Contextualisering van het Midden Paleolitisch ensemble van Oosthoven (noord-België): Veldwerkrapport / Contextualising the Middle Palaeolithic assemblage of Oosthoven (northern Belgium): Fieldwork report

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Administratieve fiche

1. Administratieve gegevens	
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d. beheer opgravingsdocumentatie:	K.U. Leuven, eenheid prehistorische archeologie
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f. projectcode:	OT (dossiernummer 2013/559)
g. vindplaatsnaam:	Oosthoven – *Heieinde* (OT)
h. locatie:	Oud-Turnhout, Oosthoven, Heieinde
i. kadasterperceel:	afdeling 1, sectie D, percelen 312A en 311
j. topografische kaart	
k. begin- en einddatum:	24/03/2014 – 04/04/2014
2. Omschrijving van de onderzoeksopdracht	
a. bijzondere voorwaarden:	eindverslag tegen 31/12/2014
b. archeologische verwachtingen	lage concentratie steentijdvondsten, zowel in de ploeglaag als in begraven positie
c. wetenschappelijke vraagstelling	in hoeverre is deze steentijdsite bedreigt door erosie, hoe is het materiaal verspreidt en hoe oud is het?
d. doelen en wensen	het in kaart brengen van de horizontale en vertikale verspreiding van de lithische artefacten
e. eventuele randvoorwaarden	niet van toepassing
3. Raadpleging van specialisten	
a. omschrijving inzake staalname	OSL specialiste Marion Hernandez (Max Planck Institute for Evolutionary Anthropology, Leipzig, Duitsland)
b. omschrijving inzake conservatie:	niet van toepassing
c. omschrijving wetenschappelijke advisering	Prof. Philip Van Peer (KU Leuven)

Samenvatting

Oosthoven-*Heieinde* is een voorname Neanderthalersite in Vlaanderen. In België zijn Midden-paleolithische vondsten voornamelijk gekend uit de Maasvallei en omwille van post-depositionele processen is het aantal vindplaatsen in Vlaanderen beperkt (Toussaint et al., 2011). In 1992 werden op deze locatie lithische artefacten aan het oppervlak gevonden die door erosieprocessen waren komen dagzomen. Vervolgens, vond in 1993 een opgraving (200m²) plaats door de KU Leuven (Van Peer and Verbeek, 1994). Hierbij werd op een diepte van 1m lithisch materiaal aangetroffen in associatie met een erosielaag boven een veenlaag. 107 stenen werktuigen werden ingezameld en hun lineaire verspreiding illustreert hellingafwaarste verstoring en potentieel voor meer artefactconcentraties helling-opwaarts. Het lithisch materiaal, gekarakteriseerd door ca. 20 kleine bifaciaal bewerkte artefacten, werd bestudeerd als onderwerp van een licentiaats-thesis (Ruebens, 2005) en vervolgens gecontextualisserd en uitvoerig gepubliceerd (Ruebens, 2006, 2007, 2012, 2013, 2014; Ruebens and Van Peer, 2011, Ruebens and Di Modica, 2011).

Verdere erosie en agrarisch gebruik bedreigen momenteel de site te Heieinde. Een recent bezoek ter plaatse toonde aan dat lithisch materiaal nog steeds aan het oppervlak gevonden wordt. Omwille van het internationaal belang van de locatie, en het unieke potentieel voor nieuw inzichten in de Vlaamse Neanderthaler-bewoning, is het belangrijk de precieze locatie en spreiding van de artefacten meer gedetailleerd in kaart te brengen. Een prospectie met ingreep in de bodem vond plaats van 24 maart tem 4 april 2014, olv Karen Ruebens (Monrepos Archaeological Research Centre, Neuwied, Duitsland).

Deze nieuwe ingreep had als doel deze unieke Neanderthaler woonplaats beter te contextualiseren. Vooreerst, werd via een handboorcampagne de verdere extent van het lithisch materiaal en het verloop van het paleolandschap in kaart gebracht. Drie transecten met een totaal van 24 boringen werden uitgezet. Een voorlopige analyse toont een groot verschil tussen de noordelijke en zuidelijke helft van het veld. In het noorden is dekzand aanwezig (Eenheden C, D en E), terwijl in het zuiden voornamelijk veen (Eenheid F) aangetroffen werd. Dit toont aan dat de artefacten zich op een zandrug aan de rand van een natte depressie bevinden.

Ten tweede, om de site en de bedreiging beter te begrijpen, werden zes 2x2m tesputten opengeled, ten oosten van de 1993 sleuf. Deze werden met de hand gegraven en een beperkte hoeveelheid lithisch materiaal werd aangetroffen in drie testputten, zowel in de ploegvoor als op een diepte van 105-120cm. De testputten in het zuiden vertoonden moderne verstoringen en een dikke plaggenbodem, die het veld artificieel geniveleerd heeft. Het middenpaleolithisch materiaal lijkt voornamelijk geassocieerd met eenheid D en E en werd niet aangetroffen in directe associatie met de veenlaag. Verdere analyse is nodig om de oorsprong van de artefacten beter te begrijpen.

Ten derde, werden in de drie testputten met vondsten negen sedimentstalen genomen voor OSL datering. Twee pogingen tot koolstofdatering leverden in 1993 geen uitsluitende resultaten, waardoor de exacte chronoligische positie van het archeologisch materiaal nog onbekend is. De stalen werden genomen zowel boven als onder de vondstlaag en vertegenwoordigen de verschillende bodemlagen. Analyse vindt momenteel plaats in het Max Planck Insitute te Leipzig en resultaten leveren hopelijk zowel een terminus ante quem als terminus post quem voor de vondsten.

Deze nieuwe ingreep illustreert dat middenpaleolitisch materiaal zich bevindt op verschillende dieptes in het noordelijke deel van het veld te Heieinde. De vondstdichtheid is laag maar omwille van het hoog potentieel voor verdere vondsten, zowel op lokaal als regionaal niveau, blijft het een belangrijke site om verder op te volgen.

Detailed fieldwork report for Oosthoven-*Heieinde*

1. Introduction

This report describes small-scale fieldwork ('prospectie met ingreep in de bodem, dossiernummer 2013/559) undertaken at the site of Oosthoven, Heieinde 74 (Oud-Turnhout, northern Belgium) from March 24th to April 4th 2014 led by Dr. Karen Ruebens (MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution, Neuwied, Germany). At the locality of Heieinde, located northeast of the village of Oosthoven (Fig. 1), lithic material has been recovered from the surface on several occasions by amateur archaeologists. The discovery on this agricultural field of these Middle Palaeolithic artefacts (including several small handaxes) led to the excavation in 1993 of a 200m^2 trench (Van Peer and Verbeek, 1994). Since erosional processes and agricultural activities are continuing, a new project was undertaken to further assess the ongoing erosion, stratigraphic position, spatial extent and chronological framework of this Neanderthal site, unique to the region.

Figure 1: Location of the site of Oosthoven-Heieinde (Oud-Turnhout, northern Belgium) (Basemap NGI@2014)

2. Geological, topographic and archaeological background

The site is located in the municipality of Oud-Turnhout, in the village of Oosthoven, near the toponym of "Heieinde". The field under investigation (Division 1, section D, parcels 312A and 311) is located at a height of 26-25m TAW. Lambert coordinates of the corners of the field (Fig.1) are:

A: x= 692.72596, y= 725.5159 (northwest corner)
B: x= 692.82342, y= 725.61313 (northeast corner)
C: x= 692.7774, y= 725.42267 (southwest corner)
D: x= 692.92947, y= 725.45702 (southeast corner)

2.1 Geology

The locality of Oosthoven-*Heieinde* is situated in the northernmost part of the Campine region ('De Kempen', northeast Belgium), which forms part of the Western European coversand belt. Coversands, (sub)horizontally layered windblown sand sheets, were deposited throughout the Weichselian (MIS 5-2) in regions near ice sheets, moraines, (dry) river and sea beds, especially when and where vegetation was sparse. Differences in grain size distinguish these sandy deposits from loess, which has particles of 2-50 µM and could therefore be carried by the wind further inland, for example to southern Limburg. The geological structure of the northern Campine comprises ca. 25 metres of Quaternary estuarine, fluvial and aeolian sediments (Wouters and Vandenberghe, 1994), which lay on top of Campine clays that can reach a thickness of more than 40 metres. After an uplift during the Cromerian (MIS-13) several river systems incised the region. Middle Pleistocene deposits seem to be absent and the resulting valleys were filled with fluvial sediments during the Early and Middle Weichselian (MIS 5-3). Subsequently, the Late Weichselian (MIS-2) is represented by aeolian (windblown) sandy sediments, known as the Gent Formation (Gullentops et al., 2001). Oscillations in climatic conditions are reflected through varying intensities of aeolian activity and vegetation growth and a distinction is made between the Sint-Lenaerts formation, aeolian sands intertwined with bands of more loamy and peaty deposits that formed in depressions, and the loamy coversands of the Wildert formation, often with the presence of a basal gravel level (Gullentops et al., 2001).

This Beuningen Gravel Bed has also been claimed to be present at Oosthoven-*Heieinde* (Van Peer and Verbeek, 1994), was defined by Van der Hammen (et al., 1967, 1971), and represents a deflation level or desert pavement within the Late Weichselian coversands as indicated by the presence of dispersed gravels and coarse sand. It is commonly seen as representing a distinct chronostratigraphic phase of degradation of permafrost (which occurred from ca. 18,000 to 22,000 years BP) and aeolian deflation in the Upper Pleniglacial (Vandenberghe, 1983). However, recent studies have stressed how the Beuningen Gravel Bed is not ubiquitously present and is difficult to distinguish from local deflation levels (Elias and Mock, 2013), making its use as a chronostratigraphic marker difficult. Similar problems arise with the occurrence of peat layers, which indicate a warmer more stable climate and a still water feature. The presence of a peat layer at Oosthoven-*Heieinde* has been suggested to correlate to a peat layer at Schuurhoven, 0.5 kilometres away, and at Beerse-Dam (Haest, 1985), the latter dated to ca. 38,000 BP, but again these correlations are difficult to maintain without further radiometric dates.

In general, reliable age information for these various Quaternary sedimentary phenomena is sparse and recorded profiles have shown both local and regional divergences. While Late Weichselian and Holocene sediment in the region have been dated through both radiocarbon and OSL methods (Vanmontfort et al., 2010; Derese et al., 2012), studies of older deposits, especially in terms of dating, are still in their infancy.

2.2 Topography

The find spot Oosthoven-*Heieinde* is located ca. 700 metres northeast of the village centre of Oosthoven. The current surrounding landscape (Fig. 2) is characterised by several small river systems, dissecting plateaus with maximum heights of around 31 metres above sea level (asl/TAW). The site is located in the catchment area of the Scheldt River, a typical rain fed lowland-river (Meire et al., 2005). More specifically the site is positioned just south of the border between the Scheldt and Meuse river

catchment areas. Archaeological material was recovered between ca. 26 and 25m asl from an agricultural field which forms a slight slope towards the small stream 'Oosthovense Loop', ca. 400 metres from its confluence with the Aa river. Especially to the northeast of Heieinde the slopes of this small river valley are quite steep, with a prominent cuesta feature.

Figure 2: General surrounding topography, looking downslope towards the Oosthovense Loop.

Southeast of Oosthoven-*Heieinde* a ca. 1,020 hectare nature reserve 'Landschap De Liereman' is located, preserving a mixed landscape of heathland, grassland, pine forests, inland dunes and boggy marshes. The centre of this nature reserves is characterised by a large, wet depression flanked by large northeast-southwest orientated sandy dunes. These dunes represent Holocene sand formations and have a unique potential to preserve Late Palaeolithic (Federmesser) and Mesolithic archaeology (Vanmontfort et al., 2010). In light of the maintenance of this nature reserve several archaeological surveys have been undertaken in and around De Liereman (Meirsman et al., 2008; Allemeersch et al., 2013), and provided substantial information on the archaeological presence and potential of the wider Turnhout region.

2.3 Archaeology

While Middle Palaeolithic sites are numerous in the Belgian Meuse Valley (Ulrix-Closset, 1975), finds from these time periods are general sparse in the Flemish lowlands, including in the Campine region (for a detailed overview see Toussaint et al., 2011). It seems that in Flanders most sites are either destroyed by erosional processes or very deeply buried. Hence, Middle Palaeolithic finds in this area are mainly isolated surface and bagger finds (e.g. Rotselaar, Van Peer, 1982). Main exception is the cluster of Early Middle Palaeolithic sites around Veldwezelt and Kesselt, located about 70km southeast of Turnhout (Van Baelen et al., 2007, 2008; Bringmans, 2011). In the Netherlands the situation is similar with one main stratified Early Middle Palaeolithic site in southern Limburg (Maastricht-Belvédère, Roebroeks et al., 1997) and a series of surface finds (commonly including handaxes, e.g. Etten-Leur) in the rest of the

country (for an overview see Deeben et al., 2005). In the Campine region, currently, the only excavated Middle Palaeolithic site is Oosthoven-*Heieinde*, indicating its importance for our understanding of Neanderthal occupation of these lowlands.

Across the Campine region Palaeolithic stone tools have been found at several localities, including several large late Palaeolithic sites (Federmesser culture; 13,000-12,000 cal BP; Van Gils and De Bie, 2003, 2006; Vanmontfort et al., 2010). For example, in the nature reserve 'Landschap de Liereman' the early Holocene topography, a dune sand ridge, is preserved and several Final Palaeolithic and Mesolithic sites are present (Meirsman et al., 2008; Vanmontfort et al., 2010). Since this is one of the few localities in Flanders where Mesolithic and late Palaeolithic material is abundant and found in different stratified positions, with a clear correlation between the Federmesser material and the Allerød (Usselo) soil, this area has been made into a protected archaeological zone in 2012.

In the Central Archaeological Inventory (CAI) 56 Palaeolithic find spots have been recorded for the municipalities of Oud-Turnhout and Arendonk, the majority being isolated stray finds. In the past the fields around Oosthoven-*Heieinde* were used to dump waste from the city of Turnhout and hence medieval and post-medieval finds (e.g. clay pipes) have regularly attracted collectors. These collectors sporadically also picked up flints but usually the exact provenance of these finds is unknown. A detailed presentation of the lithic surface finds in the De Liereman and its immediate surrounding region is presented in Allemeersch et al., 2013. These finds mainly concern late Palaeolithic, Mesolithic and Neolithic stone tools. Many finds are also too undiagnostic (e.g. unretouched flakes) to be assigned to a specific time period. A bifacial tool with a probably Middle Palaeolithic origin (Fig. 3) was found just north of the Liereman depression. A test pit dug in this area in 2008 revealed a large patinated flake from a similar topographic and stratigraphic position to the artefacts from Heieinde (Meirsman et a., 2008), stressing the large potential to find traces of Neanderthal occupation in the area.

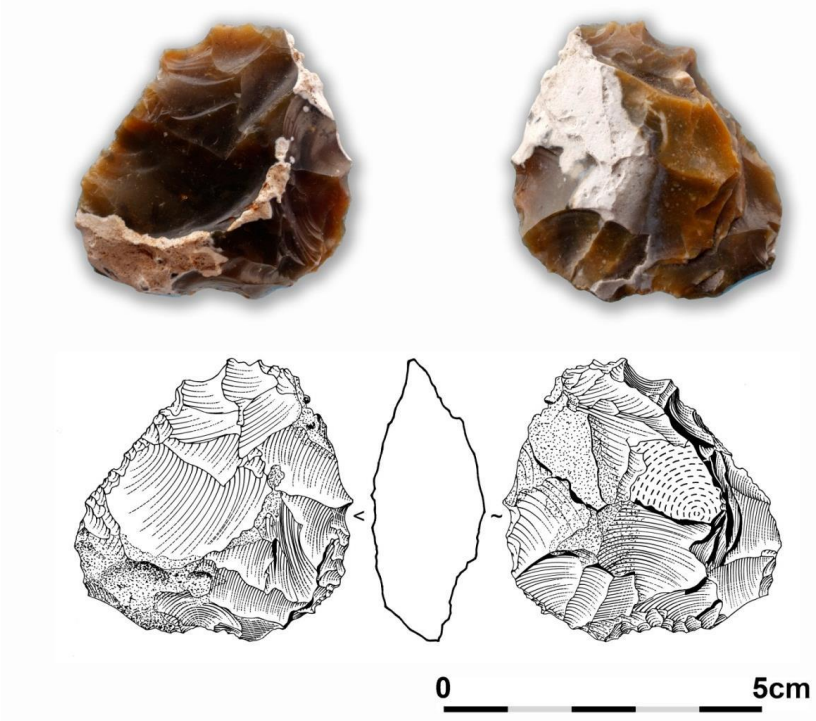


Figure 3: Bifacially worked artefact/core potentially of Middle Palaeolithic age
(Oud-Turnhout - Liereman 2; CAI- 101025, drawing Marc Van Meenen, Agentschap Onroerend Erfgoed)

At Oosthoven-*Heieinde* clay pipes were frequently collected by Gust Sels. While his finds were on display at the museum of the local heritage society 'Corsendonca vzw' Cyriel Verbeek noticed the presence of several lithic artefacts. He subsequently studied these lithic artefacts in more detail and published four, including three handaxes and one side scraper in 1993 (Verbeek, 1993). Subsequent field walking helped to locate the site since several more flakes and handaxes were found. Next, a small test pit (0.8 x 1.2m) was dug with permission of land owner Gust Geudens. This revealed the presence of more artefacts at a depth of ca. 1 metre (Fig. 4). Subsequently the Prehistory Unit from the KU Leuven was contacted to inspect this test pit and they decided to conduct an excavation in the summer of 1993 led by Professor Philip Van Peer.

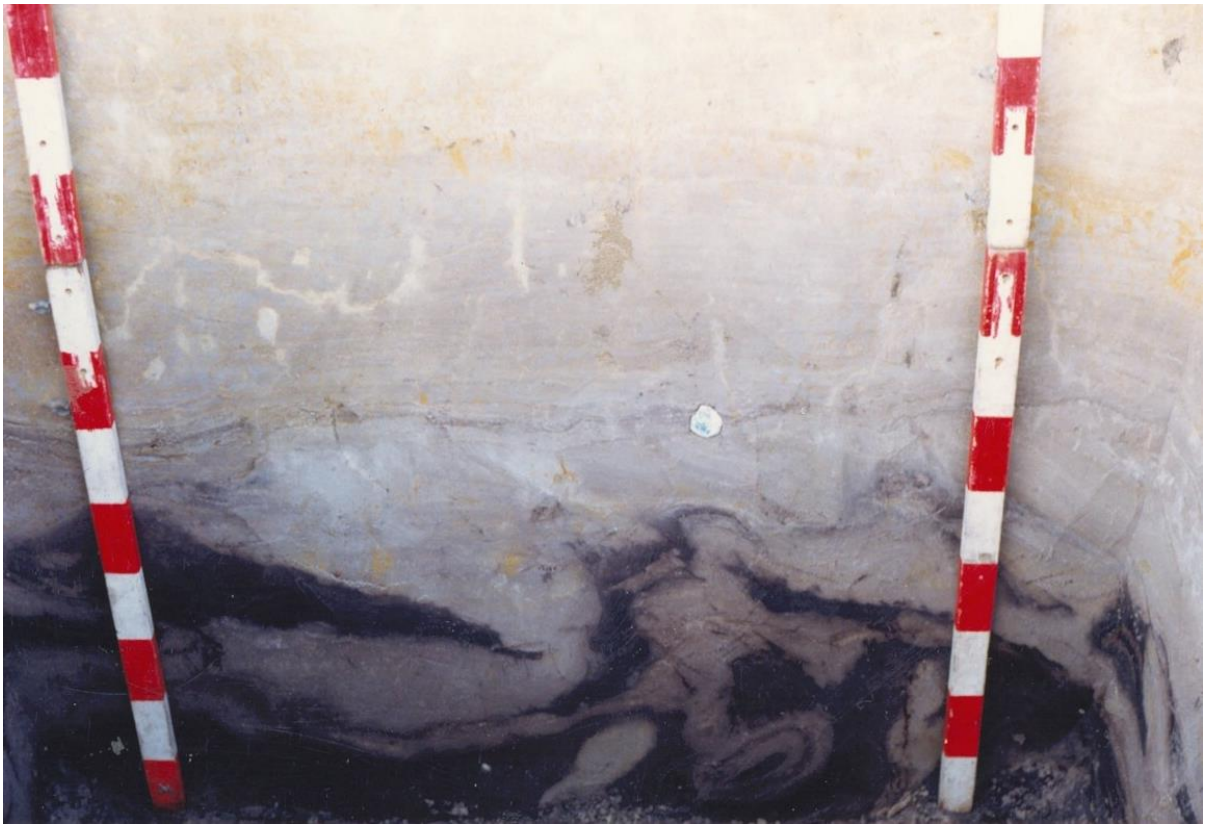


Figure 4: Profile of the test pit dug in 1993, with position of artefact in the section at a depth of ca. 1 metre

This excavation consisted of a long trench covering 200m^2. The upper sediments were mechanically removed and at several places disturbed the finds layer. In total 107 artefacts were recovered across the trench, indicating a very low artefact density (Van Peer and Verbeek, 1994). These artefacts, including over 20 bifacial tools, were studied in detail in a MA thesis (Ruebens, 2005, 2006). They were recovered from an erosional level represented by dispersed gravels, which has been suggested to be the level of Beuningen, as attested elsewhere in the region (Haest, 1985). Two samples were sent out for radiocarbon dating but provided no reliable results, leaving the age of the material still open to question. Furthermore also the stratigraphic origin, its relation to the palaeolandscape and the spatial extent of the site require further research. This is especially needed since the recurrence of artefacts on the surface and within the plough zone indicates the continued disturbance of the site through agricultural activities.

3. Methodology

The aim of the fieldwork conducted at Oosthoven-*Heieinde* in 2014 was to contextualise the Middle Palaeolithic finds made at this locality in 1993 (Van Peer and Verbeek, 1994). A threefold methodological framework was applied, including:

- a borehole campaign to map the palaeolandscape
- a series of test pits to explore vertical and horizontal find distributions
- sediment samples for OSL dating to provide a chronological framework for site formation

First of all, the baseline of the 1993 excavation was reconstructed using the original plans. Point 1 (46,76; 10; 10) was reconstructed based on two compass directions: 19 degrees towards the water tower and 247 degrees toward the Oosthoven church tower. From this point 1 the zero point of the 1993 was located in line of 169 degrees. From this point 1, parallel with the road, a baseline for the new fieldwork was set up. All subsequent measurements started from this point and investigations were aimed at contextualising the 1993 trench with a focus on the eastern side of this trench (Fig. 5).

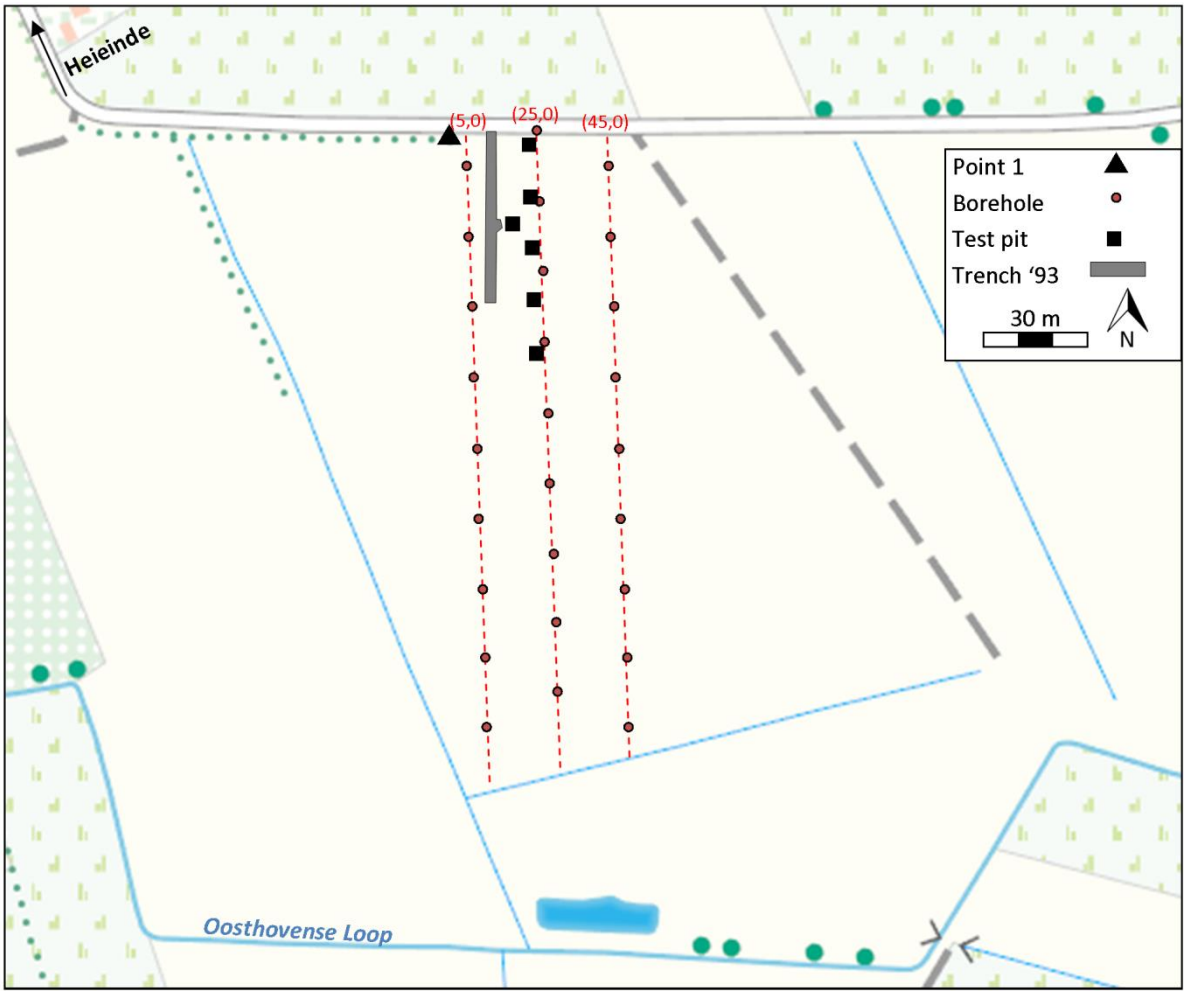


Figure 5: Schematic overview of the location of the borehole transects, the boreholes and test pits.

1. Borehole campaign

Three borehole transects were set out starting at 5, 25 and 45m east from Point 1 (Fig. 5). The transects run parallel with the slope of the field and were undertaken every 20 metres, starting at 10 metres along the 5 and 45 line, and at 0 metres on the 25 line. The drillings were made with an auger with a diameter of 7.5cm to a depth where the water table made further drillings impossible. A total of 24 boreholes were completed.

2. Test pits

To further investigate the stratigraphic position of the lithic artefacts, their overall density and spatial distribution six test pits of two by two meter were excavated by hand. They were positioned east of the 1993 trench since artefacts in this trench have been claimed to have moved from a northeast direction through gullies. The test pits were set out along the 25 metre line, every 15 metre (Fig. 5).They were orientated parallel with the road and parallel with the 1993 trench. Additionally test pit 6 was positioned closer to the 1993 trench at a position where in the 1993 trench charcoal and a slightly denser concentration of artefacts was recorded (Van Peer and Verbeek, 1994). The coordinates of the six test pits in the excavation grid are as follows.

TP1: x: 25m, y: 5m
TP2: x: 25m, y: 35m
TP3: x: 25m, y: 65m
TP4: x: 25m, y: 50m
TP5: x: 25m, y: 20m
TP6: x: 20m, y: 25m

Each test pit was entirely excavated by hand and sediment beneath the plough horizon sieved through a 3mm mesh. In each test pit each stratigraphic context has been described through a context recording sheet. This includes a description of the sediment, its position in a basic Harris matrix, the presence of any finds and further comments/discussion where necessary. The four profiles of each test pit were drawn on to permatrace on a scale of 1/10. For test pits heavily disturbed by modern feature only one or two profiles were drawn. The horizontal and spatial x, y, z coordinates of each find were recorded by hand, alongside the context, category, description, orientation and dip of the artefact. These section drawings, context sheets and finds lists have been digitised and are available as an appendix on the enclosed discs, alongside a detailed photographic record of the various stages of fieldwork.

3. OSL sampling

Since previous attempts to radiocarbon date two samples (one wood and one peat) from the site produced unclear results, it was decided to try and apply optically stimulated luminescence (OSL) dating. In contrast to radiocarbon dating, this OSL technique does not require calibration or a sufficient amount of suitable organic matter. OSL uses the mineral components (e.g. quartz, feldspar) of the sediments to determine the timing of their deposition. Sampling focussed on bracketing the finds, but also on providing a complete understanding of the sedimentary sequence. Nine samples were taken from three test pits, including 2 from unit C, three from unit D and four from unit E. A detailed description of the location of the samples follows:

In test pit 5 four OSL samples (with a diameter of 5.5cm) were taken:

OSL 1: Late Glacial coversands, above clayey horizon: x: 25.00; y: 18.51; z: 46.00
OSL 2: Late Glacial coversands, beneath clayey horizon: x: 25.00; y: 18.48; z: 75.00
OSL 3: next to artefact in section: x: 25.00; y: 18.60; z: 107.00
OSL 4: as close as possible to the peat: x: 23.72; y: 18.00; z: 124.00

Figure 6: Overview of the location of the four OSL samples taken in test pit 5 (indicated by the white labels)

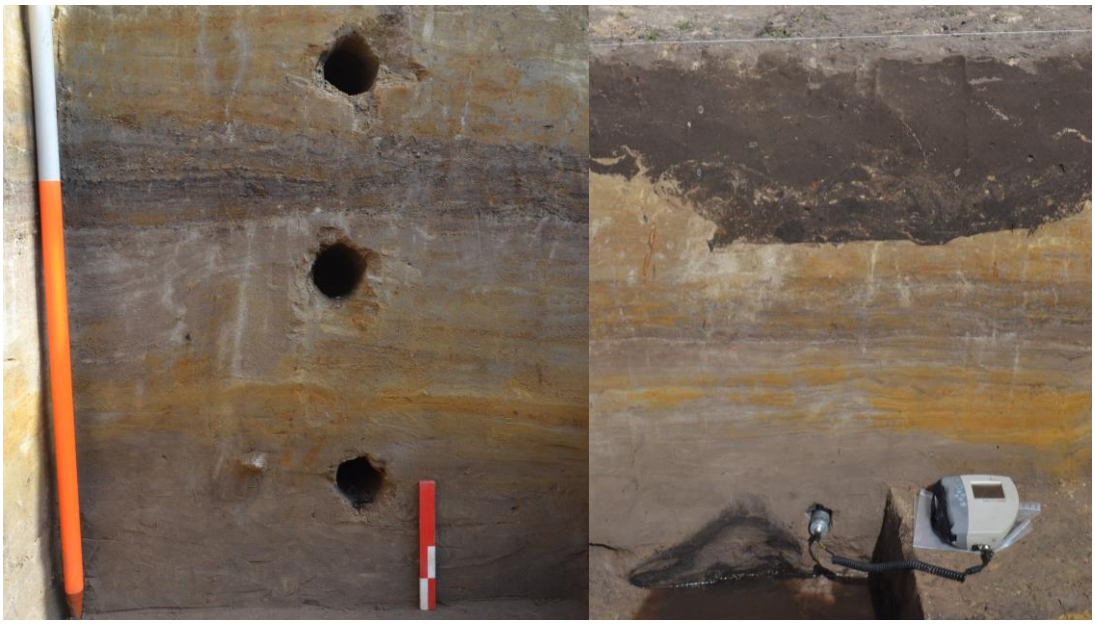


Figure 7: Detailed view of the location of the OSL samples in test pit 5. Left: OSL samples 1, 2 and 3, note the artefact in the section next to sample 3. Right: OSL sample 4, close to the cryoturbated peat.

In test pit 2 two OSL samples (with a diameter of 5.5cm) were taken:

OSL 5: above erosional level from which artefacts where recovered
x: 24.23; y: 35.00; z: 103.00

OSL 6: beneath erosional level
x: 24.11; y: 35.00; z: 119.00

Figure 8: Overview of the location of the four OSL samples taken in test pit 2 (indicated by the white labels)

Figure 9: Detailed view of the location of the OSL samples 5 and 6 in test pit 2, bracketing a darker band which as associated with several artefacts.

In test pit 6 three OSL samples (with a diameter of 5.5cm) were taken:

OSL 7: yellow medium coarse sands
x: 18.20; y: 27.00; z: 133.00

OSL 8: dark grey medium coarse sands, below artefacts
x: 18.20; y: 27.00; z: 115.00

OSL 9: lighter grey, layered sands
x: 18.20; y: 27.00; z: 92.00

Figure 10: Detailed view of the location of the three OSL samples (7, 8, 9) taken in test pit 6. Note the presence of an artefact between samples 9 and 8 on the photo on the right.

4. Results

4.1 Fieldwalking and borehole campaign

4.1.1 Fieldwalking

On March 24th field walking took place across the entire agricultural field. The corn crops had been removed at the end of 2013 and the field had not been ploughed since. The southern part of the field was very wet, making field walking very difficult.

Both natural and manmade flint artefacts were collected to get an idea of the type of flint and other raw materials present:

Find number	North coord.	East coord.	Description	Found by:
OT-400	51°20'16''	4°58'57''	Flint shatter	GMS
OT-401	51°20'15''	4°58'57''	Flint shatter	MP
OT-402	51°20'15''	4°58'58''	Flint chip	GMS
OT-403	51°20'19''	4°58'56''	Large piece of red burnt flint, natural?	MW
OT-404	51°20'6''	4°58'57''	Brown flint, shatter	MW
OT-405	51°20'16''	4°58'59''	Brown flint, cortical, natural	MW
OT-406	51°20'18''	4°58'58''	Brown flint, chip	MW
OT-407	51°20'17''	4°58'59''	Small medial blade fragment, grey flint	MW
OT-408	51°20'6''	4°59'0''	Quartzite fragment	GMS
OT-409	51°20'18''	4°58'54''	Brown flint, fragment	MW
OT-410	51°20'6''	4°58'56''	Brown flint, pebble fragment	KR
OT-411	51°20'21''	4°58'59''	Black flint, small fragment	MP
OT-412	51°20'18''	4°58'59''	Glossy flint, chip	GMS
OT-413	51°20'197''	4°58'60''	Gun flint, black flint	GMS
OT-414	51°20'16''	4°59'1''	Flint fragment, natural	MW
OT-415	51°20'14''	4°59'1''	Small quartz fragment	MW
OT-416	51°20'17''	4°59'1''	Small flint shatter	KR
OT-417	51°20'16''	4°59'1''	Flint fragment	MW
OT-418	51°20'18''	4°59'0''	Quartz pebble	MW
OT-419	51°20'18''	4°59'0''	Flint fragment	KR
OT-420	51°20'18''	4°58'60''	Flint, chip	MP
OT-421	51°20'19''	4°59'0''	Large flake, clear bulb of percussion, grey flint	GMS
OT-428	51°20'15''	4°58'59''	Brown flint, core fragment?	MW

The vast majority of these surface finds show natural features and probably originate either from the erosional horizon or from the gravel terrace related to the Oosthovense loop. No specific concentration of artefacts could be established.

4.1.1 Borehole campaign

Detailed description of the observations made in the 24 boreholes:

BH1 (x: 24m, y: 3m, z: 2.25m)

Set out in northwest quadrant of test pit 1 to test sequence once test pit became to wet to excavate further

124-144cm: grey sand becoming more clayey towards bottom

144-204: coarse grey sands, wet

204: change from grey to black sands

204-240: very wet grey green sand

240: too wet to pull out

BH2 (x: 25m, y: 20m, z: 1.38m)

0-35cm: ploughsoil

35-67cm: yellow cover sand

67-130cm: black peat, quite compact, no clear organic inclusions or remains

130-140cm: grey sands becoming more wet

140-170cm: wet yellow sands

170-185cm: very wet grey/yellow sands

BH3 (x: 25m, y: 40m, z: 1.75m)

0-50cm: ploughsoil

50-100cm: pinkish brown sands (similar to north facing sector in TP2)
at 80cm little windblown gravel

100-110cm: more clayey, grey and black, peels off in layers

110-115: black layer with think wood fragment

115-140: wet grey-yellow sands

At 140 cm too wet to pull out anymore

BH4 (x: 25m, y: 60m, z: 1.99m)

0-65: plough zone
at 40cm brown flint from the plough zone

65-80: more compact peaty black horizon

80-125: white sand

125: very wet white/grey sand

BH5 (x: 25m, y: 80m, z: 2.22m)

0-32cm: ploughsoil

32-59cm: grey sand with yellow inclusions, at base near contact with peat more grey but varied

59-185cm: dark brown/black horizon with organic inclusions between 5 and 7 cm
at 144cm: slight colour change to dark brown
at base colour change from black to grey to dark brown, still with organic material

185-200cm: greyish-brown sands but probably white with mixing at interface, dark grey colour throughout

Borehole not bottomed, sands continued past 2m but too wet to continue

BH6 (x: 25m, y: 100m)

0-38cm: ploughsoil: very compacted compared to BH5

38-42cm: very thin sand level, remaining cover sands?

42-200cm: peat with small organic inclusions, variation in colour, brown and black with lighter brown fine inclusions

200cm: top of white sands, organic inclusions at interface with the peat and darker grey in patches

Borehole not bottomed, too wet

Deep sand pretty dry, but peat holding water?

BH7 (x: 25m, y: 120m)

0-47cm: ploughsoil

47-53cm: remnants of cover sands, very thin, max of 3 bands of sand

53-164cm: peat: grey compact with dark brown organic inclusions
lighter level with more humic content at the contact with the underlying sands

164-200cm: dark grey sands, some silt inclusions, and small (>1mm) gravel inclusions

Borehole not bottomed, too wet

BH8 (x: 25m, y: 140m)
0-20cm: ploughsoil, dark grey

20-140cm: medium grain sand, light grey to beige, with grey stains and some organic remains in upper part from growing plants
from 60cm onwards peat fragments and organic remains and sand getting more white

140-240cm: dark brown peat with clearly visible organic remains
at 170cm pulled up large piece of wood
a 240cm stuck again, prob other piece of wood, also very wet at this point, liquid grey sediment

BH9 (x: 25m, y: 160m)

0-80cm: plough horizon: dark grey with pieces of brick and brown stains

80-123cm: peat: small organic remains and distinct smell
but no clear boundary, no sandy bands, no cover sands
at 120cm piece of brick?

123-126cm: brownish peat, with clear plant remains

126-170cm: medium grain grey silty sands

Very high water table so had to stop augering

BH10 (x: 25m, y: 180m)

0-66cm: similar to what we usually describe as peat, dark grey with organic remains + smell
difficult to distinguish between plough and peat?

64-66cm: more brown

66-90cm: dark but very compact compared to sediment above, but few and small organic remains

90-117cm: browner peat variety with larger organic remains

117-122cm: clayey fine sands, dark grey/beige

122-130cm: grey greenish fine sands

Had to stop since too difficult to pull up although less wet then before

BH11 (x: 25m, y: 65m)

In testpit 3 (25, 65) to check nature of disturbance
140cm: interface between black 'peat' and grey sand

BH12 (x: 25m, y: 0m)

0-38cm: plough soil

38-68cm: sharp contact with yellow silty sand, occasional orange spotting, some bioturbation
at 54cm: change to coarse whiter sand

68-171cm: level D, more clayey, still sand/silt; darker grey colour with frequent orange staining gradually becoming very yellow and wetter towards the bottom

At 170cm start of peat: dark brown, still sandy, no visible organic inclusion

Borehole stopped because too wet too pull out

BH13 (x: 5m, y: 10m, z: 1.20m)

0-28cm: Ploughsoil with some inclusions black, sandy

28-96cm: interface with ploughsoil irregular some bioturbation seen as pattern in core; pale silty-sand some yellow/orange spots; bioturbations penetrate into horizon (dark brown) with some paler sediments @ base (67cm); @ 80cm more homogenous with increase in silt though still sand but moister (C).

96-225cm: beginning of sands (D); slightly paler, coarser sand though contact quite discontinuous becoming darker grey with frequent black and orange spotting; similar composition to that in TP1 & 5; @116 moist coarse, white sand probably representing close to the erosional level; @ 139cm still coarse sand but definite darkening of sediment to brownish red with increase in moisture; @ 225cm still going in; wet dark grey coarse sand with fine layer of brown more compact sediment, very wet.

WATER PREVENTS BORE HOLE BOTTOMING

BH14 (x: 5m, y: 30m, z: 1.61m)

0-26: ploughsoil; dark black fine sandy-silt.

26-83: beginning of orange yellow sands; discontinuous contact, some bioturbation that continues into the surface; silty sand becoming lighter grey. @50cm becoming cleaner, lighter more homogenous but still some bioturbations penetrate; @66cm becoming a little darker but consistency the same (C)

83-182: transition from C into D very ephemeral; slight darkening of sediment (grey) but also coarser and slightly damper; cleaner more homogenous; occasional brown and orange spotting; becoming darker grey with brown patching @120cm and also becoming wetter with interdigitated dark brown peat level; some bioturbations with brown but becoming cleaner and much wetter around 165cm; @175cm becoming slightly finer grained

182-: sharp contact between Unit D and Unit F; still sandy @ tope of F but with occasional clayey patches though quite wet; sandy horizon emerging below compacted clayey peat

@212cm return of coarse sand possibly representing the underlying sands below peat

WATER PREVENTS BORE HOEL BOTTOMING

BH15 (x: 5m, y: 50m, z: 1.94m)

0-80: (A) plough soil; getting more sandy with occasional brick inclusions; uneven contact with plough soil; interdigitated with dark grey (in places black) sand; appears to be mix of clayey black plough with sandy

80-180cm: beginning of C; coarse pale sand with dark grey patches; mixing and bioturbation @ contact; c113cm deposits becomes slightly finer and darker grey in colour also drying out; becoming much wetter again; darker in colour with orange-yellow spots;

(D) c140cm darker grey clearer wetter with some organics; coarse sand very wet and dark grey @180cm

@180cm BORE HOLE NOT BOTTOMED DUE TO WATER

BH16 (x: 5m, y: 70m, z: 2.16m)

0-57: dark brown-black silt sand with frequent brick/pot inclusions; after 57cm increase in clay fraction

57-100: plaggen soil; increase clay with organic component; darker than overlying (A)

100-160: yellow-grey coversands silty sand (C); interface with plaggen soil disturbed; bioturbation from c100cm increase in wetness top of watertable?

160-170: beginning of grey sands (D) coarser, less silt and becoming increasingly wet

170: beginning of peat; sharp, irregular contact @ boundary; more clayey

PIT NOT BOTTOMED; TOO wet

BH17 (x: 5m, y: 90m, z: 2.06m)

0-38: plough soil, more compact silty sand with black/dark brown colour.

38-63- orange-yellow sands; clear interface with A but irregular; silty sand with some staining; c48cm interface with dark brown clay horizon; sharp, straight contact

63-190: top of peat horizon dark brown/black with smell and increasing wetness; peat continues to get more clayey with root fragments and large, infrequent organic inclusions (c5cm), increase in wetness. @150cm very wet with dark brown peat deposit with frequent organic inclusions

190: green-grey sands

PIT NOT BOTTOMED TOO WET TO LIFT

BH18 (x: 5m, y: 110m)
0-68: dark brown black silty sand (A); bioturbation with some penetrating into C; lens of orange-yellow coversands (C)

68-132: beginning of plaggen soil dark brown-black clay with inclusions of pottery in core; @109cm increasing clay with frequent small root fragments, charcoal and some small sandy lenses; @132cm becomes very dense organic and browner; increasingly wet.

132-171: lighter brown clay level with increased organics (F?); becoming lighter brown; clay with large quantity of organic frags throughout core; smells

171-195cm: beginning of dark grey-green sands; very coarse with some discontinuity and peat penetrating surface

@195cm firmly within green-grey sands; very homogenous; possibly some size sorting

TOO WET TO BOTTOM BORE HOLE

BH19 (x: 5m, y: 130m)

0-57: brown-black silty deposit with organic inclusions (A) up to 2-3cm and some sand (more silty sand); some ceramic/brick inclusions; @42cm lens of orange sand could be bioturbated surface/interface with C; @57cm becoming more clayey with various organic inclusions and pot increase (plaggen soil?)

57-96: Plaggen soil more clayey darker and more homogenous with organic and root remains

96-143: medium brown peat level very clayey deposit with substantial organic component very dense @109cm colour change to black clay deposit lacking organics but smelly; @141cm clear distinctions within peat with lighter brown, cleaner deposit underlain by darker brown horizon containing more organic material including roots and wood; very wet.

143-169: clear transition from peat into green-grey coarse sand very wet; @transition peat becomes lighter brown, some organic fragments penetrate into this horizon. Some possible sorting by size as appears to be increase in silty fraction @ around 165cm.

TOO WET TO REMOVE MORE SEDIMENT @171cm

BH20 (x: 5m, y: 150m)

0-53: ploughsoil black humic with brick and lots of charcoal

53-94: browner, smelly brick inclusions more clayey, finer large organic inclusions becoming more wet.

94-104: clay, grey without organic inclusions

104-130: brown, very humic lots of roots and large pieces of wood

130-147: green grey sands

becoming too wet too pull up; brown sticky water

BH21 (x: 45m, y: 10m, z: 1.14m)

0-32: ploughsoil; silty with some organic inclusions; some charcoal @23cm coversands mixed may represent bioturbation @ contact.

32-80: start of coversands (C); yellow-orange coarse sand; fine and bioturbated @ contact with (A); silty sand; @ 57cm little bioturbation from above; clean relatively homogenous; @61cm slight colour change very pale still coarse sand; intermittent yellow-orange spots; @73cm clayey loam horizon with charcoal; more loamy still darkish brown but more sandy @ interface with D.

80-170: coarse grey-white sand (d); becoming more orange stained with small gravel inclusions >1mm; @114cm more dark orange brown staining but coarser than overlying orange/brown (c); c140cm

becoming lighter brown losing greyish colour still coarse sand and becoming wetter; @150cm become darker grey brown which marks boundary with underlying peat; still coarse sande.

170-189: Peat (F); becoming very clayey;

189-230: becoming more sandy again and grey brown coarse grained.

230-252: 2nd peat layer with very thin with large organic inclusions.

252-268: start of green-grey sand coarse sand; very wet

@268cm TOO WET TO PULL OUT

BH22 (x: 45m, y: 30m, z: 1.41m)

0-43: black-brown silt with organic and brick inclusions (A); @24cm sand maybe bioturbation at interface with (C); slightly lighter brown and more sandy @43cm

43-46: paler brown red sand with occasional silt; lighter patches and some bioturbation (A/C mixing)

46-132: clean, pale white sand, clear interface with overlying deposit (C) some charcoal; @84cm becoming whiter but with occasional orange spots; becoming wetter; @104cm losing some orange and becomes lighter; @120cm more clayey in base with orange still; also becomes more clayey but still sand.

132-168: becoming wetter; very clayey and darker brown-black; still with (F) sand (Clayey sand); much organic material between 2-3cm

168-212: diffuse transition to coarse grey sands; very wet (G).

@218cm TOO WET TO REMOVE

BH23 (x: 45m, y: 50m, z: 1.71m)

0-100: Ploughsoil (A) with silt and some root fragments; some coarse sand lenses; becoming more sandy; @74cm slight pale colour change

100-121: colour change to pale grey coarse sand; very wet some brown staining (C).

121-185: becoming paler coarse and more wet; poss D.

@185cm TOO WET TO REMOVE; PIT NOT BOTTOMED

BH24 (x: 45m, y: 70m, z: 2.12)

0-83: silty sand brown black with organic brick inclusions (A); @77cm more clayey possibly plaggen soil.

83-150: coarse pale whitish brown sand with orange patches (C); becoming wetter. Frequent orange staining.

150-180: dark grey; coarser clean sand no staining (D)

@180cm BECAME TOO WET TO REMOVE THOUGH SANDS CONTINUING; PIT NOT BOTTOMED

Preliminary palaeolandscape observations:

Between 35 and 50 metres south from point 1 the palaeolandscape seems to be characterized by a terrace cutting. This creates the opposition between a valley situation in the southern half of the field represented by larger quantities of peat, and a ridge feature in the northern half as indicated by a thick pack of coversands on top of a thinner peat layer. In this context distinguishing between late glacial dune sands and early Weichselian cover sands is difficult but hopefully OSL dating will clarify this more. The artefacts are associated with an erosional layer, represented by dispersed gravels, and a vertical spread of ca 10-15cm. The vertical displacement, or original position, of the artefacts is still unclear, as is its horizontal distribution in gullies.

4.2 Test pits

4.2.1 Test Pit 1

Stratigraphy:

Context A: Ploughsoil: dark brown to black sandy silt, roots going down to 4.5 to 35 centimeter disturbance, including bioturbation, at the contact with C

Context C: Orange-yellow sands ca 15-40cm thick, with white frost wedges and disturbance from the overlying ploughsoil. White horizon of coarser sand 3-7cm thick but discontinuous (Allerød horizon?).

Context D: Grey silty sand clearly layered and with penetrating white frost wedges, in west facing section frost wedges penetrate both C and D

at 120cm depth bright yellow-orange sands with patches of clay and beginning of ground water level

Figure 11: North facing profile of test pit 1

Finds: Only one find in the ploughsoil, no further stratified finds.

Find number	Test pit	X coordinate	Y coordinate	Z coordinate	Context	Description
OT-422	1	/	/	/	Ploughsoil	Large flint fragment, one side cortical, other glossy and remnants of two large frost removals

4.2.2 Test Pit 2

Stratigraphy:

Context A: Plough horizon: dark brown to black sandy silt, inclusions throughout including brick and organics. Sharp contact with C but also bioturbations. Horizon deeper in east compared to west.

Context C: Sand. In the northern part the top of the deposit is orang, iron stained, becoming paler deeper through the sequence. Small frost cracks throughout. In the southern part a difference in colour can be observed, more brown/pinkish, and the grains also become finer with increase silt component but still overall a sandy deposit. The contact and A and C is obvious and more gradual compared to the north. In the southern part of the trench the bioturbations are deeper.

Context D: Coarser, grey sand with distinct fine layering with darker brown horizons, some continuous, other discontinuous. Layers quite horizontal. Some small thin ice wedges but overall limited cryoturbation. There is one thin layer of dispersed gravels (erosional level). These gravels are dispersed over the entire surface of the trench and visible in the profile.

Context F: Clayey deposit, dark brown, quite cryoturbated and hence producing an uneven profile in section. No organic inclusions visible but smaller ones do appear to be present. Very wet so unable to establish depth of deposit.

Context G: dark green grey sand

Figure 12: East-facing section of test pit 1

Finds:

One clear Middle Palaeolithic artefact, a small core (Fig. 13), was recovered from context D, grey sands, not in direct contact with the peat. Other flint fragments from the gravel bed seem natural although OT-427 could be a flake fragment.

Find number	Test pit	X coordinate	Y coordinate	Z coordinate	Context	Description
OT-423	2	x:23.94m	y: 34.56m	z:115cm	Gravel bed	Flint fragment with fresh edges and opposition between dorsal and ventral (natural)
OT-424	2	x:24.24m	y:33.48m	z:120cm	Gravel bed	Rolled, patinated flint, cortex on one side (natural)
OT-425	2	x:24.87m	y:34.26m	z:121cm	Gravel bed	Gravel bed ca. 1.7cm thick, at west facing section, refits with OT-423 (natural)
OT-426	**2**	**x:24.10m**	**y:34.45m**	**z:117cm**	**Context D**	**Small core, one cortical face, other face flaked around the perimeter**
OT-427	2	x:24.17m	y:34.32m	z:119cm	Gravel bed	White patinated flint, natural or flake fragment?

Figure 13: Small core (OT-426) from test pit 2

4.2.3 Test Pit 3

Stratigraphy:
Context A: Plough soil. Black, sandy silt with lots of brick inclusions. Vertical disturbance cutting through pit from A. Disturbance contains mix of brick and sand.

Context C: Plaggen soil (deep man-made humic layer). Black, homogenous, sandy silt with inclusions of brick, organic remains and pottery. Clearly cut by the same disturbance feature as A. More clayey and moist towards the base.

Disturbed C: Dark yellow silty sand disturbed with lots of dark clay silt inclusion and small inclusions of brick. At the interface with A the same colour as the cover sands in the other test pits.

Finds: One flake (Fig. 15) was recovered from the ploughsoil.

Find number	Test pit	X coordinate	Y coordinate	Z coordinate	Context	Description
OT-429	**3**	**x:24.30m**	**y: 64.95m**	**z:44cm**	**Context A**	**White patinated flake, naturally backed**

Figure 14: Plan view of the disturbance features in test pit 3

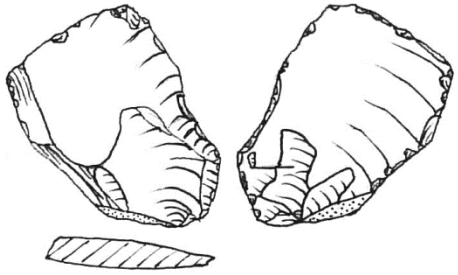


Figure 15: Artefact OT-429 (Scale 1:1)

4.2.4 Test Pit 4

Stratigraphy:

Plaggen soil: Black sandy silt with numerous inclusions of brick, pottery and roots. Thick deposit with a depth of ca. 80 cm. At base darker, black, more clayey with some humic elements. Continuous but thickness varies.

Coarse white sand: ca. 6-10 cm thick. Greater thickness in west facing section. Black horizons interspersed throughout and cut by bioturbation from higher up. Darker brown band of ca. 1-4 cm at the bottom, present in all four sections.

Silty sand with a finer fraction, more brown than coarse sands above and seems to truncate white sands in places. Potential gravel bed at water level.

Figure 16: Profile of test pit 4

Finds: A Middle Palaeolithic artefact worked bifacially, with steep retouch on one edge (Fig. 17), was recovered from the top soil.

Find number	Test pit	X coordinate	Y coordinate	Z coordinate	Context	Description
OT-430	**4**	**x:24.30m**	**y:49.10m**	**z:13cm**	**Context A**	**Bifacially worked artefact with steep Quina retouch**
OT-431	**4**	**x:23.30m**	**y:48.95m**	**z:61cm**	**Plaggen soil**	**Small white patinated blade with edge damage (burnt?) More recent than MP?**
OT-432	4	x:24.90m	y:49.06m	z:110cm	Grey sand	Large fragment, core or shatter?

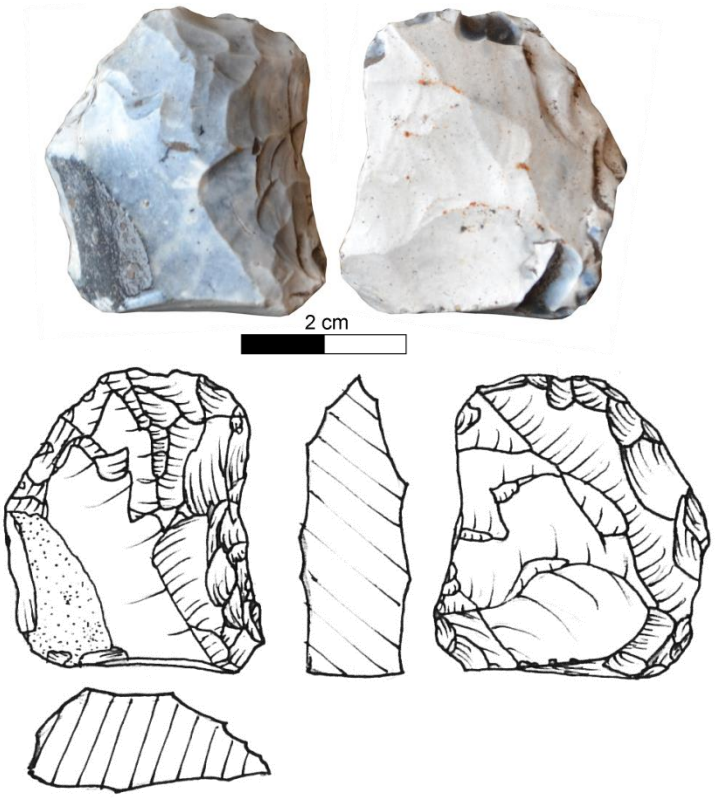


Figure 17: Bifacially worked artefact (OT-430) from test pit 4

4.2.5 Test Pit 5

Stratigraphy:

Context A: ploughsoil with bits of charcoal and brick, bioturbations at contact with C

Context C: silty sand ranging from dark to light grey, patches of orange staining and with frost cracks, with clear layers of more loamy and more clayey sediments
Context C1: layered grey sands with ice wedges and iron stains
Context C2: more clayey, dark layers (Kesselt soil?)
Context C3: very layered white grey sands with yellow staining

Context D: grey sand, layering less clear
erosional layer within: gravels dispersed vertically over several cm
not associated with a clear colour change

Context F: cryoturbated peat at water level

Figure 18: North facing section of test pit 5

Finds: Five flint fragments were recovered from the gravel bed and context D. For most pieces it is difficult to tell if it is a natural piece or an actual artefact.

Find number	Test pit	X coordinate	Y coordinate	Z coordinate	Context	Description
OT-433	5	x:23.71m	y:18.40m	z:103cm	Gravel bed	Flat, orientation of 200°, unpatinated black flint, shatter?
OT-442	5	x:24.96m	y:18.36m	z:104cm	Context D	In profile, probably flaked piece, one side cortical, other side large removals (frost?)
OT-444	5	x:24.78m	y:19.22m	z:105cm	Context D	White patinated flint (natural)
OT-445	**5**	**x:24.50m**	**y:19.30m**	**z:105cm**	**Gravel bed**	**Grey flint, on edge, orientation 11°, core frag?**
OT-446	**5**	**x:24.10m**	**y:19.50m**	**z:110cm**	**Gravel bed**	**Flat, small flake fragment with frost crack, clear bulb of percussion**

4.2.6 Test Pit 6

Stratigraphy:

Context A: Plough horizon: dark brown silt with brick inclusions, roots and frequent bioturbations going into underlying context C.

Context C: Late Glacial sands with bioturbations from the plough soil. Relatively fine silty sand with orange iron staining near the boundary with the top soil. Frost wedges going from C into D. Sediment paler towards contact with D. In east and south facing sections reddish brown disturbed unit. Pinkish AC mix? Slightly coarser.

Context D: Grey-yellow silty sand, greyer and coarser towards the base, horizontally bedded laminations with a slight dip from east to west, and from north to south, towards the southeast corner. Dark laminations are coarser brown sands (gullie?). Middle Palaeolithic artefacts are recovered from this horizon.

Context D': Dark grey brown silty sand, slightly coarser, like the laminations in D. Present in most of trench, contain small black particles (charcoal?). Dotted appearance in colour.

Yellow sands: underneath water table

Finds: Nine flint artefacts were recovered from the gravel bed in test pit 6 at depths ranging between 108 and 121cm. Three are clear Middle Palaeolithic artefacts, including a small care and basal fragment of a bifacial tool (Fig. 19).

Find number	Test pit	X coordinate	Y coordinate	Z coordinate	Context	Description
OT-434	6	**x:18.65m**	**y:18.50m**	**z:110cm**	**Gravel bed**	**white patinated, shatter or frost damaged flake?**
OT-435	6	x:18.64m	y:18.47m	z:108cm	Gravel bed	natural frost fragment
OT-436	**6**	**x:18.09m**	**y:19.23m**	**z:113m**	**Gravel bed**	**White patinated, one side cortical, other side removals, core?**
OT-437	6	x:18.54m	y:18.10m	z:110cm	Gravel bed	black flint, frost damage, flake fragment or shatter?
OT-438	**6**	**x:18.89m**	**y:18.70m**	**z:121cm**	**Gravel bed**	**base of handaxe? Cortical base, covering removals on both sides, tip missing**
OT-439	6	x:19.92m	y:19.83m	z:114cm	gravel bed	quartzite, frost fragment
OT-443	6	x:25.75m	y:19.67m	z:116cm	Gravel bed	brown flint, shatter or flake fragment?
OT-440	6	x:18.00m	y:26.10m	z:110cm	Gravel bed	Grey flint, unpatinated but glossy, frost damage, retouch or edge damage?
OT-441	6	x:26.95m	y:18.45m	z:110cm	Gravel bed	pebble fragment, brown flint

Figure 19: Basal fragment of a bifacial tool and small core from test pit 6

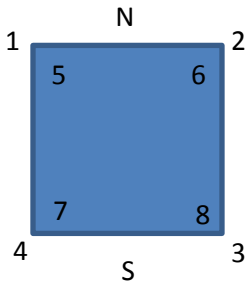
Figure 20: East facing section of test pit

Height measurements of the test pits with dumpy level

TBM: 10.00m

Backsight: 0.83m

Instrument height: 10.83m



Reading	Test pit 1	Test pit 5	Test pit 6	Test pit 2	Test pit 4	Test pit 3
1	1.01m	1.37m	1.52m	1.52m	1.81m	1.96m
2	1.03m	1.34m	1.47m	1.59m	1.80m	1.98m
3	1.03m	1.36m	1.58m	1.58m	1.82m	2.00m
4	1.03m	1.38m	1.59m	1.66m	1.80m	2.07m
5	2.24m	2.76m	2.69m	2.78m	2.53m	2.40m
6	1.75m	2.64m	2.40m	2.93m	3.11m	2.41m
7	2.26m	2.31m	2.72m	2.91m	3.11m	3.10m
8	2.44m	2.58m	3.00m	2.88m	3.07m	2.45m

Additional readings:

Test pit 4: top of grey sand
East facing: 2.79m
North facing: 2.84m
West facing: 2.86m

Test pit 2: erosional level
East facing: 2.74m
North facing: 2.78m

Test pit 6: artefacts in section
North facing: 2.66m
East facing: 2.61m

Test pit 6: top of brown level
North facing: 2.64m
East facing: 2.65m

Test pit 1: white horizon
North facing: top: 1.65m; bottom: 1.75m
East facing: top: 1.63m; 1.65m

Test pit 5: darker clayey bands
South facing: top: 1.90m; bottom: 2.07m
West facing: top: 1.93m; bottom: 2.05m

Test pit 5: top of peat
South facing: 2.55m

Test pit 5: artefact in section:
West facing: 2.38m

4.3 Chronostratigraphic framework

Stratigraphic position of the artefacts:

Both in the past and during this new fieldwork campaign several lithic artefacts have been found at Oosthoven-*Heieinde* out of their original stratigraphic position, namely on the surface and in the ploughsoil (at depths ranging from 10 to 60 cm). Conversely, lithic tools are also encountered more deeply buried, at depths between 105 and 121 cm, embedded in both sandy units D and E, in correlation with dispersed gravels, but never in direct contact with peat layer F (Fig. 21).

Site formation/taphonomy:

These lithic artefacts are found in relation to an erosional level which marks permafrost degradation, shallow channelling and aeolian deflation. During a very cold phase (Late Glacial Maximum? ca. 20,000 BP) gravels were deposited together with sand and loam by rivers that ran over the frozen land. Subsequently, the fine deposits were blown away and only the gravels remained, often having a flat, windblown, glossy appearance. At Oosthoven these dispersed gravels are of varying sizes and include both natural and manmade pieces of flint. The flint artefacts show no transport damage, with edges and ridges relatively fresh. Many pieces are heavily patinated, often with one face more heavily patinated than the other. Despite sieving of the sediments, it is clear that the small fraction of lithic production is absent, indicating a degree of site disturbance, probably related to overland water flow or small gullies.

This erosional level truncates both units D (in the North) and E (in the South). Unit D related to cross-bedded sand, near-horizontal units that are internally composed of inclined layers, which indicates that the depositional environment contained a flowing medium, either water or wind. Unit E is a pack of grey homogenous coarse sands. The relation between these two sandy units, the different test pits and the original position of the artefacts is still poorly understood. OSL dates will help correlate the various stratigraphic units and test pits. It is clear, however, that artefact density is very low and no specific artefact concentrations could be located.

Typology:

The physical condition and stratigraphic position of the artefacts seems to indicate the presence of a single archaeological layer. Based on detailed techno-typological analyses of the material collected from the 1993 excavation (Ruebens, 2005, 2006) a Middle Palaeolithic age seems very likely. Especially the presence of small, asymmetric, bifacially worked pieces and small discoidal and Levallois cores seem to indicate Neanderthals as the makers of this lithic industry. No indications of other Palaeolithic occupations, nor older, nor younger, have been encountered. The results of the OSL dates are awaited to be able to further specify the age of this material, to distinguish for example between MIS 5 (ca. 125,000-70,000 years ago) and MIS 3 (ca. 60,000-35,000 years ago).

Figure 21: Overview of the stratigraphic position of the artefacts in the various test pits: a, b: test pit 6; c: test pit 5; d,e: test pit 2

Absolute dating:

The nine OSL samples are currently being processed by Dr Marion Hernandez at the Max Planck Institute for Evolutionary Anthropology (Leipzig, Germany). As indicated on the drawings below (Fig. 22), these samples are bracketing the artefact horizon and will therefore provide both a *terminus ante quem* and a *terminus post quem* for the deposition of the artefacts. Results are expected back January/February 2015 and will subsequently be published in Journal of Archaeological Science or Quaternary Science Reviews.

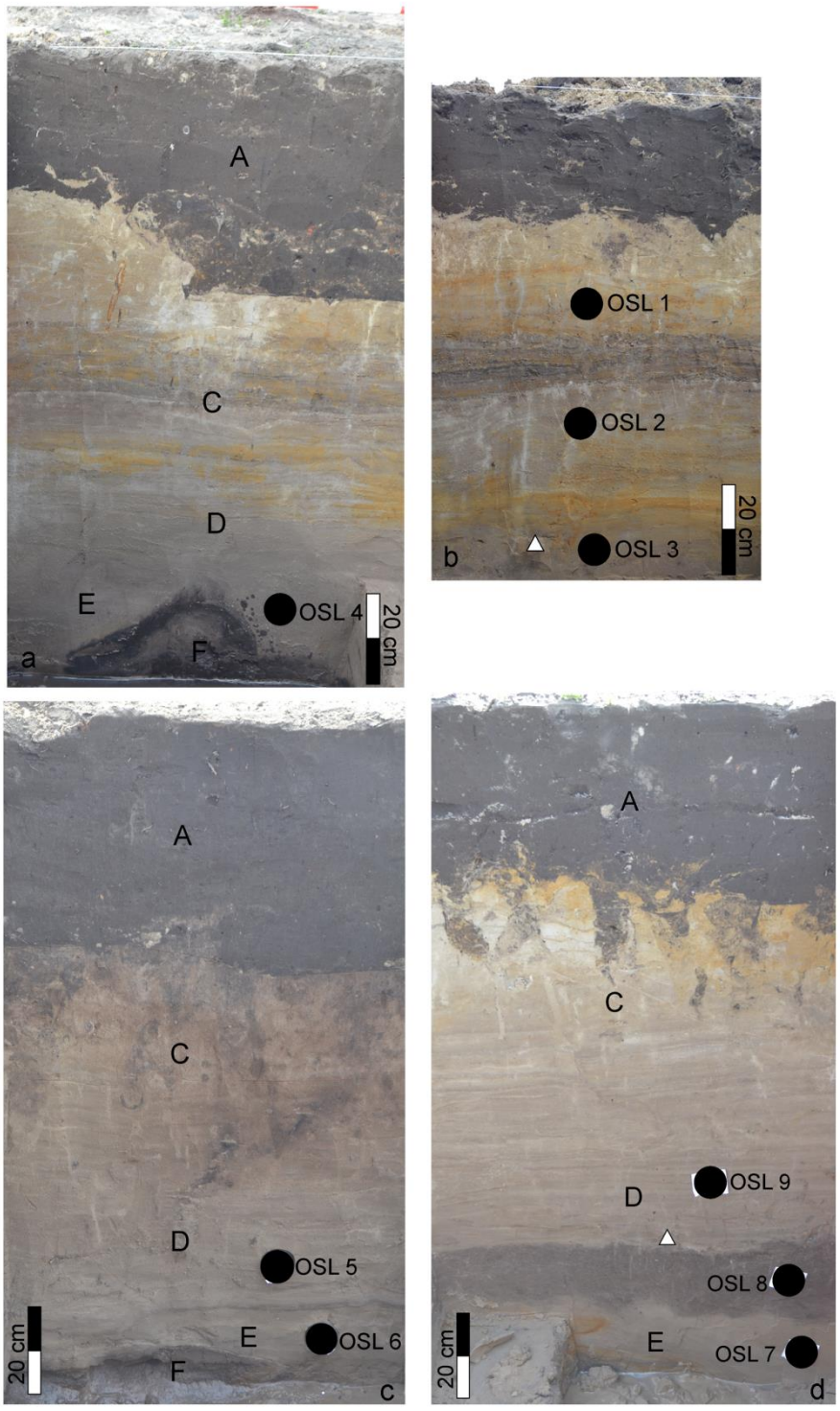


Figure 22: Overview of the location of the various OSL samples. a: TP 5 west facing section; b: TP5 south facing section; c: TP 2 north facing section; d: TP 6 north facing section

7. Synthesis

Oosthoven-Heieinde is one of the main Neanderthal sites in Flanders. Middle Palaeolithic finds in Belgium are mainly known from the Meuse Valley and due to post depositional processes is the number of sites in Flanders limited (Toussaint et al., 2011). In 1992 several lithic implements were collected from the surface of a field at Heieinde which became exposed due to erosional processes. Subsequently, an excavation of 200m² took place in 1993 led by the KU Leuven (Van Peer and Verbeek, 1994). At a depth of 1 m lithic artefacts were found in association with an erosional level on top of a peat horizon. 107 stone tools were collected and their linear distribution indicated a downslope disturbance and the potential to find more artefact concentrations further uphill. The lithic material is characterised by the presence of around 20 small bifacially worked tools, and were studied as part of a MA thesis (Ruebens, 2005) and subsequently contextualised and published (Ruebens, 2006, 2007, 2012, 2013, 2014; Ruebens and Van Peer, 2011, Ruebens and Di Modica, 2011).

Further erosional and agricultural use are currently putting the site of Heieinde under threat. A recent site visit indicated that lithic material is still being exposed on the surface. Because of the international importance of the locality, and its unique potential for further insights into the Neanderthal occupation of Fladers, it is important to further map the precise location, origin and spread of the artefacts. To this end, a small scale fieldwork project was initiated from March 24th to April 4th 2014 led by Karen Ruebens (Monrepos Archaeological Research Centre, Neuwied, Germany).

The aim of this new fieldwork was to better contextualise this Neanderthal site. Firstly, through a borehole campaign the further extent of the lithic material was mapped alongside the characteristics of the palaeolandscape. Three transects with a total of 24 boreholes were set out. A preliminary analyses indicates a main difference between the northern and southern half of the field. In the north cover sands (Unites D and E) are present, while in the south mainly peat (unit F) occurs beneath a deep manmade plaggen soil. This seems to indicate that the artefacts are positioned on a sandy ridge next to a wet depression.

Secondly, to better understand the site and current threats, six 2x2m test pits were opened east of the 1993 trench. These were dug by hand and a limited amount of lithic material as found in three test pits, in the plough soil as well as at a depth of 105-120cm. In the south the test pits showed modern disturbances and a thick plaggen soil that has levelled the field artificially. The Middle Palaeolithic material seems to be predominantly associated with sandy units D and E, and not in direct association with the peat layer. Further analyses are needed to better understand the exact origin of the artefacts.

Thirdly, nine sediment samples were collected in these three test pits with lithic material for OSL dating. Two attempts to radiocarbon dating in 1993 resulted in unreliable dates, making the exact chronological position of the site still unknown. OSL samples were taken both above and under the find horizon and represent the different stratigraphic units. Analyses of these samples is currently taking place at the Max Planck Institute in Leipzig and it is anticipated that results will provide both a terminus ante quem and terminus post quem for the finds.

This new fieldwork has illustrated that Middle Palaeolithic material is present at several depths in the northern half of the field at Heieinde. Artefact density is low but because of the high potential for further finds, both on a local and regional scale, it remains important to further monitor this locality.

8. Recommendations

In large areas of Flanders sediments dating between 300,000 and 40,000 years ago are covered by thick packs of coversands or affected by erosional processes, making the discovery of Middle Palaeolithic artefacts on the surface at Oosthoven-Heieinde of great importance. Moreover, old and new fieldwork illustrates the presence of these artefacts in buried positions, at a depth between 105-121cm, although in low densities. The exact mechanisms behind the exposure of these artefacts at the surface are still enigmatic and probably relate to a combination of factors, including erosional processes and agricultural activities. However, alongside similar surface and stratified finds in the nearby nature reserve De Liereman, it is clear that this area has a huge potential to reveal further traces of Neanderthal occupation. It is therefore important to further monitor and investigate the presence of flint artefacts on nearby fields, as well as mapping the presence of the erosional gravel bed during other field investigations.

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10. Appendices

a) Site dairy

Monday 24th March 2014
Present: Karen Ruebens (KR), Geoff M Smith (GMS), Markus Wild (MW), Mathias Probst (MP)
Weather: dry and sunny

Systematic field walking across the entire field
Started numbering finds from OT-400

Tuesday 25th March 2014
Present: KR, GMS, MW, MP, Philip Van Peer (PVP)
Weather: dry and sunny

- Set out grid from estimated baseline from 1993 excavation.
- Started test pit 1: 25 metres from zero point

A: plough soil: black sand ca. 40-50 cm deep, thicker in the north
(large flint OT-422)
C: cryoturbated orange-yellow sands
D: grey sands (start at 60 cm depth)
around 130-140cm water starts coming up, just when we hit spots with black organic sediment which has a yellow sandy level underneath.

- Set out the 25 metre transect line until 45 metre
- Second test pit positioned at x: 25m, y: 35m

A: plough zone
C: yellow-orange sands (darker 'pinkish' in the south)

Wednesday 26th March 2014
Present: KR, GMS, MW, MP
Weather: dry and sunny morning, showers late afternoon

- Test pit 1: ca. 5cm water in deepest part (ca. 150cm)
task: section cleaning
- Test pit 2: dry, at depth of 80cm
task: continue digging
- To check further stratigraphy in test pit 1 a borehole was conducted in the northwest quadrant of the test pit:

<u>Borehole 1:</u>
124-144cm: grey sand becoming more clayey towards bottom
144-204: coarse grey sands, wet
204: change from grey to black sands
204-240: very wet grey green sand
240: too wet to pull out

<u>Test pit 2:</u>
120cm: erosional layer with small and larger rounded gravels and natural pieces of flint (with wind gloss) this gravel layer truncates the grey sands and does not touch the peat
no more finds in the afternoon, patches of peat and clay on surface at the end of the day (at depth of 133cm), water starts coming up

- boreholes 2, 3, 4, 5, 6 and 7 conducted by GMS and MP

Thursday 27th March 2014
Present: KR, GMS, MW, MP
Weather: sunny, hazy day

- three more boreholes at 80, 100, 120, 140, 160 and 180m
- recording of TP1: context sheets and drawing of 4 sections
- TP2: tried to dig deeper to explore the depth and morphology of the peat but made impossible by recurring water
- set out TP3: at 65metre from the 25m point
- set out TP4: at 50 metre from the 25m point

Test pit 1: summary

A: Thick plough zone
eastern half: old ditch visible, both in section and in plan, filled in with A and inclusions
C: in the south thicker white horizon which is absent in the North
frost wedges more prominent in the south
in north contact between C and D unclear, contact deformation
water comes up around 140cm and in borehole
in East and South facing section lower orange/yellow horizon, but probably part of D

Test pit 2: summary

A: homogenous black plough soil with many bioturbations, contact with C blurry
C: in north: yellow sands with iron stains and clear black bioturbations with sharp contacts
in south: more brown, pinkish colour and bioturbations have more blurred contacts
contact between C and D difficult to follow
D: grey layered sands with few frost wedges
thicker brown layers interspersed
Layer with gravels (Beuningen) all over the 2m² test pit, but discontinuous in the section, associated with artefacts and still several centimeters above the peat
Peat: black and clayey patches
Water table prevents digger further
Only in West facing section yellow wands underneath 12cm of peat visible, elsewhere thickness of peat unclear because of rising water

Test pit 3

A: plough soil ca. 35 cm deep
Grey-yellow sands with black and orange inclusion (with patinated flake OT-429)
Thick black layer underneath with large pieces of wood and brick
in plan: sharp line between these two deposits
black layer, ditch going through: 2 phases of disturbance
test pit stopped at depth of 79 cm
Borehole 11 in test pit 3: interface between black peat and grey sand at 140cm below ground level

Test pit 4:

A: ploughsoil, find OT-430: bifacially worked piece

Friday 28th March 2014

Present: KR, GMS, MW, MP

Weather: sunny, windy day

- continue with TP4
  starts getting wet at 127cm depth
  erosional level located in NW of trench at 131cm, contains dispersed gravels of 10 to 75mm in diameter
  south facing section collapsed next to step

- borehole 12 at 0,25 metre (GMS, MP)

- set out TP5 at 20x25m
Thick plough horizon, then cover sands, then grey layered sands with gravel layer
Artefact 433, flat unpatinated and clearly associated with gravel layer
diserpsed gravels, mainly natural: rounded and glossy, also coarser sand in plan and black spots (charcoal?), however this erosional level is not associated with a colour change in the sediments

Saturday 29th March 2014
Present: KR, GMS, MW, MP
Weather: sunny day

- finish and record TP4
- continue with TP4 and explore gravel bed
- start borehole transect at 5m line (5,10; 5,30; 5,50)
- set out TP6 at 20x20m
  ploughsoil ca 35 cm deep
- water level measurements (TP3: 110cm; TP4: 126cm; TP2: 133cm; TP5: 132cm; TP1: 120cm)

Monday 31st March 2014
Present: KR, GMS, MW, MP
Weather: cloudy, dry, warm day

- set out rest of 5m transect
- continue TP6
- record TP5 and 3

<u>Test pit 6:</u>
A: plough soil
C: cover sands
D: crossbedded sands, with first gravels at depth of 87cm
end of day: depth of 105cm
gravel layer not horizontal, associated with white coarser sand, no larger gravels as yet
brown loam layers dip in SE corner

<u>Context sheets for TP5:</u>
A: ploughsoil with bits of charcoal and brick, bioturbations at contact with C
C: silty sand ranging from dark to light grey, patches of orange staining and with frost cracks, with clear layers of more loamy and more clayey sediments
C1: layered grey sands with ice wedges and iron stains

C2: more clayey, dark layers
C3: very layered white grey sands with yellow staining
D: grey sand, layering less clear
erosional layer within: gravels dispersed vertically over several cm
not associated with a clear colour change
F: cryoturbated peat at water level

Landscape morphology
Field at a height of 25-26m above sea level
In northeast direction, ca 750m away, cuesta feature with a top of ca 30m
In northwest direction, landscape raises to 31.25m
but artefacts seem to fresh to be transported long distances
Oosthovense Loop: south of the field, junction with the river Aa ca 500m southeast of field
Lowest part of the area: Liereman depression at 23.75m
Artefacts eroded out of local deposits? But which ones?
South: artefacts in erosional level that truncates E and F
North: artefacts at base of D, gullies with redeposited E, only few artefacts within erosional layer: artefacts originate from D or E?

Wednesday 2nd April 2014
Present: KR, GMS, MW, MP, Jeroen Adriaensen (JA), Marion Hernandez (MH)
Weather: cloudy, dry, warm day

- continue 5m borehole transect
- continue TP6
- OSL sampling (TP5 and 2)
- micromorphology sample in the peat of TP 5 for Vera Aldeias

Thursday 3d April 2014
Present: KR, GMS, MW, MP, JA, MH, PVP
Weather: sunny day

- continue TP 6 + recording
- continue boreholes along 45m transect
- continue TP 5
- OSL sampling in TP 6
- start to backfill TP 3 and 4
- visit Dirk Van Troy, local collector

General notes:
TP1: white horizon: Allerod? With frost wedges starting from it: Younger Dryas
duinzand op dekzand
pedogenesis with A horizon

TP5: Kesselt soil? Related to interstadial just before MIS-2 = clayey soils
cold? Cryoturbated?

warm? Tundra soil
nice pack of cover sands and late glacial dune sands

TP2: plaggen?
laminated coversands, more sandy and alternated with more clayey dunesand and melting water
clay above peat: finer sediment deposited after peat growth stopped

TP4: grey sands: pedogenesis: clay disappeared in top bit
top of coversands or directly into D?
so old depression?
natte plag

Landscape: between 35 and 50m terrace cutting
in South: valley situation

Friday 4th April 2014
Present: KR, GMS, MW, MP, MH
Weather: cloudy, dry day

- Measuring heights of test pits, layers and boreholes with dumpy level
- GPS points of the corners of the field
- Record TP6
- visit from Cyriel Verbeek, who discovered the site
- Backfilling all test pits

b) digital attachments

- 1 list of drawings
- 1 finds list
- 1 OSL sample list
- 19 profile drawings
- 2 bore hole transect overviews
- 2 preliminary artefact drawings
- 289 fieldwork photos, with description