1. INTRODUCTION

The stretch of land on the left bank of the now dry Hezerwater valley in the Vandersanden brickyard quarry at Veldwezelt-Hezerwater (Lanaken, Province of Limburg, Belgium) has been an advantageous location for human settlement throughout the late Middle and Late Pleistocene. For several years, the Vandersanden company exploited the loamy fill of the asymmetrical Hezerwater valley. The exploitation started in 1995 and came to an end in 2002. Over the last three decades, increasing attention has been paid by archaeologists to these types of open-air quarries. Particularly in the European loess belt, researchers have invested much energy in excavating large portions of open-air sites. It was thus probable that also at the Vandersanden brickyard quarry Palaeolithic remains would be discovered. In order to deal with the expected archaeological finds in a structured way, Prof. Dr. Pierre M. Vermeersch (Laboratory of Prehistory - Katholieke Universiteit Leuven, Belgium) stepped in and started the "Veldwezelt-Hezerwater Project" in 1995.

The six successive summer excavation campaigns by the Laboratory of Prehistory (Katholieke Universiteit Leuven, Belgium) at Veldwezelt-Hezerwater provided important remains of several stratigraphically separate archaeological assemblages (Bringmans 2001;
Bringmans et al. 2001, 2002, 2003, 2004a,b; Vanmontfort et al. 1998; Vermeersch 2001). During this fieldwork, the remainders of ancient human occupation were repeatedly found. Except for the presence of charcoal (835 pieces) and animal bones (613 fragments), the Middle Palaeolithic finds at Veldwezelt-Hezerwater were exclusively lithic artefacts. More than 2,500 flint artefacts were excavated at the different loci [spots where concentrations of artefacts were found]. One of the goals of the "Veldwezelt-Hezerwater Project" is the analysis of the Middle Palaeolithic occupation in this part of Northwest Europe in the context of rapidly changing climates and landscapes between ca. 190,000 and 35,000 years ago.

The question how climate change did match the resource needs and the adaptive capability of Middle Palaeolithic humans was addressed. However, the task of assessing connections between lithic Middle Palaeolithic technology and the changing environment has been made more complex by recent Quaternary studies, which show that the late Middle and Late Pleistocene climate was very unstable. Indeed, the major climatic changes recorded in the Greenland ice cores created a sensation among Quaternary researchers. Known as the "Heinrich Events" (H) (Heinrich 1988) and the "Dansgaard/Oeschger Cycles" (D/O) (Dansgaard et al. 1984; Dansgaard et al. 1993), the unstable, strikingly bipolar climate contrasted sharply with the conventional image of a long, slowly cooling, but stable (Weichselian) climate. However, climate instability was not only confined to the Weichselian ice age, but appears to have characterised the Last Interglacial s.l. and the Saalian ice age as well. These findings have led to an even greater awareness of the potential role of climate change and the palaeoenvironment in the Pleistocene human past.

An important terrestrial source of climate information is furnished by the late Middle and Late Pleistocene loess deposits, which mantle large parts of Northwest Europe. These loess-soil sequences provide excellent high-resolution terrestrial archives of climate forcing, because the sections show cycles of deposition of loess during cold stadials, alternating with milder climates, landscape stabilisation and soil formation during temperate interstadials. Not only the loess-soil sequence at Veldwezelt-Hezerwater (Gullentops et al. 1998; Gullentops & Meijs 2002; Meijs 2002), but also the loess-soil sequences in Northwest France (e.g., Antoine et al. 1999) and in the German Rhine valley (e.g., Schirmer 1999, 2000, 2002) confirm that the climate in Northwest Europe was subject to periods of warming that stopped the loess accumulation. These pauses in loess accumulation lasted (mostly) long enough for soils to develop. Nevertheless, really hard data to reconstruct the palaeoenvironment at a particular spot at a particular time is usually very sparse. Furthermore, the general late Middle and Late Pleistocene loess-soil chronological framework still lacks the temporal resolution, which is effectively needed to illuminate Middle Palaeolithic technological evolution under rapid climate changes.

2. SUMMARY OF THE VELDWEZELT-HEZERWATER ARCHAEOLOGICAL AND PALAEOENVIRONMENTAL DATA

We will briefly discuss the 8 loci at Veldwezelt-Hezerwater separately. Table 1 summarises the artefact frequencies recovered from the six field seasons at Veldwezelt-Hezerwater. Overall, the lithic assemblages contain a large number of chips (< 1 cm) and flakes (≥ 1 cm & < 20% cortex). Cortical flakes (20-95% cortex) are also abundantly present. Primary decortication flakes (≥ 95% cortex), on the other hand, seem to be quite rare. Core types include "centripetal", "parallel" and "opportunistic" cores, with single, opposed and multiple platforms. The "centripetal" core reduction technique (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 spiralling toward the centre by rotating the core with each new blow. Evidence of the "Levallois" technique at Veldwezelt-Hezerwater is combined with the more generalised centripetal core reduction. At Veldwezelt-Hezerwater, "Levallois" products are only abundantly present in the VBLB, TL and WFL lithic assemblage. "Levallois" products are virtually absent in the VLL and VLB lithic assemblages.

On the other hand, the "parallel" core reduction technique (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 opposing platforms located at both ends of a core. Parallel cores are 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 techniques (centripetal or parallel) are labelled "opportunistic" pieces. Most of the cores excavated at Veldwezelt-Hezerwater are relatively small and it is difficult to escape the impression that the cores were discarded at or near the end of their use lives. The small size of the cores, in relation to the sizes of the complete flakes and blades, and the "trimming" flakes excavated at the different loci, suggests that most of the core reduction sequence occurred at these loci. It is important to realise that the parallel core reduction technique at Veldwezelt-Hezerwater is very similar but not identical to the prismatic blade core reduction techniques of the Upper Palaeolithic (e.g., Révillion 1995). However, the Veldwezelt-Hezerwater Middle Palaeolithic version is decidedly less complex, beginning only with platform preparation at one or both ends of a flint nodule. Nevertheless, the crested blade core reduction technique (e.g., Révillion & Tuffreau 1994), in which a ridge is created along the length of a flint nodule to guide the initial removals is also attested at the VBLB locus.

Table 1. Artefact Frequencies (N) at the Veldwezelt-Hezerwater Loci

<table>
<thead>
<tr>
<th></th>
<th>VLL</th>
<th>VLB</th>
<th>VBLB</th>
<th>VBLB-S</th>
<th>TL</th>
<th>WFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Centripetal&quot; Cores</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>&quot;Parallel&quot; Cores</td>
<td>19</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>&quot;Opportunistic&quot; Cores</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total Cores</td>
<td>23</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>VLL</th>
<th>VLB</th>
<th>VBLB</th>
<th>VBLB-S</th>
<th>TL</th>
<th>WFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cores</td>
<td>23</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Primary Decortication Flakes</td>
<td>25</td>
<td>20</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Cortical Flakes</td>
<td>170</td>
<td>120</td>
<td>53</td>
<td>23</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Flakes</td>
<td>280</td>
<td>215</td>
<td>104</td>
<td>22</td>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>Blades</td>
<td>23</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
The first two loci at Veldwezelt-Hezerwater are located in a side-valley of the Hezerwater brook. There, a small gully created a slope, stable enough to allow the development of incipient soils (VLL & VLB). Both the VLL and the VLB soils contain artefacts and the VLB soil especially, contains numerous charcoal pieces, identified as Pinus silvestris (determination by F. Damblon, Royal Belgian Institute of Natural Sciences Brussels, 1998). This gully was filled by coarse silts with discontinuous laminae granules (GSL).

According to the most probable working hypothesis, this sequence belongs to the late Saalian and represents consequently the terrestrial equivalent of MIS 6. The lithic assemblages of the VLL and VLB Loci (n = 795 & 687 artefacts respectively) are situated on the slopes of this side-valley. Beside many small flakes and blades, several small bipolar cores for blades with carefully prepared striking platforms were found. Most artefacts, especially those made from local flint, show a clear trend towards parallel core reduction. Nevertheless, a few centripetal cores were also found, however these seemed to be made from imported flint. The small dimensions of the artefacts of the VLL and VLB loci are clearly determined by the character of the locally available raw material. Several refits have been found, suggesting a restricted artefact movement. The VLL and VLB lithic assemblages also yielded many tested flint.
nodules as well as large quantities of lithic waste material. Only a few tools, mostly
denticulated pieces, were excavated. The raw material found at these sites is of low quality. In
many cases, the flint nodules show a natural elongated shape.

At the VLL and VLB loci, which are also known as "the Lower Sites" at Veldwezelt-
Hezerwater, there is clearly evidence for deliberate selection of raw material, because those
elongated flint nodules were preferentially worked into blade cores. Middle Palaeolithic
humans came here to search the gravel-bed for those elongated flint nodules. The hypothesis
that surface flint quarrying activities were going on at the VLL and VLB loci seems to be
valid. The flint-rich gravel-bed itself and the gently sloping banks of the side-valley were
indeed an obvious location for Middle Palaeolithic humans to manufacture their flakes, blades
and tools. This sometimes dry gravel-bed was thus repeatedly used as a source of coarse flint
by Middle Palaeolithic humans. By the time that the flint knappers were working on the
gravel-bed and on the river banks here in the Hezerwater valley, the surrounding area would
have been covered by fresh Late Saalian loess deposits, but the surrounding area would also
have been partially covered with new boreal vegetation (e.g. pine trees).

The VLL and VLB loci were thus finally covered with colluvial sediments. In these new
sediments a remarkable succession of several Bt-horizons (PGB, RB & VBLB) separated by
bleached and humic zones can be observed. Only one of these Last Interglacial s.l. Bt-
horizons, namely the VBLB, contains artefacts and many charcoal pieces, identified as Betula
sp. (determination by F. Damblon, Royal Belgian Institute of Natural Sciences Brussels,
1998). The dark humic zone (OHZB) contains the expected volcanic minerals with enstatite,
which of course is an important stratigraphic marker. This very detailed succession of mature
soils and humic horizons, representing the "Rocourt soilcomplex" covered by the "Warneton
soilcomplex", gives a fairly complete image of the complex terrestrial climatic fluctuations
during the Last Interglacial s.l. (MIS 5).

The artefacts (n = 350) of the VBLB Locus were excavated in the upper Bt-horizon of the
Last Interglacial soilcomplex with a maximal vertical artefact distribution of less than 30 cm.
The lithic assemblage of this locus is primarily characterised by the predominance of
centripetal (Levallois) flakes and only two centripetal core. Some side-scrapers, a déjeté side-
scraper, a bifacial single convex side-scraper and one bifacial foliate were also excavated. The
largest concentration of artefacts at the VBLB locus comprises a centripetal core, large and
small (Levallois) flakes, debitage waste and chips. All the lithic material of this area belongs
to a single raw material unit and all refits are connected with this concentration. This is
probably the spot where Middle Palaeolithic humans produced their blanks in a centripetal core
reduction sequence. However, the tools were used in the northern zone at the VBLB locus.

Most of the larger artefacts of the VBLB-South Locus were excavated in the upper Bt-horizon of the
Last Interglacial soilcomplex. The lithic assemblage (n = 75) is primarily characterised
by the dominance of centripetal core reduction. A number of (Levallois) flakes, core-edge
flakes and some Pseudo-Levallois points have been excavated. No cores were found at the
VBLB-South locus.

The loess, loess-derived sediments and the many intercalating fossil soils overlying the Last
Interglacial soilcomplex belong to the Weichselian s.s., representing the terrestrial equivalent
of MIS 4, 3 and 2. Here a complex stratigraphy has been established, with several horizons
containing microfauna and abundant mollusc shells. The TL-R, TL-GF and TL-W Loci are
situated on the east facing valley-side of a Middle Weichselian Hezerwater gully. The
excavated artefacts (n = 57, 27 & 29 respectively) are related to the fill of this gully-system and not to the erosional process itself. These lithic assemblages comprise centripetal and opportunistic cores, several (Levallois) flakes and a few very large retouched flakes. A typical Quina transverse convex side-scraper and two other Quina side-scrapers have also been excavated in these loci. The Middle Weichselian TL loci are thus characterised by the presence of centripetal core reduction and Quina tools.

In the WFL horizon, an incipient red soil of Middle Weichselian age, several artefacts and an important number of mammalian remains have been recovered. The artefacts (n = 133) of the WFL locus, the bones (n = 500) and the teeth (n = 59) excavated here clearly relate to this homogenised soil. The lithic material is made up of one parallel, one unipolar lineal and one bipolar centripetal core, (Levallois) flakes and two Quina side-scrapers. Again the lithic assemblage of this, somewhat younger than the TL loci, Middle Weichselian WFL locus is characterised by the presence of centripetal core reduction and Quina tools. The faunal assemblage of the Middle Weichselian WFL locus comprises, based on preliminary assessments, cold period faunas including species such as mammoth, horse, woolly rhino, steppe bison, reindeer, cave hyena, cave lion, polar fox and badger. This is indeed a typical steppe fauna, although the presence of the badger indicates that the climate was not really cold. Gnawing marks of hyena have been observed, although no cut marks have been identified on the bones at present (J.-M. Cordy, University of Liège, 2001).

3. DISCUSSION: HUMAN PRESENCE AND LITHIC VARIABILITY AT VELDWEZELT-HEZERWATER

Now, we could try to answer the question why there is such a variation in lithic technology (parallel, centripetal & opportunistic core reduction), in the morphologies of the blanks (flakes, blades & points) and in the types of tools ("typical", notched, denticulated & Quina tools) present in the different Middle Palaeolithic assemblages at Veldwezelt-Hezerwater. Middle Palaeolithic assemblage variability has, until very recently, been based almost exclusively upon typological systematics, which emphasise retouched tools. "Cultural" transition is, therefore, usually demarcated by changes in retouched tool components. In the past, some degree of ethnic connectivity was often invoked to explain these patterns. This view arises from the tendency to see Palaeolithic stone tools as broadly analogous to their modern counterparts, which are functionally specialised and in which form and function are highly correlated (Barton 1991). Now, pure technological approaches seem to gain ground. However, there is a growing tendency to interpret these technological patterns also in terms of the same kinds of "cultural" factors invoked to explain patterns in retouched stone tools. Moreover, technological "progress" is often equated with the generalised pattern of biological evolution of Palaeolithic humans.

In our view, many factors seem to have influenced the variation in lithic technology attested at the Veldwezelt-Hezerwater loci. Some we may never fully understand, such as the ad hoc response to a local situation. But, if we accept that it is no longer realistic to look only for "cultural" influences in Palaeolithic assemblages, we will be free to study the other factors that also influenced them. One of the most important factors is the quality, size and availability of raw materials, which will affect the choice of core reduction strategies, subsequent blank morphologies and the ultimate toolkit composition. Transport of raw materials and tools is another crucial factor. Associations between raw material economy and toolkit portability provide an even more complex and challenging set of global patterns. In
Northwest Europe where late Middle and Late Pleistocene climatic fluctuations were marked, these factors might also have had climatic correlations.

We think, that the Middle Palaeolithic humans, living at different times at Veldwezelt-Hezerwater, first of all varied their strategies of core reduction and tool maintenance according to the availability of raw materials. There is an apparent link between the availability of local raw materials, opportunistic and parallel core reduction and the virtual absence of tools. On the other hand there is also a link between imported raw materials, centripetal (Levallois) core reduction and the presence of heavily reduced tools. At Veldwezelt-Hezerwater the lithic assemblages of the "Lower Sites" (VLL & VLB) were located on sources of poor quality flint. Exactly this kind of flint, which was generally unsuitable for large artefact manufacture, was used for parallel core reduction, which resulted in the production of small (<5cm) blades and a few (notched & denticulated) tools. At the VBLB and the VBLB-South loci and at all the cool Middle Weichselian loci at Veldwezelt-Hezerwater, the proximity of good-quality flint sources in the Jeker valley and the Maas valley seemed to have resulted in an important effect, namely the import of fresh grey good quality flint and even the import of translucent flint. Chalk outcrops and chalk cliffs, out of which fresh good quality flint (e.g. "Lanaye Flint") was being eroded, are situated at not more than 5 km away from Veldwezelt-Hezerwater. This phenomenon led to centripetal core reduction and the production of significantly larger (>5cm) good-quality flint artefacts at the very end of the Last Interglacial s.l. and during the first half of the Middle Weichselian. Especially at the Middle Weichselian loci, the tools are relatively big (up to 10 cm). The biggest tools are in fact Quina tools, made of fresh, grey good-quality flint. These "oversized" and intensively retouched Quina tools are probably strongly influenced by the duration of the activities in which these tools were employed under cool climatic conditions.

The apparent stability of the basic models of parallel and centripetal core reduction at Veldwezelt-Hezerwater is quite remarkable. There seems to be a great deal of equifinality in the processes by which the people, who were living at Veldwezelt-Hezerwater, reduced their cores and tools. This is probably the result of the fact that any deviation from the basic parallel or centripetal geometry resulted in significant declines in both raw material efficiency and productivity (e.g., Marks & Volkman 1983; Baumler 1988, 1995; Brantingham et al. 2000; Clark 2002a,b). What we know as "parallel" and "centripetal" (Levallois) core reduction seems to have been the "optimal" solution to some of the potential costs associated with core reduction. This phenomenon results in the independent convergence on the basic parallel and centripetal core geometry in diverse contexts. Indeed, at Veldwezelt-Hezerwater, formal convergence seems to be conditioned by the size and the quality of the raw materials. Nevertheless, core and tool reduction is by necessity dynamic, since it must "manage" an ever-decreasing amount of raw material. Flint knappers also had to cope with the irreversible consequences of subsequent removals and the (often) unpredictable nature of stone fracture. Any mistake in the reduction process had to be paid cash on "delivery". So, a certain degree of variability in core reduction is thus explained by these dynamic adjustments made during the process of core reduction. However, economic considerations (e.g., minimising preparation waste, maximising the number of usable blanks, etc.) would push core reduction strategies back towards the initial "parallel" or "centripetal" format.

At Veldwezelt-Hezerwater, common pressures such as the "optimisation" of core reduction and the willingness to exploit raw materials and tools efficiently, rather than shared "cultural" conventions of core and tool design, led to the an enormous amount of equifinality in the core and tool reduction processes. We do not think that we have to explain the presence of
"opportunistic" core reduction at Veldwezelt-Hezerwater, because in a way every core reduction sequence is "opportunistic" and even then, flint knappers always tried to produce blanks of pre-determined morphology. Well then, why did the Middle Palaeolithic humans, who were living at the Veldwezelt-Hezerwater loci, choose between parallel or centripetal core reduction? In other words, what were the contextual factors, which constrained choice among different options? We believe that the initial shape, size and quality of the nodules was crucial. At the VLL and VLB loci, elongated flint nodules were reduced in a parallel, prismatic way. The flint knappers deliberately searched the gravel-bed for these elongated flint nodules, because no suitable spherical nodules could be found there. So, Middle Palaeolithic flint knappers had to employ different types of preparation and reduction to obtain products of usable size and morphology. On the other hand at the VBLB, TL and WFL loci, centripetal cores were reduced because imported spherical flint nodules of good quality were available. At Veldwezelt-Hezerwater, parallel cores were always made of local raw materials, whereas centripetal cores were always made of "exotic" raw materials. So it seems that the original morphology and the quality of the flint nodules had a great deal of influence on the geometry of the cores. However, the use of a particular kind of core reduction does not preclude the use of other core reduction technologies, because at the VLL and VLB loci two or three centripetal cores and at the WFL loci one rudimentary parallel core was also found.

The lithic assemblages excavated at the VLL and the VLB loci at Veldwezelt-Hezerwater are thus clearly characterised by parallel core reduction, the evident presence of blades and bladelets and the presence of very small tools (<5cm). However, this should not come as a surprise. Indeed, blade technology (e.g., Bar-Yosef & Kuhn 1999) was being utilised as early as the late "Lower" and "Middle" Palaeolithic in Africa, Europe and Asia. This calls into question assumptions of both the significance of blade technologies and the putative superiority of these blade technologies. There is simply no evidence to indicate that the manufacture of blades is any more demanding than the making of handaxes or Levallois flakes. There is also no clear association between the production of blades and any single feature of human anatomy or behaviour (e.g., Bar-Yosef & Kuhn 1999).

At the VLL and VLB loci at Veldwezelt-Hezerwater, several small notched and denticulated tools (<5cm) were excavated. The issue of "small tool assemblages" is more puzzling, because these small tools were too small to be conveniently held and operated in the hand. Researchers (e.g., Burdukiewicz et al. 1994) offered various ad hoc explanations for the presence of such assemblages. The most frequent explanations claim that the small tool size was the result of limits imposed by the raw material nodule size and an "opportunistic" approach. Complex models also claim the combined action of technology and specific ecological adaptations of various groups to similar environmental circumstances. During warm periods, when organic raw material like wood was available, Lower and Middle Palaeolithic humans used small flint inserts for the manufacture of bigger organic composite tools. However, most scholars have never seriously considered the possibility of hafting (composite tools) in the Lower and Middle Palaeolithic. That is to say, until very recently, when the site of Schöningen (Thieme 1997) in Germany yielded four wooden tools interpreted as cleft hafts. It is important to note that the small tool assemblages excavated at the VLL and VLB loci at Veldwezelt-Hezerwater, were not made in an interglacial context, but in a Late Saalian interstadial context. Climatic conditions were not extreme, but rather cool, probably a steppe environment with Pinus silvestris (charcoal).

It appears to be quite possible that during temperate periods at Veldwezelt-Hezerwater wooden raw materials were more abundant in contrast to lithic raw materials, which were
covered by fresh loess deposits and dense grass and other plants. On the other hand the lithic assemblages of the cooler periods at Veldwezelt-Hezerwater include larger cores, flakes and tools. Indeed, the largest tools (all Quina tools) were excavated at the TL and WFL loci, which were inhabited during the first half of the Middle Weichselian (MIS 3). Quina tools (e.g., Lenoir 1973; Turq 1989) are dominated by thick, large blanks, which were worked into tools using Quina retouch. Stepped Quina retouch can be considered as a kind of "multi-tiered" retouch, in which the retouch scars tend to end in either step or hinge fractures. It is very interesting to note that in "Upper" Palaeolithic contexts, Quina retouch is referred to as "Aurignacian retouch" (de Sonneville-Bordes 1960: 20). There is still discussion as to whether Quina retouch was intentionally produced or whether it was just the unintentional result of resharpening thick blanks (e.g., Lenoir 1973; Dibble 1984). As has been stated before by other researchers (e.g., Turq 1999), Middle Palaeolithic humans, who produced Quina tools, were not bound to caves. On the contrary, Quina tools have been found at open-air sites repeatedly. We also have to keep in mind that only a small fraction of the open-air sites has been found yet and that at open-air sites tool reduction strategies always will be less prominent than in cave sites. This observation could bias our data set, because at open-air sites, tools are simply less common than in cave sites. Most of the retouched tools found at open-air sites were probably just brought in from cave sites to these open-air sites as part of "emergency toolkits". Large Quina tools were reliable, slightly "over-designed", risk reducing tools, which were probably used in relatively cold, harsh environments.

In the Aquitaine Basin (France), Quina tools corresponds with the stadial climatic fluctuations correlated with MIS 4 (Turq 1999), the onset of more severe, continental conditions, the spread of steppic habitats and faunal communities with abundant reindeer (e.g., Mellars 1996). These conditions created mosaic vegetational landscapes, which had a direct impact on Middle Palaeolithic technology, subsistence, land use and settlement organisation. In the Maas Basin (Belgium), Quina tools correspond with interstadial climatic fluctuations correlated with the first half of the Middle Weichselian (MIS 3), which represents the warmest phase of the Middle Weichselian (e.g., TL & WFL loci at Veldwezelt-Hezerwater). The Maas Basin lies at higher latitudes than the Aquitaine Basin. In the Maas Basin repeated interruptions of Middle Palaeolithic occupation occurred during fully stadial episodes, for instance during the second half of MIS 4 and MIS 3, when this region was characterised by a cold climate, sparse tundra vegetation and low-density arctic fauna (e.g., Cordy 1988).

Late Middle and Late Pleistocene humans may possibly have preferred open, mosaic woodland. Several researchers (e.g., Gamble 1986; Bringmans 2000) therefore have suggested that Middle Palaeolithic humans failed to colonise Northwest Europe during the Eemian s.s. (MIS 5e). The Eemian climax-forests in North Europe appear to have been "human deserts" (Gamble 1986). It is also far from clear how the situation was during earlier climax-interglacials. Therefore, it is of utmost importance to clarify that the lithic material of the VBLB and the VBLB-South loci at Veldwezelt-Hezerwater, certainly, does not belong to the Eemian s.s. The absence of artefacts in the lowest soil of the "Rocourt soilcomplex" at Veldwezelt-Hezerwater, which is the terrestrial equivalent of the Eemian s.s., has also been observed at neighbouring archaeological loess sites (e.g. Veldwezelt-Op-de-Schans, Kesselt-Brickyard-Quarry and Vroenhoven-Kanaal), where geological and archaeological research activities are currently underway. This absence of artefacts seems to indicate that at least this part of Northwest Europe was deserted by Middle Palaeolithic humans during the Eemian s.s. (MIS 5e).
In Northwest Europe late Middle and Late Pleistocene records testify to human occupation during interglacial s.l. interstadial (e.g., MIS 5c & MIS 5a) and glacial s.l. interstadial conditions (e.g., MIS 3). During these interstadial phases, a nearly continuous occupation was possible, because at these times there existed a mosaic of environments rather than undifferentiated vegetation zones. These mosaics are similar to Guthrie's (1984, 1990) model of the "mammoth steppe". The "mammoth steppe", which is seen as open and virtually treeless, tolerated a diverse assortment of mammalian species and also Palaeolithic people. Its wide-ranging herbivores comprised mammoth, woolly rhino, bison, horse and reindeer (e.g. WFL locus), albeit with varying regional densities of which the mammoth presents a classic example. The key prey species were cave hyena, cave lion and Middle Palaeolithic humans (e.g. WFL locus).

Our approach tries to understand the important role played by the palaeoclimate, which shaped profoundly the existence of Middle Palaeolithic humans. Since climate change interacts with the biosphere, we therefore can expect climate change to influence human activity and human "culture" as well. Either directly or through paths leading from climate via plant cover to food animals. The variation in technology, in the proportions of the artefacts and the types of tools present in the different lithic assemblages at Veldwezelt-Hezerwater indicates, in our view, also the adaptation by the Middle Palaeolithic humans to the unsteady climatic conditions. Indeed, at Veldwezelt-Hezerwater, lithic technology appears to change each time climatic changes occur, especially in the event of stress conditions and consequently unstable natural resources availability. Of course, local conditions of raw material availability have affected lithic production, but raw material availability is very often a function of a particular climatic setting. This phenomenon seems to play a key role at the "Lower-Sites" at Veldwezelt-Hezerwater during the Late Saalian to Eemian s.s. climatic shift (late MIS 6 to MIS 5e), with in general the presence of very small tools s.s.

In times of relative stable climatic conditions, e.g. during the late Last Interglacial s.l. (late MIS 5), lithic technology appears to be more "settled". This seems to be the case at the VBLB and at the VBLB-South loci at Veldwezelt-Hezerwater where a "typical" centripetal core reduction technology is present, together with already larger tools. During the first half of the Middle Weichselian (MIS 3), in cool interstadial climatic conditions, we see in the lithic assemblages of the TL-R, TL-GF, TL-W and WFL loci at Veldwezelt-Hezerwater the presence of in general very large centripetal cores and products in association with large Quina tools. Although there are a few exceptions, we can state that at Veldwezelt-Hezerwater, from the Late Saalian (late MIS 6) onwards, the general trend in the Middle Palaeolithic succession of lithic artefacts and tools is that they seem to increase in size as time goes by. There is thus a clear tendency to manufacture heavier-duty tools as time passes.

Indeed, there is clearly a correlation between climate, raw material availability and the size of the artefacts, namely the manufacture of bigger cores, flakes and tools in cooler periods. But could there be also a correlation between the size of the tools and the body size of the hunted animals? In fact, Bergmann's Rule asserts that within a species of warm-blooded animals, those living in colder climates tend to be larger than those in warmer climates. The hunt for larger food animals would have caused a need for bigger heavy-duty tools. Raw material availability and food animal availability are a function of the oscillating climatic conditions. Middle Palaeolithic humans were compelled to change the ways in which they procured and processed meat, because they
were forced to accede to a particular climatic setting that they could not
control. The only alternative they had, was to move South or Eastwards,
leaving our regions deserted, which seems to be the case at Veldwezelt-
Hezerwater during the warmest (MIS 5e) and coldest (MIS 4 & second half of
MIS 3) climatic phases, when no large herds of food animals seemed to be
present.

4. CONCLUSIONS

The successive archaeological excavation campaigns at Veldwezelt-Hezerwater provided us
with important lithic and faunal remains of at least five separate Middle Palaeolithic valley
settlements. It is indeed remarkable 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 (late MIS 6), the late Last Interglacial s.l. (MIS 5a) and the
Middle Weichselian (MIS 3).

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 others (e.g., Lévêque 1993; Bar-Yosef & Kuhn 1999; Clark 2002a,b;
Jehs 2003, 2004) believe that human evolution is a relatively unimportant constraint on the
character of core and tool reduction, being overridden in most contexts by mechanical
constraints and economic and ecological processes. Furthermore, equifinality and formal
convergence almost certainly overrides any hypothetical "cultural" component. Palaeolithic
technology constituted a whole range of options, which were invoked differently according to
context. These contextual factors and not "culture" constrained choice amongst these options
(e.g., availability, size and quality of raw materials, mobility, anticipated tasks, etc.).

The cyclic appearance of parallel, centripetal (Levallois) core reduction, the presence of
"typical", notched, denticulated, Quina or very small tools in the lithic assemblages at Middle
Palaeolithic open-air sites in Northwest Europe should not be seen as extraordinary events,
but simply as the natural outcome of the dynamics of flint knapping. Nor the cyclic
"reinvention" of for instance laminar débitage, but the recognition of blades (etc.) as being
more useful for certain kinds of activity in specific climatic settings, is a crucial element in the
fluctuating technological process. Technological change is thus not the result of a linear
evolution, but the outcome of isolated creative human actions. Many different elements must
come together before triggering a technological shift: the element of resource availability and
climate, the element of mobility and the element of culture innovation. We thus could put
forward the hypothesis that, at least in temperate climatic conditions, Middle Palaeolithic
humans could react instrumental in creating their own adequate life-sustaining technologies
and this through interactions with the environment, changes in behaviour and modifications in
their lithic technology. This approach considers Middle Palaeolithic humans as active agents,
rather than passive recipients of optimised environmental conditions.

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PATRICK M.M.A. BRINGMANS
PIERRE M. VERMEERSCH
FRANS GULLENTOPS
ERIK P.M. MEIJS,
ALBERT J. GROENENDIJK
JEAN-PIERRE DE WARRIMONT

Laboratorium voor Prehistorie
Katholieke Universiteit Leuven
Redingenstraat 16
3000 Leuven
Belgium

JEAN-MARIE CORDY

Ethologie et Psychologie Animales
Bât. L1 Inst. Physiologie L. Frédéricq
Université de Liège
Place Delcour 17
4020 Liège
Belgium