8. CONCLUSIONS

8.1. Geological Framework at Veldwezelt-*Hezerwater*

8.1.1. Chronostratigraphy

The most characteristic feature of the Quaternary deposits, which were studied at the *Vandersanden* quarry at Veldwezelt-*Hezerwater* (Gullentops *et al*. 1998; Gullentops & Meijs 2002), is the recurrent alternation of sedimentation, weathering and denudation processes, which were called forth by climatic fluctuations. Loess, loess-derived sediments and soils are usually very susceptible to these climatic fluctuations. In favourable conditions, as is the case at Veldwezelt-*Hezerwater*, they provide possibility for several cycles to be studied in direct superposition. At the *Vandersanden* loam quarry at Veldwezelt-*Hezerwater*, the late Middle Pleistocene and Late Pleistocene loess-soil sequence is strongly developed and provides very detailed pedostratigraphic, palaeoclimatic and palaeoenvironmental information (Gullentops & Meijs 2002).

The loess-soil sequence at Veldwezelt-*Hezerwater* (Fig. 2.3.), overlies the fluvial *Maas* terrace (Middle Pleistocene) and layers of *Hezerwater* gravel, sands and silts (probably late Middle Pleistocene). Then follow several loam and loess layers, within which several late Middle Pleistocene soils were attested. The Late Pleistocene starts with a complex of soils, which has been labelled the “Basal Soilcomplex”. In a depression at Veldwezelt-*Hezerwater*, which was created by a so-called “spring-amphitheatre” (Gullentops & Meijs 2002), the Last Interglacial “Basal Soilcomplex” starts with the formation of a sequence of soils (SRB-VLL-VLB). The most striking horizon of the “Basal Soilcomplex” is a luvisol (PGB), which shows macroscopically distinguishable traces of movement of the clay substance [“clay-coatings”]. This massive luvisol was capped by a bleached horizon. Then followed two other luvisols (RB & VBLB), which were each capped by a bleached and a humic horizon. The luvisol sequence, which has been labelled the “Rocourt Soilcomplex” (Gullentops & Meijs 2002), is covered by a series of distinct humic soils, which have been labelled the “Warneton Soilcomplex” (Gullentops & Meijs 2002). The Last Interglacial “Basal Soilcomplex” at Veldwezelt-*Hezerwater*, is overlain by relatively thick and differentiated Last Glacial loess/loam layers, which were further characterised by periods of interstadial pedogenesis (*e.g*., TL & WFL soils). Indeed, this Last Glacial loam and loess accumulation phase has been interrupted repeatedly by periods of soil formation. At the beginning of the Glacial cycle, the formation of soils exceeds the sedimentation of loess or loam, whereas to the end of the Last Glacial cycle, the deposition of pure loess prevailed.

The pedogenesis (Gullentops & Meijs 2002) of the rusty-brown decalcified luvisols at Veldwezelt-*Hezerwater* (*e.g*., SRB, PGB, RB & VBLB) took place when precipitation was abundant, but without periods of heavy downpours, which would produce erosion. We also have to take into consideration the fact that the ground was probably covered by dense shrub or by forest, which protected the surface from erosion and to a certain degree, from sedimentation as well. Luvisols represent the maximum development of vegetation in warm climates. The humic soils (*e.g*, HZ), on the other hand, suggest the retreat of forest under a marked decrease of humidity. Degradation of the humic soils pointed to the recurrence of a more humid climate. However, loess accumulation is always characterised by a cold and dry climate. The loess layers have been deposited intermittently, the sedimentation being interrupted by periods of rest. In the periods without loess deposition, weak soils developed under steppe climates (*e.g*., TL & WFL). Weakly developed soils witness to a relatively longer period of damper climate.

The loess-soil sequence at Veldwezelt-*Hezerwater* provides proof of a complicated sequence of environmental and by inference, palaeoclimatic changes, which affected this part of Northwest Europe during the late Middle and Late Pleistocene. However, soils interstratified with loess and loam deposits also recorded the principle character of vegetation established at a locality. But, because most of the studied palaeosoils at Veldwezelt-*Hezerwater* lay on slopes, these soils were probably “para-autochthonous” (*sensu* Kukla 1977), which means that their surfaces had not become fully stabilised and soil material from higher elevations continued to be redeposited into the depressions [syndepositional, cumulative pedogenesis]. Nevertheless, it seems that the complexity of climate history on land is similar to the climate history in oceans and ice-cores. The correlation of the deep-sea and ice-core isotope stages with the land-based late Middle and Late Pleistocene deposits at Veldwezelt-*Hezerwater* will be discussed next.

In depressions, the “Basal Soilcomplex” at Veldwezelt-*Hezerwater* comprises at least four Bt-horizons of truncated luvisols (SRB, PGB, RB & VBLB), each followed by a bleached pseudogley horizon and a humic steppe soil. However, the SRB-VLL-VLB soil sequence should probably be correlated with the so-called “Zeifen Zone of Woillard” (Kukla *et al*. 2002), which represents the transition from the Late Saalian to the early Eemian (transition MIS 6/5e). The “Zeifen Interstadial” has also been correlated with MIS 6.01 (Seidenkrantz 1993; Seidenkrantz *et al*. 1996). However, alternative interpretations might have some degree of foundation. The second Bt-horizon (PGB), which is thought to represent the Eemian *s.s*. “Rocourt Soil”, is the most-mature soil horizon of the whole loam quarry and seems to represent the terrestrial equivalent of MIS 5e. All the other Bt-horizons are clearly weaker in their development. The third Bt-horizon (RB) and the fourth Bt-horizon (VBLB) developed successively during MIS 5c and 5a, which is in accordance with the interpretations of other researchers (*e.g*., Kukla & An 1989; Antoine *et al*. 1999; Schirmer 2000, 2002).

The pale MB horizon heralds the onset of the Last Glacial and should probably be dated around the MIS 5a/4 transition. This interpretation is also in agreement with the interpretation of other researchers (*e.g*., Kukla & An 1989; Antoine *et al*. 1999; Schirmer 2000, 2002, Gullentops & Meijs 2002). From this follows that the “Basal Soilcomplex” is a cluster of five complex soils, which each incorporate two or three soil horizons and which are the terrestrial equivalent of three “interglacial” intervals (PGB, RB & VBLB) and two “interstadial” intervals (SRB & MB). These interglacial and interstadial soils are only separated by relatively thin layers of colluvium. These layers of colluvium with associated polygonal frost networks seem to be the terrestrial equivalent of short stadials (*e.g*., MIS 6.0, 5d & 5b). Notwithstanding the difficulties of dating unfossiliferous palaeosoils, the age of the “Basal Soilcomplex” at Veldwezelt-*Hezerwater* seems well established within MIS 5.

The “Last Interglacial Soilcomplex” at Veldwezelt-*Hezerwater* (Gullentops & Meijs 2002), is covered by a complex Weichselian loess-soil sequence (MIS 4, 3 & 2), which apart from traces of minor oscillations, also contains soils of more prolonged “interstadials”. However, most of the warmer oscillations during the Middle Weichselian, which led to the development of several “brown soils” of which some contained Middle Palaeolithic artefacts (TL & WFL), were always short-lived, of the order of *ca* 1,000-2,000 years. The Middle Weichselian loess-soil sequence is separated from the Last Interglacial and the Holocene soilcomplex by thick loess stacks, which clearly show traces of severe frost action (Gullentops & Meijs 2002). The most characteristic feature of the late Middle and Late Pleistocene loess-soil sequence at Veldwezelt-*Hezerwater* is the recurrent alternation of different sorts of sedimentation, pedogenesis and erosion, which were in all probability the result of climate forcing.

8.1.2. Geological Matrix at the Primary Context *Loci*

All in all, twenty-four archaeological *loci* were discovered at different spots in the *Vandersanden* loam quarry at Veldwezelt-*Hezerwater* (Fig. 3.1. & 3.2.). Only seven of the twenty-four discovered *loci* seemed to represent potential sites, which thus required further excavation. Although most archaeological assemblages, which were discussed here did not really represent *in situ* sites, there were clear indications to support the hypothesis that Middle Palaeolithic humans were present at Veldwezelt-*Hezerwater* at different times during the late Middle and Late Pleistocene (Table 3.1.). On the other hand, it is indisputable that the ZNB, VLL, VLB, VBLB, VBLB-S, TL and WFL lithic assemblages, which were found in geological primary contexts at Veldwezelt-*Hezerwater*, relate to important periods of soil formation. Consequently, it was possible that original living floors were still present. Indeed, the VLL, VLB, VBLB, TL and WFL soil horizons seem to be the result of synsedimentary cumulative pedogenesis (*e.g.*, Bailly *et al.* 2000). This means that the soil formation continuously went on, while regularly new sediments were deposited on top of the soil. This would imply that the living floors may still be incorporated within the soil.

At Veldwezelt-*Hezerwater*, the geological matrix (Table 8.1.) was initially characterised as fine aeolian loess ("WFL in slope position") or as colluviated loess (VLL, VLB, VBLB, VBLB-S, TL & "WFL in valley position"). Then, soil formation began to alter these sediments. The lithic assemblages were thus found in a sequence of fine deposits and palaeosoils. All artefacts found in primary geological contexts clearly relate to periods of soil formation. There seems to be no important gravel component to these palaeosoils in which the artefacts were excavated, indicating low energy environments. At the VLL, VLB, VBLB, VBLB-S, TL and WFL *loci*, animals like some species of earthworms, ants, moles and other burrowing animals probably brought sediment to the surface. As a result, the finer material was enriched in the top layer and the coarser material like gravel and artefacts was enriched in the subsoil. Artefacts may also have fallen in biopores due to gravity and may thus have become enriched in the subsoil. Bioturbation and synsedimentary pedogenesis are probably the main two reasons why most artefacts at Veldwezelt-*Hezerwater* were found in the B-horizons of the palaeosoils. Indeed, the consumption of soil material by animals in the subsoil and the production of excrements on the topsoil are important processes of bioturbation. However, it is also possible that the artefacts were left behind by Middle Palaeolithic humans on an ephemeral living floor while the sedimentation processes were still ongoing and while at the same time soil formation processes were active.

The Veldwezelt-*Hezerwater* archaeological assemblages were all situated in geologically sealed contexts. Parts of the original land surfaces have clearly been preserved intact underneath younger sediments. This is the case at the VLL, VLB, TL and WFL *loci* where the original soils, for the larger part, were still intact. At these *loci*, sedimentation and soil formation seems to have been continuously under interstadial climatic conditions. It is thus possible that at these *loci* most of the artefacts were still archaeologically *in situ*. However, this is probably not the case at the VBLB and VBLB-S *loci* where the original land surfaces have clearly been truncated (presence of stone-lines at the truncated surface). At these *loci*, sedimentation came to a virtual standstill under interglacial climatic conditions, ultimately followed by severe erosion under changing climatic conditions. This means that all artefacts, which were found at the VBLB and VBLB-S *loci*, were probably not archaeologically *in situ*. Whereas the recognition of displaced sediments is relatively easy, the recognition of displaced artefacts is much more difficult. So, it remains extremely hard to establish whether or not these lithic assemblages were found archaeologically *in situ*.

Table 8.1. The Geological Matrix at the Primary Context *Loci*

Soil Horizons:	**VLL**	**VLB**	**VBLB**	**VBLB-S**	**TL**	**WFL**
Geologically Sealed Context	yes	yes	yes	yes	yes	yes
Superposition of Separate Lithic Assemblages	yes	yes	yes	no	yes	yes
Low or High Energy Environment	low	low	low	low	low	low
Stratum: Horizontal (h) / Dipping (d)	h & d	h & d	h & d	h & d	h & d	d
Substratum: Loess	no	no	no	no	yes/slope	yes/slope
Colluviated Loam	yes	yes	yes	yes	yes/valley	yes/valley
Palaeosoil Present	yes	yes	yes	yes	yes	yes
Pedogenesis	weak	weak	strong	strong	weak	weak
Climate during Pedogenesis: Interstadial	yes	yes	no	no	yes	yes
Interglacial	no	no	yes	yes	no	no
Stream Action	no	no	no	no	no	no
Important Gravel Component	no	no	no	no	no	no
Mean Gravel Size (in cm)	0.5	0.5	0.5	0.5	0.5	0.5
Graviturbation	yes	yes	yes	yes	yes	yes
Bioturbation	yes	yes	yes	yes	yes	yes
Scavenging Carnivores	?	?	?	?	yes	yes
Krotowinas	no	yes	yes	yes	yes	no
Tree Falls	no	no	not observed	yes	no	no
Repeated Freezing and Thawing	no	no	yes	yes	no	no
(Former) Ice Wedges	no	no	yes	yes	no	no
Desiccation Cracks	no	no	yes	yes	no	no
Patterned Ground (polygons)	no	no	yes	yes	no	no
Cryoturbation	no	no	yes	yes	no	no
Solifluction	no	no	no	no	no	no
Sedimentation Rate: Slope Position	low	low	low	low	low	low
Valley Position	moderate	moderate	low	low	moderate	medium
Mean Thickness of the Soil Horizon (in cm):						
• Slope Position	5	5	25	30	20	20
• Valley Position	30	30	35	45	100	35
Horizontal Artefacts Displacement	low	low	moderate	considerable	moderate	moderate
Vertical Artefact Displacement	low	low	moderate	considerable	low	low
Vertical Artefact Distribution (in cm):						
• Slope Position	5	5	25	30	10	<10
• Valley Position	30	30	35	45	20	<20
Truncated Soil Horizon	no	no	yes	yes	no	no
Synsedimentary Pedogenesis	yes	yes	yes	yes	yes	yes
Degree of Post-depositional Distortion	low	low	moderate	significant	moderate	moderate

8.2. Lithic Raw Material Availability at Veldwezelt-*Hezerwater*

The analysis of the lithic raw materials, which have been found at Veldwezelt-*Hezerwater*, was carried out only on a macroscopic level. This approach seems warranted because the same macroscopic characteristics were probably also taken into account by the Middle Palaeolithic flint knappers themselves. It is of utmost importance to keep in mind that the Veldwezelt-*Hezerwater loci* were located in the immediate vicinity of local sources of *Maas* terrace flint and redeposited *Hezerwater* gravel bed flint. These locally-found flint nodules have been extensively rolled and they show a weathered surface. However, the quality of these flint nodules was still acceptable, since they were used extensively at the VLL, VLB, VBLB and VBLB-S *loci*. The presence of these local flint sources was probably one of the main reasons why Middle Palaeolithic humans occupied this part of the *Hezerwater* valley. On the other hand, *Maas* and *Hezerwater* flint was virtually lacking in the lithic assemblages, which have been excavated at the TL and WFL *loci*. At these *loci*, most flint has been interpreted as imported "chalk flint". Eluvial flint has not been used at Veldwezelt-*Hezerwater*.

At Veldwezelt-*Hezerwater*, three major sorts of flint have been identified: (1) "*Lanaye* Flint", (2) "*Rullen* Flint" and (3) "*Hesbaye* Flint" (Table 8.2.). "*Lanaye* Flint" and "*Rullen* Flint" belong to the so-called "Maastricht-Aachen-Liège Flint Group" (*e.g.*, Arora 1979; de Warrimont & Groenendijk 1993; Arora & Franzen 1995; Felder 1998; Claes *et al*. 2001). "*Lanaye* Chalk Flint" is found in the Maas valley (Lanaye, Belgium - 12 km) and in the *Jeker* valley in Belgium (3,5 to 10 km). The eluvial "*Rullen* Flint", which is usually covered by sand, is found in the *Voeren* region in Belgium (20 km). Finally, "*Hesbaye* Flint" (*e.g.*, Claes *et al*. 2001) is mainly found in the *Méhaigne* valley (Province of *Namur* and *Liège*, Belgium - 40 to 70 km). Different sorts of "*Hesbaye* flint" can be distinguished (*e.g.*, "*Fallais* flint", "*Jandrain-Jandrenouille* flint", "*Latinne* flint", "*Orp-le-Grand* flint" & "*Moxhe* flint"). It is often very difficult to distinguish between these different sorts of flint. However, at Veldwezelt-*Hezerwater*, "*Lanaye* Flint" and "*Rullen* Flint" were also found locally in the *Maas* terrace and in the *Hezerwater* gravel bed. These local supplies served as sources of raw material for Middle Palaeolithic flint knappers at the VLL, VLB, VBLB and VBLB-S *loci*. However, at the TL and WFL loci, virtually all flint nodules have been imported (Table 8.2.). "*Hesbaye* Flint", which has only been found at the TL and WFL *loci*, seems always to have been imported. Sources of suitable lithic raw material were thus ubiquitously and permanently present in the Veldwezelt-*Hezerwater* area.

The Veldwezelt-*Hezerwater* lithic raw material comparisons are given in Table 8.2. This table shows that "*Lanaye* Flint" makes up the bulk of the raw material, followed by "*Rullen* Flint" and "*Hesbaye* Flint". To distinguish between local and imported flint, only the criterion of the state of the cortex can be used. Terrace and gravel bed flint has always been extensively rolled and typically shows a cracked weathered surface, whereas imported flint shows a fresh, chalky surface. However, very often it is difficult to make a clear distinction between local and imported flint, since this distinction is of course a question of degree. Virtually all of the artefacts belonging to the VLL, VLB and VBLB-S assemblages were made on local flint. Within the VBLB assemblage, about 10% of the artefacts were probably imports. The contrast with the TL and WFL lithic assemblages is very striking, since they were virtually completely made on imported flint. There is a progressive tendency within these two assemblages, concerning the *Hesbaye* translucent flint, which becomes increasingly important. Contacts with the *Jeker* valley and the *Méhaigne* valley are thus almost certain. It is interesting to note that at the WFL *locus*, one tool made of "*Wommersom* Quartzite" (45 km) has also been found. This also makes contacts with the *Gete* valley likely.

Table 8.2. Sorts of Flint Found at the Veldwezelt-*Hezerwater* Primary Context *Loci*

Lithic Assemblages:	**VLL**	**VLB**	**VBLB**	**VBLB-S**	**TL**	**WFL**
Total Terrace & Gravel Bed Flint - Local	**100%**	**100%**	**90%**	**100%**	**3%**	**1%**
• *Lanaye*	85%	89%	85%	95%	2%	0%
• *Rullen*	11%	8%	3%	4%	0%	0%
• *Hesbaye*	1%	1%	1%	0%	0%	0%
• *Other*	3%	2%	1%	1%	1%	1%
Total Chalk Flint - Imported	**0%**	**0%**	**10%**	**0%**	**97%**	**99%**
• *Lanaye*	0%	0%	10%	0%	80%	55%
• *Rullen*	0%	0%	0%	0%	0%	0%
• *Hesbaye*	0%	0%	0%	0%	15%	40%
• *Other*	0%	0%	0%	0%	2%	4%

8.3. Core and Tool Reduction Strategies at Veldwezelt-*Hezerwater*

8.3.1. Introduction

We have the impression that at Veldwezelt-*Hezerwater* and at most other Middle Palaeolithic sites (*e.g.*, Geneste 1989; Turq 1989; Kuhn 1990; Mellars 1996), two general trends concerning lithic raw material availability become apparent: (1) where relatively good-quality "local" flint nodules are available, they almost invariably outnumber "exotic" flint nodules and (2) "exotic" flint nodules and tools were usually more intensively worked and presumably thus more highly "prized". Lithic reduction strategies are thus expected to vary in response to the "cost" of the available raw materials. Indeed, three major factors seem to have influenced the "cost" of flint at Veldwezelt-*Hezerwater*: (1) the natural distribution of the natural flint sources, (2) the movements of the Middle Palaeolithic foraging groups relative to these local flint sources and (3) the "scheduling" of hunting and butchering equipment requirements, which actually also deal with the functional aspect of lithic technology. These three major factors, which have mainly influenced the "cost" of flint, also had an obvious impact on the Veldwezelt-*Hezerwater* lithic assemblages. So, the first major factor is the presence of flint sources. Flint was usually readily available at the Veldwezelt-*Hezerwater loci*. However, the quality of the locally-found flint nodules was usually quite "poor". As a result, flint was also imported. However, we should also differentiate between "raw material availability" and "raw material use" (*e.g.*, Neeley 1997). "Raw material availability" only refers to the sorts of flint available in a region, regardless of use, while "raw material use" actually tries to identify those raw materials, which were found at a particular *locus*. The use of flint is usually governed by technological constraints and by the choices made by the Middle Palaeolithic flint knappers, as well as by raw material availability as such. The degree to which stone tools were maintained or recycled, was a function not only of the distribution of flint sources, but also of the mobility patterns of the Middle Palaeolithic humans (*e.g.*, Kelly 1988).

The second major factor influencing the "cost" of flint is thus Middle Palaeolithic "group mobility", which tends to minimise the intrinsic "risks" related to the local depletion of critical resources and which usually also plays an important part in determining the organisation of the lithic reduction strategies (*e.g.*, Torrence 1983; Kelly 1988; Kuhn 1995). Crucial are the notions of "expedient" and "curated" tools (*e.g.*, Torrence 1983). As has been discussed, a "curated" tool is a "well-cared-for" tool. This attitude could be manifested through advanced tool manufacture, transport, resharpening and reshaping of tools. By contrast, an "expedient" tool was made by a minimalistic reduction effort. "Expedient" tools were made and used on the spot and immediately discarded after use. It seems that more "mobile" Middle Palaeolithic groups put more emphasise on "curated" tools, while more "sedentary" groups tend to make use of more "expedient" tools. The third major factor influencing the "cost" of the lithic raw materials at the Veldwezelt-*Hezerwater loci* is the "scheduling" of hunting and butchering equipment requirements, which usually also deals with the functional aspect of lithic core and tool reduction. There are again three important factors (*e.g.*, Torrence 1983; Kelly 1988; Kuhn 1995), which all seem to relate to some sort of "function": (1) the function of the individual artefacts and tools, (2) the functional aspects of specific activities, which require specific "toolkits", and (3) the function of the sites within the larger settlement and subsistence system.

8.3.2. Core Reduction Strategies at Veldwezelt-*Hezerwater*

Table 8.3 summarises the artefact frequencies recovered from the primary context *loci* at Veldwezelt-*Hezerwater*. Overall, the lithic assemblages contain relatively large numbers of chips and flakes. Cortical flakes (10-90% cortex) are also abundantly present. Primary decortication flakes (> 90% cortex), on the other hand, seem to be quite rare. Core types include "centripetal/Levallois", "parallel/prismatic" and "opportunistic" cores, with single, opposed and multiple platforms. The "centripetal" core reduction strategy (*e.g.*, Bordes 1961; Tixier *et al*. 1980) is typical of the Middle Palaeolithic in general, although of course many variants exist (*e.g.*, Crew 1975; Geneste 1985; Boëda 1986; Van Peer 1992). Centripetal core reduction involved striking flakes from around the perimeter of a relatively flat round flint nodule, gradually spiraling toward the centre by rotating the core with each new blow. Evidence of "Levallois" core reduction has been combined with the more "generic" centripetal core reduction strategy. At Veldwezelt-*Hezerwater*, "Levallois" products were present in most lithic assemblages. However, "Levallois" products were only "abundantly" present within the VBLB lithic assemblage. It is interesting to note that "Levallois" products were virtually absent in the VLL assemblage. On the other hand, the "parallel" core reduction strategy (*e.g.*, Tixier *et al*. 1980; Bietti *et al*. 1989) includes pieces, which were removed parallel to the long axis of a core from the striking platform or from two opposed platforms located at both ends. Parallel cores were only present in the VLL and VLB assemblages, which overall show a high degree of "bladeyness". Finally, lithic artefacts that cannot be assigned to any of these two core reduction strategies were labelled "opportunistic" pieces. Most of the cores excavated at Veldwezelt-*Hezerwater* were relatively small (4-8 cm) and it is difficult to escape the impression that the cores were discarded at or near the end of their use lives. It is important to realise that the parallel/prismatic core reduction strategy at Veldwezelt-*Hezerwater* is very similar but not fully identical to the prismatic blade core reduction strategies of the Upper Palaeolithic (*e.g.*, Révillion 1995). It seems that the Veldwezelt-*Hezerwater* version of parallel/prismatic core reduction is a little less complex. However, crested blades (*e.g.*, Révillion & Tuffreau 1994) have also been attested within the lithic assemblages, which have been excavated at the VLL, VLB and VBLB *loci* at Veldwezelt-*Hezerwater*.

Table 8.3. Artefact Frequencies (N) at the Primary Context *Loci*

Unit:	**VLL**	**VLB**	**VBLB**	**VBLB-S**	**TL: R/GF/W**			**WFL**
A. Cores								
"Centripetal" Cores	0	2	2	0	1	0	0	3
"Levallois" Cores	0	2	2	0	1	0	0	3
"Parallel" Cores	7	3	0	0	0	1	0	1
"Opportunistic" Cores	9	2	0	0	0	1	0	0
Total Cores	16	7	2	0	1	2	0	4
B. Artefacts								
Total Cores	16	7	2	0	1	2	0	4
Primary Decortication Flakes	25	15	6	0	0	1	0	7
Partially Cortical Flakes	160	119	53	5	11	1	7	10
Flakes	277	215	184	29	22	18	21	73
Blades	30	11	4	2	0	0	0	1
Crested Blades	3	0	1	0	0	0	0	0
Points	0	0	0	0	0	0	0	0
"Levallois" Flakes	0	2	17	0	0	0	0	2
"Levallois" Blades	0	0	0	0	0	0	0	0
"Levallois" Points	0	0	0	0	0	0	1	0
Tools *s.s.*	9	3	4	0	1	3	0	3
Hammer-stones	9	7	4	0	1	2	0	4
Chips (< 1 cm)	251	301	70	39	21	0	0	29
Debris	15	7	5	0	0	0	0	0
Total Artefacts	795	687	350	75	57	27	29	133
C. Artefact Sizes								
Artefacts > 10 cm	1	0	0	1	3	2	1	1
Artefacts > 9 cm & < 10 cm	1	2	1	0	0	0	2	2
Artefacts > 8 cm & < 9 cm	3	1	3	0	1	1	0	1
Artefacts > 7 cm & < 8 cm	2	1	2	1	1	1	0	3
Artefacts > 6 cm & < 7 cm	7	4	3	1	4	0	4	6
Artefacts > 5 cm & < 6 cm	20	7	5	1	2	2	7	11
Artefacts > 4 cm & < 5 cm	70	55	15	5	5	2	7	21
Artefacts > 3 cm & < 4 cm	101	73	39	4	8	9	7	17
Artefacts > 2 cm & < 3 cm	124	103	68	9	5	7	1	21
Artefacts > 1 cm & < 2 cm	215	140	144	14	7	3	0	21
Chips < 1 cm	251	301	70	39	21	0	0	29
Total Artefacts	**795**	**687**	**350**	**75**	**57**	**27**	**29**	**133**

8.3.3. Tool Reduction Strategies at Veldwezelt-*Hezerwater*

The local availability of raw materials at the VLL and VLB flint extraction sites resulted in more “informal” or “expedient” toolkits. However, when raw material availability was “menaced”, Middle Palaeolithic flint knappers took measures to extend the lives of tools, which resulted in more “formal” or “curated” lithic toolkits, such as those that have been excavated at the TL and WFL *loci*. However, not only the mere availability of lithic raw materials, but also the management of “stress situations” played an important role in the reduction of the tools. Indeed, the analyses of the lithic assemblages show that the proximity of raw materials had few if any consequences for the treatment of the cores and flakes. In other words, at all the *loci* at Veldwezelt-*Hezerwater*, a lot of cores and flakes were wasted even if raw materials were relatively scarce. For example, at the TL and WFL *loci* where raw material availability was limited, we see a lot of wasted flakes, which were not worked into formal tools. However, the individual tools (*e.g.*, Quina scrapers) at the TL and WFL *loci* were more intensively worked than the formally retouched tools, which were found at the other *loci*. It seems that the management of “stress situations” was quite important to Middle Palaeolithic hunters since “stress situations” could be fatal (*e.g.*, when food and/or lithic raw material availability was low). Adequate time management would help reduce the potential risks of these “stress situations” if the proper tools were produced well in advance and if tools could be used immediately when the need arose.

That the reduction of tools, but not the reduction of cores, is so closely tied to the intrinsic raw material availability at the Veldwezelt-*Hezerwater loci* probably reflects the “energy costs” and the “energy benefits” of “transporting” cores and tools. Every core contains a relatively large amount of potentially wasted material, stone that can not be transformed into usable implements. Cores made on small flint nodules (VLL & VLB) are especially inefficient in this regard, because only a few flakes can be removed before the core is exhausted and the unusable part is relatively large compared with the original size of the piece. On the other hand, it seems that not more formally retouched tools were produced when raw material availability was menaced, but the few formal worked tools, which were already present in the toolkit, were reworked, retouched and rejuvenated more frequently (Table 8.4.). Differential access to lithic raw material leads thus to differential tool retouching. Ethnographic evidence (*e.g.*, Gallagher 1977; Hayden 1979) shows that “informants” will mostly prefer the continued use of the same tool they started with and maintain it through resharpening, rather than produce new tools. Some individual tools will thus be resharpened and reduced very quickly, where some other blanks will not be retouched at all. Thus, even with very low levels of tool reduction overall, some individual tools may exhibit rather high degrees of reduction. It seems that core tool reduction strategies were governed by different dynamics.

Finally, the reduction of entire cave lithic assemblages, with the production of many tools, is a completely different process than the one that has been attested at most open-air sites. Cave assemblages tend to represent the cumulative total or the “palimpsest” of many individual episodes of tool reduction during the course of the “palimpsest” formation. We are thus almost certainly dealing with the effects of two different lithic reduction processes, which operate on two separate levels, namely (1) the reduction of “individual” tools at most open-air and at some cave sites and (2) the reduction of an “entire” lithic assemblage, mostly at cave sites. In any case, it would seem that the heavily reduced and “recycled” lithic assemblages found in cave sites represent the cumulative total of many “individual” occupation phases. The small open-air toolkits on the other hand, more frequently tend to represent the residues of single occupation phases, which seems to be the case at most of the Veldwezelt-*Hezerwater loci*.

Table 8.4. Overview of the Tool Frequencies (n) at the Primary Context *Loci*

Lithic Assemblage	VLL	VLB	VBLB	VBLB-S	TL: R/GF/W	WFL
Tools on Flake Blank	4	1	4	0	1 3 0	3
Tools on Blade Blank	5	2	0	0	0 0 0	0
Tools on Levallois Blanks	0	0	0	0	0 0 0	0
Total Tools	**9**	**3**	**4**	**0**	**1 3 0**	**3**
Tools with Ordinary Retouch	5	0	2	0	1 0 0	0
Tools with Quina Retouch	0	0	0	0	0 3 0	2
Tools with Bifacial Retouch	0	0	0	0	0 0 0	0
Notched and Denticulated Tools	1	2	0	0	0 0 0	1
Combination Tools	3	1	0	0	0 0 0	0
Bifacial Tools	0	0	2	0	0 0 0	0
Handaxes	0	0	0	0	0 0 0	0
Total Tools	**9**	**3**	**2**	**0**	**1 3 0**	**3**

8.3.4. The Link between the Lithic Raw Material Availability and the Core and Tool Reduction Strategies at Veldwezelt-*Hezerwater*

Table 8.2. clearly shows that different sorts of lithic raw material were used at the Veldwezelt-*Hezerwater loci*. It seems that these lithic raw materials have had an impact on the lithic variability observed within the different lithic assemblages. Indeed, a number of trends concerning the use of particular sorts of lithic raw material and the production of specific artefacts have been observed at Veldwezelt-*Hezerwater*:

- Levallois products have usually been made of “exotic”, fine-grained lithic raw materials (*e.g.*, VLB, TL & WFL *loci*). It has been noticed that at Veldwezelt-*Hezerwater*, Levallois core reduction strategies tended to produce relatively large, broad flakes that were comparatively thin and light for their size. Levallois products thus usually tend to maximise the length of the cutting edge per unit weight (*e.g.*, Brantingham & Kuhn 2001). The specific technical characteristics of Levallois products thus seem to offer a relatively straightforward explanation in so-called “transport-energy” terms for the general tendency that Levallois products were preferentially made of “exotic”, fine-grained lithic raw materials, which would imply that they are more likely to have travelled greater distances relative to the initial lithic raw material source. However, it seems that at the VBLB *locus*, Levallois products have been flaked of locally available raw materials.

- Blades usually provide the maximum of cutting edge per unit weight. Blades would thus seem to represent the most “economical” or the “cheapest” stone artefacts. However, where the appropriate data exist, it has often been observed that blades are the artefacts most likely to have been made of “exotic”, fine-grained raw materials (*e.g.*, Bar-Yosef & Kuhn 1999). However, at the VLL and VLB *loci* at Veldwezelt-*Hezerwater*, blades and blade-like flakes were clearly made of locally available raw materials, which were not really fine-grained lithic raw materials. However, it seems that at the VLL and VLB *loci*, the crucial factor was the morphology of the initial flint nodules, rather than the quality of the nodules. Indeed, the Veldwezelt-*Hezerwater* blades and blade-like flakes were produced in an opportunistic fashion. Nevertheless, these blades were made by typical parallel/prismatic core reduction strategies.

- The simultaneous presence of several more or less “discrete” core reduction strategies (*e.g.*, Levallois, prismatic & opportunistic) within at least some of the lithic assemblages, which have been excavated at Veldwezelt-*Hezerwater*, shows that Middle Palaeolithic flint knappers unmistakably did make use of more than one core reduction strategy at a time. At Veldwezelt-*Hezerwater*, this phenomenon is probably a direct consequence of the flint knappers working with different sizes and qualities of lithic raw materials. Indeed, the original morphology of the usually relatively small flint nodules seems to have had a massive impact on the ultimate geometry of the cores. The Middle Palaeolithic flint knappers, who were active at the Veldwezelt-*Hezerwater loci*, were forced to employ different preparation procedures and different core reduction strategies in order to obtain blanks of usable size and morphology from relatively small flint nodules of different shapes. With larger lithic raw materials, initial preparation could be used to create cores with a more uniform geometry.

- Oversized tools, which are tools that are exceptionally big relative to the rest of the lithic toolkit, have been found at the TL and WFL *loci*. These pieces had been made of “exotic”, fine-grained lithic raw materials. It seems that these oversized tools have usually travelled greater distances than the rest of the lithic assemblage to which they belong. At first sight, there would appear to be a contradiction between “heavy” tools being transported over long distances. However, the presence of “heavy” tools can also be explained in “transport-energy” terms. Indeed, the associational link between transport and weight is strengthened by the observation that “oversized” tools are more frequently retouched than “medium-sized” tools. Under certain circumstances, Middle Palaeolithic flint knappers seem to have produced larger, broader, thicker and heavier tools. These more “long-lasting” tools, which were repeatedly retouched, actually functioned as portable and “recyclable” sources of lithic raw material. However, in places where Middle Palaeolithic flint knappers could exploit large quantities of lithic raw materials, “expedient” tools could also be quite massive (*e.g.*, Ebert 1979). Nevertheless, at the TL and WFL *loci* at Veldwezelt-*Hezerwater*, there seems to exist a general association between long-haul tool transport and continual tool rejuvenation. Similar relationships have also been observed at other sites by other scholars (*e.g.*, Caspar 1984; Roebroeks 1988; Otte 1991). Indeed, the tools made of “exotic” lithic raw materials are usually more frequently retouched and more extensively worked than tools made of locally-found flint. This suggests that most of these “exotic”, oversized and “curated” tools must have arrived in sites as part of frequently transported toolkits.

- Quina tools actually appear to be the most intensively retouched pieces of all Middle Palaeolithic tools. These Quina tools have been excavated at the TL and WFL *loci*. However, it is often said that Quina tools were frequently made of lithic raw materials of “inferior” quality (*e.g.*, Turq 1989, 1992). According to some researchers (*e.g.*, Rolland 1988, 1996; Dibble & Rolland 1992), lithic assemblages with Quina tools are more often associated with relatively cool climatic conditions. The assumption is that during relatively cool periods Middle Palaeolithic humans were more tethered to their caves. In spending more time in these places, they tended to recycle previously discarded tools. In this scheme, a lack of mobility goes hand in hand with the heavy modification and reuse of “inferior” quality flint tools. However, it is important to note that Quina tools were also made of “exotic”, fine-grained lithic raw materials, as is the case at Veldwezelt-*Hezerwater*. Within toolkits, “exotic” Quina tools usually are even more intensively retouched and modified than Quina implements, which were made of “inferior” quality flint (*e.g.*, Turq 1989, 1992). In our view however, the presence of Quina tools shows that another factor also seems to have influenced the intensity of tool rejuvenation, namely the “nature” of the activities in which these tools were employed.

- Although we believe that the initial morphologies of the Middle Palaeolithic tool blanks and tools, which have been excavated at Veldwezelt-*Hezerwater*, were primarily provoked by "functional" constraints, we also believe that tool blanks and tools did not have "stable" or "long-lasting" morphologies. Indeed, tool blanks and tools tend to change progressively their sizes and shapes until they are discarded (*e.g.*, Dibble 1995a; Clark 2002a). However, the recognition that tool blanks and tools must have followed a changeable pattern of continuous morphological adaptation, reflecting the process of continuous reduction when they were used over time, has been made explicit for more than a century (*e.g.*, Holmes 1893). Tool blanks and tools were continually modified throughout their use-life and by the time that they were discarded, their morphologies were usually quite different than initially designed. Nevertheless, tool morphologies must have been right for the tasks at hand. However, there is no simple one-to-one correlation between tool form and tool function. Then again, "expedient" tools may have been used only briefly, which resulted in only limited morphological changes. On the other hand, the function of "curated" tools may have remained unchanged during prolonged reduction processes, while it is also possible that the function of "curated" tools may also have been changed as tool morphologies changed progressively. These complex processes make it extremely difficult to determine the exact function of the tool blanks and tools, which have been excavated at Veldwezelt-*Hezerwater*.

- At Veldwezelt-*Hezerwater*, differences in lithic raw material availability and use seem to have resulted in differences in tool reduction strategies. Indeed, "curated" formal tools were more often made of "exotic", fine-grained lithic raw materials than "expedient" tools and other artefacts. However, the attested morphological differences are not always consistent within the lithic assemblage of a *locus* and between different lithic assemblages of different *loci*. Interpreting these patterns individually might prove difficult, because each lithic raw material sort distinguished, consists in turn of multiple Raw Material Units (RMUs), which actually seem to form a continuum of variability rather than discrete units. Nevertheless, we believe that we can conclude that different lithic raw materials were reduced differently by the Middle Palaeolithic flint knappers who were active at the Veldwezelt-*Hezerwater loci*.

Now the basic lithic variability within the Veldwezelt-*Hezerwater* lithic assemblages has been established, we may start to look for constraints, which may have caused alternative core and tool reduction strategies to be more advantageous in particular contexts (*e.g.*, Clark 2002a). It seems that three major technological attributes are of particular relevance here: (1) the sizes of the artefacts, (2) the shapes of the artefacts and (3) the numbers of artefacts flaked by different core reduction strategies. Indeed, contrasts in these technological attributes may provide clues as to their functional properties and their potential for prolonged use and rejuvenation.

8.3.5. Contextual Factors that Constrained Choice amongst Alternative Core and Tool Reduction Strategies at the Veldwezelt-*Hezerwater Loci*

8.3.5.1. Consumption of Lithic Raw Materials

We believe that differences in the productivity of alternative core and tool reduction strategies, may indicate which strategy might have been better suited to conditions of lithic raw material scarcity. Scarcity of lithic raw materials could result either from the distribution of flint sources or from Middle Palaeolithic land use patterns. According to the models developed by Rolland and Dibble (1992), lithic raw material availability and the intensity of tool utilisation influenced many aspects of lithic assemblage variability.

At the most basic level, lithic core reduction strategies are expected to diverge as a response to the "cost" of obtaining lithic raw materials. We could put forward the hypothesis that when good-quality flint was locally available, cores were being less systematically reduced and tools were being less heavily retouched, compared to places where flint nodules were in short supply. Another assumption underlying many studies of lithic raw material economies (*e.g*., Dibble 1985; Geneste 1985, 1989; Roebroeks *et al*. 1988; Dibble & Rolland 1992; Dibble 1995a,b) is that "cheap" artefacts are usually more desirable, whereas extensively consumed and retouched pieces would present some functional disadvantage, because of their high production "costs". We could thus presuppose that when time and lithic raw materials were not limited, Middle Palaeolithic flint knappers would choose to make "new", "expedient" and "cheap" cores and tools every time they were needed. The implication of this hypothesis is that the degree, to which cores and tools were reduced, is a direct reflection of the "costs" of replacing them (*e.g*., Geneste 1985; Kuhn 1991; Marks 1992). If cores and tools were exhaustively consumed, we may conclude that it was relatively difficult to come by new ones. Conversely, if cores and tools were abandoned in relatively "expedient" conditions, it seems that it was relatively easy to maintain a ready supply of flint.

At the VLL, VLB, VBLB & VBLB-S *loci*, there seems to be a primary emphasis on the exploitation of locally available lithic raw materials. The lithic assemblages, which have been excavated at these *loci*, often exhibit specialised blank production and the VLL and VLB lithic assemblages especially were very rich in cores and debris, yet poor in tools. However, at the TL and WFL *loci*, blank production started only after transport of lithic raw materials to those *loci*. The TL and WFL *loci* were also typically characterised by the import of Quina tools. On the other hand, there seems to be no compelling relationship between both the size and the weight of cores and the distance to lithic raw material sources. The "expedient" cores of the VLL and VLB *loci*, which were locally found, were much smaller than the "expedient" cores of the TL and WFL *loci*, which have been imported. On the other hand, the "curated" cores of the TL and WFL *loci*, which have also been imported, were actually extremely small. It seems that generally speaking, there appears to have been a more intense utilisation of cores and tools as distances to lithic raw material sources increased. Indeed, "exotic" cores and tools were usually discarded at a later stage in the reduction sequence. We think that the better quality raw materials were often brought in as Levallois cores (VLB, TL & WFL *loci*) and as formal tools (TL and WFL *loci*). Then again, there are exceptions.

8.3.5.2. Transport of Cores and Tools

The transport of cores and tools is an instrument for making "tool-manufacture potential" and tools available to people at times and places where lithic raw materials are non-existent, scarce or of poor quality. "Lithic raw material use" is governed by (1) "lithic raw material availability", (2) technological constraints and (3) choices made by highly mobile flint knappers, who were probably well aware of the raw material sources, but might have used them differently. So, it is necessary to identify the sources of the lithic raw materials that were used. Knowing where the Middle Palaeolithic inhabitants of the Veldwezelt-*Hezerwater loci* went to obtain flint and how far they carried it, provides direct indications about patterns of territorial exploitation. We have found that contacts with the *Jeker* valley are certain for the people who occupied the VLB, TL and WFL *loci*. However, contacts with the *Méhaigne* valley and the *Gete* valley are also confirmed for the Middle Palaeolithic humans who occupied the WFL *locus*. There thus seems to exist considerable variation across time and space in the economy of raw material utilisation and the frequency of core and tool transport.

Binford (1979) has suggested that lithic raw material procurement is usually embedded in other foraging activities. Kuhn (1990) has distinguished two alternative approaches to lithic raw material procurement. One tactic is to "supply individuals" with portable toolkits, which are very useful under conditions of "uncertainty". The other tactic is to "supply places" in the landscape with flint nodules. Either, or a combination of these raw material supply tactics, will be more or less advantageous given a particular situation. More mobile Middle Palaeolithic groups are expected to be associated with the "supplying individuals tactic", whereas semi-sedentary Middle Palaeolithic groups, performing highly predictable duties at particular places, are expected to be associated more with the "supplying places tactic". In Table 8.5, the features, which have characterised the raw material procurement strategies at the Veldwezelt-*Hezerwater loci*, have been listed.

Table 8.5. Characteristics of Raw Material Procurement at Veldwezelt-*Hezerwater*

Lithic Assemblages	VLL	VLB	VBLB	VBLB-S	TL: R / GF / W	WFL
Predominant Core Size	small	small	medium	?	big / big / ?	small
Tool and Tool Blank Size	small	small	medium	medium	big / big / big	big
Core Reduction Strategies						
• **Parallel/prismatic**	yes	yes	no	no	no / yes / no	yes
• **Centripetal/Levallois**	no	yes	yes	yes	yes / no / no	yes
• **Opportunistic**	yes	yes	no	yes	no / yes / no	no
Ratio of Tools to Blanks	9:795 0.0113	3:687 0.0043	4:350 0.0114	0:75 0.0000	1:57 / 3:27 / 0:29 0.0175/0.1111/0.0000	3:133 0.0225
Raw Material Quality	low	low	medium	low	high / high / high	high
Probable Import of Cores	no	yes	no	no	yes / yes / ?	yes
Probable Import of Tools *s.s.*	no	no	no	no	yes / yes / ?	yes
Raw Material Procurement Strategy:						
• **Random Flint Find**	no	no	yes	yes	no / no / no	no
• **Flint Extraction**	yes	yes	no	no	no / no / no	no
• **Supplying Places**	no	no	no	no	no / no / no	no
• **Supplying Individuals**	no	no	no	no	yes / yes / yes	yes
Transport Cost	low	low	medium	low	high / high / high	high
Climate:						
• **Interstadial**	yes	yes	no	no	yes / yes / yes	yes
• **Interglacial**	no	no	yes	yes	no / no / no	no

It seems that at the Veldwezelt-*Hezerwater loci*, low raw material availability usually resulted in "Levallois" core reduction, which basically is an "economising" core reduction strategy. On the other hand, high raw material availability usually resulted in "prismatic" and/or "opportunistic" core reduction, which are, at least at the Veldwezelt-*Hezerwater loci*, "non-economising" core reduction strategies. However, we have to keep in mind that core reduction strategies may also be largely governed by the initial morphology of the flint nodules. It is evident that oval-shaped flint nodules (VBLB, TL & WFL *loci*) will preferentially result in "centripetal" cores and elongated flint nodules (VLL & VLB *loci*) will preferentially result in "parallel" cores.

At the different Veldwezelt-*Hezerwater loci*, there indeed seems to have existed a positive correlation between the original forms and sizes of the flint nodules and the technological choices that were made by the Middle Palaeolithic flint knappers. For example, the use of small, locally-available flint nodules at the VLL and VLB flint extraction sites unquestionably constrained the technological alternatives of the Middle Palaeolithic toolmakers. Nonetheless, the small flint nodules that were collected at these flint extraction sites, appear to have been deliberately targeted by the Middle Palaeolithic occupants. This strongly suggests, but does not prove, that the use of alternative core reduction strategies at Veldwezelt-*Hezerwater*, seems to represent an apparent "premeditated" choice. The selection and use of these small flint nodules could well have fulfilled different technological, functional or strategic roles. However, at the Veldwezelt-*Hezerwater loci*, lithic raw material quality not only seems to have played an important role in the reduction of cores, but also in the manufacture of formal tools.

There is a general trend within the different toolkits of the Veldwezelt-*Hezerwater loci*, which reveals that the formal tools were preferentially produced on fine-grained lithic raw materials. However, the reliance on different core and tool reduction strategies varied from *locus* to *locus*. It was found that formal "curated" tools were more important at the TL and WFL *loci*, while less important at the other *loci* (Table 8.5.). What could be the reason for this behaviour? We do believe that this technological discrepancy can be explained by assuming that the TL and WFL *loci* were ephemeral hunting and butchering sites, which were inhabited during the Last Glacial. So, depending on the nature of the anticipated tasks, different constraints on tool blanks and tools may have been important. For example, Middle Palaeolithic hunters probably carried and kept their hunting equipment ready at hand in case of unpredictable encounters with highly mobile mammals. The particular context within which lithic tools were used, do not only reflect the strategies by which particular toolkits were organized, but also reflect the lithic raw material acquisition strategies that were followed. For example, hunting equipment can be expected to be highly portable, whereas processing-tools were probably much heavier and more robust.

It thus seems reasonable to assume that in the *Hezerwater* Valley, flint nodules, cores, tool blanks and tools were moved around by Middle Palaeolithic humans as a risk-reducing strategy for survival. This hypothesis is even more plausible particularly in the light of the technological advantages, which were afforded by sources of larger and better-quality lithic raw materials, that were located at some distance from the *Hezerwater* Valley. Indeed, at the TL and WFL *loci* especially, formal retouched tools were generally larger than the cores within the assemblages. The import of "oversized" curated tools at the TL and WFL *loci*, probably is a function of the overall scarcity of good-quality flint in the *Hezerwater* valley at that time. However, tool frequencies are low throughout the whole Veldwezelt-*Hezerwater* sample. This would imply that the frequency with which tool blanks were converted into formal tools appears to have been basically unaffected by ease of access to lithic raw materials. However, there is just no consistent relationship between ease of access to lithic raw materials and the extent to which tools were reduced. Then again, more dangerous environmental circumstances could have made it more advantageous to minimise core preparation wastage, while maximising formal tool production. Indeed, some technological attributes could mirror particular "climato-environmental" pressures favouring greater technological efficiency. Consequently, "glacial" lithic assemblages should generate more heavily worked and "curated" tools than "interglacial" assemblages. This actually seems to be the case at the Veldwezelt-*Hezerwater loci*. However, there never seems to have existed a shortage of raw materials at any of the Veldwezelt-*Hezerwater loci*. These people knew how to adapt. An important social adaptation seems to have been focusing on "mobility".

8.3.5.3. Middle Palaeolithic Mobility Strategies at Veldwezelt-*Hezerwater*

We think that an additional crucial dynamic, which drove lithic variability at the Veldwezelt-*Hezerwater loci*, was "mobility". Essential in this study were the notions of the so-called "expedient" and "curated" core and tool reduction strategies (*e.g*., Nelson 1991; Neeley 1997). Highly mobile Middle Palaeolithic groups seem to have put more emphasis on "curated" strategies, while "semi-sedentary groups" appear to have exploited more "expedient" strategies. "Group mobility" is yet another risk-reducing strategy for survival, which tends to reduce the dangers related to local depletion of indispensable lithic raw materials, food and other supplies. In Table 8.6, we have listed some links between the "curated" and "expedient" core and tool reduction strategies and the apparent "group mobility patterns", within which they must have functioned.

Table 8.6. "Curated" and "Expedient" Core and Tool Reduction Strategies and Middle Palaeolithic Group Mobility at Veldwezelt-*Hezerwater*

Lithic Assemblages	VLL	VLB	VBLB	VBLB-S	TL: R / GF / W	WFL
Predominant Core Size	small	small	medium	?	big / big / ?	small
Core Reduction	expedient	expedient	curated	curated	curated / expedient / ?	curated
Reduction of Local Cores	yes	yes	yes	?	no / yes / no	no
Import of Cores	no	yes	no	no	yes / yes / ?	yes
Tool and Tool Blank Size	small	small	medium	medium	big / big / big	big
Tool Reduction	expedient	expedient	curated	absent	curated / curated / ?	curated
Reduction of Local Tools	yes	yes	?	?	no / no / no	no
Import of Tools	no	no	?	no	yes / yes / ?	yes
Base Camp	yes	yes	?	?	no / no / no	no
Hunting and Butchering Stations	no	no	probably	?	yes / yes / yes	yes
Relative Group Mobility	low	low	medium	medium	high / high / high	high

The Veldwezelt-*Hezerwater* data show that these flint knappers drew their lithic raw materials from more than one source. However, they seemed to have preferred locally-available lithic raw materials, which were usually worked down in an "expedient" manner. Only when no local raw materials were available, or when their quality was insufficient or when the flint knappers were in a hurry (*e.g*., hunting activities), they would have used their back-up "curated" cores and tools supplies. Middle Palaeolithic flint knappers seem to have carried around flint nodules, cores, tool blanks and formal tools within the wider context of a "strategy against contingencies". The Veldwezelt-*Hezerwater* pattern shows that "curated" cores and tools were generally produced out of high-quality lithic raw materials. These artefacts have been transported furthest. On the other hand, "expedient" cores and tools were very often produced out of low-quality lithic raw materials. These flint knappers seem to have preferred local lithic raw materials when present, only in urgent situations they took advantage of their portable "back-up" toolkits, which not only included "curated" tools, but "curated" cores as well.

At the Veldwezelt-*Hezerwater loci*, the association of "curated" core and tool reduction strategies with the use of more distant high-quality lithic raw materials seems well established. The imported lithic raw materials, which were attested at Veldwezelt-*Hezerwater*, show that the distances, which were travelled by these people, were probably mainly guided by the distribution of the vital food resources. It seems that Middle Palaeolithic humans routinely moved short distances. While there is some evidence for longer lithic raw material moves, most of the evidence seems to point towards a temporal span of action of about one to two days' walking distance (*e.g*., *Lanaye* flint). However, seasonal resettlement patterns could have been more extensive (*e.g*., *Hesbaye* flint & *Wommersom* Quartzite). At Veldwezelt-*Hezerwater*, the movements of lithic raw materials, cores, tool blanks and tools were thus probably embedded in other foraging activities. "Exotic" lithic raw materials would probably be transferred onto the *loci* as "curated" cores, tool blanks and tools (*e.g*., TL & WFL *loci*), rather than as coarse flint nodules. These people must constantly have been carrying around lithic artefacts, wood, bones, meat and many other things, so that they always had sufficient supplies on hand for days, thus creating a safe "socio-economic niche".

The portable "back-up" toolkits, which were extremely helpful in practically every interaction between humans and their environment, became imperative technological extensions of the human physical apparatus in arid, cool, dangerous and life-threatening "low-food environments", in which starvation risks were greater (*e.g*., TL & WFL *loci*). These toolkits were vital safeguards against unforeseen needs and events. The VLL and the VLB flint extraction sites were probably nodes on a network of tracks, either as part of a circular tour where these *loci* were visited at least once a year or either as part of a so-called "hub-and-spoke" network where these *loci* were visited repeatedly by Middle Palaeolithic humans. On the other hand, it is also clear that the VBLB *locus* and especially the TL and WFL *loci* were probably stopped at by chance as these Middle Palaeolithic hunters were criss-crossing the landscape. This specific pattern of lithic raw material procurement and settlement dynamics suggests that these Middle Palaeolithic groups were often "tethered" (*e.g*., Kelly 1995) to places in the landscape where lithic raw materials as well as diverse faunal and other vital resources were locally abundant and easily accessible. Similar patterns have been documented in Southwest Europe (*e.g*., Mellars 1996). Undeniably, these mobility patterns were the result of complex mixtures of socio-economic and technological processes, which operated at many different levels.

8.3.5.4. Climate-related Environmental Change and Correlating "Expedient" and "Curated" Core and Tool Reduction Strategies at Veldwezelt-*Hezerwater*

The Veldwezelt-*Hezerwater* evidence shows that this part of Northwest Europe would probably have represented a very unfavourable territory during full glacial and full stadial periods. The same seems to be true during full interglacial periods. However, Middle Palaeolithic populations were definitely present in Northwest Europe during the "interglacial *s.l*." periods, which were characterised by temperate environments (*e.g*., VBLB *locus*). With the onset of increasingly colder conditions, they would have retreated southwards, leaving Northwest Europe deserted. Some of the longer interstadials were sufficiently warm for Middle Palaeolithic groups to repopulate and to survive at these more Northern latitudes (*e.g*., VLL, VLB, TL & WFL *loci*). We assume that the Late Saalian and the Middle Weichselian interstadial occupation phases, which have been attested at Veldwezelt-*Hezerwater*, represent successful social adaptations by Middle Palaeolithic humans to milder "interstadial" environments. In Fig. 8.1, we made use of the "GRIP Summit Core $ð^{18}O$ Record" (*e.g*., Dansgaard *et al*. 1993), because of the accurate and detailed representation of the Late Saalian and the Last Interglacial *s.l*.

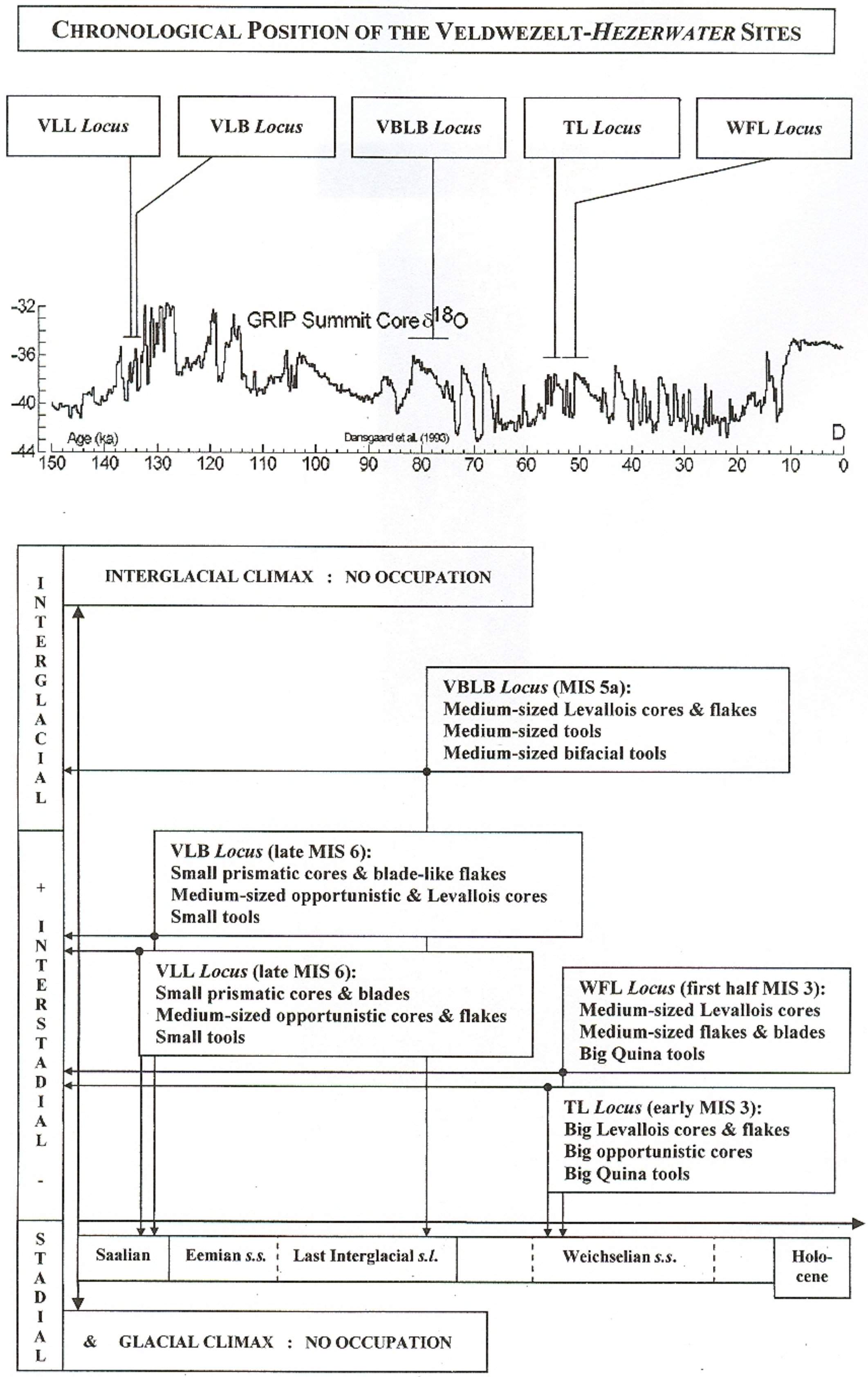


Fig. 8.1. Climato-Environmental Framework (Dansgaard *et al.* 1993) and Chrono-Technological Characterisation of the Primary Context *Loci* at Veldwezelt-*Hezerwater*

The activity-specific open-air camps at Veldwezelt-*Hezerwater*, were located not too far from outcrops of high-quality flint. Nonetheless, even at the VLL, VLB and VBLB *loci*, less "desirable" local lithic raw materials were used. Indeed, these lithic assemblages were mainly characterised by the utilisation of relatively coarse, locally-available lithic raw materials, which have been worked into "expedient" tools (Fig. 8.1.). At the TL and WFL *loci* on the other hand, the transport of high-quality lithic raw materials and tools over greater distances has been attested. At Veldwezelt-*Hezerwater*, humans were present at the relatively "warm" late Last Interglacial *s.l.* VBLB *locus*. However, by adapting to the cool conditions of the open "mammoth-steppe", humans successfully occupied Northwest Europe during the Late Saalian and the Middle Weichselian. Overall, the lithic and faunal remains and the internal organisation of many sites suggest higher mobility levels during "glacial" phases than prevailed during "interglacial" phases. These higher mobility levels were mainly achieved by the utilisation of relatively light, mobile and highly "curated" toolkits (*e.g.*, Shott 1986). Many sites (*e.g.*, TL & WFL *loci*) could be interpreted as short-term camps of highly mobile foraging groups who have used these camps to procure seasonal available faunal resources.

It was found that the Veldwezelt-*Hezerwater* lithic assemblages are quite different internally, in terms of their core and tool reduction strategies (Fig. 8.1.). However, substantial technological similarities have also been observed. These technological similarities seem to have been the result of "behavioural convergent processes". Although many sporadic or even continued ties must have existed between many of the different Middle Palaeolithic groups, who inhabited Northwest Europe, most technological similarities must have been the result of "behavioural convergences" that were driven by climato-environmental, mechanical and socio-economic factors. The economic advantages inherent in "curated" core and tool reduction strategies and the disadvantages of deviating from the basic "plan" suggest that they may constitute an adaptive technological "zenith" within a broader panorama of alternative technological strategies. "Behavioural convergences" on this adaptive "zenith" simply as a function of continuous "drift" in core and tool reduction strategies is not unlikely, especially if Middle Palaeolithic groups were exposed to a common set of strong "adaptive pressures" from exterior forces. For example, it is indeed reasonable to expect that "climato-environmental change" could lead to a decrease in access to lithic raw materials, which would cause Middle Palaeolithic toolmakers to conserve raw materials, including perhaps resharpening their formal tools more often.

It is clear that climate modulates biodiversity and food availability (*e.g.*, Stiner 1994). Middle Palaeolithic humans were also "calculating" people. So, we could predict that these "consumers" would rely on food resources that provided the best return for invested effort. However, the degree of dependence on vegetable foods declines away from the Equator as a simple function of primary environmental productivity (*e.g.*, Hayden 1981). Vegetable foods are "replaced" in the North by terrestrial game (*e.g.*, Hayden 1981). However, in "interglacial *s.s.*" environments, large mammals are highly dispersed, while in "interglacial *s.l.*" and "interstadial" environments, large mammals tend to aggregate. Yet, Middle Palaeolithic hunters could not hunt, collect and process food without tools. These tools thus provide clues about specific economic adaptations. It has also been observed that the degree of labour investment in tool production and maintenance are closely connected to how the food quests were organised (*e.g.*, Bousman 1993). The employment of "curated" tools seems to increase with latitude and with the degree of dependence on game (*e.g.*, Torrence 1983; Bousman 1993). As lithic complexity increases with latitude, the amount of time and energy expended in making and mending stone tools also increases with latitude. Torrence (1983) sees "latitudinal trends" in tool complexity as by-products of "risk-reducing" strategies.

At Veldwezelt-*Hezerwater,* just as across the rest of Northwest Europe, narrow "windows of opportunity" for hunting terrestrial game during the relatively cool Middle Weichselian interstadials, would make "optimal tool performance" really indispensable. "Optimal tool performance" was achieved primarily through the use of "over-sized", highly specialised heavy-duty tools (*e.g*., Torrence 1983; Bleed 1986; Bousman 1993). However, "high mobility levels" could potentially conflict with this "optimal tool performance" strategy, as frequent residential moves tend to promote "lightweight" toolkits (*e.g*., Shott 1986). Several researchers (*e.g*., Torrence 1983; Bousman 1993) have considered lithic raw materials, energy, time, risk and information as opportunities, which might be optimised by technology. However, risk-reduction strategies were the most useful (*e.g*., Torrence 1989a). "Risk" is made up both of the probability of not meeting dietary requirements and the "costs" of such failure (*e.g*., Torrence 1989b; Bamforth & Bleed 1997). Tools are usually the most effective objects for coping with risks that must be overcome in a short time-scale. Tools were chosen by Middle Palaeolithic hunters in function of their ability to capture prey that was only accessible for short periods of time. Failure costs and therefore the level of risk, increases toward the poles, because the availability of food decreases with longer winters *etc*. (*e.g*., Torrence 1989a,b). The Northern fringes of Europe were characterised by fewer alternative food resources, because species diversity has an inverse relationship with latitude. Latitude is therefore a useful proxy measure for severity of risk with higher latitudes. When failure costs rose, additional "high-energy" inputs were made to secure "optimal tool performance". Tool curation always seems to increase towards the poles, because adding extra production time added to the reliability of the tool and could thus decrease the time spent hunting (*e.g*., Torrence 1989a,b). Reliable tools should always "work" whenever they were needed (Nelson 1991).

We believe that the "curated" Quina tools, which were excavated at the early Middle Weichselian TL and WFL *loci* at Veldwezelt-*Hezerwater*, represented a specialised technological "risk-reducing" strategy. This strategy was oriented toward the production of "reliable" tools, which would never fail when they were needed. As has been observed before, Quina tools are most consistently associated with cool climato-environmental conditions (*e.g*., Mellars 1996). In order to secure "optimal tool performance" under "dangerous" environmental circumstances at the TL and WFL *loci*, procurement of lithic raw materials, Quina tool manufacture, tool use and repair were carefully scheduled so as not to conflict with the periods when the Quina tools were required. Indeed, these "over-sized" and "over-designed" Quina tools, which were used under "stressful" and "high-risk" cool environments, should mainly guard against tool breakage, which could have had serious consequences. "Curation" of Quina tools at the TL and WFL *loci* clearly was an important form of "risk-averse" behaviour. These Quina tools were made in advance and then "imported" to the TL and WFL *loci*, where they were used during hunting and butchering activities. We assume that the frequency of retouch and resharpening directly reflects the cost of keeping reliable tools on hand. At the TL and WFL *loci* at Veldwezelt-*Hezerwater,* the technological emphasis was clearly on "tool reliability", while "tool portability" seems to have been less important. This could be explained by the fact that these heavy-duty Quina were used and discarded at the TL and WFL *loci*. So, these Quina tools had "worked" and they were just left behind while the meat was probably carried back to base camp. We also believe that the parallel/prismatic core reduction strategies, which have been attested at the VLL and VLB *loci* at Veldwezelt-*Hezerwater*, were also developed in order to secure "optimal tool performance" under "dangerous" environmental circumstances. Although blades are generally associated with the "Upper" Palaeolithic, they were also quite common during the "Middle" Palaeolithic (*e.g*., Révillion & Tuffreau 1994; Otte 1994; Révillion 1995; Marks & Monigal 1995; Mellars 1996; Bar-Yosef & Kuhn 1999).

We even think that the appearance of blade core reduction strategies at the VLL and VLB *loci* at Veldwezelt-*Hezerwater*, basically represent a step in the Middle Palaeolithic human resettlement process of Northwest Europe after the Late Saalian occupation hiatus when Northwest Europe was too “hostile” for habitation. The presence of blades, blade-like flakes and small tools seems to suggest that these Middle Palaeolithic resettlers existed as small groups of highly mobile hunters, who frequently moved their camps to where important lithic raw material and faunal resources were available. The debris accumulations at the VLL and VLB *loci* were small, the dwellings were probably ephemeral, while it is possible these *loci* were revisited several times. The technological emphasis at these *loci* was clearly on “tool portability”, while “tool reliability” seems to have been less important. This could be explained by the fact that these lightweight tools were only manufacture and probably not used and not discarded at the VLL and VLB *loci*. Indeed, there is evidence that some blades, small tools and cores have been exported to other sites and used there. We also have to consider the possibility that not only the blades, but the small parallel/prismatic cores themselves, have functioned as “multipurpose tools *s.l.*”. Notwithstanding this, the VLL and VLB lithic assemblages were clearly organised to facilitate high mobility levels.

The “blade and small tool assemblages” as well as the “Levallois and Quina tool assemblages”, which have been excavated at Veldwezelt-*Hezerwater*, both seem to represent successful, though fundamentally different, technological adaptations to the Late Saalian and early Middle Weichselian “glacial *s.l.*” environments in Northwest Europe. It seems that base camps were connected to smaller “activity-specific camps”. In this context, cores, tool blanks, “easy-to-use” tools, faunal and other resources were being transported back and forth between smaller and larger camp sites. Middle Palaeolithic sites were often located relatively far from outcrops of high-quality flint nodules, which led to the use of less “desirable” locally-available lithic raw materials for the production of “expedient” tools. The same phenomenon led to the transport of high-quality lithic raw materials and “curated” tools over greater distances. It seems that at the Middle Palaeolithic VLL, VLB, TL and WFL *loci*, which were inhabited under cold and arid climato-environmental conditions, (1) group mobility was always high, (2) lithic raw material was usually conserved and (3) the number of “curated” tools that could be easily carried around was quite limited. On the other hand, where Middle Palaeolithic group mobility was reduced, as has been supposed for the VBLB *locus*, (1) more “expedient” tools and tool blanks were designed to fulfil ephemeral tasks and (2) tool portability and transportability strategies were less of an issue.

8.3.5.5. Middle Palaeolithic “Culture”

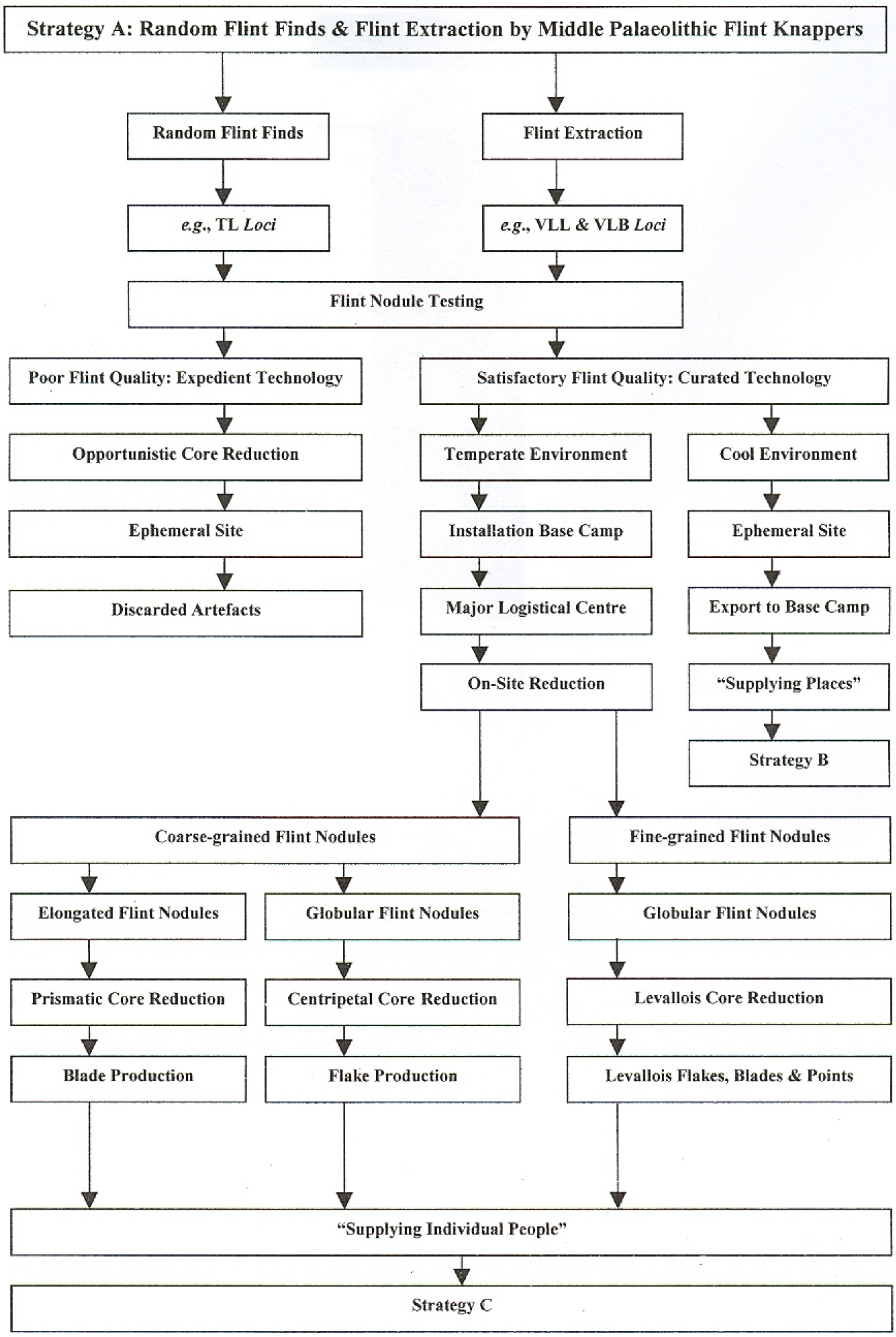
Many scholars (*e.g.*, Cashdan 1980; Torrence 1986; Bettinger 1991; Rosenberg 1994; Chatters 1998; Gould 2000; Shennan 2002) have proposed various hypotheses to explain the development of “culture” in the course of human Pre-history. However, “culture”, which basically is a complex system of information transmission and associated behaviour, is a phenomenon that is often invisible and sometimes difficult to grasp. It is obvious that applying the term “culture” in a Middle Palaeolithic context is highly problematic. Indeed, “culture” is, of course, a very broad term, but according to the definition, which has been proposed by Handwerker (2002), it consists of evolving configurations of (1) cognition, (2) emotion and (3) behaviour. So, human behaviour results from a mixture of rational and emotional choices. Indeed, reason and emotion are linked in parallel ways. There can be no doubt that each Middle Palaeolithic group held a specific set of cognitive, emotional and behavioural patterns that were distinct from the configurations, which had been adapted by other Middle Palaeolithic groups.

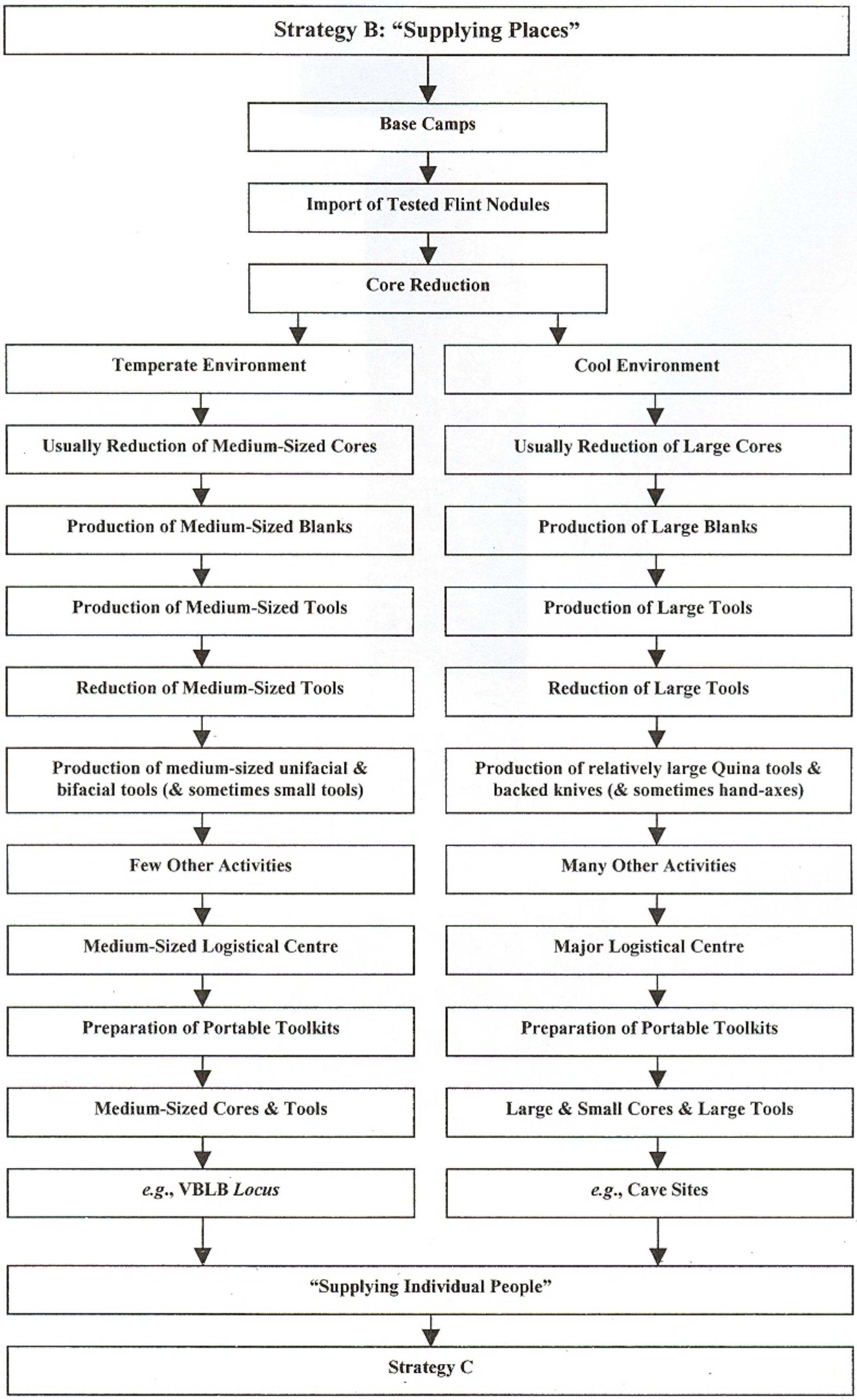
The lithic assemblages, which have been excavated at the Veldwezelt-*Hezerwater loci*, provide clear evidence for this assumption. But, how does this all add up to the big picture? We believe that the Middle Palaeolithic "cultures", which were embodied in the "super-organic" properties of hunter-gatherer groups, will probably remain enigmatic to us. What has come down to us are the many Middle Palaeolithic technological assemblages. "Cultures" and technologies were probably continually co-evolving in very dynamic and complex relationships. "New" technological strategies arose within particular "cultural" contexts, probably as the result of changing climato-environmental, socio-economic and biological needs or constraints. But once these "new" technological strategies had surfaced, they metamorphosed the "cultures" that had produced them. When on the other hand, certain technological strategies spread to other "cultures", they were changed by those "new" technologies as well. The "cultural" changes that were created by these "new" technological innovations, may then again have influenced the emergence of "new" technological strategies. This led to a continuous and dynamic process of invention, loss and reinvention of numerous technological strategies. It seems that the alleged Middle Palaeolithic "tools-making-traditions", which are "detectable" over hundreds of thousands of square kilometres and which persisted "unchanged" and intact over tens or hundreds of millennia, were not the result of, and do not represent anthropological "cultures" (Clark 2002a,b). Indeed, Middle Palaeolithic flint knappers could do similar things repeatedly, but they never did exactly the same thing. Indeed, the reaction of Middle Palaeolithic flint knappers to the results of their technological inputs could vary considerably. We think that a complex blend of many different needs and constraints has guided the Middle Palaeolithic core and tool reduction strategies. As a result, "new" diverging lithic reduction strategies could arise out of a continuum of technological roadmaps. The technological "plasticity" of lithic core reduction strategies seems almost infinite. On the other hand, many technological "converging" forces (*e.g.*, mechanical & physical properties) also played an important role. These "converging" forces led to a fair amount of "equifinality" within the different lithic assemblages. The principle of "equifinality" shows that there is always a possibility that different initial conditions lead to similar effects.

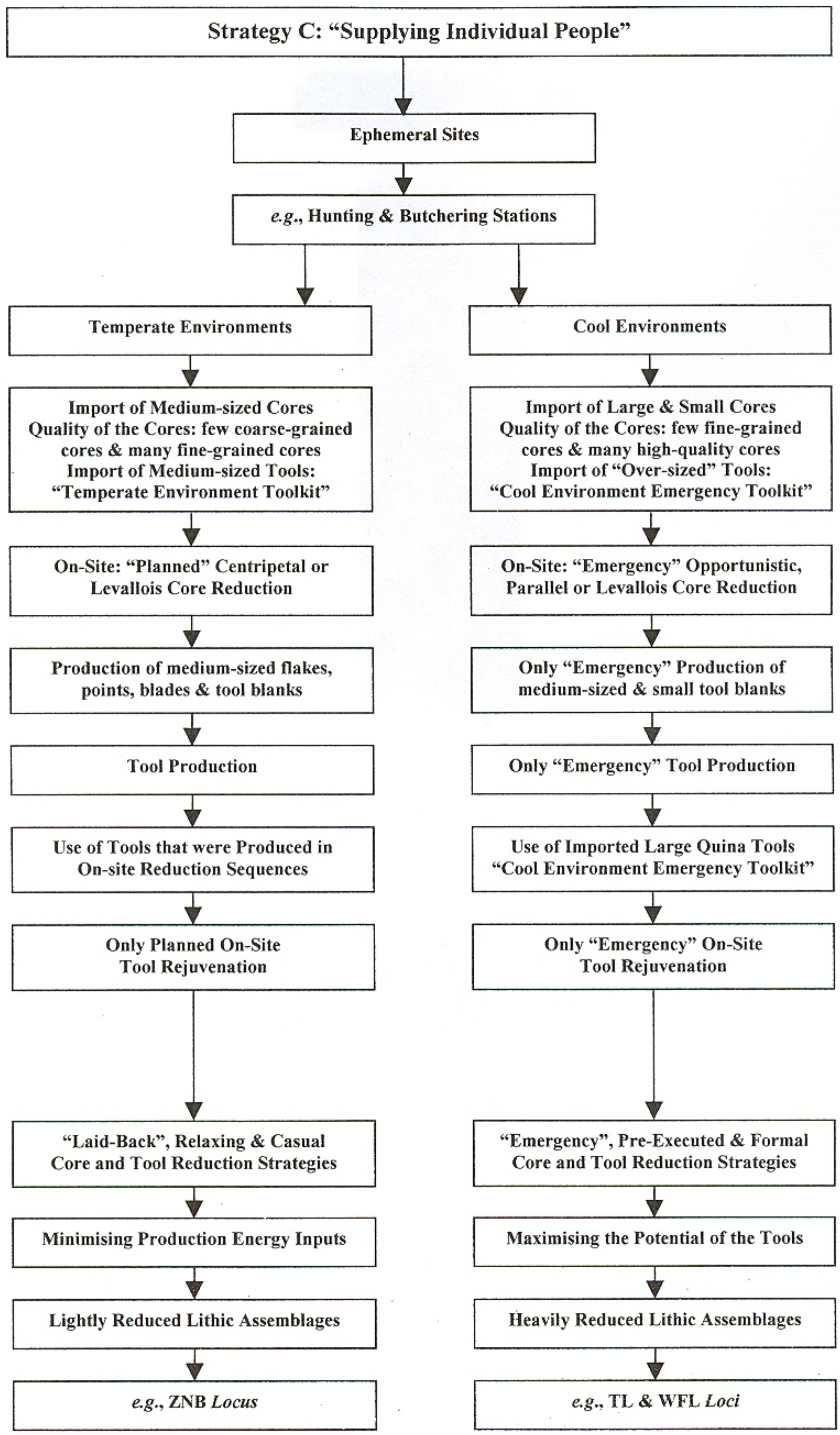
8.4. The Complex Web of Dynamic Relationships between Lithic Raw Material Economy, Lithic Reduction Strategies, Climate-related Environmental Change & Middle Palaeolithic "Culture" at Veldwezelt-*Hezerwater*

The successful Middle Palaeolithic archaeological excavations at Veldwezelt-*Hezerwater* revealed seven well-preserved and stratigraphically sealed "primary-context" lithic assemblages, which seem to represent the remainders of ephemeral activity spots. No two artefact assemblages were exactly alike. However, from a structural point of view, some significant resemblances were recognised among them (Fig. 8.2.). Most assemblages at Veldwezelt-*Hezerwater* were Levallois-dominated lithic assemblages (VBLB, TL-R, TL-GF, TL-W & WFL). However, two blade-dominated assemblages (VLL & VLB) have also been attested. The study of core reduction strategies is done best when many flakes, blades and blanks can been refitted to their original cores (VLL, VLB & VBLB). However, even without the presence of formally refitted pieces, we could usually identify the core reduction strategies through the assessment of cores and flakes alone (TL-R, TL-GF, TL-W & WFL). The reconstructed core reduction strategies provided important insights into the technological abilities of the Middle Palaeolithic flint knappers who were active at the different Veldwezelt-*Hezerwater loci*. Very informative were the initial stages of the different core reduction sequences. Finally, the presence of formal tools was very helpful to characterise the different lithic assemblages at Veldwezelt-*Hezerwater*.

Fig. 8.2. Core and tool reduction strategies at Veldwezelt-*Hezerwater*: a Flow Chart Model




Strategy B: "Supplying Places"
Base Camps
Import of Tested Flint Nodules
Core Reduction
Temperate Environment
Cool Environment
Usually Reduction of Medium-Sized Cores
Usually Reduction of Large Cores
Production of Medium-Sized Blanks
Production of Large Blanks
Production of Medium-Sized Tools
Production of Large Tools
Reduction of Medium-Sized Tools
Reduction of Large Tools
Production of medium-sized unifacial & bifacial tools (& sometimes small tools)
Production of relatively large Quina tools & backed knives (& sometimes hand-axes)
Few Other Activities
Many Other Activities
Medium-Sized Logistical Centre
Major Logistical Centre
Preparation of Portable Toolkits
Preparation of Portable Toolkits
Medium-Sized Cores & Tools
Large & Small Cores & Large Tools
e.g., VBLB *Locus*
e.g., Cave Sites
"Supplying Individual People"
Strategy C


Strategy C: "Supplying Individual People"
Ephemeral Sites
e.g., Hunting & Butchering Stations
Temperate Environments
Cool Environments
Import of Medium-sized Cores
Quality of the Cores: few coarse-grained cores & many fine-grained cores
Import of Medium-sized Tools: "Temperate Environment Toolkit"
Import of Large & Small Cores
Quality of the Cores: few fine-grained cores & many high-quality cores
Import of "Over-sized" Tools: "Cool Environment Emergency Toolkit"
On-Site: "Planned" Centripetal or Levallois Core Reduction
On-Site: "Emergency" Opportunistic, Parallel or Levallois Core Reduction
Production of medium-sized flakes, points, blades & tool blanks
Only "Emergency" Production of medium-sized & small tool blanks
Tool Production
Only "Emergency" Tool Production
Use of Tools that were Produced in On-site Reduction Sequences
Use of Imported Large Quina Tools "Cool Environment Emergency Toolkit"
Only Planned On-Site Tool Rejuvenation
Only "Emergency" On-Site Tool Rejuvenation
"Laid-Back", Relaxing & Casual Core and Tool Reduction Strategies
"Emergency", Pre-Executed & Formal Core and Tool Reduction Strategies
Minimising Production Energy Inputs
Maximising the Potential of the Tools
Lightly Reduced Lithic Assemblages
Heavily Reduced Lithic Assemblages
e.g., ZNB Locus
e.g., TL & WFL Loci

One of the most notable features of the discontinuous and sporadic Middle Palaeolithic occupation at Veldwezelt-*Hezerwater* is the remarkable long span of time, which it covers. A second notable feature is the remarkable scale and rapidity of the climatic fluctuations (Fig. 8.1), which took place during the late Middle and Late Pleistocene (*e.g*., Dansgaard *et al*. 1993). The terrestrial equivalents of these rapid climato-environmental changes have been preserved in the detailed loess-soil sequences at Veldwezelt-*Hezerwater*. In the context of these environmental changes, Middle Palaeolithic humans could probably not survive near the Northern fringes of Europe, without complex technological adaptations. Shifts in subsistence and settlement patterns are most likely to have occurred. The presence of diverse core and tool reduction strategies (Fig. 8.2.) at the Veldwezelt-*Hezerwater loci* during the course of the Middle Palaeolithic is thus not surprising. Three alternative strategies (Fig. 8.2.), which were also influenced by the reigning climato-environmental conditions, were employed at Veldwezelt-*Hezerwater* to solve the problem of keeping flint knappers supplied with lithic raw materials, flake blanks and tools. The first strategy depended on “random flint finds” and active “flint extraction”, probably at known extraction sites. The second strategy was to “supply places” in the landscape where core and tools reduction activities were performed (*e.g*., Kuhn 1995; Kuhn & Stiner 1998). The third strategy was to “supply individual people” with a flexible, portable toolkit, especially useful under conditions of “uncertainty” (*e.g*., Kuhn 1995; Kuhn & Stiner 1998). The basic argument is that if Middle Palaeolithic people were highly mobile and if the location of target resources could not be predicted (*e.g*., hunting and butchering activities at the TL & WFL *loci*), these people had to depend upon the limited array of artefacts they could carry with them. This in turn puts constraints on the sizes and kinds of artefacts and tools that ended up in what, in functional terms, would have been small, ephemeral open-air stations. On the other hand, if Middle Palaeolithic humans were more stable residentially and if occupations tended to be of longer duration (*e.g*., base camp) there would be more predictable reuse of specific locations in the landscape (*e.g*., VLL & VLB *loci*) or flint knappers could stockpile lithic raw materials, tool blanks and tools at these places in anticipation of future needs (*e.g*., cave sites).

At Veldwezelt-*Hezerwater*, the characteristic composition of the lithic assemblages was not only affected by the quantity, the quality and the morphology of the initial flint nodules. The anticipated tasks and activities, and the function of the sites themselves also played an important role. We think that “specialised-activity sites” and “complex-activity sites” must have been characterised by quite different lithic assemblages. The cave sites in the *Maas* valley must have functioned as major logistical centres. Caves are indeed mainly characterised by large palimpsests of cores and tools. The Veldwezelt-*Hezerwater* open-air sites on the other hand were characterised by an emphasis on the exploitation of immediately available lithic raw materials, sometimes relatively rich in cores and yet with very few tools. We think that the interglacial *s.l*. VBLB *locus* is a “complex-activity site”, which could be interpreted as a minor base camp or a general “living site”. Typical Levallois products and medium-sized unifacial and bifacial tools have been found. Many charcoal pieces (*Betula sp*.), which were probably the remainders of a hearth, have also been excavated. In a “spring-amphitheatre” (Gullentops & Meijs 2002) at the interstadial VLL and VLB *loci*, Middle Palaeolithic people have exploited the local, mostly elongated, *Maas* and *Hezerwater* flint nodules. Several specialised workshops where characterised by the presence of blade-based lithic assemblages and by the presence of small tools. Several hearths (*Pinus silvestris* charcoal) must have been present. Finally, the interstadial TL and WFL *loci* could be interpreted as hunting and butchering stations. These assemblages were characterised by Levallois products and large Quina tools. Several large mammals (*e.g*., horse, bison, reindeer *etc*.) were killed and butchered at these *loci* by Middle Palaeolithic hunters.

8.5. A Complex Mosaic of Results and Open Problems

8.5.1. Overview of the Veldwezelt-*Hezerwater* Research Results

- The Quaternary stratigraphic sequence at Veldwezelt-*Hezerwater*, *Limburg*, Belgium is quite exceptional from a geological point of view

- The highly differentiated Quaternary sequence at Veldwezelt-*Hezerwater* contains abundant archaeological finds

- The local river terrace was formed by the River *Maas*

- The ancient loessic deposits were clearly associated with this river terrace, because the steep cliff of the abandoned river bank provided an ideal sedimentary trap for the windblown loess and the redeposited loams

- The loess-soil sequence at Veldwezelt-*Hezerwater* can be viewed as an important source of palaeoclimatic and palaeoenvironmental information

- The palaeoclimatic and palaeoenvironmental information has been derived from comparative sedimentologic and pedologic observations

- In this favourable depositional basin, loess has accumulated under a highly continental, dry and poorly-vegetated periglacial climate

- Stratigraphical division of the loess stacks at Veldwezelt-*Hezerwater* was rendered possible mainly by the horizons of fossil soils

- The archaeologically-relevant palaeosoils at Veldwezelt-*Hezerwater* were classified into two main groups: (1) *Braunerde*/*Parabraunerde* & (2) *Rendzina*/*Pararendzina*

- (1a) The warm and dry interstadial leached *Braunerdes* [“Cambisols”] were mainly characterised by *in situ* redeposition of clay plasma

- (1b) The warm and wet interglacial leached *Parabraunerdes* [“Luvisols”] were mainly characterised by illuvial clay-enriched Bt-horizons

- (2a) The cold and wet interstadial *Rendzinas* were biologically reworked steppe soils, showing an accumulation of weakly matured humus

- (2b) The cold and dry interstadial *Pararendzinas* were biologically reworked steppe soils, showing an accumulation of strongly matured humus

- Cyclic patterns can be detected in the Veldwezelt-*Hezerwater* loess-soil sequence

- The Last Interglacial-Glacial Cycle was attested by the alternation of soils and loess

- Many soils at Veldwezelt-*Hezerwater* were “accretionary” or “cumulative” soils

- From a stratigraphic point of view, most valuable at Veldwezelt-*Hezerwater* was the well-differentiated “accretionary” Last Interglacial “Basal Soilcomplex”, which has been preserved in a buried depression [“spring-amphitheatre”]

- The Late Pleistocene at Veldwezelt-*Hezerwater* thus begins with the so-called "Basal Soilcomplex", within which the "Rocourt Soilcomplex" and the "Warneton Soilcomplex" has been observed

- The Last Interglacial *s.l.* "Basal Soilcomplex" at Veldwezelt-*Hezerwater* is the terrestrial equivalent of MIS 5

- During the Eemian *s.s.* interglacial pedogenesis, which has been attested at Veldwezelt-*Hezerwater* [PGB], the climate was even warmer and wetter than during the Holocene

- The Weichselian Glaciation *s.s.* (MIS 4, 3 & 2) at Veldwezelt-*Hezerwater* was subdivided into several sections by warmer and more humid oscillations, during which interstadial soils were formed

- The "Kesselt Suite" (MIS 3/2 transition) has also been observed

- Most of the studied palaeosoils at Veldwezelt-*Hezerwater* lay on slopes. These soils were thus "para-autochthonous", which means that their surfaces had not become fully stabilised and soil material from higher elevations continued to be redeposited into the depressions

- "Synsedimentary" or "syndepositional" pedogenesis was thus quite an important soil formation process during the Late Pleistocene at Veldwezelt-*Hezerwater*

- The loess-soil sequence at Veldwezelt-*Hezerwater* provides proof of a complicated sequence of environmental and by inference palaeoclimatic changes, which affected this part of Northwest Europe during the late Middle and Late Pleistocene

- It seems that this well-preserved loess-soil sequence could be understood as a quasi-continuous time series, without major hiatuses

- The complexity of the late Middle and Late Pleistocene climate history on land seems to be similar to the complexity in the marine and ice core ^{18}O records

- The Late Pleistocene loess-soil "cyclothem" at Veldwezelt-*Hezerwater* resembles the asymmetric sawtooth pattern, which has been attested in the Last Interglacial-Glacial Cycle in the marine and ice core ^{18}O records

- The detailed study of loess-soil sequences offers best prospects into the future and is worth of being pursued most intensely

- At Veldwezelt-*Hezerwater*, 24 archaeological *loci* have been discovered

- At least seven of these *loci* seem to represent "primary-context" archaeological sites

- However, since we are dealing here with "synsedimentary" pedogenesis, most of the Middle Palaeolithic "primary-context" artefacts have probably been left behind on almost continuously "aggrading living surfaces"

- The sedimentary build-up of many of the living surfaces brought about that the primary-context artefacts remained below the attested truncated surfaces

- The distribution of the Middle Palaeolithic sites at Veldwezelt-*Hezerwater* was closely linked to the hydrographic network, since the primary-context sites were situated in the *Hezerwater* valley, slightly above the riverbeds

- The Late Saalian "spring-amphitheatre" provided an abundant source of flint. This flint sometimes showed signs of frost-wedging (frost-cracks & potholes)

- The Late Saalian interstadial VLL & VLB *loci* were flint extraction sites. The VLL assemblage was characterised by an "expedient" blade-based lithic assemblage and small tools. At the VLB *locus*, Levallois core reduction has also been attested

- It was thought that formal Palaeolithic tools became gradually smaller over time. However, this is for example disproved at the VLL & VLB *loci* at Veldwezelt-*Hezerwater*, where the tools from these early sites were made from carefully-struck flakes, which have been skilfully made into a range of scrapers. During the Middle Palaeolithic, large (> 8 cm) and small tools (< 5 cm) were thus used

- The Last Interglacial *s.l.* VBLB *locus* was a so-called "living site", which was characterised by the presence of a Levallois-based lithic assemblage and medium-sized "curated" tools in association with *Betula sp.* charcoal pieces

- The early Middle Weichselian interstadial TL-R, TL-GF, TL-W & WFL *loci* were ephemeral hunting and butchering sites, which were characterised by Levallois-based lithic assemblages and "over-sized", "highly-curated" Quina tools

- Continuous transport of cores, tool blanks and tools has been demonstrated

- Local raw materials were used at the VLL, VLB & VBLB *loci* extensively

- The presence of local coarse-grained flint nodules at the Late Saalian VLL & VLB *loci* resulted in parallel/prismatic core reduction strategies

- The presence of imported fine-grained flint nodules at the VLB, TL-R, TL-GF, TL-W & WFL *loci* resulted in Levallois core reduction strategies

- Imported, fine-grained and fresh "*Lanaye* Flint" has been attested at the Middle Weichselian TL-R, TL-GF, TL-W & WFL *loci*

- "Exotic" lithic raw materials ("*Hesbaye* Flint" & "*Wommerson* Quartzite") have only been attested at the Middle Weichselian WFL *locus*

- Whereas the lithic raw material procurement strategies at the VLL, VLB & VBLB *loci* at Veldwezelt-*Hezerwater* could be labelled as "opportunistic", the lithic raw material procurement strategies at the TL and WFL *loci* at Veldwezelt-*Hezerwater* should be called "selective"

- At the TL & WFL *loci*, lithic raw material procurement strategies seem to have been "biased" toward some "high-quality" raw material types and away from "low-quality" raw material types. "Biased lithic raw material procurement strategies" would lead to higher frequencies of occurrences of certain lithic raw material types, independent of their environmental densities and the distance to their sources. This would imply "intentional lithic raw material selectivity"

- It seems that the Middle Palaeolithic flint knappers, who were active at the TL & WFL *loci*, were lithic raw material procurement “specialists”. These “specialists” exploited only a few “high-quality” lithic raw material types

- The flint knappers, who were active at the VLL, VLB & VBLB *loci*, were lithic raw material procurement “generalists”. These “generalists” exploited many different lithic raw material types

- Levallois core reduction was usually the standard at most Middle Palaeolithic sites

- However, it seems that where prismatic core reduction and more opportunistic core reduction strategies were employed, Levallois core reduction became less important

- Levallois and prismatic core reduction strategies usually were “economic” reduction strategies. However, we have the impression that seemingly “identical” core reduction strategies could be configured in an “economic” or in a “wasteful” mode according to context

- Prismatic and Levallois core reduction strategies were part of the diverse Middle Palaeolithic technological “*repertoire*” of modes of lithic exploitation

- Indeed, at Veldwezelt-*Hezerwater*, there must have existed a whole technological “*repertoire*”, which could be invoked according to a specific context

- Small tools (< 5 cm) were excavated at the VLL & VLB *loci*, medium-sized tools (> 5 & < 8 cm) were found at the VBLB *locus* and over-sized tools (> 8 cm) were unearthed at the TL & WFL *loci*

- However, no hand-axes have been found at the Veldwezelt-*Hezerwater loci*

- The “blade and small tool assemblages” as well as the “Levallois and Quina tool assemblages”, which have been excavated at Veldwezelt-*Hezerwater*, both seem to represent successful, though fundamentally different, technological adaptations to the Late Saalian and early Middle Weichselian “interstadial” environmental conditions in Northwest Europe

- It seems that base camps were connected to smaller “activity-specific camps”

- At the Middle Palaeolithic VLL, VLB, TL & WFL *loci*, which were inhabited under cold and arid climato-environmental conditions, (1) group mobility was always high, (2) lithic raw material was usually conserved and (3) the number of “curated” tools that could be easily carried around was quite limited

- On the other hand, where Middle Palaeolithic group mobility was reduced, as has been supposed for the VBLB *locus*, (1) more “expedient” tools and tool blanks were designed to fulfil ephemeral tasks and (2) tool portability and transportability strategies were less of an issue

- We assume that a complex blend of many different needs and constraints has guided the Middle Palaeolithic core and tool reduction strategies at Veldwezelt-*Hezerwater*. As a result, “new” diverging lithic core and tool reduction strategies could arise out of a continuum of technological roadmaps

- The Veldwezelt-*Hezerwater* data support the hypothesis that Middle Palaeolithic assemblage variability is essentially the result of the needs and the constraints imposed by lithic raw material economy

- The technological "plasticity" of Middle Palaeolithic core and tool reduction strategies seems almost infinite

- At the WFL *locus*, an important faunal assemblage has been recovered (*e.g*., horse, bison, reindeer, woolly rhino, mammoth, cave hyena, cave lion, arctic fox). However, the presence of the badger indicated that the climate was relatively warm

- The so-called "Mammoth Steppe" seems to have been the favourite environment of the Veldwezelt-*Hezerwater* Middle Palaeolithic hunters

- All the primary-context sites at Veldwezelt-*Hezerwater* were inhabited by humans only under interglacial *s.l.* and interstadial environments, thus "temperate climates"

- Climax environments, either cold or hot, seem to have been avoided by Middle Palaeolithic humans in Northwest Europe

- At Veldwezelt-*Hezerwater,* there is no evidence of Palaeolithic occupation during the Eemian *s.s*., the Early Weichselian, the second half of the Middle Weichselian and the Late Weichselian

8.5.2. Final Considerations

The successive archaeological excavation campaigns at Veldwezelt-*Hezerwater* provided us with important lithic and faunal remains of at least seven separate Middle Palaeolithic valley settlements. It is indeed awesome to imagine that Middle Palaeolithic humans were extracting flint, were hunting animals, were collecting wood, were lighting fires, were reducing cores and were producing tools at this spot in the *Hezerwater* valley at different times during the Late Saalian, the late Last Interglacial *s.l.* and the early Middle Weichselian. Middle Palaeolithic humans, who wanted to make a living at Veldwezelt-*Hezerwater* in a particular climatic setting, had to respond to that setting. This fact of course led to adaptation in terms of migrational, technological and "cultural" behaviour, which in turn affected their clothing, shelter, mobility, meat procurement and butchery methods, and thus their lithic technology. We and other researchers (*e.g*., Dibble 1984; Dibble & Rolland 1992; Dibble 1995a; Bisson 2000; Moyer & Rolland 2001; Clark 2002a,b) believe that "culture" and "cultures" are relatively unimportant restraints on the character of core and tool reduction strategies, being overridden in most contexts by mechanical constraints and socio-economic and ecological processes. It seems that Middle Palaeolithic core and tool reduction strategies constituted a whole range of technological options, which were invoked differently according to context. The "cyclic" appearance or reappearance of prismatic or Levallois core reduction strategies, the presence or absence of unifacial, bifacial, notched, denticulated, Quina or "small" tools in the different lithic assemblages excavated at the Veldwezelt-*Hezerwater* open-air sites should not be seen as extraordinary events, but simply as the natural outcome of the dynamics of flint knapping. Not the cyclic "reinvention" of some sort of core or tool reduction strategy, but the recognition of it, as being more useful for certain kinds of activities in specific climato-environmental contexts, was the crucial element in this fluctuating technological system.

Technological change is thus not the result of a linear "evolution", but the outcome of isolated creative human actions. Indeed, frequently doing the "same" thing, but minor dissimilarities in the original settings, can bring about diverging results. Various elements must come together before triggering a technological shift: the element of restricted access to certain resources, climato-environmental conditions, the element of groups mobility, socio-economic dynamics, *etc*. On the other hand, "technological equifinality" and "formal convergence" (*e.g*., mechanical & physical restraints) almost certainly overrode in most cases any hypothetical "cultural" component.

Archaeologists are entangled in deciphering the ways in which a given "technology" is also a "socio-cultural" creation. Such an endeavour is difficult to accomplish, perhaps, because we cannot observe the past core and tool reduction strategies and the other operational sequences in action. However, we think that the reasons for the use, at a given moment during the Middle Palaeolithic, of one core or tool reduction strategy, rather than another, were often related to a complex web of dynamic relationships and constraints imposed by: (1) lithic raw material economy, (2) differential access to lithic raw materials, (3) economising behaviour, (4) mechanical & physical properties of stone, (5) individual knowledge of alternative core and tool reduction strategies, (6) functional needs, (7) "expedient" and "curated" technologies, (8) faunal exploitation patterns, (9) intensity of reduction, (10) anticipated tasks, (11) intensity of utilisation, (12) longevity of occupation, (13) cave sites *versus* open-air sites, (14) recycling of tools, (15) hafting, (16) risk-reducing strategies, (17) cumulative effects of site revisits (palimpsests), (18) group size, (19) group composition, (20) mobility patterns, (21) low- and high-energy investment forager strategies, (22) climato-environmental change, (23) biology, (24) "ethnicity", (25) social systems, (26) social density, (27) social position, (28) gender, (29) age, (30) physical abilities, (31) skill, (32) the training of children as future flint knappers (production of "unusable" blanks), (33) health status, (34) seasonality, (35) human temperament, (36) style, (37) tradition, (38) symbolic meanings, (39) individual "culture", (40) group "cultures", (41) post-depositional factors and (42) a variety of other factors, which could influence everything people do (*e.g*., Dibble 1984; Jelinek 1988; Torrence 1989a,b; Nelson 1991; Dibble & Rolland 1992; Dibble 1995a; Kuhn 1995; Neeley 1997; Bar-Yosef 1998; Bisson 2000; Moyer & Rolland 2001; Clark 2002a,b).

We could thus put forward the hypothesis that, at least under "temperate" climato-environmental conditions, Middle Palaeolithic humans could react instrumental in creating their own life-sustaining technologies and this through interactions with the reigning environment, changes in general behaviour and contacts with other Middle Palaeolithic groups. However, we would like to emphasise once more, that the wrongly perceived lack of "material evidence" of contact with other Middle Palaeolithic groups in the wider *Maas* and Rhine area, does not necessarily mean that the Veldwezelt-*Hezerwater* humans have lived isolated lives. We think that "organismic" forms of interaction and exchange between different Middle Palaeolithic groups of people were probably the general rule, rather than the exception. We argue for the recognition of the universality of contact and influence as a fundamental feature of Middle Palaeolithic human existence. This approach considers the Veldwezelt-*Hezerwater* Middle Palaeolithic humans as "connected" and "active" agents, rather than passive recipients of optimised environmental conditions.

SAMENVATTING

MEERDERE MIDDEN-PALEOLITHISCHE BEWONINGSFASEN IN EEN LOESS-BODEM SEQUENTIE TE VELDWEZELT-*HEZERWATER*, LIMBURG, BELGIË

Midden de jaren ’90 van de 20ste eeuw werd er door het “Laboratorium voor Prehistorie” aan de Katholieke Universiteit Leuven een geo-archeologisch project opgestart om in de loess-groeves van Limburgs-Haspengouw naar sporen van de Pleistocene mens te gaan prospecteren. Uit deze prospecties bleek, dat vooral de loess-groeve te Veldwezelt-*Hezerwater* de beste perspectieven bood. De leemgroeve “Vandersanden” te Veldwezelt-*Hezerwater* lag in een beekdal aan de rand van een oud terras van de Maas. In deze groeve waren er vooral loess-afzettingen en bodems uit het Laat-Pleistoceen ontsloten. Aangezien het onderzoek in het nabije Maastricht-*Belvédère* zich vooral op het Saale had toegespitst, bood de groeve te Veldwezelt-*Hezerwater* uitstekende perspectieven om de kennis van de “Midden-Paleolithische” bewoning gedurende het Laat-Pleistoceen gevoelig uit te breiden. Tussen 1995 en 2004, in totaal is er meer dan één jaar lang opgegraven te Veldwezelt-*Hezerwater*, werden er 24 archeologische *loci* [plaatsen met archeologische vondsten] ontdekt en opgegraven. Na grondige analyse konden 7 van deze 24 *loci* als volwaardige “Midden-Paleolithische” sites [1. VLL, 2. VLB, 3. VBLB, 4. TL-R, 5. TL-GF, 6. TL-W & 7. WFL] geïnterpreteerd worden.

De *Hezerwater*-beek stroomde te Veldwezelt-*Hezerwater*, tot voor de aanleg van het Albert-kanaal in de jaren ’30 van de 20ste eeuw, van Zuid naar Noord door de vallei. Het *Hezerwater*-dal is vooral gedurende het Laat-Pleistoceen in verschillende fasen van West naar Oost opgevuld. Dit resulteerde in een complexe opeenvolging van sedimenten en bodems uit het Laat-Saale (MIS 6), het Laatste Interglaciaal *s.l.* (MIS 5), het Weichsel (MIS 4, 3 & 2) en het Holoceen (MIS 1). Deze bijzondere situatie bood natuurlijk uitstekende mogelijkheden om tot een gedetailleerde relatieve datering van de archeologische assemblages te komen. In de kalkhoudende loess-afzettingen werden er naast de 24 archeologische *loci* meer dan 10 horizonten met microfauna (o.a. slakken & kiesjes van knaagdieren) aangetroffen. Op slechts enkele plaatsen werden er ook goed geconserveerde resten van macrofauna en houtskool aangetroffen.

De 7 “Midden-Paleolithische” sites te Veldwezelt-*Hezerwater* waren duidelijk aan het hydrografische netwerk gelinkt. We moeten echter een onderscheid maken tussen de Midden-Weichsel TL-R, TL-GF, TL-W en WFL “*low-density-sites*”, die echt in de lage en natte zones vlak bij het *Hezerwater* lagen, en de Laat-Saale VLL en VLB en de Laat-Interglaciale *s.l.* VBLB “*high-density-sites*”, die zich iets hoger in het landschap bevonden. De “*low-density-sites*” werden meestal gekenmerkt door de aanwezigheid van enkele werktuigen, de afwezigheid van debitage-materiaal en de afwezigheid van sporen van vuur. Ze kunnen misschien het best omschreven worden als efemere “werktuig-gebruikszones”. De zogenaamde “*high-density-sites*” die zich dus op de hogere, drogere en waarschijnlijk ook “veiligere” plekken in het landschap bevonden, kenden een meer langdurige vorm van bewoning. Deze “*high-density-sites*” werden ook gekenmerkt door de aanwezigheid van stenen werktuigen, maar vooral de aanwezigheid van het vele debitage-materiaal is opvallend. Het is ook op deze “*high-density-sites*”, dat meestal de sporen van vuur aangetroffen werden.

De Laat-Saale (MIS 6) VLL en VLB *loci* te Veldwezelt-*Hezerwater* bevonden zich vlak onder het "Rocourt-Bodemcomplex" uit het Laatste Interglaciaal *s.l.* (MIS 5). Deze sites bevonden zich in een kleine "zijvallei" van het *Hezerwater*. Maar, in feite moeten we ons een zogenaamd "bron-amfitheater" (Gullentops & Meijs 2002) voor de geest roepen. De bron erodeerde het locale Maasterras en creëerde als dusdanig een natuurlijk "amfitheater" in het achterliggende terras. Echter, het "bron-amfitheater" moet bijwijlen drooggestaan hebben. De lithische assemblages van de VLL en VLB *loci* die op de lemige hellingen van dit "bron-amfitheater" aangetroffen werden, worden over het algemeen gekenmerkt door prismatische kernreductie, wat natuurlijk in de productie van een aantal klingen en kling-vormige afslagen resulteerde. Opmerkelijk is ook dat de natuurlijke convexiteit van de langwerpige stenen kernen ten volle benut werd. Op de VLB *locus* werd echter ook een *Levallois*-kern aangetroffen waarop een heel aantal afslagen *gerefit* kon worden.

Laminaire assemblages, zoals op de VLL en VLB *loci* aangetroffen werden, zijn binnen het "Midden-Paleolithicum" geen uitzondering meer, maar ze zijn toch nog altijd zeldzaam in de periode van vóór de Laatste Tussenijstijd *s.l.* Verder moeten we ook nog opmerken, dat de zogenaamde *toolkits* van de VLL en VLB *loci* gekenmerkt werden door de aanwezigheid van kleine (4-5 cm) en voor het "Midden-Paleolithicum" zelfs "atypische" werktuigen. Parallelle assemblages die goed met de VLL en VLB assemblages vergeleken kunnen worden, zijn niet direct aanwijsbaar. De "Midden-Paleolithische Mens" heeft waarschijnlijk meermaals de VLL en VLB *loci* bezocht, om er in het grint van het "bron-amfitheater" naar silex te zoeken. Dit wordt geïllustreerd door een aantal geteste kernen die daar gevonden werden. De VLL en VLB *loci* kunnen dus als openlucht "vuursteen-extractieplaatsen" geïnterpreteerd worden. Dit betekent, dat alle gedebiteerde vuursteen op de VLL en VLB *loci*, behalve die ene *Levallois*-kern, waarschijnlijk lokaal gewonnen werd.

Het jongere VBLB lithisch assemblage, dat in de bovenste grijsachtige Bth-horizont van het "Rocourt-Bodemcomplex" aangetroffen werd, moet waarschijnlijk tegen het einde van het Laatste Interglaciaal *s.l.* (laat MIS 5) gedateerd worden. We willen hier ook benadrukken, dat er in de "Eem-Bodem" (MIS 5e) te Veldwezelt-*Hezerwater* geen artefacten aangetroffen werden. Opvallend is ook, dat er gedurende de prospecties in andere leemgroeves in de buurt, ook nooit artefacten aangetroffen werden in de "Eem-Bodem". Ook in het Verenigd Koninkrijk, Noord-Frankrijk, Nederland en in het Westen van Duitsland, zijn er geen artefacten uit de "Eem-Bodem" bekend. Deze vaststelling schijnt erop te wijzen, dat dit deel van Noordwest-Europa grotendeels onbewoond was gedurende het "Eem *s.s.*" (MIS 5e), dat gekenmerkt werd door een erg uitgesproken "oceanisch" klimaat, met warme, vochtige zomers en zeer zachte winters. De Eem-vegetatie was waarschijnlijk veel te dicht voor de "Midden-Paleolithische" jagers, die het vooral van de jacht op de grote kuddedieren moesten hebben. Kuddedieren zijn altijd afwezig in de grote wouden, waar er meestal maar solitaire dieren voorkomen.

We hebben ook kunnen vaststellen, dat het lithische assemblage van de VBLB *locus* te Veldwezelt-*Hezerwater* grotendeels op *Levallois*-kernreductie gebaseerd was. De originele, min of meer sferische vuursteenknol die op de VBLB *locus* gedebiteerd werd, moet waarschijnlijk ook in de onmiddellijke omgeving van de *locus* gewonnen zijn. Waarschijnlijk in het nabije Maasterras. De *toolkit* van de VBLB *locus* wordt vooral gekenmerkt door de aanwezigheid van enkele unifaciale boordschrabbers. Daarnaast werden er ook nog twee kleinere bifaciale werktuigen (schrabber & bladspits) aangetroffen. Het eigen karakter van het VBLB assemblage, vertoont globaal genomen geen enkel punt van overeenkomst met de laminaire assemblages die op de VLL en VLB *loci* aangetroffen werden. Ze zijn fundamenteel verschillend.

Kenmerkend is ook het feit, dat we naast de debitage-plek in het zuidelijke deel van de VBLB *locus*, die gekenmerkt wordt door de aanwezigheid van relatief veel debitage-materiaal, ook nog een andere “functionele” zone in het noorden van de VBLB *locus* kunnen onderscheiden. Deze noordelijke zone werd door de “Midden-Paleolithische Mens” gebruikt om er “niet-debitage-activiteiten” uit te voeren. We hebben dit kunnen vaststellen op basis van de aanwezigheid van de werktuigen in deze noordelijke zone. Dit is duidelijk in tegenstelling met de zuidelijke “debitage-zone”, waar we geen werktuigen hebben kunnen vinden. Dit schijnt er op te wijzen, dat er op de VBLB *locus* blijkbaar toch sprake geweest moet zijn van een zekere “ruimtelijke organisatie”. De grotere afslagen (“*tool blanks*”), die uit de *Levallois*-kernreductie sequentie afkomstig waren, werden dus op één welbepaalde plek in het zuidelijke gedeelte van de *locus* geproduceerd. Echter, deze langere afslagen werden daarna als “werktuig *s.l.*” gebruikt in het noordelijke gedeelte van de VBLB *locus*. Deze noordelijke “werktuig-gebruikszone” werd verder ook nog gekenmerkt door de aanwezigheid van houtskoolresten, hetgeen op de nabijheid van een haard duidt.

Het voorkomen van het VBLB assemblage kan, in tegenstelling tot de assemblages van de VLL en VLB *loci*, goed vergeleken worden met de assemblages uit het Laatste Interglaciaal *s.l.* die op de “Midden-Paleolithische” sites in Noord-Frankrijk werden aangetroffen. Inderdaad, de meeste Noordwest-Europese assemblages uit de tweede helft van het Laatste Interglaciaal *s.l.* worden gekenmerkt door een typische technologie die op *Levallois*-kernreductie gebaseerd is. Opvallend is ook, dat deze *Levallois*-producten meestal “*medium-sized*” (6-8 cm) zijn, hetgeen duidelijk in tegenstelling is met de over het algemeen veel grotere *Levallois*-producten die bijvoorbeeld in de assemblages van de Noordwest-Europese Weichsel-sites gevonden worden.

De artefacten die op de TL-R, TL-GF, TL-W en de WFL *loci* te Veldwezelt-*Hezerwater* opgegraven werden, stammen op basis van stratigrafisch onderzoek waarschijnlijk uit de eerste helft van het Midden-*Weichsel* (eerste helft MIS 3). Opmerkelijk is dat deze *loci* zich in de lager gelegen delen langs het *Hezerwater* bevonden. De lemige matrix waarbinnen deze *loci* aangetroffen werden, was in meer of mindere mate kalkhoudend. Naast lithische artefacten werden er ook botten en kiezen van een typisch interstadiale fauna aangetroffen. De bewaring van de faunaresten op de TL *loci* was echter minimaal, zodanig dat er niet tot een goede determinatie van de vondsten gekomen kon worden. De bewaring van het botmateriaal en de kiezen op de WFL *locus* was veel beter. De macrofauna-resten die op de WFL *locus* aangetroffen werden, worden ondermeer gekenmerkt door de aanwezigheid van paard, bizon, rendier, wolharige neushoorn, mammoet, holenleeuw, holenhyena, poolvos en haas. Opmerkelijk is ook de aanwezigheid van de das, de mol en kikkers op de WFL *locus*. Deze soorten kunnen alleen maar overleven in relatief warme milieus. De aanwezigheid van deze soorten en de vrij intense bodemvorming op de WLF *locus*, schijnen erop te wijzen dat het klimaat, tenminste voor een relatief korte periode, betrekkelijk warm geweest moet zijn. Het winterseizoen was in verhouding waarschijnlijk redelijk koud. We denken echter, dat het klimaat toen min of meer gelijkaardig was aan het klimaat wat nu in Zuid-Scandinavië heerst. De beenderen van de grote zoogdieren zijn waarschijnlijk de overblijfselen van de jachtactiviteiten van de “Midden-Paleolithische Mens” in de *Hezerwater*-vallei. Paard, rendier en bizon waren waarschijnlijk uiterst geschikte prooidieren. We moeten echter ook opmerken, dat de mammoet geen volwassen dier was, maar in feite nog erg jong was. Dus, de mogelijkheid bestaat dat ook die jonge mammoet gejaagd geweest is. Helaas was de bewaringstoestand van de beenderen niet van dien aard om er eventueel nog snijsporen van menselijke verwerkingsactiviteiten op te kunnen herkennen. In elk geval is de “Midden-Paleolithische Mens” hier actief geweest. Dat bewijst de aanwezigheid van een aantal stenen werktuigen.

De lithische assemblages van de TL en WFL *loci* worden gekenmerkt door het tegelijkertijd aanwezig zijn van *Levallois*-producten en *Quina*-werktuigen. Deze Midden-Weichsel assemblages wijken met de aanwezigheid van grote *Levallois*-producten en grote *Quina*-werktuigen zeer duidelijk af van de Laat-Saale en Interglaciale assemblages die te Veldwezelt-*Hezerwater* opgegraven werden. Op de TL en WFL *loci* zien we duidelijk de aanwezigheid van geïmporteerde "*Lanaye*-vuursteen" (afstand: 3,5 tot 10 km). Op de WFL *locus* zien we ook de aanwezigheid van translucide "*Haspengouw*-vuursteen" (afstand: 40 tot 70 km) en glimmende "*Wommersom*-kwartsiet" (afstand: 45 km). We moeten hier ook opmerken, dat openluchtsites die gekenmerkt worden door de aanwezigheid van *Quina*-werktuigen vrijwel onbekend zijn in Noordwest-Europa gedurende het Midden-Weichsel. *Quina*-assemblages zijn natuurlijk wel gekend uit bijvoorbeeld de grotten van de Maasvallei. Dit schijnt er toch ook op te wijzen, dat openluchtsites en grotsites wel op een heel verschillende manier tot stand gekomen moeten zijn. Ook is er nog een mogelijke link tussen deze *Quina*-assemblages en de zogenaamde "*Keilmessergruppe*-assemblages" uit Centraal-Europa.

Te Veldwezelt-*Hezerwater* hebben we kunnen vaststellen, dat de menselijke aanwezigheid gedurende de eerste helft van het Midden-Weichsel vrij intensief moet zijn geweest. Echter, we veronderstellen dat er waarschijnlijk geen sprake was van een continue bewoning, maar veeleer denken we aan een "gepunctueerde" aanwezigheid van de "Midden-Paleolithische" mens in Noordwest-Europa gedurende de gematigde interstadialen van het Midden-Weichsel. Vervolgens is er nauwelijks bewijs voor menselijke aanwezigheid gedurende de tweede helft van het Midden-Weichsel te Veldwezelt-*Hezerwater* en ook gedurende het Laat-Weichsel is er geen spoor van bewoning terug te vinden. Dit wil natuurlijk niet zeggen, dat er gedurende deze periodes *überhaupt* geen bewoning is geweest in Noordwest-Europa. Er is natuurlijk bewijs voor menselijke aanwezigheid in enkele grotten. Maar, we veronderstellen toch dat gedurende de tweede helft van het Midden-Weichsel en zeker gedurende het Laat-*Weichsel*, de aanwezigheid van de mens in Noordwest Europa minimaal geweest moet zijn, afgezien van een paar korte warmere periodes met menselijke bewoning.

Meer algemeen kunnen we stellen, dat alle *Levallois*-producten die te Veldwezelt-*Hezerwater* ontdekt werden, gemaakt werden van exotische, fijnkorrelige, sferische vuursteenknollen (VLB, TL & WFL *loci*). Verder is het opmerkelijk, dat de klingachtige afslagen die op de VLL en VLB *loci* gevonden werden, van grofkorrelige vuursteenknollen gemaakt werden. Opvallend is dat bij de prismatische kernreductie de oorspronkelijke langwerpige morfologie van de vuursteenknollen een zeer grote rol gespeeld schijnt te hebben. Op de VLB *locus* werd er naast prismatische kernreductie ook aan *Levallois*-kernreductie gedaan. Op de TL *loci* zien we trouwens ook, dat er naast *Levallois*-kernreductie op geïmporteerde, sferische vuursteenknollen, ook nog plaats was voor prismatische-kernreductie op lokaal gewonnen, langwerpige vuursteenknollen. We mogen dus veronderstellen, dat dezelfde Midden-Paleolithische vuursteenbewerkers verscheidene kernreductie-strategieën op eenzelfde site hebben toegepast. Alleen al de kwaliteit en de vorm van de oorspronkelijke vuursteenknollen kan het toepassen van dergelijke divergente reductiestrategieën verklaren. Wat de *toolkits* betreft te Veldwezelt-*Hezerwater*, kunnen we stellen, dat de VLL en VLB *loci* gekenmerkt worden door kleine werktuigen (4-5 cm). De werktuigen, die op de VBLB-*locus* opgegraven werden, waren van middelmatige grootte (6-8 cm). Ze waren unifaciaal en soms ook bifaciaal geretoucheerd. De werktuigen die op de TL en WFL *loci* aangetroffen werden, waren dan weer extra groot (> 8 cm). Van alle werktuigen die te Veldwezelt-*Hezerwater* gevonden werden, beantwoorden de "ijstijd-werktuigen" van de TL en WFL *loci* het best aan het verwachtingspatroon. Inderdaad, deze werktuigen zijn "typische", wat we zouden kunnen noemen, "Mousteriaan-werktuigen".

Echter, we zien dat de technologische ontwikkeling van de werktuigen doorheen de tijd te Veldwezelt-*Hezerwater* gaat van "klein" (4-5 cm), over "middelgroot" (6-8 cm), naar "groot" (> 8 cm). Dit is eigenlijk toch wel merkwaardig, vermits er meestal net het tegenovergestelde beweerd wordt, als er enkel maar naar het Weichsel gekeken wordt. In de loop van het Weichsel zien we inderdaad eerder een "geleidelijke" reductie in de omvang van de werktuigen. Maar, deze trend is enkel geldig voor het Weichsel. Het blijkt namelijk, dat interglaciale werktuigen meestal middelgroot zijn, terwijl de interstadiale werktuigen uit het Weichsel over het algemeen zeer groot zijn. De werktuigen uit het Jong-Paleolithicum en het Laat-Weichsel blijken dan over het algemeen weer veel kleiner te zijn dan de typische Midden-Paleolithische Weichsel-werktuigen. Echter, te Veldwezelt-*Hezerwater* hebben we in het Laat-Saale ook al de aanwezigheid van kleine tot zeer kleine werktuigen kunnen vaststellen. We kunnen ons terecht de vraag stellen wat dit allemaal te betekenen heeft. Werden deze werktuigen uit het Laat-Saale misschien geschacht? Voorlopig kunnen we die vraag echter nog niet goed beantwoorden.

Wel kunnen we veronderstellen, dat de grote TL en WFL "Mousteriaan-werktuigen" uit het Midden-Weichsel te Veldwezelt-*Hezerwater*, het gevolg zijn van een technologische adaptatie aan koelere klimaten. We kunnen ons terecht de vraag stellen in hoeverre hier seizoenale factoren ook nog een rol gespeeld hebben. Indien er op de TL en WFL *loci* een klimaat heerste dat inderdaad te vergelijken zou zijn met een relatief warm, Zuid-Scandinavisch klimaat, dan kunnen we stellen dat de zomers weliswaar warm waren, maar dat de winters ook koud en vooral erg sneeuwrijk geweest moeten zijn. De zomermaanden vormden dan in principe geen echt probleem voor de "Midden-Paleolithische" bewoners van Noordwest-Europa, maar de sneeuwrijke wintermaanden zouden misschien bijzondere technologische adaptaties vereist hebben. Naast eventuele seizoenale migraties naar meer zuidelijk gelegen gebieden, zouden we kunnen veronderstellen, dat het gebruik van *Quina*-werktuigen op de TL en WFL *loci* te Veldwezelt-*Hezerwater* en andere sites een technologisch antwoord was op de koude, sneeuwrijke en "gevaarlijke" winters uit het Midden-Weichsel. Blijkbaar moet hier in verband met de voedselbevoorrading een kritische grens overschreden geweest zijn die dergelijke technologische adaptaties noodzakelijk maakte. We hebben op de TL en WFL *loci* kunnen vaststellen, dat de *Quina*-werktuigen waarschijnlijk kant en klaar geïmporteerd werden. Er was inderdaad geen enkele aanwijzing te vinden dat ze eventueel lokaal vervaardigd werden. Deze werktuigen werden waarschijnlijk door rondtrekkende groepjes jagers meegenomen naar de TL en WFL *loci* te Veldwezelt-*Hezerwater* en daar achtergelaten.

Opmerkelijk is ook, dat de *Quina*-werktuigen, die op de TL en WFL *loci* te Veldwezelt-*Hezerwater* gevonden zijn, op goede fijnkorrelige "*Lanaye*-vuursteen" werden gemaakt. Dit is eigenlijk ook weer tegenstrijdig met de bewering dat *Quina*-werktuigen altijd van inferieure vuursteen werden gemaakt, zoals dit blijkbaar vooral in de grotten in het Zuiden van Frankrijk en in Wallonië gebeurde. Wij veronderstellen echter, dat de productie van *Quina*-werktuigen weinig met inferieure vuursteen te maken had, maar waarschijnlijk het gevolg was van de klimatologische en ecologische context waarbinnen deze werktuigen functioneerden. We veronderstellen, dat de "Midden-Paleolithische Mens" die gedurende het Midden-Weichsel hier in onze streken moesten overleven, altijd op "veilig" speelde. De grote, zware en "veilige" *Quina*-werktuigen zijn hiervan waarschijnlijk de materiële uitdrukking. Wij veronderstellen, dat deze *Quina*-werktuigen in alle omstandigheden moesten "functioneren". Ze mochten dus gedurende het gebruik zeker niet breken. "Veiligheid" betekende voor deze "Midden-Paleolithische" jagers, die op de TL en WFL *loci* actief waren, vooral "efficiëntie", "snelheid" en dus de voorafgaandelijke productie van betrouwbare stenen werktuigen.

Inderdaad, het exacte ogenblik waarop wilde dieren ergens opdoken, was waarschijnlijk grotendeels onvoorspelbaar. Deze "Midden-Paleolithische" jagers moesten hun jachtwapens (waarschijnlijk houten werpsperen) en hun werktuigen dus altijd bij de hand hebben. Ze wilden waarschijnlijk ook geen tijd verliezen met de productie ter plaatse van nieuwe werktuigen om de jachtbuit te verwerken. Dit zou trouwens ook geen sinecure geweest zijn, bijvoorbeeld in het midden van de winter wanneer het landschap met een dik sneeuwtapijt bedekt was. Interessant is in dit verband ook het gegeven, dat er op de laaggelegen TL en WFL *loci* te Veldwezelt-*Hezerwater* geen aanwijzingen voor "vuur" zijn gevonden. Het sprokkelen van hout zou door het sneeuwpakket bemoeilijkt worden en het is nog maar de vraag of men vochtig hout *überhaupt* makkelijk aan het branden kon krijgen. Blijkbaar hebben de "Midden-Paleolithische" jagers hun jachtbuit snel verwerkt en hebben ze vervolgens de TL en WFL *loci* ook weer vlug verlaten, zonder zich nog om veel andere zaken te bekommeren. We mogen trouwens ook niet vergeten, dat er in de buurt holenleeuwen en holenhyena's rondzwierven die door de geur van het bloed van de gedode dieren van heinde en verre aangetrokken werden. Het vlees werd dus waarschijnlijk snel naar het "basiskamp" getransporteerd.

De werktuigen die de "Midden-Paleolithische" jagers op de TL en WFL *loci* gebruikt hadden, werden dus gewoon terplekke achtergelaten. Deze werktuigen hadden blijkbaar geen enkele waarde meer voor hen. De jagers gingen dus blijkbaar rechtstreeks naar het "basiskamp" terug, zonder dat ze deze werktuigen nog eens nodig dachten te hebben. De jagers wisten, dat er in het "basiskamp" voldoende vuursteen en stenen werktuigen aanwezig zouden zijn, die ze bij een volgende jachtpartij konden gebruiken. Een andere hypothese is, dat deze mensen wisten waar ze makkelijk aan vuursteen konden raken. De extractie van vuursteen en de productie van stenen werktuigen zou dan een autonoom proces zijn, dat volledig los stond van de jachtactiviteiten. Met ander woorden, gedurende de jacht zelf werden er in principe dus geen werktuigen geproduceerd, tenzij in "noodgevallen". Hoe dan ook, de *Quina*-werktuigen, die na gebruik gewoon op de TL en WFL *loci* achtergelaten werden, waren op dat moment dus enkel maar overtollige ballast. Het lijkt er zelfs op, dat na de jacht en de verwerking van de jachtbuit op de TL en WFL *loci*, het vlees gewoon een veel grotere waarde had dan de stenen werktuigen. De zware *Quina*-werktuigen hadden blijkbaar naar behoren gefunctioneerd en ze werden vervolgens dus gewoon terplekke achtergelaten.

We moeten blijkbaar dan ook niet redeneren in termen van "vuursteenschaarste". Integendeel, want zelfs gedurende het Midden-Weichsel werd er op de TL en WFL *loci* te Veldwezelt-*Hezerwater* blijkbaar op een zeer kwistige manier met geïmporteerde, fijnkorrelige "*Lanaye*" en "*Hesbaye*" vuursteen omgesprongen. "Vuursteenschaarste" zou men eerder kunnen inroepen op de VLL en VLB *loci*, waar er lokale grofkorrelige vuursteen gebruikt werd. Echter, de fijnkorrelige *Levallois*-kern die op de VLB *locus* werd aangetroffen, was ook van een uitstekende kwaliteit. Deze vuursteen moet dus zeker ook geïmporteerd geweest zijn. "Vuursteenschaarste" moet dus nauwelijks een rol gespeeld hebben. Het lijkt erop, dat deze "Midden-Paleolithische" vuursteenbewerkers op een zeer "opportunistische" manier tewerk gegaan zijn. De lokaal aanwezige lithische grondstoffen werden meestal eerst geëxploiteerd (VLL, VLB & VBLB *loci*). Indien er om bepaalde redenen toch vuursteen van een betere kwaliteit nodig bleek te zijn, dan beschikten deze mensen blijkbaar over een voorraad vuursteen en werktuigen, die meteen aangesproken kon worden (TL & WFL *loci*). Het is inderdaad opvallend, dat op de TL en WFL *loci* de lokale vuursteen nauwelijks of niet gebruikt werd, en dit ondanks het feit dat er ook toen lokale vuursteen beschikbaar was. Blijkbaar moeten er gedurende het "Midden-Paleolithicum" complexe strategieën van transport van stenen kernen en werktuigen in de *Hezerwater*-vallei bestaan hebben.

We moeten ons ook afvragen in hoeverre we echt van "Midden Paleolithische Culturen" kunnen spreken? We zijn er echter van overtuigd, dat er zeker "Midden Paleolithische Culturen" bestaan hebben. Maar, wij zijn er aan de ander kant toch ook van overtuigd, dat we het begrip "cultuur" enkel en alleen maar in antropologische zin moeten en kunnen begrijpen. "Culturen" worden volgens ons best begrepen als evoluerende configuraties van (1) cognitie, (2) emotie en (3) gedrag. In die optiek zouden we kunnen stellen, dat de invloed van de individuele "Midden Paleolithische Cultuur" en de invloed van de supra-organische "Midden Paleolithische Culturen" van groepen van mensen op de uiteindelijke vorm van de stenen werktuigen minimaal moet zijn geweest. Wij veronderstellen dan ook, dat er eerder een complex web van dynamische relaties tussen stenen grondstoffeneconomie, reductiestrategieën, lithische breukmechanica en bepaalde ecologische milieus bestaan moet hebben. De invloed die er uiteindelijk van een "Midden Paleolithische Cultuur" uitging op de definitieve morfologie van de stenen werktuigen, moet in de meeste gevallen dan ook door dit complex web van relaties vrijwel volledig geoblitereerd geweest zijn.

De zogenaamde "Mammoet-steppe" was duidelijk het geprefereerde leefmilieu van deze "Midden-Paleolithische" jagers. Inderdaad, alle sites te Veldwezelt-*Hezerwater* hebben een "interglaciaal *s.l.*" of "interstadiaal" karakter. Deze mensen hielden van gematigde klimaten en milieus. Dus, niet te warm en vochtig en niet te koud en droog. Deze voorkeur van de "Midden-Paleolithische Mens" resulteerde in Noordwest-Europa in het feit dat hij enkel maar in een relatief "open" landschap aanwezig was. In een dergelijk "open" landschap trokken de grote kuddes dieren rond die enkel daar voldoende gras vonden om te kunnen overleven. Grote roofdieren zoals de holenleeuw en de holenhyena maakten jacht op deze kuddedieren. Echter, we veronderstellen dat de "Midden-Paleolithische Mens" als het echte "*super-predator*" beschouwd moet worden. Maar, wanneer de grote kuddes dieren in een bepaald gebied verdwijnen, dan zien we de mens ook verdwijnen. Er is geen enkele aanwijzing, dat er mensen in de *Hezerwater*-vallei aanwezig waren onder echt koude en droge of echt warme en vochtige klimatologische omstandigheden. Dit feit moet toch te maken hebben met hun levenswijze die er vooral op gericht moet zijn geweest om jacht te maken op de grote zoogdieren die in kuddes door het "open" landschap trokken. Als het te koud was, waren die kuddes niet aanwezig in Noordwest-Europa en binnen de interglaciale climax-bossen zijn er dus evenmin grote kuddes te vinden, maar veeleer solitaire dieren.

De *Hezerwater*-vallei vormde naast de *Jeker*-vallei één van de belangrijkste natuurlijke verbindingswegen tussen het Maasdal en de hoger gelegen *Haspengouw*. Beiden worden gekenmerkt door een eigen biotoop met rijke voedsel- en grondstoffenbronnen. Deze twee erg verscheiden milieus met het iets verder gelegen grottenlandschap van de Maasvallei, boden uitstekende gelegenheden aan de "Midden-Paleolithische Mens" van Veldwezelt-*Hezerwater* om in hun dagelijks onderhoud te kunnen voorzien. Wij beschouwen de "Midden-Paleolithische Mens" dan ook niet als een wezen dat gebonden was aan één bepaald milieu. Integendeel, wij denken dat de "Midden-Paleolithische Mens" door middel van kennis en technologie op een gepaste en actieve manier kon reageren op veranderingen en onregelmatigheden in zijn leefomstandigheden.