XIVth Congress
of the International Union of Prehistoric
and Protohistoric Sciences - U.I.S.P.P.

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Philosophy and Human Studies

UNESCO

2 - 8 September 2001 Liège - Belgium

STRATIGRAPHY AND PREHISTORY OF THE RIVER MAAS VALLEY IN LIMBURG - BELGIUM

EXCURSION GUIDE

edited by

Patrick M. M. A. Bringmans

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Institute for the Archaeological Heritage of the Flemish Community (I.A.P.)

Gallo-Roman Museum of Tongeren (Province of Belgian-Limburg)

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U.I.S.P.P. 2001 EXCURSION B12
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This publication has been made possible by the generous support of the Institute for the Archaeological Heritage (*I.A.P.*) of the Flemish Community.

INSTITUUT voor het ARCHEOLOGISCH PATRIMONIUM

The Late Palaeolithic *Federmesser* Camp at Rekem (Belgium)

Marc DE BIE & Jean-Paul CASPAR

The site of Neerharen-Rekem is situated in the NE part of the Belgian lowlands, some 6 km north of Maastricht and at about 45 m above present sea level. This fertile stretch of land on the left bank of the river Meuse has been a beneficial place for settlement throughout the prehistoric, protohistoric and historic periods. The presence of Gallo-Roman buildings at this site had already been surveyed and reported in the nineteenth century. Following small-scale excavations in 1955 and 1956 , the area was extensively explored over some 40,000 sq m in the late 1970's and early 1980's. During this fieldwork, repeated human occupation could be attested from the Late Palaeolithic to the early Middle Ages. This included extensive Late Bronze age and Early Iron age Urnfields, Middle Iron age and Early Gallo-Roman settlement, a Gallo-Roman villa with related buildings, a late 4th to early 5th century Germanic settlement, and indications of Merovingian and 11th/12th century habitation.

Research at the *Federmesser* site started in 1984 and quickly evolved to a large-scale project with additional field seasons in 1985 and 1986. The excavations were directed by Robert Lauwers and were made possible thanks to close collaboration between the *Laboratorium voor Prehistorie* of the *Katholieke Universiteit Leuven* and the former Belgian *Nationale Dienst voor Opgravingen* (National Service for Archaeological Excavations), succeeded by the present *Instituut voor het Archeologisch Patrimonium* (Institute for the Archaeological Heritage) of the Flemish Community.

The prehistoric remains were found on an elongated sandy elevation of Late Weichselian age, on the inner edge of a lower river terrace, about a kilometre from the present Meuse riverbed. The exact distance from the site to the Late Glacial river at the time of occupation is unknown, but an abandoned channel has been recorded only 150 m from the site. Except for the unique presence of resin on a projectile point, ^{14}C-dated to 11,350 ± 150 BP (OxA-942), and the occasional appearance of (mainly intrusive) charcoal, the Palaeolithic finds at Rekem are exclusively lithic and mineral materials (in all, about 350 kg.). The excavated assemblage was quickly recognised as belonging to the *Federmesser* groups. The site can be securely dated in the Allerød Interstadial, which places it in a rather temperate context, with a subsistence economy potentially based on large mammals present on a year-round basis, albeit in low densities, and on fishing.

The general pedo-stratigraphy of the site can be summarised as follows (Fig. 1.1). The top of the gravels of the Weichselian Meuse terrace (the terrace of Mechelen a/d Maas) is situated at nearly two meters below the present surface (Fig. 1.1: 6). This terrace is covered with aeolian sands, clearly layered at the base of the profile (coversands; Fig. 1.1: 5) and topped with tardiglacial dune sands. The *Federmesser* artefacts were situated at a depth of ca. 80 cm to 100 cm below the actual surface. The material was vertically spread (on average ca. 30 cm) in bleached sand, i.e. possibly the A2 of a palaeosoil, but which is, to varying degrees, obliterated by recent soil formation processes (Fig. 1.1: 2).

Sporadic aeolian granules occur in this layer. Given its position in aeolian sands, the vertical dispersion of the artefacts is not unexpected, and may be ascribed to post-depositional bioturbation. However, the degree of dispersion varies considerably from one archaeological unit to another. Post-abandonment factors of biogenetic origin, as well as on-site agencies such as trampling, are deemed responsible for this. The industry is separated from the younger levels by some 20 cm of sterile sand (Fig. 1.1: 1). A heavily bioturbated cultural layer (20 to 25 cm), dating from the Bronze Age to the Roman period and clearly enriched by (sub)recent humus infiltration, is truncated by a plough-zone of about 45 to 50 cm thick (Fig. 1.1: 0).

In all, 1.7 ha were systematically excavated, with at least 16 spatially distinct units of lithic material identified (Fig. 1.2). Little but lithic remains such as flint, quartzite, quartz, sandstone, and haematite were preserved. The sandy environment did not permit the preservation of organic remains, even in carbonised form, despite the ubiquitous evidence of fire-related rock features. While the excavations have seemingly not yet exposed the entire settlement area, at least twelve concentrations of archaeological remains (Rekem 1, 4-8, 10-13, 15 and 16), called 'habitation zone 1' , and grouped in a NW-SE cluster, extend over a surface of about 80 x 35m. This distribution coincides well with the topography of the sandy elevation. At a distance of 80 to 110 m E and W of this central area, were four other concentrations (Rekem 2, 3, 9, and 14), which possibly belong to neighbouring habitation areas.

Within habitation zone 1, two neighbouring NW-SE alignments can be distinguished. The western line consists of large concentrations, each covering a surface of about 50 sq m (Rekem 10 and Rekem 12) to 60 sq m (Rekem 5 and Rekem 6) while smaller, nearly circular areas, rarely exceeding more than 4 to 5 sq m, form the eastern row. The large concentrations preserve evidence of decomposed structures, defined by numerous quartzite and sandstone pebbles most of which show traces of burning, and thus were probably hearth stones. At Rekem 10, traces of a semicircular structure (of ca. 5-6 m diameter) could be perceived from the spatial distribution of the dispersed lithic remains. The varied inventories of these concentrations suggest a palimpsest of activities. The smaller areas produced a variable number of flint artefacts and they represent the material record of a limited activity range, focused on flint working and tool production (Rekem 15, Rekem 16, Rekem 13, Rekem 7 and Rekem 11). They possibly also represent an additional function, that of refuse depository (Rekem 1), or limited other activities (Rekem 16 and Rekem 11). There is little material other than flint in these areas.

One of the major aims of the research project at Rekem was to investigate whether and to what degree a Late Palaeolithic 'sand site', clearly disturbed by post-depositional natural agents, can hold adequate information for detailed spatial analysis. An aborate study of non-spatial observations (composition, use, raw material, style of knapping and of tool manufacture, etc.) preceded this evaluation. Several methods and approaches were combined in this study: exhaustive microwear research (2500 pieces), elaborate attribute analyses, extensive refitting, and detailed mapping. This integrated research strategy proved to be extremely productive for a detailed examination of the archaeological record and its interpretation in behavioural terms, providing significant new insights into the functioning of a Late Palaeolithic settlement site.

In terms of weight, the non-flint rocks represent the most important category (some 270 kg.). This group mainly consisted of sandstone blocks, quartzites and quartzes. They were essentially confined to the large concentrations. These objects were mostly burned and many showed intentionally trimmed edges. Their exact function remains to be established, but they were presumably adequate for tasks in which size and mass were especially important, such as chopping, hacking, sawing, and digging.

Some clusters suggested localised activities. In addition to these 'heavy duty tools', other rocks served as hammerstones, shaft polishers and slabs for the grinding of haematite or for cutting. Quartzes, finally, were presumably used as cooking stones. In addition to their function as individual tools, rocks were also intensely employed as structural elements, in hearths or dwellings and therefore constitute an essential framework in the spatial analyses. In all, they turned out to be an extremely mobile class of objects, travelling both within and between different loci.

The bulk of the material in quantitative terms consists of flint artefacts. In all, almost 24,000 pieces were counted at the various loci, all typical of a *Federmesser* context. The combined research revealed aspects relating to the procurement of raw materials, knapping methods, tool manufacture, use, maintenance and, finally, discard.

The lithic industry at Rekem is characterised by a poorly elaborated blade technology, aiming at the production of short unstandardised blades and laminar flakes using direct hard hammer percussion. Flint knappers exploited a wide range of stones, in terms of quality, size, and morphology. Whatever the initial form of the stone, the artisans always tried to take advantage of its appearance in a most profitable way. Blanks selected for tooling and use were marked by great formal diversity, though with a certain preference for elongated elements. Tool types were manufactured in series, on blanks produced from single reduction sequences, generally rather skilfully knapped on good quality flint nodules. On the other hand, no particular reduction methods accompanied the various types of production, and blades of the most appropriate production sequences were mostly ignored for tool production. Some of these were used without modification.

The dynamic analysis of the various tool categories revealed new aspects of manufacture, repair, use and discard. The three major tool categories at Rekem are lateral modified laminar pieces (Fig. 1.3), burins, and scrapers. For the first category, a major distinction appeared between slender (less than 12 mm wide) and large elements. The former could be interpreted as projectile points or - occasionally - barbs, presumably inserted into reed shafts (for certain pieces at least) and shot with low-weight bow and arrow. The latter were either knives or the result of tool-production mishaps. The reconstruction of the 'preconceived forms' is heavily masked by the very incomplete state of the archaeological record. This mainly includes shaping mishaps in the production areas and broken, rejected fragments in locations where arrows were repaired.

Most of the burins at Rekem were clearly expedient tools that were used, rejuvenated, and abandoned at the same spot where they were manufactured. This explains the high refitting rate for this tool class. The joining of burin spalls, retouch flakes, and fragments revealed that burins were very 'dynamic'. In the course of the 'use-resharpening-reuse' cycles, they could frequently be classified as different 'types' (eg. dihedral burin, burin on truncation, etc.). Burins primarily served on bone or antler and occasionally also on hide. As hand-held (unhafted) items, burins were *de facto* discarded when the reduction in length attained 3 cm. Scrapers at Rekem were not very standardised. Although they were classified as various types of blade and flake scrapers, the overall impression is one of notable variety and boundlessness with regard to any imposed classification attempts.

With regard to the place of production, a distinction could be observed between projectiles on the one hand and 'domestic' tools on the other. For the former group, the presence of both local products (possibly made from recycled blanks) and extra-local pieces at the large retooling loci of Rekem 5 and 6, contrasts with the local production of laterally modified laminar pieces at Rekem 7 and 11 (Fig. 1.4). The production of scrapers, burins and other tools is mostly local at the various sites. Only at the dwelling of Rekem 10 do more piece seem to have been imported.

At the loci that were interpreted as small knapping spots (Rekem 15, Rekem 16, Rekem 13), or tool production places (Rekem 7 and Rekem 11), the spatial layout of the flintworking process perfectly corresponded with parallels from knapping experiments and ethno-archaeological contexts. These sites were identified on the basis of the assemblage composition, usewear, and refitting results.

At the larger habitation sites, the distribution of flint material equally corresponded with the expectations of artefact distribution around hearths and inside dwellings (Rekem 5 West and Rekem 10).

Finally, a surprisingly high level of spatial resolution could be perceived in the large and dense concentration of Rekem 5 East. Here, the open-air combustion area seems to have attracted a sequence of activities related to the procurement of game (maintenance of hunting gear), butchering and food processing activities, hide fleshing and dehairing, dry hide working, and various aspects of bone or antler work.

Notwithstanding this amalgamation of refuse-producing activities in a single place, each performance appeared to have preserved specific intra-locus spatial patterning. The topographical location of used projectile points depended on their state of fragmentation. Short basal fragments were pressed out of the shaft adhesive and dropped near the hearth area, while longer specimens were pulled out and thrown to the periphery. With regard to scrapers, the location of the activity and the organisation of manufacture and resharpening, varied according to the physical state of the hides at the time of working.

Fresh hide scraping and dry hide work occurred in separate areas at each side of the hearth. In the case of dry hide work, the production and resharpening of the scrapers was moreover spatially segregated from the scraping activity, presumably to avoid depositing retouch waste on the hide located outside the main concentration. The manufacture, use, maintenance, and discard of the burins, finally, essentially occurred at a single spot. If the blanks of earlier production sequences were present there, they occasionally were incorporated in the task at issue (esp. bone or antler work).

In all, it could be clearly established that the post-depositional processes at Rekem generally failed to blur the fine-grained spatial patterns connected with past human activities. Together, the results depict the *Federmesser* settlement at Rekem as a relatively large camp area with, on the one hand, widely spaced settlement units representing residential areas where a sequence of processing and maintenance activities occurred and, on the other hand, some isolated knapping spots, either reserved for arrow(head) manufacture (and the fabrication of burins), or else lacking tool-production altogether (Fig. 1.4 & Fig. 1.5).

In short, the site was organised into more or less distinctive activity or disposal areas to such an extent that the ultimate contents of each site sector was very different. The topographical position of these loci, on an elevated sand ridge on the edge of the river bed, provided a view over the wide valley to the Northeast and a means to survey possible game animals attracted by the water. The river probably also supplied a rich fishing ground and in any case abundant lithic material.

In all, it is not hard to imagine why the site was an appropriate location for camps of hunter-gatherers. In more recent history, this fertile strip of land between the alluvial plain and the Campine Plateau, actually remained the scene of an almost unbroken record of human activity.

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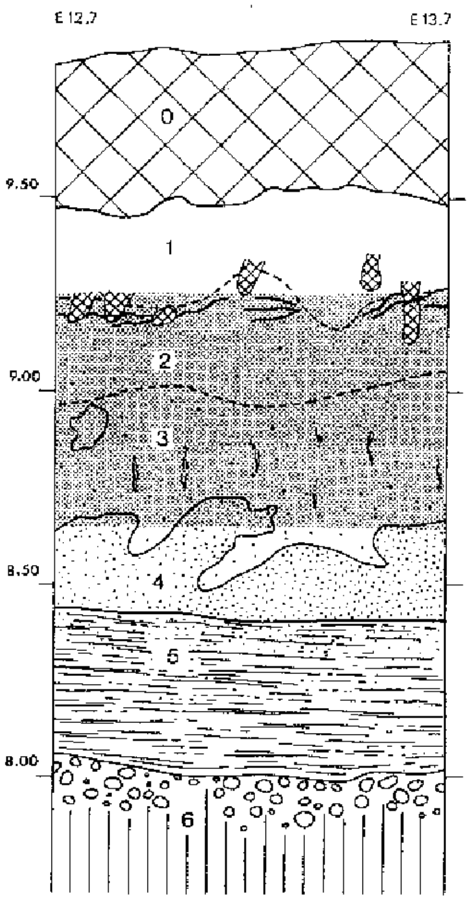

Fig. 1.1 - Profile at Rekem 5: Dotted line represents vertical spread of *Federmesser* artefacts (© I.A.P.).

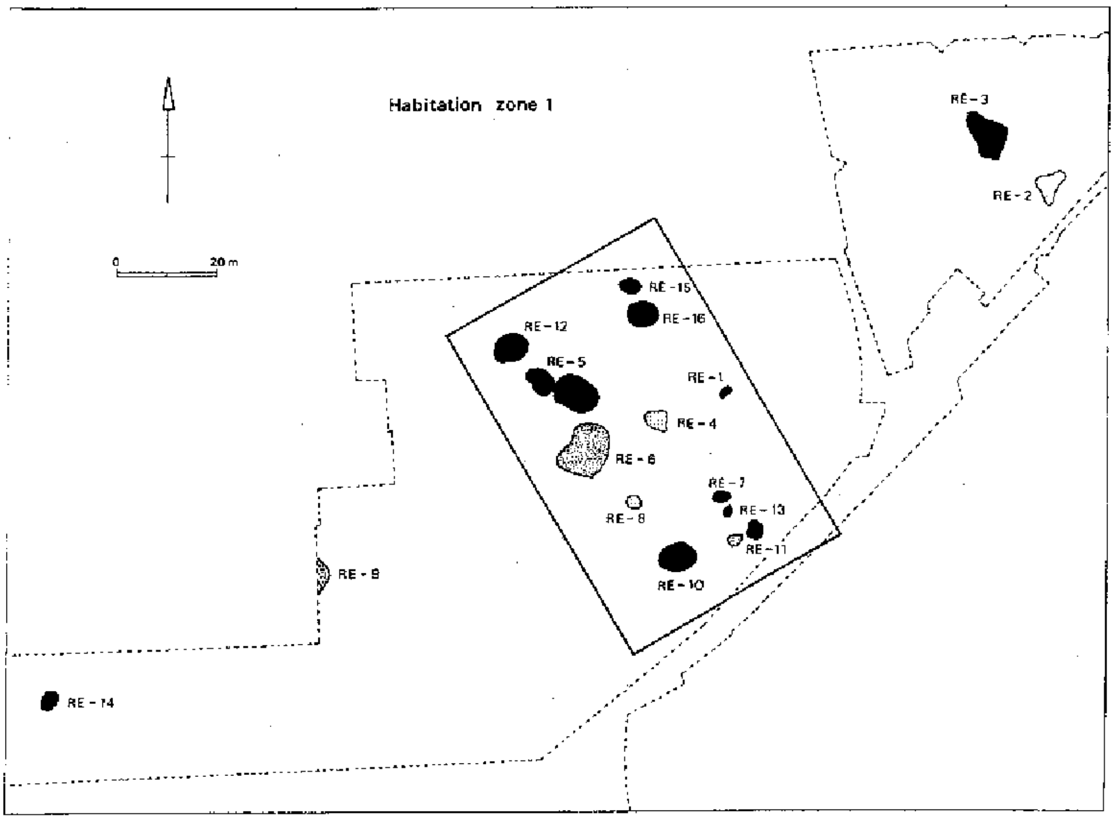

Fig. 1.2 - Rekem 1984-86: Map of the excavated area, with location of the 16 *Federmesser* loci. Twelve loci are grouped in 'habitation zone 1'. Darker schadings reflect increasing artefact densities (© I.A.P.).

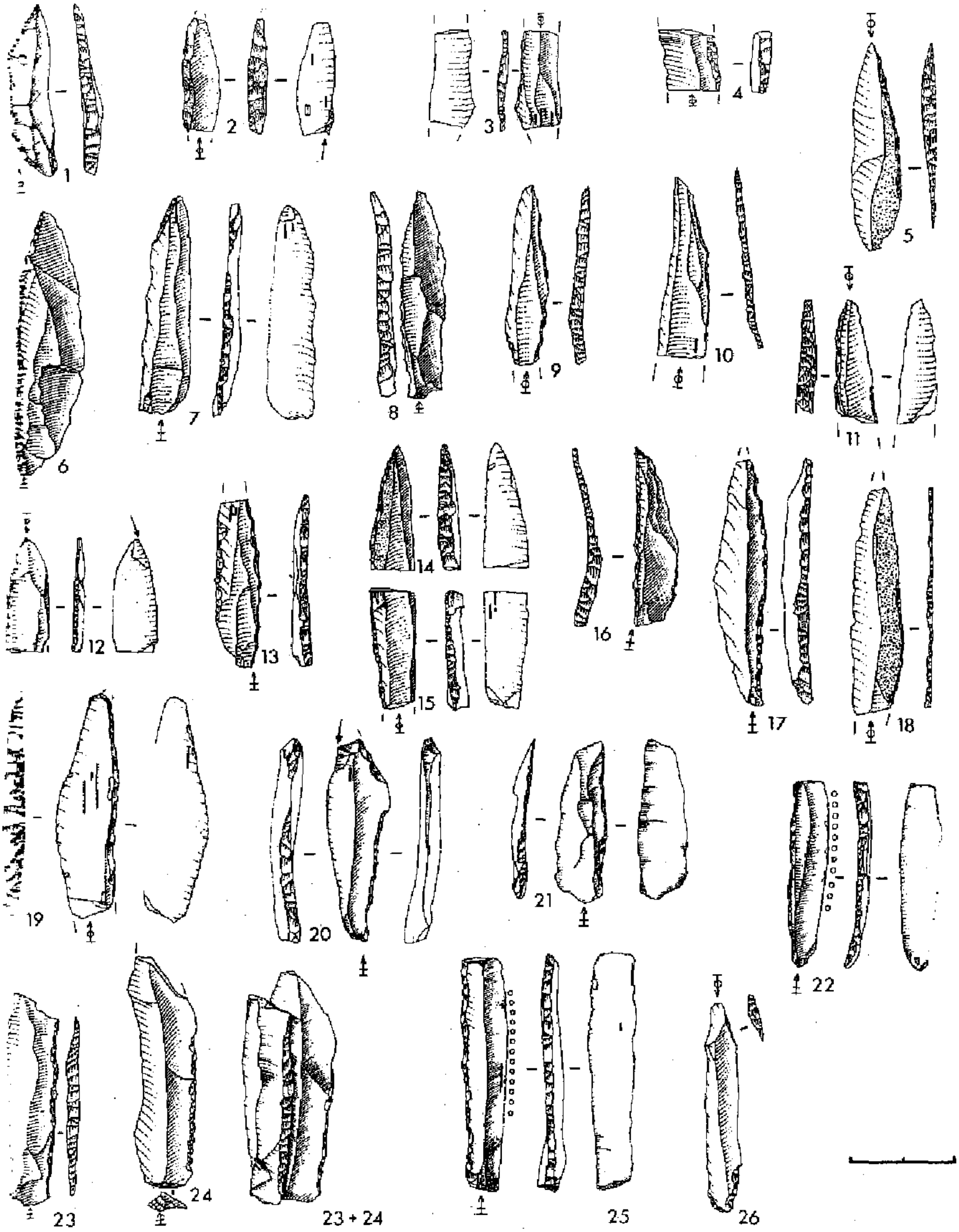

Fig. 1.3 - A selection of laterally modified laminar pieces from Rekem: 1, 5-15: curved backed points; 2, 16-19: rectilinear backed points; 3-4, 21-26: backed bladelets; 20: angled backed point; 23+24: reduction refit of 2 backed bladelets (© I.A.P.).

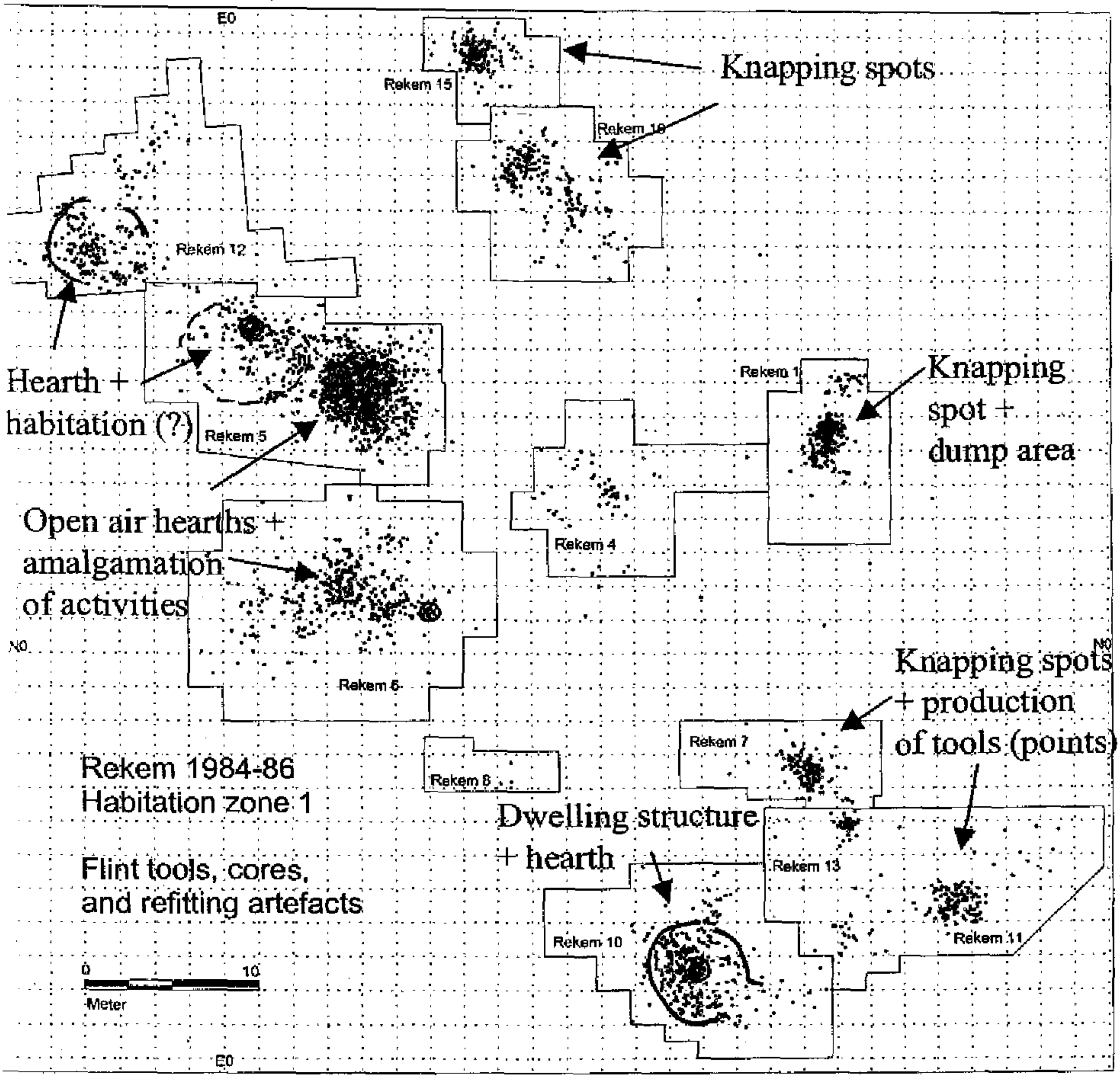

Fig. 1.4 - Rekem habitation zone 1: Interpretation of the various loci, with a series of 'domestic' units along a western axis and specific production places (and a dump area) along an eastern axis (© I.A.P.).

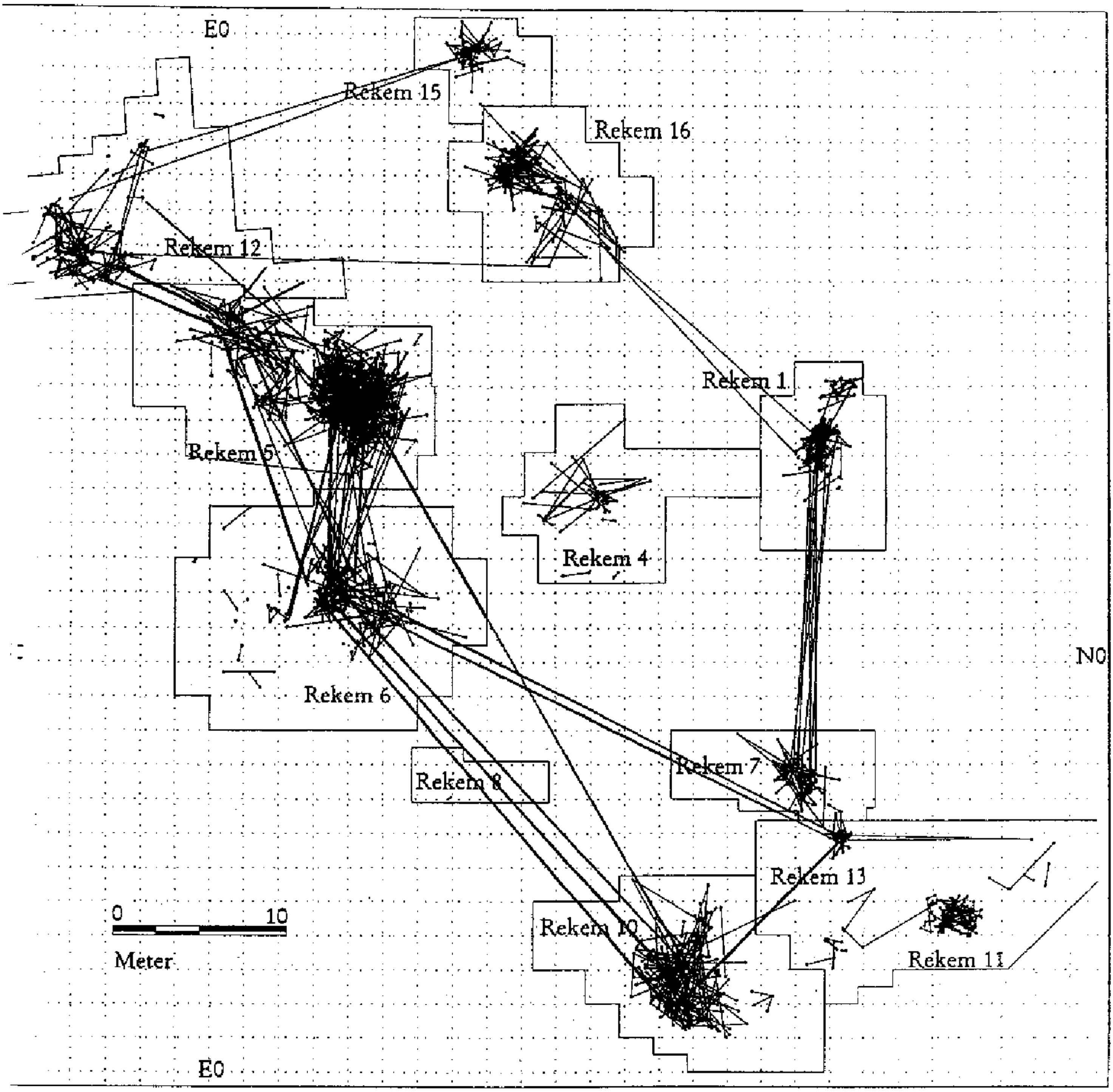

Fig. 1.5 - Rekem habitation zone 1: Inter-locus connections realised by refitting (© I.A.P.).

The Prehistoric Collections in the Gallo-Roman Museum Tongeren (Belgium)

Guido CREEMERS

The Gallo-Roman Museum was opened in 1954. The museum (Fig. 2.1) in its present state is mostly a new building and incorporates some older parts. It was inaugurated in 1994. The collection started in the 19th Century when the first researchers collected objects from the ancient capital of the *Civitas Tungrorum - Atuatuca Tungrorum* in Roman times, now the city of Tongeren. The archaeological research in Tongeren and surrounding region (Haspengouw) gradually increased and still continues today. In the fifties the Provincial Council of Limburg decided to build a museum. From that time on, there was a second dimension to the collections; namely the rest of the territory of the province (the Campine Region and the Maas Valley). In the fifties, the sixties and even in the seventies, a lot of Epi-Palaeolithic, Mesolithic, Metal-Age and even Merovingian sites had been discovered and excavated in the Province of Limburg. In the last two decades, the collections have been extended with further spectacular discoveries.

A contemporary archaeological museum has to offer more than a mere collection of objects: the result is a co-operation of scientists, educators, curators and an interaction between information, atmosphere, architecture, town life and life in the region. It invites people to ask questions, to learn and to enjoy and to contemplate. As a contemporary museum, the Gallo-Roman Museum, which attracts some 100.000 visitors per year, has a rather characteristic way of presenting its collections. The objectives are not simply to "present" the past, but to get some kind of interaction with visitors and to make the visitors think about their past. The presentation of the section "Prehistory" starts with an introduction where general questions about Prehistory and broader aspects of our past are raised. The introduction supplies some answers and shows that archaeologists' opinions and views change. The introduction also provokes public debate on the issues of culture, religion, social differences...etc.

The Gallo-Roman Museum possesses the most important Prehistoric collection (Fig. 2.2) in Flanders, although its' findings origininate exclusively from the Province of Limburg. The presentation begins chronologically with the oldest evidence; the Middle Palaeolithic material of the most important sites like Kesselt-Albertkanaal (Lauwers, 1984), Lauw and Schulen. We can see some handaxes, Levallois products and some side-scrapers. A remarkable object is a fossilised fragment of mammoth bone from Schulen (Van Peer, 1979). A recent study has put forward several arguments to interpret this bone as a primitive musical instrument. By rasping a stick or piece of bone in a rhythmic movement over the carved grooves, a kind of music could have been produced, perhaps during religious ceremonies. The "Venus of Laussel" holds a comparable object, namely a horn, marked with thirteen regularly spaced incisions (Huyge, 1991). Middle Palaeolithic sites are known from the Maas Valley and the Haspengouw region. The sandy Campine Region has only yielded some casual finds.

The Upper Palaeolithic is represented with the finds from the Magdalenian site of Kanne (Vermeersch *et al.*, 1985). We can see some blades, burins, scrapers, blades with blunted edge, borers, cores and an impressive refit. The people from the Magdalenian Culture clearly came to this region to search for flint of good quality and they found it in the valley slopes, south of Maastricht. The Federmesser Culture is represented with finds from the Campine Region (Zolder, Lommel, Zonhoven), where people settled near fens and rivers. The most important site of the region is undoubtedly the one of Neerharen-Rekem (De Bie & Caspar, 2000) in the Maas Valley. It yielded several concentrations of artefacts in which habitation areas, flint-knapping areas and areas with tool production could be found. Besides artefacts, which are current for this period like blades, cores, burins, scrapers and borers, a grooved sandstone artefact, used for polishing the wooden arrow shafts and a stick of ochre are displayed.

Lots of Mesolithic (Vermeersch, 1984) sites have been [illegible] Campine Region [illegible] Limburg. Most of them are situated near fens and rivers. A few [illegible] from the Maas Valley, although no Mesolithic sites have been excavated in the [illegible] up till now (Fig. 2.4.). Apart from chert, Mesolithic hunters-gatherers in the region [illegible] Wommersom quartzite. The amount gradually increased during the Mesolithic. In the [illegible] Mesolithic artefacts like different types of microliths, burins, borers and scrapers from sites like [illegible] Schaapsschoorbrug, Donk, Helchteren, Lommel, Meeuwen, Opglabbeek and [illegible] are exhibited.

Although we know some casual finds from the Campine Region, the settlements of the Linear Pottery Culture (LBK) are restricted to the loess soils of the Haspengouw Region. A lot of sites are known in the eastern part of the Limburgian-Haspengouw Region. The most important excavations on LBK sites in Limburg were executed in the sixties and seventies on settlements like Vlijtingen-Kayberg (Marichal *et al.*, 1987) and Rosmeer-Staberg (Fig. 2.3). In the showcases we can admire some typical LBK material: pottery, adzes, LBK arrowheads, borers, scrapers, blades with sickle sheen, ochre, and a big storage vessel. Settlements of the Rössen Culture are known from the adjacent part of Limburg in the Netherlands, but in Belgian Limburg they remain unknown. We know some casual finds of *Rössener Keile* like the one on display from Maasmechelen. Perhaps they were exchanged for raw materials or even food from the Mesolithic population which still inhabited the region.

From the Middle Neolithic onwards, flint mining is attested in the southern part of Limburg in the Netherlands and in the adjacent Voer Region (Belgium). The collection of the Gallo-Roman Museum contains blades, cores, flint picks and unfinished axes of ancient collections from Sint-Geertrui (The Netherlands) and from older collections as well as recent excavations from Rullen (Belgium). During the Middle Neolithic, the region became gradually but finally neolithisised by the Michelsberg related people. We know some important sites in Dilsen and Meeuwen, of which material is presented here. Although it is still not very clear how these people interacted with the Mesolithic population, we know that some Mesolithic traditions persisted (Vermeersch, 1991). In the showcases we can see a vessel of Meeuwen-Donderslagheide (Creemers & Vermeersch, 1989), polished axes, several types of arrowheads (leaf-shaped, triangular and transverse arrowheads), blades from the neighbouring mining sites, grinding stones and polishing stones amongst other items.

The Beaker Cultures are not well represented in Limburg. We know some casual finds like battle axes, flint daggers (some of them are from Grand Pressigny - France) and some sherds of the different phases of the Beaker Culture. Up until now no settlements have been excavated. The beaker which was discovered in the centre of a circular ditch, probably the surrounding of a grave mound, at Rekem dates from the Barbed Wire Culture, just like the big *Arbeitsaxt*, which is a find from the same site. Most of the other objects, like the two other battle axes, the triangular and barbed arrowheads and the polished axes and chisels, of which some are made from Lousberg flint (Germany), are casual finds.

The collection of the Metal Ages is traditionally focused on material from the urnfields, which have been investigated in the Campine Region since the end of the 19th century. Pottery from the most important urnfields, like Donk, Grote Brogel, Neerpelt, and Rekem are on display. In the last decade, the Gallo-Roman Museum acquired several spectacular assemblages. Examples are the 47 bronze socketed axes and the spearhead from the votive deposit of Maaseik-Heppeneert, dated 8th century BC and the two *situlae* and the ribbed bucket or *Rippenziste* from the three princely tombs of Wijshagen, dated 5th – 4th century BC. And finally the gold deposit of Beringen, which was found inside a native La Tène settlement, dated 2nd or 1st century BC and comprises two golden torcs, a bracelet and some 25 golden *Regenbogenschüsseln*. With these last finds, we come to the end of the Prehistoric Period and the start of the Roman Period in Western Europe.

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Belgium

http://www.limburg.be/galloromeinsmuseum

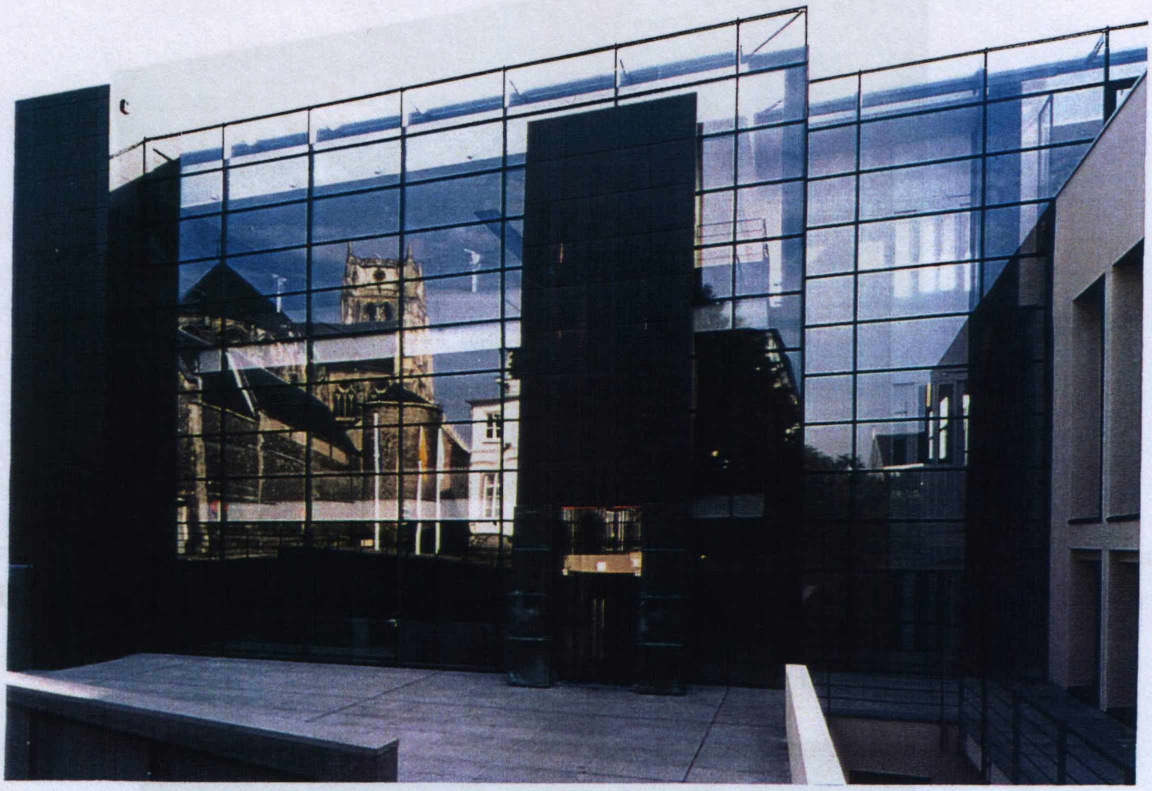

Fig. 2.1 - Gallo-Roman Museum Tongeren: View on the main entrance to the Museum.

Fig. 2.2 - Gallo-Roman Museum Tongeren: General view on the Prehistoric collections of the museum

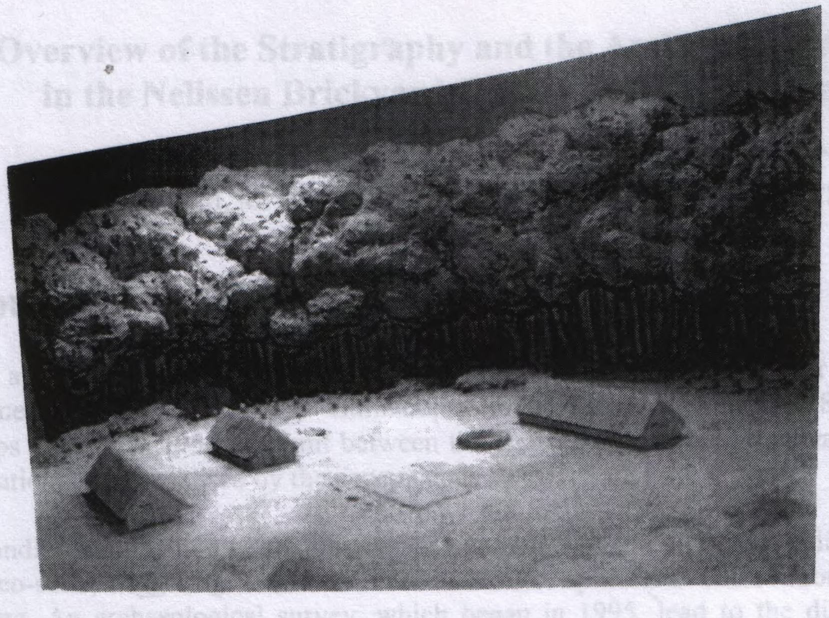

Fig. 2.3 - Gallo-Roman Museum Tongeren: Model of a typical Linear Pottery Culture (LBK) village in the loess area of Limburg - Belgium, *c.* 5,300 BC.

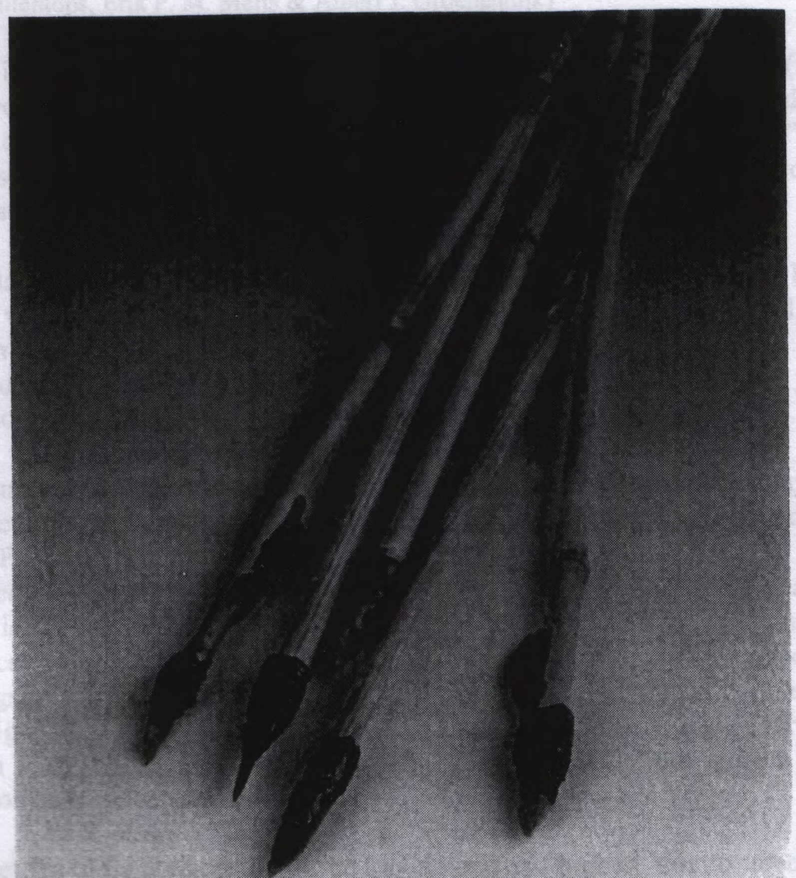

Fig. 2.4 - Gallo-Roman Museum Tongeren: Experimental Archaeology: reconstructed Mesolithic arrow armatures.

Overview of the Stratigraphy and the Archaeological Levels in the Nelissen Brickyard Quarry at Kesselt (Belgium)

Albert J. GROENENDIJK, Erik P. M. MEIJS, Frans GULLENTOPS,
Patrick M. M. A. BRINGMANS & Pierre M. VERMEERSCH

INTRODUCTION

For half a century the Nelissen brickyard quarry has been a key-site for the study of Late Pleistocene loess sediments (e.g. Gullentops, 1954; Mees & Meijs, 1984). In this quarry Gullentops defined in 1954 the limit between the Brabantian and the Hesbayan loess-units of the last glaciation, as materialised by the conspicuous Kesselt Soil, now K. Suite.

The expanding exploitation of the quarry has continuously revealed new sedimentological layers and palaeo-soils, triggering a flow of new and often ephemeral observations, also from other researchers. An archaeological survey, which began in 1995, lead to the discovery of the first prehistoric artefacts in the Nelissen brickyard quarry (Meijs & Groenendijk, 1999). Until now six different archaeological levels have been identified, sometimes accompanied with faunal remains.

STRATIGRAPHICAL OVERVIEW

(by Frans Gullentops, Erik P. M. Meijs & Albert J. Groenendijk)

The quarry is situated on a Maas terrace belonging to the Lanaken Formation (Fig. 3.1). The gravel layer is covered by fluvial sands and loams, in which a podzolic palaeo-soil developed. In the NE part of the quarry it was covered by up to 4 m clayey loessic silt ("X-loess") on top of which a strong luvisol ("X-soil") was developed (**Level A1**). This strong Bt was covered by 40 cm of greyish bleached A-horizon material.

This interglacial soil of a deciduous forest was extraordinarily characterised by a number of tree-fall pits in which lumps of A-material were intermingled with charcoal and pieces of red burnt earth (thermoluminescence dates for this forest-fire are not yet available). A contemporaneous polygonal desiccation net was traversed by frost-cracks filled with new yellow loess of the following cover.

The next unit, the "Lafelt loess", begins mostly with an eroding gravelly layer (**Level A2**) with local thickenings in shallow grit-bedded run-off systems, which are typical for a periglacial pediment (Fig. 3.1). The yellowish grey, calcareous loess is built up to a height of 9 m. It is characterised throughout by a fine (mm) lamination, interpreted as some yearly snowmelt effect (niveo-aeolian). The laminations are continuously deformed in a reticular network (25 cm), the whole indicating a cold, rather dry climate. This unit is further characterised by the presence of very light grey horizons, 20-25 cm thick, of which up to 5 have been counted. They concentrate abundant signs of life: snails in the top, *Pupilla* and *Trichia* mostly, inside earth worm borings and pearls with slug shields. However, no traces of an important root system is seen, nor humus accumulation as in meadow soils.

We interpret the albic horizons as formed by a chelating process due to vegetation rich in lichen, producing the powerful chelating agent, lichenic acids. For the formation of these cambi-podsols a duration of thousand years is estimated to suffice. Together with the intervening loess deposition it indicates a slight climate cyclicity of around 3,000 years. The whole Lafelt loess would then represent about 15,000 years.

In three locations a capping by an important luvisol has been seen (Fig. 3.1). A strong Bt is covered by an E horizon ending in a pronounced bleached layer. This complex soil has been shown to contain several illuviation phases and in one location separate Bt horizons could be observed in the field (**Level A3 & A4**). It is finally covered with a dark humic layer containing the enstatite tephra. This phenotype corresponds to the Rocourt Soil covered by a Warneton Bed and its complex history would correspond to the whole Last Interglacial or Marine Isotope Stage (MIS) 5.

A few gullies (**Level A5**) are cut into this basement and filled with laminated silts, snails, vertebrate remains and thin gleysols, with locally strong cryoturbations (Fig. 3.1). They belong to the Hesbayan Member and attest of humid, snow-rich conditions, which on these exposed positions mostly lead to erosion.

The whole scene is finally covered by a blanket of light yellow, calcareous loess, the Brabantian Member, which is around 5 m thick in the area (Fig. 3.1). The basal horizon is very characteristic. It begins with a rather flat erosion surface bevelling the subsoil with some small pebbles and eventually a varnished flint (**Level A6**) indicating an extraordinary deflation under extremely dry and cold conditions.

It is followed by a layer of orange-brown sandy silts and silts in irregular layers becoming increasingly silty towards the top. The very typical colour is interpreted as due to the dehydration of the iron films around the grains in these utmost harsh conditions. It is abruptly followed by typical Brabantian loess, dark grey at the base due to humus and some soil activity, with slight iron mottling underneath indicating some leaching. This shows considerably ameliorated conditions. The actual tongue-like intermingling of the orange and dark grey horizons is due to soil-creep in the active layer of a next short permafrost spell, also indicated by deep thin frost cracks, filled with new loess. This succession of phenomena is now called the "Kesselt Suite".

The Holocene luvisol on top is strongly influenced by more than 5,000 years of agriculture, but is less weathered than the fossil forest soils.

ARCHAEOLOGICAL REMAINS

(by Albert J. Groenendijk, Erik P. M. Meijs, Patrick M. M. A. Bringmans & Pierre M. Vermeersch)

The Kesselt quarry located on a distance of 2 km in south-western direction of the Vandersanden brickyard quarry at Veldwezelt-Hezerwater (Bringmans *et al.*, this volume), is situated on a terrace of the River Maas, on which the "X-loess" was deposited, followed by the development of the "X-soil". Artefacts were found in the upper part of this Intra-Saalian luvisol (MIS 7). The artefact assemblage of **Level A1** is made up of four broken flakes (2-3 cm). The flint artefact assemblage of **Level A2** (Fig. 3.2), recovered in a layer formed by wind and water action, contains two irregular cores (11-15 cm), twelve flakes (2-8 cm), five cortical flakes (5-10 cm), five broken flakes (3-4 cm) and three chunks (2-3 cm). All these 27 artefacts were strongly weathered by wind and frost action. Just on top of the lowest light grey horizon (N-1) remnants of lemming (*Dicrostonyx gulielmi*: determination by J.-M. Cordy, University of Liège, 2000) were found. On top of the following light grey horizon (N-2) a horse-jaw and again remnants of *Dicrostonyx gulielmi* (determination by J.-M. Cordy, University of Liège, 2000) were discovered.

Analogous to the "X-Soil" several tree-fall pits are present at the top of the lowest Bt of the Rocourt Soil (Fig. 3.1). In the northern part of the Kesselt pit one tree-fall pit was filled with leached, whitish silt and reddish burnt loam mixed with charcoal pieces of oak (*Quercus sp.*: determination by F. Damblon, Royal Belgian Institute of Natural Sciences Brussels, 2000). The charcoal was dated by Carbon-14 analysis at an age older than 45.000 BP (personal communication J. Vandenberghe, University of Amsterdam, 2000). However, on stratigraphical grounds it is probable that this tree-fall pit dates to the Eemian (MIS 5e). It is important to note that there were also several artefacts present on top and in the vicinity of this tree-fall pit.

The Laboratory for Prehistory at the Catholic University of Leuven organised an excavation to discover the possible association between the burnt tree-fall pit and these artefacts. But it soon became clear that there were no artefacts to be found in the tree-fall pit and no relationship at all could be established between the artefacts and the lowest Bt horizon. In the middle Bt horizon of this complex soil (**Level A3**) only one cortical flake (5 cm) in vertical position was found. It is likely that this artefact was not *in situ*. In the upper Bt of the Rocourt Soil (**Level A4**) only one Levallois flake (8 cm) and one chip (<1 cm) were excavated.

In a Weichselian erosion gully (Fig. 3.1) that runs over the tree-fall pit and the middle Bt, but cuts the upper Bt of the Rocourt Soil, 47 artefacts (**Level A5**) were excavated. The artefact assemblage of this level (Fig. 3.2) contains nineteen broken flakes (1-3 cm), five chips (<1cm) and one chunk (5 cm). But also, ten flakes (1-5 cm), four cortical flakes (3-6 cm), three Levallois flakes (4-7 cm), one Pseudo Levallois point (3 cm), two retouched flakes (3-5 cm), one bifacial tool (7.6 cm) and one double biconvex side scraper (6 cm) were excavated in this level. A skull of a woolly rhino (*Coelodonta antiquitatis*) and remnants of a horse (*Equus caballus*), both identified by J.-M. Cordy (University of Liège, 2000) were also unearthed in this gully. The association of woolly rhino and horse indicates a Middle Weichselian age (MIS 3).

The presence of imported flint types like Rullen and translucid flint in **Level 5** is very characteristic. Most of the artefacts have probably not been eroded out of the upper Bt of the Rocourt Soil (MIS 5) by this gully. Presumably, most of these artefacts are, just like the bones, also to be dated to the Weichselian *s.s.* However, the question remains whether the artefacts and the faunal remains found in this level are actually contemporaneous.

After the formation of the Rocourt Soil and the Warneton Bed, periods of severe erosion took place, subsequently followed by the deposition of calcareous loesses, which are intercalated by several tundrasols (Fig. 3.1). In the Patina Layer, the base of the orange horizon of the "Kesselt Suite", two reworked, heavily wind glossed and white patinated artefacts (**Level A6**) were found. The first artefact of this level is a flake (4 cm.) and the second is a bifacial retouched point (8 cm).

CONCLUSIONS

Most of the artefacts were found in deflation horizons (**Level A2 and A6**) and/or erosion gullies (**Level A2, A5 and A6**) or were moved by post-depositional processes (**Level A3**). The only artefacts that seem to be more or less *in situ* were excavated in palaeo-soils (**Level A1 and A4**). The "Lafelt Loess" holds an interfluve position between the valleys of the Wolder to the south and of the Hezerwater to the north, both tributaries of the River Maas. The artefacts of **Level A1 and A2** are in fact older than this "Lafelt Loess" and can be found to the south as well to the north of this interfluve position. All the other and younger artefacts (**Level A3, A4, A5 and A6**) were excavated at the top of a gentle north/north-east facing slope of the Hezerwater Valley.

On stratigraphical grounds the artefacts of **Levels A1** can be dated into the Intra-Saalian Interglacial (MIS 7). On techno-typological grounds the artefacts of **Level A1 and A2** can be attributed to the Early Mousterian of the Early Middle Palaeolithic, the period predating the Eemian. The absence of artefacts in the lowest Bt horizon (MIS 5e) of the Rocourt Soil is remarkable. This phenomenon has also been observed in the neighbouring loess quarries; e.g. Veldwezelt-Hezerwater (Bringmans *et al.*, this volume). On stratigraphical grounds the artefacts of **Level A3 and A4** can be dated to the end of the Last Interglacial *s.l.* (MIS 5). Most of the used flint nodules at Kesselt are of local origin, found in the Maas terrace gravels. But, in **Level A5** imported flint types like Rullen and translucid flint were also used. On techno-typological grounds the artefacts of the **Levels A3, A4 and A5** can be attributed to the Late Mousterian of the Late Middle Palaeolithic, the period post-dating the Eemian.

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Fig. 3.1 – Kesselt: North Profile of the Nelissen Brickyard Quarry.

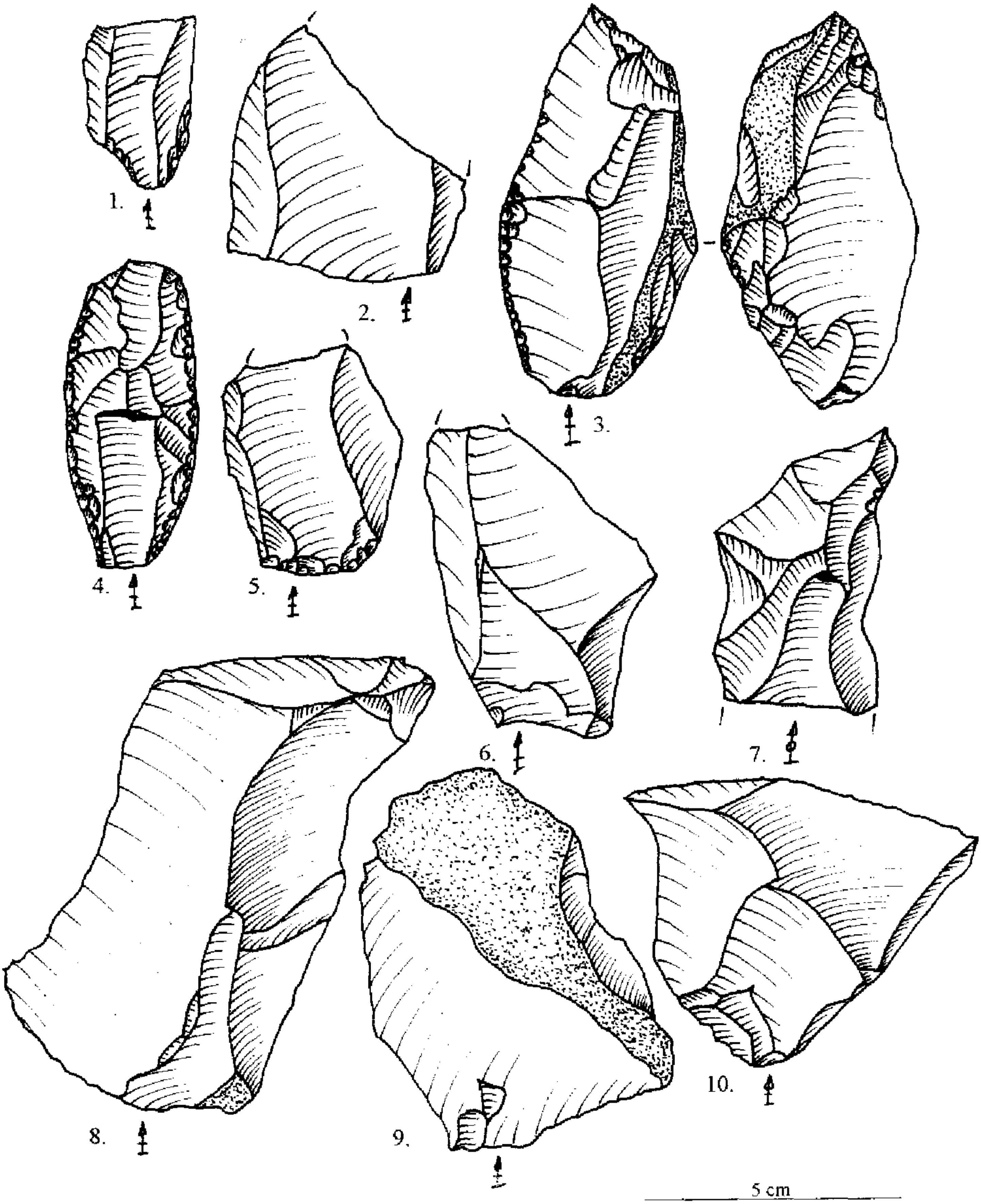

Fig. 3.2 – **Kesselt:** **Level A5:** 1 and 5. Retouched flakes; 2, 6 and 7. Levallois flakes; 3. Bifacial tool; 4. Double biconvex side scraper. **Level A2:** 8 and 9. Cortical flakes; 10. Flake. (Drawings: P. M. M. A. Bringmans, 2001.)

Preliminary Report on the Excavations [redacted] Valley Settlements at Veldwez[redacted]

Patrick M. M. A. BRINGMANS, Pierre M. VERMEERSCH, Albert J. [redacted],
Erik P. M. MEIJS, Jean-Pierre DE WARRIMONT & Frans GULLENTOPS

INTRODUCTION

The Veldwezelt-Hezerwater sites are located in the Vandersanden brickyard quarry, which exposes the loess deposits of the south-east facing side of the Hezerwater Valley. The research of the quarry by the Laboratory for Prehistory at the Catholic University Leuven, in collaboration with the Institute for the Archaeological Heritage (*IAP*) of the Flemish Community and the *Provinciaal Gallo-Romeins Museum* of Tongeren, started in 1995. (Gullentops *et al.*, 1998; Bringmans *et al.*, 2000; Vermeersch, 2001; Bringmans *et al.*, 2001)

PRINCIPAL ELEMENTS OF THE STRATIGRAPHY

(by Frans Gullentops, Erik P. M. Meijs, Albert J. Groenendijk & Jean-Pierre De Warrimont)

The Vandersanden pit exploited the fill of the asymmetrical Hezerwater dry valley. The final exploitation wall was graciously preserved by the Vandersanden Firm and put at the disposal of the Laboratory for Prehistory at the Catholic University Leuven for adequate excavations, because several archaeological levels had been located. The actual wall is slightly oblique to the valley and gives excellent exposures of the contact between the erosion in the valley side and the fill.

The steep valley-side is made up of 4 m of Maas gravel (Fig. 4.1), which belongs to a younger terrace of the Lanaken Formation. It is overlain by a thin layer of reworked marine gravel and sand; the first alluvial fan of the Hezerwater. Next follows an incision of this small tributary over at least 6 m, the base being not yet reached.

The actually deepest gravel is badly sorted, with coarse elements from the terrace. It is covered by more than a metre of stratified alluvial silts with numerous small sand lenses. These are not simple overbank deposits but represent individual threads of snowmelt-water, probably under snow cover. Laterally occurs against the valley-side a lens of aeolian silts with sand laminae blown in from this alluvial plain. Aggradation continues with a new gravel spread, locally overlain by a disordered mass of terrace gravel. It represents a rock-fall from a frozen block of Maas gravel from the nearby terrace-wall. This produced shock-waves with small thrust-planes in the underlying alluvium. The debris was finally obliterated by water-lain aeolian silts.

A small depression is cut into the previous aggradation and fixed by an incipient soil (VLB) under temperate conditions (Fig. 4.1). The horizon contains artefacts and *Pinus* charcoal pieces. The depression is first filled by coarse silts with discontinuous laminae granules (GSL) denoting colluvial activity, followed by loessic silts. These are weathered into orange-brown luvisols with stagnic overprinting. The upper one (VBLB) contains artefacts and *Betula* charcoal. They converge on the terrace in a deeply weathered polygenetic soil.

The upper bleached E-horizon (BHB) develops into typical white silt, devoid of any clay and is always overlain by a dark humic layer (OHZB), with *Pinus* charcoal and in which the important enstatite tephra is present. This succession of mature soils denotes a long period of temperate climates with different forest covers. It is interpreted as giving a fairly complete image of the climatic fluctuations of the long Last Interglacial, corresponding to Marine Isotope Stage (MIS) 5.

Between this humic horizon and the upper characteristic Brabantian loess with at its base the typical erosive "Kesselt Suite" is seen the very diversified Hesbayan Member (Fig. 4.1). In the valley fill a complex stratigraphy could be established with numerous erosional hiatuses. The actual section gives considerable detail of these erosional phases, of which five can be seen.

The first erosion occurs immediately after the enstatite-humus with deep solifluction scoops in which, then frozen lumps of the humus flowed down. In the valley fill they were found covering the interglacial fluvial sand. They indicate the first cold push with which started the last glacial. It is followed by a grey dust cover, which is fixed by a thin meadow soil. After a thin second dust cover follows typical stratified soil colluvium with erosion products of the interglacial luvisols. Other ravines are transformed by solifluction of their sides. From the final horizon (WFL) of one gully-fill (Fig. 4.1), artefacts and an important number of mammalian remains have been recovered, with horse and woolly rhinoceros as most typical.

The most crucial erosion is materialised by chest-shaped gullies: torrential cross-bedding undercuts frozen vertical walls and are filled with angular frozen blocks. We assist in the development of a thermokarst, when a permafrost degrades and the melt-waters carve the surface along the ice-wedges of original tundra polygons. All these phenomena show wet, snow-rich conditions, too cold for a forest vegetation, but often rich in life. Only once, short deep permafrost transformed the landscape and tbe special erosion of the thermokarst when it melted and demonstrated the enormous power of these pbases on soft rock scenery.

ARCHAEOLOGICAL MATERIAL

(by Patrick M. M. A. Bringmans, Albert J. Groenendijk, Erik P. M. Meijs, Jean-Pierre De Warrimont & Pierre M. Vermeersch)

The excavations extend along the gently sloping valley-wall of the Hezerwater tributary of the River Maas. A small gully (Fig. 4.2) created a slope, stable enough to allow the development of an incipient soil (VLB). Both the VLL and the VLB horizon contain artefacts and the VLB horizon especially, contains numerous charcoal pieces, identified as *Pinus silvestris* (determination by F. Damblon, Royal Belgian Institute of Natural Sciences Brussels, 1998). This gully was first filled by coarse silts with discontinuous laminae granules (GSL) and later followed a general cover of loessic silts (See front-page). According to the most probable working hypothesis, this sequence belongs to the late Saalian and represents consequently the terrestrial equivalent of Marine Isotope Stage (MIS) 6.

The lithic assemblage (n = 375) of the **VLL-VLB Site** (Fig. 4.3 & 4.4) is situated on the slopes of this small gully. Most of the artefacts came out of the VLL and the VLB horizons of the incipient fossil soil. Beside many small flakes and blades, several small bipolar cores for bladelets with carefully prepared striking platforms were found. The small dimensions of the artefacts of the VLL-VLB Site are clearly determined by the character of the locally available raw material. Several refits have been found, suggesting a restricted artefact movement.

A succession of several luvisols separated by bleached and humic zones can be observed (Fig. 4.2). One Bt-horizon (VBLB) contains artefacts and many charcoal pieces, identified as *Betula sp.* (determination by F. Damblon, Royal Belgian Institute of Natural Sciences Brussels, 1998).

The dark humic zone (OHZB) contains the expected volcanic minerals with enstatite. This very detailed succession of mature soils and humic horizons, representing the Rocourt Soil covered by a Warneton Bed, gives a fairly complete image of the complex terrestrial climatic fluctuations during the Last Interglacial *s.l.* (MIS 5).

The artefacts (n = 350) of the **VBLB Site** were excavated in the upper Bt (Fig. 4.2) of the Rocourt Soil (MIS 5) with a maximal vertical artefact distribution of less than 30 cm. The lithic assemblage of this site (Fig. 4.4) is primarily characterised by the predominance of Levallois flakes and only one Levallois core. Some side scrapers, a *déjeté* side scraper, a bifacial single convex side scraper and one bifacial foliate were also excavated. The largest concentration of artefacts on the VBLB Site (Fig. 4.3) comprises large and small Levallois flakes, debitage waste and chips. All the lithic material of this area belongs to the same raw material unit and all long-distance refits are connected with this sector. This is probably a spot were prehistoric man produced his blank Levallois flakes. The tools were used elsewhere on the VBLB Site. The majority of the artefacts excavated on the VBLB Site can be assigned to at least seven Levallois reduction sequences, but the expected Levallois cores have not been found at present.

Most of the larger artefacts of the **VBLB-South Site** were excavated in the upper part of the Rocourt Soil (MIS 5). The lithic assemblage (n = 55) is primarily characterised by the dominance of the Levallois debitage technique. Several Levallois flakes, blades, core-edge flakes and some Pseudo-Levallois points have been excavated.

The loess, loess-derived sediments and tbe many intercalating fossil soils overlying the Rocourt Soil and the Warneton Bed belong to the Weicbselian *s.s.*, representing the terrestrial equivalent of MIS 4, 3 and 2. Here a complex stratigraphy (Fig. 4.1) has been established, with several horizons containing microfauna and abundant mollusc shells. The **TL-R and the TL-GF Sites** are situated on the east facing valley-side of a Middle Weicbselian Hezerwater gully (MIS 3). The excavated artefacts (n = 75) are related to the fill of this gully-system and not to the erosional process itself. The lithic assemblage (Fig. 4.5) comprises a core, several flakes and two large retouched flakes. A typical Quina transverse convex side scraper has also been excavated on this site.

In the WFL-horizon, an incipient red soil of Middle Weichselian age (MIS 3), several artefacts and an important number of mammalian remains have been recovered. The artefacts of the **WFL Site** (n = 125), bones (n = 190) and teeth (n = 59) excavated here clearly relate to this homogenised soil. The lithic material (Fig. 4.5) is made up of unipolar lineal and bipolar recurrent Levallois cores, two side scrapers and several flakes. The faunal assemblage of the WFL Site comprises, based on preliminary assessments, cold period faunas including species such as horse and woolly rhino. Gnawing marks of hyena have been observed (personal communication J.-M. Cordy, University of Liège, 2001). Although no cut marks have been identified on the bones at present, evidence for the anthropogenic origin of these finds is provided by systematic bone cracking, probably for extracting marrow.

In the Patina Layer, the base of the orange horizon of the "Kesselt Suite", 59 reworked, heavily wind glossed and white patinated artefacts have been found. Finally, the characteristic "Kesselt Suite" was covered by up to 5 meters of aeolian Brabantian loess (Fig. 4.1), in which the Holocene soil developed.

CONCLUSIONS

It can be concluded, that the geological sections at Veldwezelt-Hezerwater represent the most complete terrestrial evidence, in one and the same loess quarry, of the complex climatic changes during the last 175,000 years. The excavations at Veldwezelt-Hezerwater disclose important remains of at least five different Middle Palaeolithic valley settlements. Humans were living, hunting and producing their tools at this spot in the Hezerwater Valley at different times during the late Saalian (MIS 6), the late Last Interglacial *s.l.* (MIS 5) and the Middle Weichselian (MIS 3). The floral and faunal remains suggest that the climate was temperate or even cool.

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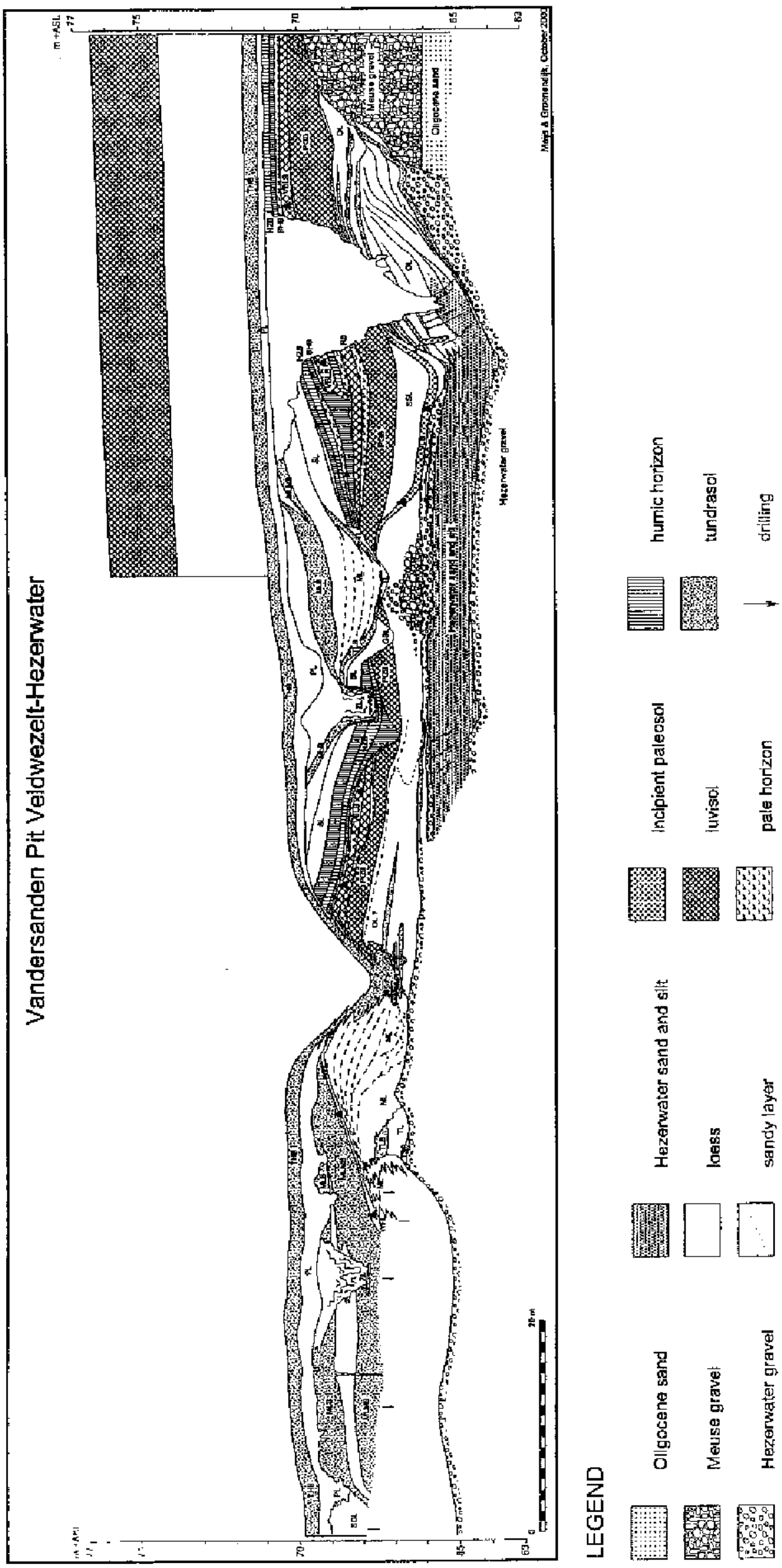

Fig. 4.1 – Veldwezelt-Hezerwater: West Profile of the Vandersanden Brickyard Quarry.

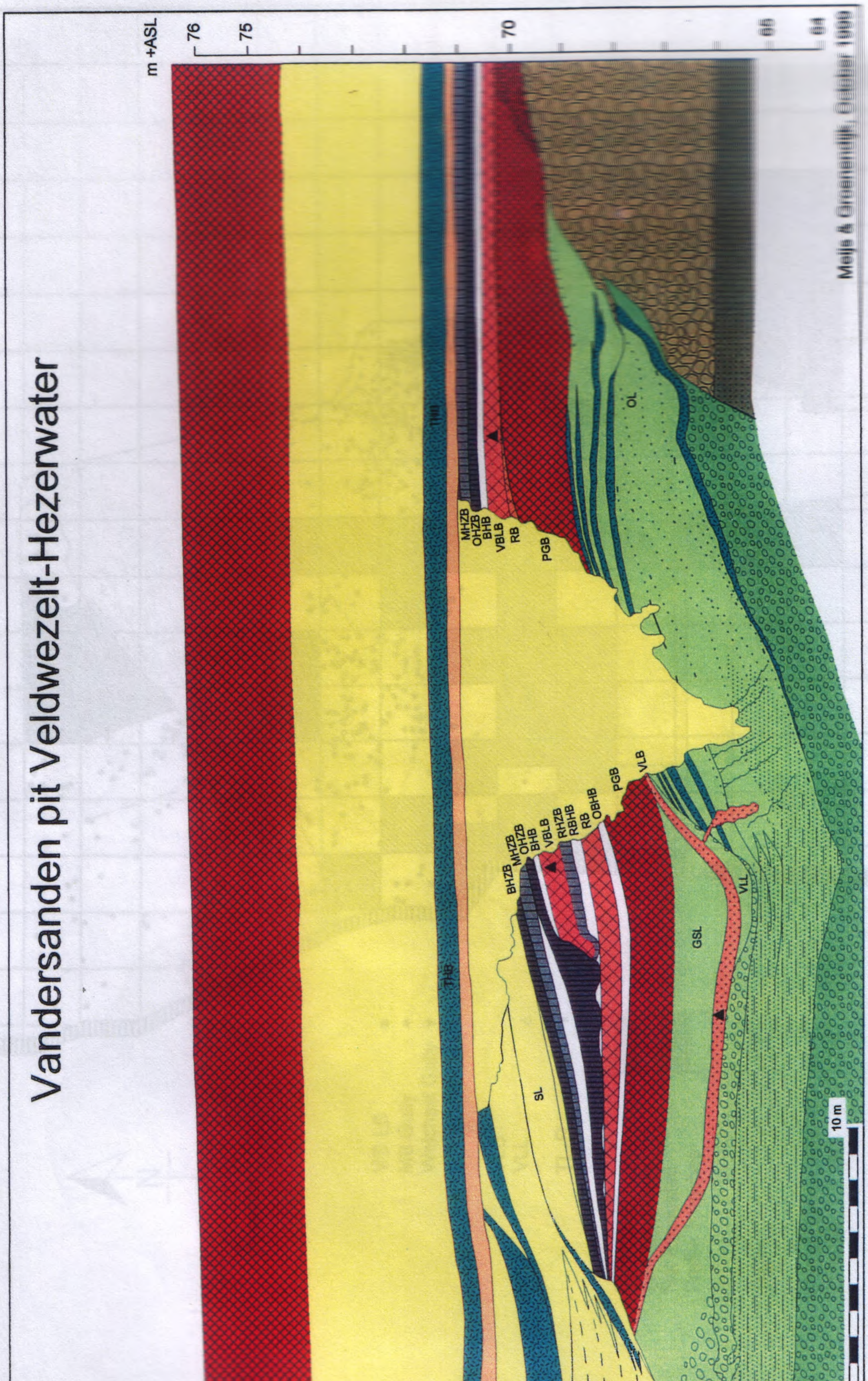

Fig. 4.2 - Veldwezelt-Hezerwater: Detail of the West Profile: stratigraphical position of the VLL-VLB and the VBLB archaeological levels. (Legend: see Fig. 3.1)

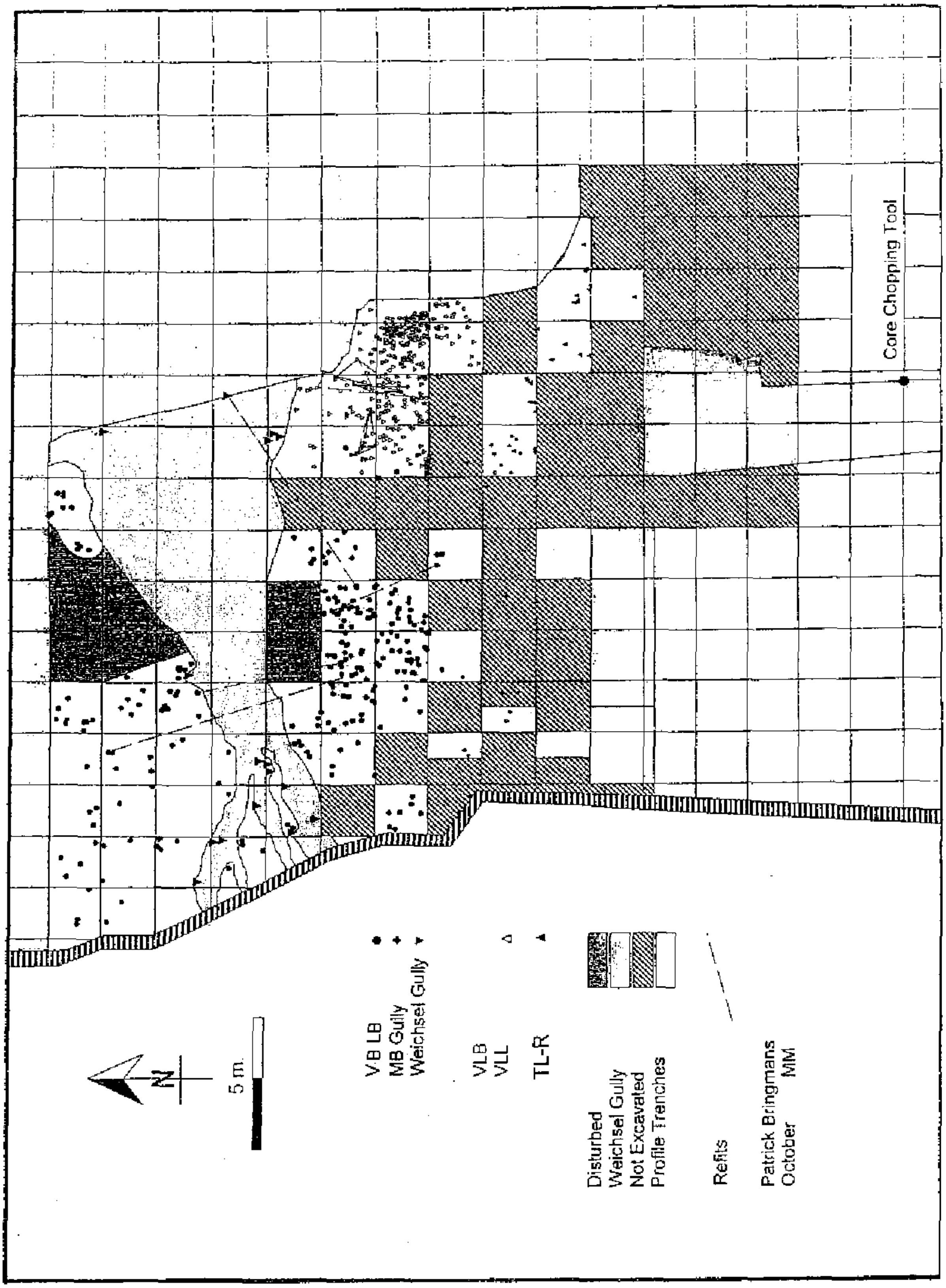

Fig. 4.3 - Veldwezelt-Hezerwater: Horizontal distribution of the artefacts of the VLL-VLB, VBLB and TL-R Sites

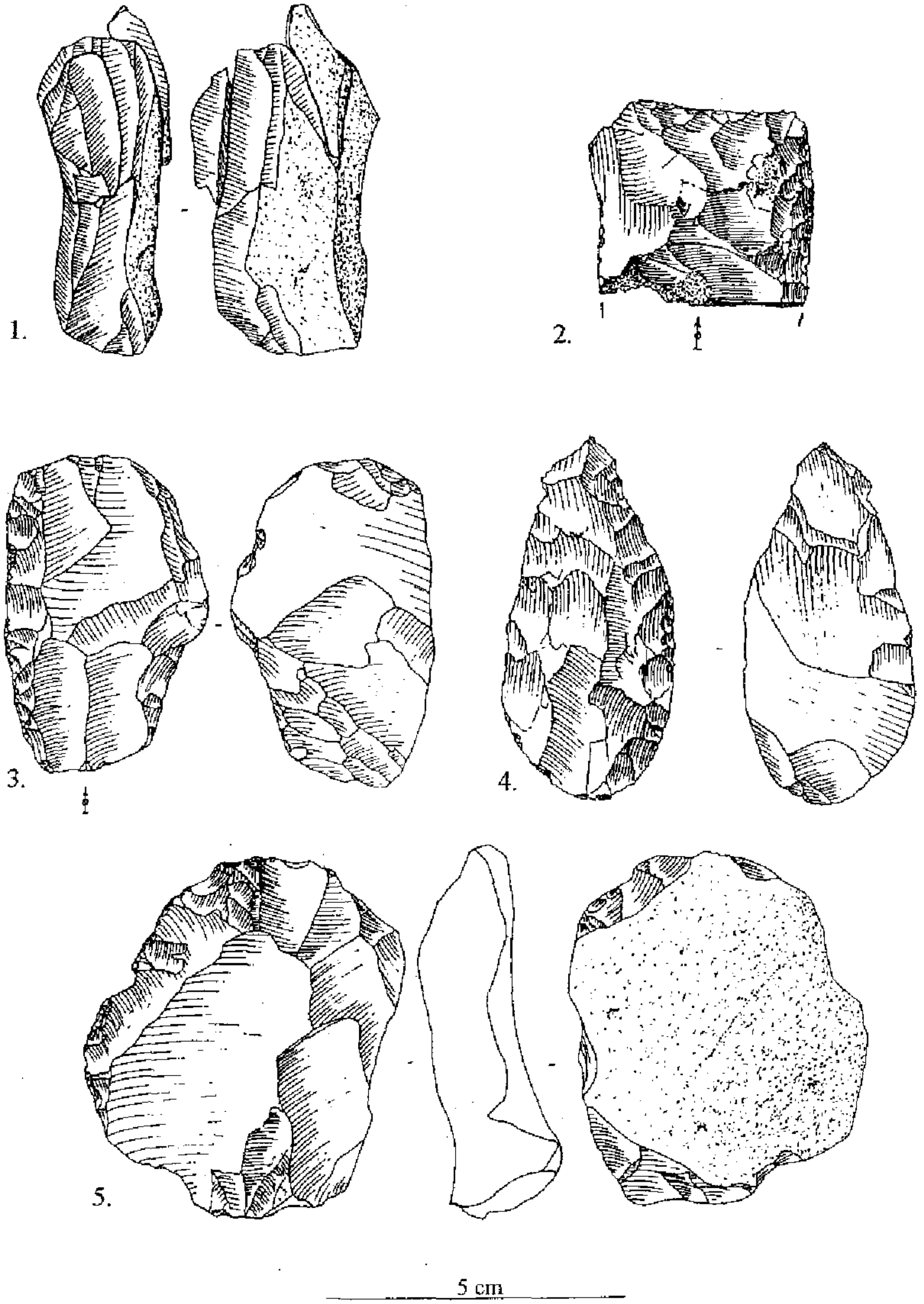

Fig. 4.4 – Veldwezelt-Hezerwater: VLL-VLB Site: 1. Core with three refitted bladelets. **VBLB Site:** 2. *Déjeté* side scraper; 3. Bifacial single convex side scraper; 4. Bifacial foliate; 5. Levallois core, reworked as a convex side scraper. (Drawings: R. Geeraerts, *L.V.P.*, 1998.)

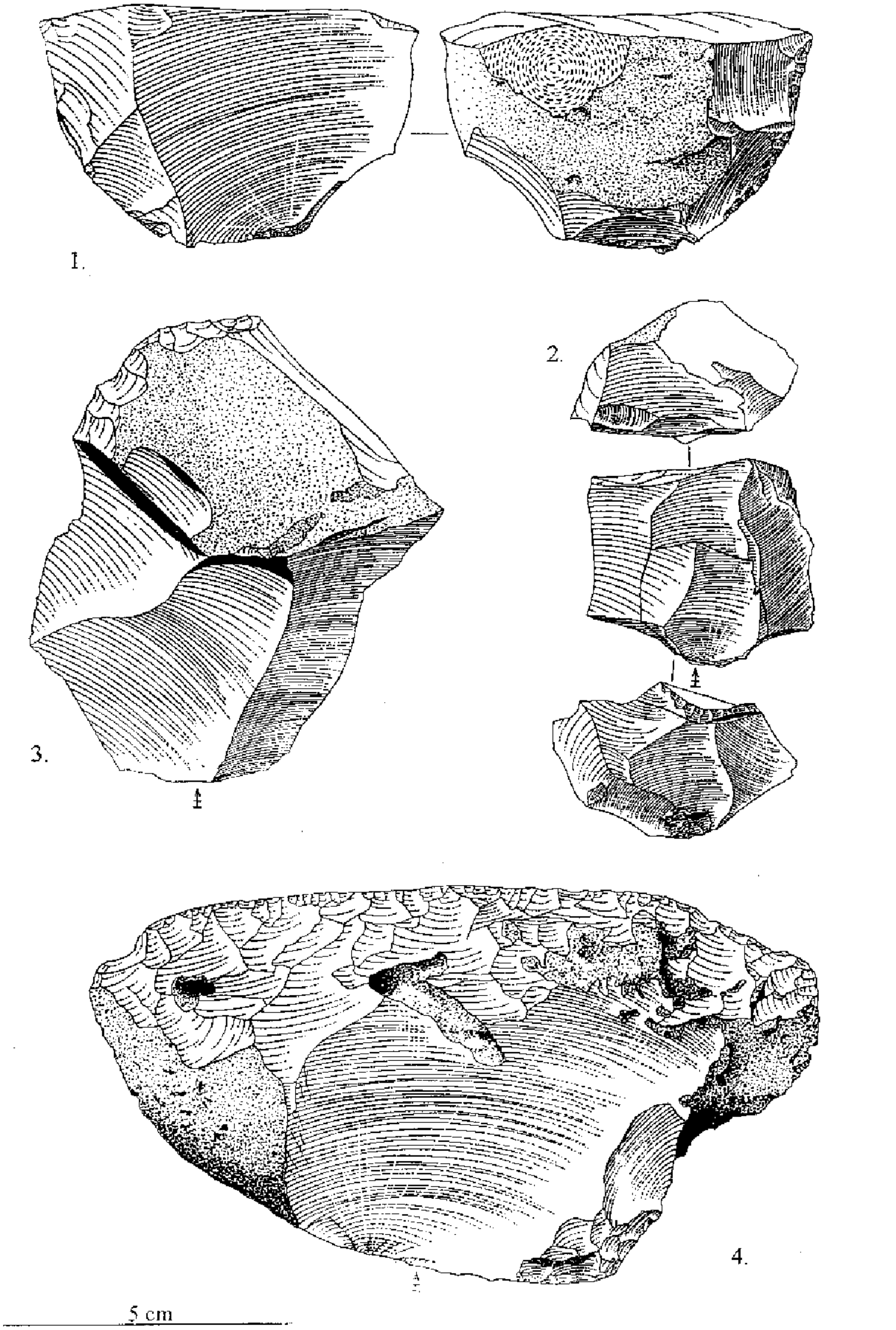

Fig. 4.5 – Veldwezelt-Hezerwater: WFL Site: 1. Unipolar lineal Levallois core; 2. Bipolar recurrent Levallois core with a refitted broken blade. **TL-GF Site:** 3. Flake with Quina retouch; 4. Quina transverse convex side scraper. (Drawings: M. Van Meenen, *I.A.P.*, 2000.)

MAPS

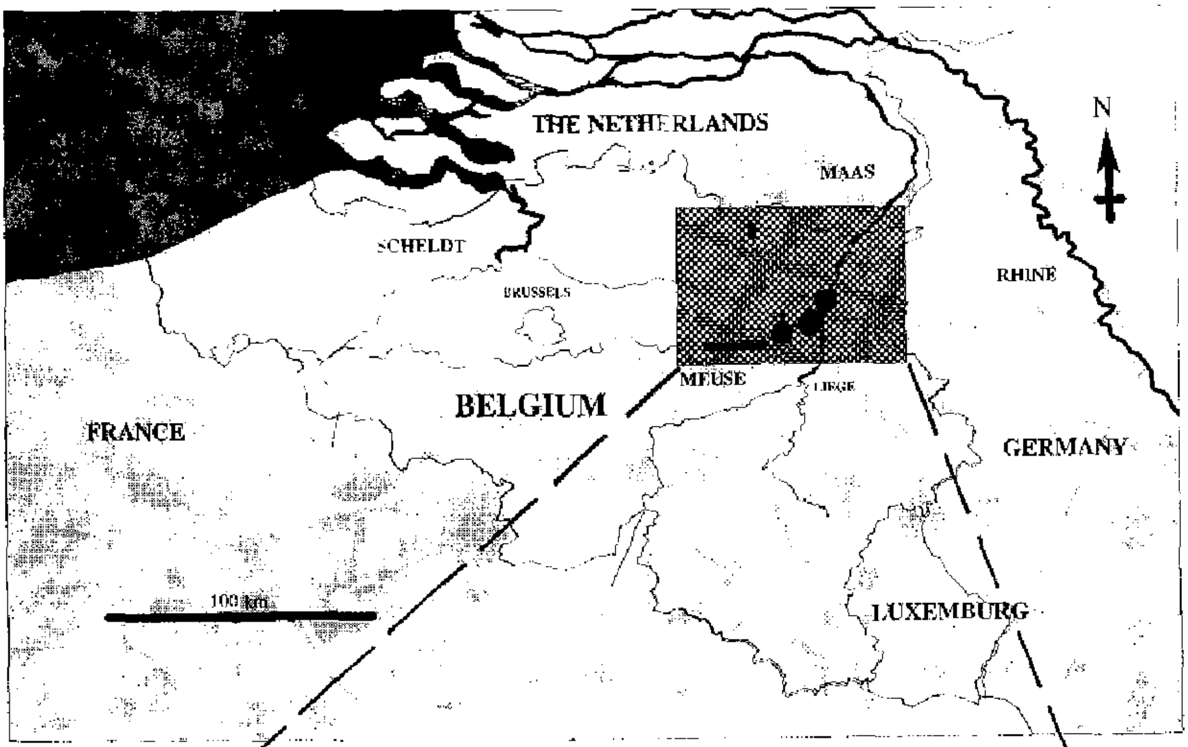

Fig. 5.1 – Belgium: Schematic map showing the main rivers.

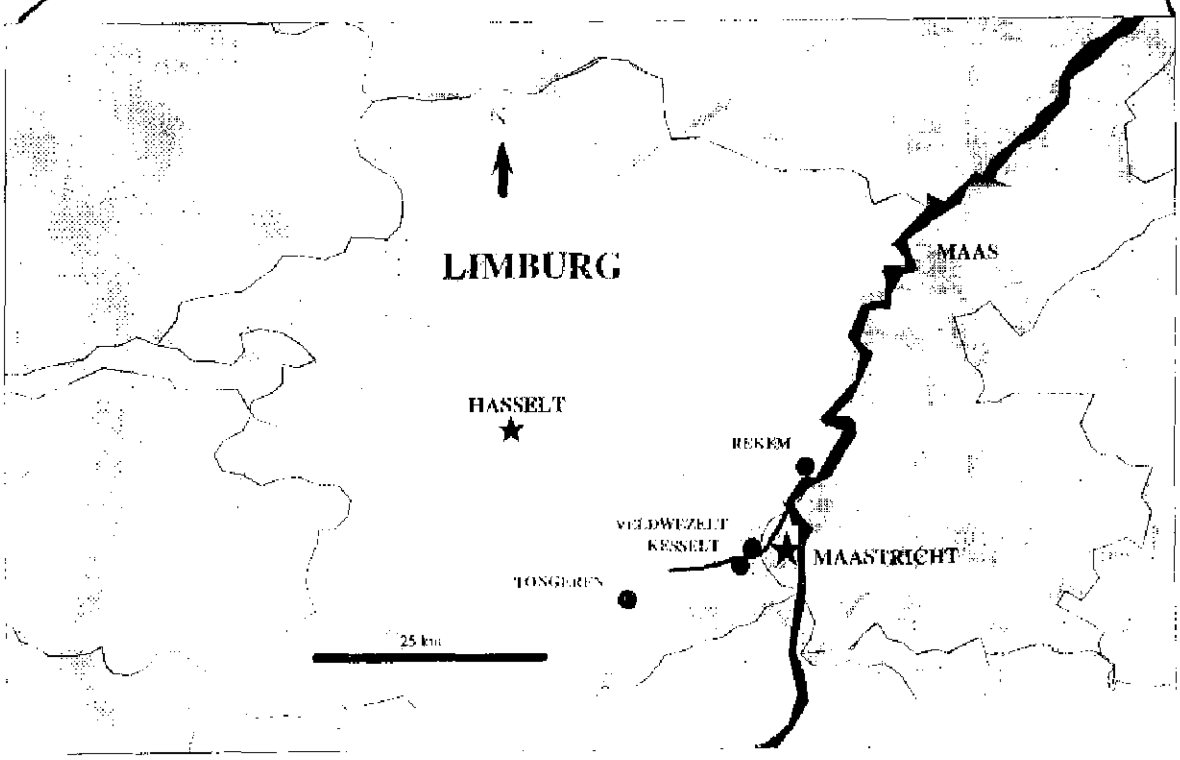

Fig. 5.2 – Limburg [illegible] map showing the area visited.

TL age determination of burnt loess from the X-soil in the Nelissen brickyard quarry (Kesselt, Belgium)

Peter VAN DEN HAUTE & Frans DE CORTE

SAMPLES

Information on the stratigraphic position of the X-soil (Level A1) and the related archaeological finds is given by Groenendijk *et al.* (2001). Two cylindrical steel rings (diameter en height 5 cm, volume 100cc) were hammered into the loess sediment of the luvisol on spots where the reddening of the sediment due to burning was striking. The cylinders were covered with light tight lids and transported to the TL laboratory. Only the material of ring 1 (R1) has been analysed so far. In the TL darkroom the loess was pushed out of the ring and cut into five slices each approximately 1cm thick The two outermost slices (nos. R1/1 and R1/5) were used for the determination of the annual dose, while the three inner slices (nos. R1/2-4) served as subsamples for the determination of the palaeodose.

TL ANALYSIS

The analytical procedures that have been applied are essentially the same as the those that were used earlier for the age determination of the Saalian-Weichselian loess deposits exposed in a higher level of the same quarry (Van den haute *et al.*, 1998). After HCl and H_2O_2 treatment to remove carbonates and organic material respectively, the remaining powder was sedimented in 2mg aliquots from an acetone suspension on aluminium discs and analysed with the fine-grain technique. The measurements of the thermoluminescent signals were carried out with a RisØ® TL/OSL dating system DA-12-A equipped with an EMI® 9236 QA photomultiplier and using an optical filter set composed of a heat absorbing (Chance Pilkington® HA-3) and a blue transmitting (Corning® CN5-58) filter. Before measurement the samples were stored at 70°C for one week and in addition, a 1min preheat at 260°C was applied to eliminate the thermally unstable part of the TL signal.

The palaeodose was determined as an equivalent β–dose (EDβ) with the β-regeneration technique on all 3 subsamples of R1. The irradiation doses were administered with an Elsec® type 9022 irradiator equipped with a 100 mCi $^{90}Sr(^{90}Y)$ β-source. Figure 1 shows the results of these experiments. In this figure, each glow curve represents the average of five to six sample discs. From the glow curves, the EDβ curve was calculated and on this curve the temperature interval 320°C- 400°C was selected for the construction of the growth curves and the final derivation of the palaeodose.

Additive β-dose dose experiments were carried out on two subsamples (R1/2 and R1/3). Instead of calculating a palaeodose from these experiments, the resulting growth curves were combined with those obtained in the regeneration experiments with the aid of the "Australian slide" method (Prescott *et al.*, 1993). The method indicated that in the temperature interval 320°C-400°C, there is no serious sensitivity change in the regeneration curves (IS parameter varying between 1 and 1.1) and yielded a palaeodose of 805 ± 75Gy and 794± 90Gy for respectively R1/2 and R1/3.

An anomalous fading test carried out on sample R1/2 and R1/4 revealed a loss of signal intensity of 6 ± 5 % which, cannot be regarded as totally insignificant.

The determination of the annual dose relies on thick source α-counting (TSAC) for the determination of the internal α- and β-dose rate originating from uranium and thorium and on atomic absorption spectrophotometry (AAS) for the determination of the internal β-dose rate originating from potassium (K). Alpha counting was performed with an Elsec® α-counter type 7286 using an EMI® 6097B photomultiplier and ZnS scintillation screens.

The important numerical results are summarised in the table below. In this table the typical a-value for sediments of 0.1 has been adopted while the quoted moisture content represents an average value of previous measurements carried out on samples from higher stratigraphic levels in the loessic sequence exposed in the quarry.

sample	palaeodose. Edβ (Gy)	α-count rate (cnts/ks)	a-value	%K	Moisture (%)	Dose rate (Gy/ka)	TL-age
R1/5		9.37		1.20			
R1/4	876 ± 180	= R1/5	0.1	= R1/5	0.23	3.06	286 ± 61
R1/3	1214 ± 300	8.91*	0.1	1.15*	0.23	2.96*	415 ± 97
R1/2	754 ± 46	= R1/1	0.1	= R1/1	0.23	2.70	279 ± 44
R1/1		8.09		1.10			

* average of R1/1 and R1/5

TL AGE AND DISCUSSION

The weighted average of the three age determinations obtained with the regeneration method (using the error as a weighing factor) amounts to **297 ± 34 ka** and is considered to be our final estimate for the age of the burnt loess. The average age of the two subsamples that were treated with the slide method is practically the same (296 ± 60 ka). Hence, the internal consistency of the TL measurements is undoubtedly good. However, this does not guarantee the accuracy of the age estimate. The TL signals are close to saturation and this together with the observed fading suggests that the TL age may underestimate the true age of the event.

GROENENDIJK A.J., MEIJS E.P.M., GULLENTOPS F., BRINGMANS P.M.M.A. & VERMEERSCH P.M. 2001. Overview of the stratigraphy and the archaeological levels in the Nelissen brickyard quarry at Kesselt. Excursion guide XIVth congress of the U.I.S.P.P., edited by P.M.M.A. Bringmans: 15-20.

PRESCOTT J. R., HUNTLEY D.J & HUTTON J.T. 1993. Estimation of the equivalent dose in thermoluminescence dating - the *Australian slide* method. *Ancient TL* 11: 1-5.

VAN DEN HAUTE, P., VANCRAEYNEST L. & DE CORTE F. 1998. The late Pleistocene loess deposits of eastern Belgium: new TL age determinations. *Journal of Quaternary Science* 13, 5: 487-497.

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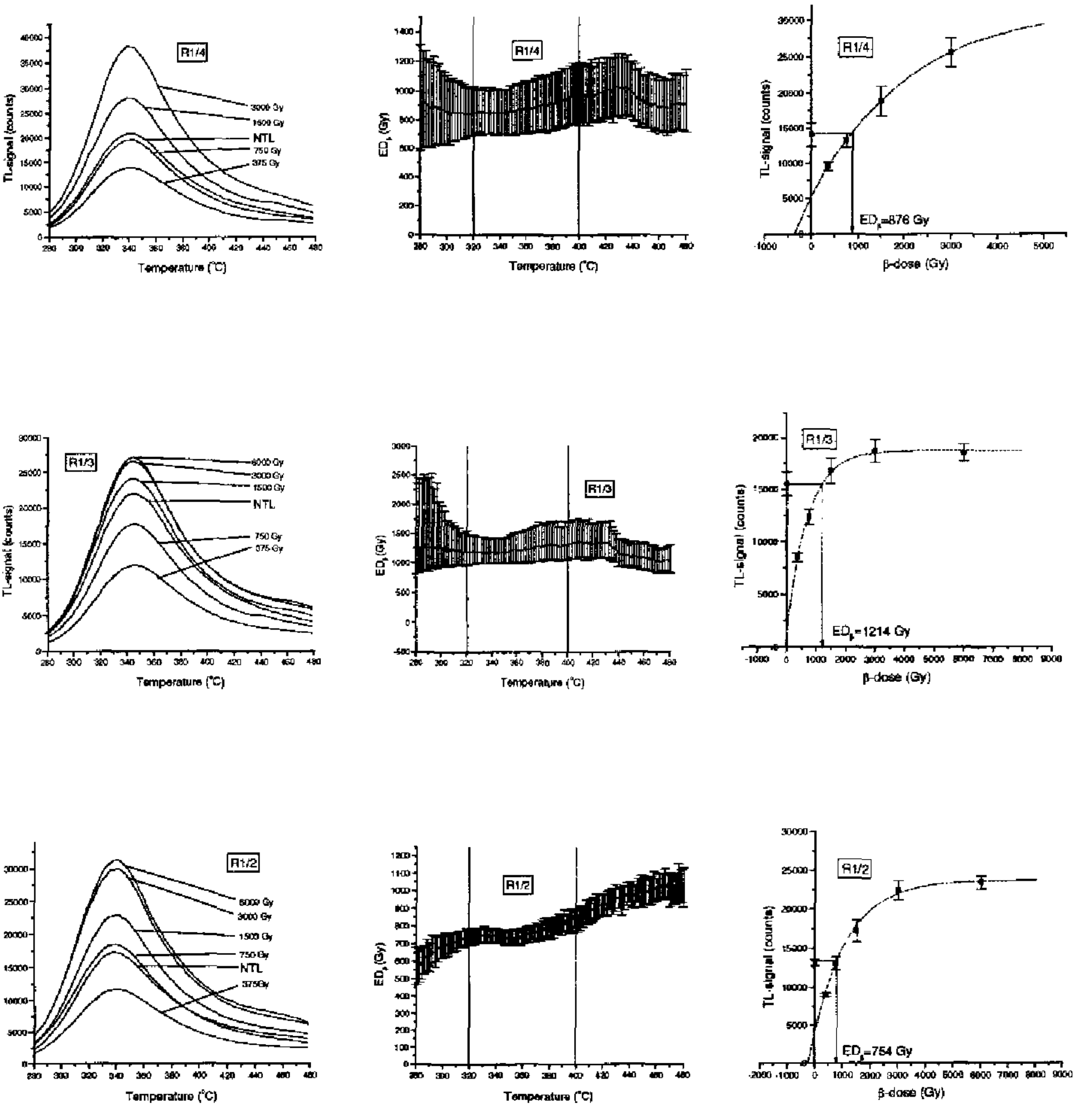

Figure 1: TL-glow curves (left), EDβ curves (middle) and signal growth curves (right) for the regeneration experiments carried out on the three subsamples of R1.