau of Düzen Tepe into the valley, which would make this the most easily accessible part of the Ağlasun valley for people from Düzen Tepe. Additionally, only one other location provided indications for the presence of Düzen Tepe related material. Unfortunately, the western parts of the Ağlasun valley and the valley of Yeşilbaşköy have, as of yet, hardly been surveyed intensively. The Sagalassos Project will seek to fill during the 2018 survey campaign where we will explicitly tackle these parts of the area. Although our evidence is limited, this clearly suggests that this general area at the western side of Sagalassos' catchment was in principle accessible to people from both communities. If any form of boundary existed, it must have been rather permeable – even if to differing degrees for the movement of people, goods, and ideas – and should perhaps rather be seen as some sort of intermediate 'boundary zone' where spheres of influence overlapped and intermingled[425]. Unfortunately, replicating our findings from the Ağlasun valley for the adjoining valley of Yeşilbaşköy is as of yet impossible due to the fragmentary nature of our survey record in this part of the landscape.

For now, we would like to propose to use these points to draw a hypothetical boundary line between the settlement chambers of both communities. Given the absence of any early material at the most southwestern point that was surveyed, possibly due to river sedimentation, this intermediary 'no man's land' – located along to the expected boundary zone – can be left open, for now. Recent intensive surveys in the eastern parts of the Ağlasun valley towards the modern village of Dereköy have yielded very little indications for settlements or other forms of occupation in these parts from the Archaic to Hellenistic periods. Sagalassos at these times clearly felt no need to exploit the available potential in these parts of the landscape, instead focusing on their immediate catchment within the central part of the Ağlasun valley.
If we look only at the fertile valley lands in the current landscape within this maximally delineated extent, about 1000 hectares would have been potentially available for the community of Düzen Tepe to sustain its subsistence needs. Even if we follow Brandt's suggestion that only up to 70% of the valley bottoms in the Pisidian Lake District are suitable for agriculture, this leaves us with about 700 ha of usable land. This fits comfortably with the maximal required area of 417ha calculated earlier. Moreover, this does not take into account the space available at the plateau of Düzen Tepe itself. This creates an extra safeguard that allows us to suggest that the total energetic requirements of Düzen Tepe could well have been sustained by the available land, and allow a small population to live in the valleys.

If we then look at Sagalassos, again a similar amount of land was potentially available. If we were to try to replicate for Sagalassos the same exercise performed here, some caveats must be stated, as we do not have nearly as much information regarding population numbers and diet reconstruction for this contemporary community. It is therefore very difficult to conduct a direct comparison between Düzen Tepe and contemporary phases of habitation at Sagalassos. If we were to assume however, that, due to the highly similar nature of their material culture, both settlements were also more or less comparable in size, complexity and overall energetic needs, then we can transpose the results of Düzen Tepe towards Sagalassos. If so, we can conclude that the community at Sagalassos had access to sufficient agricultural lands to sustain a community comparable to that of Düzen Tepe. The observations that Sagalassos in these times apparently never moved into the available lands towards the eastern Dereköy valley, provides further proof for this hypothesis. It can therefore be concluded that both communities were most likely content and able to, at least for structural subsistence needs,

[425] Stoner 2012: 386.

rely on their respective hinterlands to sustain internal energetic needs, and leave some margin for the people residing in the valleys.

Return to the social metabolism

For the final part of this paper, we wish to return to the concept of social metabolism and the five metabolic flows of energy and resources highlighted earlier to discuss in some more detail the various processes behind the subsistence strategies employed at Düzen Tepe and Sagalassos during late Achaemenid and early Hellenistic times. To recapitulate, the basis of every metabolic system consists of five metabolic flows, which act as elements of connectivity, on the one hand linking the social system to the natural environment through appropriation and excretion, and, on the other hand, interconnecting different constituent components within the system through multiple flows of circulation, transformation and consumption.

When energy and material flows are consistently and continuously invested to sustain certain durable avenues of energy, resources, and information flows, institutional patterns may emerge to provide a structured and manageable framework. These structures can be related to a number of general determinants, shaping social, political and economic organisation: ideology, knowledge, technology, property rights and rule systems of political, juridical, cultural and economic nature[426]. Institutions and structures of a given society (including its technological level) in turn determine, organise and constrain its subsequent metabolic processes. Together, agents and flows involved with the five metabolic functions, combined with the associated institutional configuration, make up the constituent elements of society. Depending on the nature and scope of different activities conducted by a community and the institutional framework regulating these activities, a differentiated territorial extent could potentially be tapped. In this sense, different kinds of communities have been associated with different amounts of territorial control over various spatial extensions[427]. The development of a society's social organization logically depends on the effectiveness of the various metabolic flows of material and energy. As societies become more complex, so do each of these processes. By approximating the various flows between society and nature postulated by this model, we can gain crucial insights in the organisation and dynamics of social life of a given society.

Appropriation

The most important conclusions from the findings presented here, relate to the appropriation of foods. Indeed, subsistence activities at Düzen Tepe were discussed in detail above, but the reasons for choosing particular agricultural strategies still need to be explained. Which investments were made to prepare the environment for agricultural production? And how did they gear agricultural production strategies to their food preferences and environmental conditions?

Part of the answer to the first question may be found by looking at the way natural landscapes were affected by the impact of appropriation processes during these periods of time. In a recent study on human induced soil erosion based on the proportion of arboreal/non-arboreal pollen in the nearby valley of Gravgaz, a drastic land clearance peak could be observed between 800 and 500 BCE[428]. While disturbance levels would generally be sustained until 1100 CE, land cover on the hill slopes was still most affected during the Achaemenid and early Hellenistic periods. Of course, we should be careful in directly transpose findings for the Gravgaz valley to conclusions on the Ağlasun valley or valley of Yeşilbaşköy. The timing of these changes coincides with that of the more general Beyşehir Occupation Phase (BOP) of widespread environmental changes, which started between 400 and 280 BCE for the nearby Gravgaz and Bereket valleys[429]. Developments related to this phase include partial deforestation of the land, replacement of oak forests with pines, and the appearance of cultivated species such as olives, walnuts, manna ash, chestnuts, and grape vines[430].

[426] de Molina and Toledo 2014: 68.
[427] Bintliff 2000b.
[428] Van Loo *et al.* 2017.
[429] Bakker *et al.* 2012: 253-254.
[430] Eastwood et al. 1999; Kaniewski *et al.* 2007.

It can therefore be suggested that these changes were at least partially due to anthropogenic impact. Pollen analysis have indeed shown variability in the extent and chronology of changes at different locations, with significant human impact observed in core drills at Sagalassos but not in the nearby Çanaklı valley[431]. In this sense, it is interesting to note that no settlement of a comparable size to that of either Düzen Tepe or Sagalassos has been identified in these lands so far. We can therefore suggest that while part of the observed changes could well have been partially caused by climatological changes, the impact of local communities on the landscape should be considered as well. To what extent did these changes effectively affect these communities? The soil depletion model of Gravgaz suggested that it might not necessarily have had a negative impact, since at least a part of the loss in crop yield on the slopes due to soil erosion was compensated by an increase in soil productivity in the lower lying valleys through soil accumulation[432].

The second question is harder to answer. Earlier, we already hinted at the fact that the rearing of livestock in enclosed spaces and providing them with highly similar feeds, was a conscious choice. Indeed, if all animals would have been free grazing, the amount of land required to feed the animals would have far exceeded the available grasslands surrounding Düzen Tepe. Still it could have been possible that animals grazed in the Ağlasun Dağları north of the site, as shepherds still do today with flocks of goat and sheep. This would have, in fact, resulted in less land requirements in the valleys, as feeding animals still required fodder that had to be grown on arable lands, while these mountainous grasslands were *a priori* not suited for crop cultivation.
Yet, keeping animals close was clearly considered more important than saving space in the valley. Two reasons for this come to mind: first, the animals' proximity is very useful when it comes to milking and shaving wool, as well as for collection of their manure, which can be used for fertilizing the land. Secondly, it has been suggested that agricultural production at Düzen Tepe was organised in smallholder systems. Such systems were typical for self-sustaining agricultural communities[433] and consisted of households taking care of the majority of their own subsistence with only minor surplus production[434]. In such instances, it is easier to keep the animals close to home or fields, as this diminished the amount of labour force needed to exclusively look after the livestock. A single person cannot spend the day farming on the field and shepherding in the mountains at the same time. The presence of bitter vetch, which is considered to have served as fodder, in the settlement itself, suggests that at least some animals were kept in the village. It can nevertheless be assumed that mainly those areas in the valley which were not suitable for crop cultivation were used for rearing livestock. On the one hand, it is logical to safeguard fertile farmland from livestock and feed these animals on grounds less suitable for agriculture, on the other hand, the proximity of domesticates provided in manure. As calculated, the average household of five only needed an area of *c*. 0.4-4.6 ha to provide in their energy needs. Given the amount of animals needed to sustain Düzen Tepe, one household had enough with 12 ovicaprines, 3 cows and a single pig. This livestock size resembles those in modern smallholder systems: '*To graze the land the owners may have a few horses or cattle but small ruminants – sheep and goats – in flocks of 5-50 are very popular*'[435].

Circulation

When it comes to the process of circulation of energy and resource flows, mostly the transportation and exchange of farm products should be considered. The suggestion of a smallholder system implies that most of the foods (and other commodities) are considered of local or sub-regional origin. Let us now briefly consider whether this was really the case and households in Düzen Tepe did indeed only utilize self-produced foods and other products, such as pottery?

[431] Vermoere *et al*. 2002b.
[432] Van Loo *et al.* 2017: 503.
[433] Daems and Poblome 2016: 96; De Cupere *et al*. 2017b: 14.
[434] Shiferaw *et al*. 2009: 605-607.
[435] Purohit 1982: 459.

The archaeobotanical and zooarchaeological record provide important information. Of the encountered plant remains, all are suitable to be grown in the immediate environs of Düzen Tepe. In contrast, some of the animals are not locally reared or hunted. Fish bones of tuna and airbreathing catfish (*Clarias*), as well as a murex shell must have been imported from the Mediterranean Sea or – in case of the catfish – from either Northern Africa or the Levant[436]. Hunting played only a minor role at Düzen Tepe and almost all attested game was to be found in the proximity of the site[437]. Transport vessels, such as amphorae, were completely absent in the find assemblages, and, as discussed elsewhere, wine production too was organized locally[438]. Transportation from the field to the village most likely took place with donkeys as their number in the archaeozoological record is quite high, and they are suited as draught animal on the rough walking paths into Düzen Tepe.

Indications for exchange patterns are in general limited at Düzen Tepe. Although pottery imports are occasionally attested, these constitute only a minor part of the total pottery assemblage and are mainly associated with specific vessel types such as Achaemenid bowls. Additionally, almost all of its own pottery production has for now only been attested either at the site itself or in its immediate vicinity, with hardly any indications for it ending up beyond this local scope or in neighbouring settlements. Still, contacts with the outside world existed, as is indicated by a handful of coins from Erythraea, Magnesia and Selge, although it remains difficult to assess the nature and scale of these contacts. Of the five coins found at Düzen Tepe, only two were struck in bronze, while the rest was minted in silver. In general, however, the mechanisms of circulation at Düzen Tepe were probably aimed at basic subsistence exchange within the settlement itself, with, safe for a few exceptions, little incentive or intent to move into farther-reaching networks of exchange.

Transformation

After appropriation, energy and resources often need to be converted – or transformed – from external energy to internally useful energy to be able to 'do work'[439]. For many foodstuffs this entails preparatory acts such as storing and cooking. Cooking practices at Düzen Tepe have been discussed in some detail elsewhere[440], but here we will look to what extent storage and cooking was influenced by agricultural production and carrying capacity, and *vice versa*.

Seasonality in food production often caused problems in ancient societies. Brian Hayden therefore posited that carrying capacity should be calculated for that season where agricultural output was at its lowest[441], usually winter. Yet, communities have always sought for ways to cope with food production in winters or very dry summer months, through storage and cultivation of plants that are adapted to arduous circumstances. For animal foods, this caused less of a problem, as milk, eggs and meat could be provided throughout the year. Crop cultivation as observed at Düzen Tepe, however, indicates that specific choices were made towards preservation measures. Indeed, staples at this settlement and elsewhere in the ancient world[442], being cereals and pulses, are easy to store when kept in dry, cold and dark spaces[443].

The abundance in domestic contexts of sherds belonging to ceramic storage vessels (*pithoi*) and the absence of large storage facilities (in contrast to, for example the Hellenistic market building at Sagalassos) indicates that just as with agricultural production, preservation of foods was organized on the level of the household. In a single room structure associated with a domestic building at Düzen Tepe, three depressions were cut in the bedrock, each holding remains of a *pithos*. Given that the

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436 De Cupere *et al*. 2017a; Van Neer *et al*. 2000: 833.
437 De Cupere *et al*. 2017a; Cleymans *et al*. 2017: 75-76.
438 Cleymans *et al*. 2017: 74.
439 Kay 2000.
440 Cleymans *et al*. 2017.
441 Hayden 1975.
442 Garnsey 1999: 17-19.
443 Zohary *et al*. 2012: 75.

average storage vessel of this size may contain *c*. 150kg[444], 450kg of cereals and pulses could be stored in this room. Given their relative weight percentages on site, these vessels could have contained *c*. 195kg of wheat, 160kg of barley and 95kg of peas, which comes down to a respective energy content of *c*. 670,000kcal, 550,000kcal and 230,000kcal. Given their respective caloric share in the diet of the average Düzen Tepe person, wheat provided *c*. 350,000kcal of the yearly energy intake, barley 285,000kcal and peas 118,000kcal. This means that these storage vessels sufficed to provide basic nutrition for 2 people during a full year, or a small household half a year, just based on these staples.

When it comes to cooking, the most popular type of foods – based on the ceramic cooking and consumption wares – were so-called 'wet meals', such as porridges, soups and stews[445]. Such dishes require heating for one to several hours. Consequently, dried cereals and legumes have the opportunity to rehydrate during the preparation process. Cooking practices at Düzen Tepe thus seem to have been properly matched with locally produced plant and animal foods. An important consequence of such long cooking times is the need of large quantities of fire wood or charcoal[446]. As a result, the energy needed for the heating of food might have led to deforestation[447]. Episodes of deforestation were indeed observed in the pollen data[448], however it remains unclear to what extent these can be linked directly to exploitation measures by the community at Düzen Tepe. Deforestation and soil erosion are also indicative of a more general transition from a natural landscape towards a cultural landscape.

Consumption

Consumption of energy and resources takes place at every stage of the metabolic process from the moment of appropriation onwards. For example, certain plants can be consumed immediately after harvesting without any additional transformation steps. Water as well can be appropriated from the environment and immediately used for consumption. Additionally, water could also be used for transformation of external energy into workable exergy, for example when used in water mills[449]. Nutritional value of certain foodstuffs such as meat is significantly increased through transformation processes such as heating. Moreover, some crops such as grain and certain kinds of pulses can generally only be consumed after being processed through transformation processes involving heating.

The consumption practices and foodways at Düzen Tepe were quite conservative in nature and seemed to have been functional in the first place[450], meaning that these were intended primarily at generating a large energy input and the lowest possible effort in production and preparation. As the average rim diameter of the cooking pots corresponds to a volume typically eaten by a nuclear family[451], consumption took place mostly within the context of the household. Community life at Düzen Tepe in various aspects thus seems to have revolved around the family as core social unit.

Excretion

Finally, both energy and materials are also disposed of through processes of excretion and discard. Here we must differentiate in quality of excreted residues, and whether these are intrinsically recyclable or not[452]. Certain forms of waste material can be re-used, as for example happens when broken pottery is reused as temper for further pottery production. Most nutrients lost during agricultural practices were replenished by returning animal and plant wastes to the land, i.e., by

444 Giannopoulou 2010: 82.
445 Cleymans *et al*. 2017: 86-87.
446 Janssen *et al*. 2017; Harris 2011; Malanima 2006.
447 Janssen *et al*. 2017.
448 Kaniewski *et al*. 2007.
449 Kay 2000.
450 Cleymans *et al*. 2017.
451 cf. Jackson and Tidmarsh 2011: 299.
452 de Molina and Toledo 2014: 64.

recycling organic waste products (manures, forest litter, crushed bones, sewage, cesspit residues, ashes, sediments, *etc*.)[453].
For Düzen Tepe such practices can be deduced too. It has already been mentioned that the animals were probably kept closely together, allowing their dung to be collected for manuring. Although part of the animals were possibly kept at the village itself, given the tentative identification of a smallholder system at Düzen Tepe, it can be suggested that the majority of the animals would likely have been kept close to the fields. This would facilitate the transport and usage of animal dung as fertilizer, as well as easily allow the animals to graze the fields after the harvest, removing any waste left behind, such as plant stubble. In any case, refuse of cereal and legume cultivation, such as stubbles, hay and chaff would likely have served as feed for the animals. These practices, however, cannot be archaeologically attested for Düzen Tepe. Yet, for the must and pulp – as by-products of wine making – there are good indications that these were used as solid fuel[454].

Conclusions

The method presented in this paper was developed to calculate most likely ranges of population sizes for a given community. This could then be compared with the extent of land required to sustain a community of such size. The aim was to construct a bottom-up approach grounded in data derived from the site itself, instead of relying on standard numbers that are extrapolated from various external case studies. We have demonstrated that this method allowed us to deduce that Düzen Tepe, with a population within a range of *c*. 454-1461 people, could sagely sustain its subsistence strategies when depending on its immediate natural hinterland of the Yeşilbaşköy valley, with sufficient margins for partial crop failure and possible parts of the population living in the valley itself outside of the settlement. In the discussion, we explored the heuristic potential of this tool by discussing the results in a social metabolism framework. By doing so, we were able to classify the subsistence strategy at Düzen Tepe as a smallholder system in which production, storage, preparation and consumption of foods mainly took place in the context of the household.
The presented results constitutes only the first step towards a full implementation of social metabolism. Additional calculations are still needed to extend the framework, for example to estimate the amount of land required for the production of fodder, whereas the use of sawing seed and oil crops are as of yet not taken into account. More importantly however, we have only sketched a first preliminary tracing of the full application of the social metabolism framework, focusing primarily on flows associated with endosomatic needs and subsistence strategies for the community at Düzen Tepe, and by extension at Sagalassos. Further work is still ongoing to extend this first step towards calculating exosomatic energy needs and its associated land requirements as well.

[453] Wilken 1991.
[454] Cleymans *et al*. 2017: 68-69. cf. Margaritis and Jones 2006: 799-800.

4.2.3 Socio-economic organisation

This publication grew out of a paper I presented at the "Quantification in Classical Archaeology: objects, methodologies and aims" workshop at the University of Barcelona in February 2017. In the presentation, I provided the outlines of a minimal case study for approximating aspects of production complexity, which was used for the conference proceedings published in the journal of Instrumenta. Upon discussing the outlines of the paper with prof. Jeroen Poblome, the applicability of its methodology was considered sufficiently valuable to try to extend the case study towards an approximation of the overall complexity of the economic-productive system at Düzen Tepe and Sagalassos. It was agreed that I would write a paper for the Sagalassos Project contribution in the conference proceedings of the "Complexity: A New Framework To Interpret Ancient Economic Proxy Data" workshop held in September 2015 at Ağlasun. The paper has been accepted by the editors and is currently awaiting publication in the Collection Latomus series.

Social complexity and complexity economics. Studying socio-economic systems in the past.

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Introduction

In this paper, I will demonstrate how the use of causal factors and mechanisms of complexity development can contribute to our understanding of the workings and dynamics of socio-economic complexity in the past. It should be made clear from the outset that in this paper we will be specifically considering dynamics of social and economic complexity at the level of individual settlements and communities. The framework presented here will be grounded in a conceptual model, which will be applied to a case study of the late Achaemenid and early Hellenistic communities at Sagalassos and Düzen Tepe, both located in southwest Anatolia (5th to 2nd centuries BCE). I will focus mainly on the material culture of both communities, more specifically the pottery material as this constitutes the most abundant preserved category of material culture at both sites. The aim of this paper is to use observations on resource procurement, production processes, production output, and structures of exchange as proxies to identify and approximate the intensity of causal factors contributing to the development of socio-economic complexity at this local scale. It has been observed that Sagalassos from the 2nd century BCE onwards went through a phase of rapid social, economic and political transformation.[455] This process has been axiomatically associated with a concordant increase in (social/economic/political) complexity. The present paper intends to clarify what underlying factors were important for the development of this complexity, focusing on its socio-economic component.

A framework of socio-economic complexity

The framework of this paper is based on a conceptualisation of human societies as complex adaptive systems (CAS), which can be defined as large networks of interacting components with simple rules of operation, exhibiting dynamic emergent behaviour that cannot be reduced to the summation of characteristics of the individual parts and is responsive to its environment.[456] Human societies as complex adaptive systems are formed from a multitude of social interactions between individual agents. Out of these interactions, processes of structuration take place through the development of social practices performed across time and space, giving rise to social systems exhibiting complex emergent behaviour that exerts (positive and negative) feedback mechanisms onto the behaviour of constituent agents. The archaeological record is ontologically suited to match this framework given

[455] Poblome *et al.* 2013; Talloen and Poblome 2016.
[456] Holland 1995; Mitchell 2009.

that it is in essence a fragmentary reflection of the material end-result of social practices performed in the past.[457]
When discussing the workings of human societies as CAS, it is essential to define what exactly constitutes complexity in these systems, and how it develops. Unfortunately, complexity is often used as a descriptive term, whose origins and development often remain something of a black box. It has been stated that "*one of the hurdles in defining a theory of complexity, and with it, developing a fundamental, helpful approach is that there is no uniformity in the meaning of complexity*".[458] The term can, for example, refer to both an aspect and subpart of a system, as well as the magnitude and variety of the overall system. It is commonly associated with aspects such as intricate interdependencies among parts, non-linear behaviour, emergence, and self-organization[459]. The complexity of a system is often tied into the non-linear nature of its emergent behaviour. This means that no direct linear relation can be drawn between system input and output. When different system components interact and mutually affect each other, it can be difficult to see where system changes are coming from. This is precisely why many complex systems approaches have been limited to descriptive approaches rather than providing explanatory accounts.

It has been noted that different aspects or manifestations of complexity can exist, sometimes simultaneously within the same system, but none of them *is* complexity *per se*. Renate Sitte described a number of fundamental types of complexity: structural, functional, topological, algorithmic, and architectural.[460] I will focus mainly on the first three, as both architectural and algorithmic complexity have seen few applications beyond very specific fields and are of limited use in the context of the present paper. Structural complexity involves elements of dimensionality, networks, hierarchy, and levels depth/breadth. Functional complexity pertains a differentiation between single or multifunctional components. Topological complexity, in turn, refers to aspects such as connectivity, relation, number of relations, and direction of relations. For descriptive ease, for the remainder of this paper I will subsume the different aspects of each type of complexity under a common denominator, respectively: dimensionality, diversity, and connectivity.
'Dimensionality' refers to the constituting components within the system, structured both vertically and horizontally. In general, the deeper the vertical nesting of various horizontal groups of components, the more complex the system. Diversity, at the most basic level, pertains the distribution of quantities over distinct classes.[461] The term actually covers two different aspects, on the one hand 'richness', pertaining the number of categories within a sample, and on the other, 'evenness', which can be considered the manner in which a quantity is distributed among these categories in relative abundances. Finally, connectivity is what makes complex systems truly 'tick'. Complexity occurs only when a diverse set of components become interconnected, start to interact and generate novel information which determines further system dynamics. Increasing returns induced by connectivity therefore have a strong multiplier effect in system dynamics. These three aspects can be considered mechanisms of complexity development, inducing further system dynamics. Social complexity can then be defined as the extent of functional differentiation among social units, integrated in coherently organized systems in both horizontal – as in various roles or social subgroups – and vertical – as in hierarchical concentration of decision making and power – dimensions.[462]

The prevalent paradigm in economics ever since the 19th century has been that of the economy as a system in equilibrium.[463] For a long time, mainstream economic models hardly considered the dynamic

[457] Lucas 2012.
[458] Sitte 2009: 25.
[459] Mitchell 2009.
[460] Sitte 2009: 25.
[461] Jones and Leonard 1989: 2.
[462] Blanton *et al.* 1993; Feinman 2012: 36.
[463] Beinhocker 2006: 17.

workings of complex systems that exhibited far from equilibrium properties. Complexity and economic thinking were eventually brought together during a 1987 workshop held at the Santa Fe Institute, joining economists, physicists, biologists, and computer scientists to work out a new framework for thinking about economic problems. A new paradigm of complexity economics was developed focusing on contingency, change and adaptation of agent strategies in response to mutually created outcomes.[464]

To use this outline of complexity economics as a starting point, we must consider how complexity develops specifically in socio-economic systems. A key emergent property of CAS is their capacity for computation and transmission of information among its components.[465] System changes occur when information input is received, interpreted according to internal rules, and transformed through behavioural mechanisms into a system output in the form of an adapted pattern of behaviour. Formalized, this comes down to a model of input information (I), causal factors (X), mechanisms of complexity development (M), and (socio-economic) system output (Y). The resultant *Y* can then feature as part of novel *I*, operating in a recursive loop of system dynamics. Due to the non-linear nature of complex system dynamics, multiple causal factors and mechanisms can interact and co-evolve simultaneously, rendering any interpretation of the resultant system output probabilistic in nature.[466] Still, simplified representations will help us make sense of the different components of system dynamics and the nature of their interrelations. Identifying these mechanisms could then effectively open up black boxes in our argumentation. Ideally it can be stated that a factor *X* causes *Y* if, and only if, $P(Y|X) > P(Y|x)$, with x being any other factor part of the overall system, within a set of understood *ceteris paribus* background conditions.[467] Such an ideal structure is hard to get by in the reality of analyses with archaeological data. This is exactly why many archaeologists prefer a more ambiguous narrative framing of interpretation to this more 'bare-boned' approach. Still, the advantage of clarity makes any such formal approach worthwhile, even only as a preliminary attempt for others to build on. The formal approach can be represented as: $Y \leftarrow \langle (X) \wedge (X|I) \wedge (M|X) \rangle$

The angular brackets indicate that the conjunction of events is ordered from left to right. *X* can be considered as an element of a given system state developed out of a combination of *I* from prior system outcomes and external stimuli. Information is then evaluated according to a rule set derived from internalised practical knowledge and socialized behaviour in causal factor *X*, and transformed into a new system response *Y* through a mechanism *M*.
To conclude, we must consider what causal factors can be responsible for developing complexity within socio-economic systems. I will focus here on a limited number of variables which return frequently in economic literature: 1) supply and demand, 2) (human and physical) capital investment, 3) institutionalization, 4) division of labour, 5) technological development, and 6) property rights. As we will see, these causal factors contain the inherent *potential* to increase socio-economic complexity. For example, it has been noted that development of novel technologies may induce further technological innovation in response to the creation of new needs associated with the original innovation.[468] As a result of such positive feedback loops, a new technology is not just a one-time disruption to the current system state, but rather a permanent ongoing generator of further technological novelties which induces still further technological development. However, for this loop to emerge, complexity mechanisms are needed to operate onto these causal factors, in this case diversity in functional needs.
Before moving on to the case study, let us first discuss how to operationalise the approximation of complexity development in socio-economic systems through the framework outlined so far. Here, we

[464] Arthur 2015: 1.
[465] Holland 2014; Mitchell 2009.
[466] Ragin 2014: 24-25.
[467] Gerring 2012: 199.
[468] Arthur 2009, 2015.

will focus on approximating the intensity of the relevant causal factors contributing to social complexity development, applied through a comparison between Sagalassos and Düzen Tepe.

Methodology

A rich body of literature exists on measuring complexity, yet, it has proven difficult to construct a suitable and widely applicable method.[469] A list of complexity measures compiled by Seth Lloyd discerns three main groups of measurement: difficulty of creation, difficulty of description, and degree of organization.[470] The first group measuring difficulties of creation is mainly related to human-made or engineered complex systems and therefore not very relevant for 'organically' developing complexity in human systems. Many complexity measures from the second group hail from the field of cybernetics[471], based on measures of communication information and system entropy in description length of a given system.[472] While entropy measures of information description work great in theory, they are often cumbersome to calculate and therefore difficult to apply in practice.[473] It is not my intention here to add onto such elaborate measures with a new technique, trying to improve on others in potency or elegance. Although conceptually attractive, the practical use of such measures has turned out to be rather limited. Instead, I will attempt to provide a very basic way of approximating the intensity of certain causal factors in developing socio-economic complexity through mechanisms as diversity, dimensionality, and connectivity. This approach is more closely related to the third group of measurements of system organization.

Measurement, by definition, has a connotation of objectivity and precision. If a certain phenomenon is measured, then it can be exactly compared to another phenomenon that is given any other quantified measure (insofar as the units of measurement are comparable). However, one approach to complexity actually derives from a *subjective* measure of development.[474] In this view, the degree of complexity depends on available frames of reference starting from a reference simplicity. This makes sense as a given system can only be considered complex insofar it can be compared to others, which may be perceived as simple. The equation goes: $K(S) = F(\mu(S), D(SR)$

Where a subjective measure of system complexity *K* is a function of inputs μ (size of the minimal description in a given context) and *D* (distance function)[475]. The proposed measure has the advantage of being able to compare just two cases, whereas more common comparative statistical methods used to measure distance between variables – such as cluster analysis – generally require a larger sample size to be effective.[476] However, we cannot just conceptualize any distance of system change compared to a given input value. We must also make sure that any such distance is effectively contributing to system complexity. Any distance measure of social complexity must therefore be related to the mechanisms of system complexity outlined above: diversification, dimensionality, and connectivity.

The present argument is an elaboration of an earlier paper where I suggested an (overly) simplified measure of complexity development based on the distance between two social systems, one reference system and a comparative system.[477] Here, I intend to build on that approach. For each (qualitative) parameter of comparison, an evaluation is given for both systems. Next the intensity of development, i.e. the distance, needed to get from the reference value to the comparison value, is approximated. In the previous paper, I used a ratio scale ranging from -3 to +3 to evaluate this distance. One strongly impeding factor in any attempt at an explicitly quantitative approach to archaeology, however, is that the archaeological data often do not allow a very precise estimation of the extent and scope of a given

[469] Page 2010: 27.
[470] Lloyd 2001.
[471] Castellany and Hafferty 2009: 115.
[472] One seminal work is Shannon's entropy equation in information theory, see Shannon 1948.
[473] Page 2010.
[474] Efatmaneshnik and Ryan 2016.
[475] A distance function defines differences between pairs of types, see for example Weitzman 1992.
[476] No written rule exists but a general rule of thumb is 2^m samples (where m = number of clustering variables).
[477] Daems, In press.

process. This is why many archaeologists prefer to work with more ambiguous valuations such as 'very low', 'low', 'moderate', 'high', 'very high'. Due to the nature of the archaeological record, such evaluations are probably unavoidable. Unfortunately, due to imprecise and uneven use of such denotations, sometimes even within the same publication, comparison is often difficult. In addition to the +/- system, I therefore suggest to attach a fixed numerical valuation to all nominal evaluations.[478] Using a fuzzy set of numerical values ranging between 0 and 1 (Figure 1), we can clarify how different processes compare to one another through the consistent use of a measurement indicator.

Nominal	**very low**	**low**	**moderate**	**high**	**very high**
Range	0-0.2	0.2-0.4	0.4-0.6	0.6-0.8	0.8-1

Figure 1: Coding of intensity measures of development.

Subtracting for each parameter the numerical value of the reference system from the value of the comparative system then gives a value for the distance or intensity of this specific process. This intensity can provide an indication for the degree of potential generated by each causal factor for inducing further system complexity. By comparing intensities of development, we can determine which elements of the socio-economic systems at both communities contributed most to overall system complexity.

Results: socio-economic systems at Düzen Tepe and Sagalassos

In this part, I will present the results of a case study focusing on a comparison of the socio-economic system during the earliest phases of habitation at Sagalassos and Düzen Tepe. The reference point for our comparison will be Düzen Tepe – as a proxy by extension for the habitation phase during the late Achaemenid and early Hellenistic periods (5th to 3rd centuries BCE) at Sagalassos, see 4.2.1.2 – to uncover the relevant causal factors as drivers of development. This reference point will then be contrasted with the subsequent system state, i.e. the habitation phase during middle Hellenistic times (2nd century BCE) at Sagalassos, to determine the intensity of development. Again, any comparison of system dynamics in both periods of time can only be conducted under the assumption that both communities operated on a similar level of socio-economic complexity prior to 200 BCE. I will provide additional evidence for the validity of this assumption through the upcoming parts. We will specifically look at three major components of the chaîne opératoire of pottery production and consumption as a proxy for the overall socio-economic complexity at both communities: resource procurement, material production and distribution.[479] Clearly, the fourth major domain, subsistence, and its importance as the economic basis of agricultural societies, merits a full discussion in its own right.[480] The three domains discussed here offer a window into economic practices and choices performed by members of the local community, embedded in the constraints and opportunities of their wider social, political, economic and ecological framework.

Resource procurement and exploitation

For both Sagalassos and Düzen Tepe, numerous clay beds are present at the sites themselves, as well as in the surrounding area, although with varying suitability for pottery production. Petrographic analysis of the pottery found throughout the wider research area[481] has identified four regional ceramic production groups based on petrology and clay chemistry: A) Burdur basin groups, B) detrital

[478] See Torvinen *et al.* 2016 for a similar methodological procedure.
[479] Costin 1991.
[480] Subsistence strategies at Düzen Tepe and Sagalassos is the central theme of another paper: Cleymans *et al.* (In preparation), see 4.2.2
[481] Here the research area of the current Sagalassos Archaeological Research Project, more or less coinciding with the territory controlled by Sagalassos in Roman imperial times.

clay groups from the Çanaklı and Ağlasun basin, C) a mixed flysch–limestone group, and D) an ophiolitic–volcanic group.[482]
The fine clays derived from the more distant Burdur plain are only marginally attested at Düzen Tepe[483] and not at Sagalassos so far. The bulk of the late Achaemenid and early Hellenistic material found at Düzen Tepe and Sagalassos was made from clays derived from the sites themselves or from the immediate vicinity in various parts of the Ağlasun valley. The flysch-limestone fabric group was produced with clays derived from weathered bedrock found on the flanks of the mountain ranges surrounding the Ağlasun and Çeltikçi valleys.[484]
Clay quarrying has been attested in the central depression of what would become the Eastern Suburbium of Roman imperial Sagalassos, where core drilling indicated the development of a *palaeosol* horizon on top of a clay quarry phase that could be dated to 370-200 BCE.[485] This *terminus ante quem* for the quarrying activities suggests that these clays could have been in use in late Achaemenid and early Hellenistic times. Moreover, control excavations conducted at the Upper Agora of Sagalassos confirmed a large anomaly, previously identified through geophysical research, to be related to the fill of a large pit resulting from clay quarrying activities before the construction of a public square at this location.[486] Although it cannot be conclusively proven that these specific quarries were necessarily exploited for pottery production, it does seem plausible that at least part of the clay raw materials were used by potters, as ceramics attributed to this clay group represent the bulk of production of common wares and buff tablewares during late Achaemenid and early Hellenistic times.
Pottery related to the ophiolitic-volcanic trace element group can be associated with the entire range of common wares found at Düzen Tepe. Specifically, the illite-rich ophiolite clay beds from the immediate vicinity of the settlement were used to produce the ceramics associated with this group.[487] Interestingly, no tablewares seem to have been produced with these clays. The majority of tablewares at Düzen Tepe were produced from the flysch-limestone clays derived from the immediate vicinity of the site. A small portion of the tableware assemblage of Düzen Tepe, however, was made from detrital clays derived from the northwestern parts of the Çanaklı valley (located at a distance of 4-5 km from Düzen Tepe). As this relates to less than 1% of the total amount of sherds found and studied at Düzen Tepe, exploitation of these clays can be considered as ephemeral compared to the majority of the local production. The potters at Düzen Tepe are thus presumed to have operated within a least-effort productive framework, where mainly those resources in the immediate vicinity of the settlement were targeted and exploited.

At Sagalassos, largely the same picture emerges for the late Achaemenid and early Hellenistic periods, with a majority of the pottery material pointing towards the use of clays from the immediate vicinity of the site. This image starts to change towards end of the 3rd century BCE, with the development of a fine tableware fabric, which can be seen as the precursor of the local production of Sagalassos Red Slip Ware (SRSW) in Roman imperial times.[488] Petrographic analysis conducted by the Center for Archaeological Sciences (University of Leuven), on some late Hellenistic sherds indicated two provenance areas for the clay raw materials of this fabric.[489] Besides local clay beds found at the site or its immediate environment, a component of this production also made use of greenish detrital clays originally accumulated as part of a sequence of lake deposits derived from the northwestern parts of the nearby Çanaklı valley (located at 7-8 km from Sagalassos). The associated tableware fragments from a body of ceramics found in control excavations at the Upper Agora, dated to the later 3rd-early

[482] Braekmans *et al.* 2017.
[483] Only eight diagnostic pieces were identified by the author, mainly related to a bowl functionality.
[484] Neyt *et al.* 2012.
[485] Vermoere *et al.* 2003: 2210±50 BP 14C date with 1σ confidence interval.
[486] Talloen and Poblome 2016.
[487] Neyt *et al.* 2012: 1301-2; Braekmans *et al.* 2017: 17.
[488] Poblome *et al.* 2002; Degryse and Poblome 2008.
[489] Poblome *et al.* 2002; Neyt *et al.* 2012; Braekmans *et al.* 2017

2nd centuries BCE, are produced almost exclusively in this well-levigated fabric (see 4.2.1.3). At this time, the systematic occurrence of pottery produced with these more distant clays is symptomatic for more consistent and controlled strategies of resource procurement and clay preparation for the production of the higher-end spectrum of finer tableware.[490] This could be an indication for a more developed and extended raw material economy.

For now, it remains unclear whether the systematic exploitation of these more distant clays is only a sign of the increased catchment area upon which Sagalassos depended, or whether this development was matched by a genuine territorial increase in a political sense as well. The first clear indication for the establishment of a political territory can be found in the writings of Livy, who describes the expeditions of the Roman general and consul Gnaeus Manlius Vulso as he crossed large parts of southwestern Anatolia in the aftermath of the battle of Magnesia (190 BCE) to move against the Galatians, and also passed through the territorial borders of Sagalassos. The marshlands where Manlius Vulso is said to have approached the borders of the territory of Sagalassos[491], can only have corresponded to the area immediately to the southwest of Lake Burdur, near modern Düğer.[492] This would suggest that by 189 BCE, the territory of Sagalassos already extended all the way up to this point, also including large parts of the fertile Burdur plain.
Unfortunately, prior to this point, we have little indications of how and when the territory of Sagalassos was extended. Recent material studies on the pottery material found during intensive surveys indicated that the majority of the material datable to the 4th and 3rd centuries BCE found at numerous locations in the central parts Ağlasun valley could be linked to fabrics produced at Sagalassos. Düzen Tepe-related fabrics were only marginally present on a few locations closest to the site. This might suggest that, at least for the central parts of the Ağlasun valley, the majority of these lands were at this time mainly associated with Sagalassos rather than with Düzen Tepe. To what extent this was also the case for the western parts remains unclear for now, in the absence of intensive surveys matching those in other parts of the landscape. It is suspected, however, that Düzen Tepe was mainly reliant on this western part of the valley. It can therefore be suggested that Sagalassos and Düzen Tepe relied mostly on the catchments immediately surrounding these sites – respectively the central parts of the Ağlasun valley and the valley of Yeşilbaşköy – for its subsistence and resource exploitation (see 4.2.2). The addition of (parts of) the fertile Burdur plain to the territory of Sagalassos would then have entailed a massive territorial increase unlike anything either settlement had seen before. Clearly, the exploitation of the energy potential derived from this far more extensive environment could have created the necessary base for an increasingly more potent hub of social dynamics and developments at Sagalassos from mid Hellenistic times onwards.

Production processes and output

The urban transformation occurring at Sagalassos around 200 BCE – possibly reflecting an earlier socio-political phase of transformation – not only impacted the built-up fabric of town, but is also associated with a profound change in material culture and production processes. Local production activity was attested at Düzen Tepe through the partial excavation of a workshop containing the remains of a dismantled kiln, likely related to pottery production. From this updraught kiln, only the circular floor – *c*. 1m in diameter – consisting of a layer of fired clay was preserved.[493] No stratigraphic association could be made between the kiln and nearby structural remains (Figure 2).

[490] Braekmans *et al.* 2017: 16; Poblome *et al.* 2002; Poblome 2014.
[491] Liv. 38.15; Plb. 21.36.
[492] Waelkens 2000: 175.
[493] Waelkens 2012.

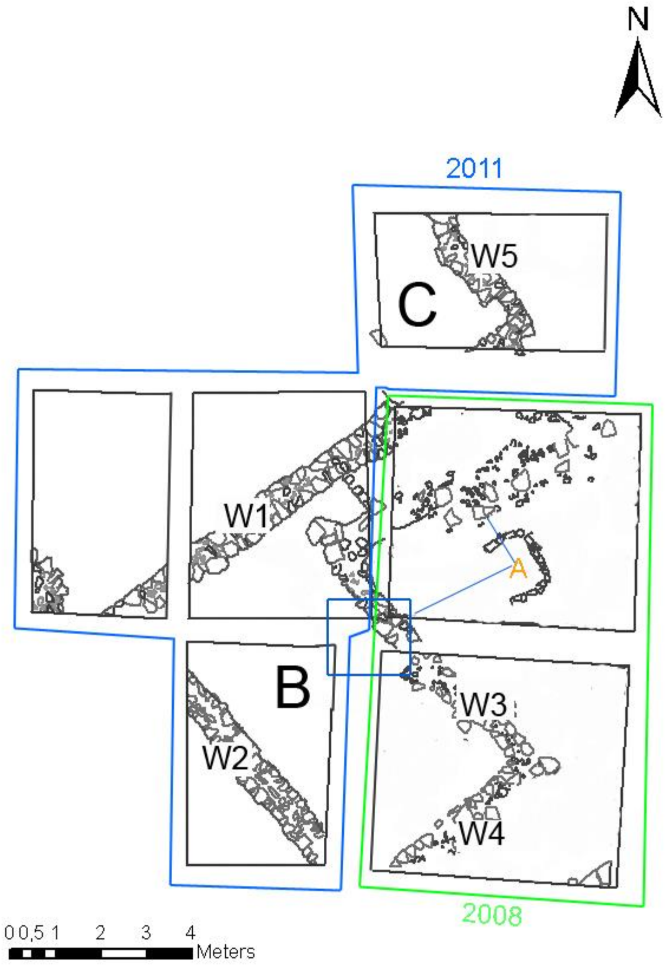

Figure 2: Plan of the Kiln Area excavation, with indications of years of excavation (Vyncke 2013: 162).

Strangely, the opening of the kiln is oriented towards the closest southwestern wall of the nearby structure, limiting the available space to operate the kiln to less than 2m, although it is hard to assess to what extent this would have actually impeded the activities of the artisans working the kiln. It is also possible that the structure was not yet present at the time the kiln was in use, or that this orientation was constructed intentional for reasons unknown, possibly related to ventilation and airflow.[494] To what extent this structure was functionally linked to the production activities, or whether for example a combination with a domestic function can be supposed, is hard to assess.

At Sagalassos, the remains of a similar kiln were discovered during excavations underneath the Roman Odeon. Pottery found in fill layers inside this dismantled kiln were dated to the end of the 3rd century BCE and early 2nd century BCE.[495] Given that the kiln had already been constructed, used, and abandoned, the existence of pottery production facilities at this location can be assumed to date back already to the 3rd century BCE. As in Düzen Tepe, the structure likely consisted of a basic updraught kiln structure. Geophysical research revealed a number of anomalies in the vicinity of the excavated kiln. While so far no excavations have taken place at these locations, these anomalies can likely be related to other pottery kilns. If so, it might be suggested that already from the 3rd century BCE onwards, this area was reserved for pottery production in the form of a potters' quarter.[496] Geomagnetic surveys at Düzen Tepe yielded a number of magnetic anomalies throughout the

[494] Vyncke 2013: 163.
[495] Poblome *et al.* 2013: 180-183.
[496] Poblome *et al.* 2013: 177.

settlement which might be linked to the presence of burnt clay.[497] Whereas the presence of other kilns cannot be excluded, some of these anomalies are probably too small to be linked to remains of (pottery) kilns. Trace element analysis of approximately 100 soil samples collected from across the site moreover seem to suggest a connection with metalworking activities, possibly ore smelting.[498] It can therefore not be excluded that certain of these anomalies were connected with metallurgy processes. Given their location intermixed between domestic structures throughout the settlement, we do not have the same indications to suggest the presence of a distinct, spatially delineated area for craft activities at Düzen Tepe, as we have for mid Hellenistic Sagalassos. Such a reserved area for production facilities, with multiple workshops operating simultaneously, would allow a markedly increased production output at Sagalassos from the late 3rd-early 2nd centuries BCE onwards.
Full-time production activities, as for agricultural activities, were *a priori* impossible in this area, where climatic circumstances characterized by long, very cold winters with much snow and short dry summers[499] would not have allowed year-round production, implying that seasonal production must have been the norm. Shifts between agricultural and production activities throughout the year are therefore quite likely. Production processes were presumably carried out by a small number of artisans, as the majority of population at Düzen Tepe consisted of farmers or herders who were mainly preoccupied with subsistence strategies, operating in a smallholder system.[500] More important than trying to exactly delineate time investment in one or the other, however, is to consider to what extent people were economically dependent on either agriculture or artisanal production for their subsistence. This degree of dependence can be surmised from degree of production specialisation and radius of distribution of the resultant production output.

For late Achaemenid times, only a limited amount of material has been retrieved from Sagalassos. Although almost no stratigraphically secure contexts from the late Achaemenid period have been identified (except for a few contexts associated with a terrace wall in the eastern parts of the site), a small number of fragments have been found either in excavations as associated residual material in later contexts or as surface material during intensive urban surveys. Due to the nature of the find contexts, it is often quite difficult to securely date this material.
Only a few fragments could be assigned unequivocally to the late Achaemenid period (late 5th - 4th centuries BCE), mainly based on properties of fabric and slip, with the majority of this material considered more general late Achaemenid-early Hellenistic (4th – 3rd centuries BCE) in date. Most of these fragments are related to a jar, storage or cooking vessel functionality, with only few attestations of tableware. The overall nature of this material, both in typological variation and in technical features such as slip and fabric use, appears to be quite similar to that of contemporary Düzen Tepe. The far larger amounts of material found there, allows a far more extensive analysis to be made, beyond the more descriptive work for the contemporary pottery of Sagalassos.
The pottery of Düzen Tepe was characterized by low product standardization, resulting in a high degree of variability in vessel dimensions, even within individual types. For example, the rim diameter of Achaemenid bowls found at Düzen Tepe[501] ranged between 12 and 24cm, with an average of 18cm. Almost no specific wares can be uniquely associated with a specific fabric, nor with specific parts of the overall functional assemblage. Most fabrics cover large parts of the full typological assemblage, although a few exceptions of more specialized production such as the black-glazed pottery and cookware do exist. Instead, we have identified only a relatively small number of types within a basic spectrum of forms that re-occurred throughout different fabrics, stressing the generic nature of the material. High variability in fabric compositions, vessel dimensions, fabric-function associations and

[497] Waelkens *et al.* 2012.
[498] Vyncke *et al.* 2014.
[499] Paulissen *et al.* 1993: 231.
[500] Cleymans *et al.* In Preparation.
[501] Out of the total 97 identified pieces, a sample of 18 fragments was usable for measurements as for these sufficient parts of the rim have been preserved.

general low degree of standardization, together suggest that little specialization can be found throughout the different steps of the productive process. This suggests that the artisans at Düzen Tepe generally invested little additional labour efforts towards producing specific and specialized goods, preferring instead to supply a generic product line. These production strategies were not geared towards wider structures of exchange but mainly aimed at fulfilling the basic needs of the local community. This is corroborated in the observed distribution patterns of this pottery material (see next part). It can therefore be suggested that the general nature of these production processes and the resultant material culture would best fit a more village-like nature of settlement. Artisanal production at Düzen Tepe was therefore likely conducted in addition to agricultural activities, which constituted the bulk of investment in time and labour. Insofar we can draw any strong comparisons from the more limited amounts of late Achaemenid-early Hellenistic material at Sagalassos, both bodies of pottery show strong similarities (see 4.2.1.2).

Along with the observed changes in production infrastructure at Sagalassos from middle Hellenistic times onwards, we also see marked changes in the resultant output of material culture dated to this period of late 3rd – early 2nd centuries BCE. The pottery material associated with the pottery kiln found underneath the Odeon, as well as a number of contexts from control excavations conducted at the Upper Agora[502] have yielded a coherent body of material indicating marked developments compared to the earlier material at Düzen Tepe and Sagalassos. Whereas previously, almost the full typological range was covered by multiple fabrics, from this point onwards, a more defined typological division between tablewares and coarse wares can be observed. This is a clear indication of stronger functionally specific associations between fabric and end product. Moreover, we see that for the production of tableware, the potters of mid Hellenistic Sagalassos increasingly started to employ the finer, well-levigated clays from the northwestern parts of the Çanaklı valley.[503] This is indicative for the development of a more extensive raw material economy at the time.

Coarse wares from mid Hellenistic Sagalassos show the same range of poorly sorted inclusions, compared to earlier times, however, notably in lower quantities and generally smaller and more rounded. Pores as well became smaller, and less elongated. As a result, these Hellenistic coarse ware fabrics have a relatively more fine-grained overall texture. These changes may be linked to more extensive preparations during the productive process. Additional preparation of clays and inclusion material enhances plasticity, producing better shapeable clay pastes and allowing more precision and refinements to be applied to the objects being produced. By forming a more regular and uniform base material, its properties become more predictable, controllable, and suitable during forming and firing in (large-scale) production processes.[504] Additional preparation measures performed during the production process are therefore an essential step for a more extensive and standardized production output.

When looking at intended functionality of these objects, it is no surprise that both at Düzen Tepe and Sagalassos, the full spectrum of domestic activities related to day-to-day use of pottery is present in the observed assemblage. We therefore need to go a step further and see whether we can trace differences in variation within each functional header. We could for example look at the number of types identified for each of the functional groups, under the assumption that two different types within the same type group might be interpreted as indications for consumer choice. In this sense, the nature of the objects being produced hinges on prevalent patterns of consumption, (in part) determined by the socio-economic roles available to the community.[505] Looking at the major components of household functional assemblages – consumption, serving, storage, and cooking – a more diversified

[502] Talloen and Poblome 2016.
[503] Braekmans *et al.* 2017: 16; Poblome *et al.* 2002; Poblome 2014.
[504] Orton and Hughes 2013: 125.
[505] Costin 1991.

spectrum of shapes with an increasing amount of specifically designed forms is produced in mid Hellenistic Sagalassos, especially for the tablewares (as summarized in Figure 3).

Functional category	**Functional group**	**Düzen Tepe**	**Sagalassos**
Consumption	cups	1	4
	bowls	4	4
	dishes	7	8
Serving	jars	7	11
	open containers	3	3
Storage	*pithoi*	3	3
	jars	5	5
Cooking	cooking vessels	4	7
Total		34	45

Figure 3: Summary of number of types per functional group, in the two different periods.

For example, whereas at Düzen Tepe most open tableware forms ranged between bowls and dishes of variable sizes, with only the so-called Achaemenid bowl attested as a clear type of drinking cup, at mid Hellenistic Sagalassos two additional types of drinking cups were identified in the form of mastoid cups and hemispherical cups. In general, typological variety at mid Hellenistic Sagalassos was equal or higher in every functional group compared to Düzen Tepe and early Sagalassos. Whether or not the noted typological differentiation is solely a reflection of distinct choices made by consumers or whether other factors were at play as well, can at this point not conclusively be answered. We can however at the very least conclude that *potential* for choice diversity was higher in Sagalassos compared to Düzen Tepe.

Structures of exchange

Some of the elements discussed so far regarding raw material procurement and organisation of the production process can be seen as indicative examples for the predominantly locally-oriented community at Düzen Tepe (see 4.2.5). This general conclusion is also corroborated by observed pottery distribution patterns. It is interesting to note that the distribution of pottery produced at Düzen Tepe is mostly limited to the site itself, while surveys in the adjoining Ağlasun valley system, although only with partial coverage of the valley lands surrounding the site[506], show them to be only marginally present, and even there only at those locations closest to the site and decreasing sharply as the distance from the site increases.[507]

Although import is attested occasionally at Düzen Tepe, it constitutes only a minor part of the total pottery assemblage and is mainly associated with specific vessel types such as Achaemenid bowls. In a recent study of 623 diagnostic sherds, five out of 97 identified fragments of Achaemenid bowls could be linked to import. On the total body of material under study, about 2% is considered imported. Contacts with the outside world did exist, as can be deduced from a handful of coins from Erythraea, Magnesia and Selge found at Düzen Tepe, although it remains difficult to assess the nature and scale of these contacts.[508] Additionally, the large denominations of these silver coins suggest that they were not used in day-to-day transactions or trade.[509] The limited attestations of glass objects in the excavations at Düzen Tepe[510] suggests these were imported rather than locally produced, as was customary for this period of time. In general, the mechanisms of distribution at Düzen Tepe were mainly aimed at basic subsistence exchange within the settlement itself, with, safe for a few exceptions, little incentive or intent to move into larger scale networks of exchange.

[506] A caveat the Sagalassos Project will address during the upcoming 2018 study campaign.
[507] Braekmans *et al.* 2017.
[508] Vyncke 2013: 217-218.
[509] Stroobants 2017.
[510] Only 19 glass fragments were found during 6 years of excavation.

At Sagalassos, a markedly different picture emerges from mid Hellenistic times onwards. Pottery from Sagalassos is at that time distributed throughout the entire Ağlasun valley and gradually spreads towards neighbouring valley systems as well, especially from the middle of the 2nd century BCE onwards.[511] Fine tableware produced at Sagalassos was notably encountered in a range of settlements to the south, both within and outside of the borders of its newly enlarged territory. Pottery imports found at Sagalassos also became more extensive, with a wider functional range attested, from drinking cups, to containers, jars, *unguentaria*, and most notably also amphorae.

It has been noted how amphorae are completely absent from Düzen Tepe, whereas these are attested, albeit in limited quantities, at Sagalassos from middle Hellenistic times onwards. The appearance of amphorae originating from Rhodos, Kos, and Chios around 200 BCE has been linked to participation in larger scale exchange networks, associated with the initial phase of urban development at Sagalassos (see 4.2.1.4). At the same time, a new institutional fabric developed alongside and within this new urban matrix. Interestingly, the earliest material reflections of institutional development at Sagalassos can be situated in the socio-economic domains, and appear to be intrinsically related to aspects of exchange.

Around 200 BCE, existing clay quarries in the settlement were filled to allow the construction of a first public square or agora, traditionally considered the heart of social, political, religious and commercial activities.[512] The agora as a space for public exchange increased the possibility of acting politically and economically outside the closely knit social network of neighbourhood, friendship, and kinship ties. Moreover, the agora acted as a central hub for flows of goods, services and money, both internally within the community and externally in connections with markets abroad.[513] Development of an agora has also been specifically related to the political 'coming of age' of urban communities or *poleis.*[514] It has been noted that prior to the observed petrification of institutions, already a form of political community might have been in place in the 3rd century BCE (see 4.2.4).

One generation after the construction of the agora, around 180 BCE, a Market Building was constructed along the eastern side of the agora. These one-, two- or three-storied colonnaded porticoes with attached outbuildings, generally contained multiple workshops, storage spaces and other facilities and were commonly located on or near the city's central agora. They are a typical feature of cities in Hellenistic and Roman Asia Minor and started to emerge more frequently during the 2nd century BCE.[515] The physical monumentality of the building at Sagalassos, its locational prominence within the urban fabric and its early construction date within this new settlement phase, all point towards the importance of the kind of day-to-day economic activities taking place here within the overall social fabric of the community. The formalisation of social interaction expressed through the construction of such settings, allowed the civic administration to facilitate governmental control over commercial exchange and financial transactions within the building and on the agora, for purposes of taxation, regulation, safety of transactions and surveying weighting and measuring. All this in stark contrast with Düzen Tepe where few clear indications for institutionalization beyond the household level have been found, especially none related to wider economic exchange and distribution (but see 4.2.4 for a discussion of functional collective action measures).

Discussion: Approximating socio-economic complexity

In this final part, I wish to integrate the archaeological observations described in the previous part with the theoretical framework outlined at the beginning of this paper. The socio-economic dynamics underlying the remarkable developments at Sagalassos from the (late) 3rd – early 2nd centuries BCE onwards, were part of a wider process of transformation, traditionally subsumed (partially) under the

[511] Poblome *et al.* 2013: 535.
[512] Talloen and Poblome 2016
[513] Davies 1998.
[514] Starr 1986.
[515] Köse 2005a.

moniker of urbanisation, but which can actually be subdivided in a number of distinct socio-economic processes driven by developments through a number of causal factors. I compare properties of the socio-economic system at Düzen Tepe (5th – 3rd centuries BCE) with Sagalassos (3rd - 2nd centuries BCE) through the intensity of development in a number of variables. A summary of these variables, outlined to various degrees already in the previous part as well as in the following discussion, can be found in (Figure 4).

In this discussion, we focus on six crucial causal factors of socio-economic development: 1) structures of supply and demand, 2) capital investment, 3) institutionalization, 4) division of labour, 5) technological development, and 6) property rights. This paper is not primarily concerned with the discussion whether developments in any one of these factors effectively entails economic growth, be it aggregate or *per capita*. Still, each of these causal factors can at least provide the necessary *potential* for further socio-economic complexity development.

Domain	**Parameter**	**Düzen Tepe**	**Sagalassos**	**Trend**	**Intensity**
Exploitation	Opportunity costs	Low	Moderate	+	0.2
Exploitation	Catchment area	Low	Very high	+	0.6
Exploitation	Different resources	Moderate	High	+	0.2
Production	Division of labour	Low	Moderate	+	0.2
Production	Specialization level	Low	Moderate	+	0.2
Production	Temporal specialization	Low	Low	0	0
Production	Technology level	Moderate	Moderate	0	0
Production	Tool use	Low	Moderate	+	0.2
Production	Infrastructure specialization	Moderate	High	+	0.4
Production	Standardization in object dimensions	Low	Moderate	+	0.2
Production	Specialisation fabric	Low	Moderate	+	0.2
Production	Fabric composition	High	Moderate	-	0.2
Production	Specialisation typology	Low	Moderate	+	0.2
Output	Assemblage diversity	High	High	0	0
Output	Typological diversity: Consumption	12	16	+	0.2
Output	Typological diversity: Serving	10	13	+	0.2
Output	Typological diversity: Storage	8	8	0	0
Output	Typological diversity: Cooking	4	7	+	0.2
Exchange	Distribution	Low	Moderate	+	0.2
Exchange	Import	Low	Moderate	+	0.2
Exchange	Institutionalization	Low	High	+	0.4

Figure 4: Parameters of socio-economic complexity.

From the evidence outlined above, it can by now be concluded that the community at Düzen Tepe relied mainly on its immediate vicinity within a locally-oriented productive landscape, be it on the plateau itself or in the nearby valley of Yeşilbaşköy, for sustaining its various activities, including resource procurement, production, but also raising livestock, farming, and other subsistence strategies.[516] Isotopic analysis has, for example, indicated that livestock was primarily kept together within the immediate vicinity of the settlement.[517] Likewise, production output was first and foremost intended to supply the own community, with only limited involvement in wider exchange networks. The overall impression of Düzen Tepe is one of an inward-oriented village community. When taking the full "ecology of subsistence strategies" as a starting point for a complexity economics perspective[518], it can be stated that only a limited amount of different strategies was available in such

[516] De Cupere *et al.* 2017a.
[517] Fuller *et al.* 2012.
[518] Arthur 2015.

a village community, where the majority of population was mainly preoccupied with agricultural production aimed at personal subsistence. The urban context developing from mid Hellenistic times onwards at Sagalassos would allow a slightly more diversified ecology of strategies consisting of more opportunities beyond agriculture, with more people earning a living as craftsmen, traders, *etc*. Increasing division of labour therefore results in increase of complexity through increased diversity of composition in socio-economic roles and professions.

An important element here is the opportunity costs associated with non-subsistence activities, such as for example pottery production. Given the generally low degree of labour specialization, only a limited amount of artisans/potters would have been present in Düzen Tepe, with the majority of population rather involved in general subsistence activities. The bulk of potential opportunity costs would therefore not have been associated with the nature of labour *per se*, but rather with the conversion of agricultural lands for resource exploitation. For all locations with suitable raw material sources, an assessment needed to be made whether to invest in resource exploitation or leave the land for agricultural conversion. If certain lands were to be targeted for exploitation of raw materials, these would consequently be no longer available for agricultural production. This means that opportunity costs associated with this decision would be somewhat higher in a farmer community like Düzen Tepe and thus acting as a constraining factor for innovation, compared to the urban community at Sagalassos, where more possibilities might be available for people to generate their own income outside of the agricultural sector.

It was recently calculated that both Düzen Tepe and Sagalassos in late Achaemenid times had access to sufficient amounts of land to sustain its subsistence activities.[519] The exploitation of certain parcels of land for clay procurement would then have depended mainly on the availability of suitable clay beds and somewhat less on the need to choose between different strategies (subsistence or raw material exploitation). Opportunity costs at this time would therefore have been rather low. Given the relatively higher degree of division of labour at Sagalassos from mid Hellenistic times onwards, the potential opportunity costs would by default have increased, as relatively more possibilities for the populace to earn a living in non-subsistence activities would have presented themselves. This development might allow people to diversify their income portfolio, leading to more extended land ownership as well as allow long-term clay exploitation on specific land plots rather than an exclusive use for agricultural cultivation.

Whereas the production infrastructure does not seem to have developed significantly between the 5th and 2nd centuries BCE, as the same type of updraught kiln appears to have remained in use, certain technological innovations do seem to have been initiated. The systematic use of fine clays allowed better slip, and more refined finishing and shaping of the vessels to take place. This can for example be observed in the statistically significant more thin-walled Hellenistic pottery at Sagalassos compared to their predecessors at Düzen Tepe (see 4.2.1.4).

Perhaps the main differences between both technological systems, however, pertains to differences in organizational structures. Intensification of production in antiquity was typically achieved by multiplying small-scale production units rather than enlarging existing facilities.[520] The organisation of different workshops in a spatially distinct zone of artisanal activity would then have allowed sufficient critical mass to induce a process of production and labour specialization, generating an increasing return on investment. However, sufficient incentives needed to be present for people in the past to intensify production beyond basic subsistence needs. If demand is not high enough, the average cost per unit will increase because of fixed production costs for products reaching a decreasing customer pool.[521] To what extent division of labour may have been applied between different production units – for example contributing to a combined effort for resource exploitation and gathering as may perhaps be expected from the increasingly specialized use of Çanakli-based clay sources, rather than

[519] Cleymans *et al.* 2017.
[520] McCormick 2001: 58; Poblome 2006: 349.
[521] Acton 2016: 158.

multiple individual efforts – to offset the associated cost increase, remains unclear for now. The successful multiplication of production units through the establishment of a pottery production quarter observed at Sagalassos therefore suggests that sufficient incentives of demand were at that time present or at least being created in order to increase production output. Multiplication of production units then resulted in a positive feedback loop driving increased production output as long as demand continued to provide sufficient incentives.

On a local scale, material culture generally operates within two different contexts of engagement: household and community.[522] Concordantly, two different levels of economic contexts can be said to exist: domestic and political economy.[523] In many pre-modern societies, domestic economies, characterized by a predominant focus on household subsistence and production, and inter-household reciprocity, provided the economic base for a family-based social organization.[524] Political economy, on the other hand, constitutes an additional level where economic surpluses generated through material flows of goods are constricted and channelled through selective control measures and reinvested by social elites create additional wealth in order to finance institutions of rule, construct status identity and organise communal activities.[525] Can the differences in socio-economic organisation between Düzen Tepe and Sagalassos and the concordant increase in economic potential and system complexity be explained by the elaboration of the level of political economy, in addition to the continued existence of domestic economy?

One way to try and trace the development of a political economy is through the emergence of institutions. An important explanatory factor of the increased economic potential of Sagalassos is undoubtedly its territorial expansion in middle Hellenistic times, allowing a political and territorial claim over a far larger quantity of natural resources to be exercised in function of potential exploitation. A closely related advantage may have been that the extended territory could have allowed Sagalassos to reach a far larger potential customer pool. Unfortunately, we have only limited evidence regarding markets and other exchange structures on a local and regional scale in this period of time. Moreover, a long-term diachronic study on the material culture and settlement patterns of the Bereket valley, located in the southwestern part of the territory of Sagalassos, indicate that this area was structurally integrated only in Roman imperial times, and even then still relatively disjointed and for a relative short period of time.[526] We can therefore wonder whether the potential of this (assigned) expanded territory would have been efficiently exploited in Hellenistic times.

Nevertheless, market diversity in general is an important element in the development of an economic system. Through the causal factor of supply and demand, diversity enters market exchange in three different ways: 1) diversity in what agents bring to buy and sell, 2) agent's preferences for different goods, and 3) different adaptation to information, mainly in the form of prices.[527] Although the exact structures of exchange are not known to us, some of its material reflections can be traced in the archaeological record. The construction of a market building shortly after the expansion of the territory may have been indicative of the ambition of the local community to tap into the potential offered by these new possibilities. It has been noted how the appearance of amphorae in the archaeological record from Sagalassos from 200 BCE onwards suggests the initiation of participation in long-distance trade networks.

Clearly, the shift from domestic to political economies resulted in a markedly different economic landscape even in local communities. This need not necessarily mean that participation in such long-distance networks was a political or centrally driven process, but rather that people in the local community started to see and utilize a whole new range of possibilities to conduct their business. Such

[522] Kohring *et al.* 2007: 107.
[523] Earle and Kristiansen 2010.
[524] Vranic 2012: 40.
[525] Earle 2002: 1.
[526] Kaptijn *et al.* 2013.
[527] Page 2010: 17.

long-distance trade then contributes to economic development by increasing the effective size of markets reached by producers, enabling economies of scale and division of labour, as well as by enabling distributed and more complex manufacturing, so that a wider range of goods may be produced at a given place.[528] It has also been noted how the range of pottery imports considerably increased at Sagalassos, compared to Düzen Tepe. Exchange in itself can be considered to have an important multiplicative effect. Following the general non-zero-sum characteristics of communication and interaction[529], exchange has been argued to facilitate exploitation of diversity in dynamics of supply and demand, as the sum of the values of individual goods is greater afterward than it was before any exchange occurred.[530] This general process has clear economic implications, as value is therefore not only created through production but also through the very act of exchanging goods.[531]

The material configurations of trade and exchange generally only becomes archaeologically visible once it becomes institutionalized, and social and political 'rules' for economic exchange become fixed.[532] One aspect of such institutionalization process entails the erection of permanent and fixed marketplaces to offer a formal setting and framework for these exchange to take place.[533] Interestingly, the agora and Market Building are some of the oldest known instances of any such formalised material settings as part of institutionalisation processes at Sagalassos, constructed in the late 3rd – early 2nd centuries BCE, perhaps testimonial for the importance of economic exchange in this community. It cannot be excluded that this phase of monumental petrification at Sagalassos reflected the origin of a political community in an earlier phase of community formation during the 3rd century CBE. Such formal settings reduce investment in information gathering as it presupposes a sufficient number of participating buyers and sellers – at least in periodic attendance taking into account seasonality of production – to underwrite system development.[534] Institutions can be considered a 'petrification' of social practices[535] in a society as it provides a structural solution for frequently repeated actions, such as exchanging goods, by reducing uncertainty and 'noise' in communications through standardized ways of coupling fixed pathways of interaction.[536]
Of course, it has been recognized that institutionalization does not necessarily automatically equate (continued) efficiency.[537] Due to path dependent structuration of its dynamics, institutions are costly to change and therefore tend to remain unchanged over longer periods of time. Whereas stability could at first offer suitable conditions for continued interactions to take place, it is prone to turn into rigidity when configurations remain unchanged – a characteristic feature of institutions – even if the circumstances within the rest of the system or its environment change. Processes of institutionalization, as well as increased specialization are – among others – induced by the increase of internal and external connections within and between system components. At the same time, these trends often increase overall system rigidity to such a degree that the system may no longer adequately response to disturbance events and break down. Still, we suggest here that the system developments from late Achaemenid to mid Hellenistic times sketched in this paper are mainly testimony of the transition towards increased institutionalization and specialization, generating additional potential and capital through increasingly interconnected system components, but with no indications that institutional rigidity had already started to set in.

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[528] Bowman and Wilson 2009: 30-1.
[529] Parsons 1977.
[530] Simmel 1978.
[531] Staubmann 1997: 85.
[532] Garraty 2010: 6.
[533] Harris and Lewis 2016.
[534] North 1990.
[535] Turner 2003.
[536] Fletcher 1995: 143-144.
[537] Zuiderhoek 2015: 13-14.

Throughout this paper I have sketched a number of developments in resource procurement, production and exchange of pottery for the communities of Düzen Tepe and Sagalassos during late Achaemenid and Hellenistic times. The development of the latter into an urban community during the middle Hellenistic period, has been clearly reflected in each of these domains. Moreover, I have tried to indicate for each of these domains where the necessary capital, value or potential might have been generated to sustain these developments. Figure 5 summarizes this argument by listing the most important causal factors for each of these parameters, along with concordant mechanisms of complexity development, responsible for the observed development of increased potential/capital in the socio-economic system of Sagalassos. Of primordial importance were territorial increase and the associated access to additional resources and energy, an elaborated participation in exchange networks, an increased production output due to multiplication of production units, institutional development, and diversification of potential socio-economic roles through an increased division of labour.

Parameter	Causal factor	Mechanism	Düzen Tepe	Sagalassos	Intensity	Description
Resource procurement	Division of labour	Diversity	Low	Moderate	0.2	Opportunities generated by urbanization
Resource procurement	Capital	Connectivity	Very low	High	0.6	Potentially exploitable territory
Production	Capital	Dimensionality	Very low	Moderate	0.4	Multiplication of production units
Production	Capital	Connectivity	Low	Moderate	0.2	Standardization of production output
Production	Supply & demand	Diversity	Low	Moderate	0.2	Production output
Exchange	Supply & demand	Connectivity	Low	High	0.4	Potential customer pool
Exchange	Capital	Connectivity	Low	Moderate	0.2	Exchange networks
Exchange	Institutions	Dimensionality	Very low	High	0.6	Institutional development

Figure 5: Causal factors and mechanisms of complexity development at Düzen Tepe and Sagalassos with indication of relative intensity of each process.

It should be remembered that the assigned intensity of development pertains only to a relative comparison between Düzen Tepe and Hellenistic Sagalassos. In the subsequent Roman imperial period, many of these factors would continue to develop on a hitherto unprecedented scale. Taking this development into account would of course strongly skew the intensity measures presented here for this earlier period. The purpose of this paper was not to present an absolute measure of complexity development, but rather to situate and interpret certain processes related to past socio-economic systems as observed from the archaeological record in one specific phase of societal transformation.

Finally, I have extensively discussed *how* the development of socio-economic complexity at Sagalassos compared to the initial system state at Düzen Tepe may have occurred. However, I have left the matter of *why* this development occurred, as well as why it only happened at Sagalassos, but not at Düzen Tepe, unanswered so far. In the next two parts, I will turn towards answering these questions.

4.2.4 Socio-political organisation

This publication grew out of a paper I presented at the "Conference on Complex Systems" held in Cancun in September 2017 in the "Evolution of Cultural Complexity" session. Papers presented at the session will be published in a special issue of Adaptive Behaviour in July 2018 and contributions are currently in review.

Living together. Community formation and social organisation at Sagalassos and Düzen Tepe (SW Anatolia)

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A model of community formation

Man is a social animal (and so are women and children by the way). For most of our history, we have sought to live together in social groups of varying sizes and configurations. In many of these groups, kinship played an important part. Yet, oftentimes what constitutes a 'community' goes beyond immediate kin relations. Community formation entails matters of cooperation between individuals (Axelrod 1984; Blanton and Fargher 2016). Collective action measures are undertaken to mobilize a group of people towards a common goal. The reasons why people might venture into these collective endeavours are legion. The principal causal factors in developing collective social organisation are often considered to be related to the material conditions of human existence, i.e. demographical, ecological, technological, and economic factors, as these relate to the most basic human needs concerning the production of subsistence and the reproduction of human life (Sanderson 1999). Even if we can consider the full spectrum of community formation dynamics to be more extensive than this, collective action driven by these material conditions still constitutes the basic platform for such dynamics to develop, as a common plane upon which shared, day-to-day activities, interactions, and socialization take place (Smejda and Baumanova 2015, 53).
At the same time, community formation cannot be fully reduced to mere aggregation of face-to-face interactions and practices (Blau 1964). Human societies should rather be considered as complex systems where social organisation is a complex property emerging out of the social interactions that are its constituent building blocks. Social interaction occurs when two or more people 'encounter' each other, that is, create an episode of mutual awareness supplemented by communication (Turner 2003, 4). Communication is considered here in a broad sense as any exchange of information (Castellani and Hafferty 2009, 38). Information transmission is not merely a "like-for-like" process, but has an important multiplicative effect following the non-zero-sum characteristics of communication and interaction (Parsons 1977). One definition of social complexity states that "complex social systems are those in which individuals frequently interact in many different contexts with many different individuals, and often repeatedly interact with many of the same individuals over time" (Freeberg *et al.* 2012, 1787). It has therefore been argued that the origins of increasing social complexity lie in growth of community sizes and an associated exponential increase in (potential) structural social interactions (Dubreuil 2010; Fletcher 1995). But how does the multiplicative effect of social interaction come to be? And what are its effects?

In recent years, the concept of communities as 'social reactors' has started to gain tract, positing that increased face-to-face interactions operates as a nexus between baseline demographic processes of population growth and aggregation, and resultant societal changes generated by processes of community formation, socio-economic growth, and scalar stress (Bettencourt *et al.* 2013; Ortman *et al.* 2015, 2016; Smith 2017). The central notion is that spatial proximity induces improvements in flows of information, thus creating the observed spill-overs, both on a social and economic plane. When a higher amount of people is more closely concentrated, learning and transfers of knowledge can take place more efficiently. Knowledgeable agents are more likely to be present, and in highly clustered networks interactions can take place with higher frequency and are affected by more rapid feedback loops, thus decreasing lag time in the transfer of information.

By focusing on the central role of social interaction and associated flows of information within a community, the social reactor model can be applied both to urban and non-urban communities (Ortman and Cofey 2015). Urban communities are generally seen as characterized by pronounced divisions of labour, intensive and widespread interaction structures, and large flows of people and resources within dense, ordered infrastructure networks. Rural communities such as villages, on the other hand, are considered as comparatively 'simple' places where the division of labour above the household level was limited, social interaction was structured primarily by kinship, and the built environment was relatively unorganized (Cowgill 2004; Southall 1973). From this perspective, the emergence of urban communities represents a dramatic point of innovation in history, a revolution as Gordon Childe (1950) famously put it. However, the posited outcomes of social reactors are not necessarily unique to urban communities but should rather be considered as an intensification of existing processes induced by increased population densities. Along this trajectory, rapid urban development can occur when the community at some point approaches a threshold phase or tipping point, where even very small changes can lead to a substantial system change once it crosses the threshold (Gladwell 2000; Marston 2015).

The emergent effects induced by social reactors are processes of community development, socio-economic growth, and scalar stress. Growth and development on a social and economic plane via the first two elements are not limitless, but delineated by the latter, which is induced by limits to human information processing capacities (Johnson 1982). Information processing is considered to be an essential biological limit to group sizes (Dunbar 1993). Human groups, however, can 'circumvent' these biological limits through the development of structural social organisation in order to better process socially transmitted information and take collective decisions more effectively (Auban *et al.* 2013, 56). This process should not be seen as an inevitable trajectory of organizational development in increasingly complex societies, as was prevalent in older works on social evolution (Service 1962). It was argued by Claudio Cioffi-Revilla (2005) in an algorithmically formalized model of socio-political complexity development through decision-making processes, that whether or not organizational development occurs and is sustained, depends on a sequence of steps in a recursive loop of signal detection, information-processing, and problem-solving, resulting in either successful or failed adaption and development of social organisation. The loop is induced by a social group reacting to situational events, which can be highly various in nature, including stresses and opportunities, endogenous and exogenous processes, social or physical in nature, and human or environmental induced. The loop consists of a dual trajectory, with a 'fast process' of crisis and opportunistic decision-making through collective action feeding a 'slow' process of socio-political development or decay.

But where does the archaeology come in?

The model highlighted above can be used as a general framework to trace processes of community formation, organizational development, and social complexity dynamics. How can we now relate this general conceptual framework with the archaeological record, given that we cannot directly observe the constituent practices, interactions and activities of social organisation in the past?

It should be stressed that all actions and interactions inherently have a temporal, spatial, and social dimension. They take place at a given time, at a given place, and within a certain social framework, including face-to-face encounters, social groups, communities, *etc.* For example, a settlement can be considered to reflect the actions and practices of the community it housed (Robb 2007; Smith 2003). Others have questioned this approach, suggesting that community space almost inevitably extended beyond that of the site as typically defined (Kolb and Snead 1997). However, whether or not both necessarily fully converge is not the point of interest here. I rather wish to stress that the material remains intrinsically *can* be correlated with the actions of the society or community producing it. We can in this sense consider a settlement as a 'pocket of interaction' where, given their generally higher population numbers and increased population density, an increased amount of social interactions occurs in settlements compared to the surrounding areas (Southall 1973, 6). The settlement can

therefore be considered a general approximation of the spatial delineation of the most dense parts of the network of interaction in a given community.
Settlements were considered containers of social interactions and actions in Anthony Giddens' concept of 'locale', defined as the temporally and spatially defined context in which social practices are manifested (Giddens 1984, 110). Spatial and temporal configurations are essential, both as external context and internal structuration of these practices. This entails not merely the physical properties of space in a Euclidean sense but also its material context and how space is used for human activities and provides for the context of social life (Bryant and Jary 1991). Locales can essentially be located within any spatial setting, a room, a house, a street corner, a town, a city, *etc*. Spatial properties and performance of social practices can also be combined through the concept of 'place', defined as 'lived space', ascribing meanings, identities and memories that actively shape people's daily practices and experiences (Feld and Basso 1996; Low and Lawrence-Zuniga 2003; Preucel and Meskell 2004; Rodman 1992). Places offer spatial contexts for people to orient themselves and act within culturally constituted landscapes based on heterogeneous social knowledge and experience (Robb 2007, 9). Through the concepts of locale and place, a mutually constituting relationship between settlement form and the actions and interactions of heterogeneous individuals, groups, and institutions, each with their own motivations and identities can be proposed (Fisher and Creekmore 2014, 1).

This is all highly relevant for archaeologists, as it essentially allows material environments to be analysed, not only as invariant contexts for social action and interaction, but also as reflecting at heart the nature and intensity of these processes, and thus providing a way to connect the 'static' archaeological record with the 'dynamics' of the society which produced it. We can look in particular at Amos Rapoport's (1988, 1990a, 2006) model of material environment-behaviour interactions, distinguishing between three levels of material communication and information transfers: 1) Low-level meaning focusing on mnemonic cues for identifying the uses for which certain material settings are intended, enabling users of a certain place to behave and act appropriately and predictably; 2) middle-level meaning communicating deliberate statements about identity, status, wealth, power, and other traits; 3) high-level meaning as a symbolic representation that only exists within the context of a specific cultural and religious system. It should be noted that not all three levels can or will necessarily be distinguished in any particular instance of the archaeological record. Moreover, in absence of written sources it will often be highly difficult to comprehensibly trace high-level meanings.
Still, the approach allows a clear pathway to move from material settings to social practices in the past. Moreover, it allows us to integrate the material culture in this perspective as well. Through specific instances of usage, material objects are 'enchained' in interlinked sets that are structured spatially and temporally, thus creating distinct and circumscribed locations pulling together sets of material linkages to constitute social practices in which these objects are 'proper' to be used (Lucas 2012). If the iteration of usage is sufficiently recurrent and extensive, stabilized networks of action are formed, where the interactions between interrelated sets of enchained objects and the circumscribed spaces in which they are embedded, create socially meaningful contexts (Fletcher 1995). Of course, human action need not always follow prescribed rules. Individual engagement with material culture within a technological system, both from a production and consumption point, inevitably results in variability and diversity (Page 2010). In any given social context, this variability can carry a range of social meanings. While variability is created through the productive side of the *chaîne opératoire*, its consolidation lies in visual recognition, or lack thereof, by others within the community (Kohring *et al*. 2007, 103). Within the social arena of a given community, a certain leeway exists for both producers and consumers to manipulate the material culture to their disposal and the meanings they carry. In essence, different 'stakeholders' involved in all steps of the operational sequence of production and usage of material goods (most notably producers, traders, and consumers) enter a complex negotiation of meaning associated with particular objects. In this sense, material culture itself should be considered as carrying certain messages of meaning and therefore as transmitting information.

This is nothing new, material culture was already considered by David Clarke (1968) as inherently carrying flows of information. More recently, it has been suggested that diversity in material culture can be directly linked to its functionality as an information transmitter through its role as regulator in managing cognitive limits to information processing (Kohler *et al.* 2004; Nelson *et al*. 2011). Homogeneity (i.e. low diversity) in material culture is linked to overall strategies of social conformity by inducing conformist behaviour, thus facilitating intragroup cooperation as a way to reduce scalar stress in consensual decision making by establishing a degree of social cohesiveness (Hodder 1979; Johnson 1982). More homogeneous material culture is a trait often associated with increases in group size, density, or scale (Johnson 1982; Kohler *et al.* 2004).

Information is thus contained in the physical and material world around us, and as such inherently deposited in the objects and structures providing the setting for human life (Hidalgo 2015). These objects allow people to communicate messages, coordinate our social and professional activities, and transmit knowledge and knowhow as the necessary 'software' that allow information processing to take place (Hidalgo 2015, xviii). As such, objects are embodiments of knowledge and knowhow, integrated in social and economic networks. Information is thus stored and accumulated in social and economic networks of people, places and objects. The nature and composition of a communities' social and economic networks is therefore of primordial importance for its subsequent development. Let us now illustrate the theoretical and conceptual framework highlighted so far with a case study. I will specifically focus on the origin of community formation and initial development social complexity at two settlements, Sagalassos and Düzen Tepe (southwest Turkey), during the Achaemenid and Hellenistic periods (5th – 2nd centuries BCE).

Community formation and social organisation on the ground.

Düzen Tepe

In a village community such as Düzen Tepe, characterized by a smallholders-based subsistence system (4.2.2) and inward-oriented economic system (4.2.3), social life was likely for a large part oriented towards the household or other family-based social units. The generally disordered settlement layout of the village shows no clear indications for an additional, centralized or public locus onto which communal life could have been systematically oriented (Figure 1).

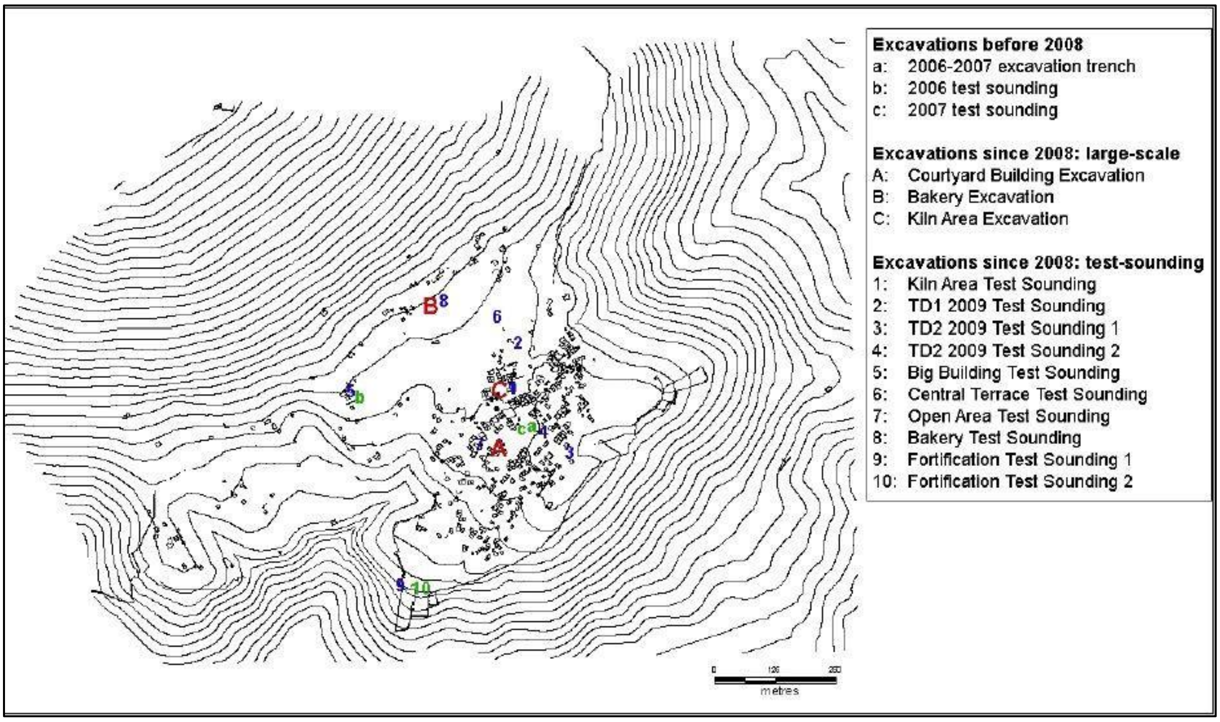

Figure 1: Settlement plan of Düzen Tepe with excavated buildings (Vyncke 2013, 101).

Only one domestic structure was excavated, the so-called 'Courtyard Building' (CYB) (see Figure 2). Of this building, 26 5x5m sectors were excavated, exposing an area of over 650m² centred on a cluster of 9 rooms that were oriented along an L-shaped open space (80m²), most likely a central hallway or courtyard (hence the name of the building). The structural remains consist of *in situ* preserved stone socles of about 50 to 75cm wide, which provided the foundations for the rest of the structure built from perishable materials such as possibly mudbrick. The socles consisted of limestone rubble, most likely field stones collected from the surface of the immediate surroundings of the site. No traces of a mortar binder were found in any of the socles and they were built directly onto the bedrock, incorporating any height differences on the terrain.

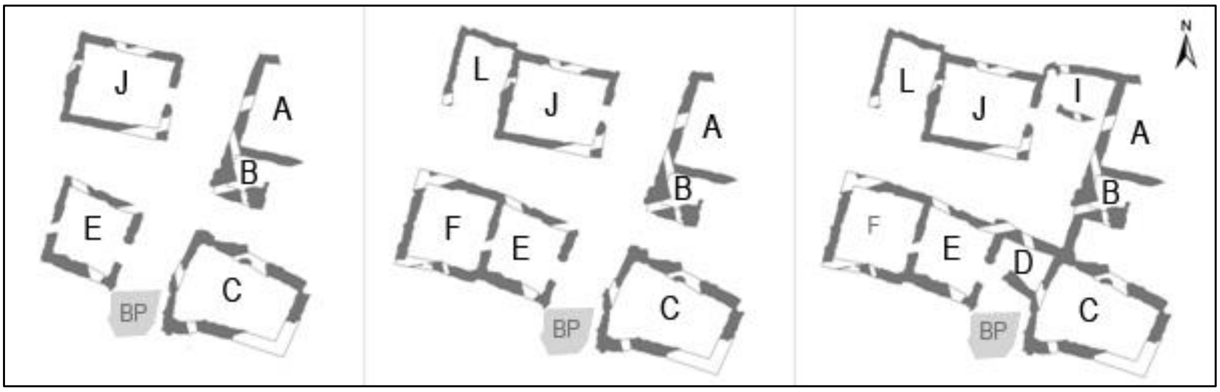

Figure 2: A proposed reconstruction of the different building phases of the Courtyard Building, with indications of the remaining unexcavated banks from the Wheeler box-grid system that was applied (Vyncke 2013, 149).

Most spaces are roughly square or rectangular in shape, ranging between 11m² (Room B) and 42m² (Room C). It has been suggested that the structure was not originally planned as one single building, but rather that several rooms were added in different phases (Vyncke and Waelkens 2015, 164; see also Figure 2). However, it must be noted that this suggestion could not be corroborated with stratigraphical evidence. Instead, it was merely indicated that the walls of some rooms were clearly abutting those of others, indicating a sequential building procedure. While I do not contend the sequential building procedure as such, this does not tell us much regarding the elapsed time between original conception and later addition of these structures. Still some indications such as the lack of doorways between certain rooms and the discontinuous wall trajectories of certain rooms do suggest that at least parts of the building may indeed not have been part of the original building phase. Consequently, the L-shaped central space may only have been a coincidental result of successive building activities, although it is remarkable that the central cluster of the building can be subdivided in two sequences of rooms (L-J-I and F-E-D) each bordering an apparent open space. However, whether this was really the case for the space south of the building is unclear given the limits of the excavated zone. Possibly this sequence was mirrored at the eastern side as well in the sequence of rooms A-B (and C?).
It is unclear whether each of these room sequences represented three distinct clusters, for example centred around different individual households, or whether the entire structure belonged together. The fact that the rooms within each of the sequences only open up towards the different open spaces, but not towards each other, seems to favour the first hypothesis. Little 'depth' in room access could be observed, with quick access from the outside possible for most rooms. Only in room F, no clear doorways have been observed in the outer walls, suggesting it had no direct access from the outside, but was only accessible through room E, unless the entrance was located in the unexcavated axis of the Wheeler box-grid in the southwestern and northwestern corners of the room (see *infra*).

Slightly towards the north of CYB, a single-room structure was found with three roughly circular holes with a diameter between 0.25-0.50m, dug out in the bedrock. The remarkable amount of fragments of large storage vessels found here suggests that these may have been used to fix *pithoi* vessels in the floor bed (Vyncke and Waelkens 2015, 166). Additionally, a variety of objects were found, including a

loom-weight, spindle whorl, a fibula, an arrow head, some coins and astragals, as well as some amounts of production waste and undefined metal objects. This isolated structure can likely be interpreted as a storage room. Whether it can be associated with the CYB remains unclear.
In the open space south of the CYB, a square pit (BP, see Figure 2) of 3x3m wide and 0.50 to 0.60m deep was cut into the bedrock, however, its relation to the structure remains unclear. In the northern side, a triangular niche containing fire remains was cut out. In an occupation layer at the edge of the pit, the remains of a cremation urn were found. Unfortunately, the relationship between this burial, the pit and the building to the north remains unclear. The deepest layer of the pit contained remains of a plastered hearth and is suggested to have been the original occupation layer, covered by a possible destruction layer and two post-occupational layers (Vyncke 2013, 149-150). Especially for the latter, this interpretation should be considered highly tentative as, although huge amounts of material have been collected from these contexts, the finds provide little indication as to the nature, chronology or functionality of the pit. It has been suggested that it represents the remains of a pit-building pre-dating the construction of the CYB given that the opening of rooms D and F open towards the pit, suggesting that it was not present at the time of occupation of the house and therefore possibly testimony of an earlier phase of settlement (Vyncke 2013, 150). However, no indications could be found in the pottery material collected from this bedrock pit that this would have been markedly older, or in any other way different for that matter, than the CYB as both generally yielded the same types of material.

Houses such as CYB likely constituted the main places where life at Düzen Tepe took place. The vernacular architecture, with mudbrick walls roofs from perishable materials, that characterised these structures provided the locale for social practices related to subsistence, reproduction, and other basic spheres of social life, such as food processing and cooking, storage, production, habitation, leisure, and discard.
In rooms A, C, F and J, as well as the northern courtyard, a series of features consisting of a horizontal layer of fired clay were found, most likely hearths. It is interesting to note that all hearths found inside were located close to the corner, possibly suggesting a cooking function instead of heating (Vyncke *et al.* 2011, 2290). Additionally, a number of fire contexts lacking the distinct layer of fired clay have been noted as well, both inside and outside the rooms. Likely these can be associated with the use of portable braziers, as a few examples of such objects were attested in the excavations at Düzen Tepe, and should rather be associated with heating practices (Figure 3).

Figure 3: A brazier fragment from Düzen Tepe.

The presence of a refuse pit in the central courtyard and outside room F, containing small animal bones and large faunal remains moreover provides additional evidence for food processing activities taking place within the contours of the building. The central courtyards along which the rooms were oriented would likely have provided a central focus for many household activities, including outside cooking in

the times of year when the weather would have permitted it. At the same time, the centrality of the courtyard was essential in tying different architectural elements together into a single unit because of the low amount of inter-room connections. As a result, the courtyard possessed a high control value in monitoring social life. In the northeast corner of room I, a pebble floor (1.9x0.8m) was discovered on top of the ground level, consisting of small limestone pebbles. It has been suggested this area constituted a working area, with the pebble surface possibly serving to provide a clean area free from floor sediments (Vyncke 2013, 144). Except for a burnt sediment covering the pebble surface at the southern side, possibly as a result of fire used here for certain activities, no further indications as to the exact nature of this space have been attested. The tentative suggestion of Vyncke (2013, 144) that it may have served a religious function, for example as a (house-)shrine is in no other way corroborated and should be rather considered in the mould of the common trope 'if you don't know what it was used for, it is probably ritual'.
To assess in more detail the potential usages of this structure, floor sediments of room F were sampled intensively and subjected to chemical analysis to identify traces of anthropogenic residues which may provide additional indications for space usage and activity zones (Vyncke *et al.* 2011). The procedure and details of analysis left aside, the results indicated clear differentiation between a zone where the chemical trace was diffused possibly due to its presence near a door opening in the northwestern corner, a 'toilet' zone, where possibly a portable recipient may have been placed to gather excrements in the opposite corner, a hearth zone and possible food preparation area in the northeastern corner, a location for a portable heating recipient such as a brazier in the middle of the room, and a transit zone between different activity areas (Vyncke *et al.* 2011, 2290). Interestingly, in the southeastern corner of the room a striking absence of chemical residues was noted, possibly suggesting that it could have been used for activities that did not leave any traceable chemical residues, for example as a sleeping area. This analysis indicates that all basic functions of a household were present in a single room. Whether or not this also suggests that other, if not all, rooms in the compound combined the same functions, thus compartmentalizing the overall structure even further into distinct spatial (and associated social) units, is hard to assess, although we can safely assume that in general little spatial specialization would have existed and rooms likely had a multi-functional use. However, given the fact that an internal doorway existed between rooms F and E in the southern sequence, and rooms I and D are likely too small to be considered separate units, we can assume that at least the provisional identification of three different clusters belonging more or less together, can be maintained.

The artefacts found across the different rooms of the building hardly provided more clues. A number of remarkable finds were attested, such as three arrow heads and a pilum head, a ceramic dice, a fibula, some astragals and a loom-weight in room F, a stone axe in room E and one in the central courtyard, an iron knife in room I, and an iron spear head in room J, as well as a host of other undefined metal objects in virtually every room, and a number of loom-weights and production waste fragments at different locations in the building as well. However, the distribution of these finds does not tell us much regarding possible functional differentiation among the rooms. In general, so-called post-occupational layers yielded far more material compared to the "original occupation contexts" (Vyncke 2013, 263). These layers have been interpreted as refuse contexts, possibly of dumps brought here from elsewhere on the site once the building was abandoned. However, to what extent this can be maintained, and what the origin of these layers, and their (chronological) relation to the occupational contexts might have been, remains unclear. No indications of clear (relative) chronological differentiations between occupational and post-occupational layers have been attested. Interestingly, the open spaces in between the rooms yielded far larger amounts of material compared to inside, suggesting that either these were used more frequently, or that more refuse accumulated in these spaces, or a combination of both (Vyncke 2013, 273).

The settlement layout of Düzen Tepe appears highly unordered, with no clear pathways of movement or channelling of spaces through architecture. The resultant pattern of movement, vision and interaction throughout the settlement would therefore have flexible and polycentric (Rob 2007, 90). A variety of building types are identified, including many one-room structures, but also several multi-room complexes. The excavations at CYB show that one-room structures may have had a storage function, and that multi-room complexes could possibly be subdivided in several distinct units. As far as we can tell, such multi-room complexes with living spaces and storage rooms, possibly consisting of different house units but with shared walls and little 'depth' in room access, seems typical for the settlement and its community. Unfortunately, only a fraction of the settlement has been excavated, and the CYB is likely the only domestic structure amongst the limited amount of excavated structures, giving us no comparable material to assess to what extent the finds at CYB are indeed typical for the settlement.

Still, it would be nonsensical to assume that the entire settlement at Düzen Tepe was constituted of houses. Although only limited indications exist for social organisation beyond the household level, some examples can be highlighted. A second major excavation conducted at Düzen Tepe was centred on a rectangular building (19.5x7.8m) located at the foot of mount Zencirli. Through GPR it was discovered that it consisted of a sequence of three rooms. Upon excavation, it was found that, surprisingly, only for the central room (A) the southern wall covered (almost) the entire side, whereas in room C less than a third of the south side is covered, whereas room B is completely open from that side (Figure 4). The architecture of the building is generally the same as the courtyard building, consisting of stone socles providing the base for mudbrick walls, with a roof made from perishable materials. The most notable features of this excavation, however, were a series of small ovens, presumably bread ovens of the tandır-type, leading the building to be termed the 'Bakery'. Extensive etnographic parallels for such tandır ovens have been attested in northeastern Anatolia (Köşklü 2006).

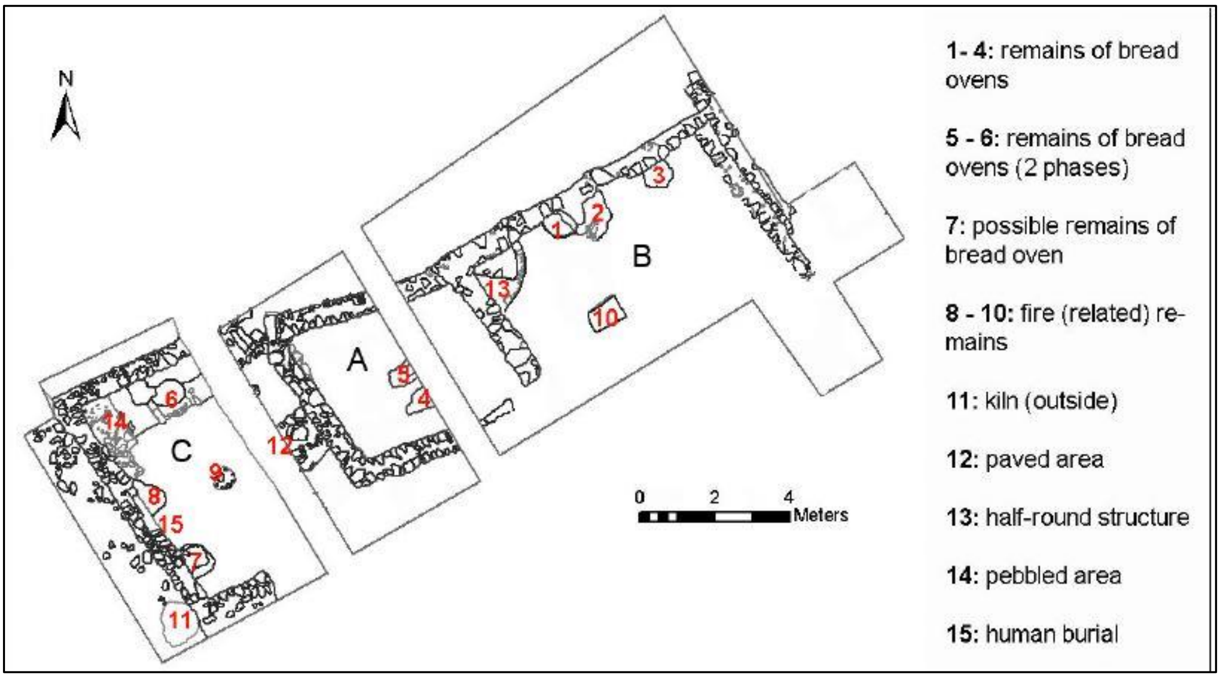

Figure 4: Plan of Bakery excavation (Vyncke 2013, 155).

The remains of the ovens consisted of a base of thin fired clay plaster up to 0.50m in diameter, with in some cases the onset of a semi-hemispherical upper structure with walls covered with a thin fired clay lining present as well. The presence of the ovens likely explains the (partially) open southern side, which would have allowed the smoke to have escaped the building during usage. In the northwestern corner of Room C, an area covered with small limestone pebbles was discovered, much like the one in the courtyard building, possibly indicating the presence of a working surface here as well. The interpretation of the building as a bakery seems straightforward because of the presence of multiple bread ovens, as well as the discovery of four fragments of so-called 'Olynthos mills' or hopper rubbers, a type of fixed two-piece grinding installation used to grind grain into flour. However, some caveats need to be stated. First, we have few indications as for the lifespan of such an oven, nor of the duration

of occupation of the structure. However, several structures appear to have been contemporaneous based on the stratigraphy. Moreover, the identification of overlaying sequential phases of ovens at a single location suggests that after the lifespan of one oven was expired, it could be rebuilt on the same spot, which makes the simultaneous usage of different ovens at different spots within the building not unfeasible. Even if this were to have been some kind of bakery, to what extent does this imply the presence of professional bakers? Alternatively, the ovens could have been professional equipment that was collectively available for a group of people, for example several households or families, to prepare food, as presumably this kind of infrastructure was unfeasible to be present in every individual household. Furthermore, the identification as bread ovens is of course only tentative, and they may have been used to prepare various kinds of foods, perhaps suggesting rather a function as some sort of general communal kitchen rather than a bakery specifically (Vyncke 2013, 157).
Interestingly, a human burial was also found inside of room C, along the middle part of the western wall. Samples from the skeleton were dated by AMS radiocarbon dating and yielded a date between Cal 350-60 BCE. How this burial relates to the function building is unclear, but it has been posited that its location, possibly in-between two occupational phases, suggested an ancestral burial within the building, which could then have served a domestic function. Still, we have no further indications to that end, therefore I prefer to stick to an interpretation as some form of communal food preparation facilities. The infrastructure was likely used by a social group beyond the household level, but to what extent it can be considered an attestation of community-level organisation remains unclear.
At the same time, the construction of an elaborate fortification system indicates that, at least for essentialities such as communal safety and defence, sufficient incentives existed to initiate collective action measures, even if these escape our notice on any other instances. Perhaps it can therefore be posited that, even if the main focus of social life likely remained at the household level, general functional collective action measures could be undertaken if the incentive to do so was perceived and acted upon by the community. These functional collective needs are mainly related to elements of subsistence, defence, production, *etc*.

How can we now interpret these data regarding social life and the nature of collective action at Düzen Tepe? As noted in the first part of this paper, collective action measures basically entail establishing cooperation between members of a community, in other words, find a consensus on appropriate strategies in face of certain problems or opportunities the community faced. In general, two major modes of consensus-seeking strategies can be discerned. First, centred on (formal or informal) centralised institutions, for example authority, leadership, broadcasting (i.e. one-to-many distributors of information), centralised incentives for collective coordination, and closed information feedback loops (Baronchelli 2017, 2). When centralised institutions are not present in a given society, consensus comes either from the interaction between agents or from some predefined individual behaviour that is deemed ‘desirable’. This ‘spontaneous’ emergence of consensus is then produced by self-interested individuals who are not intentionally aiming towards collective coordination. Its main mechanisms are: communication, (social) punishment of deviants, positive payoff externalities (i.e. pathways of development where once certain norms are established they persist), and conformity bias, all stimulating community formation dynamics.
So far, no clear indications for centralised institutions have been attested at Düzen Tepe. Excavations conducted at the so-called ‘Big Building’ (20x25m) were planned with the aim of tackling a relatively large building compared to the average structure size at Düzen Tepe, and which could therefore potentially have indicated some sort of public function. The walls of the building were up to 3m wide, and on average 0.3m wider compared to other structures at the site, as well as generally constructed with larger stone blocks. Two large limestone architectural fragments were found, one ashlar block and a cut block with levelled edge, which were the only attestations of architectural stone working at the site. Due to the large amount of stone fall, it was suggested that the building could have been constructed completely out of stone and had a tiled roof (Vyncke and Waelkens 2015, 163). To what extent the walls would actually have consisted of stone is hard to assess but at least the suggestion of a tiled roof can be doubted as it is based on only two pieces, which were likely misidentified and

belonged rather to a large storage vessel. Still, the structure certainly stands out in many ways from the average building at Düzen Tepe (or at least compared to the overall fairly limited amount of other excavated structures) that questions should be raised regarding its functionality. It was tentatively suggested that it could have been the residence of some sort of communal leader (Vyncke 2013, 477), although no arguments really support the argument other than the comparatively 'monumental' appearance of the structure. Unfortunately, the excavations did not yield much archaeological material either. We therefore hardly have any clear indications as to the original function of the building. Botanical remains indicate a significantly high presence of barley that can be associated with processing or consumption of cereal foods but not enough to sustain even a tentative interpretation as a location for communal dining or food preparation practices (dr. Elena Marinova, personal communication). Clearly, we do not have enough evidence to conclusively support the hypothesis of the Big Building having a public function.

Insofar as any indications for social organisation beyond the household level are present, it pertains to a functional set of collective action measures, related to basic social needs such as subsistence or defence. The majority of the built environment of Düzen Tepe would therefore likely have operated on Rapoport's low level of meaning, focusing on mnemonic cues for appropriate usage of spaces, primarily aimed at practical applications, rather than communicating identities, statuses and worldviews. This overall appreciation of the community is clearly reflected in its material culture. Remember, that objects also inherently carry information regarding the spatial, temporal and social context or locale in which they were used. The pottery material of Düzen Tepe was clearly first and foremost aimed at functional usage, consisting of a basic process of least-effort resource exploitation, simple production technologies, production organisation centred on the household, a basic repertoire of functional shapes, multi-purpose fabric usage, and subsistence exchange. Both from a technological and functional point of view, the material culture of Düzen Tepe displays a high degree of homogeneity and low diversity. Low material diversity has been considered characteristic for a non-centralised mode of consensus strategies, inducing conformist behaviour, also known as biased conformist transmission referring to the tendency of people to copy or imitate ideas or behaviours of the majority of the group, thus facilitating intragroup cooperation as a way to reduce scalar stress in consensual decision making by establishing a degree of social cohesiveness (Hodder 1979; Johnson 1982).

In general, a village community like Düzen Tepe, consisting mainly of farmers in a smallholder system, would likely have been characterised by low degrees of social differentiation and inequality. The absence of clear indications for Rapoport's high-level meaning and worldviews need not necessarily mean that this was 'merely' a community of backward farmers whose only concern was working the land and trying to survive another day. It mainly means that we do not have enough suitable evidence to note this level of meaning in the available archaeological record. Here we meet the limits of the information available from Düzen Tepe, given the limited coverage of the site by excavations. Let us therefore now move on to the second case study, the nearby site of Sagalassos.

Sagalassos

Sagalassos was located about 1.8km from Düzen Tepe, on the mountain slopes north of the Ağlasun valley. The oldest signs of systematic habitation at the site in the form of a small-scale village community date from the late 5th century BCE onwards. Between the 5th and 3rd centuries BCE, Sagalassos was a village community very much like that of Düzen Tepe, based on the high similarities in material culture. From the 3rd century BCE onwards, however, the archaeological record of Sagalassos changes with the development of an urban settlement fabric (Talloen and Poblome 2016) and an associated new mode of material culture (Daems *et al.* In review). This date seems fairly secure, based on stratigraphic evidence and dating of the associated pottery material, however, it should be noted that the observed changes in the archaeological record are likely only the 'petrification' of processes which were already, at least to some degree, initiated earlier.

In 1996 and 2001, two parts of an inscription were found near the Upper Agora, where it was possibly incorporated in a renovation phase of the Northeast Building. The inscription relates an agreement

made in a decree on protecting the city against an internal rebellion, stating that those who seize the mountain fortress (*akra*), exile (parts of) the population, take up arms, or form an internally divisive faction, should be put to death by the *dikastai*, some form of magistrate (Vandorpe and Waelkens 2007). The decree was signed off by 24 *archontes*, likely the highest magistrates in the city. Based on stylistic arguments of the letter forms that were used, a date between 333 and 200 BCE was suggested for the inscription, with a preference for the 3rd century BCE (Vandorpe 2000, 490). The inscription clearly provides general provisions for the occasion of rebellion and the seizing of the mountain fortress by the rebels. Yet, it has also been argued that the inscription was erected precisely to mark the end of a particular instance of such a rebellion, and ensure that it would not be repeated in the future. This would suggest that somewhere between 333 and 200 BCE, a civil revolt took place at Sagalassos and its fortress. The *akra* referred to in the text can likely be identified as the fortress on top of the mountain ridge right above Sagalassos (1885m a.sl.), which was built to guard the relatively easy passage from the north across the ridge at that location. The oldest material found in recent test soundings conducted at the fortress could be dated to the 2nd or 1st centuries BCE, somewhat later than the majority of the urban and political development at the town.
At the city itself, it does not come as a surprise that no evidence for associable struggles or destruction phases have been attested so far, given the general lack of stratigraphically secure contexts dated to this period. However, it was suggested that the inscription would have been erected at the agora, the central focus of the community, where it would be most visible. Recent excavations at the Upper Agora indicated that the square was only constructed from 200 BCE onwards, whereas previously a large clay quarry was present at this location. Clearly, if such a public square would have existed already in the 3rd century, its location must be found elsewhere, but remains hitherto unknown.

If the inscription did indeed refer to a specific event somewhere in the 3rd century BCE, it would clearly have preceded the first phase of urban development at Sagalassos. Given the mention of magistrates as the *archontes* and *dikastai*, this would mean that some sort of formalised and institutionalised political organisation had already developed, prior to the urban development of town. *Dikastai* are also mentioned in an inscription of nearby Termessos, dated to 281/280 BCE, presumably more or less the same period as, or preceding, the one from Sagalassos and written in similar letter forms (Vandorpe 2000, 490). The addition of a law section at the bottom of the inscription, specifying the change of punishment on theft occurring in the 3rd century BCE, possibly associated with looting after a rebellion, from a fine of three minas to the death penalty, indicates that a formalised law code must have been present at Sagalassos even prior to these events as well. How far back we need to push either phase of development remains unclear for now. Regardless, it stands in stark contrast with the (admittedly little) evidence we have on the material culture from Sagalassos in these early phases of community formation, which rather point towards a general socio-political matrix associated with a village community, as in Düzen Tepe.
We appear to have landed here on a mismatch between the historical and archaeological record. Even if the inscription does not refer to a specific instance of a rebellion, the general mention of a system of public offices and a mountain fortress guarding the city offers some problems. It seems strange that the existence of a formalised public office would not have been reflected in a formal public space as well. Here at least we can suggest that the fragmentary nature of the archaeological record of the early phases of Sagalassos could perhaps offer the explanation that any such space has either been lost to us or that it was not recognised due to later construction works and occupation phases. Again, we only have limited amounts of material collected from a small number of test soundings, but still it could be expected that at least some indications for older material would have been found, if it had been present. Are we perhaps again reaching the limitations of the archaeological evidence at this point?

Even if all traces of architectural remains from this phase of community life at Sagalassos during the 3rd century BCE would have been lost to us, it would still be strange that no indications of any material culture associable with this phase are preserved. Clearly, older material from the late 5th and early 4th centuries has been attested. Likewise, the stratigraphic contexts associated with the urban

transformation of Sagalassos around 200 BCE generated a considerable amount of material. It is possible that material from the intermediate period has been encountered, but not recognised as such. Still, this would mean that no marked changes would have occurred in the material culture during the 3rd century BCE compared to the earlier phases, even if society at large at the time underwent an important transformation, as attested by the development of public and institutionalised offices.
A general caveat can be stated that we must differentiate between the moment of genesis of material culture – born out of the combination of production processes and consumer tastes at a given point of time – and the genesis of the archaeological record. In-between both phases, processes of production, exchange, usage, consumption, discard, and deposition take place, with a variety of possible chronological timespans associable with each phase, resulting in a potentially wide chronological range that could be associated with a certain type of object. This is why the transition from relative chronologies based on stratigraphic and pottery data towards absolute chronologies is an intellectual enterprise that must always be undertaken critically. Of course, the observed urbanization will likely have been the result of a petrification of already ongoing societal features. Even if we stretch the suggested date of 200 BCE back in time to allow for a larger margin of error due to the life history of the material, the question is still, how far do we stretch it back?
The fact that we see little indications for changes in material culture in-between the material associated with the earliest phase of a village community from the 5th century BCE onwards on the one hand, and the material associated with the urban transformation phase on the other, suggests that maybe only a limited period of time separated both phases. If so, we can perhaps suggest a general date somewhere in the second half of the 3rd century BCE for the inscription, the events it describes, and the legal and political system it attests. The underlying rationale would then be that a close temporal sequence would not allow sufficient time for a widespread shift in material culture production processes and consumer tastes to be reflected in the material culture. Two things can be noted. First, we can wonder to what extent the material culture reacts onto changes in socio-cultural and political fabrics in a comparably rapid fashion. For the urban transformation phase, it can be noted that the shift in associated material culture does indeed appear quite rapid and radical, opening up at least a window of opportunity for such a scenario. Second, if such shifts can indeed potentially appear quite rapidly, would there be any reason why an urban transformation would have been more readily reflected in the material culture compared to a political transformation? Finally, it leaves the matter of explaining why the limited – but certain – 'lag' time' (give or take 1 or 2 generations) between the emergence of a political community, and an associated transformation of the settlement lay-out from a village to an urban community even existed.

To this end, let us take a look at what the urban transformation of Sagalassos actually means with regard to the actual social activities, practices and interactions shaping the community that used these places on a day-to-day basis. The first phase of urban development at Sagalassos consisted of the construction of an agora around 200 BCE (or slightly earlier, *cfr*. *supra*) of about 25x40m. One generation later, a Market Building was erected along its eastern side. The monumentalisation of the area surrounding the agora was extended in the second half of the century, with the construction of a monumental building of unknown function at the northeastern side, and a monumental terrace wall. Combined with a number of notable changes elsewhere in town, including the development of a spatially demarcated production quarter in the southern parts, the demarcation of the inhabited zone with spatially distinguished *necropoleis*, and the construction of a fortification wall towards the end of the century, the 2nd century BCE saw a markedly radical transformation of the urban townscape. Multiple aspects of this process have already been discussed throughout this chapter to varying degrees of detail and will not be repeated here. I just wish to stress that the central element of this process was not necessarily the monumental nature of this process, but rather the societal function it represented and fulfilled.
Monumental public buildings represented a clear and circumscribed arena of public life. Whereas at Düzen Tepe, the household was likely the main locus of the community, social life at Sagalassos would have been increasingly drawn into these focal points, thus creating a clearly defined spatial container

for social interactions to be oriented towards. Clearly, a wholly new range of interactions supplementing those within the regular context of the household – which possibly would have continued without major changes, even though no household contexts from this period are known to us – would have emerged and developed within these newly defined places. Think for example of public voting procedures for selection of the public officials, which would likely have taken place at the agora as the political, social and economic heart of the community.

It is not coincidental that the observed petrification and monumentalisation of town started and spread out from the agora. Through intensive usage of this new focus of public life, the locale centred on this location would have easily been extended to include closely associated areas as well. The erection of the market building can for example be considered as a partial specialization within the economic sphere of life, where specific parts of the multi-purpose functionality from the agora was shifted towards a more specialized locale (Sielhorst 2015, 187). These market buildings were colonnaded porticoes (*stoa*) with additional substructures and a number of rooms below and behind the colonnades, generally located at the agora (Köse 2005a). They are attested at numerous towns across Anatolia, such as Pergamon, Miletos, Priene, Magnesia, Herakleia, Xanthos, Selge, and Aspendos, mainly from early Hellenistic times onwards. They often combined storage facilities with spaces for commercial exchange (shops and workshops). It provided a circumscribed location where frequently repeated actions, such as exchanging goods, could be streamlined through the reduction of uncertainty and 'noise' in communications by offering a fixed of interaction (Fletcher 1995, 143-144). Considered from a neo-institutional point of view, such formal settings reduce investment in information gathering by offering the certainty of encountering a sufficient number of participating buyers and sellers – at least in periodic attendance – to underwrite system development (North 1990).

Besides this functional aspect, monumental urban architecture also communicates a number of messages (Sielhorst 2015, 188), including the ability of the community (or its government, both need not necessarily coincide) to carry out elaborate construction projects, demonstrate power, and transform disorder into order. The latter pertains to centralized attempts to convert grassroots dynamics, movement and interaction centred on the households into centralized and controllable structures of order and channelled movement, centred on clearly defined and visible public spaces. By taking control over certain spheres of life (social, economic, and political), the community as a whole attempts to guide individuals towards conforming to societal needs, desirables and habits (Smith 2007, 35), thus forming an 'official' message of social behaviour and worldviews.

The emergence of circumscribed public spaces of social life thus entails a shift from decentralized or spontaneous consensus-seeking mechanisms, such as at Düzen Tepe, partially expressed through material culture, towards an institutionalisation of consensus-stimulating mechanisms resulting in centralized control over an 'official' message and the values it expressed. As a result, there would have been less need for an equally excessive degree of social conformity over material culture. This might then allow for increased material variability to be observed due to the different stakeholders within the productive process to have more freedom for deviant incentives in the complex negotiations of meaning. This point was discussed in more detail in part 4.2.1.4, but it has indeed been observed that surface treatment and finishing, as well as dimensions such as diameter size and wall thickness, all displayed higher degrees of variability in the material culture of Hellenistic Sagalassos compared to Düzen Tepe.

Clearly, at this point a pathway of development was initiated at Sagalassos, which saw it develop into a prominent local, and regional urban hub from Hellenistic times onwards, continuing well into Roman imperial times. Düzen Tepe, on the other hand, was abandoned during the 2nd century BCE, roughly at the same time when developments at Sagalassos started to take off, with the community of the former possibly moving to Sagalassos. Elsewhere (see 4.2.5 and 4.4) I have suggested several possible scenarios, involving both endogenous developments and possible external incentives for system development. While a fully endogenous, nor a one-sided externally-induced development cannot be fully excluded, I have argued for the mediating role of macro-scale polities in local dynamics, extending economic and political policies aimed at collaborating with local partners and structures of administration to supplement the central and provincial bureaucracy, which could well have stimulated – if not initiated – such a development (see 4.4). In this scenario, local communities react upon external stimuli to initiate a transformation from villages into an urban system hub, necessary to act as a reliable local partner, both in an economic and political/strategic sense. Population increase and aggregation associated with such an event would then have provided the necessary base to kick-start social dynamics at the site onto a whole new level. Can we provide a plausible scenario for such a development at Sagalassos?

Explaining the urban transformation at Sagalassos

Given the evidence presented so far, I argue that we can make a case for the application of the urban transformation model at Sagalassos. To do so, we must first identify a plausible external polity which may have been involved in this process. In this case, we can look at the Seleucid dynasty, which ruled over large parts of Anatolia, including the area of Sagalassos, from 281 to 189 BCE (roughly around the time of the observed changes), as the prime potential candidate to be associated with this transformation. I will discuss the evidence for a strong bond between the Seleucids and Sagalassos in more detail in part 4.4.

We can suggest the following scenario. Upon gaining control over Anatolia, the Seleucids sought to extend centralized structures of control, focused mainly on surviving imperial and provincial administrative structures left by the Persian empire, with a local dimension (Aperghis 2004). The Seleucids are known as highly active in city foundations (Cohen 1978), however, rather than founding a new city *ab novo*, they chose here to seek out an existing community to act as a local partner. The reason behind this choice is unclear and can perhaps be found in the murky realm of historical contingency, as historical pathways of development may at times be constrained and developed along (semi-)random circumstances and decisions. Given the overall nature of human societies as complex societies, societal dynamics are highly sensitive to initial conditions, where even very small differences can lead to widely divergent trajectories of development (Bintliff 1997a). Perhaps a minor twist of fate decided on why Sagalassos ended up as primary centre, whereas Düzen Tepe dwindled out of existence. This of course remains for a large part speculative as the archaeological evidence will likely never provide conclusive.

Still, we can attempt to provide some possible explanatory factors. It can be noted that Sagalassos held certain locational advantages over Düzen Tepe. The strategic position of the latter on top of an elevated plateau would have had certain military advantages, however, at the same time it also markedly limited its ability to exploit the economic potential of the environment due to comparatively difficult access routes. Moreover, the limited extent of the plateau also markedly limited the growth potential of the site. Sagalassos on the other hand, while still being strategically positioned on the mountain flanks, had far easier access to the lower valleys and disposed of a relatively extensive area for potential extension. Moreover, its extensive access to water sources would have offered a comparative advantage for housing an extensive settlement as well. However, geographical elements alone provide a necessary but not sufficient cause. We need additional causal factors if we are to find a satisfactory explanation.

In analogy with ecosystems, changing circumstances (situational events) can create wholly new niches for species (communities) to proliferate and develop. Whatever the underlying reason(s), once the stimuli associated with an initial situational event were produced, a new niche for development opened up, allowing new ways for communities to develop. However, in order to do so, local communities still had to perceive the opportunity, interpret its potential, and react in a proper way to exploit this newly founded niche. None of these steps should be taken for granted, and indeed the divergent development between Sagalassos and Düzen Tepe could have been due to different perceptions or responses in any of these steps involved with such opportunities. The effectiveness of collective action measures to stimulate community-level social consensus and induce more efficient responses to such opportunities would to a large degree have influenced this pathway of development as well. Unfortunately, the limitations of the archaeological record of Sagalassos at this period of time inhibits a comparison.

If the policies of the Seleucids can indeed be considered a relevant situational event producing the necessary stimuli, what factor could then explain the divergent development between Sagalassos and Düzen Tepe? It has been suggested that an urban transformation essentially entails two processes: the development of an urban landscape consisting of monumental public and/or religious architecture, in short urbanization, and the formation of a political community (Zuiderhoek 2017, 20). The development of a monumental urban fabric is first and foremost an expression of underlying societal practices and dynamics. Although these practices will often take on new form as the new framework is created, they are usually already present in some ways before the transformation. Think for example of the Market Building in Sagalassos as a locus for storage and exchange activities. Naturally, exchanges will have taken place at the settlement before the construction of this monumental building, however, the process will have been altered significantly when being conducted in this new facility, most notably becoming more formalized (see *supra*).

If not the monumentalization *per se*, could we perhaps look at the establishment of a political community as relevant causal factor? It is difficult to assess the structures of social and political organisation at Sagalassos prior to the oldest attestation of public officials in the aforementioned inscription. However, in chapter three, I already discussed the development of a political community out of village communities through the model of *polis* formation in Boeotia by John Bintliff (1999a). In this model, a form of village organization centred on a village council develops in communities of a given size. These corporate communities are already characterised by clear socio-political structures (Bintliff *et al*. 2007, 60, 2014, 265). Yet, this socio-political development is at this point not (yet) mirrored in an urban transformation. The model appears to match the data from Sagalassos quite well and it is likely that such a base layer of political organisation was present even if it is not traceable in the archaeological record. To what extent existing structures of socio-political organisation in either Sagalassos or Düzen Tepe would have offered more or less potential for the initiation of the subsequent transformation phase is difficult to ascertain. Here we must admit the limitations of the evidence available to us, as well as those from archaeological data in general.

The importance of a political community as a causal factor for system development can be highlighted further, however, through a comparison with Hellenistic Egypt. Here, only three *poleis* have been attested – Naucratis, Alexandria and Ptolemais - all founded by Greek settlers or Ptolemaic Kings. However it has been noted that not a single Egyptian city developed into a *polis* in the sense of an urban political community (personal communication with prof. Katelijn Vandorpe), with also no clear attestations of *poleis* mentioned in the CPC inventory either (Hansen and Nielsen 2004). The answer for this remarkably divergent development compared to other regions in the Mediterranean may be found in the central position of temples as main institutions in Egyptian society. Egyptian towns are therefore first and foremost religious communities, which could explain the noted absence of political communities.

One of the key elements of creating a political community entails the formation of a limited set of formal officials wielding well-defined authority in a circumscribed aspect of life. This often involved a formalized codification of laws and public rules, defining the rules of behaviour, and setting the penalties for breaking them. The situational event induced by the synergy between Seleucid policies and local strategies would likely have had such a socio-political impact, with the introduction of a limited number of 'spokespersons' to govern local affairs and conduct communication with higher levels of organizational structures. Perhaps the mention of such officials in the inscription mentioned earlier can be linked to such a situational event. The fact that this process of urbanization was initiated with the construction of an agora, should not come as a surprise given that it can be considered the focal point of a city's political identity created by the members of a political community as a place of self-assertion and representation to the outside world (Sielhorst 2015, 188).

The development of political organisation has been observed in many Anatolian communities in the 3rd century BCE, and has been interpreted as a strategy of establishing and maintaining internal autonomy in the face of increasing impact and intervention of the Hellenistic kingdoms onto local configurations (Mitchell 2017). The supposed development of *polis* communities in Anatolia should in this sense not be seen as a form of cultural dissemination, but rather as part of a wider political strategy born out of the interaction space between local communities and the overarching central administration of the Hellenistic kingdoms, in this case the Seleucids.

The initiation of this process of urban transformation would likely have entailed a certain influx of resources, (physical) capital and knowledge (or human capital). The marked extension of the territory to include the fertile Burdur plain would definitely have allowed a significant increase in potential energy and resources to become available to the community at Sagalassos, supporting the observed developments at the site and the increased energy requirements associated with building and maintaining monumental public architecture and increasing production outputs. To manage this influx of capital, along with the greatly extended territory, specialized officials would have been needed.
This addition of external capital and knowhow to local networks of knowledge, would explain why a community – which up to then operated in a very much locally embedded network, oriented towards local environmental circumstances and niches within a local pathway of development – suddenly initiated this marked transformation of settlement fabric, material culture and socio-political organisation in response to a newly developed potential niche of development. However, some caveats should be stated. Even if the potential avenues of exploitation would have been made available, it would likely have taken some time before these were sufficiently initiated for this potential to be tapped and capital would start to flow towards Sagalassos.
Even if the urbanization of town was initiated at more or less the same time, this would also explain the observed lag-time between the genesis of a political structure, and the realization of the transformation in urban infrastructure, given the slower replication rate and higher inertia of the material environment compared to rapidly changing dynamics of social interaction (Fletcher 1995, 16). Moreover, it could explain why the transformation, once induced, was stretched into a trajectory of development spanning the majority of the century (and even continuing well into late Hellenistic and Roman imperial times) as after the initial investment, it was reliant on the development of avenues of energy exploitation and labour expenditure, channelling the exploited capital of the wider territory towards the centre. Moreover, we can wonder to what extent the full potential of this territory could have been exploited, given that even in Roman imperial times it has been observed that certain parts of the territory were only loosely integrated in the overarching economic and administrative structures (Kaptijn *et al.* 2013). The asymmetric location of Sagalassos compared to its surrounding territory could have inhibited the full development of regular structures of exploitation, relying instead on a system of more of irregular and episodic structures, especially for the western part of the territory, as Sagalassos would have more naturally oriented towards the eastern parts centred on the Ağlasun and Çanaklı valleys. This argument will be extended in part 4.3.

Even if we have no way of finding out which precise actors within the community initiated the local shift in strategies to move towards the newly-available niche of opportunity – was a certain degree of social inequality already present which would allow existing leaders within the community to react upon new opportunities or perhaps one or more clever *primus inter pares* who better recognized the potential to gain a prominent position within the community – we do see who eventually claimed the available space. The initiation of a political class of public officials during the 3rd century BCE would provide the necessary foundations for influential members of community to start proliferating. The transformation phase at Sagalassos was therefore accompanied by the development of a socio-political elite which increasingly started to manifest itself through strategies of self-representation and symbolic expression of identity. These strategies would increasingly come to be expressed through the development of public arenas of social life, most notably the agora (Zuiderhoek 2017, 30), which came

to be gradually furbished at Sagalassos with honorary monuments and inscriptions, especially towards the late Hellenistic period (Talloen and Poblome 2016, 121-122).
Of course, the observed full-scale transformation of the community cannot be fully reduced to an elite-driven development. Undoubtedly, various social groups, households, grassroots initiatives and individuals would have markedly affected this development as well. For example, a variety of actors, ranging from producers and traders to consumers, well beyond the elite, would have been involved in the transformation of material culture associated with the urbanization of the settlement itself. Clearly, a newly developed social elite could maybe have induced the transition towards a wholesale transformation of the social, political, economic and architectural fabric of the town, but it would be sustained only if their ambitions were supported by large parts of city-dwellers throughout all layers and groups within the community (Smith 2003, 24-28). Unfortunately, these other actors are not always as visible in our archaeological record.

Conclusions

In the end, the trajectory of development presented here is only one possible scenario, given the archaeological and historical evidence available. More evidence and studies will be needed to transform parts of this hypothesis into conclusions. Still, I hope to have been able to show how this proposed trajectory would make sense within a local context of historical development.
The trajectory started from the presence of small-scale inward-oriented village communities at Düzen Tepe and Sagalassos from the late 5th century BCE onwards. It should be stressed that there is no need to interpret these village communities from a modernist or Eurocentric perspective, labelling them a simple society in the sense of 'rudimentary or 'old-fashioned' (Vyncke and Waelkens 2015). These people were part of a traditional community, who lived and did certain things in a way that came natural to them, likely in more or less the same ways as their parents had done before them. However, we should remember that this type of living clearly was successful for a long time. These kinds of communities are often well aware of the landscape surrounding them, conscious of its possibilities and limitations, and using these to carve out a niche for themselves to live their lives and maintain their community. Their way of life effectively constituted a local basin of attraction, adapted to match local circumstances and landscapes. It was suggested that these village communities operated within a local historical pathway of development, centred on basic needs such as subsistence, habitation, defence, production, exchange, *etc.*, within functionally-oriented contexts of engagement and social life, conducted mainly within the framework of the household and supplemented with a limited degree of (functional) inter-household or community-level organisation and collective action measures.
In the long run, such an approach would likely have continued to be successful. At some point however, circumstances changed. The introduction of new situational events – possible induced by outside stimuli and policies – created a new playing field, changing the rules of the game. Whether the community at Düzen Tepe was unable to cope with these changes, or whether they did not see the need to react, or simply did not want to, in the end the result remains the same. Sagalassos made the leap and took the mantle of prime local and regional centre from Hellenistic times onwards. The transformation of the social, political, economic and architectural fabric of Sagalassos saw the extension of this local template of community organisation, with 'symbolic' strategies of self-representation and identity, centred on monumental public spaces and buildings, providing a locale for a completely new set of dynamics and practices, reflected in a new mode of material culture. Regarding Rapoport's level of meaning, it constituted the clear supplementation of low level meaning of mnemonic cues and practical usage, with middle level meaning communicating status and identity. This transformation effectively induced a change in local basins of attraction, transforming the village community of Sagalassos into an urban hub, which started to increasingly pull in flows of energy, resources and information from the 3rd and 2nd centuries BCE onwards. At the same time, the settlement at Düzen Tepe was abandoned during the 2nd century BCE, with its population possibly moving to Sagalassos, and the original community forgotten between the folds of time. Unfortunately, as the saying goes "history is written by the victors", and the less fortunate tend to be forgotten, that is, until maybe someday an archaeologist walks by....

4.2.5 A model of local community formation

This paper was published in 2016 in a thematic volume of The Archaeological Review of Cambridge on "Landscapes and People" It presents a first attempt at synthesis between the major outlines of the theoretical framework, observations in material culture, and interpretation of the meaning of this material regarding overall social complexity. The core tenets of the approach advocated in the paper grew out of the intellectual background provided by conversations with and contributions by prof. Poblome, who was therefore rightfully assigned as co-author. The text has been written entirely by myself but has significantly improved with the insightful comments and feedback by prof. Poblome.

Adaptive cycles in communities and landscapes. The case of Sagalassos and Düzen Tepe during the Classical/Hellenistic period.

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Introduction

Long past are the days when landscapes were considered a mere background scene for 'the play of life' to unfold. Recent interpretations of landscapes as dynamic, meaningful and socially constructed combine the physical attributes of space with the concept of 'place', which is defined as 'lived space', ascribing meanings, identities and memories that actively shape people's daily practices and experiences (Feld and Basso 1996; Fisher 2014; Low and Lawrence-Zuniga 2003; Preucel and Meskell 2004; Rodman 1992). Present-day conceptualisations of landscape therefore include both a natural and a social component, as well as the interconnections between these. The trend of increasingly tying the natural landscape into human actions and conceptualisations has led some scholars to try and discover the mental processes of people in the past through concepts such as ideational or sacred landscapes (Ashmore and Knapp 2003). While highly valuable, such approaches address only certain aspects of the interactions between people and their surrounding environment, and still need to be complemented with approaches towards people and landscapes that pertain to social, economic and political aspects. The framework presented here is specifically aimed at integrating both archaeological and ecological data more closely in studying community development in the past. A case study will be presented that discusses developments at Sagalassos and Düzen Tepe during the Classical and Early Hellenistic periods (5th – 2nd centuries BCE).

Methodology and aims

A society's long-term viability depends on its ability to live within a range of environmental possibilities, determined by active approaches towards the landscape (Anderies *et al*. 2004; Ostrom 2009; de Molina and Toledo 2014; Manfredo *et al*. 2014). On a general level, these approaches are centred on different strategies of energy capture. For human beings to perform any kind of action, energy is needed, and, following the general laws of thermodynamics, additional energy is required to sustain these actions and counter increasing entropy. Energy is foremost derived from the immediate environment. However, societies with more developed forms of social organisation can extract energy and resources from a wider environment as well (de Molina and Toledo 2014).

This paper will focus mainly on how local communities developed regarding appropriation of land and resources, and how effects of inter-scalar dynamics flowed back into the community to propel additional social innovations. To this end, we will complement our SES-based approach with the concept of adaptive cycles derived from the field of resilience theory (Gunderson and Holling 2001). This concept is ideally suited as a focal point to trace flows of energy within SES and provides a platform to conceptualize and describe multi-scalar dynamics of change. The concept of the adaptive cycle describes changes in three parameters - potential for change, internal system connectedness, and system resilience, through four phases: exploitation (r), conservation (K), release (Ω), and reorganization (α). Starting in the exploitation phase, incremental changes lead from r into K through the increase of potential and connectedness, whereas at the same time resilience decreases. This results in a more rigid system in the conservation phase. At a given point, internal or external stresses result in rapid release of potential bounded by connections between different system components in the Ω-phase, after which parts of the existing cycle are recombined with elements of innovation in α, eventually restarting r in a new cycle (Gunderson and Holling 2001, 72-3).

Local communities, local landscapes

In this part, we will describe two settlements, Sagalassos and Düzen Tepe, sharing the same catchment area in one of the valleys located in the Taurus Mountains in southwestern Anatolia. The region is subject to an Oro-Mediterranean climate with long, wet winters and short, dry summers (van Zeist *et al*. 1975; Paulissen *et al*. 1993). Two main vegetation zones are identified with pine and oak woodlands dominating the land up to 1200m, whereas higher areas are less densely forested and characterised by the presence of cedar trees, pines and general shrubbery vegetation (Kaniewski *et al*. 2007).
The emergence of human occupation in the area has been linked with the Beyşehir Occupation Phase (BOP), a widespread phase of environmental changes in southwestern Anatolia (van Zeist *et al*. 1975). BOP started between 400 and 280 BCE for the nearby Gravgaz and Bereket valleys (Bakker *et al*. 2012: 253-4). Developments related to this phase include partial deforestation of the land, replacement of oak forests with pines, and the appearance of cultivated species such as olives, walnuts, manna ash, chestnuts, and grape vines (Eastwood *et al*. 1999; Kaniewski *et al*. 2007). These developments are partly related to the impact of anthropogenic activities on the area. Pollen analysis shows variability in the extent and chronology of changes at different locations. Whereas extensive deforestation is attested by cores drilled at Gravgaz and Sagalassos, it was not in the nearby Çanaklı valley (Vermoere *et al*. 2002b). Incremental environmental changes gradually provided more suitable conditions for human occupation, to which local populations reacted by tapping the potential made available to them in specific areas. This way, BOP can effectively be interpreted as an r-phase in an adaptive cycle. Let us now illustrate the further development of the adaptive cycle with some developments in Sagalassos and Düzen Tepe.

Düzen Tepe

Düzen Tepe was located on a plateau overlooking the valleys of Başköy and the Ağlasun river. Based on ceramic evidence, coin finds and radiocarbon dating, the maximum extent of occupation at Düzen Tepe can be placed between the 5th and the 2nd centuries BCE, with a core occupation period during the 4th and 3rd centuries BCE (Vanhaverbeke *et al*. 2010). Geophysical and archaeological surveys determined roughly 150 structures extending over approximately 13 ha. Excavations have revealed houses with stone foundations and walls constructed from perishable materials such as mudbrick. Fortifications were constructed at the southern and western sides of the settlement, whereas the northern and eastern sides were protected by the steep slopes of mount Zencirli.
The plateau itself not only offered a strategic view over the surrounding valley, but also provided a number of resources that could be exploited by the community. Limestones suitable for construction are abundantly present on the plateau. Geomagnetic surveys located several sources of ores usable in metal production, whereas analysis of local magnetite ore samples, as well as production waste and metal objects excavated at Düzen Tepe, have indicated that metal was produced at the site with locally-procured ores (Vyncke *et al*. 2014). Petrographic analysis of the ceramics of Düzen Tepe showed that clays used for the majority of ceramic production at the site belonged to a volcanic-biotite group, which was procured from the immediate vicinity (Neyt *et al*. 2012; Braekmans *et al*. 2016). Finally, the analysis of stable carbon (δ^{13}C) and nitrogen (δ^{13}N) isotopes from faunal remains indicate that livestock was herded closely together, either in the same general area or kept in enclosures and fed the same food, most likely close to the site (Fuller *et al*. 2012).

The plateau, however, could not fulfil all the needs of the community by itself. Today, fields can be found on the plateau on the lower slopes of mount Zencirli, but in antiquity, this area was likely also densely occupied, rendering agriculture impossible. At the western promontory, poor soil quality might have prevented any proper cultivation at all (Vyncke 2013, 66). Additionally, natural water sources are absent at the site and there are no clear indications of forms of water management, such as cisterns. Today, there is one cistern presently in use, but its existence in antiquity cannot be proven. Water provisioning might therefore have become a genuine problem at some point. It can therefore be assumed the people of Düzen Tepe used at least some parts of the surrounding valleys to sustain the community. This suggestion was recently corroborated by the identification of a number of ceramics found in the lower Ağlasun valley, which were demonstrated, based on fabric association, to have been produced at Düzen Tepe.

The overall image of Düzen Tepe is that of a community relying mainly on its immediate vicinity, be it on the plateau itself or in the surrounding valleys, for the procurement of different kinds of resources. Düzen Tepe can generally be described as a self-sustaining community that produced its own material culture, domestic animals, and agricultural products to sustain community dynamics. This 'inward-oriented mentality' required maximizing the potential of the local environment. This does not mean the community lived in isolation from the outer world. Evidence of this can be found in a small, yet consistently present, amount of ceramics made from clays obtained from the Burdur lake basin (Braekmans *et al*. 2016). It is moreover becoming increasingly clear that the general typological spectrum of the ceramics points towards a wider Anatolian template. The community at Düzen Tepe was clearly aware of wider developments and specifically selected elements deemed relevant for their own needs. Yet, to actually perform these practices, they mainly turned towards the potential of their immediate environment.

Sagalassos

Sagalassos was located on the mountain flanks bordering the Ağlasun valley to the north. At its largest extent in Roman Imperial times, Sagalassos' territory spanned an area of about 1200 km² from Lake Burdur in the west to the valley of the Aksu river in the east. The oldest datable material found at the site are ceramics generally datable to the Classical/Hellenistic period (5th – 3rd centuries BCE), but likely to be situated from the second half of the 4th century BCE onwards based on fabric and typological features. Although few architectural remains can be associated with these finds due to superposition of Roman and Byzantine occupation, we may assume the existence of a small-scale community due to the relatively sizeable quantity of ceramics produced with materials derived from clay beds close to the site (Braekmans *et al*. 2011).

A number of natural resources could be exploited from the direct vicinity of the settlement. Geochemical analysis has yielded a number of anomalies (Mg, Cr, Co and Ni) that indicate the existence of local mineralisation outcrops. A number of anomalies related to metal working (Fe, V and Ti) was also identified, which suggests metal production at the site using locally procured resources (Degryse *et al*. 2003). The ophiolite volcanic tuff soils and flysch deposits that characterise the geological fingerprint of the region (Muchez *et al*. 2008) provided clay sources suitable for ceramics and building materials. Abundantly present limestone outcrops also provided suitable material for construction works. Core drills at the eastern part of the later town have indicated the importance of clay-quarrying activities even for the earliest phases of habitation (Six 2004; Poblome *et al*. 2013a). Clay quarrying was also attested in a depression first identified through geophysical research at the location of the Roman Upper Agora. This has since been corroborated by recent control excavations (Talloen *et al*. 2015).

The area of the later Eastern Suburbium also provided suitable grounds for agricultural land to supply this early community (Claeys 2016). On top of the quarrying phase a palaeosol layer developed, dated to 370-200 BCE (Vermoere *et al*. 2003), thus providing a *terminus ante quem* for the quarrying activities. The development of this palaeosol can be linked to deforestation of the higher slopes due to preparation of the land for agricultural cultivation. The importance of agriculture is corroborated by excavations conducted nearby, yielding Classical/Hellenistic material in association with a terrace wall. Geomorphological surveys showed the presence of natural water sources at the site, as well as a high number of sources in the mountain range to the north of the settlement (Six 2004).

The little evidence we have regarding the earliest phases of community formation at Sagalassos points towards a small community, yet one which operated within a self-sufficient productive landscape for its basic needs. Around 200 BCE, however, the overall nature of the settlement changed markedly. Geophysical research in the area east of the Odeon at Sagalassos revealed a number of anomalies. During excavations of one of these anomalies underneath the Odeon, the remains of a pottery kiln that was destroyed and filled with layers of material were revealed. The oldest of these layers was dated to the end of the 3rd century BCE (Poblome *et al*. 2013b, 176). Comparable material was found underneath the Macellum and in control excavations on the Upper Agora (Talloen *et al*. 2015). This body of material indicates a more specialized production process with raw materials specifically selected to suit production of specialized vessels, characterized by consistent function-specific associations between fabrics and end-products. Along with these changes in material culture, the production infrastructure changed as well. Whereas at Düzen Tepe the partial remains of an isolated pottery kiln were excavated, the associated anomalies in the area east of the Odeon, suggest the existence of a genuine potter's quarter in Hellenistic times (Poblome *et al*. 2013b). This would indicate a whole different level of production organization at Sagalassos compared to Düzen Tepe.
From 200 BCE onwards a process of urbanization takes place at Sagalassos. At this time, the clay quarry on the Upper Agora was filled up and transformed into a public square (Talloen 2016). Around 180 BCE a market building was constructed along the eastern edge of the agora, and about a generation later a terrace building was erected to the north of the square. Excavations along a northwestern section of the fortifications determined this section of the walls to have been constructed around 100 BCE. At some point, social dynamics at Sagalassos clearly developed into a whole new kind of productive landscape (including production, infrastructure, and output), while Düzen Tepe was abandoned during the 2nd century BCE.

Communities, landscapes, and empires

The overhaul of the productive and material landscape observed at Sagalassos from 200 BCE onwards could only have taken place if sufficient energy flows were directed towards the community to sustain new system dynamics. One way to provide such additional energy flows is to expand territorial exploitation, thus tapping into newly acquired resources and externalizing system entropy. Although we have few indications for territorial development, one fixed point of reference may be found in the expedition of the Roman general and consul Gnaeus Manlius Vulso, who crossed parts of Asia Minor in the aftermath of the battle of Magnesia (190 BCE), including Sagalassos. Finding no one at the borders of their territory to greet him, Manlius Vulso decided to move into the lands surrounding Sagalassos and plunder the crops (Livy*, Ab urbe condita*, XXXVIII, 15.9). Interestingly, from the account of Livy, it appears Manlius Vulso entered the territory of Sagalassos somewhere southwest of Lake Burdur, suggesting an already significant territorial increase. Control over the fertile Burdur plain (±350 km²) could have played a major role in providing additional energy flows to sustain developments at Sagalassos.
When looking at the map, Sagalassos was located at the fringes of its controlled area, making the resulting territory hard to administer. As far as we know, no other community ever moved into the area. Did Sagalassos possess sufficient military power to ensure the area was left uncontested? Or can we perhaps here catch a glimpse of an intervention by higher echelons of power preventing others to claim it?

One way for these lands to have been allocated to the community was through royal benevolence. In such gifts, lands were commonly conceded to a city with the right of attachment, effectively turning these lands into private property belonging to the community (Aperghis 2004, 99-100). However, no literary sources confirming this process for Sagalassos have been attested so far. As a result questions remain regarding the exact nature of the process, or the specific benefactor. The most logical candidate for such an intervention would be found in one of the Hellenistic dynasties competing for power throughout southwest Anatolia at that time. In general, it has been extensively demonstrated how all Hellenistic kings and their administration were highly preoccupied with local communities and their territories within their area of control (Ma 1999). Even if not involved directly, we could therefore suspect higher authorities to at least have been aware of these developments at Sagalassos and to have condoned the appropriation of these lands.

After Alexander's death in 323 BCE, the Eastern Mediterranean was engulfed in conflicts between his successors. Despite the general turmoil of that era, the Seleucids were in control over most of southwestern Anatolia before and during that key transformative period starting in 200 BCE. The Seleucids even appear to have been quite popular at Sagalassos. Prosopographical studies have indicated that, unlike other parts of Pisidia, names related to the Seleucid royal family, such as Antiochos, were very popular at Sagalassos (Waelkens 2004). The use of Seleucid iconography has also been attested in Sagalassos' city seal, showing an Indian elephant, commonly interpreted as a symbol of Seleucid power (Vandorpe 1995).

Another aspect pointing towards a key role for the Seleucids in the development of Sagalassos is their policy of stimulated urbanization. It has been argued that the Seleucids initiated a conscious policy of monetization throughout their empire in response to high demand for silver to pay mercenaries (Aperghis 2004, 30-32). The first coinage of Sagalassos was indeed issued under Seleucid rule and should be viewed within this context. As tax payments were increasingly to be paid in silver, additional markets needed to be created for farmers to sell their produce in exchange for coin. The Seleucids therefore founded a high number of new cities and supported local urbanization processes within the wider region. These included both *de novo* foundations such as Seleukeia Sidera north of Sagalassos, or the re-founding of existing settlements such as Kelainai into Apamea (Cohen 1978). In sum, we can tentatively suggest that the Seleucids were the most logical party supporting these local developments.

To explain the historical development of Sagalassos and Düzen Tepe we can now integrate the ramifications of the potential Seleucid intervention with developments in the r-phase outlined earlier. The adaptive cycle of SES in the Ağlasun valley started during the 4th century BCE with the emergence of systematic occupation at Düzen Tepe and Sagalassos, along with a number of farms on the lower slopes. These communities were characterized by a locally-oriented, largely self-sufficient productive landscape. Continued exploitation of local resources gradually increased appropriation of local landscape potential within existing connections, resulting in a system shift from the r-phase of exploitation to a conservation phase K. Associated positive feedback loops led to the need for increasingly intensified exploitative processes to sustain community life. As a result, local SES became less resilient in dealing with system shocks, for example when harvests failed due to harsh weather.

Human impact on the landscape has been studied through dynamic soil models developed for the nearby valley of Gravgaz. These models indicate that since 2000 BCE, vegetation and land cover was at its highest point of degradation during the Hellenistic period (Van Loo *et al*. 2016). Such a massive impact on the landscape is quite remarkable and can be explained by continuously intensified exploitation of the local landscape. At this point, a crossroads was reached where social reorganization was needed in order to sustain the long-term viability of these communities.

Different trajectories for Sagalassos and Düzen Tepe can be suggested at this point. First, it might be argued that continued development at Sagalassos was made possible due to the widening of its exploitation radius, whereas Düzen Tepe did not, or could not, do the same. One element impeding continued development might have been difficulties in water provisioning. At any rate, additional flows of energy and resources would have allowed Sagalassos to gradually start pulling the socio-political, economic, and demographical potential of local and regional landscapes towards sustaining its own community dynamics at the expense of Düzen Tepe. In this scenario Sagalassos effectively moved through the release phase Ω into an α-phase of reorganization and started a new development cycle, whereas Düzen Tepe remained within K until resilience became so low the system could no longer deal with incoming disturbances. In this case, the start of Ω effectively spelled the end of the settlement. It is difficult to directly follow such a chain of events, but perhaps some of its effects may be traced in the archaeological record. It is interesting to see that the distribution of ceramics produced at Düzen Tepe is mostly limited to the immediate vicinity of the site (Braekmans *et al*. 2016), whereas Hellenistic ceramics from Sagalassos have been distributed throughout the wider region, which may suggest a wider impact radius (Poblome *et al*. 2013a). From a production side, this can be illustrated by the observation that from Hellenistic times onwards Sagalassos increasingly moved into the fine-grained clays from the Çanaklı valley (7-8km distance from the town) to produce high-quality tableware, instead of using clays available at the immediate vicinity of the site as was done in earlier times. Çanaklı clays were also occasionally used for production of ceramics in Düzen Tepe but never in a similarly systematic way. Both examples illustrate a tendency at Sagalassos to move beyond the immediate environment of the site.

Two other options focus on the process of *synoikismos* as a possible explanatory factor. This process involves the confluence of two or more communities, in which either one party could merge into the other, or a whole new entity could be formed (Hansen 2006a, 52). Could such a scenario have resulted in the movement of the population from Düzen Tepe towards Sagalassos, thereby explaining the abandonment of the former?

It might be argued that such a process could be induced by the Seleucids themselves as part of a conscious policy of urbanization, aimed at rearranging local settlement configurations. This would be a prime example of top-down induced interruption of local system dynamics. However, this option remains hard to prove without clear literary sources. On the other hand, *synoikismos* could also be driven by local stimuli when communities agree that it is in their best interests to join forces. Interestingly, the construction of monumental architecture such as has been observed at Sagalassos after 200 BCE, has been associated with moments of socio-political or economic stress. Especially when establishment of group solidarity was most needed (Abrams 1989, 62). Perhaps increasing system stress associated with transitioning towards conversation phase K would have provided the context for such a development at Sagalassos. At this time, increased energy and resource expenditure would be geared towards constructing monumental buildings at Sagalassos, whereas the community at Düzen Tepe was restricted in its potential to follow suit. One can imagine such processes to have intensified following a possible *synoikismos* event when a second population was suddenly added to the original community. The territorial increase associated with the merging of these two settlements would provide the new community the necessary boost to move beyond the Ω-phase into a new adaptive cycle. This new cycle was then centred on the development of an urban fabric and specific socio-political institutions commonly subsumed under the moniker of *polis* formation (Hansen 2006a). This would allow the community to transform itself in such profound ways as to be able to present itself to the Seleucids as suitable local partners for a "dialogue of mutual benefit" (Ma 1999) in their policies towards the region. The initial impetus for developments at Sagalassos would then be the *synoikismos* event with Düzen Tepe, whereas the addition of the Burdur plain would allow these dynamics to be sustained. In this scenario, an overarching socio-political unit would act upon impulses provided by local communities and their elites.

It is clear that this paper only offers a first step towards solving the problem at hand. At any rate, additional research will be needed to improve the chronological resolution of the abandonment date at Düzen Tepe and the addition of the Burdur plain to Sagalassos' territory if we are to work towards conclusively choosing one option over the others. Still, we hope that this paper has demonstrated how a SES-based framework centring on the workings of adaptive cycles can help our attempts of untangling the multitude of social, political, and economic relationships between communities, their environment and overarching structures of government in the past. Though this approach is still being developed, it is hoped that the arguments presented here have set the course in transforming this framework into a suitable methodology to be applied in studying the interplay between communities and landscapes.

4.3 Community formation on a sub-regional scale

This paper is based on the material studies conducted in the summer campaign of 2017 at Sagalassos. Its main purpose is to contextualize the local case study of Sagalassos and Düzen Tepe in a wider chronological and spatial framework, covering the study area of the Sagalassos Project for dynamics of community formation, also including the preceding Iron Age period. Because the necessary material studies could only be conducted during the last campaign, the subsequent steps of the process of publication have only fairly recently been undertaken. Data processing, the integration of newly generated data with existing datasets regarding fabric analysis, and the search for relevant comparative material in the archaeological literature has all been undertaken in the weeks/months before submission of the text. The text in its current form has therefore been adapted and written towards the present context of this dissertation, referring to different parts of the thesis and omitting certain aspects of introduction to the sites and their context, which normally would have been (more extensively) present. When this part will move towards publication, these aspects will be changed to fit the publication context. The paper is planned to be submitted to "Anatolian Studies". The text has been fully written by myself. Co-author prof. Jeroen Poblome provided input for the search for relevant comparative material in his extensive collection of archaeological literature, as well as valuable feedback for improving the text.

Material culture and community formation in the area of Sagalassos from Iron Age to Hellenistic times

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Introduction

In recent works, we have focused extensively on studying the origin of community and initial development of social complexity at Düzen Tepe and Sagalassos, two communities overlooking the Ağlasun valley, located in a region called Pisidia (SW Anatolia). Their material culture indicated that both communities originated in late Achaemenid times, around the late 5th century BCE (Daems *et al.* 2017; Daems and Poblome 2017). In these early phases of development, both settlements were predominantly village communities, focused on a smallholder's subsistence system (Cleymans *et al.* In preparation) and functional material production strategies (Daems Accepted; Poblome *et al.* 2013b; Vanhaverbeke *et al.* 2010). From the 3rd and 2nd centuries BCE onwards, a divergent development was noted, with a marked urban and political transformation occurring at Sagalassos, and the contemporaneous abandonment of Düzen Tepe (Daems and Poblome 2016; Daems and Talloen Submitted).

The purpose of this paper is to contextualize the origin of community formation at Düzen Tepe and Sagalassos by extending the spatial and temporal scope of analysis. The former to include the full study region of the Sagalassos Project, more or less coinciding with the later, administrative territory of Roman imperial Sagalassos. The latter, by including the preceding period of the Iron Age. This way, we will present how the material culture of Düzen Tepe and Sagalassos can be placed within an existing pathway of development, grafted on the example of existing communities in the area.

Before moving on to presenting the case study, however, some chronological demarcations should be clarified. A debate has been ongoing regarding the periodisation and terminology of the Iron Age in Anatolia (for an overview, see Summers 2008). Regarding pottery wares a certain degree of consensus has been reached regarding the general relative chronological sequence that can be upheld (see *infra)*. Unfortunately, the terminology used to denote the associated time periods has not been consistent, varying between different locations and even different research projects. Additionally, the majority of the diagnostic material used to pinpoint the different Iron Age periodisations, is derived from survey material (*inter alia* at Çaltilar, Kelainai, Balboura, and also Sagalassos) or (older) excavations where the stratigraphical sequence is insufficiently known or documented (as in Ulyupinar and Düver Ada). The few excavation projects that did yield a more systematic stratigraphic sequence (Gordion, Ephesos, or Perge) are not necessarily the most relevant ones for the material presented here, given the relative large distances or the more limited spectrum of attested pottery wares. Choosing to discard any associated cultural labels, the most logical chronological demarcation to be used here in light of the material would be Early Iron Age (12^{th}-10^{th} centuries BCE), Middle Iron Age (10^{th}-7^{th} centuries BCE), Late Iron Age (7^{th}-6^{th} centuries BCE). This demarcation is better suited to match the survey material we are dealing with here and allows a wider chronological association to be made.

Painting the scene

The first traces of systematic occupation in the Ağlasun valley can be traced back to the late 5^{th} century (Poblome *et al.* 2013). Interestingly, the pollen data obtained from core samples collected from the central parts of the Ağlasun valley indicated that the first indications for human impact in the area, associated with the onset of the so-called *Beyşehir Occupation phase* (BOP), already occur between *c*. 800–500 BCE (Bakker *et al.* 2012, 254). Most notably, pollen analysis indicated the cultivation of anthropogenic species such as walnuts, olives and grains in this period. Elsewhere in the research area, indications for land cover changes induced by human impact have been attested in the Gravgaz valley (van Loo *et al.* 2017, 501).

Of course, these findings should not be extrapolated over the rest of the area uncritically. Even within the Gravgaz system itself, plenty of variation in effects of environmental change could be observed. It should be noted that even if soils were eroded from the hillslopes, the morphology of the Gravgaz catchment would allow sediments to be stored in the valley bottoms, which in turn would result in maintained averages or even increases of crop yields in the lower fields. Additionally, steep slopes are *a priori* not favourable for cultivation, not only for the lower productivity values but also because of the physical challenges associated with exploiting these slopes. These steeper slopes are therefore often used for extensive grazing practices. Still, plenty of indicators of human impact have been noted. Decrease of forest vegetation noted in particular from 800 BCE onwards in the Gravgaz valley, is corroborated by a peak in sediment accumulation rates observed in the Büğdüz valley starting around 800-700 BCE, which is considered to be a result of an initial phase of deforestation (Dusar *et al.* 2012, 379).

It has been noted that the onset of the BOP differs from site to site. It is characterised by the introduction of more favourable climatological circumstances, associated with a marked increase of human impact on the landscape, observed through deforestation, increased rates of sedimentation, and introduction of anthropogenic species in the palynological record (Bottema and Woldring 1984; Vermoere *et al*. 2000, 2002a; Vermoere 2004; Kaniewski *et al*. 2007a, 2007b; Bakker *et al*. 2012, 2013). In the Gravgaz valley, the onset of BOP is dated between Cal 400 and 210 BCE (Vermoere *et al.* 2002b, 581). The start of the BOP for Bereket is estimated at 280 BCE, based on two palynological studies (Kaniewski *et al.* 2007b, 2210; Bakker 2012), largely contemporaneous with that of Gravgaz (Bakker *et al.* 2012, 255). The combination of the late onset of BOP with the observed changes in settlement patterns in the 3^{rd} century BCE (see *infra*) has led to the suggestion that the BOP can perhaps be considered more a result of human factors. Possible factors are, for example, political reforms, or increased importance and wealth of the city of Sagalassos and its surrounding region, rather than of any local or regional bioclimatic shift (Bakker *et al.* 2013). It can be questioned however, to what extent the emergence of Sagalassos as a political centre would have influenced this isolated valley at this point in time (again see *infra*).

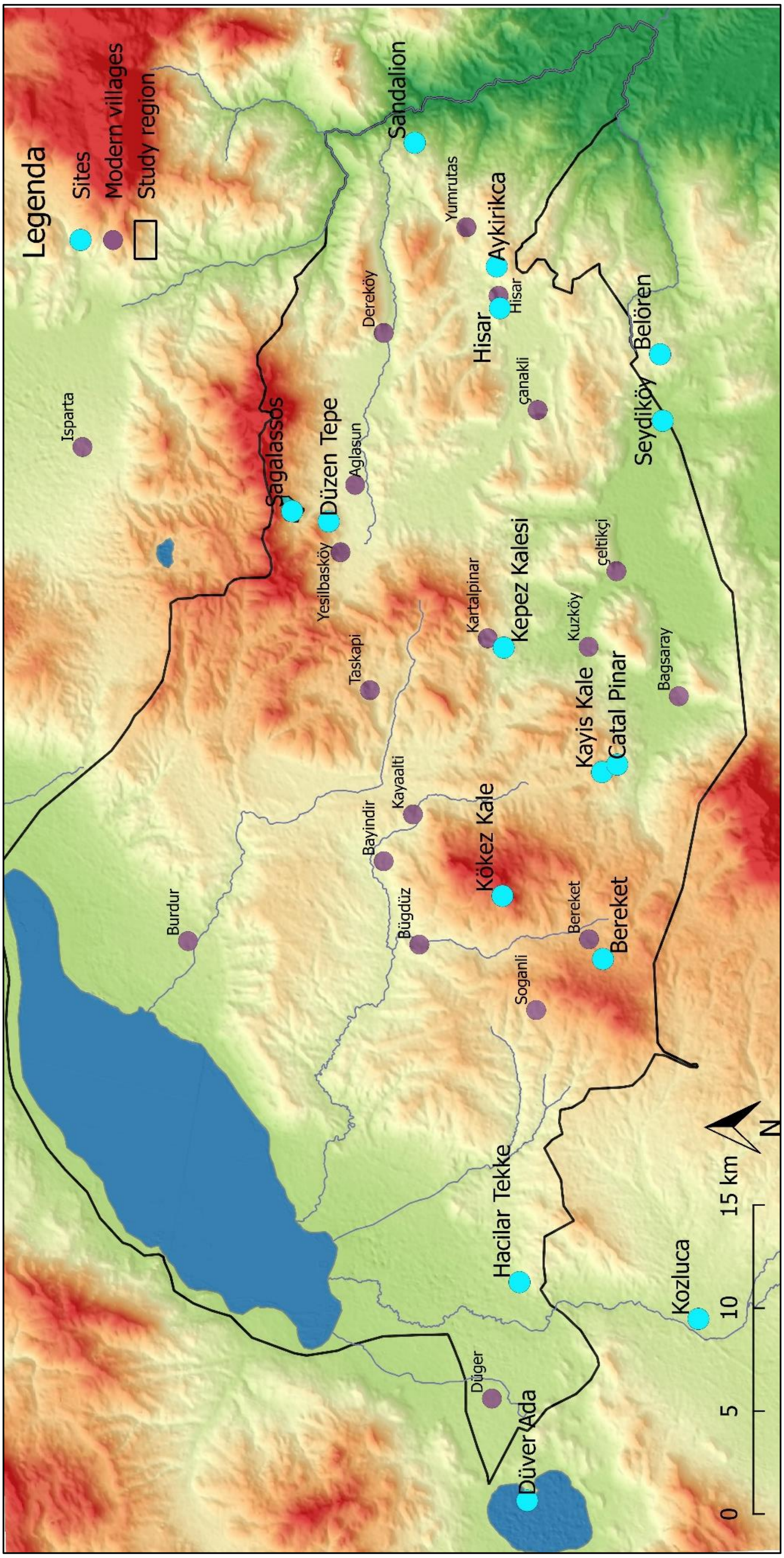

Figure 1: Indication of important sites discussed here and demarcation of the study area of the Sagalassos Project (full line).

Some of the oldest traces in the archaeological record associated with this period at the site of Sagalassos pertain to three thick slipped/burnished ware sherds, found during the urban surveys in the western parts of the site, two reduced and one oxidized sherd, of which two were a type of plain open bowls (Figure 2). These sherds can likely be dated to the Late Bronze Age – Early Iron Age transition, as we will discuss later on.

Figure 2: Burnished wares found at Sagalassos.

Unfortunately, a follow-up excavation on the find spot of these sherds in the Western Domestic Area in 2009 yielded no associable structures or material. Recent material studies identified the presence of two fragments likely attributable to the Late Iron Age, one buff ware ring base found at the Upper Agora, and a fragment of a slipped storage vessel found at site N in the eastern part of town (Figure 3), which preceded that of the colour coated tradition of Achaemenid times (see *infra*).

Figure 3: Late Iron Age material from Sagalassos.

Intensive surveys in the central parts of the Ağlasun valley did not yield any indications for habitation at this period of time, safe for a single Black-on-Red pottery sherd. Only from the late 5th century BCE onwards – more or less contemporaneous with the onset of habitation at Düzen Tepe and Sagalassos – do we find material that can be associated with systematic human presence throughout the valley, likely to be associated with farming activities. Towards the east, the areas surrounding the modern village of Hisar were surveyed in 2004 and were recently revisited for intensive surveys (Figure 4). This area was long considered to be less suitable for human occupation compared to the fertile plains of Burdur and Celtikçi (i.e. a 'marginal area', see Vandam *et al.* 2017). Large parts of the area remained unoccupied in Iron Age, Achaemenid and Hellenistic times (and would continue to be so until Late Roman times, see Vandam *et al.* 2017). Most concentrations of survey finds, indicating human presence, can be situated at the edges of the hilly areas bordering the plains. Sizeable settlements have been identified at the Middle/Late Iron Age hilltop site of Aykırıkça (2.5ha[538]), and an Achaemenid and Hellenistic site near Hisar. A number of burial mounds or *tumuli* were also identified, which, based

[538] This and all subsequent size estimations were done by dr. Eva Kaptijn, personal communication for publication in preparation.

on the pottery material, could be associated with the Middle Iron Age occupation at Aykırıkça (Vandam *et al.* 2017, 330). Also at Hisar, similar round structures were observed. The oldest traces of occupation at the site of Hisar start in the 5th century BCE. Most other pottery, however, could be dated to the Roman imperial and early Byzantine periods. In the debris of recent illegal excavations conducted at some of these tumuli at Aykırıkça, fragments of burned human bone, metal artefacts and geometric painted pottery were found (Vandam *et al.* 2017, 330). Yet, these settlements by themselves, although not insignificant, cannot explain the signal noted in the pollen data collected in the central parts of the Ağlasun valley. Clearly, we are missing part of the picture.

Perhaps additional intensive surveys – such as those planned in the valley of Yeşilbaşköy in the western parts of the Ağlasun valley for the 2018 fieldwork campaign – will provide some additional information regarding the missing pieces of the puzzle. For now, however, we must try to approach these "known unknowns" in another fashion. Strikingly, if we extend our spatial scope to include the wider research area, we find little indication for the origins of communities contemporary to Düzen Tepe and Sagalassos.[539] To properly contextualize the condition of origin of community formation at Düzen Tepe and Sagalassos, we must extend our view to include the preceding Iron Age period.

Our evidence for this period is patchy. The majority of available Iron Age material consists of grab samples collected during extensive survey campaigns conducted in the wider study area. So far, we do not have a direct spatial association between archaeological and environmental data, which rules out the possibility of relating observed changes in the palynological record to the settlements known from the archaeological record. The aforementioned first indications of human impact from 800 BCE onwards at the Ağlasun, Çanaklı and Gravgaz valleys, can therefore only generally be chronologically associated with the emergence of a number of (relatively) large, sometimes fortified hilltop settlements throughout the area (Waelkens *et al.* 1997, 2000). Some of the most notable examples include Kayiș Kale, Hacılar Kalesi, Kökez Kale, Kepez Kalesi, Taşkapı Kalesi and the aforementioned site at Aykırıkça.

Near the village of Taşkapı, a hilltop site (Taşkapı Kale) dated to the Middle Iron Age was identified at about 1575m a.s.l. which was only accessible from its southern slopes, where it was protected by a half-circular wall constructed from rocks in dry masonry (Waelkens *et al.* 1997).

A few hundred meters to the northeast of the modern village of Kayiș, at an altitude of 1430m a.s.l., a hilltop settlement was located at Kayiș Kale (13ha). On top of the hill, a small fortress of 0.7ha was found, walled on all sides except for the northern one, which is protected by a steep cliff. Lower down the slopes, several secondary lines of defence were established and remains of several buildings in dry rubble masonry were traced over a surface of *c*. 22 ha (Vanhaverbeke *et al.* 2011, 145).

On the lower hill slopes nearby Kayiș, the site of Çatal Pınar (10ha) was found. The site had a long habitation history, yielding material dating back to the 8th century BCE until the 10th century CE. Whereas only a few indications for 8th-6th century BCE material were observed, a first main occupation phase started only in the Achaemenid period, whereas, only a limited amount of Hellenistic material was identified. A strong increase in material could subsequently be observed from the 1st century CE onwards, continuing in late Roman and Byzantine times. It remains unclear so far where the population of this valley could have been located in Hellenistic times.

[539] Based on an intensive material studies campaign conducted in 2014 by prof. Jeroen Poblome and dr. Eva Kaptijn, with the aim of (re-)dating most of the pottery material collected in previous survey campaigns throughout the research area.

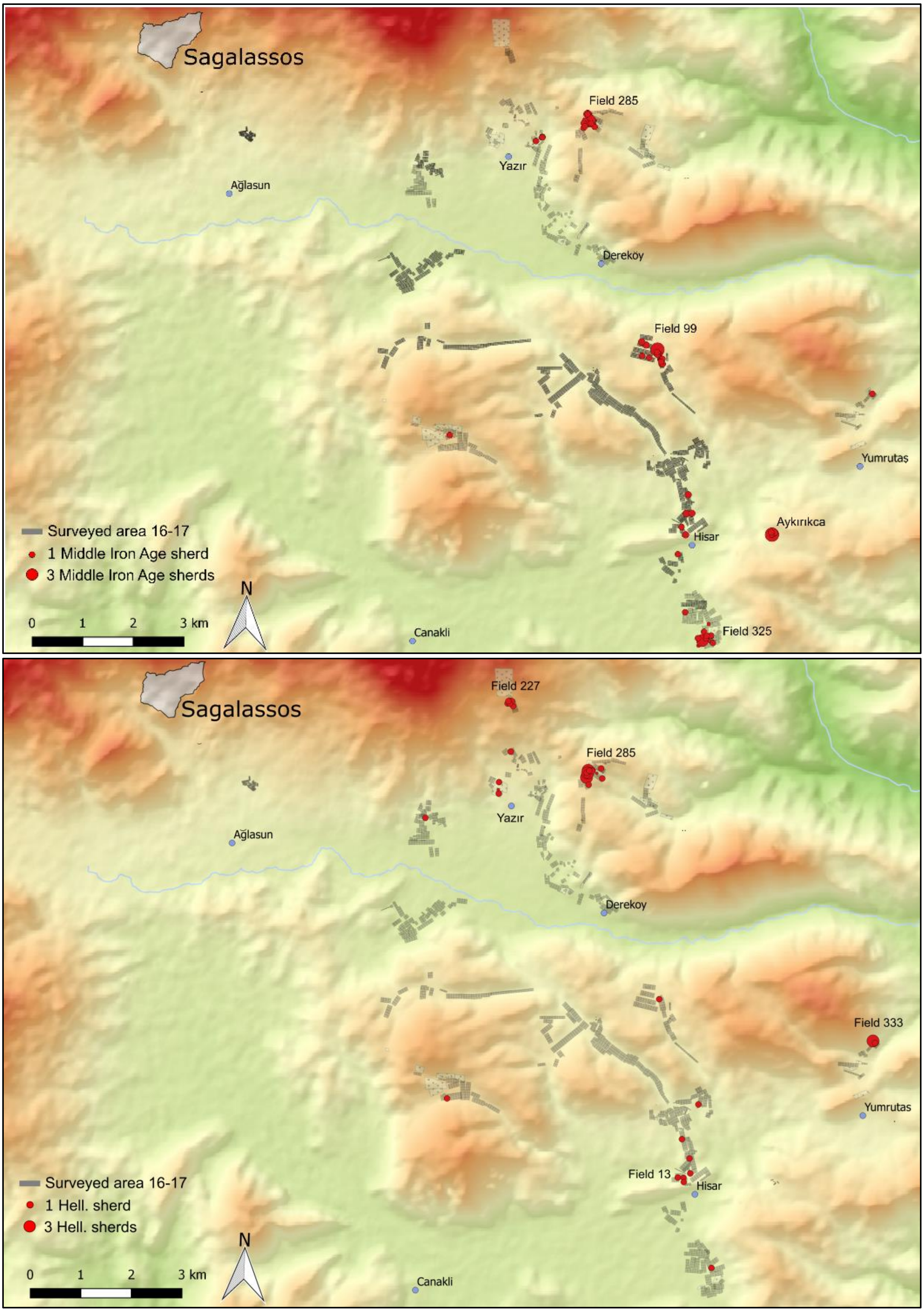

Figure 4: Sherd distributions in recent intensive surveys (2016-2017) in the Hisar-Dereköy area for the Middle (and Late) Iron Age and Hellenistic periods (made by dr. Ralf Vandam).

In the northern part of the Bereket basin, close to the village of Kökez, at an altitude of 1928m a.s.l., the remains of a hilltop settlement were found at Kökez Kale (9ha), located on two flat areas on top of the mountain, separated by a lower area that might have been used as grazing land (Waelkens *et al.* 2000, 64). Remains of a collapsed wall could be seen, connecting the eastern side of the flat outcrops, and continuing along the crest of the northern peak. South of the hill top, the main area of settlement was located, on its north and south sides contained by mountain flanks, and in the west and east by walls in dry rubble. A number of structures could be delineated within the kale (Vanhaverbeke *et al.* 2011, 141). The high location of the settlement allowed an excellent view over the surrounding lands, especially the western parts of the territory of Sagalassos, extending all the way to a watchtower at Tekke above the Burdur plain, the fortress of Soğanli, the Bereket basin, and the southern boundary of the territory at Akyayla (Waelkens *et al.* 2000, 64). Preliminary dating based on pottery finds suggested a small proportion of Middle Iron Age material dated to the 9th and 8th centuries BCE, with a main occupation from the 7th to the 5th century BCE. The settlement continued to be occupied during Hellenistic times (3rd - 2nd centuries BCE), with some Roman imperial and (limited) Byzantine material present as well. From Hellenistic times onwards, however, a shift in the weight of settlement patterns towards the lands surrounding the modern village of Bereket at the valley bottom was observed, with subsequent human occupation in the valley continuing during Roman imperial, late Roman and early Byzantine times (Kaptijn *et al.* 2013).
Towards the south, the settlement of Kepez Kalesi was located on a promontory on top of a hill overlooking the Kuzköy basin. Although a few indications of Middle and Late Iron Age pottery have been found, the main occupation phase of the site dated between the 5th century BCE and 1st century AD. An impressive fortification wall was constructed, consisting of a southern section of about 50m long, with two projecting towers and a gate of about 2.77m wide between them, and a northeastern section of about 78m containing three rectangular towers. The width of these walls ranged between 1.45 to 2.10m with a preserved height of up to 3.70 meters. It was suggested based on architectural stylistic arguments that the fortifications are Early Hellenistic in date, based on the coursed, almost pseudo-isodomic trapezoidal masonry (Waelkens *et al.* 1997, 71). At all other sides, the settlement was surrounded by very steep slopes, making additional fortifications redundant. This configuration somewhat resembles the use of topography at Düzen Tepe. The entire promontory included a virtually flat surface area of 500 x 800m, including the walled area of about 10ha at the northern side and a necropolis with several Hellenistic *osteothecae* and monumental tombs.
In the utmost southern parts of the research area, a second major Middle Iron Age settlement was identified at Seydiköy (about 2ha), located on a hill overlooking the lower parts of the Çeltikçi valley. Remains of unworked stone walls of differing heights were attested at the site. The oldest pottery from the site was dated to the 8th to 6th centuries BCE, but most material could be linked to an occupation phase situated between the 6th and 4th centuries BCE. In Hellenistic times, the area was centred around a site at Belören (ancient Keraia), which was an independent polity in the Early and Middle Hellenistic period, located on the Sivri Tepe, overlooking the valley of Çeltikçi to its west. Impressive fortifications, large cisterns and a *bouleuterion* were identified, testimony to its autonomy and importance at this time.

In the Burdur plain, an Iron Age settlement (Hacılar Kale) was found on a hilltop near Hacılar, the famous prehistoric site excavated by James Mellaart in the 1950's. At Hacılar Kale, a number of pottery fragments of the so-called 'southwest Anatolian ware tradition' were identified (Birmingham 1964). Further towards the east, at the edges of the study area, an important settlement – denoted by several names such as Düver Yarımada, Ada Tepesi, or Düver Ada – was identified on a peninsula of the saltwater Lake Yarışlı, southwest of Lake Burdur. The site could only be reached by a track that was already cut out in the rocks in antiquity to accommodate traffic. The peninsula consists of three low hills, of which the most southern one housed the settlement, at 965m a.s.l., with lots of traces of buildings still visible at the surface. 'Phrygian' grey wares and painted black-on-red pottery of the southwest Anatolian ware tradition, which can be dated to the late 8th to 6th centuries BCE, has been extensively attested at the. Only at Düver were these fine wares attested in larger amounts. Elsewhere

in the area, this type of ware was mainly found as so-called 'matt painted' wares, being of a cruder fabric with less refined finishing (Braekmans 2010; Talloen *et al.* 2006, 180). A considerable amount of decorated architectural terracottas was found at Düver Ada, indicating a relatively complex building technology (Mellink 1965; Thomas 1965). Several rock-cut structures were identified, including two stepped altars, two temples, a rock-cut relief and a tomb with geometric decoration, prompting the suggestion of the existence of a religious complex for the Mother Goddess at the site (Kahya and Ekinci 2014, 2015, see also Talloen *et al.* 2006). Earlier work sought to connect these elements with possible Phrygian influences, suggesting, for example, that the decorated architectural elements could be linked to a Phrygian type of *megaron* structures, suggesting an interpretation of the site as the seat of a local dynast influenced by Phrygian culture (Waelkens *et al.* 2000, 183-184).
More recent contributions however, have rather sought to explain the attestation of these architectural remains through the workings of peer-polity interactions (Talloen *et al.* 2006; Kahya 2012). It was suggested that the sites at Düver and Seydiköy could be regarded as the main Iron Age principalities in the study region (Poblome *et al.* 2013b). Both sites, situated on prominent landscape features, can be interpreted as major settlements overlooking (and possibly controlling) large agricultural plains. Recent intensive surveys in the Burdur plan revealed a series of agricultural villages and hamlets, located at close intervals (approx. 1 km) along the transition between the fertile plain and the Badlands to the east (Kaptijn *et al.* 2012; Vandam *et al.* 2013; Vandam and Kaptijn 2015, 171), as well as fortification systems and ritual sites, possibly related to the principality at Düver, which could have acted as a central place for this area (Poblome *et al.* 2013b). The same settlement pattern seems to have continued in the following centuries in the Burdur plain, although it is unclear to what extent Düver Ada retained its importance, with a major shift in settlement patterns occurring only during Roman Imperial times. In the Çeltikçi valley as well, Seydiköy remained the prime settlement in the subsequent Achaemenid period, whereas in Hellenistic times, the focus shifted towards nearby Keraia. Although certainly a significant amount of Iron Age material was identified at Seydiköy, this did not approach the quantities nor quality of the material found at Düver and the Burdur plain. Although the site is also located on an important natural throughway, it seems not to have been at the same level as Düver Ada.

As noted earlier, the only major shift observed in late Achaemenid times is the emergence of systematic occupation at Düzen Tepe and Sagalassos in the Ağlasun valley. Elsewhere, the same settlement patterns seem to have continued to a large extent. Given the overall inward-oriented nature of these village communities at the time, it can be expected that the emergence of both communities would hardly have impacted the surrounding valleys, where indeed a largely undisturbed continuation of preceding dynamics has been observed (Poblome *et al.* 2013b). Only in the valley of Kayiş do we see a shift towards Çatal Pınar, located on the lower hill slopes in Achaemenid times. Towards the Hellenistic period, however, the scenery started to markedly change. It has been noted that site numbers, site diversification, and investment in fortifications increased from Hellenistic times onwards (Poblome *et al.* 2013b). Although it was suggested that most settlements in the area at this time were either fortified or located at higher elevations out of an increasing concern for safety rather than exploiting agricultural potential (Waelkens 2002, 318), this view should be somewhat nuanced. Shifts in settlement patterns from hilltop sites towards the lower hill slopes are observed in several valley systems, suggesting that the image must have been more varied, and indeed a more diversified settlement pattern emerged.
In the northern part of the territory, near the modern village of Günalan, a major village site was identified on the southern slopes of the Kalenin Taşı. The oldest material collected from the site could be dated to mid Hellenistic times (2nd century BCE). The site is incredibly difficult to reach from the northern and western sides due to the steep slope, cliffs and dense vegetation. Access was only possible from the eastern side, where a comparatively easier slope led to the top of the hill. At this side of the top of the hill, remains of a fortification wall are preserved that would have guarded the site against entry from this side. This fortification probably dated back to Hellenistic times, with the

settlement extending over the higher parts of the slope. The settlement gradually moved towards the lower slopes in Roman imperial times.
The basin of Bereket was in Roman imperial times centred on the village of Moatra, located on a low hill to the south of the modern village (Kaptijn *et al.* 2013, 77-78). The Roman village had antecedents already in the Hellenistic period, with pottery material indicating that the origin of the settlement can be dated back to the 3rd century BCE.
The southeastern parts of the Çeltickçi valley were probably only added to the territory of Sagalassos at the end of the 1st century BCE. In Hellenistic times, this valley was controlled by the independent polity of Keraia, located on a steep hilltop approximately 8km from modern-day Bucak and 25km south of Sagalassos. Keraia lost its political autonomy shortly after 25 BCE, when the Augustan colony at Kremna was founded, and was subsequently reduced to the status of a village dependent on the latter town. It was suggested that along with this political reorganization, and the incorporation of the settlement in the territory of Kremna, the remainder of the valley lands surrounding the settlement was allotted to Sagalassos (Mitchell 1995, 8-9; Waelkens *et al.* 1997, 54.). The oldest pottery identified during extensive surveys at the site could be dated to the Achaemenid period (5th – 4th centuries BCE). Only a relatively small portion of the assemblage could be ascribed to the middle Hellenistic period (2nd century BCE) with most material dating to the late Hellenistic, Roman imperial and Early Byzantine periods.
Kapıkaya was strategically located on a mountain peak at 1740m a.s.l., overlooking the Aksu valley. Visual connections could be established with the communities at Sandalion, Adada, and Kremna. A fortification wall was constructed in dry irregular polygonal masonry at its southeastern side. Several public spaces were identified, including an agora, a market building, and an open air *bouleuterion*, as well as several other, unidentified monumental structures, architecturally datable to the Hellenistic period (Waelkens *et al.* 1997, 26). Nearby, at the outmost eastern boundary of the territory of Sagalassos, a site located on a rock outcrop at Sandal Asar was identified as ancient Sandalion, mentioned by Strabo (XII, 6, 4) as the only Pisidian stronghold that held out against king Amyntas until his death in 25 BCE (Waelkens *et al.* 1997, 29). Its location on a steep rocky outcrop (185x30m) was likely too small to hold a sizeable settlement (Waelkens *et al.* 1997, 30). No clear indications of monumental buildings have been found, although a number of rock-cut houses and *acrosolia* were identified on the top of the hill. It is unclear for now whether the area of Sandalion was already part of the territory of Sagalassos in the late Hellenistic period, or whether it was only added in early Roman imperial times.

It was suggested that the continuation of occupation at several hilltop sites indicated their integration in an extended system of fortified settlements guarding the territorial borders of Sagalassos in Hellenistic times, including Kökez Kale, Soğanli Kale and Akyayla Kale (Waelkens *et al.* 2000, 208). At this time, the administrative territory of Sagalassos was indeed markedly extended and the site gradually developed into an urban hub pulling in energy and resources from an increasingly wider hinterland. To what extent settlement patterns elsewhere can be related to this development remains unclear. The pathway of development leading from the origin of community in the late 5th century to the pivotal transformation of the site in the 3rd and 2nd centuries BCE has been sufficiently discussed elsewhere and will not be repeated here (*cfr*. *supra*). However, the larger framework of this origin has so far only been preliminary sketched (Poblome *et al.* 2013b). One of the major goals of the present paper will therefore be to compare the point of origin of Düzen Tepe and Sagalassos, to the ongoing dynamics in the wider area, developing out of the preceding period. It is only against this background that the further development of these communities can be properly contextualized and understood within wider pathways of development. The main focus of this analysis will be on a diachronic comparison of the material culture – notably pottery – collected from settlements in the research area. Out of this first comparison and reconstruction of complexity trajectories in Iron Age and Achaemenid times, we can also provide some further indications as to the wider context for the further development at Sagalassos in Hellenistic times. Whereas it has been noted how the site developed into a system hub, exercising pulling forces onto the surrounding hinterland, it has so far not been considered in detail how the differential development of various network structures – including social, economic and political networks – may have impacted the integration of different settlements and valley systems within the area into the sphere of influence of Sagalassos. However, additional work will be needed before any clear answer can be provided on these subjects. The current paper will in this regard only provide some preliminary outlines and raise some prancing, currently unanswered research questions.

Material culture in the study area

The pottery material presented here was collected from a number of settlements located in the wider region of Sagalassos – more or less coinciding with the area controlled by the town in Roman imperial times and late antiquity – during various survey campaigns, with both extensive and intensive methodologies. Because of this variation in survey methodologies and intensity of material collection, it is virtually impossible to make straightforward comparisons between the different settlements discussed in this paper regarding their size, function, or intensity of occupation. The absence of excavated material from these sites entails certain limitations as to the potential information that may be derived. With no evidence available for production facilities, it is generally quite hard to make strong assertions on production technologies, organisation of labour and the logic behind the distribution of wares. We also have no idea where the pottery presented here was actually produced during the periods under scrutiny. Geochemical analyses of Iron Age, Achaemenid and Hellenistic pottery from the study region of Sagalassos has identified a number of fabric groups, which from the nature of their clay raw materials, can be associated with a regional provenance. These fabrics occurred in more or lesser degrees on various sites, rather than being conclusively associated with specific sites or settlements (Braekmans *et al.* 2017).

We will start with an overview of the different fabrics and wares identified for Iron Age to Hellenistic pottery in the study area. Fabrics will be discussed from a geochemical and macroscopic point of view, combining information on the composition of the clay matrix and its inclusions. As we will see, this approach is too limited to effectively study the material at hand. To this end, typologies, surface treatment and decoration need to be included as characteristic properties of the pottery for each period. In short, an approach starting from the concept of a pottery 'ware' needs to be considered. Additionally, a diachronic comparison of production properties, along with continuities and changes in morphological typologies from these different periods will be discussed.

The pottery of Düzen Tepe and Sagalassos will be compared to that of a number of key sites, including Kökez Kale, Kayiş Kale, Kepez Kalesi, Seydiköy, Keraia, Çatal Pınar, Bereket, Hisar and Aykırıkça, all selected because of earlier preliminary dating of the collected survey material assigning them to the relevant periods. From these sites, we selected and identified 676 sherds (of which 96x were dated to the Iron Age, 497x Achaemenid period, and 83 late Achaemenid/early Hellenistic), of which 235 (189 rim fragments, 17 handles, and 29 bases) were illustrated, photographed and measured. Insofar typological continuity could be observed, type codes were used from existing typologies for the Achaemenid and early Hellenistic material at Düzen Tepe (Daems *et al.* 2017), the Hellenistic (Daems *et al.* In review) and Roman pottery of Sagalassos (Poblome 1999; Degeest 2000). At times, this approach resulted in some numbering discontinuities within type groups as a full typological continuity did not occur, however, in return, we gained a significantly increased potential for typological comparisons over different chronological periods, which allows us to trace continuity and discontinuity in material culture.

Fabric analysis

Recent efforts on the pottery typologies from Düzen Tepe and Sagalassos in Achaemenid and Hellenistic times have focussed extensively on the combined interpretation of fabric and morphological features as a main classificatory scheme (Daems *et al.* 2017; Daems and Poblome 2017; Daems *et al.* In Review). For the wider research area of the Sagalassos Project, pottery studies for these periods so far focused mainly on petrographic and geochemical analyses to identify fabrics and ware groups (Braekmans *et al.* 2011, 2017; Neyt *et al.* 2012). One extensive study, combining macroscopic properties with surface, technological and compositional features, identified 15 major regionally produced ware groups (Braekmans *et al.* 2017). However, these groups turned out to be hard to systematically trace in macroscopic analysis. We will therefore start with an overview of these petrographic and geochemically identified ware groups, before moving on with some separate macroscopic observations.

Petrographic analysis was performed on a sample (n=273) of thin sections taken from material collected from eleven sites, spanning the major valley systems in the study area, including (1) Ağlasun valley (Düzen Tepe and Sagalassos; (2) Çeltikçi and Kuzköy valleys (Keraia, Kepez Kalesi, Aykırıkça, Hisar and Seydiköy); (3) Bereket valley (Bereket and Kökez Kale) and (4) in the wider area of the Lake Burdur plain (Düver Ada and Kozluca). Based on this material, 13 petrographic groups were identified, linked to distinct provenances in the local geological substrate (Braekmans *et al.* 2017). Each petrographic group encompassed several ware groups, occurring on various settlements. Especially for the common wares, a wide range of petrographic provenances was observed, distributed over a wide range of sites (Figure 5).

Petrographic groups	Sagalassos	Düzen Tepe	Hisar/Aykırıkça	Düver	Kepez Kalesi	Bereket/Kökez	Seydiköy/Belören	Hacilar	Kozluca
Calcite-sedementary	x	x	x	x	x	x	x		
Volcanic-biotite		x	x		x		x		
Volcanic-sedimentary	x	x	x	x	x	x	x	x	
Radiolarian chert						x			x
Volcanic chert	x	x	x		x	x	x		
Muscovite		x		x					
Mudstone	x	x				x	x		
Serpentine	x	x		x					
Metamorphic	x	x							
Grog-calcite	x	x	x			x	x		x
Fine-grained A		x							
Fine-grained B	x	x		x			x		
Fine-grained C	x	x			x	x			

Figure 5: Distribution of petrographic groups over sites in the research area (after Braekmans et al. 2017).

The marked omnipresence of Düzen Tepe in all of these groups, except the radiolarian chert, can be explained by differences in sample size, with excavations conducted at Düzen Tepe allowing a far larger body of material to be selected for analysis. It should also be noted that significant sample sizes existed in sherds attributable to different petrographic groups, ranging from 65 for the volcanic-biotite group, to five for the metamorphic group. The limited sample size in some groups (most notably, from up to down: nrs. 4, 6, 7, 8, 9 and 10) should be taken into account when interpreting the results. To what extent we can use these results to argue for connections or even exchange between sites remains an open question.

Geochemical analysis on part of this sample (n=124) identified seven groups, distinguished through principal component analysis of 38 distinct trace elements (Figure 6). These seven groups can be combined further into four distinct types of resources used in the region based on common petrology and clay chemistry: a non-regional provenance (A), Burdur basin clays (B and E), detrital clays from the Çanaklı and Ağlasun basins (C and D), a mixed flysch-limestone group (F) and an ophiolithic-volcanic group (G). When looking at the ware groups identified in these groups, some interesting patterns can be noted. Interestingly, group B is uniquely related to Hellenistic material derived from Sagalassos and Kozluca, whereas group E can likely be linked with a production of Düver provenance, possibly derived from lake sediments to the south of the Burdur area (Neyt *et al.* 2012). These Burdur clays were already used in the production of common wares, as well as the characteristic black-on-red tableware from the Middle Iron Age period at Düver, and its usage for high quality tablewares seems to have continued well into Hellenistic and Roman imperial times.

Group D clay resources were used for pottery production at Sagalassos and Düzen Tepe since late Achaemenid times. While the Sagalassos Red Slip Ware production also made use of the same clay group, a distinct geochemical fingerprint suggests the use of different outcrops compared to production in earlier times. Additionally, late Hellenistic material from Sagalassos was attributed to group C – similar to group D – but more compatible with the detrital clays from the western part of the Ağlasun valley. The petrographic classification of group F is highly variable, but appears to be particularly linked with the sites around the Çeltikçi valley, Kepez Kalesi, Seydiköy and Keraia. Interestingly, the pottery from the Burdur plain is virtually absent in this group, suggesting a clearly distinct production logic. Finally, group G consists of a highly distinguishable clay signature that can be linked to the ophiolite clays around the site of Düzen Tepe and can be linked to the range of common wares identified at Düzen Tepe and Aykırıkça.

	Group A	Group B	Group C	Group D	Group E	Group F	Group G
Calcite-sedementary			x	x			
Volcanic-biotite							x
Volcanic-sedimentary						x	
Radiolarian chert		x					
Volcanic chert						x	
Muscovite	x						
Mudstone					x		
Serpentine					x		
Metamorphic					x		
Grog-calcite				x			
Fine-grained A						x	
Fine-grained B				x	x		
Fine-grained C		x	x				

Figure 6: Geochemical composition groups of petrographic fabrics (after Braekmans et al. 2017).

Interestingly, an overall pattern can be noted. In the Iron Age pottery, we can generally differentiate between production systems located in different valley systems, each operating within their own local environmental logic, exploiting nearby clay resources available to them. A distinct signal is noted for the general area of the Burdur area, the southern Çeltikçi valley, the Bereket basin, and the area of Ağlasun/Hisar (centred on Aykırıkça as main site at this time). However, despite the overall sense of compartmentalization, several indications for cross-valley connections in production and/or distribution systems can be attested for this period. For example, the use of calcite-sedimentary clays from the Ağlasun/Çanaklı basin has been attested for the so-called matt-painted pottery of the Iron Age period, found locally at Aykırıkça, but also at Kökez Kale and sites around the Çeltikçi valley such as Kepez Kalesi and Seydiköy. To what extent this observation can be linked to either production processes taking place at Aykırıkça, with subsequent distribution to other sites, or the exploitation of similar clays by sites from different valley systems is impossible to answer at this point in the absence of clear identification of production facilities.

This pattern seems to continue in Achaemenid times, when Düzen Tepe and Sagalassos entered the picture and started to participate in the local production context of the Ağlasun valley area, as well as make use of the detrital clays of the nearby Çanaklı valley. The latter connection is extended from Hellenistic times onwards and becomes even more intensified in late Hellenistic and Roman imperial times, when different outcrops within this clay group are being exploited. At the same time, the observed divisions between the various compartmentalized units within the general landscape are starting to be taken down, as Hellenistic material production at both Sagalassos and Kozluca also notably started to tap into the available raw materials of the Burdur basin clays, previously used for the production of black-on-red pottery found at Düver. It has been noted that the Hellenistic assemblage at Kozluca is characterized by a very distinct production, both petrographically and chemically, from the material of Sagalassos (Braekmans *et al.* 2017), suggesting that both sites independently started to extend their area of influence to draw in resources from an increasingly extensive hinterland. This observation can be framed in the observed development of Sagalassos into an urban system hub and regional production centre, with an associated territorial increase, in the 3rd and 2nd centuries BCE (see *infra*).

Petrographic and geochemical analyses can provide a lot of information regarding the composition and provenance of the raw materials used for production and are therefore a highly useful addition to the methodological toolbox available to archaeologists. However, in the field, the majority of pottery studies must necessarily rely on macroscopic analysis of the pottery fabrics. It is therefore certainly useful to provide some additional observations regarding macroscopic fabric classifications observed for this material.
During an exploratory fabric analysis of the common ware pottery from Kayiş Kale and Seydiköy, conducted in the study campaigns of 2016 and 2017, respectively, it was noted how the general nature of most of the material seemed to fall in the same overall bracket of material culture production as observed for the late Achaemenid and early Hellenistic pottery of Düzen Tepe. In both cases, the majority of the material was common wares fabrics, supplemented with a considerable amount of finer buff ware tableware. Production of most of this material seemed to focus on locally exploited resources, and basic production technologies aimed largely at producing a functional body of material culture.
However, whereas the Düzen Tepe material was predominantly characterised by thin, brownish mottled slips, a portion of the material from Kayiş Kale and Seydiköy was characterised by intricately painted decoration schemes. As these painted pottery wares are notably associated with the Iron Age period, the absence of such painted wares at Düzen Tepe was considered an important argument in dating the occupation of that site to the 5th-2nd centuries BCE (Poblome *et al.* 2013b). The properties of this painted pottery will be discussed in more detail later on.
The common wares of Kayiş Kale and Seydiköy had a rough surface feel, with colour variations including black, grey, dark brown, light brown, orange, red, and buff colour. Colour variations were not considered a decisive factor in defining fabric groups, as similar compositional properties seem to recur across different colour variations. We therefore focused mainly on the composition of the matrix and inclusions in the break. Based on these elements, three general trajectories of technological production properties could be identified. 1) A very rough fabric group with abundant amount of inclusions; 2) a medium rough fabric group with moderate amounts of inclusions; and 3) a smooth fabric group with few inclusions, which can be further subdivided in a very smooth paste group with no visible granulation but occasional large inclusions and huge elongated voids, and a smooth fabric with fine-grained matrix and very small inclusions. Among these general production trajectories, six distinct fabrics could be systematically distinguished (Figure 7):

A) A characteristic and frequently encountered fabric in this body of material was a medium-rough fabric which is at least partially reduced. It occurs frequently with 1/3 reduced grey core and light brownish/orange margins and surface, sometimes called the ‘sandwich effect’. In other instances, it is also completely reduced with only the outer margins having an oxidized colour. Occasionally it can also be half reduced/half oxidized. Sherds in this fabric can range from quite soft and powdery over slightly rough to smooth and hard (sometimes scratchable with fingernails but all by metal blade). Inclusions can be small or medium large and are generally fairly well sorted. Inclusion range includes: calcite, quartz, feldspar, flint/chert, mica, clay pellets, grog. Small to medium pores are present, sometimes elongated (but not frequently). A remarkable difference with material from the Ağlasun and Çanaklı valley is the apparent lack of volcanic inclusions in this fabric (or only very rarely present), and the presence of a distinctly blueish type of inclusions can be observed. These remain undetermined for now. Occasionally a fully oxidized variant is found which can be associated with the more common grey core variant due to its similar overall texture and inclusion range.
B) A rough fabric with characteristic abundant amount of inclusions, apparently predominantly associated with large storage vessels. Very rough/hackly texture with coarse inclusions and medium to large pores; hardness between 2.5 and 5. Most commonly, it has a dark brown coloured break but

variations include grey, light brown and dark red hues as well. Inclusions include quartzite, chert, mica, calcite, sedimentary rock(?), and clay pellets.
C) A fairly homogeneous texture in break but with occasional large pores. Colour of break ranges from red, orange to light and dark brown. Generally ranging between slightly rough and smoothened. The break mainly shows small to medium pores, with occasional large and elongated ones attested as well; inclusions include calcite, quartzite, mica, chert, as well some undetermined ones. Some examples can be fired extremely hard. Additionally, a variant with comparable range of colours and inclusions but with more lime-based temper has been observed as well.
D) Smooth and fine-grained fabric, with colours ranging from grey, buff, light brown to red and dark brown. Texture is very homogeneous with sparse to moderate amount of small-medium pores and inclusions include calcite, grog, clay pellets, chert, and quartzite. Some of these are in macroscopic appearance closely related to detrital Çanaklı clays.
F) A soft fabric with a smooth and sometimes powdery feel. Colours frequently range from orange, buff, to pinkish red. Very fine-grained texture with very small inclusions but occasionally also some large ones, mainly lime, some grog and quartz, with occasional large pores and/or voids visible as well.
G) 'Pasty' smooth fabric with a very dense texture, but with occasional large to very large pores. Colours are generally light brown/buff to more orangeish. Sparse but very large inclusions present, including grog, sedimentary rock, calcite, flint, *etc.* This fabric appears mainly related to either very large or flat fragments. It cannot be excluded that the latter include some sort of architectural elements.

Figure 7: Fabrics in the Iron Age material of Kayiş Kale (Upper row left to right: A-B-C; lower row left to right: D-E-F).

A preliminary study on the selected diagnostics indicated that these three general trajectories could be observed on most other sites as well, albeit with some compositional variation pertaining to the usage of local raw materials. It must be noted, however, that it is in principle quite hard to draw any strong conclusions on the chronology and dating of pottery material, based on fabric paste properties alone.
For the Iron Age, Achaemenid and Hellenistic material discussed here in particular, only an integrated approach based on the identification of pottery wares can provide a sufficiently secure basis to start drawing conclusions regarding the chronology and interpretation of this (surface) material. Petrographic and geochemical analysis suggested a long-standing use of similar resources throughout the area across different periods of time, allowing hardly any chronological distinction to be made. This is why we must turn to other diagnostic information, for example, derived from type and style of surface treatment, to assign a more precise chronological demarcation. Especially for the common wares of Iron Age and Achaemenid times, hardly any differentiation is possible given the general lack of well-dated stratigraphic deposits. It was noted, for example, that the material from Düzen Tepe,

dated to the (late) Achaemenid period, could be situated in a similar general bracket of production logic and technology, further impeding clear chronological demarcations. Additionally, a fair degree of typological continuity can be observed (see *infra*). At this point, to define the chronological horizons of a specific body of material, we are often forced to fall back on a general appreciation of the context and the association of common wares with more diagnostic fine fabrics. The lynchpin diagnostic element in the next part will therefore be the identification of wares, and their chronological sequence.

A chronological overview of pottery wares

A 'ware' can be defined as a recurring combination of distinctive attributes, including colour, temper, forming and finishing techniques, vessel forms and types of decoration (Henrickson 1994). In the absence of securely dated (local) stratigraphic contexts, it is through the integrated evaluation of these properties that we will have the most chance of gathering the maximum information from the surface material under scrutiny here.

Iron Age

It has been noted that the problems in identifying and dating surface material are particularly pressing for the second millennium BCE and Early Iron Age, partly because of the scarcity of excavated sites that can offer adequate parallels (Momigliano *et al.* 2011). At Çaltılar in northern Lycia, near Balboura and Oenoanda, material dated to the Early Iron Age (11th – 10th centuries BCE) has been attested in association with a presumed sanctuary site. This material is characterised by a production sequence resulting in a reduced core and oxidized margins (see *infra*), and various finishing and decoration schemes, including self-slip or wash, occasional burnishing, and a range of geometric decorations (Momigliano *et al.* 2011, 85-86). These can range from simple matt black bands to more complex motives such as concentric circles, triangles, crosshatched triangles and bichrome motifs. Occasionally, moulded and incised decorative elements are attested as well. Typical shapes include collared or ledged rim jars with a high neck and sometimes flattened top, storage vessels with a rounded or flattened protruding rim, a variety of open bowls with plain rim, flattened top rim, or flattened protruding rim. Bases can range from flat bases to ring bases or even occasionally high standing bases. Similar material was classified in the Balboura Survey (French 2012, 5).

Additionally, a second discrete group of burnished grey wares was also identified at Çaltılar (Momigliano *et al.* 2011, 93) and in the Balboura Survey, with an additional red monochrome ware (French 2012, 5-6). Although a regional production provenance cannot be excluded, it is suggested that these wares were either being imported from (north)western Anatolia – as the region was known to produce and export grey wares during the Iron Age (Bayne 2000) – or belonged to a class of Phrygian pottery, called Phrygian grey wares. These would become the predominant component of the local pottery production at Gordion from the 10th century BCE onwards. Large-scale production of grey wares started at Gordion in the Early Phrgyian period (950-800 BCE), and was characterised by increased standardization of shapes, vessel sizes, methods of manufacture and general simplicity of finish (Henrickson 1993, 2005). The Phrygian grey ware was attested over a wide spatial range in Anatolia, from the Meander basin in the west to Central Anatolia (Mellaart 1955; Summers 1994), whilst clearly regional off-shoots of this tradition need to be considered, such as at Çaltılar, the Balboura area and Kelainai (Lungu and Dupont 2016, 438) and perhaps also our study region. In addition to reduction-fired grey wares, production technologies at Gordion also included painted buff wares. Surface treatment generally focused on relative simple techniques, including occasional burnishing and thin slipping, whereas the majority of the material was smoothed or self-slipped (Henrickson 1994).

Although these wares can generally be dated to the Early Iron Age period, as well as the Middle Iron Age, its attestations on different sites in the area of Sagalassos can likely be dated to a more limited chronological range (9th-7th centuries BCE). In accordance with the image of Gordion and Çaltılar, two main wares can be distinguished: a painted buff ware and a thick slipped/burnished grey ware (Figure 8).

Figure 8: A selection of Middle Iron Age material from the study area of Sagalassos.

The most diagnostic type of pottery found in the research area which can be dated to the Early and Middle Iron Age are painted buff wares decorated with concentric circles, cross-hatched triangles, semicircles pendant from a ground line, fishnet patterns, bands and wave lines (Poblome *et al.* 2013b). Attested types in this painted pottery ware include bowls with flattened rims (B140), rounded rim cups (A180), storage vessels (G100/110), shifted rim vessels (H171), and collared jars (H160) (Figure 9). Earlier work by Dennis Braekmans (2010, 99) denotes this type of pottery with the term 'Matt painted' wares, noting them to be generally of a more fine grained fabric, with less inclusions and a higher standard of finishing compared to the common wares. This type of pottery has been attested at Düver, Hacılar Tekke, Cığırtkankaya Tepe, Aykırıkça, Seydiköy, Kepez Kalesi, Kayiş Kale, Kökez Kale and Çatal Pinar.

Four distinct matt painted fabrics have been distinguished, however, none could be linked exclusively to a single site or area. No strict chronological demarcation can be applied for this material, although it can be generally posited that this type of pottery circulated from the 9th until the 6th centuries BCE. Another characteristic element was a thick slipped/burnished grey ware, attested among others at Kökez Kale, Kayiş Kale, Seydiköy, and Kepez Kalesi and Sagalassos. While these grey wares are most commonly associated with the Early Iron Age, a continuation of self-slipped grey wares was attested extensively at Sardis until the 7th and 6th centuries BCE (Braekmans 2010, 21).

Again, in the absence of other diagnostic chronological markers, a wider potential chronological range should be considered. Examples have been attested at Kökez Kale, Kayiş Kale, Seydiköy, and Kepez Kalesi. In addition to burnishing, this ware is sometimes also decorated with so-called 'chevron' patterns, consisting of a sequence of 'V' mark incisions, which is attested at Kökez Kale, Kayiş Kale and Kepez Kalesi. Finally, a few fragments also carry an intricate stamped decoration, forming a fishnet pattern as attested at Kökez Kale, and can likely be dated to this period as well. Although the majority of the burnished pottery are reduced grey wares, some of the cream-coloured pottery display traces of burnishing as well, as attested at Kökez Kale.

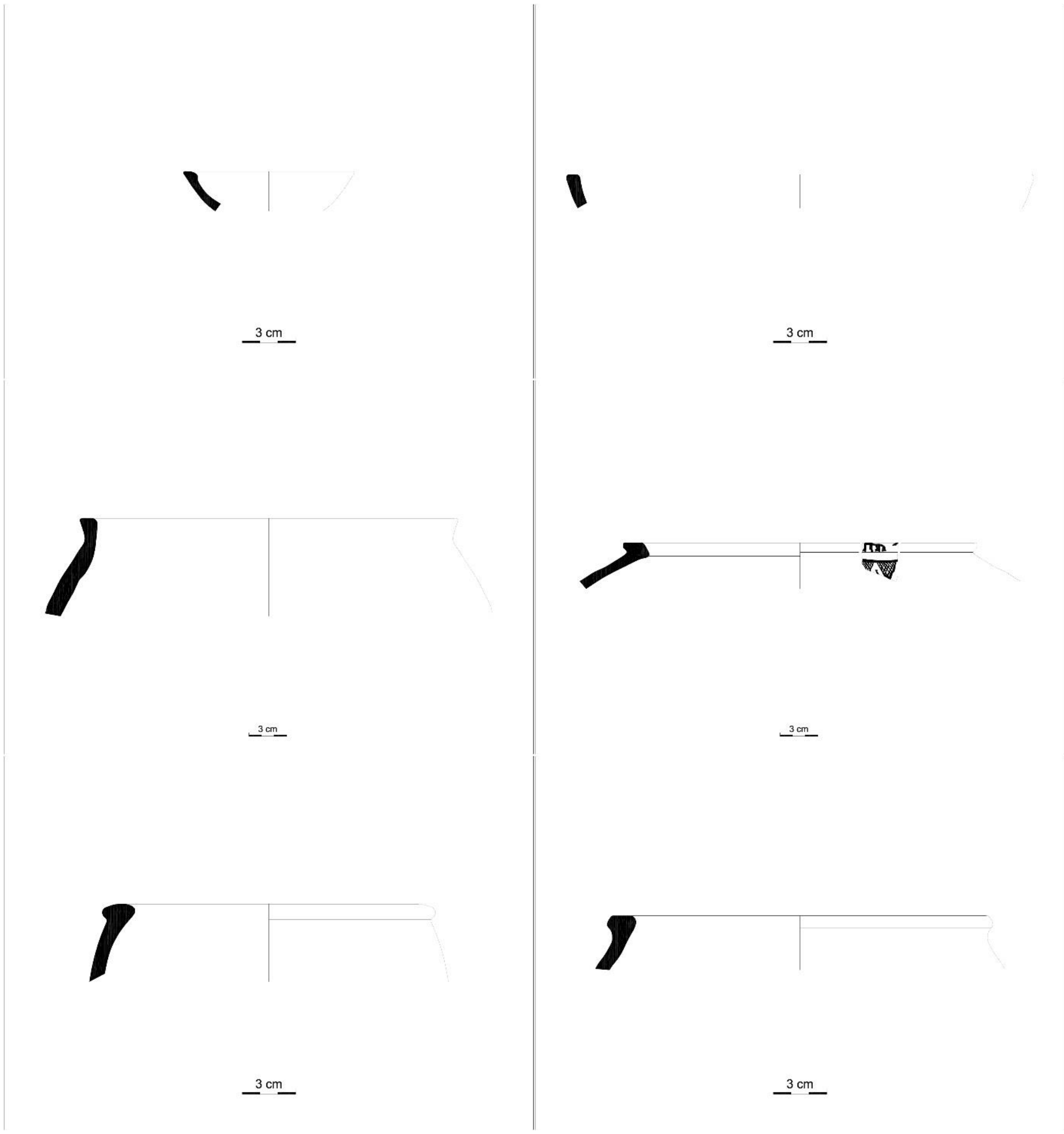

Figure 9: Painted pottery shapes; A180 (upper left), B140 (upper right), H160 (middle left), H171/G110 (middle right), G100 (bottom left), G110 (bottom right).

Additionally, one oxidized sherd with lustrous red surface treatment and extensive burnishing was attested as well at Kökez Kale. This fragment can be traced back to the earlier tradition of burnishing during the (Late) Bronze Age. Both the painted and burnished wares adhere to a more general trend in material culture production and design, but were likely produced regionally, even if the exact provenance site cannot be ascertained (Braekmans *et al.* 2017).

In the Late Iron Age (7th-6th centuries BCE) the painted pottery developed into a distinct banded painted ware, attested at Çaltılar (Momigliano *et al.* 2011, 97), Perge (Eschbach 2003, 89-90, 92) and Ulyupinar (Çokay-Kepçe 2009, 42). At Çaltılar, this type of pottery was considered to be imported from western Anatolia. At Ulyupinar, two groups, were attested: either a bichrome surface decoration covered with a cream coloured slip, or with decorations applied directly onto the clay (Çokay-Kepçe 2009, 42). This ware was characterised by a monochrome or bichrome banded decoration. Similar material was noted at Kelainai during the surface survey collection of 2008 (Dupont and Lungu 2011, 250). In the study area it was attested at Kökez Kale, Seydiköy, Kayiş Kale, Düver, Kepez Kalesi, and Çatal Pinar (Figure 10).

Characteristic shapes attested in banded painted pottery are folded rim jars (H130), straight collared jars (H160), deep plain rim bowls (B151), thickened rim jars (H111) (Figure 11). Interestingly, a number of sherds attested at Kökez Kale, Kayiş Kale, Seydiköy, and Kepez Kalesi display faint traces of burnishing as well banded painted decoration, suggesting perhaps that these can be considered as testimony for the transition from Middle to Late Iron Age (around the 7th century BCE). A type of straight flaring rim jar was attested, which, based on the partially burnished and banded painted decoration could be attributed to the Iron Age period (Figure 12). Unfortunately, we have no indications for the extended profile of these vessels, but they could resemble the local production of high collared rim jars attested at Çaltılar in the Middle Iron Age (Momigliano *et al.* 2011, fig. 26 A). Additionally, two other types of jars, a typical thickened rim jar and a shifted blocked jar, were attested (Figure 13).

Figure 10: Selection of Late Iron Age material from the study area of Sagalassos

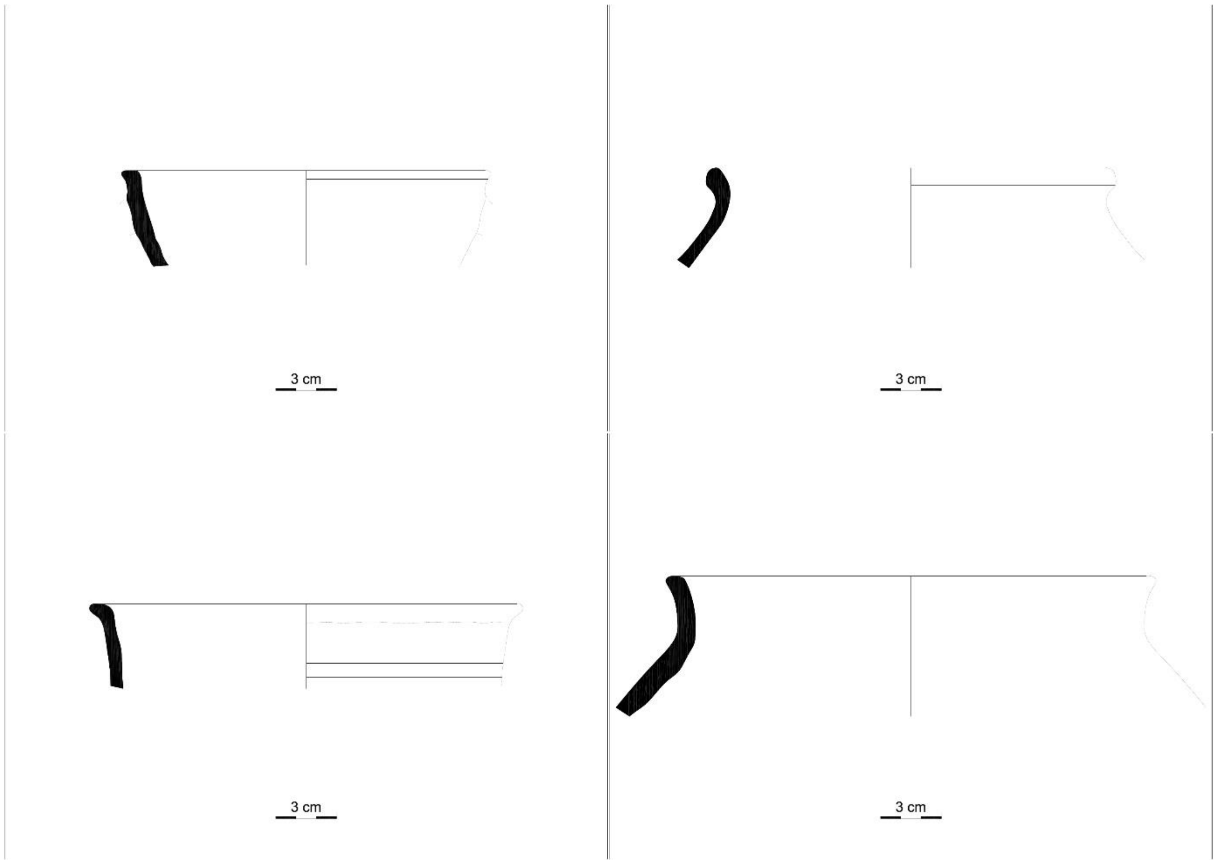

Figure 11: Banded painted pottery: B151 (upper left), H111 (upper right), H130 (lower left), H160 (lower right).

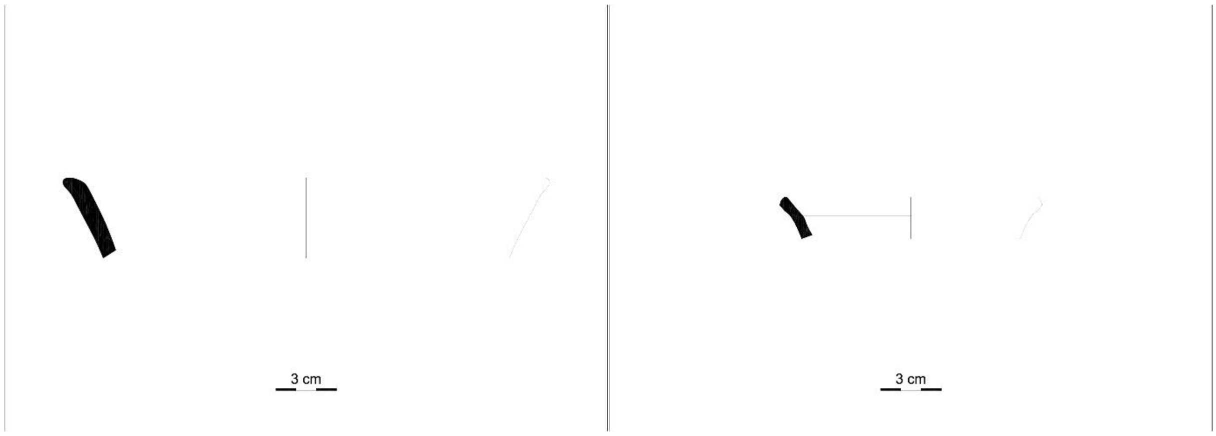

Figure 12: Middle Iron Age straight flaring rim jars.

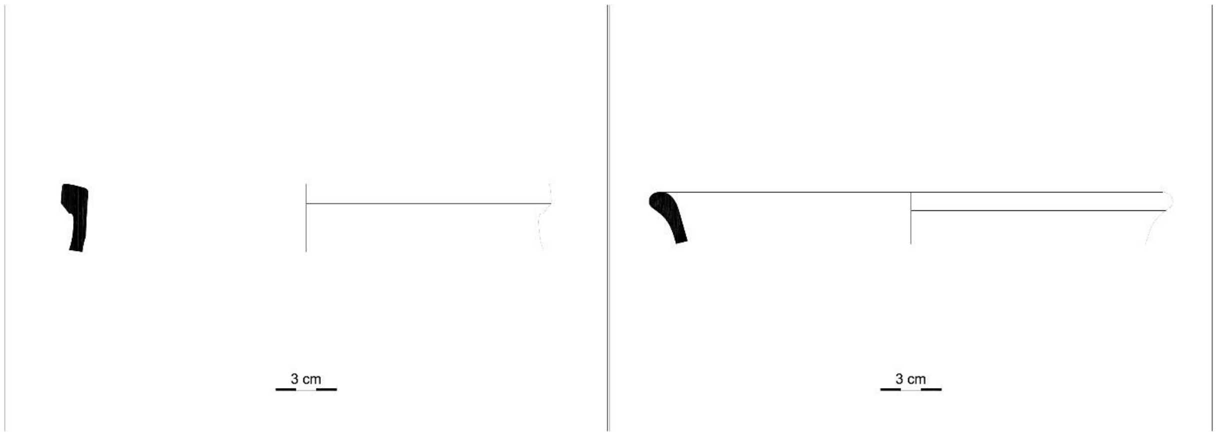

Figure 13: Middle Iron Age jars.

Also associated with the 8th to 6th centuries BCE is a fine- and medium-walled black-on-red ware, as attested at Çaltılar (Momigliano *et al.*, 92), as well as in the Balboura survey (French 2012, 5-6), at Kelainai (Dupont and Lungu 2011, 251), Perge (Eschbach 2003, 88), Gordion (Schaus 1992, no. 22), Ephesos and Sardis (Greenewalt 1973, 144, n.22), Pogla (Aydal *et al.* 1997, 141-172), Kilise Tepe (Hansen and Postgate 1999) Akalan (Cummer 1976, nrs. 16–18), and several sites along the Xanthos river and along the southern coast such as Tlos, Pinara, Xanthos, Patara, and Kaş. David French (2012, 9) defines the homeland of these wares in the regions to the south of the Maeander and west of the Sultandağları. Given the extensive distribution of the ware across Anatolia, Cyprus, and even the Near East, it was assumed that production was to be situated on Cyprus, which acted as a major connective network hub at the time. However, (an) Anatolian production(s) cannot be excluded (Schreiber 2003). James Mellaart (1954) was the first to identify the material as part of a characteristic southwest Anatolian ware tradition.
An extensive black-on-red pottery assemblage was also attested at a necropolis discovered at Ulyupinar, near Lake Gölhisar in the Burdur province, where three large mounds containing several graves were encountered, containing rich pottery assemblages dated to the Middle Iron Age. This ware can be classified into two subgroups, one with black decoration applied on slip, while with the other applied it on a plain burnished surface. Common decoration schemes involve linear and geometric patterns, including banded decoration, concentric circles, inverted triangles, dotted squares, ladders, checker boards, meanders and dot series (Çokay-Kepçe 2009, 37).

Figure 14: A selection of Iron Age material from Düver.

It was argued that these decoration patterns were highly influenced by Eastern centres, including Cyprus, Sardis, Gordion, and Kültepe, as well as the Aegean islands, in combination with local tastes (Çokay-Kepçe 2009, 39). The ware eventually became widespread throughout the Eastern Mediterranean from the 9th century onwards, resulting in the emergence of various production lines. Sardis has been distinguished as an important production centre of black-on-red ware in Anatolia, although clearly other production centres must have existed given the variability in attested fabrics. Petrographic and geochemical analysis on the Black-On-Red pottery of Düver indicated that these were

produced with local clays linked to the Burdur area (Braekmans *et al.* 2017), whereas local production has also been suggested for the material collected at Kelainai (Lungu and Dupont 2016, 438). The decorative patterns and morphological features of the black-on-red pottery at Ulyupinar most closely resembled the finds from Phrygia and Lydia, suggesting that they should be considered in light of the Southwest Anatolian Iron Age Pottery group coined by James Mellaart (1955). The functional spectrum of this ware included squat jugs, perfume bottles, cups, bowls, dishes (so-called 'fruit stands') and a variety of large open vessels, oftentimes associated with East Greek shapes (Braekmans 2010, 21). In the study area, this very fine-grained and high-quality ware was found in considerable amounts at Düver Ada, as well as in the associated settlements within the Burdur basin (Figure 14). Elsewhere in the area it was attested at Kökez Kale, Seydiköy, Aykırıkça and Kepez Kalesi.
A final distinct ware is the so-called 'Lydian Marbled ware', characterised by a distinctive method of decoration whereby overlapping and wiggling brush streaks – termed streak painting – were used to form an uneven streaked decorative pattern and create a marbling effect (Momigliano *et al.* 2011, 95).

Figure 15: Streak painted pottery.

Although the marbling technique could be attributed to different production centres, its origin has been established to be in Lydia, more specifically at Sardis and environs, during the late 7th-late 6th centuries BCE (Çokay-Kepçe 2009, 35; Greenewalt 2010), but likely continuing until the late 5th century BCE (Braekmans 2010, 24). Only one piece was attested at Kelainai and at Çaltılar, where it was associated with a 6th century BCE date, however, it was well attested at Ulyupinar (Çokay-Kepçe 2009) and Gordion (Henrickson 1994). In general, this ware can likely be associated with the same chronological range as the black-on-red pottery ware, *i.e.* 8th to 6th centuries BCE. In the study area it was attested only at Seydiköy (Figure 15). Both the Lydian marble ware and the black-on-red ware, rather than being a straightforward expression of Lydian influence, identity or ethnicity, should be seen as part of a broader (west) Anatolian tradition prevalent at this time (Braekmans 2010).
In addition to the distinct decorated Iron Age wares discussed so far, a considerable amount of undecorated common wares was found throughout the research area as well. In the previous part, we already discussed the three major fabric lines observed in these sherds, based on the material from Kayiş Kale and Seydiköy. A macroscopic study by Dennis Braekmans (2010, 105-110) identified seven distinct fabrics in the common wares of the study area. In general, these follow the same major lines of the analysis discussed in the previous part and recognise the same general trajectories of production are identified, ranging from rough feel and abrasive break with abundant inclusions to rather smooth, straight and little inclusions. In the next part, we will try to associate some of these fabrics with a more precise provenance area.
It is apparent that comparatively less fragments attributable to the open tableware component (cups, bows, dishes) can be observed. Whether this is due to a preservation bias or different production quantities is at this point hard to assess. Of the little material we do have, a type of deep bowl with a fairly straight wall profile and rounded rim appears to be a characteristic element recurring at various

sites, including Seydiköy, Kepez Kalesi, Kökez Kale, and Kayiş Kale. In one case, the onset of an ellipsoid handle could be found about 2 cm underneath the rim (cfr. Figure 11). Another characteristic shape is the large open dish with a flattened and sometimes protruding rim, produced almost exclusively in a rough undecorated reduced grey ware, sometimes with black core (Figure 16).

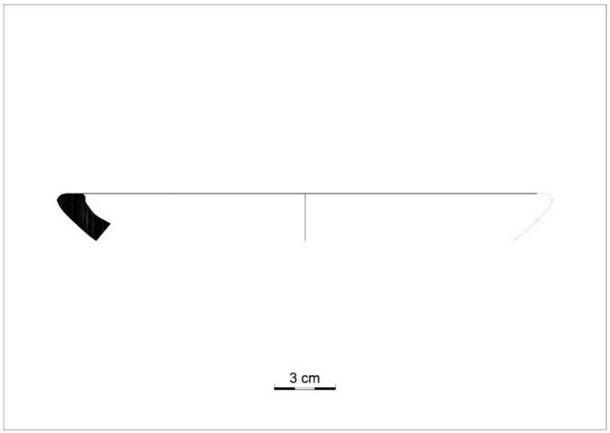

Figure 16: Large open dish.

They were mainly attested at Aykırıkça, but also at Hisar, Kökez Kale, Kayiş Kale, Çatal Pinar, and Keraia. A smaller, more refined dish variant is attested as well at Hisar, Kökez Kale, Kayiş Hale, Kepez Kalesi, Çatal Pinar, and Keraia (Figure 17).

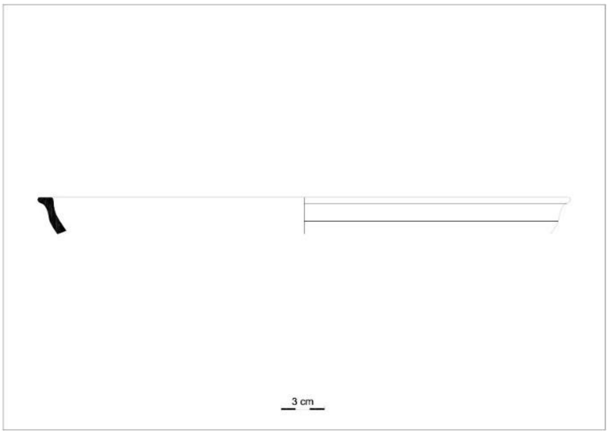

Figure 17: Open dish with pronounced rim.

In Achaemenid and Hellenistic times, these dishes would develop into dishes with rounded rims (C170), flattened protruding rims (C171) and both in and outward protruding rims (C172) (Daems *et al.* 2017). In Roman imperial times, the type continued in the production of Sagalassos Red Slip Ware as type 1C170 (Poblome 1999). Other characteristic shapes for this period are the relatively high collared jars, with a straight neck profile (Figure 18). This high collar reoccurs in a variety of rim shapes. One of the most commonly attested shapes is the plain folded rim jar, where the rim is folded outwards horizontally, with either a straight of slightly flaring neck profile (H130). The turned part of the rim can either be plain or significantly thickened. Depending on the gradient of the turn we can also distinguish between the horizontal or slightly downwards folded rims of this type, and more upwards sloping rims, with a gradient of 45° compared to a perpendicular neck profile. For the fragments where a larger part of the profile was preserved, a carination in the wall leading from a convex body up to a straight or slightly flaring neck seems to be characteristic. Sometimes these high collared jars are flattened at the top, resembling some Middle Iron Age parallels at Çaltılar (Momigliano *et al.* 2011, 88, Fig. 26 D & F). A final type of jar appears to be characteristic, albeit relatively rare, for Iron Age pottery, characterised by a strap handle appearing in, or even curved above, a simple out-turned rim. Characteristic for these jars are the wide strap handles, either long and straight, or curved, in the latter case sometimes transitioning into the rim at the upper end.

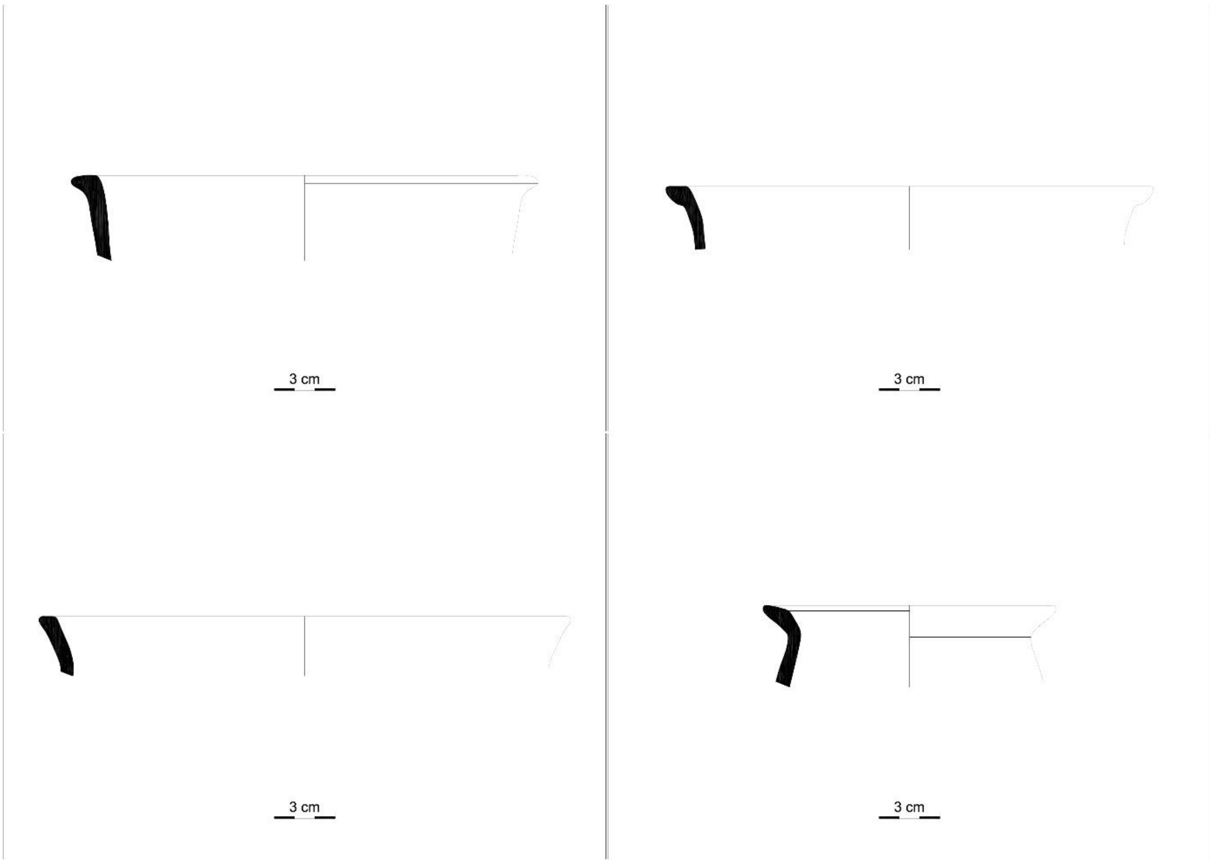

Figure 18: High collared jars from Middle and Late Iron Age. H130 (upper left), H131 (upper right), H160 (lower left), H240 (lower right).

The Achaemenid period

The main difference between the pottery at Düzen Tepe and that of the material discussed so far is the notable absence of painted wares. This has been considered a meaningful chronological indicator (Poblome *et al.* 2013; Vanhaverbeke *et al.* 2010). Based on this absence, in corroboration with numismatic and ^{14}C analysis, the pottery from Düzen Tepe – as well as the earliest phases of habitation at Sagalassos – has been dated to the late Achaemenid and early Hellenistic periods, as has been discussed extensively in earlier contributions (Daems *et al.* 2017; Daems and Poblome 2017). Instead of the painted wares, a tin, mottled colour slip seems to become the prevalent surface treatment. Local production became increasingly oriented towards a new range of products within the so-called 'colour-coated' wares (Hayes 1991; Poblome *et al.* 2013). Although fabric idiosyncrasies have sufficiently been noted, the morphological features of the common wares in both periods seem to largely correspond. Especially for the common wares, macroscopic differentiation between Iron Age and Achaemenid pottery can be quite difficult and can only be clearly based on association – or lack thereof – with more diagnostic wares. If the latter include painted wares, a general Iron Age date for the assemblage can be suggested. If it pertains to a class of unpainted but mottled slipped buff wares, these can be placed in the Achaemenid period, as for example at Düzen Tepe.

During the fabric analysis of the Iron Age material found at Kayiş Kale (see *supra*), the large similarities in overall production logic and technologies with the fabrics of Düzen Tepe were immediately noted (Figure 19). One notable difference is the hardness of many sherds compared to the soft and powdery nature of Düzen pottery. This was likely a result of the combination of usage of specific clays, firing conditions and different preservation conditions in local soils. An in-depth comparison will take us too far at this point, however, it can be stressed that these communities operated largely in a similar techno-productive context based on local conditions, preferences and resource availability (Braekmans *et al.* 2017; Neyt *et al.* 2012). In addition to this local 'substrate' of material production, these communities partially oriented themselves to prevalent wider modes of material culture formation and shaping, in the case of Kayiş Kale (and contemporary settlements) the painted and burnished wares, whereas at Düzen Tepe an orientation towards colour coated wares was noted.

Figure 19 A and B: Collection of pottery from Düzen Tepe (A: up) and Kayiş Kale (B: down).

Many of the types identified at Düzen Tepe also feature frequently in the common ware component in the study area. For example, the folded rim jars (both the upward and horizontally folded type) occur in the late Achaemenid material of Düzen Tepe as well as in the Hellenistic material of Sagalassos. However, in both cases it was only marginally present. In the studied survey material, by contrast, it was by far one of the most numerous and characteristic elements in the sample (n=156 or 31.4% of the selected rim fragments). We interpret this marked abundance of material as a characteristic element of the selected sample, suggesting that it may be indicative of the common ware assemblage chronologically preceding Düzen Tepe, and therefore associated with the Iron Age occupation at various sites in the study area.
Another element is a type of flattened rim jars with marked high neck (n=15), which only highly exceptionally appears at Düzen Tepe. We will not discuss all types individually or in great detail (to that end, see Daems *et al.* 2017 and *infra*). However, material dated to this period could be identified on each of the major sites – except for Bereket – in our sample (Kökez Kale, Seydiköy, Kayiş Kale, Çatal Pinar, Kepez Kalesi, Düver, Keraia, Aykırıkça, and Hisar). Clearly, the Achaemenid period was a pivotal age in the historical trajectory of the study area. We will therefore return to the marked changes in settlement patterns and modes of community organisation later on in this paper.
One additional novelty emerging in the late Achaemenid material of the area was the presence of a (marginal) component of black-glazed pottery[540]. This general development where painted wares disappeared, to be replaced with fully-slipped mottled or monochromic pottery, such as the colour coated and black-glazed wares, was observed not only in the study area, but as a general phenomenon in the eastern Mediterranean as well (Braekmans 2010, 30). Instead, black-glazed pottery develops into a major product, spread all over the eastern Mediterranean from the 4th century BCE onwards (Rotroff and Oliver 2003). Testimony to their popularity is the observation that, while Attic in origin, local production lines would develop at several places in Anatolia during the 5th to 3rd centuries BCE. Likewise, geochemical and petrographic analyses suggested that in addition to some imports, a local production of these black-glazed vessels was initiated in the study area as well during the 4th or 3rd centuries BCE, displaying high similarities with the powdery buff wares that constituted the main component of the local tableware assemblage at the time (Braekmans 2010, 302).

The Hellenistic period

In Hellenistic times, the tradition of colour coated wares continued, albeit covering a slightly larger variation in colour, including orange, brownish red or black slips – with an apparent preferences for the more orange parts of the spectrum – which are generally thin and dull or watery in appearance. Most studies on Hellenistic pottery material in the study area have focused on the sites of Sagalassos (Daems and Poblome 2017; Poblome *et al.* 2002; van der Enden *et al.* 2014a,b; Poblome *et al.* 2013a,b) and Kozluca (Poblome *et al.* 2002; van der Enden 2013). Archaeometric analysis conducted on Hellenistic tablewares from both sites concluded that these wares were actually highly similar, despite apparent macroscopic differences (Poblome *et al.* 2002). The Hellenistic pottery at Kozluca was characterised by a type of very fine and hard grey tableware fabric.
Interestingly, however, it has been noted that the morphological assemblage attested at this site, differed significantly from that of Sagalassos (van der Enden 2013, 350; Waelkens *et al.* 2000, 190-192). Most notably, the extensive presence of mouldmade bowls, large grey ware upturned rim dishes, rolled rim plates and projecting rim plates, rouletted cups and bowls has all been attested at Kozluca (Figure 20). It has been suggested that the matter site was more closely connected to a mode of material culture production prevalent in Hellenistic sites at the west coast of Asia Minor (van der Enden 2013, 350), whereas Sagalassos was likely more oriented towards the Anatolian inland (Daems *et al.* In Review). Alternatively, it has also been suggested that the material at Kozluca was slightly later in date (2nd – 1st centuries BCE) compared to the assemblages from Sagalassos (3rd-2nd centuries BCE) that were used in comparison. Indeed, if we look at some of the late Hellenistic contexts at Sagalassos, the presence of types such as upturned rim dishes, rolled rim plates and projecting rim plates has been

[540] 0.1% of study assemblage at Düzen Tepe (n= 26,813) (Braekmans 2010).

noted (van der Enden 2014a). Still, the hard grey fabric typical for Kozluca appears sufficiently distinct to maintain the suggestion of a markedly different technological production context at both sites.

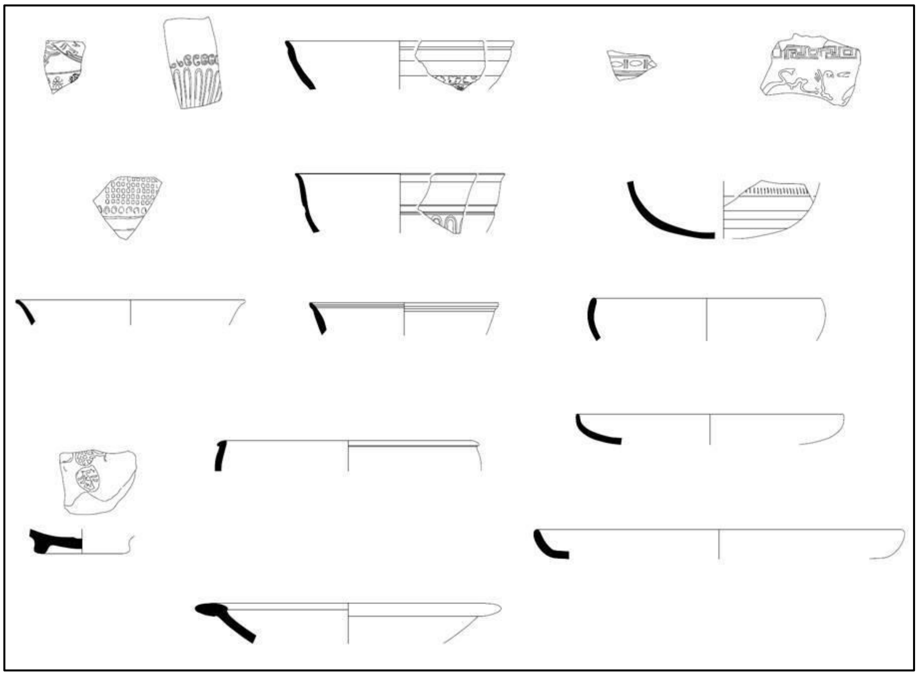

Figure 20: Selection of Hellenistic material from Kozluca.

Whereas in Achaemenid times, the community at Sagalassos mainly exploited clays found at, or in the immediate vicinity of the site, in Hellenistic times it would increasingly start to exploit very fine clays from the nearby Çanaklı valley for its production of tablewares (Braekmans *et al.* 2017; Poblome *et al.* 2002). Clearly, Sagalassos at this time started to consciously move beyond the previously set limits of its immediate vicinity for targeted exploitation of suitable raw materials to sustain its own productive processes.

Most of the Hellenistic tablewares found in the study area were characterised by a well levigated orange fabric, with only few inclusion and pores, and were attested at almost all sites with clear Hellenistic occupation phases (Braekmans 2010, 104). Several distinct elements could still be noted, however. A distinct Hellenistic Red tableware was retrieved exclusively from Düver, generally fired very hard and with straight break and smooth feel, again indicating some degree of independence of this area compared to the rest of the study area. The Hellenistic pottery of Bereket is made of a very fine orange fabric, with an orange mottled slip covering all or part of the vessels. A preliminary macroscopic study of this pottery indicated that slip, fabric and typology were sufficiently distinguishable from the Hellenistic material of Sagalassos to postulate that the settlement at this point of time was likely oriented towards other spheres of influence, possibly grafted onto Kozluca and Düver. More studies are needed to confirm this hypothesis. Two interesting finds of Hellenistic tableware pottery with West slope decoration were attested at Kepez Kalesi, pertaining to a 3rd century BCE plain rim bowl and small saucer.

Pottery production and provenance

Now that we have discussed the material both from a fabric and ware perspective, can we perhaps provide some suggestions towards a better delineation of the provenance of this material?

In the previous part we already discussed the petrographic and geochemical analysis conducted by Dennis Braekmans and colleagues (2017), which distinguished four general local provenance zones (the Burdur area, the Ağlasun/Çanaklı valleys, the Çeltikçi valley, and the Berket basin). While clear-cut associations between these provenance areas and individual fabrics are hard to draw given the widespread distribution of some of the material across different sites, certain trends can be noted and

some closer site- and area-specific associations could be suggested, based on the associations between fabric and ware properties, as well as raw material usage and provenance.
For example, it was already noted how the clays from the Burdur area in particular could be clearly differentiated from the rest of the study area. This geochemical signal can now be associated with the distinct black-on-red pottery, which appears in considerable quantities at Düver and other sites in the Burdur plain. It was also noted that one mica-based microporous common ware was only attested at Düver (Braekmans 2010, 106), likely as a result of the specific usage of fine-grained local Burdur clays. The same distinct Burdur-based signal continues well into Hellenistic times and can be associated with the Hellenistic Red pottery fabric. Hardly any fabrics dominating the Burdur area were encountered in the Ağlasun area, and *vice versa*, suggesting a minimal degree of contact between both areas, especially in Iron Age and Achaemenid times. By contrast, in Hellenistic times Sagalassos and Kozluca would both start to tap into the resource availability of the Burdur area, likely testimony to the extended spatial claims of both communities. Interestingly, however, Sagalassos-based production would only enter the Burdur area in significant quantities in early Roman imperial times, with the preceding Sagalassos-based Hellenistic production of tablewares virtually absent in the area. Whether or not this one-sided flow of resources could be interpreted as a sign of the development of exploitative political networks, rather than two-sided economic exchange or any other kind of connective mechanism, is unclear for now. If the observed patterns were indeed part of larger networks of exchange, then we do not (yet) see clear attestations of the return flow.

Different degrees of distinction in trace elements were also associated with the sites around the Çeltikçi valley, on the one hand, and the Bereket basin, on the other. For the latter, a more close geochemical affiliation with the Burdur clays could be suggested (Braekmans 2010, 313). It is interesting to note that for the Hellenistic material of the Bereket basin, this also translates in the use of different fabrics and the production of a clearly distinct shape and type assemblage compared to the contemporary material at Sagalassos. By contrast, the material appears to be more closely affiliated with the Burdur area resources. To what extent these associations in raw material usage between Kozluca, Bereket and the Burdur plain can also be traced morphologically still needs to be evaluated. It has been noted that the brown-grey late Hellenistic tablewares attested at Sagalassos were most likely produced at Kozluca or somewhere else in the Burdur area, which could possibly provide additional indications for the intensification of (exchange) contacts between these areas. (Braekmans 2010, 315).
Finally, the southern area of the Çeltikçi valley could at certain points be distinguished. For example, one group of common wares with a more red-brown fabric colour, occasional grey core, and smoothened surface with general lack of any additional surface treatment, appeared most prevalent in this area, particularly on the sites of Seydiköy and Keraia. This fabric was likely associated with the use of the predominant calcite-sedimentary clays in this area. However, a significant degree of overlap with the Ağlasun area on the one hand, and the Çeltikçi area on the other, was noted as well. A matching volcanic-biotite component in the pottery assemblage of the Çeltikçi and Ağlasun areas could be associated with the so-called Aykırıkça ware, attested most notably in the characteristic large open dishes found at this site, but also in the south (Braekmans 2010, 314). To what extent this overlap can be associated with a certain degree of contact between both areas, or the use of similar clays in distinct local production centres, remains unclear for now.

Diachronic comparison

A comparison of typological assemblages can be found in Figure 21. For this comparison, we consider merely continuities and discrepancies in material assemblages dated to specific periods, combining for example the material from the various sites in the study area discussed above in one general comparison. Given the noted difficulties in distinguishing between (Late) Iron Age and Achaemenid period material, especially in surface material, we take into consideration only those types identified through association with diagnostic elements such as painted or burnished wares, as well as those types clearly attested in both periods of time, as part of the Iron Age assemblage, or attested through parallels. We consider this body of material together as Late Iron Age/early Achaemenid in date, due to the aforementioned local trajectory of material production. These are compared to the (late) Achaemenid material of Düzen Tepe and the Hellenistic material from Sagalassos. Likewise, for Düzen Tepe and Sagalassos we combine type counts of different excavations which can be placed in the same general chronological bracket. For Düzen Tepe, this pertains to the Courtyard Building, Bakery and Kiln Area excavation, whereas for Sagalassos we combined material from the Upper Agora, the Odeon, Site N and Site F.

The combination of different sites and excavations for these counts also resolves the potentially problematic differences in sample size between the first three components. While by far the highest amount of material in this comparison is derived from Düzen Tepe, this at least allows us to try and draw some meaningful comparisons. Only for the Hellenistic material from the study area comparatively less material was included as this was not the main aim of the material studies, but rather pertains to a count insofar it was encountered in search for Iron Age material. Type codes used in the table are those of the existing typologies of Düzen Tepe and Sagalassos pottery, supplemented with a few specific additions for the material identified only in the study area. Green and red denote presence and absence, respectively, while yellow in the last column denotes an absence, but whose potential presence might be suggested based on attestations at contemporary Sagalassos.

Type code	Study region	Düzen Tepe	Sagalassos	Hellenistic TAS
A120	0	97	29	14
A130	0	0	55	24
A131	0	0	14	0
A180	1	0	1	2
A200	0	0	5	2
B140	5	31	0	5
B150	13	16	35	27
B151	7	0	0	0
B170	3	78	45	12
B230	0	4	0	1
B270	0	0	25	0
C120	3	53	0	0
C170	8	7	16	4
C171	33	11	4	4
C172	6	9	0	5
C260	3	0	4	2
C270	0	0	1	0
C280	0	1	36	0
C290	1	9	7	1
F120	2	3	3	0
F150	27	12	43	6
F151	0	1	7	1
G100	11	12	0	1
G110	8	13	0	4
G120	9	8	0	0
H100	15	22	8	5
H101	19	15	3	1
H102	6	3	1	0
H110	15	26	2	3

H111	18	38	1	3
H112	1	2	2	1
H120	8	0	0	3
H130	95	9	2	10
H131	28	0	0	0
H140	3	8	29	0
H150	5	1	1	1
H160	14	5	0	4
H170	9	1	5	2
H171	1	0	0	1
H180	8	0	0	0
H240	43	0	2	0
H260	4	0	6	3
Q200	1	71	5	4
Q210	2	40	19	3
Q220	0	7	0	0
Q240	0	0	2	0
Q250	0	1	1	5
Total	435	614	419	164

Figure 21: Diachronic comparison of types and counts of diagnostics from study region, Düzen Tepe and Sagalassos.

Some immediate observations can be made on this simple side-by-side comparison. It can be noted that only one fragment of cup types (A) was attested for the Iron Age assemblage in the study region. While it could be that some fragments were erroneously assigned to the Achaemenid period, it should be noted that diagnostic material belonging to the finer tableware spectrum was generally less present. This general lack of fine-walled cup types might be due to preservation conditions related to the genesis of the surface material.

A next notable observation is that a wide diversity of types is present in the jug/jar (H) component of material from the study region. It should be noted however, that this component is by far the most numerous in this part of the sample, suggesting that survival bias could have been at least partially a contributing factor. Finally, the absence of cookwares in the study region's assemblage is apparent. Here it should be noted that a certain morphological overlap exists between jar and cookware types, for example H101/H111 and Q200 respectively denoting small/large thickened rim jars and thickened rim cooking pots, or H140 and Q240, respectively denoting almond rim jars and almond rim cooking vessels, where the difference in these types pertains to the attested fabric rather than morphological distinctions. For Düzen Tepe, common wares and cookwares are quite easy to distinguish. A similarly clear distinction cannot be made for the material from the study area. Possibly, no clear fabric differentiation and associated production specialization was present in Iron Age times, implying that it cannot be excluded that part of the extensive jar component of this material was actually used for cooking as well. Additionally, it also possible that cookwares associated with this period are not recognised as such in the undifferentiated surface material.

Overall, 47 distinct types or variants have been noted across the selected sites and time periods. If we compare only the material of the study area with that of Düzen Tepe, it can be noted that only six types do not feature in either assemblage. For 26 out of the remaining 41 (63%), attestations were found in both components, thus indicating significant typological continuity. Of the 15 types attested in only one of both, five were exclusive to the earliest periods, whereas interestingly, four were attested in the earlier period, as well as the subsequent Hellenistic period, but not in the intermediate Achaemenid material. These include a type of cup, upturned rim plate, and two types of jars. Of the latter, the upward folded rim jar (H240) in particular seems like a peculiar case as it was a major

component of the Iron Age and early Achaemenid material, yet, is absent at Düzen Tepe, and resurfaces – albeit marginally – in Hellenistic times. Whether this absence is specific for the site of Düzen Tepe or rather for the whole period is difficult to assess at this time.
If we extend the chronological range, 25 out of 47 types (51%) were attested in all three periods (19 out of 47 if we count only Sagalassos and exclude the other sites in the study region), again indicating significant continuity in material culture. The diversification of cup types through time can be particularly noted. Virtually no traces of this type group are attested in earlier times, in the late Achaemenid material of Düzen Tepe, specialized production of a single type, the Achaemenid bowl, was noted, whereas in Hellenistic times, a wider variety of typological diversification emerged. The absence of storage vessels (type group G) in the Hellenistic material of Sagalassos has been noted earlier. It was posited that this could be due to the nature of the contexts where the majority of the material was collected, associated with the construction and usage of the Hellenistic phase of the central agora. The presence of storage vessels in the contemporary surface material gathered in the surrounding settlements seems to corroborate this suggestion. A more in-depth comparison between the Düzen Tepe and Sagalassos assemblage has already been presented in part 4.2.1.4. and will not be repeated here.

Discussion

For the final part, let us now move from this pottery-specific discussion to a more general discussion to arrive at some conclusions regarding community formation, social organisation and settlement patterns in the study area of Sagalassos from Iron Age until Hellenistic times. At times, this discussion will posit more questions then can be answered given the state of our knowledge and available data. We therefore consider this work to be only a first step towards a more integrated understanding of settlement patterns and community dynamics in these times.
In the Middle Iron Age, settlement patterns were oriented onto a number of hilltop sites, and a series of agricultural villages in the large plains. The relation between both configurations is not entirely clear. Some have argued that these hilltop sites each controlled a single valley (and associated farmsteads) (Vanhaverbeke *et al.* 2011). Others, however, suggested that sites in the mountainous areas and those in the plains were actually part of a more integrated settlement system (Poblome *et al.* 2013b). The former hypothesis will likely be correct for many relatively small-scale settlements at this time, each operating within distinct valley systems according to a local logic of material production and subsistence strategies.
However, it does not explain the full picture. The advantage of the latter hypothesis is that it provides a better overall explanatory framework to interpret the meaning of observed changes in the archaeological record. It was noted that the location of the major settlement of Düver Ada along a series of important natural connections and avenues of communication, could have held the explanation for the prominence of this site and its rich material culture at this time (Poblome *et al.* 2013b). On the one hand, it was part of the only east-west connection between the area of the Burdur lake and the valleys to the west centred on modern-day Denizli, on the other hand this east-west connection transitioned into *the* major north-south corridor connection the Anatolian highlands with the Pamphylian coast, through the Burdur-Fethiye corridor. It was therefore suggested that its prominent position along a large agricultural plain, would have allowed the community to exploit sufficient agricultural potential to sustain a significant settlement, whereas its location on a key node within these major avenues of connectivity, might have allowed the community to tap into wider developments connecting large-scale Mediterranean networks of exchange with the Anatolian inland. It was suggested that the contemporary hilltop sites noted earlier could perhaps be considered part of this settlement system as dependencies of the principalities in the plain areas, providing strategic control over these thoroughfares (Poblome *et al.* 2013b).

The material culture found at these sites offers some additional perspective as to the possible underlying drivers of community formation and development. The pottery material at this time consists of two major components, high quality tablewares such as painted wares, burnished grey

wares, and black-on-red wares, in addition to an extensive component of utilitarian common wares. Whereas the former are characterised by extensive care in surface treatment and decoration schemes, the latter are generally more rough and unfinished in nature. As can be expected, common wares appear at every site in the study area, regardless whether these were (fortified) hilltop settlements, major plain sites or villages. The distribution of the high quality tablewares – while spread fairly extensively across many different sites – is much more uneven, and nowhere in the study area did we encounter such large amounts of high quality vessels in these traditions as at Düver and associated sites. It can perhaps be considered indicative for this hypothesis that at Panemoteichos, a settlement towards the south also located at the edge of a fertile plain along this natural thoroughfare towards the Pamphylian coast, similarly extensive amounts of black-on-red pottery have been attested (Aydal *et al.* 1997, 151-152).
It can be suggested therefore that these wares might have been testimony for the participation in wider networks of interaction. Abundant parallels for these wares have indeed been noted, and, for example, the black-on-red ware in particular has been famously described as a characteristic southwest Anatolian ware tradition (Mellaart 1955). The interpretation of Düver Ada as seat of a local dynast influenced by Phrygian traditions (Waelkens *et al.* 2000, 207-208) can likely not be upheld. However, the site clearly played a major role in local settlement configurations, likely acting as some kind of central place for the wider hinterland at this time. Still, the common ware component was just as well recognised at the major site of Düver Ada. Here, we see a duality in material culture, a local 'substrate' of material cultural centred on local traditions of shaping, production and usage of ceramic vessels. This local substrate was supplemented with an additional level of material culture, the introduction and integration of which was dependent on the association with larger-scale dynamics operating on a regional and interregional scale throughout southwest Anatolia.

These developments stand in stark contrast with the developments in the more mountainous areas towards the east, as for example the Ağlasun valley, which was more distant from these avenues of connectivity and saw only limited development of systematic occupation with traces of significant settlements only found at Aykırıkça and Taşkapı Kale. Additonally, wetland indicators in the pollen record (*Carex, Apium/Berula* type*, Sparganium/Typha angustifolia*) show highly increased values, suggesting that large parts of the Aglasun valley at the time would have been rather unsuited for extensive human occupation (Bakker *et al.* 2011, 253).
It could perhaps be suggested that combination of unsuitable local circumstances and the central place function exerted at Düver operated as a 'push/pull forces' in the local landscape (Altaweel 2015; Chliaoutakis and Chalkiadakis 2016; Crema 2014; Turner 2003). This resulted in settlements like Düver Ada drawing in the available towards the larger fertile plain areas, while at the same time constraining the potential of other parts of the hinterland for developing extensive settlement patterns. It was hypothesised by prof. Jeroen Poblome that the seemingly paradoxical observation of human impact in light of an apparent lack of widespread human occupation in the Ağlasun valley, as well as the nearby valleys of Buğduz and Gravgaz, from 800 BCE onwards, could perhaps have been somehow associated with the development of Düver Ada as such a system hub in the western part of the study area. It was suggested that energy needs of developing communities in the Burdur plain induced a widespread deforestation of the slopes in the neighbouring valleys, triggering the widespread erosion phase noted in the palynological record (Bakker *et al.* 2012).
For now, no conclusive answer can be offered. To corroborate this hypothesis, a number of additional studies are needed. First, the energy requirements of communities such as Düver need to be approximated. To this end, the parameters of a model of wood exploitation strategies recently developed and applied to Roman imperial Sagalassos (Janssen *et al.* 2017) could be adapted to fit the particularities of this context. Next, the available energetic potential of the immediate hinterland of the site should be estimated and compared to the expected energetic potential, to assess whether the local landscape could have provided for these requirements or whether additional import was needed from the surrounding valley systems. In the case of the latter, the nature of potential pulling dynamics exerted by sites such as Düver onto the wider hinterland need to be elucidated and approximated.

Fulfilling these considerations would bring us too far in the current context. However, these questions can act as guiding principles for future research.

It is against this background that in the late 5th century BCE occupation at Sagalassos and Düzen Tepe emerged, as part of an existing tradition of elevated sites located on hill slopes or raised plateaus. Whereas the suggested pulling force from the Burdur plain constrained the development of extensive human occupation in these lands for the better part of several centuries, at this time changes appear to be abound. Alongside the origin of habitation at these two sites, several small farmsteads across the valley landscape have been observed to emerge as well. Could it be that these pulling forces from the Burdur plain started to weaken at this point to allow more decentralised local development? If so, can the answer be found in local configurations and developments? Or should we perhaps look at wider developments in prevalent orientations and focus points of system dynamics?
Around the middle of the 6th century BCE, the existing geopolitical relations in the Near East were completely overthrown with the rise of the Achaemenid empire, covering a huge landmass extending from Anatolia to the river Indus. Could the predominantly continually-oriented configurations of the Achaemenid empire, have changed the prominence of existing pathways of communication and interaction? For the region of Pisidia, the emergence of Kelainai, the Achaemenid capital of Greater Phrygia and local administrative seat of the Achaemenid government at 50km to the north of Sagalassos, would likely have had a marked influence on local flows of information. However, to what extent this would have altered the importance of sea-bound connections with the Pamphylian coast, or reorienting major lines of transportation and communication towards the Anatolian inland, remains unclear. It is therefore also difficult to determine whether any impact on the importance of Düver Ada could be supposed.
Some caveats should be stated for such a direct connection at any rate. First, a considerable lag time existed between the Achaemenid conquests and the observed changes in local settlement patterns. Of course, to some extent we must account for existing pathways of development, which tend to contain and expend energy and resources in a given direction of system dynamics, thus generating a delayed system response to changing environmental (as in external) circumstances. The typological continuity observed in the pottery material from Iron Age to Achaemenid, and even Hellenistic times could perhaps be seen as testimony to such continued pathways of development. Additionally, it must always be remembered that the observed changes in the archaeological record are (fragmentary) traces of the material reflection of already ongoing social dynamics. To what extent our chronologies of this material coincide with the actual chronologies of events should always be questioned, and it cannot be excluded that the changes dated to the late 5th century were already initiated earlier to some extent. Still, the lag is considerable in this case, and some additional explanations will need to be offered for this scenario to be considered a serious explanation.
Alternatively, the explanation could, for example, also be found in more ‘mundane’ processes of population growth and aggregation. The impact of the Persian conquest of Anatolia on local settlement patterns has also been noted at Balboura in Lycia, where it was suggested that the period of Persian rule coincided with a switch to pastoral subsistence strategies, in contrast with the agricultural settlement systems prevalent in the preceding and subsequent periods (French and Coulton 2012, 59).

Regardless of the underlying reason, community formation eventually occurred at several places in the hitherto more ‘marginal’ landscapes, including notably at Düzen Tepe and Sagalassos. It has been suggested that in different parts of the local landscape, this shift can be partially explained by slope erosion, following deforestation activities that had been ongoing since *c*. 800/700 BCE and would have left most of the limestone slopes without cultivatable sediments by *c*. 300 BCE (Dusar 2011, 172). In turn, the eroded sediment accumulating in the valley would have resulted in the creation of large fertile areas suitable for crop cultivation, thus effectively paving the way for more extensive human occupation and the amelioration of local potential for community formation and settlement development. Large scale agricultural activities on these lands could then, for example, explain the observed changes in the palynological record associated with the onset of BOP in Gravgaz and Bereket.

It has been noted how the material culture associated with the early phases of community formation at Düzen Tepe and Sagalassos was markedly different compared to the preceding Iron Age material. Whereas the latter was characterised by pottery wares with abundant decorative schemes and variation in finishing techniques, the former was embedded in a tradition of thin, mottled colour-coated slips, displaying a significant reduction in decorative 'richness'. While the presented data do not contradict this general observation, it should be nuanced by repeating that significant typological continuity could be observed. However, richly decorated pottery wares were still being produced in Achaemenid times, as for example in Gordion (Henrickson 1993), although these no longer seem to be part of the local repertoire of material culture observed here. To what extent this development can be considered characteristic for the Achaemenid period at large, or rather as testimony for local communities falling back onto a more locally oriented substrate of material culture and social organisation is hard to assess at this point. To do so, we need more contemporary comparative cases with communities in the wider hinterland. Recent projects such as the Isparta Archaeological Survey Project covering the northern parts of Pisidia, and the surveys conducted by Ralf Becks in the area of Komama in the southwest (Becks 2015), have recently started to fill in these shortcomings, however, their results have not yet been extensively published.

In the earliest stages of the trajectory of community development, both Düzen Tepe and Sagalassos remained small-scale settlements operating largely as self-sufficient and inward-oriented communities, providing largely (but not completely) in their own needs with local production and subsistence strategies. As such, they were modelled after the majority of existing settlements in the wider area, as part of a larger pathway of development in local modes of community development and social organisation. Major sites such as Düver Ada pulling in resources from a wider hinterland were likely the exception to the rule.
The typical geographic circumstances in the area, consisting of constrained valley bottoms delineated by mountain ridges, impeding extensive inter-valley contacts, would have resulted in typical communities embedded in distinct local valley systems. Examples are, among others, the hilltop sites of Kökez Kale, Kayiş Kale, Seydiköy, and Kepez Kalesi. These geographic circumstances should of course not be seen as deterministic and insurmountable barriers for communication and interaction. The degree of cohesiveness of the material culture, as well as the overlapping distribution of different pottery fabrics attested at various sites throughout the area, clearly indicates that a fair degree of contact must have existed between different valley systems. A number of general subdivisions in pottery production provenances linked to the usage of distinct locally available raw materials have been noted, distinguishing between the Burdur area, the Ağlasun/Çanaklı area, the Bereket basin, and the southern lands around the Çeltikçi valley.

This picture would only be markedly altered with the rise of Sagalassos as the major local system hub from the 3rd and 2nd centuries BCE onwards. Alongside its political and urban transformation, Sagalassos also developed an extensive territorial claim over the surrounding hinterland by the early 2nd century at the latest. At this point, Sagalassos' territory expanded all the way to Lake Burdur, as is indicated by Livy, who described Manlius Vulso's campaign against the Galatians in 189 BCE and related how the Roman army, on march from Pamphylia, moved on from Kormasa into the territory of Sagalassos (Livy 38.15.7-9). The city of Kormasa has been plausibly located at Kozluca Höyük, a large mound on the eastern side of the Lysis river (Hall 1986, 141 n. 5). Moreover, the 'marshy lands' described by Livy could only have been located somewhere to the south of Lake Burdur (Waelkens *et al.* 1997), indicating that the territory of Sagalassos stretched as far as this area in 189 BCE.
While it is difficult to draw exact demarcations of territorial extent, especially in the absence of boundary markers or inscriptions, we have tried to approach this matter from the perspective of material culture by looking at spatial distributions of survey material. Recent material studies on pottery material found during intensive survey campaigns[541] conducted in the area to the southwest

[541] Surveys conducted in 2010 and 2011 and coordinated by dr. Eva Kaptijn and dr. Ralf Vandam.

of Lake Burdur, stretching towards the modern village of Düver and further towards the Archaic settlement of Düver Ada at the shores of Lake Yarışlı yielded no indications of material culture relatable to Sagalassos before the beginning of the 1st century CE. This indicates that the reach of pottery products made at Sagalassos did not yet extend to this area in Hellenistic times, suggesting perhaps less intensive contacts between these parts of the territory and Sagalassos, than we perhaps could have expected given the territorial claim of Sagalassos over these lands. Clearly, no direct relationship between structures of political and economic networks should be assumed, insofar as pottery formed part and parcel of the latter.

Similarly, we looked at survey material from a number of settlements towards the south of Sagalassos, to try to approximate the expansion of its dependent territory in this area as well. Here the picture is even less straightforward. Given that the catchment of the – largely self-sustaining – community at Sagalassos during the Achaemenid period was limited to the central parts of the Ağlasun valley, we can assume it to have had no systematic (political and/or economic) connections to any of the southern settlements at this point in time. This assumption is reflected in the archaeological record as no indications of Achaemenid pottery derived from Sagalassos were encountered outside of this catchment so far. In Hellenistic times, however, marked changes in settlement patterns can be observed at several places

.

At the same time, pottery related to Sagalassos starts to appear at several of these settlements in varying quantities. To correctly interpret our observations, it is essential to disentangle the connections between these sites, as well as their relationships with Sagalassos. Given the fragmentary nature of the archaeological record, and the limited amount of material available to work with, only tentative conclusions can be drawn here. In the 4th century BCE, habitation at Seydiköy gradually started to shift towards nearby ancient Keraia, which has been identified as a separate polity independent from Sagalassos in Hellenistic times. This area was only added to the political territory of Sagalassos in early Roman imperial times. Surprisingly, not much material datable explicitly to the (Early) Hellenistic period was collected at this site, although this sample was only collected through extensive surveys. From the 20 clearly identifiable Hellenistic sherds, 5 could be identified as produced in the detrital clays from the Çanaklı valley, as was custom for the Hellenistic material of Sagalassos, whereas 15 were of distinctly other, hitherto unidentified source (a 1 to 3 ratio), based on fabric and typological properties. Given its independent political status, this material may have ended up at the settlement through economic structures of exchange. Clearly, we cannot connect the distribution patterns of the pottery material observed here with direct political or economic implications. However, they can provide some indications as to the degree of contact between different sites, even if the interpretations of these contacts can then only be drawn from the combination with other data and sources.

For the Bereket basin, a shift from the hilltop settlement at Kökez Kale towards the site in the valley bottom occurred during the 3rd century BCE. However, to what extent this can be related to developments at Sagalassos remains unclear for now. It might be tentatively hypothesized that this valley system was part of a different network (be that political, economic or of any other nature) in Hellenistic times, oriented towards the west centred onto settlements such as Kormasa. When reconstructing the potential routes in GIS (by plotting pathways of least resistance in the topographical base layer) Bereket seems to have been an important connective nod between Kormasa (outer southwest) and the eastern part of the area of Sagalassos (Figure 22).

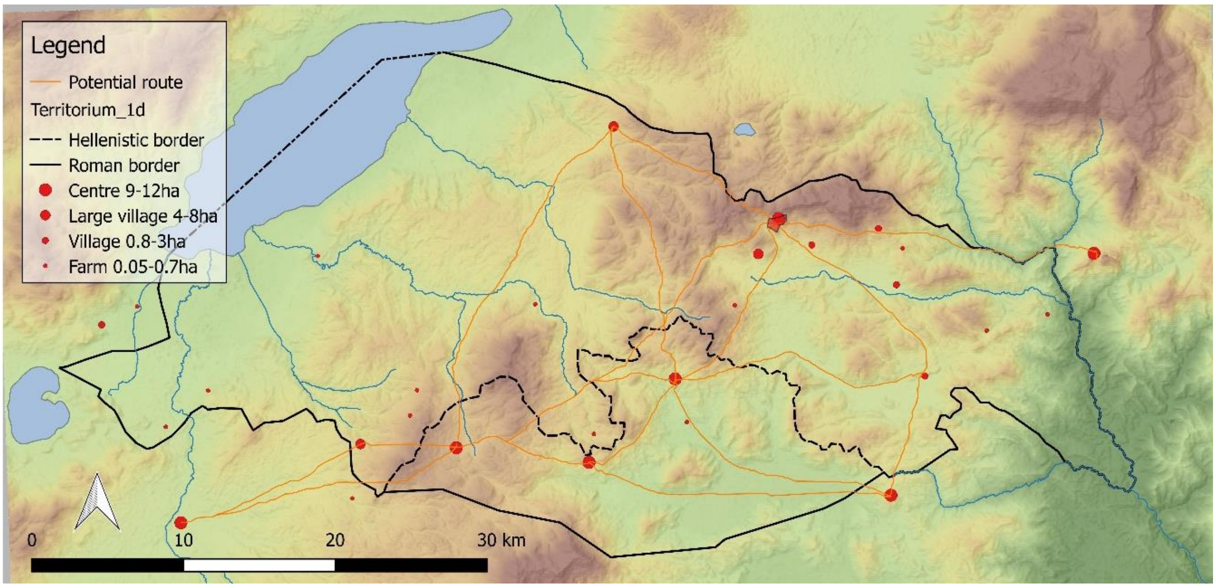

Figure 22: Potential routes between Hellenistic settlements in the eastern part of the study area (made by dr. Eva Kaptijn).

The hill-top site of Kepez Kalesi, already inhabited in the Iron Age, was allowed to build an extensive fortification wall somewhere in the Early Hellenistic period. Building fortifications was not a given, but rather a privilege granted to local communities by the royal administration (see part 4.4). As such, this may be indicative for the ambition of the local community to aim towards becoming a prominent local centre as well. When looking at the route network, it is clear that Kepez Kalesi holds a highly prominent central positon in this network. For some reason, however, this ambition fails and at some point Sagalassos – although it is far more a-centrally positioned in the local landscape – gained control over Kepez Kalesi, although it cannot be conclusively stated when this occurred.
It has been noted, however, that pottery material of Hellenistic Sagalassos starts to appear relatively extensively in the archaeological record of Kepez Kalesi. In the Hellenistic material of Kepez Kalesi, of the 64 diagnostic sherds, 47 Sagalassos related *versus* 17 non-Sagalassos related sherds were identified, which equals a 3 to 1 ratio, inverse to that of Keraia. Perhaps this markedly different ratio may be considered already indicative of different network structures connecting this settlement with Sagalassos. Whether this can then be assumed to be a political/territorial connection or not is at this point unclear and would, at any rate, require a more extensive analysis beyond the single proxy of pottery. If so, however, it could be suggested that Kepez Kalesi, a well-fortified settlement located at the outskirts of the mountain range shielding the northern side of the valleys surrounding modern-day Çeltikçi, perhaps constituted the most southern boundary of the territory of Sagalassos in Hellenistic times

The extension of political boundaries and structures of control over an extended hinterland covering an area from Lake Burdur in the west to the Kestros river in the east, would have resulted in a significant increase in availability of *potential* energy and resources to be exploited and directed towards the urban centre. However, to what extent this potential could effectively be exploited across this large area remains an open question. The distinct morphological and techno-productive properties of Hellenistic pottery material in the southwestern parts of this territory – covering the Burdur plain, the Bereket basin, and Kozluca, compared to Sagalassos has been particularly noted. To what extent this effectively constituted the existence of a cohesive, alternative mode of material cultural will still need to be elucidated in more detail. This mode of material culture found most eminently at Kozluca was possibly again a result of its positioning along the same major thoroughfares connecting the interior with the Pamphylian coast (van der Enden 2013; Waelkens *et al.* 2000, 190-192).
Additionally, it will need to be assessed to what extent different sites in the territory were integrated at different speeds through differential network structures of a social, political and/or economic nature. In this respect, the markedly different nature of the pottery assemblage at Kozluca signifies

the possibility of different choices being made, which need not necessarily have focused on Sagalassos as a central system hub. We may therefore perhaps conclude this paper with a short note of 'counterfactual history', or in other words, asking ourselves "What if…?". What if it was not Sagalassos, which developed, in the most prominent local centre? The resultant network structures connecting these local communities would have likely been very differently oriented. Other communities in the area likely had the same aspiration of taking the mantle of local prominence. Several potential prime communities emerged at the edges of the later territory of Sagalassos in the Early Hellenistic period, including Keraia, Sandalion, and Kapıkaya, both likely harbouring an ambitious local community striving for local prominence. This competitive interaction will be discussed in greater detail in part 4.4.

Conclusions

In the Middle Iron Age, settlement patterns in the study region were centred on a number of fortified hilltop settlements in the east, and the important settlement/sanctuary of Düver Ada in the west. The latter likely held a prominent position in local settlement configurations through its participation in wider trajectories of movement and interaction connecting the southern coast and the Anatolian inland. The site possibly acted as a central place for a series of agricultural villages in the Burdur plain. In the Ağlasun valley, at the time, no traces of systematic occupation were attested except for the hilltop site of Aykırıkça in the utmost eastern part. Strangely, the palynological samples collected from the Ağlasun valley indicated that around 800 BCE, the first traces of human impact in the landscape can start to be discerned, something we do not see reflected in the archaeological record.
The incipience of community formation at Düzen Tepe and Sagalassos in the late 5th century BCE, can be situated against the observed background centred on elevated sites located on hill slopes or raised plateaus, dating back to the Middle Iron Age. Such small-scale communities were typically embedded in limited hinterlands, acting as demarcated units within the landscape with minimal mutual interaction. Throughout the study region, we see at in late Achaemenid times a diversification of the settlement pattern, indicating a movement towards filling up new ecological and topographical niches. In the late 3rd – early 2nd centuries BCE, the picture markedly altered as Sagalassos started to reach beyond its immediate hinterland.
In the early 2nd centuries BCE at the latest, the community had established a significant political territory extending all the way from the Kestros river in the east to Lake Burdur in the west. Differences in distribution patterns of material culture seem to reflect this shift to some extent, but it remains difficult to directly connect these patterns to the establishment of political or economic networks in the area. Still, the pottery of Sagalassos increasingly started to be distributed in various settlements throughout the study area, indicating an extended action radius and increasingly intensive interaction between these sites. However, the establishment of these networks clearly developed at an uneven speed across the various parts of the landscape. It can be suggested that not all valley systems in the area were integrated to a similar degree. Most notably, in the western part, Bereket, Kozluca and Düver seemed to have maintained a different orientation in material culture than that of Sagalassos, perhaps indicating different underlying economic or political structures, or degrees of integration. Further studies will be needed to corroborate this latest hypothesis.

4.4 Community formation in SW Anatolia

The final paper of this chapter will once more widen the spatial scope, integrating certain trends, observations and contexts from southwestern Anatolia (Pisidia, Lycia and Pamphylia) to provide an additional level of depth to the presented case study. Being one of the final parts written for this thesis, it has perhaps been most affected by the current structure of the thesis. Large parts of the introduction, presentation of the sites, and discussion of the evidence has been repeated already throughout the different preceding parts of this chapter and have therefore been left out. The current version presented is significantly shortened compared to the intended publication text. No publication journal has of yet been selected, however, we will look into the possibility of "Hesperia" or "American Journal of Archaeology". My co-author dr. Peter Talloen and I have extensively collaborated on compiling the evidence presented in this paper. The introduction was written in collaboration. In the original draft, the introduction was followed by an extensive part preparing the local evidence of Sagalassos and Düzen Tepe for the case study that was written by myself. This was left out here to avoid repetition. The contextualization of the case study in the 'Community development…in SW Anatolia' part has been co-written, with a first draft presented by my co-author, which was extended and elaborated upon by myself. The part on push-pull dynamics between local communities and the impact of empire was borne out of the theoretical framework I have been composing for my dissertation. Its intellectual and conceptual background was compiled, elucidated and written by myself. Part of the argumentation, specifically the various examples of Seleucid influence at Sagalassos, was compiled by dr. Talloen. The further integration of this evidence in the wider argument, as well as the conclusions were written by myself.

Moving in together? Synoikismos and modes of community development through push/pull dynamics in SW Anatolia

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Introduction

When narrating the conquest of Pisidia (SW Anatolia) by Alexander the Great in 333 BCE, Arrian describes Sagalassos as "… not a small city", using the Greek word *polis*. It can be questioned to what extent this can necessarily be held to indicate that the local community was at this point organized as a Greek-style city-state or *polis*, or displayed its characteristic urban and cultural properties (see chapter 2). It should especially be noted that Arrian was writing more than four centuries after the actual event. To what extent the definition of *polis* at that time was still comparable to whatever a *polis* might have been in centuries past is difficult to ascertain, and at any point beyond the immediate scope of this paper. Irrespective of Arrian's characterization, and what that would have meant in an Anatolian context at the time, Sagalassos does not appear to have been an urban centre prior to the late 3rd - first half of the 2nd centuries BCE. It may have had some form of political constitution and codified law system from the (second half of the) 3rd century BCE (Vandorpe 2000, 2007), followed by the initiation of civic coinage minting between the last quarter of the 3rd century and the first decades of the 2nd century BCE (Van Heesch and Stroobants 2015), construction of monumental public architecture from 200 BCE onwards (Talloen and Poblome 2016), and the development of a dependent political territory, as indicated by Livy in his description of the campaign of the Roman consul Manlius Vulso after the Battle of Magnesia in 189 BCE at the latest (Livy*, Ab urbe condita*, XXXVIII, 15.9), extending into the lands south of Lake Burdur (Waelkens 2000, 175).
Instead, all indications suggest the presence of a relatively small village community, comparable to the nearby settlement of Düzen Tepe, which was characterized by the apparent absence of archaeological

attestations of social stratification and limited communal organization. For Düzen Tepe, recent studies have estimated a population size between 700 and 1600 people (see 4.2.2) and it is difficult to gauge whether Sagalassos matched this, as we are confronted with a limited amount of evidence. In any case, a significant trajectory of development occurred at Sagalassos, when moving from a village configuration towards what could be considered a *polis*.

Polis development in Pisidia, including Sagalassos, and other parts of southwest Anatolia (see map in introduction) has been traditionally considered in a framework of peer polity interaction (Mitchell 1991; Vanhaverbeke and Waelkens 2005), with local communities adopting the city-state model as a result of socio-political competition. In chapter two, I already argued to use the concept of *polis* as a descriptive term for certain trends in social, political and economic dynamics, as a label for a highly institutionalized urban centre, rather than having an explicit interpretive function as denoting a Greek cultural phenomenon. The approach highlighted in chapters one and two has been applied throughout this chapter to consider how local communities operated within a specific framework of orientation that integrated external influences within local preferences and choices.

The different parts of this chapter have focused on essential driving forces and selection pressures of material production, subsistence strategies, social, economic and political organization, and community formation, all shaping the nature of social life in these communities. This chapter has been predominantly preoccupied with Düzen Tepe and Sagalassos as main case studies. In the previous part, this scope was extended to incorporate a sub-regional scale by looking at settlement patterns and community formation in the surrounding area, limited to the study area of the Sagalassos Project. In this part, the horizon will again be widened further to incorporate the main traces of community formation and organisation in southwest Anatolia. The intentions are twofold. On the one hand, the framework of origin of *polis* traditionally used in the area, will be contrasted and compared with the one presented here so far. On the other hand, an additional level of depth will be added to the local case study by explicating how it fits the wider social, geographical and temporal context, looking at the potential explanatory power of push-pull dynamics between local scale communities and socio-political configurations on different scales.

Regarding the latter, it has been suggested that the significantly intensive trajectory of development observed at Sagalassos in the 2nd century BCE seems difficult to explain as a purely endogenous scheme of community formation, especially for a settlement that appears to have been a mere village only a relatively short while earlier. In part 4.2.5, three potential different scenarios were particularly highlighted, comparing the endogenous growth scenario with two scenarios involving a *synoikismos* event of the communities at Sagalassos and Düzen Tepe, as an important catalyst for system development. Here, two possible scenarios can be suggested, one focusing on a locally induced process, and one suggesting the potential involvement of the Seleucid administration. In this part, the dynamics occurring in the interplay between local initiatives and external strategies and incentives that could spark such a process will be explored, as well as compared with external parallels to trace the parameters of such a development.

Community development, polis formation and synoikismos in SW Anatolia

The early stages of the origin and initial development of community life at Sagalassos and Düzen Tepe in late Achaemenid and early Hellenistic times has by now been sufficiently discussed. In the previous part, it was already demonstrated how these villages and their material culture were firmly embedded in local pathways of development favouring small-scale, subsistence-based and locally oriented communities. This mode of community organisation was not uncommon for the wider region as Pisidia as a whole. In pre-Hellenistic times, it was generally characterised by a lack of urban centres, as was for example common in Caria at the time as well (Labuff 2016; FrGH 26 F1).

As was noted earlier, however, the defining aspect of a city-state was not necessarily (only) its urban nature. Even on the Greek mainland, several examples exist of distinctly non-urban settlements advocating their *polis* status, for example, the settlement of Chorsiai in Central Greece which is explicitly called a *polis*, yet could have housed at most 500 people and showed no urban architecture of note (Bintliff *et al.* 2007, 56-57). A second defining aspect is the (political) community, most prominently advertising itself through decrees, often inscribed in monumental inscriptions, and other forms of communication such as coinage. The most significant element of *polis* formation is therefore considered to be the transformation of local institutions to match the language of self-representation grafted on the *polis* model (LaBuff 2016, 4). Features of monumental urban architecture are thus to be considered part of the material expression of this transformation. In this way, the *polis* model could be considered more of a narrative of self-representation in an Anatolian context, rather than a distinct 'real' settlement entity with classificatory value. In the case of pre-Hellenistic Pisidia, only Selge is considered to fulfil some of these criteria, mainly based on the use of Graeco-Pamphylian dialect in monumental inscriptions (Hansen and Nielsen 2004, 1213).

The urban and political transformation observed at Sagalassos implies a range of considerable steps in community development and social organization, which at first sight seem difficult to initiate by a relatively small community such as at Sagalassos in the earliest phases of its development. It is interesting to note that the transformation of Sagalassos occurs largely simultaneous with the decline of Düzen Tepe – likely early 2nd century BCE - which could suggest that the two processes were interconnected. A simple relocation of the community from the former to the latter, as was the case, for example, at Herakleia on-the-Latmos (Labuff 2015, 44-45), is not the case as the two communities existed contemporaneously during the period of the 5th to 2nd centuries BCE, which were furthermore characterised by a distinct material culture applying different fabrics for pottery production (Braekmans *et al.* 2017; Daems and Poblome 2017).
We rather hypothesise that Sagalassos absorbed large parts of the population of Düzen Tepe after the latter settlement was abandoned in the early 2nd century BCE. Distributions of pottery derived from archaeological surveys conducted in central parts of the Ağlasun valley, seem to indicate that site numbers decreased in rural areas in the early Hellenistic period compared to the preceding (late) Achaemenid period.[542] This could be another result of a concentration of population in the newly developing centre. The formation of denser population clusters opens up new possibilities and potential contexts of social interaction which may have cultural consequences in terms of social structure and organization, cult practices, as well as in terms of political or economic development (Fletcher 1995; Osborne 2005; Smith 2017).

Throughout antiquity, a merger of (small) population groups forming a larger, single community is often indicated with the term *synoikismos*, which literally means "moving in together" (Hansen and Nielsen 2004, 115; Kosmetatou 2013). In the Hellenistic period, the term *synoikismos* came to refer to the physical resettlement or augmentation of a city's population (LaBuff 2016, 13). According to Labuff, the term is generally used to describe the merger of a *polis* with one or more *poleis* (or small settlements of some other type) rather than the coming into being of new a *polis* (see LaBuff 2016, 14-15 for examples). Yet, for the unions of cities in the Hellenistic world, scholars tend to use the term *sympoliteia* rather than *synoikismos*, meaning joint citizenship (Rhodes 2006). At the end of the Hellenistic period, such a scenario of *sympoliteia* – the agreement between two or more cities to merge (LaBuff 2016, 1) – occurred at a number of Pisidian cities: Kremna absorbed the smaller city of Keraia, situated between Kremna and Sagalassos (Horsley and Mitchell 2000, 94) and also Termessos in the south appears to have absorbed several smaller communities such as Kitanaura, Neapolis and Typallia (Talloen 2015, 33 and 36). However, the difference is technical and, in the end, not all that relevant for the present purposes.

[542] It should be noted, however, that due to fabric properties, some of the Hellenistic material is more difficult to identify compared to the late Achaemenid pottery. For example, it is generally quite hard to distinguish between tablewares from Hellenistic and Roman imperial times, except through detailed sherd-by-sherd analysis which proved to be not feasible. On the other hand, clearly identifiable Hellenistic common wares found in excavation contexts have also been sparsely encountered, which supports our hypothesis.

Attested examples of actual *polis* formation by *synoikismos*, seem to have involved the (partial) relocation of one or more communities (Hansen and Nielsen 2004, 117). Could the disappearance of Düzen Tepe as a settlement in the course of the 2nd century BCE therefore suggest that we are dealing here with such a process of physical *synoikismos*? It can in this respect be noted that it was indeed exactly during a period of innovative social and political orientation that the latter settlement became deserted. However, a *synoikismos* did not necessarily entail the *full* relocation of an existing community, allowing in some cases the original settlements to continue to be inhabited (Hansen and Nielsen 2004, 116). *Synoikismos* could also be the result of war and conflict between communities, whereby a conquered settlement had its population relocated and amalgamated with the population of the victor (Hansen and Nielsen 2004, 118). However, no indications for violence or destruction phases were identified in the excavations at Düzen Tepe, suggesting a political rather than military drive of the merging process. Alternatively, it has been argued for the communities of Caria, that processes of *synoikismos* can have been a conscious political strategy which allowed local communities to gain a stronger foothold in the interaction with the different Hellenistic kingdoms competing for dominance in the area (LaBuff 2016).

It was stated by Reger (1997, 468) that probably no single model of *polis* formation has enjoyed as much widespread acceptance as the view that *poleis* were formed as a result of the *synoikismos* of earlier separate, pre-polis settlements. However, this model should not be considered as a blanket-concept applied by all possible actors under all possible circumstances, in all possible cases. We will demonstrate that a variety of lines of development can be identified, based on a combination of existing pathways of development and the introduction of novel circumstances and stimuli. To this end, it will be useful to look at comparative evidence elsewhere in southwest Anatolia to contextualize the presumed processes. Can it be ascertained in these cases how urban centres originated? Whether this was comparable to the origin of Sagalassos? Whether the *polis* framework offers a useful comparative framework? And whether what can be considered a *synoikismos* event may have laid the foundation for subsequent kick-starts of development?

It was observed already by Stephen Mitchell (1991) that in the 2nd century BCE, a widespread wave of urbanization occurred throughout Pisidia, suggested to be induced by economic prosperity under Attalid control over the region. However, the observed changes probably started earlier than posited by Mitchell. It was recently lamented that, although in several communities, non-archaeological evidence from coins, inscriptions and historical texts indicate that these already resembled Greek *poleis* in the 3rd century, there is little trace of associated monumental public architecture anywhere in the region before the 2nd century BCE. It should be remembered that archaeology as a discipline is inherently better capable of tracing the origins of *polis* as a physical settlement, rather than its socio-political component. As a result, in most of Pisidia, the suggested developments in the 3rd century BCE remain “an archaeological enigma” (Mitchell and Vandeput 2013, 103).

Still, some evidence exists. The earliest known city in the region, Selge, may have copied the constitution of its Pamphylian neighbour Aspendos, judging by its civic coinage which imitated that of Aspendos (see *infra*). Selge is known to have issued silver coins from the late 5th century BCE onwards. Its pre-Hellenistic coinage was struck on the Persian standard and imitated the types of the neighbouring Pamphylian centre of Aspendos, only differing from each other in their ethnic and field symbols (Head 1911, 711). This early coinage is held by Hansen and Nielsen as a possible sign of city constitution, albeit of ‘barbarian’ type (2004, 148). Following the conquest of the region by Alexander the Great, the silver coinage of Selge continued to feature the same types, but instead of the legend ΣΤΛΕΓΙΙVΣ in Pamphylian dialect the issues now started to bear the Greek ethnikon ΣΕΛΓΕΩΝ, a recognised designator of polis status (Hansen and Nielsen 2004, 58-69). As to the process that lead to this city status, no evidence is available, although the close relationship between Selge and Aspendos, an attested city at least since Classical times and situated in a traditional region of Greek colonisation (see below), could have been the catalyst in city-formation.

For the Pisidian settlement of Etenna as well, the earliest evidence for city formation comes in the shape of civic coinage minted during the 3rd century BCE. Its big neighbour Selge may have been the example, though employment of its inhabitants in the Ptolemaic army is sometimes also held to have played a role (Nollé 1992, 75). In the case of Termessos, the base of operations for Perdikkas (*c.* 355-320) in his struggle with Antigonos Monophthalmos, an honorific inscription records how the local assembly or *ekklesia,* as well as a collegiate board of three magistrates of the city honoured a Ptolemaic official in 281/280 BCE (Robert 1966, 53-58) which suggests that this other centre of southern Pisidia already adopted a *polis*-constitution at an earlier point in time. The attestation of a political community at Termessos was also associated with the erection of monumental public buildings such as a *bouleuterion* and a *gymnasion*.

One important process of city formation attested in Pisidia is the foundation of colonies. In northwestern Pisidia, well-known sites are the Seleucid foundations of Apollonia, Neapolis, Pisidian Antioch and Seleukeia Sidera. These colonies were located at strategic locations, controlling road and trade networks between Lycia-Pamphylia and the inland. Pisidian Antioch (*Antiochia ad Pisidiam*), was founded in the 3rd century BCE by the Seleucids, on a hill at 1236m a.s.l. north of the river Anthius (nowadays the Yalvaç Çay), overlooking a plain with highly fertile arable land. Likewise, Seleukeia Sidera was founded on a hill, overlooking the fertile plain northeast of Lake Burdur. The only visible architectural remains of its original Hellenistic phase are parts of its fortification walls.
Pottery found at the site indicated Iron Age habitation and that the settlement could have been resettled by the Seleucids early in the 3rd century BCE, rather than being founded *de novo*. Its Hellenistic pottery material included black glazed and west slope decorated pottery. Beyond these Seleucid foundations, the recent survey campaigns of the Isparta Archaeological Survey project have started to identify several sites in the area. At Kale Tepe, a nucleated settlement was found, likely to be identified as ancient Konane, with an extensive fortification system enclosing a large domestic quarter and a system of streets, wells and cisterns and pottery finds dated to the 3rd and 2nd centuries BCE (Hürmüzlü *et al*. 2016). Nearby Kale Tepe, a similar fortified settlement was found at Serikli Toptaş

In the southern parts of Pisidia, by contrast, no evidence is available for the urban transformation observed in the north prior to the late 3rd-early 2nd centuries, except maybe for the poorly known site at Kretopolis, located in the later territory of Komama, which has been suggested to have been a colony of Macedonian mercenaries by admiral Nearchos during the later 4th century BCE (Sekunda 1997). Elsewhere in the south, Ariassos, located on the border between Pisidia and Pamphylia, was founded around 190 BCE (Mitchell *et al.* 1989, 65).
Nearby, the city of Panemoteichos probably originated somewhere in the mid Hellenistic period, although a precise date is hard to come by. An older site was discovered on the higher slopes behind the later settlement at an altitude of 1000m a.s.l., inhabited during the Late Iron Age and Achaemenid period (Aydal *et al.* 1997, 145-147). This older site covered about 6.5 hectares and was enclosed with a walled circuit. Pottery material collected at the surface of the site consisted of the typical Black-on-Red and 'matt' painted wares with geometric decoration as attested elsewhere in the area as part of the Southwest Anatolian ware tradition.
At some point, habitation at the old site ceased and the population moved to a new location on the lower slopes about half a kilometre to the west. The new site still contained a fortified acropolis, albeit of a smaller size compared to the previous settlement. The dry masonry technique used for the fortification wall suggests a Hellenistic date for this new settlement, corroborated by the Hellenistic pottery collected from the surface (Aydal *et al.* 1997, 158). Houses were constructed along the slope, with the rear wall often formed by the cut-out rock-face, a technique also used at nearby Hellenistic sites at Ariassos, Kaynar Kale (possibly ancient Kodrula) and Sia. The older hill-top site has been interpreted as a 'precursor' site of Panemoteichos, "not yet showing the characteristic structure of self-government found at other Pisidian sites in the Hellenistic period…we are fortunate to recognise the precursor of this development in the fortified *tribal* settlement of Panemoteichos" (Aydal 1997 *et al.* 159-160) [not original emphasis]. Close to the site, a hilltop fortress was identified at Ören Tepe. Although no clear indications for dating the site were found, with the dry rubble technique of the fortifications suggesting a general pre-Roman date, a few pottery fragments, possibly of Hellenistic

coarse wares, could suggest a Hellenistic date (Aydal *et al.* 1997, 166). It was suggested that the fortress was founded and maintained by the Attalids in the 2nd century BCE, trying to consolidate their newly received lands after the battle at Magnesia, and in particular the major route connecting the Pamphylian coast with the inland (Aydal *et al.* 1997, 169).
This chronological discrepancy between north and south already suggests that the picture of a single blanket process of peer polity interaction as driving force of city formation processes in Pisidia is likely oversimplified (Vanhaverbeke and Waelkens 2005).

A markedly different picture arises in the lowland zone of Lycia, which was already from the 8th and 7th centuries BCE centred on major settlements such as Xanthos and Limyra, located on strategic locations in the landscape, in association with an extensive rural settlement pattern of hamlets and isolated farmsteads. Rural sites were sometimes furbished with elaborate tower-houses in Central Lycia, testimony to its wealth likely generated by participation in wider networks of exchange and contact through intensive export-oriented agriculture (Coulton 2012, 243). These settlements – both urban and rural – were well-connected to the Mediterranean world, particularly towards the Aegean and the Levant.
In the 6th century BCE, community development in Lycia focused on significant fortified hill-top settlements such as Avșar Tepesi (14ha), Xanthos (26a), Limyra (25ha) and Telmessos (16.5ha) (Kolb 2008, 35). These so-called *Herrensitzen* are identified as power bases for local dynasts, controlling various parts of the landscape. From the 5th century onwards, these settlements appear to have attained an urban character (Kolb 2008, 60). The settlement at Avșar Tepesi, for example, at this time seems to have expanded beyond its fortifications, with the fortified citadel now likely acting as a refuge in times of need rather than housing the full community. It was suggested that the settlement performed important central place functions for the surrounding hinterland on a political-administrative, military and economic level (Kolb 2008, 60). Several smaller fortified sites such as Trysa, Kyaneai and Korba were at this time likely dependent on Avșar Tepesi. No scenario of *synoikismos* as a merger of low-scale settlements into larger units is known in the region of Lycia. There, except for the Rhodian colonies in the east part of the peninsula founded in the 7th century BCE (Adak 2007), it is argued that dynastic settlements gradually adopted Greek *polis* institutions (Behrwald 2000, 49-68; Gygax 2001, 92-141; Kolb 2008, 184-186, 2016; Schuler 2016).
In the 4th century BCE, Kyaneai gradually starts to increase in importance, at the expense of Avșar Tepesi, and develops into the prime local centre. At this point, Kyaneai is considered to develop into a *polis*, as in a political urban centre, and characterised by the finds of Greek-styled culture, including monumental public buildings, cults, coinage, and inscriptions with Greek script (Coulton 2012, 168). This process also appears to be more widely attested in the region at large at this time, when cities like Xanthos issued inscriptions in which the term *polis* is used (Keen 1998, 53-54). Under Achaemenid rule, Lycia was characterized by a political system called *dynasteia* by Aristotle (Pol. 4.1292b). This was the most extreme form of oligarchy in which an aristocratic family monopolized power. It were the residential towns of these dynasts which developed into cities. When the Carian satrap Maussollos was entrusted with the administration of Lycia by the Persian Great King in the third quarter of the 4th century BCE, after a period of conflict among the indigenous aristocrats who had ruled the Lycian since the Archaic period (Kolb 2016) the dynastic system disappeared. The Lycian communities were transformed into Greek-style *poleis* consisting of autonomous citizen communities. Each territorial unit took the name from the main settlement, generally a former residential town of a dynast, which functioned as political and economic centre and controlled a territory of varying size. Thus, the Lycians, prodded by their Hecatomnid overlords, took over and adapted the most advanced model of political and social organization of the time (Schuler 2016, 46).

A different picture emerges in the inland zone of Lycia. The city of Balboura originated only around 200 BCE on a hill near the Xanthos river on the border between Lycia and Phrygia. Its most important nearest neighbours were Boubon, Kibyra, and Oinoanda. Indications for its territorial extent in Hellenistic times are sparse, and it was suggested that its boundaries may have been rather unstable

during the formative years of the settlement (Coulton 2012, 28). The *polis* status of Balboura in Hellenistic times is well-attested, as well as displaying a range of monumental architecture at the city centre, including a fortification wall enclosing an area of *c.* 8.6ha, and a theatre (Coulton 2012). At this time, the four aforementioned cities – Balboura, Oinoanda, Kibyra and Boubon, formed the Cybriatic tetrapolis, minting their own local coinage, another attestation of its aspirations towards *polis* recognition (Coulton 2012, 79).
However, the urban community originated against a markedly different background compared to Sagalassos. Whereas extensive material and occupation traces were attested for the Iron Age, including the site at Çaltılar Höyük, yielding extensive amounts of painted wares and black-on-red pottery (Momigliano *et al.* 2011), strikingly, no pottery is found in the survey area covered by the Balboura Survey Project that could be dated to the period between 500 and 200 BCE (French and Coulton 2012, 54). However, several funerary monuments have been attested, including tumulus graves, which could be dated to this period, indicating a degree of continuity. It has been suggested that the absence of visible settlement in the area was due to a focus on pastoralist subsistence strategies, rather than agriculture (French and Coulton 2012, 56). The former would have preferred lighter and more easily transportable containers of perishable materials such as wood, rather than ceramic vessels, which could explain the lack of pottery in the archaeological record as well. The emergence of Balboura in 200 BCE then indicated a return to agricultural subsistence strategies centred on nucleated settlements, along with habitation in rural areas, in the form of hamlets and farmsteads, possibly induced by land allotment associated with city foundation (Coulton 2012, 85).
The emergence of the city of Balboura has been notably associated with the expansion of Pisidian involvement in the area (Coulton 2012, 63). Likewise, about 17km south of Balboura, the city of Oinoanda was founded as a colony of Pisidian Termessos, and Pisidians are also said to have taken over Kibyra at the end of the 3rd century BCE (Coulton 1982). However, for Balboura, no actual evidence has been attested for its foundation as a formal colony. The hypothesis has rather been posited because of the rapid establishment of both its urban centre and its associated rural settlement pattern resembling more that of a city foundation than a gradual *polis* emergence as seen in southern Lycia (Coulton 2012, 245). While the observed patterns could indeed point at external interventions, possibly related to city foundations, it can be questioned to what extent these should be associated with the growing influence of 'Pisidians' in the area. However, as with Sagalassos, in the absence of any clear-cut textual or epigraphic references, uncovering the actual agents behind such a development can prove very difficult. At any rate, regardless of the relevant actors, the development of political communities centred on an urbanised centre only took off in the area of Balboura during the first half of the 2nd century BCE (Coulton 2012, 245).

The history of city-formation is less clear for Pamphylia, a region traditionally associated with Greek migration (Adak 2007; Grainger 2009; Mitchell 2017, 14-15). Recent excavations on the acropolis of Perge, a major settlement since the Bronze Age, have yielded traces of a growing Greek influence from the 7th century BCE onwards in the shape of pottery, new building techniques involving stone masonry, monumental sculpture and the use of the Graeco-Pamphylian dialect. This is all held by the excavators as the material manifestation of the Greek (Aeolian) colonisation of Pamphylia and the foundation of its cities (Martini and Esbach 2017, 468-488) which would make city formation in the area a direct result of Greek colonisation, either *de novo* or through the settlement of colonists in existing centres. However one wants to interpret this evidence, it is clear that Pamphylian centres like Aspendos and Perge were paying tribute to Athens (and the Delian League) during the 5th century BCE, and certainly Aspendos issued its own coins by the end of the 5th century BCE with a legend mentioning the indigenous name of the settlement in Graeco-Pamphylian alphabet ESTFEDIIYS; Mitchell 2013). Even if some scholars contend that these 'colonies' were unable to preserve their Greek identity in the face of local cultures and power structures (Mitchell 2017, 16), by the 5th century city formation was already a fact for at least part of these Pamphylian communities.

Elsewhere, Aphrodisias in Caria has been cited as an example of voluntary *synoikismos* based on an inscription recording the merger with Plarasa to form a single *demos* during the second half of the 2nd century BCE, as Aphrodisias was not believed to be a *polis* at the time (Reynolds 1985). Recent research, however, has indicated that it already had city status under Rhodian rule earlier that century (Chaniotis 2010). The process recorded in the aforementioned inscription can therefore be described as that of a *sympoliteia* rather than a synoikismos. Again, the origin of the city of Aphrodisias is not clear but could have involved Macedonian settlers (Chaniotis 2010, 464-465). Elsewhere in the region, though, the merger of smaller Carian settlements into larger communities is attested. A fragment of a Greek historian of the 4th century BCE (Chrubasik and King 2017, FGrHist 26 Konon F 1 para 11) describes the Carians as a large nation (*ethnos*) which lived in villages (*komedon*). Following the example of Maussollos who promoted the *synoikimos* of smaller indigenous communities into Greek civic centres (Mitchell 2017, 25), in the Hellenistic period, several Carian communities, who described themselves as *koina*, fused to become *poleis* (see Robert 1983, 188; Fraser and Matthews 2013, xxiii). Many of these were small settlements whose limited resources and populations restricted their capacity for further development, though it has been seen by some as a transitional status between village and polis.
These instances of *synoikismos* appear to have been part of a widespread regional tendency to form larger political units. During the Hellenistic period many small *poleis* in Caria were also absorbed by their larger neighbours or merged to form larger political units. These changes occurred through the process of *sympoliteia* (Reger 2004, 145-180; Labuff 2016). The circumstances and the motives of the participants were highly variable but often involved an external authority whose interests were served by these geopolitical changes. A flurry of such combinations of cities occurred in the years around 200 BCE (LaBuff 2016, 15). This impulse towards consolidation may have occurred as a response to pressure such as the territorial ambitions of the Seleucids and Ptolemies.

Although Phrygia towards the north is traditionally held to be a region where the *polis* or city-state was not a popular model of state organization, it does provide us with one of few known examples for Asia Minor where voluntary *synoikismos* lead to the foundation of a city. Toriaion, an ancient settlement situated in the east part of Phrygia Paroreios near the modern town of Ilgin (in the province of Konya) obtained *polis*-status from Eumenes II *c.* 187 BCE (Jonnes and Ricl 1997) which would place it roughly in the same period as the foundation of Sagalassos. Essential elements of polis status, according to the inscription, were a city-constitution, own laws and a gymnasium. The members of the community, "and others living with them in fortified places", were allowed by Eumenes II to organize themselves into one citizen body, *de facto* indicating a *synoikismos*, in this case possibly consisting both of natives (*euchorioi?*) and settlers (*katoikountes*), probably military settlers or soldiers serving in a garrison. Overall then, different structures of urbanization can be observed in the various regions of southwest Anatolia, growing either out of existing major centres such as in lowland Lycia, or developing as a generally new configuration of community organisation, as in inland Lycia and Pisidia. In general, however, voluntary *synoikismos* by local communities does not appear to have been a very common process of *polis*-formation in southwestern Anatolia during the Hellenistic period, or at least not one that is easily brought to bear by the archaeological record.

Push/pull dynamics and the impact of empire

In the previous part, some broader dynamics in community developments were traced, highlighting some marked regional idiosyncrasies and trajectories of development. It was noted how urbanization in regions such as lowland Lycia grew out of existing settlement patterns oriented on major centres as focal points in the local landscape. Elsewhere, this tradition was less common, resulting in a stronger role for externally induced interventions such as acts of colonization, as in northern Pisidia or inland Lycia. To differentiate between the parameters of endogenous and exogenous factors of community formation, let us now take a look at the potential impact of such macro-scale units onto local communities. For the periods under scrutiny here, this pertains specifically to the Achaemenid to mid Hellenistic periods, from the 5th to 2nd centuries BCE. In this period of time, a succession of empires

took place, respectively from the Persian empire, to the rule of Alexander the Great, who appointed Antigonos Monophthalmos (333-301 BCE) as the local satrap, followed by Lysimachos (301-281 BCE), the Seleucids (281-189 BCE), and the Attalids (180-129 BCE).
It is important to note at this point that the main difference between empires and states is that the former were systems based on military conquest and aimed at exacting capital and resources through tribute rather than directly governing lands and people (Mann 1986). Looking at the way these macro-level socio-political structures have been conceptualized, one of the major flaws is the neglect of potential impact of interactive dynamics operating on various scales. Specifically, the role and impact of communities is rather underexposed. This is not to say local and regional developments are ignored altogether. Often, when local and regional scales enter the picture, they are regarded through a focus on the workings of the central administrative apparatus (Meadows 2005). Yet, also the other way round, when looking at developments in local scale settlements, communities and their immediate hinterlands, a proper integration of dynamics on different scales is often lacking. One notable exception is the impact of episodic acts such as city foundations or the merging of existing communities through *synoikismos* (Cohen 1978; Mueller 2006). Too often in these works, however, monarchs and their central administration enter the picture descending from their thrones as if they were a *deus ex machina* to change the path of local development. This kind of interventions are too often considered in isolation as hardly any attention is paid to how these episodic events were related to the flows and dynamics of the local system before and after.
Structures of empire were built around general lines of administrative, military and economic control formed by a central governmental apparatus and spanning a certain territorial extent (Aperghis 2004; Ma 2013, 339). We are at this point not directly interested in the exact configurations of central administration or which offices and officials this consisted of, as the central administrative apparatus is often reduced on the local scale in favour of the co-optation of local institutions and facilities. Rather, we wish to focus in this part on how local communities and governmental structures came together in two-way interactions, offering both constraints and opportunities for local development. On the one hand, these interactions represent material flows of capital and resources moving on a vertical axis between the central administration and peripheral areas in the shape of taxes, levies, gifts and benefactions. On the other hand, individual communities could use these structures to negotiate aspects of social, political and economic power and status representation on a horizontal axis.
The political reality of the interaction space between the empire and local communities was messy, complex and negotiated. Empires generally rule over populations without direct administration, a mode of governance termed “hegemony without sovereignty” (Kolata 2006, 210). Power and influence are not exercised through unilateral impositions of administrative regulations by a centrally controlled bureaucracy, but rather by strategic application of force – not only warfare, but also through demonstration of cultural and military superiority, display of material wealth, and conspicuous consumption (Sahlins 2004). Rather than merely imposing central edicts and totalitarian control, central administrations therefore generally found it much more effective to enter into negotiations with local communities to find locally acceptable forms of power, notably by combining gift-giving and concessions in return for symbolic honours representing factual submission to imperial control (Ma 2013, 342). Highly divergent developments could occur in different parts of the empire as a result of the idiosyncrasies of negotiated processes against a variety of different existing backgrounds and pathways of development.

It has been noted that the imperial policy of the Achaemenid dynasty is difficult to detect in the archaeological record of Anatolia, suggesting a ‘light touch’ of governance (Hornblower 1994; Rojas 2016). The most notable exceptions can be found in the development of satrapal capital cities as these were essential nodes in the central governmental apparatus, for example to collect taxes. Striking features are the presence of citadels, palaces and royal gardens (*paradeisoi*) as monumental institutions of power. It is through such loci of power that the imperial administration was represented and demonstrated its imperial authority, most notably through interaction with local elites. During the

period of Achaemenid rule (550– 334 BCE), the region of Sagalassos was part of the satrapy of Great Phrygia.
The capital of Great Phrygia was located at Kelainai (later refounded by the Seleucids as Apameia and in modern days called Dinar). Here, the Persian king Xerxes (485-465 BCE) founded a citadel and palace at an already existing site upon his return from the failed campaign in Greece, as well as a *paradeisos* added later on (Xenophon Anabasis 1.2; Summerer *et al.* 2011). It has been suggested that Achaemenid power never really extended into the mountainous region of Pisidia (Sekunda 1991, 108). Local Pisidian communities would therefore rather have been operating at the fringes of empire. However, Kelainai was located at only 50km northwest of Sagalassos. We might expect this kind of proximity to the administrative structures of the Achaemenid empire to have had, one way or another, some implications for local developments. Yet, in accordance with the aforementioned 'light touch' of Achaemenid imperial power, it has been remarked how little overtly Achaemenid cultural influences can be discerned from the local archaeological record, for example in the wining and dining practices of Düzen Tepe (Cleymans *et al.* 2017) or its pottery material (Daems *et al.* 2017).
The opportunities offered by the spatial proximity of Kelainai as a seat of the imperial administration and authority for negotiating aspects of social, political and economic power and status would have been most notably directed towards local elites. It should in this respect be reiterated, however, that virtually no indications for structural social stratification and inequality have been identified at either Düzen Tepe or Sagalassos during the Achaemenid period. This need not necessarily mean that social inequality was absent, however, it can be wondered – if no strongly developed (or at least manifested) local elite was indeed present – to what extent any common ground for notable push/pull dynamics between the imperial administration and local community to develop could have existed in the first place? To elucidate this situation, let us now move towards a comparison with state-community interactions and dynamics during the subsequent Hellenistic period.

Three general core functions of the Hellenistic kingdoms have been commonly distinguished: war making, conspicuous consumption and gift-giving (Ma 2013, 343). Waging war and maintaining the military apparatus was probably the single highest form of expenditure for the Hellenistic kingdoms, entailing *inter alia* the distribution of rations during campaigns, payment of military salaries and bonuses, and various other logistical expenses (Chaniotis 2005).
In the 3rd century BCE, Pisidia was a frontier zone between the Seleucids to the north, who controlled Phrygia, and the Ptolemies to the south, who controlled Pamphylia and Lycia. The north-south routes appear to have been of major importance for the conflict in this region. In the second quarter of that century the Seleucids posed a formidable threat to the Ptolemaic possessions in Lycia, as indicated by the honorary inscription set up by the Lycian city of Tlos for a Ptolemaic commander who had beaten off a 'barbaric invasion' of Agranians and Paionians – Macedonian crack forces – together with Galatians and Pisidians (Ma 1999, 40 n. 51). As Tlos is situated near the southern end of the Lysis corridor which connects Phrygia with Lycia (Poblome et al. 2013), it seems most likely that the Seleucids made use of this corridor for their invasion. Their control over this corridor is also suggested by the presence of Thracian settlers in the area as attested in the late 1st century BCE (see Hall 1986). In the later 3rd century BCE, Pisidia served as a base of operations for the conquest of Pamphylia and Lycia by Antiochos III (Meadows 2009).
Related to this ongoing military activity was the establishment of Seleucid veteran-colonists in settlements in the area during the 3rd century BCE as a means of assuming control over the local and regional landscape. The kings of this dynasty at this time – Antiochos I or II - were especially active towards the northern part of the region where colonies were founded along the major Seleucid military route, the so-called "Common Road", connecting western Asia Minor with the Cilician gates (Cohen 1978). From west to east they included Laodikeia, Apameia (formerly Kelainai), Apollonia (formerly Mordiaion), Antiocheia, and Laodikeia Katakekaumene which all touched upon the northern fringes of Pisidia. The colony of Seleukeia Sidera was founded within the region itself, immediately north of Sagalassos. Control over vast agricultural lands northeast of Lake Burdur possibly played a role in the choice for this location as well. These new Seleucid settlements, founded around the middle of the 3rd

century BCE, are considered to have served as “avatars of Hellenism in Pisidia as in much of inland Anatolia” (Cohen 1995, 15-71), exercising influence on the development of local communities like Sagalassos. To what extent a direct involvement can be supposed will be elucidated below.

Constant warfare between the different Hellenistic monarchies would therefore have been one of the primary drivers of socio-political dynamics at this time, also providing a major incentive to generate surpluses through monetization of the economy in order to fund military exploits (Aperghis 2004). Besides war making, the extracted surplus was used by the state to demonstrate its power in the form of conspicuous consumption by the royal dynasties. The primordial stage of demonstration was presented at the royal courts as focal point of royal power and prestige (Strootman 2014). As a result, little concrete indications for this dynamic can be attested on the ground in the provinces, we will therefore not discuss this point in more detail. The third core dynamic of Hellenistic empires – gift-giving – as an attestation of royal magnificence can to some extent be considered as a form of conspicuous consumption as well.

Gift-giving as a form of royal magnificence was performed, both towards communities as a whole, and to individual high-ranking officials of the administration or other members of the elite. As is evident from the rich epigraphic record at many cities on the west coast of Asia Minor, these gifts – although often mediated through influential individuals who gained prestige because of their connections with the royal court – ultimately benefitted the community in general (Ma 1999). Possible personal gifts included endowments of land, income, and luxury goods, whereas communal gifts could entail territorial extension, city status, tax exemptions, and the right to strike coinage (Ameling *et al.* 1995). Previously in Achaemenid times, lands granted to officials were made *in usufruct*, meaning that only the revenue of the land was transferred to the beneficiary but leaving the ownership of the land itself in the hands of the king. During the Hellenistic period, however, lands were commonly conceded with the right of attachment to a city, effectively turning these lands in private property belonging to these communities (Aperghis 2004, 99-100).

Gift-giving, even if considered an element of royal magnificence, was not assumed to be a one-way process. It was part of a complex two-way flow of favours, services and capital. Beneficiary communities were therefore expected to provide return flows as well. Reciprocal flows of capital and resources flowed between three main units, central administration, local cities, and the surrounding rural areas. Resources and capital moved from centres and rural areas to the central administration in the form of regular and recurrent taxation to satisfy fixed costs and immediate expenditure of empire. Capital also flowed from the urban centres and central administration towards rural areas in exchange for food, which formed the basis of the economic policy of monetization performed by the Seleucids (Aperghis 2004).

It might at first not be entirely clear what the incentive was for the return flow from the central government towards local communities. Clearly it was expected of the king to perform demonstrations of benevolence and benefaction towards his subjects. Gift-giving and benefactions were bestowed by the king upon local communities to reinforce a mutually obligatory relationship. Whereas in the Achaemenid period this benevolence extended mainly to valued individuals, in Hellenistic times, the community as a whole started to receive the majority of these benefactions. Clearly something interesting in the interactive dynamics between these components had changed.

One explanation might be found in the presence of competing states in Anatolia, in the form of rival Hellenistic dynasties, that could make alternative offers, both ideological and material, to local actors (Ma 2013, 350). This volatile competition is insolubly connected to the general nature of the Hellenistic states as largely arbitrary formations whose shape and content was partially dependent on contingent processes (specifically, the overturning of the Achaemenid world by Alexander the Great and violent subdivision of his empire after his death) driven by self-expressions of a power elite focused on accumulating prestige through warfare, gift-giving and conspicuous consumption (Ma 2013, 350). Gift-giving in this sense featured not only as a bribe to maintain or gain control over local communities when and if required, but also constituted a form of obligation between community and king. The underlying consideration is one of *do ut des* as part of an ‘interactive’ mode of kingship (Chaniotis

2005, 69). It has for example been noted how the (exceptional) refusal of such donations or benefactions might free one side of reciprocal obligations, as was the case when the Achaian League refused an offer of benefaction from Eumenes II of Pergamon in 185 BCE (Polyb. 22.7.3).

Gift-giving practices should therefore be seen as an inherent component of political and economic policies (Ma 2013). Robinson (1972) has stressed the importance of local collaborators for exercising successful imperial control over local communities. The Seleucid dynasty in particular has been credited with exercising a conscious policy to develop the economic resources of their empire (Aperghis 2004, 2005).

Naturally, the expenditure related to the core functions of empire listed above could only be made possible by mechanisms of administration and extraction of economic surplus. It has been argued that when Seleukos Nikator (358-281) found himself in urgent need of silver after returning to Babylon in 311 BCE, in order to consolidate his power and defend himself against his rivals, specifically Antigonos Monophthalmos (382-301), he initiated an economic policy aimed at levying taxes to generate a sufficient flow of silver from the vast lands under his control (Aperghis 2005, 27-28). More generally, the need to pay standing armies of mercenaries in order to immediately respond to potential threats, created a high demand for silver during the Hellenistic period, draining existing coin reserves. Hardly any revenue from taxes were until that time collected in silver to ensure the regeneration of these reserves. During the preceding Achaemenid period, surpluses were roamed off in the form of commodities and stockpiled to feed the king, his administration and army (Aperghis 1999). Additionally, the royal administration was responsible for selling/exchanging taxes contributed in kind to various external consumers (Briant 1994; Descat 2006).

The Seleucids initiated a shift in monetization processes, placing the burden of extracting and selling surplus production from local lands, thus converting it to cash, onto local communities rather than central administration. The Seleucids therefore initiated a conscious policy of localized monetization throughout their empire (Aperghis 2004, 30-2). As tax payments were to be increasingly paid in silver, this meant additional markets needed to be created for peasants to sell their produce in exchange for coin. To this end, the Seleucids started to extensively stimulate the development of urban centres throughout their empire. On the one hand, they embarked on an extensive program of city (re-)foundations, as already mentioned above. Additionally, a significant supply of local coinage was maintained through the creation of a number of local mints throughout the Seleucid empire, providing a more extensive coverage of the various provinces, including at Sagalassos. The attestation of amphorae fragments at Sagalassos from the early 2nd century CBE onwards, suggest a more intensified local participation in exchange networks. As the provenance of these fragments has been placed in the Aegean and Italic world, these fragments are highly indicative of the integration in large scale networks, in addition to the existing local and regional patterns of exchange.

It should be noted, however, that some scholars dispute a direct link between military expenses, the need for adequate silver resources and taxation, on the one hand, and active urbanization and monetization on the other. It has been noted, for example, that at times a chronological gap existed between city-foundations and the start of local coinage. Moreover, the issues of large denominations commonly encountered in the monetary record at this time were not suited for daily transactions on the local market (de Callataÿ in press). Others have criticized the focus on monetary policies as central locus of interaction between local communities and central administration, downplaying the possibilities of flows of resources (provisions) or human capital (manpower) or even cultic honours as part of the complex process of negotiation (Bringmann 2005; Brodersen 2007).

As we will see, however, the model presented by Aperghis might provide some explanatory power for our case. Let us therefore now turn away from considerations of macro-scale policies and see how matters were translated “on the ground” in the archaeological record derived from Sagalassos, Düzen Tepe and the surrounding hinterland. The emergence of Sagalassos as an urban centre, the expansion of its dependent territory by 188 BCE, and the more or less contemporaneous decline and abandonment of nearby Düzen Tepe have all been discussed extensively and will not be repeated here.

To what extent can we now link these local dynamics and processes to a wider framework of push/pull dynamics between local communities and central administration outlined so far? We especially want to stress the importance of the Seleucid dynasty as a major potential factor in this process. It is in this sense important to restate that possession of the area around Sagalassos also encompassed a large part of the major natural corridor along Lake Burdur and the Lysis valley further south, connecting the Phrygian highlands - where many of the Seleucid colonies were situated, including the former satrapal capital of Kelainai, now Apameia – with the Lycian coast, until recently in the hands of the Ptolemies, which would have been of great strategic interest for the Seleucids. Control over this corridor, as would be implied by the extended territory of Sagalassos, could only have happened with consent of the Seleucids, and would also require a position of trust (Poblome *et al.* 2013).
It was suggested that a few decades earlier, the Pisidians were expanding westwards, settling in the Milyas and Kabalia, where they founded the cities of Balboura, Boubon, and Oinoanda (Coulton 2012, 63). It is unlikely that such an expansion would have been possible without Seleucid consent. Indeed, this could even have been encouraged by the Seleucids, who would have welcomed the presence of allies on the border with Ptolemaic Lycia and were themselves active in the area during the following years with the conquest of Lycia and Pamphylia in 197 BCE (Ma 1999). The subsequent Attalid presence in cities of the Lysis valley, such as Kormasa (Thonemann 2009) and Olbasa (Kearsley 1994), corroborates the importance attached to the area by Hellenistic rulers.
Moreover, the acentric location of Sagalassos in the Ağlasun Valley, some 37 km east of Lake Burdur, seems to contradict that this expanded territory was the result of an exclusively local and endogenous process, especially for a comparatively small community like Sagalassos as it was in late Achaemenid times. The considerable growth of the city's territory seems unlikely without at least the consent of the Seleucid overlords. The Seleucid activity in the area and the expanding territory of Sagalassos therefore appear to be related. It is difficult to explain otherwise how a relatively unimportant settlement like Sagalassos, likely not more than a village in its earliest phases, would have obtained control over such a large and strategically important territory in the course of only a couple of decades after the first display of community development beyond a village framework. Could it therefore be suggested that the sudden expansion of territorial control by Sagalassos might be interpreted as an act of royal gift-giving and a reciprocal process of mutual benefit as part of wider policies of political, military, and economic strategies?

Close ties between Sagalassos and the Seleucid dynasty are suggested by a number of other elements. Firstly, there is a clay seal from Sagalassos found in a peristyle building immediately south of the Doric fountain house and dating to the Roman Imperial period (Vandorpe 1995). A fire in the building during the 4th century CE caused it to be baked and preserved. The fibre pattern at the back shows that it was originally fixed to a papyrus roll. The legend 'CΑΓΑΛΑϹϹЄѠΝ' ('of the Sagalassians') identifies it as a city seal. City seals normally imitate the local coinage (Vandorpe 1995, 299) but this instance depicts an Indian elephant advancing towards the right, with characteristic high convex back and small ears, not exactly an animal present in the natural environment of the city. Indian elephants were chiefly found in the realm of the Seleucid kings of Syria. Seleukos made Indian elephants his special weapon in war and the emblem of his house (Toynbee 1996, 32). The elephant is a common type on the royal coinage, especially of kings Seleukos I (359-281), Antiochos I (324-261) and Antiochos III (241-187), all of which used Indian elephants in warfare. The Seleucid realm is the only kingdom in which the Indian elephant evolved into a real symbol of power. The Sagalassian seal therefore most probably refers to Seleucid power (Vandorpe 1995, 301-302).
The fact that the city continued to use this symbol well into the Roman imperial period suggests a significant Seleucid influence during the formative stages of the community (enough to last for centuries), which must have occurred prior to the battle of Magnesia in 189 BCE. The victory of Antiochos I over the Galatians, dated 269/268 BCE, may have saved Sagalassos and the major role of elephants in that battle could explain the city's choice of symbol, as previously suggested (Vandorpe 1995, 302). Pisidian soldiers – whether or not from Sagalassos is impossible to determine – are also known to have served in the Seleucid forces (see below) where they will certainly have encountered

war-elephants, but one may wonder whether this suffices to adopt the animal as a city symbol. A formative role in its development into an urban centre, on other hand, would certainly provide a suitable motive for Sagalassos to adopt and use the symbol of the elephant as a reference to its own glorious past.

Another indication of Seleucid influence relates to the start of silver city coinage in the form of pseudo-Alexander tetradrachms during the late 3rd-early 2nd century BCE (Van Heesch and Stroobants 2015). During the last decades of the 3rd century BCE, an upsurge of silver coin production occurred in the neighbouring region of Pamphylia where several cities began to issue their own posthumous Alexander tetradrachms. These coins were produced at the mints of Phaselis, Aspendos, Perge, Sillyon, Termessos, and possibly Magydos, and were part of a broader phenomenon of posthumous Alexanders during the late 3rd and 2nd century BCE. The issues, characterised by a city-mark and the indication of an era, were an important component in the coin circulation in the western part of the Seleucid empire until the end of the 2nd century BCE.

According to Meadows (2009), these coins should be seen as 'proxy-Seleucid' issues rather than purely civic ones, i.e. they were possibly produced partly with Seleucid silver at a civically controlled mint, and primarily produced within the framework of the different Seleucid military activities and presence in the area. The beginning of the Alexander tetradrachms in Perge and Sillyon in 223 BCE, for example, can be linked to the campaigns undertaken by Seleukos II against the Pergamene king Attalos I, whereby both cities issued coins for Seleucid military needs as probable allies of the king. The silver coinage struck by Termessos around the same time can be explained by the same event. A few years later, the small peaks in the Alexanders struck at Perge in 215/4-214/3 BCE are probably related to the Seleucid military activities against the usurper Achaios (Meadows 2009, 76). The city of Aspendos started its production of posthumous Alexanders in 213/2 BCE, a year after Achaios was murdered and when the region once again returned to Seleucid control. The fact that the era of Phaselis started in the same year could moreover point to a shift in the balance of power between the Seleucids and the Ptolemies in the wider area, in favour of the former (Meadows 2009, 75).

The coinages that arose around 205-203 BCE are in turn linked to the renewed interest and presence of Antiochos III in the region (Mcintyre 2006, 28-29; Meadows 2009, 80-81). The overrepresentation of Pergaian Alexanders during this period and during the years 198/7-195/4 can also be explained by Antiochos' military activities in the area. From this overview, it should be clear that both the outset and the peaks in the coin production in this period can be related to Seleucid military activities in the region, and the same can therefore also be argued for the tetradrachms of Sagalassos, which would then have served as one of these proxy-mints. The restricted production quantity (only three coins known, all from a single die) suggests that they were minted for a special occasion, within the context of the campaigns of Antiochos III (Van Heesch and Stroobants 2015). The fact that the issuing of these coins came to an end around the time of the Peace of Apameia further supports such a Seleucid link (Meadow 2009). A role of Sagalassos as base of support for the Seleucids would also explain the relatively severe penalty demanded by Manlius Vulso (25 talents of silver and 10.000 *medimnoi* of wheat and barley) for what is essentially a diplomatic error, *i.e.* failing to greet a victorious general. It is also in this respect that Vulso's harsh treatment of the Galatian allies of the Seleucids should be considered (Mitchell 1993, 23-25).

The depiction of elements of weaponry on funerary monuments is a common trait for Pisidia, something that allegedly refers to the warlike character of the Pisidians (Talloen 2017). Yet, in the case of Sagalassos, distinct 'Macedonian' elements in the shape of round phalangite shields were depicted on funerary and public monuments alike during the late Hellenistic and early Roman Imperial periods (Kosmetatou and Waelkens 1997, 277-291; Kosmetatou 2005)[543]. These do not necessarily reflect a Seleucid presence or influence on Sagalassos' development. Indeed, the fact that none of the names listed in the aforementioned law code inscription was Greek, as would be expected if such settlers

[543] For the funerary context of most of these representations see the full treatment by Köse 2005b: 49-77.

were involved in the foundation of the city, seems to rule out that they played a predominant role in the new community. Yet, the depiction of the shields does suggest a local familiarity with one of the Macedonian armies – likely the Seleucid – and could hint at the role played by the locals in those armies. People from Adada and Balboura are attested as serving in the Seleucid army at Sidon (Robert 1935, 428-430), and Pisidians were also among the Seleucid troops invading Lycia during the first half of the 3rd century BCE as mentioned before and they served as targeteers (*caetrati*) during the Battle of Magnesia (Livy XXXVIII 15.9). It would therefore not be unlikely that people from Sagalassos or Düzen Tepe as well did their part in the Seleucid war effort.
Finally, there is the later prevalence of dynastic names such as Antiochos, Seleukos and Makedonios (Kosmetatou 2005, 219) which could have reminded people at Sagalassos during the Roman Imperial period of their Seleucid past (Waelkens 2004). Also elsewhere in the region the kings were remembered fondly as indicated by the worship of the Seleucids during the Roman Imperial period: a statue of Theos Nikator was erected in the territory of the Seleucid colony of Apollonia in the 2nd century CE (MAMA IV n° 226) undoubtedly in honour of Seleukos Nikator, while the worship of Zeus Nikator, attested at Konana (Labarre *et al.* 2010, 85 n° 4) and near Etenna (Nollé 1992, 76) can be seen as another form of the posthumous cult of Seleukos Nikator.

While none of these elements individually constitute firm proof for Seleucid involvement in the city formation at Sagalassos, put together they present a strong case to suggest some form of Seleucid influence. One point of remaining uncertainty is the chronological sequence of events. The aforementioned political, economic, social, and material developments at Sagalassos were likely initiated in the (second half of the) 3rd century BCE, and therefore part of the period of Seleucid rule. This was the start of a trajectory of development, most visibly expressed in the urban transformation of town, which would continue for the better part of the 2nd century BCE, including the construction of the fortifications only towards the end of the century. At some point in this trajectory, the nearby settlement of Düzen Tepe was abandoned. Although material studies have suggested a core occupation period of 4th and 3rd centuries BCE based on pottery parallels, the general chronological bracket of the end of occupation (also based on ^{14}C and coin dating) has been placed in the 2nd century BCE (Poblome *et al.* 2013; Vanhaverbeke *et al.* 2010). Unfortunately, it is difficult to ascertain precisely when this would have occurred. A second, related question is why exactly the observed developments occurred at Sagalassos, and not at Düzen Tepe, given that both settlements were likely inhabited at the time of the initiation of the process. Unfortunately, we have little information to build on at this point.

Still, let us try to take reconstruct a likely potential scenario given the evidence at hand. The processes described above must to a large extent have been two-way processes of negotiation, consisting of one party (the Seleucids) offering stimuli and incentives for certain developments (city formation) to another (Sagalassos). In such dynamics, all parties make certain choices depending on internal strategies and external opportunities, and it is often difficult to disentangle the complex interactions at play. It is at any rate interesting to note that, in this case, the Seleucids preferred to work with an existing local partner, even if it did not possess the most strategic location, rather than to found a new urban centre *de novo*, for example somewhere in the plain of Burdur. Here, this new hub would be able to maximise the economic potential of this area, as well as provide a closer connection to the strategically vital north-south corridor at the end of the Lysis river.
The asymmetric location of Sagalassos within its territory therefore raises questions both from a strategic and economic point of view. However, the case of Seleukeia Sidera is only one of the examples that indicated that Seleucid city foundations oftentimes consisted of the influx of settlers to existing settlements, rather than *de novo* foundations, although an example for the latter can be found in the case of Attaleia on the Pamphylian coast (Strabo XIV.4.1; Cohen 1995, 337; Grainger 2009, 129-130). Apparently, the benefits of having a readily-available local partner outweighed the eventual strategic disadvantages. Perhaps due to the political turmoil of the time it was more beneficent and cost/effort efficient to collaborate with existing communities, rather than going the extra mile for a

city foundation, which would have required more initial investment and would take more time to develop before it was ready to play its part in shaping local (economic, military and political) dynamics and configurations. Several other relatively sizeable communities had likely already emerged in the area by the Early Hellenistic period, including Keraia to the south, Kormasa to the west, and Kapıkaya to the east. Why in the end, Sagalassos gained the upper hand over these other viable possibilities is unclear.

Instead of a *de novo* city foundation, it could be suggested that a merging of two existing communities through a process of *synoikismos* – either locally-induced or through Seleucid intervention – could create a stronger base for the intensified system dynamics related to the development of an urban centre. The extensive literature on the cross-cultural links between group size thresholds and societal complexity has been extensively discussed in the first chapter. Unfortunately, our limited evidence does not allow a reconstruction of the possible population sizes before and after the potential *synoikismos* event.

Recent studies have shown greater scepticism with respect to the involvement of Hellenistic rulers in processes of *synoikismos*, criticizing the restriction of agency primarily to the "big men" of history (see LaBuff 2016, 17). There are several indications here that *synoikismos* was guided and contingent on local cooperation, rather than enforced by a Hellenistic king. The reasons behind effecting this policy at Sagalassos rather than Düzen Tepe are difficult to capture. But it should be noted that even small details could have made all the difference. When considering human societies from a complex systems perspective, it has been noted that even infinitesimal small differences in system properties or changes in system inputs, can radically alter system output (Bintliff 1997a). This 'sensitivity to initial conditions' (Lorenz 1963) has profound consequences for the ways societies are conceptualised and studied as the unpredictability of nonlinearity magnifies any initial uncertainties in the system state. Although both communities initially were highly similar and operated within largely the same socio-cultural framework, even slight differences in properties of a number of key components may have been sufficient to tip the scale towards a certain trajectory of development.

The exact nature of these small initial differences can be legion. Some of them could be related to the possibilities of the natural environment of the site. In this sense, topographical considerations likely played their part. The plateau of Düzen Tepe, while suitable to house its community up until that point, would have offered little potential to be extended into a veritable urban centre due to its limitations in available space, suitable soils, and comparatively difficult connectivity to the surrounding valleys. Of course, we should be wary of relapsing in geographic determinism when postulating potential contributing factors.

Differences in the socio-political fabric between both communities possibly played a part as well, even if we currently have little evidence to go into much detail here. The first attestation of the development of a formal political (and legal) constitution can likely be placed in the latter half of the 3rd century BCE (Vandorpe 2000). It is difficult to ascertain whether this document constituted an internal development of a political constitution, possibly grafted on examples encountered in existing institutionalized urban communities, such as in coastal Lycia, and whether this would have offered an existing 'competitive advantage' for the community of Sagalassos to participate in Seleucid policies compared to its local rivals. Alternatively, it could perhaps also be interpreted as the marker of the initial moment of synergy between the Seleucids and the local community inducing the development of a formal political framework, in which case the initial impetus still eludes us. The widespread development of political organisation in 'indigenous' Anatolian communities in the 3rd century BCE has been interpreted as a strategy of establishing and maintaining internal autonomy in the face of increasing impact and intervention of the Hellenistic kingdoms onto local configurations (Mitchell 2017). The supposed development of *polis* communities in Anatolia should in this sense not be seen as a form of cultural dissemeniation, but rather as part of a wider political strategy born out of the interaction space between local communities and the overarching central administration of the Hellenistic kingdoms, in this case the Seleucids.

In the end, the result remains that Sagalassos transformed into a veritable urbanised political centre, or *polis*, increasingly turning into a regional system hub, attracting flows of energy, resources and capital. The initiated process was likely, at first, mainly a political one, resulting in the transformation of Sagalassos as a village community with informal institutional and organizational structures towards a formal institutional framework with fixed public offices. In this respect it is important to note that political formation is not necessarily identical to urbanization. The silver coinage of Sagalassos, for example, is of an earlier date than that of any of the known urban monuments. It proves that the community was already politically and civically organised before it became architecturally defined on any monumental scale, as far as we know. This was also the case for Aphrodisias in Caria. There, it was only after Plarasa was given up as part of the *sympoliteia* that Aphrodisias experienced the first wave of urban development (Raja 2012, 16-18). In other words, the monumentalization of the city centre should be distinguished from the political process that enabled and preceded it.

The creation of a political class, and associated social stratification, would in this scenario have offered sufficient drive for continuation of the initialized process throughout the 2nd century BCE. The initial process of politicization can then be considered an essential pull factor, moving the local community into a new attractor state, inducing a constraining pathway of development stimulating continued capital investment to sustain these novel system dynamics. After this initial impetus, attested throughout Pisidia, the region appears to have undergone a process of continued urban development, comparable to that seen in Karia and Lycia in the 5th and 4th centuries BCE (Thonemann 2009, 228). The region of Pisidia, with little or no previous history of monumental urbanism, witnessed the creation of new towns festooned with copies of all the hallmarks of a Hellenic city during the course of the 2nd and 1st centuries BCE. The spread of monumental building projects throughout the region at this time can be likely seen as the result of a combination of external impulses, internal impetus and local competitive interaction, possibly interpretable in the framework of peer polity interaction, resulting in settlements with a reasonably homogenous kit of public buildings and infrastructure developing over an extended period of time.

Conclusion

Up until the later part of the 3rd century BCE, Sagalassos was a small settlement and village community of little importance, on a political, economic or urban level. At some point around the turn of the century, however, an intensive process of local development started, expressed in the formal definition of a political community, the construction of a monumental urban fabric, spatially demarcated zones of production, an associated mode of material culture production and consumption, and the considerable extension of a politically dependent territory. The archaeological evidence leaves no doubt that by the early 2nd century Sagalassos had a public centre, a shared central space for the community and a clear sign of urban living. The building projects that took place in the following decades embodied some of the basic elements which were essential to the definition of an urban society and communal self-representation in this period. These buildings were essential for a new form of social interaction context to emerge, through which the community could define and express itself. These changes can all be observed in the local archaeological record, however, in the absence of written sources, the relevant actors behind this process often elude us. Still, we hope to have demonstrated here that a convincing case can be made for the (at least partial) involvement of the Seleucid administration.

The Seleucids were known for their considerable interventions in local configurations as to advance their own political and economic policies aimed towards creating an increasingly monetized economy. The (re)foundation of local communities as Seleucid colonies, with considerable influx of settlers, are the most visibly attestations of these interventions, however a range of policy measures was possible. The strategic importance of the nearby north-south corridor along the Lysis river and the plain of Burdur would at the very least have ensured willingness among the Seleucids to exert their policies towards securing the area, in collaboration with a trusted local partner. Although the exact reasoning behind the choice for this partner remain elusive, it can be suggested that Sagalassos was eventually integrated in these policies, as is indicated by the apparent popularity of the Seleucid dynasty within the community even in later centuries. This could perhaps be considered indicative for their importance in the formative stages of the community. The interaction field generated by the Seleucid administration, possibly offering stimuli through favours related to royal gift-giving, combined with impetus of local actors, would have resulted in the local community starting to participate in wider dynamics of economic and political importance. The right to strike coinage bestowed upon Sagalassos at this time should also be considered in this respect. At this point it is difficult to ascertain whether the observed rise of a political framework at Sagalassos was the result of Seleucid intervention inducing formal 'spokespersons' in the local community to guide the interaction among different levels of administration, or whether this development had already occurred earlier as a result of local political strategies to maintain internal autonomy, thus offering a suitable 'breeding ground' for the incentives of the Seleucids to be received and reacted upon.

The development of Sagalassos as a primal centre in the local landscape, would have increasingly resulted in capital, energy and resources being pulled into the centre. The contemporaneous decline of the neighbouring settlement of Düzen Tepe and indications for a considerably extended territory, points towards a significantly decreased potential 'breathing space' for this neighbouring community. Possibly, the assignment of this extensive territory to Sagalassos would have induced a reorganization of the local settlement pattern. It is ultimately unprovable what exactly transpired, however, it might be suggested that the population of Düzen Tepe was moved to Sagalassos, in an event traditionally described with the term *synoikismos,* to denote a joining of two communities as the basis of *polis* formation. The resultant increase in population size would have provided an improved base upon which the aforementioned developments on a political, economic, and urban level could be initiated and the transformation into a veritable urban centre could be sustained. The lack of indication for an external influx of people in the form of settlers may provide additional indication that the demographic base created through such a *synoikismos* was deemed sufficient.

While the initial political transformation seems to have been at least a partially planned or guided process due to the involvement of the Seleucid administration, the subsequent monumentalization/urbanisation of the city can possibly be ascribed to the resultant competitive interaction between peer polities as part of the complex negotiation ground between different actors within the local landscape and possible external involvement. The development of political city formation – attested more readily in non-archaeological evidence – followed by a marked process of urbanization in the late 3rd century BCE, has been observed at several places in the wider region of Pisidia, possibly indicative for the wider effects of Seleucid policies in the area. In regions such as Lycia with its existent traditions of major centres, these continued their role as main focal points of the local settlement pattern. In Pisidia however, such a settlement pattern was not present at the time of the Seleucid rise to power in Anatolia, resulting in a more marked overhaul of the settlement pattern in the form of formal colonies and stimulated city formation.

The processes described in this chapter, however radical for local configurations, were therefore ultimately nothing special in a wider context. The development of Sagalassos from a village community into a prominent urban centre, can be considered as only one particular case of a series of wider processes, affecting many different communities in a variety of ways. For the community itself however, this phase of its history entailed the beginning of a new pathway of development which set its subsequent trajectory into a wholly new direction towards local and regional prominence.

Chapter 5: Synthesis and conclusions

"It's the questions we can't answer that teach us the most. They teach us how to think. If you give a man an answer, all he gains is a little fact. But give him a question and he'll look for his own answers."
-Patrick Rothfuss, The Wise Man's Fear.

5.1 Moving towards the end

In the previous 350 pages or so, I have outlined the results of three years of research as part of the Sagalassos Archaeological Research Project at the University of Leuven. The text I have presented here represents my attempts at contributing to the discipline of archaeology in this time. In this final chapter, I wish to present an overview of this journey and present its major results in one final synthesis. At the same time, I wish to highlight what is still lacking, some of the missed opportunities, unanswered questions, and potential avenues of future research. It is only through the combined presentation of both – that what was accomplished, and that what is still left to do – that this work will truly be able to contribute to the development of our discipline, in whatever humble way.
To kick-off this assessment, let us take a look at where we came from. This research has been made possible thanks to a FWO fellowship, originally titled "*Complex Dynamics in Society: An application of complexity studies on community formation in southwest Anatolia during the Hellenistic Period (323-133 BC)*". If we put aside for a moment the awkward phrasing, a clear shift can be noted when comparing with the intermediate title submitted for the fellowship renewal after two years: "*Dynamics of social complexity: Community formation beyond the origin of polis in Southwest Anatolia during the Archaic, Classical, and Hellenistic periods"*. Most clearly, the chronological framework was at this point extended from a focus on the Hellenistic period to include also the preceding Archaic and Achaemenid periods in order to allow better integration in prolonged trajectories of social complexity development. When we compare this intermediate title with the eventual title on the front page of this work: "*Dynamics of social complexity: Community formation beyond the origin of polis during the Iron Age, Achaemenid, and Hellenistic periods. The case of Düzen Tepe, Sagalassos and southwest Anatolia"*, it becomes immediately clear that an additional shift in focus occurred. Aside from the replacement of 'Archaic' with 'Iron Age' (see 4.3), the main shift entails moving from the sole mention of southwest Anatolia as context for application of the intended research, to emphasize the specific case studies of Düzen Tepe and Sagalassos. This reflects the emphasis of the contents of this work as well, where it was only in the last two parts of the previous chapter that the focus on a local framework was extended to include southwest Anatolia.

The reasons behind this shift were mainly practical. It was considered of primordial importance to extend the primary case study as much as possible to try and cover a maximally comprehensive analysis of the way both communities originated, developed and operated. At the same time, I could not neglect to sketch the background onto which these developments could be projected, either on a spatial, temporal or social plane. Unfortunately, we can only do so much with the time that we are given. The sustained focus on the primary case study, naturally, acted as a communicating vessel with the allocated time for the extended integration of the wider spatial and temporal background. As a result, the latter has remained comparatively underexposed. The efforts in parts 4.3 and 4.4 should therefore be seen mainly as tracing the outlines of the framework in which the more extensive case study can (and should) be embedded. The findings addressed in those parts should at the very least provide sufficient indication that pursuing such a perspective in the future is very much worthwhile.
Before discussing in more detail the outcomes of the research, let us first take a look at the main elements of its incipience, *i.e.* the major components of the research application. Here, two main elements can be discerned. First, the proposed research outline was said to focus on looking beyond the framework of origin of *polis* to describe and interpret dynamics of community formation at Sagalassos in particular, and, in southwest Anatolia, by extension. Second, it was aimed to incorporate the conceptual framework of the adaptive cycle into the praxis of archaeological research. Both elements have been extensively discussed, respectively in the second chapter of the narrative of origin of *polis*, and the first chapter pertaining to the applied conceptual framework. They can now be integrated in the present synthesis, including a more extensive overview of the main tenets, results and conclusions of the presented research.

5.2 Grand synthesis

In the overall introduction to this work, I already called for the need to integrate several avenues of societal development across various variables and domains to study social complexity within a multi-dimensional approach. I argued for the utility of a 'middle range theory' approach, integrating theoretical approaches with a differential epistemological scope and explanatory power, ranging from hands-on, data-minded approaches, to more general 'high-level' theory. In chapter one, I extensively discussed the different components of the theoretical framework which shaped and guided this approach. The lower and middle levels of this approach – social practices and community formation, social complexity, and social metabolism – have all been discussed to an extensive degree in the previous chapters. I will at this point provide a short recap of these approaches and how they are interconnected in order to highlight the main tenets of the presented conceptual model of social complexity development in community formation processes.

By condensing the theoretical framework presented earlier and highlighting the interconnections between its various key components, its cohesiveness for generating a model with high explanatory power will be stressed as much as possible. The main part of this synthesis will subsequently be dedicated to lifting these 'intermediate' theoretical considerations – along with the integration of the presented data – onto the highest proposed level of theory, *i.e.* that of the adaptive cycle and the panarchy. The adaptive cycle framework was already tentatively tested in the case study in part 4.2.5. However, a more extended integration of its scope and explanatory value has not yet been undertaken. To do so will allow this dissertation to reach fruition.

The framework highlighted here, starts from the general premise that a community can be considered as a collective plane upon which shared, day-to-day activities and interactions can take place, giving rise to durable structures of social organisation. The pivotal concept is that of social interaction, which occurs when two or more people engage in an instance of information transfer. Structured avenues of repeated interaction are expressed as social practices. These practices always have a spatial, temporal, and social dimension, and oftentimes – but not always – a material dimension as well. I have focused mainly on the combination of spatial and material dimensions, using material settings as spatial pockets of interaction, and associated material objects to circumscribe the concordant social dimension, in order to reconstruct the nature of social practices, organizational structures and social complexity.

It should be noted that the temporal dimension has been left comparatively underexposed here, restricted to chronological subdivisions in general time periods. This is mainly due to the limited temporal differentiation discernible from the studied material itself. Most prominently, virtually no chronological differentiation could be surmised from the material of Düzen Tepe, neither in the composition of the overall assemblage, nor from relative stratigraphic context differentiation. An attempt to provide some more chronological detail in the stratigraphic contexts of Düzen Tepe through seriation did not yield any clear results, following an earlier inconclusive attempt by dr. Dennis Braekmans (hence it was decided not to incorporate it here). As a result, the entire lifespan of the village was necessarily treated as consisting of a single chronological block – at most reducible to the core period of the 4th and 3rd centuries BCE – which was considered as a cohesive whole to look into the dynamics of community formation and social complexity. Additionally, this had clear implications for the comparative case of Sagalassos as well, given that, because of the paucity of material remains, the earliest phases of community development at this site were discussed within the framework and parameters set by the Düzen Tepe material. The only chronological differentiation in this case was the contrast with the developments and material culture from the late 3rd-early 2nd centuries BCE, which was therefore greatly elaborated upon in the main case study.

Moving from social practices to community formation and social organisation can be considered as a micro- to macro-scale transition, where combinations of various micro scale practices give rise to emergent macro-scale phenomena. This transition does not move in a deterministic fashion through fixed avenues of development. Instead, community formation should be considered as developing out of probabilistically operating selection pressures. These selection pressures operate on various scales, being related to micro level circumstances and aims of face-to-face interactions, giving rise to meso-level mechanisms of social integration and differentiation, and inducing larger sociocultural patterns and organisations through macro-level forces operating in a number of key domains, including demography, production, distribution, regulation and reproduction. Selection pressures can be induced by three sources: 1) internal (as in pertaining to the members of a community) strategies and goals; 2) external (as in the 'environment' at large, including other communities or social units and the natural environment) stimuli, opportunities and constraints; and 3) a measure of human unpredictability and 'randomness'.

As a result, no two cases of community development can ever be completely the same. Still, this does not mean that comparative research is *a priori* meaningless. Convergences and differences in societal outcomes can still significantly elucidate the workings of underlying selection pressures of social organisation. However, to avoid the obvious critique of determinism – in archaeology often expressed through the accusation of reintroducing processual archaeology – a suitable conceptual framework is needed to properly integrate the contingent and structural component of these selection pressures shaping social life and communal organisation. Such a framework has been presented here through the incorporation of a complex systems perspective, centred on the aspect of social complexity. In archaeology, social complexity is often considered as an expression of 'complex societies', generally conceptualised as consisting of a large number of people, with many social and economic roles and specializations, and centred on large (urban) settlements. However, social complexity should not be reduced to an (archaeological) sense of complex societies. Instead, a complex systems perspective entails focusing on a conceptualisation of open systems requiring energy input to maintain their internal structural organisation, regardless of their size or configuration. Complex systems in this sense consist of a multitude of interactive constituent elements – in the case of social units mainly individual people – producing unexpected, emergent phenomena which cannot be fully reduced to the aggregation of the properties of the individual components.

The key mechanisms of complexity development can be related to the multi scalar selection pressures highlighted earlier. More specifically, I have argued for three major mechanisms: diversity, connectivity, and dimensionality. System diversity as a complexity mechanism develops in response to certain needs and opportunities that are asserted. Connectivity between diverse subcomponents is what makes the overall system truly complex, as it allows the necessary multiplicative interactions that generate emergent behaviour. Finally, dimensionality refers to the constituting ordering of diverse, interconnected components within the system, structured both vertically and horizontally.

One of the key properties of complex systems is their capacity for computation and information transmission. The workings of such complex systems should be conceived as information processing systems, entailing a focus on flows of information and decision-making. A model of organizational development using information input, processing, and decision-making has been discussed through the conceptualisation of a dual loop of socio-political complexity development. This model effectively relates the development of socio-political complexity to its 'problem-solving' functionality. Information regarding a given situational event – including both stimuli and challenges, induced either internally or externally – potentially impacting the community, needs to be recognised, properly processed and result in the successful development and implementation of solution measures through a series of rapid *ad hoc* decisions and strategies. These, in turn, feed a slow loop of complexity accruement.

Subsequent *ad-hoc* decision-making loops induce increasing complexity through the three mechanisms of complexity development highlighted above: 1) diversification of rule sets, social groups, institutions, *etc.*; 2) increasing connectivity between system components, thus linking their operational and functional structures to stimulate information flows; 3) developing new horizontal and vertical structures of organization. In the case of continued successful problem solving, various runs of the loop are superimposed and interconnected, thus generating ever-increasing complexity. However,

the model goes beyond a unidirectional interpretation of social development as a teleological and unavoidable trajectory towards increasing complexity, by incorporating the possibility of failure in mobilising the community, inducing collective action, or developing social organisation at every step of the process.
It should be reminded that complexity development in and by itself is but a by-product of these problem-solving processes, often unintended and unforeseen. As such, it is neither inherently good nor bad, but functional at best, and disruptive at worst. Increasing diversification is considered essential for absorbing disturbances and facilitating social reorganization following disruptive situational events. However, diversification *ad infinitum* will not help a community in the long run, but will only make it more difficult to effectively induce collective action measures. Increasing connectivity induces more efficient information transmission, multiplicative effects, and knowledge spill-overs, but can also result in a state of hypercoherence where increasing inter-reliance of system components results in an overly rigid system state, which cannot adequately respond to novel situational events. Nested layers of decision-making can result in more efficient information transmission, however too much nestedness may stem efficient information flows, thus inducing a lag in response times whenever new situational events occur. Clearly, no 'magic formula' exists. Specific measures of problem-solving complexity might work very well for certain situational events in conjunction with a mechanism of development in one context, whereas at other times similar combinations could fail miserably. Internal structures, external circumstances and 'chaotic' elements of randomness will always result in divergent developments – that is the famous sensitivity to initial conditions in chaotic-complex systems – whose effects cannot be replicated in different instances.

A second approach that was highlighted, shows how social complexity induces both positive and negative effects in community development. The social reactors model posits that the multiplicative effects of increased face-to-face interaction, following demographic drivers such as population growth and aggregation, will provide increasing returns to scale on social outcomes such as community formation and socio-economic growth, but also scalar stress. Scalar stress can be induced by human cognitive limits on information processing, impeding successful mobilisation of a community and the development of collective action measures in the face of situational events. Scalar stress can therefore effectively disrupt the community formation process, sometimes even resulting in internal social fission. Communities can actively develop measures to counter these limits on information processing and the scalar effects they induce. In general, two major modes of consensus-seeking strategies can be discerned. First, (formal) centralised institutions can be developed as 'calibrated' pathways of interaction, using itinerated communication to reduce noise and redundant information in a bid to induce collective coordination, and more efficient information feedback loops. Additionally, consensus measures can be developed through bottom-up, 'spontaneous' emergence of desirable behaviour, produced by self-interested individuals who are not intentionally aiming towards collective coordination. Material culture should be seen as a quintessential element in this process, as degrees in material uniformity can be related to measures of social conformity and prevalent strategies of collective action.

Complexity as a by-product of the development of organizational structure, even in the case of successful problem-solving measures, does not come freely. Various costs are associated with implementing different strategies, some being more difficult to maintain while having differential problem-solving power. 'Costs' can be interpreted as requiring more individuals to be supported or mobilised by a polity, but also as a direct measure of required capital. As a general rule, effective low-cost measures with high returns will, if available, be pursued first, after which increasingly expensive measures will be needed to maintain the same margin of effectiveness, given a general decreasing return on investment. With every iteration of the recursive problem-solving loop, subsequent strategies and solutions become superimposed. This eventually generates a costly decision-making apparatus, consisting of multiple, partially overlapping structures of administration, laws, rules, practices and organizational structures, as well as an intricate set of social norms and values, and various avenues of communication between people, social groups and central administration. All of these are costly to maintain and therefore require increasing amounts of energy to be invested in the form of expenditure of labour, money and/or time. Energy is never free flowing in a society. It needs to be targeted, exploited, transformed, and consumed in order to be effectively employed to sustain societal dynamics.

One suitable model to describe flows of energy and resources in human-environment interactions is that of social metabolism. The model traces input, inner, and output flows subdivided over five metabolic functions: appropriation, circulation, transformation, consumption and excretion. These functions can operate on two distinct levels, an individual or biological, and collective or social level, corresponding to a general division between endo- and exosomatic energy needs. Whereas the former remains fairly stable over extended periods of time, being mainly a function of population sizes and composition, the latter can vary greatly for different kinds of communities, depending on the amount of technological capital associated with different activities, practices, and strategies that may require highly diverging amounts of energy. The different ways communities affect, appropriate, transform, consume, and excrete resources and energy derived from their environment are articulated through formal and informal structures of social, political, and economic organization.

Whereas social metabolism offers a specific gateway into the workings and dynamics of a given metabolic unit, the adaptive cycle model provides an encompassing integrative framework to describe general trajectories of change and dynamics in complex human and environmental systems. It describes three dimensions of change: 1) potential for change, determining the range of possible options of system development though accumulated capital; 2) degree of system connectedness between internal variables and processes and 3) system resilience, measuring vulnerability to unexpected disturbance events. These three dimensions move simultaneously through four phases: exploitation (r), conservation (K), release (Ω), and reorganization (α). Individual cycles need not necessarily pass through all phases, and not always in the same fixed order, but this is the standard flow. Changes are neither continuous nor chaotic, but are rather part of an episodic flow, consisting of periods of slow accumulation of capital, connections, and structures when moving from r to K, punctuated by sudden release and reorganization of system components, respectively in Ω and α.

Dynamics in one adaptive cycle operate on a specific scale, with associated organizational, temporal and spatial scope and properties. However, studying one scale of analysis in isolation will provide only a partial explanation of the process under scrutiny, as the effects of many processes in complex systems inherently unfold across various scales, or its properties and dynamics are influenced by processes on higher and/or lower scales. Individual cycles can be integrated in a multi-scalar perspective – a panarchy – connecting cycles of different 'sizes' moving at different speeds, from small and fast to slow and large. The size of the cycle refers both to its spatial and organizational scope. Different scales can be interconnected in various ways. Two types of systematic connections that are frequently mentioned, are 'memory' and 'revolt'. In the former, larger cycles provide 'inertia' and stability that permit lower scale cycles to pass through release and reorganization while maintaining similar functions, *i.e.* staying within the same basin of attraction, thus allowing adaptive cycles at one level to be repeated in the same or similar cycles of system configuration. In the latter, coordinated release at small and fast scales may trigger release at larger scale cycles, in cascading fashion, especially if these are at that time in the K phase characterised by low resilience. This process precipitates potential shifts into new basins of attraction at large scales through a phase of creative destruction. However, multi-scalar dynamics of change need not necessarily run according to these schemes. Larger scales can generate novelty and induce new basins of attraction in lower scale dynamics as well, whereas lower scales can act as stabilizing factors in times of turmoil higher up in the panarchy.

The general nature of the overall system dynamics described by the adaptive cycle has provoked some criticism as to its actual use beyond offering a mere metaphor of change. The criticism receives extra cachet when the framework is transposed to archaeology, a discipline which is more inherently inclined towards narrative frameworks and use of metaphor. I think it is worthwhile to cite an insightful passage on this matter:

> "One might distinguish between those models which serve to reduce observed complexity and those that serve to enhance it. In the physical and formal sciences the tendency has been to strip observations further and further down, to formalize maximally, in order to allow for discussion without misunderstanding. In archaeology phenomena cannot be stripped, they have to be dressed in order to reconstruct the reasons for the particular configurations of remains we have found. The essence of the social phenomena responsible for them is their complexity. Thus formalization has a different function - not to create intersubjectivity but to explicate intuition. Even a model which uses formalization is in many cases necessarily a metaphor in archaeology."
> -Mcglade and van der Leeuw (1997, 22).

The usage of the adaptive cycle framework is intended here as part of a conceptual model. It should therefore be considered as a 'tool for thought' (Waddington 1977) which may help us to uncover and elucidate some of the complex patterns and processes observed for societies in the past. In an earlier chapter, I called for the use of more formal methods in archaeology. While the chasm between the usage of metaphor and formal scientific approaches may appear nigh unbridgeable, we should not see it as a black and white dichotomy. If metaphor as a figure of speech stands on one side of the spectrum, mathematical formalism stands on the other. However, in-between both lies not a dark abyss, but a range of possible research methods and approaches with varying degrees of formalism. Likewise, the debate regarding the usage of quantitative versus qualitative methods is no dichotomy. Many different qualitative approaches exist, with high degrees of formalism and which are perfectly compatible with quantitative approaches (Ragin 2014). It is only when we forget these intermediate procedures of scientific thought that both ends of the spectrum seem incompatible.

There is nothing inherently wrong with the usage of metaphor, even if only for rhetoric effect. As is evident from the quote above, metaphors can help 'dress' our descriptions of archaeological and social phenomena as to make them intelligible and comprehensive. However, this should be embedded in an overall approach which aims to move beyond the stylistic usage of words, to attain a degree of formalism so that our reasoning becomes clear and inherent assumptions are made explicit. The framework built on causal factors and mechanisms of system development advocated in this work is developed with this goal in mind (Ragin 2014). The usage of the adaptive cycle in the following pages should be considered in the same way.

For the remainder of this final synthesis, I will now work towards answering some of this criticism by integrating the results of the case studies presented in chapter four into this adaptive cycle framework and demonstrate its added value as an explanatory conceptual model.

Although concepts such as the adaptive cycle are explicitly nested across time and space, starting from small-scale factors and fast loops up until large-scale and slow-moving loops, still, many proponents of applying elements of resilience theory and complex systems approaches in archaeology mainly focus on large-scale issues such as climate change and its effects on subsistence strategies. Few explicitly start out from identifying and analysing smaller-scale factors to determine how these influence larger scale developments. However, if we are to understand why people form and maintain communities within an ever-changing environment, we must integrate local-scale social interactions and their material manifestations. This is exactly what I have attempted here.

This work has focused on dynamics of community formation at Sagalassos and Düzen Tepe, along with the surrounding area of 1200 km², corresponding to the research area of the Sagalassos Project. The oldest temporal phase under scrutiny in this work is the Iron Age (12^{th} – 6^{th} centuries BCE). The chronological framework extends until the mid Hellenistic period (2^{nd} century BCE). Within this range, we see the development of Sagalassos from a village community into an urban hub of considerable local importance. This pathway of development continued well into Roman imperial times, when Sagalassos became an important centre for all of Pisidia. It should be remembered, however, that from a long-term perspective, this urban phase of Sagalassos constitutes an exception to the rule regarding settlement and community configurations. In general, we see for this region a large cycle of community organisation centred on small-scale settlements embedded within their own local environmental context, superseded at some point by a temporally smaller scale operating at a higher speed, centred on the pull off an urban hub.

The earliest indications of systematic settlement patterns can be traced back to the latter parts of the Early Iron age (12^{th}-10^{th} centuries BCE) and the transition towards the Middle Iron Age (9^{th} – 7^{th} centuries BCE). In most of the research area, settlement patterns were at this time centred on a number of hilltop sites, commonly fortified. Additionally, a series of villages along the edge of the Burdur plain were attested, likely oriented towards the important settlement/sanctuary at Düver Ada. The latter likely played a significant role in local configurations and possibly exerted a central place function onto the surrounding communities.

It has been suggested that Düver Ada made use of connections with the outside world, possibly through dynamics of peer-polity interaction, induced by its positioning along important avenues of communication and movement in the form of a natural thoroughfare connecting inland Anatolia on an east-west axis towards Denizli, as well as a major north-south corridor through the Burdur plain and along the Lysis river valley, towards the Pamphylian coast.

It is interesting to compare at this point with a model of urban emergence posited by Sander van der Leeuw and James McGlade (1997), who posited that the development of urban systems generally follow five successive stages. The full model does not need to be recapitulated at this point, I would just like to point at the third phase – or bifurcation of system development, as they are called - of development, that of 'pre-urban smouldering' (van der Leeuw and McGlade 1997, 342). In this phase, short-term 'urban-like' structuring occurs at various locations within a regional system, only to dwindle and rekindle elsewhere. The underlying driver of these pockets of structure are long-distance heterarchical corridors of connectivity, interaction and communication which would permit certain groups of hierarchically organized societies to integrate into a larger system. Consequently, local system configurations become increasingly reliant on distributed information processing and energy obtained from elsewhere, resulting in a destabilized system configuration if the system is not robust enough to sustain these dynamics of increased connectivity. The attestation of 'prestige-goods economy' at Düver Ada in the form of richly-decorated tablewares from a southwestern Anatolian tradition could perhaps be interpreted in light of this connectivity. Moreover, such centres are said to occur simultaneously with hillfort settlements, generating a local size hierarchy among the latter.

Clearly, even though thus model was developed for a case study on the La Tène culture in northern Europe, it provides a useful framework for the cases presented here. However, some caveats should still be stated. First, the settlement pattern in the Burdur plain appears fairly stable over a considerable period of time, likely extending even until Hellenistic times. The dynamic emergence, dwindling and rekindling of pockets of semi-urban structures posited by the model therefore seems to have been more stable in this case. Perhaps this is indicative of a more robust system of connectivity providing a stable supply of energy and resources which allowed Düver Ada to maintain its position for an extended period of time. However, the mechanisms and drivers behind this suggested connectivity remain unclear. It should be remembered that our archaeological evidence is limited for this early period, thus making our assertions tentative at best.

Palynological and sedimentation data gathered from various valley systems (Gravgaz, Bügdüz, and Ağlasun) have indicated that from the 8^{th} century BCE onwards, clear patterns of increasing human impact could be observed throughout the local landscape. This suggests that at this time, human occupation started to move increasingly into more diversified niches, exploiting various pockets of potential in the landscape, characteristic of a system in the r-phase of development. In this phase, connectivity is generally low, meaning that the few existing well-connected nodes would have a competitive advantage in accumulation of the available potential – in the sense of capital, resources, knowledge, social networks of cooperation, leadership and social trust – which was available for the

system to initiate new dynamics. This could possibly explain the prime role of Düver Ada in the local settlement system at the time.
It is against this background that in the late fifth century BCE the earliest phase of habitation at Sagalassos and Düzen Tepe emerged as part of an existing tradition of elevated sites located on hill slopes or raised plateaus. Slightly earlier, most of Anatolia was unified under a Persian banner, following the conquests of the Achaemenid dynasty. Of course, we should be very careful in wanting to connect developments on such a macro scale to observations in the local archaeological record. Periods of major upheaval on higher scales/cycles can indeed result in existing connections and configurations to be broken up – *i.e.* induce an Ω-phase – which releases potential that can subsequently be tapped into by new and emerging system components. However, no direct evidence for such a causal link across scales can at this point be offered here. At any rate, the existing settlement pattern in and around the Burdur plain was indeed retained well into Hellenistic times, making it one of the most stable configurations across the research area. This suggests that the impact of any such macro-scale transition should not be overestimated.
Elsewhere in the area, however, certain changes do occur as we see a gradual shift from hilltop settlements towards a more diversified settlement pattern, increasingly geared towards the lower valley slopes as well. Several (connected) reasons for this development can be posited. First, perhaps factors of security and communal defence strategies became comparatively less important, reducing the need to concentrate population in hilltop settlements with difficult access. Second, due to overall population growth, these hilltop settlements of a generally limited size might at some point no longer have sufficed to house all people, inducing a need to move elsewhere. Third, the diversification of settlement patterns continued an already existing trend of moving towards the exploitation of more diversified niches within the landscape. Fourth, the transition can perhaps partially be linked to changing resilience of the landscape. It has been suggested that in different parts of the local landscape, the observed shift in settlement patterns can be partially explained by slope erosion, following deforestation activities that had been ongoing since *c*. 800/700 BCE. The eroded sediment accumulating on the lower slopes would have resulted in the creation of increasingly fertile valley areas, suitable for crop cultivation, thus effectively paving the way for more extensive human occupation and the amelioration of local potential for community formation and settlement development in these areas. At the same time, it would have reduced the potential of the higher hillslopes to sustain the continued importance of the hilltop settlements. However, the latter remain inhabited to some extent suggesting at least that sufficient potential for some form of continued habitation was still present. It can therefore be suggested that these observations fit a continued development in the r-phase, gradually moving towards – but not yet transitioning into – the K-phase.

So far, given the patchy evidence of these early periods, I have mainly considered one specific adaptive cycle, that of the aggregated landscape, through overall dynamics in local settlement patterns. Wherever higher cycles have been mentioned, the impact of these macro-scale patterns can rather be downplayed in favour of local and sub-regional orientations and pathways of development. At this point, however, we can draw in lower level cycles specifically centred on individual community formation and development at Düzen Tepe and Sagalassos. By now, both settlements have been sufficiently described as village communities during their earliest phases of community development. For Düzen Tepe, its strategic location on a plateau flanked by steep slopes would undoubtedly have been an important factor for the incipient community. The plateau itself, moreover, offered sufficient space to develop and maintain a considerable village community. However, the comparatively poor and thin soils on the plateau would have meant that the settlement would still have been at least partially reliant on the surrounding valley lands for most of its agricultural needs. As far as we can tell, access to the plateau and traffic towards the lower valley bottoms could not have been straightforward, using steep pathways that would likely have been unsuitable for traffic by cart. This would likely have exercised a significant constraint on the capacity for exploitation of the potential of the hinterland. However, it clearly did not affect the viability of the community in its original configuration.

At Sagalassos, the presence of clay beds, soils and water sources likely would have had significant attraction force for an incipient community. These resources were indispensable for community life, for example, as essential elements used for the construction of mudbrick houses, as was attested at Düzen Tepe. Additionally, proximity to suitable clay sources, while far from scarce in the region, would have offered an important advantage for the local development of pottery production. To what extent this would have been an explicit factor in the initial choice for developing a community at this location, is difficult to ascertain. However, given the subsequent development of Sagalassos into an important pottery production centre in Hellenistic, and especially in Roman imperial times, the pathway of development initiated by this locational choice is significant to note.

It has been argued that one important undertaking attested for the early community phases of Sagalassos, was the preparation of the area east of the settlement for agricultural activities by levelling the slopes through the construction of terrace wall. Such an undertaking would already have required some form of community to sustain its construction and continued upkeep. Agricultural potential was therefore likely not one of the initial attraction forces drawing in people to start a community here, however, it was important enough to be pursued from the very beginning of communal life. Compared to Düzen Tepe, access from Sagalassos to the lower valley slopes was markedly easier. This could perhaps explain why the majority of material traces of the earliest systematic activities in the central parts of the Ağlasun valley could be associated with Sagalassos, rather than Düzen Tepe. Although it should be noted, that it is quite likely that the latter was oriented mainly towards the valley of Yeşilbaşköy in the east, which is to be intensively surveyed in the summer of 2018.

If so, both communities at this time relied on a specific catchment area, covering only the immediate hinterland of the site for their basic needs in energy and resources. It was in these spatial pockets that both communities had successfully carved out a suitable niche to establish community life within the parameters set by their immediate hinterland. Subsistence strategies were mainly conducted in a smallholder system, characterised by household farming and small-scale pastoralism in close association to the settlement. Likewise, resource exploitation was almost exclusively conducted within the immediate hinterland of both sites, indicating a least effort raw material economy targeting easily available resources rather than pursuing potentially more qualitative resources at greater distances. Material production was aimed primarily at providing a generic functional assemblage with little direct fabric/function associations and low degree of standardization. This suggests a production system with a basic level of technological investment and low production specialization. These production strategies were not geared towards wider structures of exchange but were mainly aimed at fulfilling the basic needs of the local community. Social life in these communities revolved mainly around the household as core social unit, supplemented with a limited degree of (functional) inter-household or community level organisation and collective action measures.

These kinds of communities are oftentimes described as 'simple' – used almost as an epithet of affront – and 'backward', especially in comparison with what are considered more complex and advanced societies, most eminently the Greek *poleis* on the Anatolian west coast. Such approaches consider these communities from a modernistic and Eurocentric perspective, reducing any and all idiosyncrasies and particularities to a single paradigm of socio-cultural evolution, across an enormous temporal and spatial extent. Instead, we should consider these communities as deeply integrated in particular locales in the local landscape, and well adapted within their natural environment. This way of life constituted a well-defined basin of attraction, adapted to match local circumstances and landscapes. It has been suggested that these village communities operated within a local historical pathway of development, centred on basic needs such as subsistence, habitation, defence, production, *etc.*, within locally and functionally oriented contexts of engagement.

This type of community life was inherently geared towards keeping the local system from transitioning towards the K-phase. Communities operated as compartmentalized units within the landscape, maintaining minimal connectivity and basic intensities of exploitation of the hinterland. The core energy potential of these relatively small hinterlands sufficed to sustain their basic activities and

dynamics within a village community fabric, but would have restricted any subsequent development beyond this framework. In and by itself, such communities would likely have little incentive or desire to induce a phase transition and break out of their current basin of attraction anyway.
However, history is not static. Ever-changing circumstances are inherently part of life. Here too, at some point, new opportunities and challenges would eventually arise, disrupting existing system configurations. In 333 BCE, a major upheaval did indeed occur when Alexander the Great conquered the Achaemenid empire, storming through Anatolia as he went. During his conquests, Sagalassos is explicitly mentioned as one of the cities sieged and subdued along the way. However, as far as we know, Sagalassos at the time was still a village community, with no indications in the archaeological record that it would have specifically required his explicit attention. Such mismatches between the historical and archaeological record are not uncommon, and the point is not necessarily here to determine which one is right. At any rate, it is interesting to note that again, the connection between micro- and macro-scale dynamics is not straightforward to make. As far as we know, the passage of Alexander had no immediate effect on social life or community development at either Sagalassos or Düzen Tepe.

Given the evidence we have, marked system developments only took place at Sagalassos in the latter half of the third century BCE at the earliest. Associated with this development are a range of processes that broke the existing constraints which kept the system in the r-phase. We have no indications that the system at any point moved into an Ω-phase, either due to crossing the resilience limits of the landscape or by entering a rigidity trap. This suggests that, at this point, the system passed a significant threshold as it transitioned directly to the α-phase. As a result, the system underwent a reorganization of system components and developed marked emergent phenomena. In the space of more or less two generations, a complete transformation of the organizational structures, urban townscape, material culture, and social life would have taken place. At this point, the community re-oriented towards an entirely new adaptive cycle of development, centred on a new basin of attraction. Moreover, somewhere along this process, systematic community life at Düzen Tepe was abandoned. A significant part of this thesis has been spent on describing, contextualizing and explaining this marked phase of transformation. We have posited three possible scenarios: 1) a largely endogenous process of intensification of internal system dynamics at Sagalassos itself; 2) a locally induced *synoikismos* event between Düzen Tepe and Sagalassos, which kick-started the transformation; 3) a process induced or guided by the involvement and policies of the Seleucid dynasty.
From the archaeological record alone, it is virtually impossible to conclusively prove one scenario over the other. We can also wonder whether we necessarily should try to pick a definitive option in the first place. It can be suggested that, to a large degree, the transformation process would likely have involved elements of the three scenarios.

It has been suggested that one of the main driving forces of this process – if not lying at the root of the bifurcation then certainly reinforcing the first steps onto this new pathway of development – was the establishment of a political community, first attested at Sagalassos in an inscription dated to the latter half of the third century BCE. To some extent a 'chicken-or-the-egg' conundrum remains unanswered. It is difficult to determine to what extent such a political community was already present, even if not visible in the archaeological record, or whether a socio-political structure was newly established out of the synergy between existing local configurations and Seleucid policies. On the one hand, even so-called corporate communities, while being of comparably small size, were already characterised by clear socio-political organizational structures, on the other hand, the development of formal structures of political organisation in Anatolian communities during the 3rd century BCE has been interpreted as part of a wider strategy of establishing and maintaining internal autonomy in the face of increasing impact of the Hellenistic kingdoms onto local configurations.
The impact of the transformation of the community at Sagalassos can be most notably observed in the archaeological record through the construction of a set of monumental public buildings. This process started around 200 BCE with the construction of an agora as centre of communal life, followed by a

series of buildings that were essential to the definition of the new urban society, providing a new form of social interaction context through which the community could define and express itself. While this development is perhaps most apparent, and therefore often receives the most attention in traditional archaeological research, in and by itself, it tells us little of the underlying mechanisms of development. If we look at the changes in material culture and production processes associated with this urban transformation, perhaps part of the answer can be suggested.

Material culture from Hellenistic Sagalassos is characterized by an increasingly clear delineation in fabric/function associations and targeted raw material exploitation, geared towards selecting more qualitative resources to assure high quality production outputs. The usage of finer clays, combined with better preparation of the paste and increased technical skills can all be associated with a more specialized production. During this transition, production infrastructure generally remained fairly static. The observed changes in material culture were therefore not the result of technological innovation *per se* in a reductionist sense, as was for example the case for the major upheaval of production infrastructures occurring during the Industrial Revolution. The main difference pertained to organizational structures of production, as intensification of production in antiquity was typically achieved by multiplying production units. The organisation of a series of parallel workshops in a spatially distinct zone of artisanal activity as observed at Hellenistic Sagalassos would have allowed sufficient critical mass to induce a process of production and labour specialization. Clearly, intensification of local system dynamics (our first scenario) was an important aspect of the observed changes in this respect.

However, to execute this strategy, sufficient incentives needed to be present to intensify production beyond basic subsistence needs. The observed multiplication of production units at Sagalassos suggests that sufficient incentives of demand were at that time present or at least being created in order to induce production increases. Higher production outputs can perhaps be linked with an increased customer pool, on the one hand, possibly because of local population growth resulting in an increased community size, on the other hand through the establishment of a larger distribution and exchange pattern associated with this production. Production output from Sagalassos from the second century BCE onwards did indeed show an increasingly wider spatial reach, being distributed across various settlements in the area. However, to what extent this distribution can be linked to either economic or political networks is at this time difficult to ascertain.

Along with the observed transformation of the urban townscape and material culture production, the associated territorial extent of Sagalassos markedly increased as well, now ranging from the Kestros river in the east to Lake Burdur in the west. Here, our two other possible scenarios of development come into play. The exact chronological sequence of events remains unclear. However, at some point in close association with the extension of the political territory of Sagalassos, Düzen Tepe became largely abandoned. Perhaps the intensified developments at Sagalassos, drawing in energy and resources from an increasingly wider hinterland, took away the necessary 'breathing space' for Düzen Tepe to maintain its position this close to a newly developing centre with increasingly grander ambitions. In this case, Düzen Tepe moved into an Ω-phase from which it could not recover, resulting in the end of the community. However, part of the process and its key drivers remain unclear to us, especially whether the abandonment of the site constituted a one-off event or rather a gradual displacement.

It is at any rate difficult to provide a definitive answer to such questions, but it is possible that these local communities made a conscious choice to merge together, with the population of Düzen Tepe moving to Sagalassos. The underlying motivations behind such a process will likely remain unclear. However, part of the explanation might perhaps be found in the remarkable popularity of elements associated with the Seleucid dynasty at Sagalassos, not only in Hellenistic times, but lasting well into Roman imperial times as well. Such a profound and sustained impact can likely be associated with an important role of the Seleucids in the formative stages of community formation at Sagalassos.

The Seleucids are known to have been actively intervening in local system dynamics as part of a deliberate policy towards political control and economic monetization. Whether or not they actually

were actively involved in local community development at Sagalassos is hard to ascertain. Given the strategic importance of the north-south corridor connecting the inland with the coast through the Burdur plain and Lysis river valley, it can be suggested they would at the very least be aware of important local developments, and will likely have wanted a trusted local partner to control this natural thoroughfare.
The first attestation of a formal political government at Sagalassos can indeed be dated to the period of Seleucid rule in the area. This need not necessarily mean that the formation of a political community and potential *synoikismos* was a top-down Seleucid *Diktat*. While it is at this point impossible to determine any direct causal link, processes of *synoikismos* can often be interpreted as a political strategy, which allowed local communities to gain a stronger foothold in the interaction with the Hellenistic kingdoms as well. The establishment of a formal governmental and legislative framework at Sagalassos would have provided the necessary framework to conduct such a process, as well as provide clear spokespersons to guide the interaction between the local community and central administration in a bottom-up process of community development.

Whatever the underlying reasoning, it can be argued that the observed transformation could only have been induced and sustained by an immediate transition towards the K-phase in the new adaptive cycle. The construction of monumental public architecture, extension of the settlement, support of a larger population, and upscaling of production output, would all have to be sustained by a significant increase in energy and resources to be invested in the centre and its population. The increased territory associated with Sagalassos would likely have offered the necessary *potential* for energy and resources the community needed. However, to what extent this potential could be readily exploited from the very onset remains an open question. Even if Sagalassos would have claimed political authority – be it through Seleucid grant or fiat – this does not mean that it also had the right economic mechanisms needed to efficiently exploit the potential of the area. The Burdur plain was one of the most fertile locations in the territory, however, even if the potential avenues of exploitation would have been made available, it would likely have taken some time before these were sufficiently initiated for this potential to be tapped and capital would start to flow towards Sagalassos. Moreover, it remains unclear to what extent resources could and would have been systematically redirected, especially given its acentric location. It is at any rate telling that local settlement patterns in the area did not seem to markedly alter at this time, suggesting that existing connections and configurations were upheld and local resilience was not undermined. Whether this necessarily excludes the additional redirection of part of the energy flows towards Sagalassos cannot be ascertained given the present data.
In the case of direct Seleucid involvement, some form of capital investment could be suggested. If the Seleucids were indeed actively involved, physical capital would likely have been limited given that the process was part of a policy of monetization geared towards generating income for Seleucid expenditure elsewhere. Perhaps a limited stimulus was provided to induce the transformation process, which could then be intensified and sustained by local development. More likely, however, any direct involvement would have been in the form of human capital, offering some of the necessary technological skills and knowhow which had no previous local parallel, for example masons needed for the construction of the urban infrastructure. At any rate, we currently have no direct evidence to corroborate this suggestion. However, even if no direct influx of external capital was involved, the process itself can be generally posited to have been associated with push/pull factors induced by the interactions between organizational structures on different scales.

Regardless of the initial impetus, the comparatively extended period of urban transformation, for the most part spun out over a good deal of the second century BCE, does indicate that local dynamics driving this transformation could only sustain a gradual process. This suggests that any mechanisms of exploitation would at the very least have taken time to develop. Part of the necessary capital could have been generated by the intensification of production output geared towards this wider territory. This process would likely have induced a positive feedback loop between supply and demand, driving a sustained increase in generated capital. The attested process of production specialization can be viewed as part of this wider strategy of production intensification. Reduction of variability is a characteristic control system for inducing efficiency and streamlining technological operations. As a result, internal system components become increasingly interconnected as they become mutually dependent within self-organized clusters of relationships, sometimes resulting in extremely high levels of integration or hypercoherence. Perhaps the attested clustering of workshops in a demarcated spatial zone can be viewed as an expression of this process, where new organizational structures developed due to (re)combination of inter-unit connections during the α-phase, which gained a foothold into the r-phase of the new adaptive cycle, and intensified during the subsequent transition towards the K-phase to sustain the increased capital expenditure required for the urban transformation of the centre.

As part of these phase transitions, potential is increasingly bound to existing structures as it becomes accumulated in the central hub. Dynamics of increasing specialization, efficiency, and process optimization resulting in more narrow avenues of development can generate a multiplier effect induced by increasing returns to scale. However, efficiency and optimizing behaviour, although theoretically desirable, can sometimes be problematic in practice. In being efficient – as in optimizing behaviour – organizational structures often eliminate redundancies that emphasize a broader range of values and interests, resulting in a more homogenous system in terms of functions and response diversity, which can result in a dramatic decline in flexibility and hence resilience. In general, it can be stated that as the system becomes increasingly interconnected, more and more energy and resources go into maintaining existing structures, with less potential available to absorb unforeseen disturbances. Gradual development of socio-political complexity may indeed provide short-term solutions, but need not necessarily be effective on the long term as increasingly elaborate structures require ever more maintenance and rob the system of the necessary flexibility to deal with new challenges.

The re-orientation towards a new basin of attraction induced by the properties of the phase transition from r to K described here, was therefore not without risk. Elsewhere in the area, examples can be found of urbanized communities striving for local primacy, such as Keraia, Sandalion, Kapıkaya, and perhaps Kepez Kalesi, only to be outstripped by Sagalassos. However, risk-taking has been highlighted as being an essential element of robust and resilient strategies (Wildavsky 1988). If successful, trial and error and risk management is considered a more resilient strategy than risk-averse precautionary strategies. In general, a mixed strategy of anticipation and conservation can in this sense be considered optimal for managing risks and answering to certain opportunities or challenges the system is subjected to.

However, the main condition in this case being indeed *if* successful. Even if the process may have been induced or guided by the Seleucids, this was still no guarantee for success. Several examples can be found in the epigraphic record of cities petitioning the Hellenistic kings for gifts to alleviate their dire financial situation. Grand ambitions always need to be supported by internal capital generating dynamics if they are to be sustained. Moreover, in the volatile political landscape of Hellenistic Anatolia, even the support of the ruling dynasty does not mean much if it were to be overthrown and replaced by another, with perhaps very different strategies and intentions. For Sagalassos, this does not appear to have posed a problem. After the downfall of the Seleucids, the Attalid dynasty maintained most of the existing local configurations, and indeed, business at Sagalassos seems to have continued as usual. At no point in the chronological scope considered here do we find indications that the limits of the system were crossed and a Ω-phase would have been induced. Even the initial transition to a new basin of attraction seems to have been rather a reaction onto new possibilities and potential niches that could be filled up by an ambitions local community, rather than a consequence of overstretching the boundaries of the resilience of the local landscape or hypercoherence in system components resulting in rigidity traps. The transition may have been risky, but it was a successful one for Sagalassos, even in the long run. The transformation of the community at the end of the third century BCE was the start of pathway of development extending over several centuries, leading to local and regional primacy well into Roman imperial times.

Throughout this work, I have stressed the need to consider community formation and complexity development within particular structures of orientation and an idiosyncratic socio-cultural framework, generated by the combination of internal dynamics and local preferences with external influences and stimuli. This approach was developed as a means of going beyond the prevalent interpretation of local community formation dynamics within a framework of origin of *polis*. It was concluded that the *polis* model could only be retained as a descriptive framework to present a distinct model of community formation that could be used to compare and evaluate local dynamics. To this end, it is essential to focus on a comparison of selection pressures in community formation and development, rather than applying models of cultural impact or diffusion.

The model of polis formation in Boeotia discussed earlier, started from 'empty' landscapes with dispersed settlements, which were gradually filled up through processes of population growth and nucleation. The resultant settlement pattern emerged out of the gravitational pull from the urban centre, exerted by limitations in walking distances that constrained territorial extent. These walking distance limits provided a strong selection pressure that kept local communities in their existing basin of attraction oriented on small, nucleated settlements or *proto-poleis*. As the intermediate spaces between settlements grew smaller, continued development was induced by fusion dynamics, resulting in the development of *polis* settlements characterised by a threshold set by a 5-6 km radius extent of the territory, equalling one-hour walking distance.
Clearly, at first glance, a markedly different dynamic was going on here compared to our case study of Sagalassos and Düzen Tepe. No structural infilling of the landscape seems to have taken place, nor did walking distance limits exercise a strong constraining role in community development, as far as we can tell. The identification of a smallholder system at Düzen Tepe (and by extension Sagalassos), especially for its incipient phases, does suggest that the majority of population would have lived in the settlement, moving to their fields on a daily basis to conduct agricultural activities and keeping the animals close to the site. At this point, walking distances would likely have exerted some limits to the range of movement, however, it seems to have had little constraining effect on the later development at Sagalassos, given that its territory extended far beyond these limits. Moreover, *polis* development in this model was a fully endogenous, bottom-up process, befitting the circumstances of Iron Age and Archaic period Greece, where no higher-up powers were present on the ground to influence local system transformations. The fusion of smaller-scale communities to form larger units can therefore only be considered superficially similar, given that wholly different mechanisms underlined and shaped these processes.

The model of *polis* formation reviewed here was developed out of a long research history within a specific region, *i.e.* Boeotia. By reducing all of the variability in possible configurations and selection pressures of community formation to a single model, we would again make the same mistake of gross oversimplification. Moreover, there is no apparent reason to specifically consider developments at Boeotia as most eminently comparable to those of southwest Anatolia. However, the general approach of the model, using clear selection pressures underlying community development, provides the closest parallel to the approach advocated here, making it the ideal window into the world of the *polis* in this context. Regrettably, this world has not been explored here as much as it would deserve. To do so would require a wholly different Ph.D. by itself.
More than the developments on the Greek mainland, the comparison with Greek modes of community formation and social life needs to incorporate the communities on the southern and western coasts of Anatolia. In these cases, the *polis* model as a Greek *cultural* phenomenon could indeed to some extent be considered relevant. However, the west coast of Anatolia was not discussed in any detail given that it lies beyond the spatial scope of this thesis. For the more limited number of supposed *poleis* on the south coast (16 *versus* 148 on the west coast), it has been argued that Greek culture and ways of living

were only ephemerally important and largely replaced by indigenous configurations. Again, these communities have not been discussed in great detail. I mainly noted in the last part of the previous chapter that the comparatively earlier development of these coastal settlements resulted in a wholly different pathway of development. These settlements developed out of endogenous system dynamics, independent of macro-scale polities, especially up until the Achaemenid conquest.

Polis development in Pisidia has been mainly studied through the framework of peer-polity interaction. All implied Hellenocentric cultural biases aside, can the underlying mechanism offer any explanatory value to interpret the observed system dynamics? It is at any point interesting to note that in several Pisidian settlements, the development of a civic community can be traced back to the (end of the) third century BCE, with the urban transformation of the site following slightly later in the second century BCE. It is indeed tempting to suggest that horizontal competitive interaction between these settlements would have stimulated local dynamics, even if hard evidence is difficult to present. To these horizontal structures we can add the vertical component of interactive relationships between local communities and central administration as relevant drivers of system development. In this sense, the supposed development of *polis* communities in Anatolia should not be seen as a form of cultural dissemination, with local communities adopting a conscious cultural identity fashioned after Greek templates, but rather as part of a wider local socio-political strategy born out of the interaction space between local communities and the overarching central administration of the Hellenistic kingdoms, in this case the Seleucids.

Throughout this work, I have only briefly brushed upon matters of cultural identity at either Düzen Tepe or Sagalassos. This was a conscious choice as I feel that aspects of cultural identity are difficult to capture and require a highly specific approach which merits a separate research agenda in its own right. Moreover, the nature, amount and limitations of the data available for this research did not allow any strong conclusions on matters of identity in the first place. I have instead rather focused on elements such as communities of practice, highlighting social practices and ways of doing as highly peculiar aspects resulting in small but significant differentiations in material culture of these communities. As such, it was concluded for the pottery material that practices of production and consumption were geared towards an Anatolian framework rather than an overtly Aegean or Greek one.

Additionally, I have mainly tried to stress that complex processes such as community formation, social organisation and social complexity were the result of a convoluted negotiation between different stakeholders, along many lines of interaction, in different domains, and for a variety of reasons. Defining and isolating the effects of one key driver over the others is almost an impossible task. Instead, I have tried here to uncover, present, and frame the complexity and richness of these processes in an intelligible framework. In doing so, it is worthwhile to keep in mind that grand models such as the origin of *polis* can remain useful if applied on a descriptive and explanatory, rather than a normative basis.

More important, however, is to take the full potential of our archaeological evidence seriously into account. The archaeological record has been famously described as being mute. While I have not yet heard my sherds talk back to me (even if I do talk to them), this does not mean they do not have a story to tell. However, to hear it, we must decipher the messages contained in these material traces of the past. Throughout these pages, I have tried to highlight the potential of social complexity approaches for winkling out these messages from the archaeological record. I think the presented approach is both extensive and limited at the same time. It combines a wide variety of models, concepts, and theories, yet leaves out many more. Certain choices needed to be made as for what to include and what to leave out. Undoubtedly, other choices could have easily been argued for as well. In the end, I think the presented framework offers a lot of potential for archaeological uses. I have tried to present part of this potential in the associated case studies. However, much more work is left to be done. In the very last part, I will now provide some outlines for such future works.

5.3 Wrap it up: Potential future research avenues

> "*The time will come when the progress of research and prolonged study will reveal to sight the mysteries of nature that are now concealed. A single lifetime, though it were wholly devoted to the study…does not suffice for the investigation of problems of such complexity…The day will yet come when our successors will wonder how we could have been ignorant of things so obvious.*"
>
> – Seneca, *Naturalis Quaestionis* VII.25

It was already apparent to Seneca how we can sometimes be wholeheartedly ignorant to the answers of some of the questions we are asking. To some extent, it would be arrogant to think we can guide the gaze of those following in our footsteps towards what seems to us the most interesting prospects to investigate. Undoubtedly, much of what we today consider truth, will in the future be seen as folly, and that what we find intriguing, might turn out to be trivial. It is therefore only with some reservation that I embark on this final part of my Ph.D. thesis, a consideration of what seem to me interesting avenues of research for the future. I do not have the pretence that these recommendations will necessarily stand the test of time. However, the only way to find out is by trying, so it is a risk we will just have to take.

As always, academic research hardly ever starts from scratch. This research has built on the findings of my predecessors whose works provided the foundations for my own contributions. I have in particular made extensive use of the framework for material studies within the Sagalassos Project, established and developed by the works of, among others, prof. Jeroen Poblome, dr. Roland Degeest, and dr. Philip Bes. The in-depth case studies of Düzen Tepe presented here has benefitted greatly from earlier Ph.D. theses studying this site, by dr. Kim Vyncke on an interdisciplinary functional space analysis of the site, and dr. Dennis Braekmans on petrographic and geochemical analysis of the pottery material. I have also made use of the countless other contributions to the built-up knowledge through decades of accumulated research on Sagalassos and environs. To name them all would require a chapter in its own right. Likewise, I hope this work will find its way to inspire those following in my footsteps.

Many opportunities can still be noted to extend the present work. In the first chapter, I developed a general theoretical framework to study social complexity dynamics. Many different approaches can be pursued in the field of complex systems studies, but I have focused mainly on an informational approach, considering the workings of complex systems and its material dimension as information processing and transmission systems. Several other intriguing approaches were left out or have been mentioned only briefly, including the autopoietic functionality of complex social systems (Luhmann 1995; Padgett and Powell 2012), settlement scaling (Bettencourt 2013), and (social) network analysis (Brughmans 2013).

Even among the included elements, I have not pursued all possibilities and potential to their fullest extent. Quantification of complexity development has only been ephemerally tackled here. A rich literature exists on information, entropy and diversity measures which have been posited as suitable measures of (social) complexity (Lloyd 2001). However, to pursue these to their full potential, a far more extensive and knowledgeable background in mathematics is needed. Similarly, multi-scalar discontinuity analysis has been developed as a suitable analytical method for studying the adaptive cycle and panarchy framework (Sundstrom 2014), but has not been explored here. The application of the social metabolism framework has only recently been initiated in archaeological research, and has, likewise, only been tentatively approached here. The focus on endosomatic energy requirements applied here only posits a first step towards its full implementation, and needs to be supplemented with methods of approximating exosomatic energy needs, involving a variety of processes and activities such as production, construction, transport, *etc.* The first steps towards this goal have already been undertaken, for example by the model of energetic requirements for heating, both in a household context and the upkeep of the Roman Baths of Sagalassos (Janssen *et al.* 2017).

However, for the social metabolism and adaptive cycle approach, and by extension the full complex systems framework presented here, to take off, a full-blown modelling approach will have to be initiated. Decades of interdisciplinary research at Sagalassos and environs has resulted in extensive datasets on long-term dynamics in a wide variety of domains. During this time, archaeology and the various partner disciplines have made significant progress in understanding aspects of life throughout different periods in the past. However, we have reached the limits of what the individual disciplines can manage. Further interdisciplinary integration and exploratory analysis is needed if we are to extend on the existing base of knowledge. Computer modelling will have a central role in these aspirations. The theoretical framework presented here has resulted in a detailed and extensive conceptual model, however, its full implementation and operationalisation will require it to be translated into a computer model so that it can be used for formal data analysis and hypothesis testing.

At the onset of this research, I had the ambition of combining both in one go, developing a conceptual framework and implementing it in a testable modelling environment as well. However, both familiarizing myself with the various theoretical approaches of complex systems studies, and gaining the necessary computer programming skills at the same time, while also conducting my own research on the archaeological data, turned out to be overly ambitious. As a result, I have focused here on the development of the conceptual approach.
Still, I can perhaps offer some suggestions as to fruitful future modelling exploits starting from the framework presented here. The opportunities are legio, and I will highlight only a handful of possibilities. A first major endeavour will be to tackle flows of energy between environment and society. The ways people exploit, transform and consume energy highly shape the potential pathways of development available for the construction of social organisation. The social metabolism framework presented here would offer a suitable structuring framework for such an undertaking. Modelling various strategies of energy exploitation in sync with capital expenditure may provide highly illuminating insights into the potential choices and strategies of collective action and social organisation measures. Secondly, the modelling of social organizations as communication networks has recently started to take off (Wolpert *et al.* 2017). It would be interesting to complement these approaches with models of material culture as information containers and structuring elements of communication and social interaction. Such an undertaking would add an entirely new dimension to archaeological research and the way we approach what is still our primary data source, the archaeological record. A third and final element I would like to highlight pertains to the integration of the case studies presented here in a long-term perspective. I have focused here on a marked phase of urban transformation/emergence at Sagalassos, inducing a pathway of development into a regional system hub pulling in energy and resources. Over a long-term perspective, however, this urban cycle is part of a larger cycle of social organisation centred on small-scale units with little pull on an extended environment. It would be highly interesting to tackle this long-term perspective by modelling interactive dynamics between primary and secondary centres through a set of push/pull dynamics in order to reconstruct larger and more extensive trajectories of complexity development. Adaptive cycles and the panarchy have been demonstrated to offer a suitable framework to approach this matter by using its parameters to generate testable hypotheses (Rogers 2017). This approach allows for the hot iron of historical contingency to be approached in a more formal manner by integrating phases of transformation and emergent behaviour in dynamic trajectories of social change.
Perhaps I will in the future get the chance to develop one of these suggestions myself, but if not, someone else certainly will. The potential of the full implementation of this approach is too great not to do it, or to pass up on the opportunity. If the past three years have taught me anything, it is that all the building blocks are present to lift archaeological research to a new level. Past research has generated extensive datasets that are readily available, and new research methods and approaches are increasingly tapped into to exploit their potential. The Sagalassos Archaeological Research Project holds a privileged position in this wave, and should strive to be at the forefront of our discipline's progress in the 21st century. Witnessing the dynamics of the team I was privileged to have been part of these past few years, I have no doubt that the project will succeed in this ambition.

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