First evidence of Neanderthal presence in Northwest Europe during the Late Saalian ‘Zeifen Interstadial’ (MIS 6.01) found at the VLL and VLB Sites at Veldwezelt-Hezerwater, Belgium

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ISSN 1573-3939

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Abstract

The Middle Pleistocene to Late Pleistocene transition (MIS 6/5e transition), which has been observed within the loamy sediments of the VLL and VLB sites at Veldwezelt-Hezerwater, was a period of remarkable change in both climate and environment. Indeed, the incipient VLL-VLB soil horizons at Veldwezelt-Hezerwater seem to represent Late Saalian phases of pedogenesis under boreal conditions just prior to the MIS 6/5e transition. The pedostratigraphical position provides a firm basis to conclude that the VLL and VLB soil horizons at Veldwezelt-Hezerwater represent the terrestrial equivalent of the Late Saalian ‘Zeifen Interstadial’ (MIS 6.01), whereas the capping GSL unit seems to represent the terrestrial equivalent of the so-called ‘Kattegat Stadial’. Indeed, assuming that Northwest Europe was too hostile for humans during the extremes of MIS 6 and given the pattern highlighted by Gamble (1986) that Northwest Europe seems to be a bit of a wasteland during MIS 5e, then the VLL and VLB sites at Veldwezelt-Hezerwater offer unique snapshots of people appearing in Northwest Europe for a short spell (MIS 6.01) and then going away again. Indeed, during the period of climatic amelioration during the ‘Zeifen Interstadial’ (ca. 133,000 years BP), which followed the Saalian Glacial Maximum (ca. 135,000 years BP), Northwest Europe probably saw a significant demographic expansion and the development of ‘new’ Middle Palaeolithic technologies. During the Middle Pleistocene to Late Pleistocene transition phase, semi-rotating parallel/prismatic and opportunistic core reduction strategies and ‘small tools’ were in place at the VLL site at Veldwezelt-Hezerwater. So-called ‘expedient’ core reduction strategies were used to flake locally-found low-quality lithic raw materials. At the VLB site at Veldwezelt-Hezerwater, the same trend towards ‘parallel’ core reduction was also present. However, it is very interesting to see that at the VLB site, Levallois core reduction has also been attested.

Key-words: Veldwezelt-Hezerwater, Middle Palaeolithic, Neanderthals, Zeifen Interstadial, climate change, loess stratigraphy, Pleistocene pedogenesis

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1. Research history at Veldwezelt-Hezerwater

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, figure 1) has been an advantageous location for Middle Palaeolithic 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 open-air quarries as a means of examining Middle Palaeolithic occupation in Northwest Europe. Particularly in the European loess belt, researchers have invested much energy in excavating large portions of Middle Palaeolithic open-air sites. It was probable that also at the ‘Vandersanden’ brickyard quarry Palaeolithic remains would be discovered. The area, which was archaeologically surveyed, comprised approximately 75,000 square metre and over 24 archaeological horizons could be identified. Unfortunately, artefacts encountered in many of these horizons were situated in geologically secondary positions. However, the quarry also provided important remains of seven in situ Middle Palaeolithic settlements, of which ultimately 1,000 square metre were excavated (Bringmans, 2000, 2001, 2006; Bringmans et al., 2001, 2004, 2006).

2. Middle Palaeolithic occupation and climate evolution in Northwest Europe

Quaternary research has recently combined climatic modelling, geology, archaeology and oxygen isotope analysis (Dansgaard et al., 1984, 1993; Van Andel, 1998; Van Andel & Tzedakis, 1996; Van Andel & Davies, 2003) in order to find out when and how Northwest Europe could have been occupied by Middle Palaeolithic
humans. Indeed, Northwest Europe is usually regarded as having had an extreme cold climate during glacial phases. These cold glacial periods made Northwest Europe only marginally fit for human occupation. On the other hand, the Pleistocene interglacial forests in Northwest Europe must have functioned as ‘green deserts’ (Gamble, 1986). These ‘green deserts’ were spaces abandoned by man due to the dense vegetation cover, which resulted in low prey density and a lack of other food items. However, we are actually dealing with complex cycles of fluctuating climate. For example, the Weichselian ice age also included several long, mild interstadials during which temperatures were up to 7°C warmer (Dansgaard et al., 1993) than during the intervening cold spells (stadials). At times, temperatures were only 2°C cooler than the local Holocene average (Dansgaard et al., 1993). The Weichselian was actually characterised by an unstable, strikingly bipolar climate, which contrasts sharply with the conventional image of a long, slowly cooling, but ‘stable’ Weichselian climate. Climate instability, however, was not only confined to the Weichselian ice age, but appears to have characterised the Last Interglacial s.l. (MIS 5) and the Saalian s.l. (MIS 8, 7 & 6) as well.

Signs of climate change have also been observed in the European loess-soil sequences. Indeed, 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 (Antoine et al., 1999) and in the German Rhine valley (Schirmer, 1999, 2000, 2002) confirm that the late Middle and Late Pleistocene 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.

For Middle and UpperPalaeolithic people who occupied the North European Plain, the accumulation of loess sheets, which mantle large parts of Northwest Europe, must indeed have been an important environmental factor. During stadial climatic conditions, large parts of Northwest Europe must have been reduced to loess deserts and loess-storms must have created intolerable conditions during periods of heavy winds. Indeed, traces of Middle and Upper Palaeolithic occupation are usually confined to the various soil horizons (Tuffreau & Antoine, 1995; Antoine et al., 2003). Depositional environments serve as curatorial entities preserving the archaeological record. The various sedimentary settings have huge implications for the integrity of the preserved archaeological lithic assemblages, as the alternation between sedimentation and soil formation is an important factor in the genesis of stratigraphically differentiated archaeological assemblages.

3. Chronological framework of the VLL & VLB sites at Veldwezelt-Hezerwater

3.1. Stratigraphy and pedology

The ‘Basal Soilcomplex’ at Veldwezelt-Hezerwater (figure 2, 3) is composed of four independent phases of polycyclic ‘complex pseudogley with fragipan’ pedogeneses (Bringmans, 2006). The first soilcomplex (SRB-VLL-VLB), which was also named the ‘Hezerwater Soilcomplex’, is situated in the depth of a buried secondary ‘spring-amphitheatre’ of the Hezerwater brook, well below the so-called ‘Rocourt Soilcomplex s.s.’ (Gullentops & Meijs, 2002). The SRB-VLL-VLB sequence can be seen in the sections of the southern and northern banks of this side-valley. Towards the centre this sequence merges into a thick gley. Towards the southern and northern shoulders of the ‘spring-amphitheatre’, the SRB-VLL-VLB sequence is obliterated by the overlying ‘Rocourt Soilcomplex.’ (Gullentops & Meijs, 2002). It is now clear that the ‘Hezerwater Soilcomplex’ is a fully independent soilcomplex, which consists of three soils: (1) a truncated luvisol (SRB), (2) a bleached pseudogley (VLL) and (3) a humic steppe soil (VLB). On top of the SRB-VLL-VLB sequence, the so-called ‘Rocourt Soilcomplex’ can be observed. This complex is the terrestrial equivalent of MIS 5 (Gullentops & Meijs, 2002). Initially, the ‘Rocourt Soil’ was defined in 1954 by Gullentops. At that time, it was thought to consist of a thick red-brown clayey loam horizon overlain by a whitish horizon and capped by a humic horizon, which was later correlated with the so-called ‘Warneton Soilcomplex’ (Paepe, 1967, 1969). The ‘Rocourt Soil s.s.’ of the ‘sol brun lessivé’ type was always more weathered than the Holocene luvisol (Gullentops, 1954). In the humic horizons on top, which were later interpreted as the ‘Warneton Soilcomplex’, a volcanic ash layer, characterised by enstatite (‘Rocourt Tuff’) was found (Gullentops, 1954) and later used as a stratigraphic marker, which should be dated around 70,000 years ago (Paepe, 1967, 1969; Van Vliet-Lanoë, 1990; Gullentops & Meijs, 2002).

However, micromorphological study of the ‘Rocourt Soil’ enabled Van Vliet-Lanoë (1975, 1989, 1990, 1992) to recognise a succession of three major pedogeneses. These three pedogeneses were respectively correlated with the Eemian s.s. (MIS 5e), the ‘Saint-Germain I’ (MIS 5c) and the ‘Saint-Germain II’ (MIS 5a), recognised at Grande Pile (Vosges, France) by Weilhard (1975, 1978, 1979). The ‘Rocourt Soil Complex’ was further studied at Kesselt (Juviné et al., 1996), at Remicourt (Haesaerts et al., 1997, 1999) and at Saint-Sauflieu (northern France) it was studied by Antoine et al. (1999) and in the Lower Rhine region in Germany by Schirmer.
However, the sequence at Veldwezelt-Hezerwater (Gullentops & Meijs, 2002) turned out to be the most complete and the most informative one. It allowed, for the first time, the macroscopic study of the whole ‘Last Interglacial s.l. Soilcomplex’ in full detail. Indeed, the ‘Basal Soilcomplex’ at Veldwezelt-Hezerwater (Gullentops & Meijs, 2002) reveals a succession of five complex phases of ‘interstadial’ and ‘interglacial’ pedogenesis: one phase during the ‘Pre-Last Interglacial,’ three phases during the ‘Last Interglacial s.l.’ and finally another phase during the ‘Post-Last Interglacial.’ The ‘Pre-Last Interglacial’ is still ‘Late Saalian,’ although the warming-up of the interglacial had already started and the ‘Post-Last Interglacial’ is already ‘Early Weichselian s.s.’ although the climate had only just started to cool down. Within these five complex phases of ‘interglacial’ pedogenesis, five complex soils ([SRB], [PGB], [RB], [VBLB] & [MB]), including 14 independent soil horizons, which all represent different slices of time ([SRB-VLL-VLB], [PGB-OBHB], [RB-RBHB-RHZB], [VBLB-BHB-OHZB] & [MB-MHZB-BHZB]), have been identified (Gullentops & Meijs, 2002). The ‘Hezerwater SRB-VLL-VLB Soilcomplex’ (late MIS 6), the ‘Rocourt PGB-OBHB-RB-RBHB-RHZB-VBLB-BHB-OHZB Soilcomplex’ (MIS 5) and the ‘Warneton MB-MHZB-BHZB Soilcomplex’ (MIS 5a/4) together make up the ‘super’ ‘Last Interglacial s.l. Soilcomplex’ at Veldwezelt-Hezerwater.

In depressions, the ‘Basal Soilcomplex’ at Veldwezelt-Hezerwater comprises at least four Bt-horizons of truncated luvisols (SRB, PGB, RB & VBLB), each followed by an own bleached pseudogley horizon and a humic steppe soil. The older SRB-VLL-VLB soil sequence seems not to belong to the ‘Rocourt Soilcomplex s.s.’ Indeed, the SRB-VLL-VLB soil sequence should probably be dated to the transition from the Late Saalian to the early Eemian s.s. (transition MIS 6/5e). 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 (Kukla & An, 1989; Van Vliet-Lanoë, 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 interpretations of other researchers (Kukla & An, 1989; Van Vliet-Lanoë, 1990; Antoine et al., 1999; Schirmer, 2000, 2002, Gullentops & Meijs, 2002). From this follows that the ‘Basal Soilcomplex’ at Veldwezelt-Hezerwater (figure 3) 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 thus 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). The whole ‘Basal Soilcomplex’ with its interglacial and interstadial soils and its stadial colluvium layers seems to represent a single long period of landscape stability. Indeed, there occur neither phases of severe erosion, nor phases of important sediment accumulation (e.g., loess). Notwithstanding the difficulties of dating unfossiliferous palaeosoils, the age of the ‘Basal Soilcomplex’ at Veldwezelt-Hezerwater seems relatively well established within MIS 5.

Figure 3. Overview of the units within the Veldwezelt-Hezerwater Basal Soilcomplex. Figure by the author.

3.2. The chrono-stratigraphical position of the SRB-VLL-VLB soil sequence

One of the major problems within the ‘Basal Soilcomplex’ at Veldwezelt-Hezerwater remains the chrono-stratigraphical position of the SRB-VLL-VLB soil sequence. This sequence, which has also been labelled the ‘Hezerwater Soilcomplex,’ does not seem to fit into the general stratigraphic scheme that has been proposed for the Last Interglacial s.l. (Antoine et al., 1999, 2003; Schirmer, 2000, 2002): the so-called ‘Hezerwater Soilcomplex’ has indeed never been discovered before. However, to explain the stratigraphical position of the SRB, VLL and VLB soil horizons, we could put forward three major working hypotheses: (1) the ‘SRB Soilcomplex’ represents the ‘Intra-Saalian’ soilcomplex, which is the terrestrial equivalent of MIS 7, (2) the ‘SRB Soilcomplex’ corresponds to a Late Saalian ‘Younger Dryas-type’ climatic oscillation just prior to the MIS 6/5e transition and (3) the ‘SRB Soilcomplex’ represents the first part of the Eemian s.s. (MIS 5e).

The first hypothesis puts that the ‘SRB Soilcomplex’ represents the ‘Intra-Saalian’ soilcomplex. The SRB soil horizon indeed is a reddish-brown Bt-horizon. However, the presence of a Bt-horizon was not necessarily the result of ‘interglacial’ pedogenesis, because Bt-horizons are also attested in cool temperate ‘interstadial’ contexts (Driessen & Dudal, 1991; Kuipers, 1996). Further, the ‘Intra-Saalian’ soilcomplex is a ‘double’
soilcomplex with two separate Bt-horizons (Schirmer, 2002). This is not the case at Veldwezelt-Hezerwater. The stratigraphical situation where the ‘Last Interglacial Soilcomplex’ cuts the ‘Intra-Saalian Soilcomplex,’ which in this case is the hypothetical situation at Veldwezelt-Hezerwater, is well known at the loam quarry in Kesselt (Gullentops & Meijis, 2002). However, in Kesselt several other loam deposits and phases of pedogenesis are attested between the ‘Last Interglacial Soilcomplex’ and the ‘Intra-Saalian Soilcomplex.’ For example, the presence of a so-called ‘Nassboden’ between the ‘Last Interglacial Soilcomplex’ and the ‘Intra-Saalian Soilcomplex.’ At Kesselt of utmost importance. In other sections at Kesselt, it has been observed that in the Late Saalian loess (MIS 6) five ‘Nassboden’ were present (Vandenberghhe et al., 1998; Van den haute et al., 1998; Gullentops & Meijis, 2002). These ‘Nassböden’ have been named the ‘Bruchköbel Soils’ (Schirmer 2002). The ‘Nassboden,’ which was attested between the ‘Last Interglacial Soilcomplex’ and the ‘Intra-Saalian Soilcomplex’ at Kesselt could probably be interpreted as the ‘N5-Nassboden,’ which is probably the equivalent of the ‘OLB Nassboden’ at Veldwezelt-Hezerwater (Meijis, 2002). If the ‘OLB Nassboden’ could indeed be correlated with the ‘N5-Nassboden’ of Kesselt, which is in fact the youngest of the Late Saalian ‘Nassbodens,’ then the whole sequence from OLB to GSL, at Veldwezelt-Hezerwater is probably of Late Saalian age (MIS 6).

Another argument, which supports the Late Saalian chrono-stratigraphical position of the SRB soil, is given by the heavy mineral analysis of the loess-soil sequence at Veldwezelt-Hezerwater (Meijis, 2002). Indeed, the ‘OLB Nassboden’ at Veldwezelt-Hezerwater contains between 13.5 and 8 % of green amphibole and the ‘N5-Nassboden’ at Kesselt contains between 11 and 9 % of green amphibole (Meijis, 2002). This shows that these two ‘Nassbodens’ could indeed be correlated with each other. If the ‘OLB Nassboden’ had an Early Saalian (MIS 8) age and the expected green amphibole percentage would probably fluctuate between 3 and 1.5 %. However, the counted high percentages of green amphibole in the ‘OLB Nassboden’ at Veldwezelt-Hezerwater are clearly too high to suggest an Early Saalian age. So, the whole lithostratigraphical sequence from OLB to GSL, at Veldwezelt-Hezerwater almost certainly has a Late Saalian (MIS 6) age and not an Early Saalian (MIS 8) age. This would imply that the SRB soil thus developed in final Late Saalian loess.

It is however important to keep in mind that not only the SRB soil was developed in Late Saalian loess, but the first soil of the ‘Rocourt Soilcomplex,’ the PGB soil, has been partly developed in Late Saalian loess as well. Notwithstanding this, an important part of the PGB soil has developed in colluvial loam. Indeed, the PGB soil has formed polygenetically between 60 and 90 m north and between 115 and 145 m north in loess and above the so-called ‘spring-amphitheatre’ (Gullentops & Meijis, 2002) between 90 and 115 m north, the PGB soil was clearly formed in colluvial loam. So, there seems to exist a ‘time-gap’ between the SRB and PGB pedogeneses. This ‘time-gap’ is clearly marked by the presence of the VLL soil and the VLB soil and the GSL colluvial deposits. Indeed, no ‘cold’ aeolic loess is present between the SRB and the PGB soils. Now, does this ‘time-gap’ represent the Late Saalian to early Eemian s.s. climatic transition or is it an ‘Intra-Eemian s.s.’ phenomenon? This matter brings about the second and the third working hypotheses which put that: (2) the ‘SRB Soilcomplex’ represents a Late Saalian ‘Younger Dryas-type’ climatic oscillation just prior to the MIS 6/5e transition or (3) that the ‘SRB Soilcomplex’ represents the Eemian s.s. or at least part of the Eemian s.s. (MIS 5e). In order to deal with these two possibilities, we will have to unravel the Saalian to Eemian transitional process.
Lanoë, 1988). According to these researchers, the ‘limon-à-doublet-soil,’ which is attested at these sites, is the terrestrial equivalent of the ‘Zeifen’ climate oscillation. This ‘limon-à-doublet-soil,’ which developed in Late Saalian soliflucted loess deposits, clearly shows evidence of clay illuviation. The soil was mostly truncated before being buried by reworked loam within which the ‘Eemian’ soil s.s. developed. The ‘limon-à-doublet-soil’ seems to have marked an ‘early’ phase of pedogenesis under Late Saalian and still ‘boreal’ conditions, with evidence of a shrub tundra environment (Van Vliet-Lanoë & Guillocheau, 1995). After the development of the soil, a short cooling phase resulted in vegetation degradation, soil erosion with loess reworking and finally the genesis of a weakly developed fragipan. Only after these developments the biological stability of the Eemian s.s. was finally reached (Van Vliet-Lanoë & Guillocheau, 1995). In the Czech Republic and in Slovakia, the same phenomena prior to the MIS 6/5e boundary have been observed earlier (Kukla et al., 1961; Kukla, 1977; Rousseau et al., 1998). Generally, the genesis of the ‘interglacial’ soilcomplex in the Czech Republic and in Slovakia begins with a layer of redeposited, washed, but unweathered loessic sediments within which a ‘gleyic cambisol’ was formed under a ‘pre-interglacial-climax’ climate. Later, new redeposited sediments capped the initial ‘gleyic cambisol’ and then followed the genesis of a humic soil of ‘rendsina’ or ‘regosol’ type. This rendsina is preserved but sporadically, for example at Nové Mesto on the Váh, now in Slovakia (Kukla et al., 1961; Kukla, 1977). However, in most cases, these loams with initial soil formation, which were situated just below the basal zone of the Eemian soil s.s., were usually ‘secondarily’ altered (obliterated) under the influence of the development of the later Eemian soil s.s. Nevertheless, these Late Saalian soil horizons indicate a rather temperate and humid climate following the dry and cold phase of prior loess sedimentation.

Figure 4. Position of the Zeifen Interstadial and the Kattegat stadial. After Seidenkrantz et al. (2000: figure 3).

The SRB-VLL-VLB sequence at Veldwezelt-Hezerwater, which is situated underneath the PGB soil, also seems to represent ‘early’ phases of pedogenesis under ‘boreal’ conditions just prior to the ‘MIS 6/5e Transition.’ This is attested by the presence of the Pinus silvestris charcoal, which has been excavated in the VLB soil. The pedostratigraphical position also seems to indicate that the SRB-VLL-VLB soilcomplex represents the equivalent of the Late Saalian ‘Zeifen Interstadial’ (MIS 6.01), whereas the GSL unit seems to represent the terrestrial equivalent of the ‘Kattegat Stadial.’ However, the SRB-VLL-VLB soil sequence at Veldwezelt-Hezerwater is more complex than the pedological evidence that has been discovered earlier. It is important to realise that the SRB-VLL-VLB sequence represents three different soils, which constitute an independent soilcomplex. So, one major relatively ‘warm’ phase of pedogenesis and two minor relatively ‘cool’ phases of pedogenesis were interrupted by two brief cool phases of climate deterioration. The SRB-VLL-VLB soilcomplex was then overlain by a clear ‘unconformity,’ namely the GSL lithostratigraphical unit, which represents a major deposit of colluvium. The GSL unit thus clearly indicates a major cessation of pedogenesis, which represents a ‘single’ relatively cold ‘Kattegat Event,’ which has never been repeated again during the formation of the Last Interglacial Soilcomplex. So, it is probably correct to attribute the ‘Zeifen Interstadial’ to
the Saalian and not to the Eemian, just as the ‘Bolling-Allerød-Younger Dryas Oscillation’ has also been attributed to the Weichselian and not to the Holocene.

The cool ‘GSL-stop’ in pedogenesis thus relates to an important period of climatic deterioration. This seems to suggest that the initial warming at the end of the Late Saalian was interrupted by a ‘Younger Dryas-type’ oscillation just prior to the MIS 6/5e boundary (Kukla et al., 1961; Pisias et al., 1984; Martinson et al., 1987; Dansgaard et al., 1993; Van Vliet-Lanoë & Guillocheau, 1995; Seidenkrantz et al., 1996; Sánchez Goni et al., 1999; Henderson & Slowey, 2000; Spötl et al., 2002; Kukla et al., 2002). The SRB-VLL-VLB soil complex should thus probably be correlated with the Late Saalian ‘Zeifen Interstadial.’ However, the ‘Zeifen Interstadial’ and the ‘MIS 6.01 Event’ should not be seen as a brief singular ‘incident,’ but more as a ‘process’ that lasted several thousands of years. Indeed, it is likely that similar to the ‘MIS 2/1 Transition,’ the ‘MIS 6/5e Transition’ also experienced several climatic oscillations. This seems to be the case at the ‘Grande Pile Peat Bog’ (Woillard 1975, 1978 & 1979) where the ‘Zeifen Interstadial’ had a double peak. Indeed, in some high-resolution ice cores (e.g., ‘GRIP Summit Ice Core’ - Dansgaard et al., 1993), the ‘Zeifen Interstadial’ seems to be composed of one major peak followed by two minor peaks just prior to the ‘MIS 6/5e Transition.’ At Veldwezelt-Hezerwater, the ‘Zeifen s.s.’ could be correlated with the SRB soil. However, the ‘Zeifen s.l.’ also incorporates the VLL soil and the VLB soil.

The incipient VLL-VLB soil horizons at Veldwezelt-Hezerwater thus represent an early phase of pedogenesis under boreal conditions (Pinus silvestris) just prior to the MIS 6/5e transition. The pedostratigraphical position and the available thermoluminescence dates provide a firm basis to conclude that the VLL-VLB soil horizons at Veldwezelt-Hezerwater represent the terrestrial equivalent of the Late Saalian ‘Zeifen Interstadial,’ whereas the GSL unit represents the terrestrial equivalent of the ‘Kattegat Stadial.’ According to this most probable working hypothesis, it may be argued that the Middle Palaeolithic artefacts of the VLL and VLB sites at Veldwezelt-Hezerwater belong to the Late Saalian ‘Zeifen Interstadial’ (MIS 6.01). Indeed, assuming that Northwest Europe was too hostile for humans during the extremes of MIS 6 and given the pattern highlighted by C. Gamble (1986) that Northwest Europe seems to be a bit of a wasteland during MIS 5e, then the VLL and VLB sites at Veldwezelt-Hezerwater offer unique snapshots of people appearing in Northwest Europe for a short spell (MIS 6.01) and then going away again.

4. Discussion of the archaeological implications

4.1. The VLL site

The VLL lithic assemblage includes 795 artefacts. Overall, the VLL lithic assemblage contains 16 cores, 277 flakes (> 1 cm), 33 blades and blade-like flakes, 25 primary decortication flakes (over 90 % cortex), 160 partially cortical flakes (10-90 % cortex), 251 chips (< 1 cm), nine hammer-stones and nine tools s.s. At the VLL site, flint is virtually the only rock type that was used to produce lithic artefacts. The term ‘raw material’ is used here to designate all potentially flakable material as it exists in its natural state. At the VLL site, the lithic raw materials were relatively small (usually < 10 cm) and subsequently the core reduction chains were relatively short either. The VLL core forms provide the first ‘reading’ on variation in the lithic reduction chains within the lithic assemblage. The VLL cores without refits (68 %) will necessarily be classified according to the final tools were relatively small, which seems to suggest that cores

The variation in core reduction strategies at the VLL site at Veldwezelt-Hezerwater can be classified in terms of two broad ‘trends’ characterised respectively by the presence of ‘parallel’ and ‘opportunistic’ cores, with single, opposed and multiple platforms. ‘Parallel/prismatic’ core reduction (Tixier et al., 1980; Bietti et al., 1991; Révillon & Tuffreau, 1994; Révillon, 1995) is clearly present at the VLL site. The usage of this core reduction strategy resulted in blanks that were removed ‘parallel’ to the long axis of a core from one striking platform or from two opposed striking platforms located at both ends of the core. Still, ‘parallel/prismatic’ core reduction was not the only core reduction strategy that was present at the VLL site at Veldwezelt-Hezerwater. Several cores excavated at the VLL site did not appear to represent identifiable reduction chains with distinctive products. Consequently, they were labelled ‘opportunistic’ cores. One of the most characteristic features of the VLL site at Veldwezelt-Hezerwater concerns the complete absence of the centripetal cores, which also include the Levallois cores.

The lithic toolkit at the VLL site was made up of retouched blades and flakes, notched pieces and combination tools. It is worth noting that most tools were relatively small, which seems to suggest that cores were reduced beyond the point at which they yielded blanks large enough to be conveniently held in the hand.
This can only mean that there effectively was some sort of use for these small tools. It is obvious that we are dealing here with dynamic core and tool reduction strategies, which started with the deliberate selection of sometimes even frost cracked flint nodules. Since the natural forms of the flint nodules had a great deal of influence on the geometry of the resulting cores, the Middle Palaeolithic toolmakers had to employ different core reduction strategies to obtain flakes, blade-like flakes, blades and tool blanks of usable size and morphology. There is no evidence of systematic resharpening of the tools, which seems to indicate that the tools were discarded rapidly near the spot of use.

We suppose that the VLL site was first of all inhabited by Middle Palaeolithic humans because it was a place where lithic raw materials were extracted from the gravel-bed of the ‘spring-amphitheatre’ and from the Maas-river terrace. Indeed, the basic activities, which were executed at the VLL site, were all related to its ‘quarry’ function. The VLL site should thus essentially be characterised as a specialised ‘workshop’ devoted to the extraction and testing of lithic raw materials, the systematic working down of the initial flint nodules (decortication) and the production of portable (weight reduction) cores, flakes, blade-like flakes, blades, tool blanks and tools, which are thus assumed to have been transported from the VLL site for use in other sites. The poor quality of the flint nodules that have been worked into cores and tools at the VLL site is remarkable. This goes contrary to the notion that river and terrace gravel flint would have been largely avoided for tool manufacture, owing to the effects of battering and frost action on the nodules. The lithic artefacts that have been excavated at the VLL site are for almost 100 % derived from these local flint outcrops. There is no indication that other lithic raw materials have been imported to the site. This could be an expression of deliberate ‘energy-economising’ behaviour that would preferentially place emphasis on the most local and easily accessible raw material sources.

4.2. The VLB site

The VLB lithic assemblage, which was excavated at Veldwezelt-Hezerwater, includes 687 artefacts. Overall, the VLB lithic assemblage contains seven cores, 215 flakes (> 1 cm), 11 blades, two Levallois flakes, 15 primary decortication flakes (over 90 % cortex), 119 partially cortical flakes (10-90 % cortex), 301 chips (< 1 cm), seven hammer-stones and three tools s.s. The VLB lithic assemblage contains an interesting diversity of core forms. Indeed, the core reduction strategies, which occurred within the VLB lithic assemblage could be classified in terms of three broad ‘trends,’ materialised by the presence of ‘parallel’ and ‘opportunistic’ cores. However, the ‘centripetal/Levallois’ core reduction strategy was also attested at the VLB site, which was not the case at the VLL site. The centripetal/Levallois cores were clearly made on an imported flint nodule, which was exceptionally big in the context of the lithic raw material environment at the VLL and VLB sites at Veldwezelt-Hezerwater.

The usually small raw material nodules, which at the VLB site at Veldwezelt-Hezerwater were worked into opportunistic or ‘parallel/prismatic’ cores, provided little opportunity for preliminary shaping of cores by the Middle Palaeolithic flint knappers. The two ‘centripetal/Levallois’ cores on the other hand, which were excavated at the VLB site at Veldwezelt-Hezerwater, were extensively prepared and shaped. Contrary to the VLL lithic assemblage, which shows a high degree of ‘bladeyness,’ the degree of ‘bladeyness’ of the VLB lithic assemblage is much less pronounced. Nevertheless, the ‘parallel’ core reduction, which is attested at the VLB site at Veldwezelt-Hezerwater, seems to be effectively identical in most respects to the ‘prismatic’ core reduction strategies documented within the VLL lithic assemblage.

At the VLB site at Veldwezelt-Hezerwater, the simultaneous presence of (1) parallel/prismatic, (2) opportunistic and (3) Levallois core reduction was attested. This seems to add evidence to the hypothesis that Middle Palaeolithic people could choose and employ different core reduction strategies according to specific contexts. The most prominent feature of the Levallois core reduction sequence is that this form of core reduction was only performed on imported, high-quality and more or less oval pieces of lithic raw material. At the VLB site, there seems to exist a strong association between the forms of the cores and the shapes of the initial flint nodules on which they were made. However, there also seems to be a strong association between the forms of the cores and quality of the initial flint nodules on which they were made. Relatively small, elongated and cylindrical local flint nodules were reduced in a parallel way, whereas chunky local flint nodules were reduced in an opportunistic way. On the other hand, relatively large, more or less oval and high-quality imported pieces of raw material were processed in a Levallois core reduction sequence. Levallois core reduction resulted in the longest reduction chains attested at the VLB site. The manner in which cores were reduced afforded the Middle Palaeolithic flint knappers at the VLB site genuine control over the functional characteristics of the resulting blanks. The lithic toolkit at the VLB site, was made up of two notched blades and a so-called ‘core-burin.’ It is worth noting that these tools were almost too small to have been conveniently held in the hand. However, notwithstanding their extreme small dimensions, there must effectively have been some sort of use for these small tools.
4.3. Northwest Europe

In Belgium, northern France, the Rhineland (Germany) and in the United Kingdom several Middle Palaeolithic sites rich in blades (Révillion & Tuffreau, 1994; Révillion, 1995) have been excavated over the course of the last few decades. These laminar Middle Palaeolithic lithic assemblages appear to be limited to open-air sites. Several of these Middle Palaeolithic laminar assemblages are datable to a Post-Eemian (MIS 5e) and mostly to an Early Weichselian (the very end of MIS 5a and the first half of MIS 4) context. Other laminar assemblages can be dated to a Pre-Eemian, in *casu* a Saalian s.l. (MIS 8, 7 & 6) context.

During the Saalian s.l. the dual-component nature of laminar technology is reflected in the presence of, on the one hand Levallois and on the other hand non-Levallois laminar assemblages. Saalian laminar Levallois key sites are Mesnil-Ennard (Seine Basin) (Bordes, 1954), Rissori (Hainaut) (Adam & Tuffreau, 1973), Étaples-Bagarre (couche 7) (Tuffreau, 1987), Biache-Saint-Vaast (*niveau IIA*) (Tuffreau & Sommé, 1988) and the GRA-Level 1 at Veldwezelt-Hezerwater (Bringmans *et al.*, 2001). Saalian laminar non-Levallois key sites are Crayford (Kent) (Spurrell, 1880; Roe, 1981; Cook, 1986), Coquelles (Pas-de-Calais) (Lefèvre, 1969), Saint-Valéry-sur-Somme (Sommé) (de Heinzelin & Haesaerts, 1983; Tuffreau, 1987), the VLL site and the VLB site at Veldwezelt-Hezerwater (Bringmans, 2000).

For the first time, the Veldwezelt-Hezerwater data reveal that, with a high degree of certainty, Middle Palaeolithic humans were effectively living in this region of Northwest Europe during the Late Saalian ‘Zeifen Interstadial’ (MIS 6.01). The Middle Palaeolithic ‘Veldwezelt-Zeifen Laminar Industry,’ which was excavated at the VLL site and at the VLB site at Veldwezelt-Hezerwater, shows a clear trend towards laminar production. At these sites, this trend clearly expresses itself through direct unipolar and bipolar non-Levallois laminar debitage. Blades and the accompanying blade cores are the most prominent component of these assemblages, although flakes are also present. The blades were produced directly from one or two striking platforms. Resharpening of the striking platform of the elongated blade cores is attested by means of the removal of core rejuvenation flakes. The highly reduced nature of the cores, the small size of the artefacts and the fact that only a very small number of laminar blanks were retouched into tools are other important characteristics. The toolkit comprises notched pieces, denticulated tools and one burin.

5. Conclusion

The analysis of the lithic assemblage, which was left behind by the Middle Palaeolithic flint knappers who were occupying the VLL site at Veldwezelt-Hezerwater (figure 5), allowed the following general inferences regarding the most important characteristic technological features of the lithic assemblage: (1) the core assemblage was dominated by parallel/prismatic core reduction, (2) especially relatively small cores were found, (3) the appearance of strategies for rejuvenating core striking platforms (core rejuvenation flakes) has been attested, (4) a general predominance of laminar end products has been observed and (5) a toolkit, which was essentially dominated by small tool forms, has been found. The lithic assemblage, which was excavated at the VLL site, shows that an essentially ‘small-tool-component’ could be added to ‘macrolithic’ Middle Palaeolithic assemblages. Indeed, it seems that the heavy Middle Palaeolithic tools were thus sometimes replaced by a much lighter toolkit. At the VLL site at Veldwezelt-Hezerwater, there was a clear increase in the production of blades, as well as in the production of burins, notched and denticulated pieces. The core and tool reduction strategies made possible a much lighter and more portable toolkit that would allow small expeditionary task groups a higher degree of mobility. These techno-typological features, which are relatively common in the lithic assemblage of the VLL site, appear to signal some sort of ‘ecology-driven’ change in Middle Palaeolithic technological adaptations.

During this part of the Middle Pleistocene to Late Pleistocene transition phase, boreal forests began to develop in Northwest Europe. Charcoal remains, which were found at the VLB site at Veldwezelt-Hezerwater (figure 5), showed the local presence of the pine *Pinus silvestris*. The landscape was thus likely to have been fairly open, marked by concentrations of pine and probably birch. The analysis of the lithic assemblage, which was left behind by the Middle Palaeolithic flint knappers who were occupying the VLB site, allowed the following general inferences regarding the most important characteristic technological features of the lithic assemblage: (1) the presence of parallel core reduction, (2) the occurrence of opportunistic core reduction, (3) the presence of flat-faced, ‘classic’ Levallois *nuclei*, (4) the presence of a few Levallois flakes and (5) a toolkit, which was essentially dominated by small tool forms. It seems that the lithic artefacts, which were excavated at the VLB site, were partly an ‘expedient’ response to the shapes of the flint nodules available at the ‘spring-amphitheatre.’ These Middle Palaeolithic flint knappers just improvised and simply adapted to the local lithic raw material situation. On the other hand, the presence of high-quality formal Levallois cores at the VLB site also shows that these people also planned their activities well in advance.
The VLL- VLB soil horizons at Veldwezelt-Hezerwater seem to represent Late Saalian phases of pedogenesis under boreal conditions just prior to the MIS 6/5e transition. The pedostratigraphical position provides a firm basis to conclude that the VLL and VLB soil horizons at Veldwezelt-Hezerwater represent the terrestrial equivalent of the Late Saalian ‘Zeifen Interstadial’ (MIS 6.01), whereas the capping GSL unit seems to represent the terrestrial equivalent of the so-called ‘Kattegat Stadial.’ If the late Late Saalian dating of the VLL and VLB lithic assemblages is correct, then these Late Saalian lithic assemblages are chronologically and technologically speaking quite close to the so-called ‘Eemian’ sites, which were found in the east of present-day Germany. However, assuming that Northwest Europe was indeed too hostile for humans during the extremes of MIS 6 and given the pattern highlighted by Gamble (1986) that Northwest Europe seems to be a bit of a wasteland during MIS 5e, then the VLL and VLB sites at Veldwezelt-Hezerwater offer unique snapshots of people appearing in Northwest Europe for a short spell (MIS 6.01) and then going away again.

6. Cited literature


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Date of publishing: 1 October 2007.

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