Early hominin activity in Waziers

Reconstructing the environment of the Somme Valley, France during the Eemian interglacial

Bert Verleijsdonk

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Reconstructing the environment of the Somme Valley, France during the Eemian interglacial

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BA3 Thesis

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Table of Contents

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1. Introduction

In the present time, humans are distributed over most land masses on earth, adjusted to most habitats present on our planet. Humans cause land transformation and degradation by expanding infrastructure and agriculture. This expansion is accelerated because of population growth. Hooke and Martin-Duque (2012, 4), estimate that more than 50% of the earth's land surface has been modified by humans. Areas not colonized by humans are mostly unsuitable for agriculture, mainly tropical rainforests and (polar) deserts, demonstrating the successfulness of *Homo sapiens* to adapt to any environment. However, we can conclude from the hominin fossil records that the geographic distribution of early hominins was more restricted. The fossil record suggests that hominins first dispersed out of Africa into Europe and Asia, expanding their geographical distribution slowly in the last two to three million years, which led to the current human distribution. Potts (1998, 111) suggests adaptive changes arise in hominins in response to environmental variation. Climate change, environmental variation and new ways to exploit or compete for natural resources provided by technological innovations are used to explain the adaptation to new habitats and changes in geographical distribution of hominins (e.g. Dennel 2003; Roebroeks 2001; Potts 2012). Although the relationship between climate and environmental change and evolutionary mechanisms is still not clear (DeMenocal 2011, 540), understanding the change in geographical distribution of hominins can help us understand changes in the behavior or biology of early hominins that provided them the opportunity to adapt to these habitats (e.g. Joordens *et al*. 2011). Interglacial Europe is one of these geographical areas and is researched extensively by scholars to find the limits of early hominin occupation of this area. New data on spatial distribution of sites dated to Interglacial Europe can add to our understanding of the social and technologically abilities of early hominins to adapt to this specific ecosystem.

The occupation of Northwest Europe by early hominins has been a topic of long debate. By reviewing the environmental background, examining archaeological key sites in north-western Europe and providing a chronological framework, Roebroeks and colleagues (1992) demonstrated that there were archaeological sites in north-western Europe during the Paleolithic in both glacial and interglacial periods, proving *Homo neanderthalensis* was present during this period. This contradicted the hypothesis that Gamble (1986) presented, who argued that interglacial northern Europe was a hostile environment for hominins. However the *Homo neanderthaensis* population must have had a low density (Hublin and Roebroeks 2009, 505). Hublin and Roebroeks (2009, 503) argue that *Homo neanderthalensis* presence in northern European environment must have been discontinuous, due their inability to adapt to extreme glacial conditions, making hominin occupation coherent with favorable climatic conditions and local extinctions coherent to unfavorable climatic conditions. Although there are still many questions about the occupation of northern Europe by *Homo neanderthansis*, it is notable that there are no archaeological traces dated to the Eemian stage present on Great Britain, suggesting that the island remained unoccupied during the last intergacial, even though there is evidence for the presence of hominins in earlier interglacials (Roebroeks *et al*. 1992, 567). Two hypotheses are presented by Ashton (2002) to explain the absence of hominins in Great Britain during the Eemian stage. His first model explains the absence by the rapid forming of the English Channel between Britain and the mainland, forming a physical barrier, discouraging Neanderthal expansion (Ashton 2002, 96-97). Moreover, his second model explains the absence of Neanderthals by their increasing specialization towards mammoth steppe-environments (Ashton 2002, 97-100), thus favoring the eastern regions of Europe. It is crucial to explain the absence of *Homo neanderthalensis* in Great Britain, because it would provide valuable information for our understanding of *Homo neanderthalensis*.

Furthermore, Archaeological evidence for hominin presence in northern France is important for our understanding of hominin occupation in northern Europe and especially Great Britain. In this thesis data will be presented of a recently discovered archaeological site named Waziers, which is dated to the Last Intergacial and located in northern France. Because a study of the environment can help us better understand hominin behavior and provides context to the hominin occupation at Waziers, an attempt is made to reconstruct the environment during this period. Botanical macrofossils will be analyzed and are used to reconstruct the environment which early hominins exploited at Waziers during the last interglacial. Furthermore, an overview of the data generated by the French excavation team will be provided and put in context with other relevant data on the hominin occupation of northern Europe during the last interglacial and the absence of *Homo neanderthalensis* in Great Britain, to add to the discussion why early hominins appear to not have crossed the North Sea Canal during Marine Isotope Stage (MIS) 5e.

It should be noted that the Eemian stage is dated from approximately 130-115Kya, based on the δ^{18}O values of deep sea sediments and in the ice sheet on Antarctica

(Stouthamer *et al*. 2015, 201). In this paper, several terms will be used to refer to our period of study. The terms, Eemian stage, Last Interglacial and Marine Isotope Stage (MIS) 5e, have different definitions but are used promiscuous in the literature.

2. Excavations at Waziers

The archaeological site Waziers is found in an area name ‘’Le Bas-Terroir’’, located just northeast of Douai (fig 1), northern France. It lies on a low-lying plain on the southeast border of the Scarpe, on an altitude of approximately 21 meters above sea level.

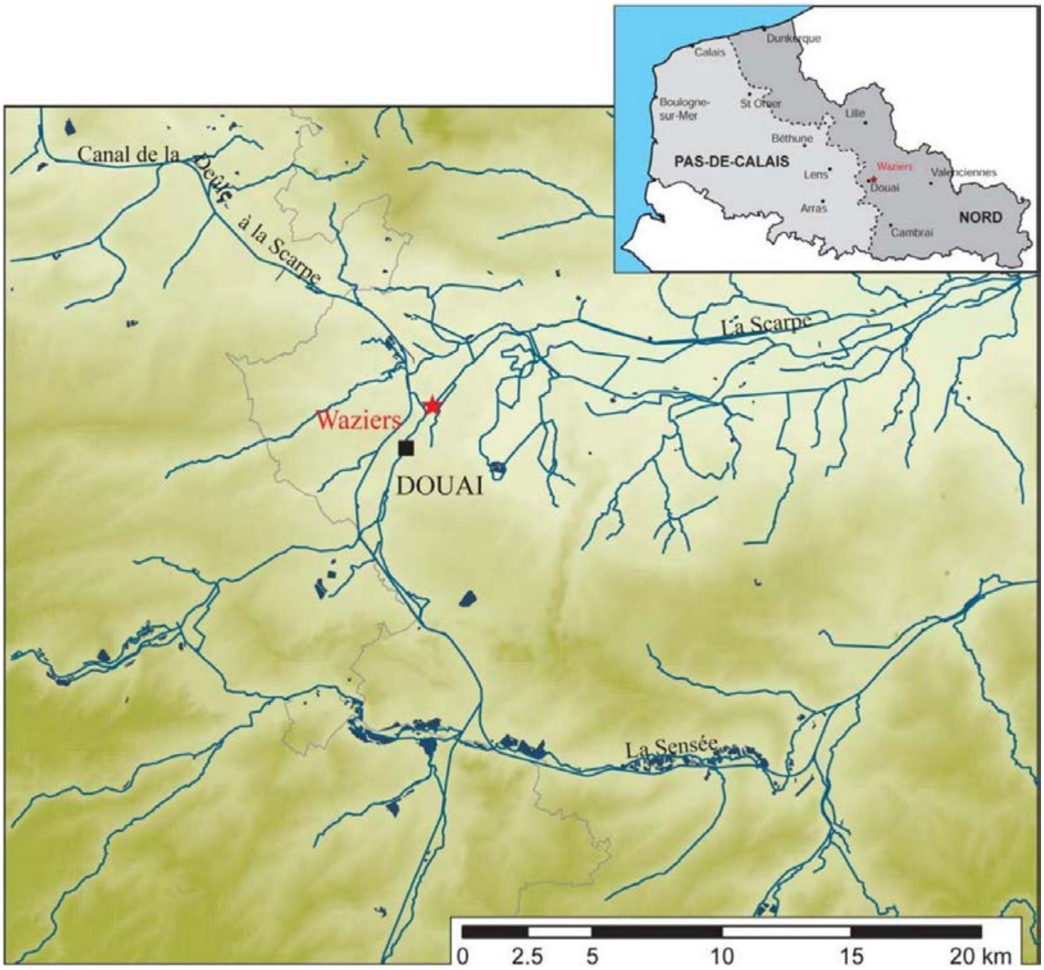

Figure 1: Site location (Sergent 2013 in Hérisson *et al*. 2017, 11).

Because the township of Waziers had construction plans in this area, the Communauté d’Agglomération du Douaisis- Direction de l’Archéologie preventive diagnosed the area should be investigated for archaeological traces. Test units in this location, made between 14 and 16 November 2011, revealed archaeological remains dating to the Iron Age and the Roman time. This research was carried out by Petit. One of the drill cores revealed a peat layer of over 1 meter thick at a depth of approximately 3.2 meters. Petite (in Hérisson *et al*. 2017, 15) identified it as a layer belonging to the Tardiglacial (approximately 13.000-10.000 Kya).

However, new observations made in 2013, provided new information about the nature of this layer: lithic artefacts and auroch remains coming from this layer made the researchers believe this layer was older. This belief was confirmed by Radiocarbon dating done on preserved wood found in the peat, which showed that the layer dated to a period before 43.500 BP (Hérisson 2016, 2; Hérisson *et al*. 2017, 15), confirming that the layer indeed deposited in a period before the Terdiglacial.

To understand the nature of the area and the distribution of the depositions, Hérisson and colleagues (2015) decided to map the distribution of the peat and alluvial depositions, other geological variations and the course of the paleochannel the Scarpe. For this they used an electromagnetic ground conductivity meter (EM31) was used (fig 2). Excavations were started in 2014 in the peat deposition.

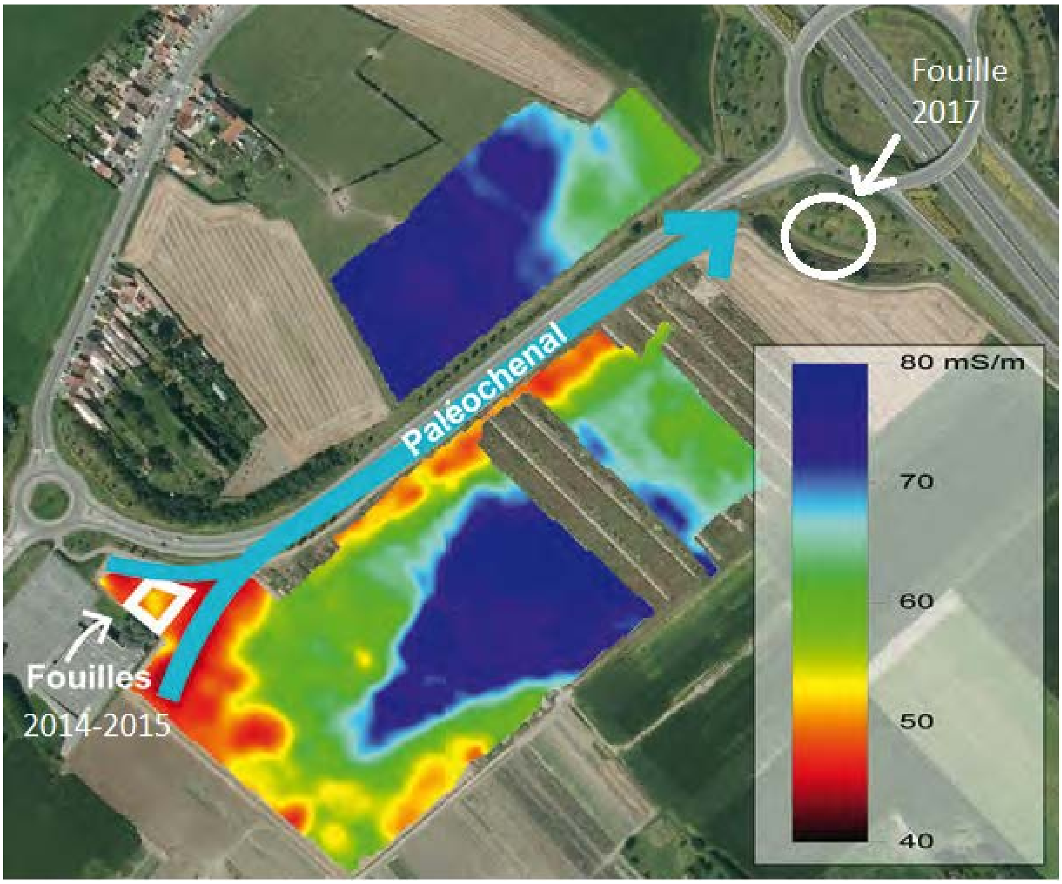

Figure 2: Location of the excavations in 2014-2015 and 2017 in context with the course of the paleochannel the Scarpe mapped with the data of electrical conductivity. Soils represented here: Blue (clay) conducting depositions to red (peat and alluvial deposits) resistant depositions (after Hérisson 2016, 2).

In this chapter the results of the excavations at Waziers will be studied. For more detailed information on these topics, Hérisson (2017) can be consulted.

2.1 Stratigraphy

To map the course of the Scarpe paleochannel and the distribution of the peat and alluvial depositions further, in total 17 drill cores were taken and 40 test pits were dug. Dozens of hectares were mapped using this method (Hérisson 2016, 2).

Three cores showed that there was a peat layer of 1.2 meter thick present at approximately a depth of 3 meters. Lithic artefacts and remains of auroch were found in this layer. Calcite in this layer has been U/Th dated to a minimal age of 110.000 Kya, dating it to the Eemian stage (Hérisson 2016, 2).

During the excavations of 2014 and 2015 the stratigraphic sequences of a sector of 211 m^2 were explored. The bottom of the stratigraphic sequence was made up of Thanetien (59.2-56 Mya) sandy clay depositions. These were followed by thick fluvial depositions. Mollusks and faunal remains are present on the top of this layer which is coherent to an open landscape that is typical for the Saalien stage (Hérisson 2016, 4). Following these depositions are peat and organic loam layers (fig 3), dated to the Last Interglacial (Hérisson 2016, 2). Lithic artefacts and faunal remains were discovered in this layer. Furthermore, aquatic mollusks become dominant in this peat layer and various snail species typical for interglacial stages are present in this layer (Hérisson 2016, 4). This layer is covered with sand, gravel, chalk and loess sediments, deposited during the Weichselien glacial stage (110.000-12.000 Kya).

Not that often Eemian depositions are present in northern France. So far Waziers has only been the second archaeological site in northern France discovered, that dates back to the Last Interglacial, the other one being Caours, another archaeological site in located approximately 20 kilometers southwest of Waziers (Antoine *et al.*. 2006; Auguste 2009). Therefore a multidisciplinary research was started in this area.

Figure 3: The stratigraphic sequence uncovered during the excavations at Waziers, showing: A. Fluvial depositions deposited at the end of the Saalien interglacial stage, leading to the start of the Eemian stage; B. Peat and organic loam depositions deposited during the Eemian stage; C Sand, gravel, chalk and loess depositions deposited during the Weichselien glacial stage (Hérisson 2016, 3).

2.2 Faunal data

In total, 16 different taxa have been identified during the excavations of 2014. There were several types of vertebrate faunal remains recovered, including mammals and birds (Hérisson *et al*. 2015, 21; Hérisson *et al*. 2017, 25). The identified faunal remains retrieved are very similar to the assemblage of the previously mentioned archaeological site Caours (Antoine *et al.*. 2006; Auguste 2009),. During the whole excavation period, several bone pieces that show evidence of butchering techniques have been retrieved, mostly auroch and beaver, scattered over the whole excavation area, ranging in different levels (Hérisson 2016, 5). One piece of bone that was found during the 2014 excavation stands out and truly confirms the hominin presence: a fragment of the frontal of an auroch (fig 4.), which shows an activity of separating the skin from the skull (Hérisson *et al*. 2017, 101), named skinning. All this evidence strongly suggests that *Homo neanderthalensis* repeatedly visited the area (Hérisson 2016, 5).

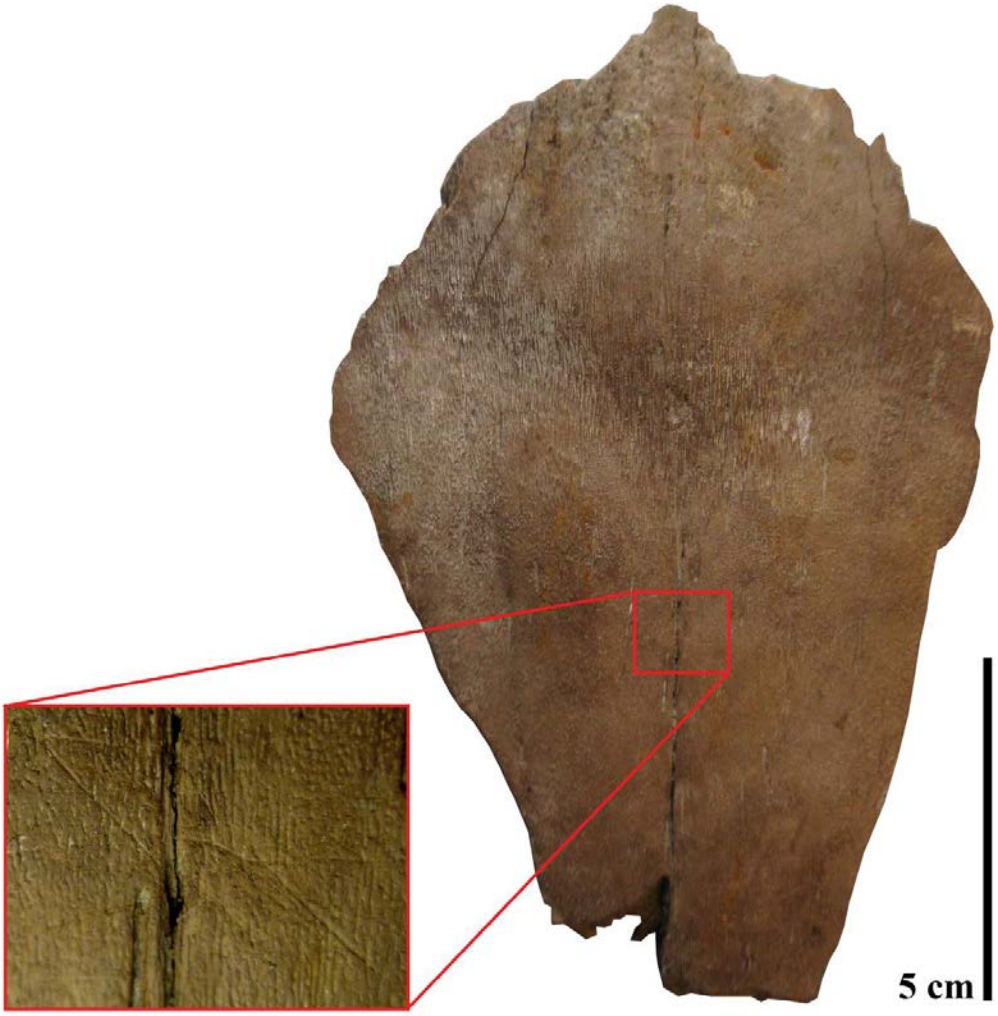

Figure 4: Bone fragment of the frontal of the auroch that showis clear evidence of skinning by hominins. Dorsal view (Hérisson *et al*. 2017, 101).

During the excavations of 2017, remains of vertebrate bones and teeth were discovered in several stratigraphic layers: 62 pieces in total. Most of the species found were duck, which were found in at least pairs of two, but mammal remains were also discovered. Furthermore, small bird and turtles were found during the excavations (Hérisson *et al*. 2017, 98).

A particularly interesting piece of bone recovered during the excavations was again identified as auroch. This is one of the found fragments that showed strong evidence of hominin interference. This bone piece was fractured, caused by hard thumping, which implies that it could be caused by butchery (Hérisson *et al*. 2017, 98). Other interesting finds during the excavations include the remains of a horse and a fragment of the lower molar of a proboscidean. Because of the morphology of the blades, the author concludes that the molar is likely to belong to a forest elephant and not to a mammoth (Hérisson *et al*. 2017, 99).

These 2017 findings are in corroboration with the previous findings of the excavations in 2014-2015, with the exception of the elephant. In addition, the conservation of the peat material from unit 6 and 7 is equal to stratigraphic units of previous excavations. All taxa point towards a mild climate with tree vegetation. The anthropogenic impact on these elements is always fleeting, probably because the depot lies in an aquatic area and secondly because of the human occupation of the riverbank (Hérisson *et al*. 2017, 99).

2.3 Lithic artefacts

In the first excavations two clusters of flint artefacts (fig. 5) have been uncovered. Presumably, several flakes have been produced here by *Homo neanderthalensis*, possibly for butchering and hunting purposes (Hérisson 2016, 6).

Figure 5: Levallois-flake found during the excavations in Waziers, 2013 (Hérisson 2016, 6).

In addition, during the 2017 excavations, a carved part of lithic was discovered, which is very rare. This is because the erosion, taking place at the top of the bank and the interfluvial zone between the primary and secondary channel decreased the probability of finding such pieces in the area. Only the reshaped pieces that can be found in the gravel certify that there were passage ways or occupation near the open trench (Hérisson *et al*. 2017, 115). Further research should be conducted in the South-East extension of the trench to find out more about the conservation of the South bank and possible human occupation.

Two pieces, discovered in unit 200, indicate that more recent occupation during the Last Glacial could have taken place. However, these pieces are of little interest due their technological nature and secondary position (Hérisson *et al*. 2017, 115).

2.4 Palynology

The palynological study at the Waziers site was done using Log6 analysis. Stratigraphically, the log6 sequence includes U4a sedimentary units (silty sands) to U5b (peat). Three 50cm samples of Log6 were taken in 2014. Hérisson and colleagues (2017) provide more information on the methodology regarding this research subject.

During this research, 82 different tree and herb taxa were identified (Hérisson 2016, 4), coming out the peat layers. The results support an idea that during the start of the Eemian stage there was an open landscape without dense vegetation. Thereafter, several pioneer tree species appear around the peat area, e.g. *Betula, Pinus* and *Ulmus.* Thereafter, *Quercus* appears, indicating a warm and humid temperate climate. The final stage is a marshy forest composed of *Corylus*, *Alnus* and *Carpinus* (Hérisson 2016, 4).

2.5 Micro morphology

Through observing pedo-sedimentary features using a microscope, pedogenic processes are identified in a qualitative or semi-qualitative way (Stoops et al. 2010 in Hérisson *et al*. 2017, 126). These features can be interpreted in terms of sedimentary and pedogenic phases, and allow a reconstruction of paleoenvironments (e.g. Kemp 1997).

Few micromorphological studies have focused on peat or histosols[1] (Stoops et al. 2010 in Hérisson *et al*. 2017, 126). The observations will focus on classifying peats based on the degree of decomposition. This is done to determine the significance of the detrital fraction and observe post-depositional changes related to the age of the formation.

Four sediment blocks were extracted in 2016 (blocks B1, B2, B3 and B4). Block B1, B2 and B3 are useful for studying the dynamics of pedo-sedimentary history of the area. Below the results per block as given in Hérisson and colleagues (2017, 126-130) will be briefly summarized.

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[1] Soils consisting primarily of organic materials

The deposits in block B1 are characterized by a high amount of organic material. Most of the plant remains have deteriorated and are blackened. However, a few fibres are still visible. Amongst others, a silty fraction (quartzose with a few specs of glaucony) is visible. Small sand fills the biological blanks. In addition, some spherolites of earth worms have been discovered. The deposit was split on the side, forming large aggregates. On the point of splitting there is presence of lenticular or geometric crystallization, arranged in a radial way and with shades of weak birefringence, possibly gypsum. The crystals look automorphic and undisturbed (Hérisson *et al*. 2017, 126).

In the B2 block, the deposits are related to lined peat. Like in B1, the organic materials that were found were deteriorated and blackened. Only the largest elements in the peat have recognizable units. A small fraction consisting of silt and quartz is present. At the base of the block, a bed of broken mollusk shells can be found (Hérisson *et al*. 2017, 126).

Contrary to B1 and B2, the sediment in block 3 is very organic. The lower half of the block consists of peat without minerals. The organic material is crumbled into small pieces. In the upper half, stringers were present (Hérisson *et al*. 2017, 126).

Finely laminated silt layers are present in block 4. The sizes of the silt laminations are less than one millimeter. The sediment contained quartz, with pieces of glaucony and micas. Some elements of carbonate are visible. Finally, some laminations hold organic matter, in the form of small irregularly shaped black elements (Hérisson *et al*. 2017, 129).

2.6 Ongoing research

Several other researches that study the site of Waziers are still being carried out at the moment. Still ongoing research include entomological research, analysis of microfauna, faunal isotope analysis, aminostragraphy on operculum *Bithynia*, U/Th dating of wood, ESR-U/Th dating of teeth and analysis of botanical macrofossils. This thesis will provide more information on the analysis of botanical macrofossils found at Waziers.

3. The botanical macrofossil data

The botanical research was started after the soil samples that were taken at Waziers were shipped to Leiden University. At Leiden University, the soil was first analyzed to generate data and after generating the data it was processed there. For both generating and processing the data, certain methods and technics were used. In this chapter the methodology used to generate and process the data will be discussed. Furthermore, the results of the processed data and the analysis and discussion of the generated data will be discussed in this chapter.

3.1 Methodology

The methodology used in archaeobotany is very much determined by how the organic material in a sample is preserved. The organic material taken at Waziers is waterlogged. Organic material can preserve in almost anaerobic to complete anaerobic (low to absent oxygen levels). These conditions are often met in environments where constant dampness thrives, such as marshes and lake bottoms (Greig 1989, 12). Decomposers are inactive in these environments, resulting in waterlogged seed and fruits remains, which have a dark colour and have no starch content (Weiss and Kislev 2008, 164). The tougher, outer layer of a seed remains preserved in these conditions and can be studied. However, some species of plants do not produce seeds or fruits with these tougher outer layers and will not be preserved in these conditions (Greig 1989, 13).

The samples used for this research are taken during the excavations of Waziers in 2017 by dr. Field. It was taken from coupe 1, partie 2, extending to a depth of 70cm below surface. In total five layers were distinguished in coupe 1, partie 2 (fig. 6 and 7).

For studying, the samples were brought to Leiden University, where the samples were studied under supervision of Dr. Field. In Leiden, the samples were stored in a fridge. This device was kept on a constant temperature of 1.8°C to prevent any damage to the fossils. At lower temperatures, the soil will freeze and the fossils might break. At this temperature microorganisms are inactive and nothing will evaporate.

From each soil sample an exact amount of 200 cm^2 for the macrofossils was taken. To obtain this result a tube with scale was filled with water until 300 cl after which soil from the concerned sample was added until 500 cl. For each sample the surface tension was used to determine the exact 500 cl.

The soil containing the sample was carefully and precisely rinsed out into a bucket so nothing gets lost. Each sample was left in this bucket with water for a week for flotation. After flotation, each sample got sieved separately. Four sieves, standing on top of each other were used for this. The sieves were, from top to bottom, respectively 1 mm, 500 µm, 250 µm and 100 µm. This way, macrofossils of all types and seizes would be represented in the assemblage. No chemicals were used to clean the soil samples. After the sieving the fractions were put in a Petri dish with just water to analyze the soil for plant macrofossils with a microscope. Macrofossils were collected and put in a preservative, consisting of 1/3 alcohol to stop the fossils from growing moldy, 1/3 water to keep the fossils wet and 1/3 glycine to keep the alcohol in a good state.

To identify the seeds, the macrofossils that were picked out were compared with the seed reference collection of the Botany Lab of the Faculty of Archaeology of Leiden University. Furthermore, some hard to identify seeds were compared to figures in the work *Bestimmungsschlüssel für subfossile Juncus-Samen und Gramineen-Früchte* (Koerber-Grohne, 1964). The results produced from each sample were sorted and counted by taxon. Fruits and seeds that were fragmented have not been counted together with whole specimens. This is to clarify the nature of the samples and to increase the reliability of the conclusions made based on the samples.

The produced data will be presented and explained in the next chapter. Furthermore, an overview and description of all present taxa will be presented.

3.2 Context of the sample

During the excavations of 2017, 4 coupes were made. Five layers were distinguished and sampled (fig. 6 and 7) in coupe 1 partie 2, extending to a depth of 70cm below surface. Separated from 6a by 6c Dr. Field sampled from bottom to top. This way no soil fell down on one of the layers that had yet to be sampled. The bottom sample is thus samples 1 and the top sample is sample 5.

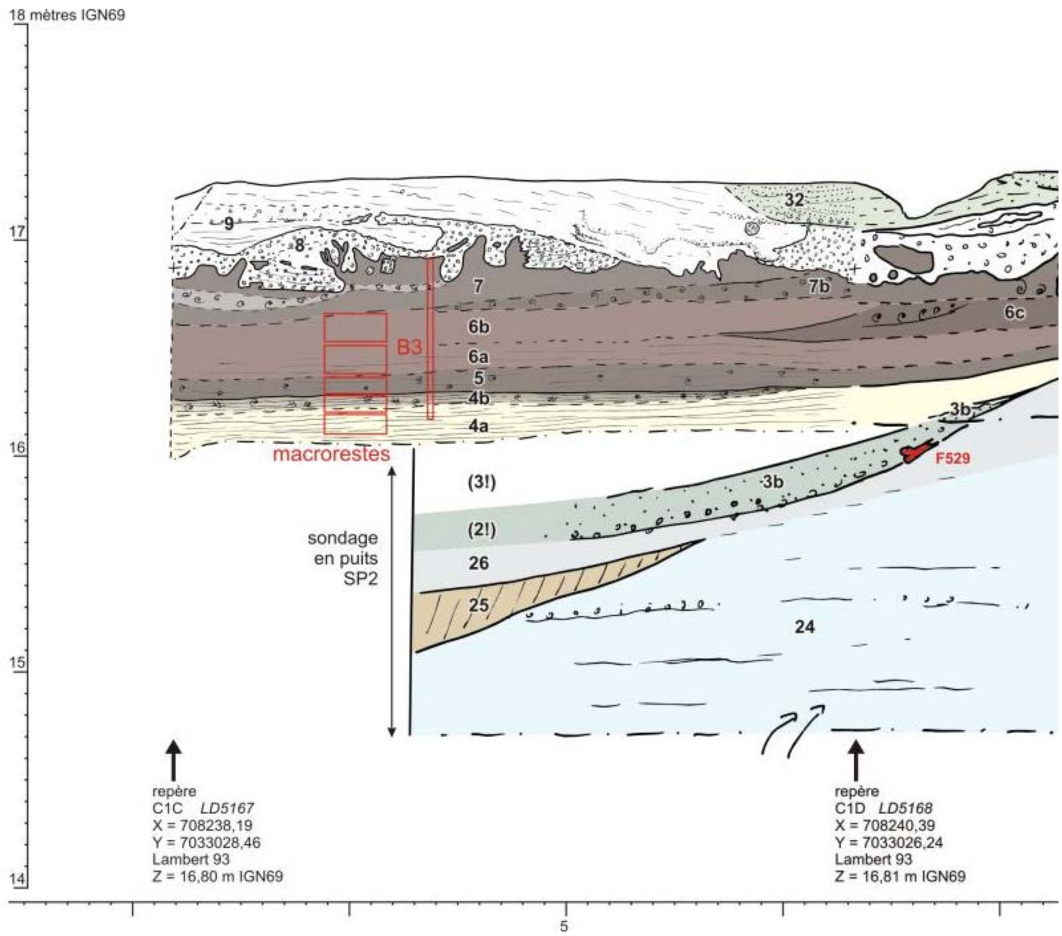

Figure 6: Schematic overview of coupe 1 partie 2. The exact place where the samples for the botanical macrofossil analyses are taken are shown in this. The layers have been sampled from bottom to top. Layer discriptions are as following: 4a. very fine tuffaceous bed with well-preserved scattered plant debris; 4b. Similar to 4a but with more abundant and thicker plant debris, which form small beds with a peaty tendency. Visible malacofauna more abundant; 5. Dark brown peat, fibrous, malacofauna; 6a. Littered peat; 6b. Littered peat. Separated from 6a by 6c (After Hérisson *et al*. 2017, 70).

The sampled layers varied in thickness. Layer thickness and layer description as provided by Hérisson and colleagues (2017, 67) are as follows:

Sample 1 has a minimum depth of 48 cm and a maximum depth of 70 cm. It is taken in layer 4a, which is composed of very fine tuffaceous bed with well-preserved scattered plant debris

Sample 2 has a minimum depth of 40 cm and a maximum depth of 48 cm. It is taken in layer 4b, which is similar to 4a but with more abundant and thicker plant debris, which form small beds with a peaty tendency. Furthermore, visible malacofauna is more abundant in this layer.

Figure 7: Picture of the stratigraphic sequence sampled by Dr. Field with scale. Picture taken by Dr. Field, 2017.

Sample 3 has a minimum depth of 28 cm and a maximum depth of 40 cm. It is taken in layer 5 which is composed of dark brown, fibrous peat with malacofauna.

Sample 4 has a minimum depth of 8 cm and a maximum depth of 28 cm. It is taken in layer 6a which is composed of literred peat.

Sample 5 has a minimum depth of 0 cm and a maximum depth of 8 cm. It is taken from layer 6b and is composed of littered peat. This layer is separated from layer 6a by layer 6c.

3.3 Results

In table 1 and diagram 1 the results of the analyses of the samples for macro botanical remains are displayed. All taxa found in the samples are presented in the diagram, grouped by their ecology (aquatic, damp ground, grassland, woodland and unclassified) and placed in alphabetic order in the group. Some taxa appear very frequent in a sample, while appearing marginal in other samples. It is difficult to see this in diagram 1. Therefore, the amount of plant macrofossils per taxa encountered in a sample in absolute numbers is displayed in sample 1.

During this research 22 taxa that have been identified to either family, genus or species level and in which frequency they are present per sample. The preservation of several fossils was poor, making identification to species levels difficult in general. Furthermore, some taxa produce more seeds than other species, resulting in a large sum compared to other taxa and influencing the appearance of these species in the sample. Care must thus be taken while interpreting the data shown in diagram 1.

One of the macro botanical remains present in the samples is a budscale. This plant macrofossil is not identifiable and gives no additional information about the environment. Therefore, it will not be further discussed. All other present taxa will be elaborated below, considering which specific ecological conditions it prefers.

3.3.1 Aquatic taxa

***Characeaeae* sp. (Stoneworts)**

The *Characeae* family contains green algae which grow generally in stagnant water, but they can be found in running water as well. Plants in this family are capable of growing in various conditions. They can be found in freshwater and brackish water, shallow and deep water and in environments with nutrient poor to nutrient rich conditions (Van Raam and Maier 1993, 116). Members of this family are capable of producing high amounts of oospores, explaining their abundance in the samples. Many species are in this family, making it a challenge to identify them further, while providing little extra information if identified. For this reason, they are not identified further. *Characeaea* is especially abundant in sample 1. It is completely absent in sample 2 and 3 and it appears again in small margins in samples 4 and 5. The presence of a lake or river in this area in the period that the layer where sample 1 comes from was deposited, explains the high amounts of *Characeaea* found in this sample. The waterbody present during that period disappeared, explaining the absence or scarceness of *Characeae* in the other samples.

Taxa	**Ecology**	**Sample 5 0-8cm**	**Sample 4 8-28cm**	**Sample 3 28-40cm**	**Sample 2 40-48cm**	**Sample 1 48-70cm**
Characeae sp.	Aquatic	2	14	0	0	4000
Lemna sp.	Aquatic	1	44	0	0	0
Potamogeton pectinatis	Aquatic	1	0	0	0	1
Salvinia natans	Aquatic	0	0	2	0	0
Berula erecta	Damp Ground	0	0	1	4	0
Cladium mariscus	Damp Ground	435	37	0	0	0
Eupatorium cannabinum	Damp Ground	1	8	0	0	0
Lycopus europeus	Damp Ground	0	1	0	0	0
Mentha aquatica	Damp Ground	0	0	9	58	0
Cf. Phragmites	Damp Ground	0	0	0	5	0
Ranunculus scleratus	Damp Ground	0	0	0	0	2
Scirpus lacustris	Damp Ground	0	0	1	1	0
Typha sp.	Damp Ground	1	10	1	240	302
Polygonum lapathifolium	Grassland	1	0	0	0	0
Cenoccocum geophilum	Woodland	37	5	0	0	0
Urtica diotica	Woodland	9	1	0	1	0
Budscale	Unclassified	1	0	0	0	0
Carex sp.	Unclassified	12	0	2	9	1
Cirsium sp.	Unclassified	0	0	0	0	1
Dryopteris sp.	Unclassified	1000	1000	258	6000	0
Musci sp.	Unclassified	1	0	1	1	0
Poeacea sp.	Unclassified	2	6	53	19	0

Table 1: Overview of the different taxa present in the sampled layers, alphabetically classified per habitat group. The amount of plant macrofossils per taxa encountered in a sample is displayed in absolute numbers.

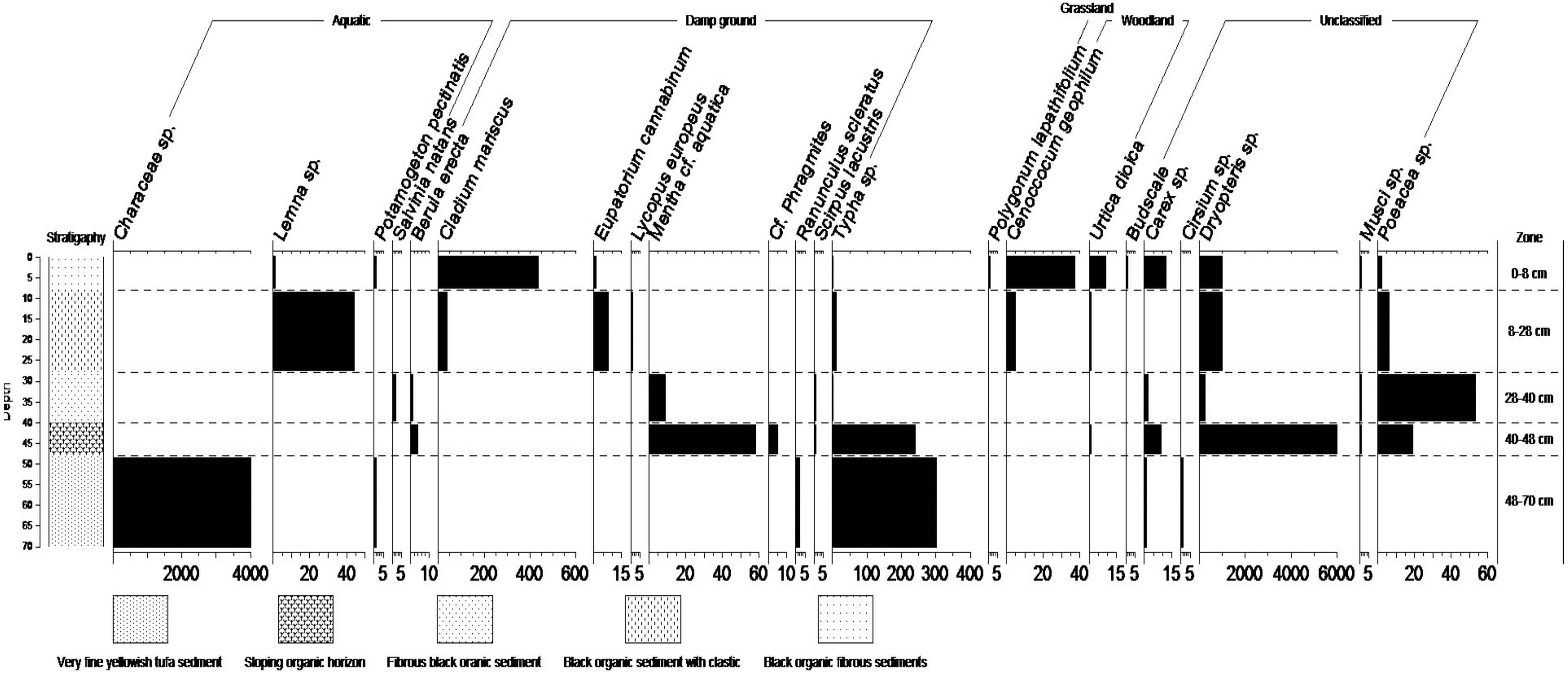

Diagram 1: Overview of the different plant macrofossils encountered in all samples taken from coupe 1 partie 2 at the excavations at Waziers by M.H. Field, alphabetically classified per habitat group. The frequency is shown per taxa per sample. The zones give information about the maximum and minimum depth of the layer were the sample was taken .Furthermore, each zone has received its own stratigraphic description. Diagram is made by Bert Verleijsdonk and Astrid Rachel, 2018.

***Lemna* sp. (Duckweed)**

Species in the *Lemna* genus grow in both still-moving freshwater and brackish water, floating on or under the water surface. The thalli[2] are frost resistant (Blamey and Grey-Wilson 1989, 470; Meijden 1983, 81; Stace 1997, 779; Weeda *et al*. 1994, 233). *Lemna* is absent in the lower layers, but becomes especially abundant in sample 4, to almost disappear again in sample 5, hinting there must have been a waterbody during the period sample 4 which has disappeared.

***Potamogeton pectinatis* (Fennel Pontweed)**

This plant thrives in nutrient rich, dynamic and changeable environments. *Potamogeton pectinatis* grows in brackish and calcareous waters and is tolerant of polluted water. The plant often grows in running water, but it can also grow in stagnant water. *Potamogeton pectinatis* can be found in deep and shallow water, in rivers, ponds, canals and ditches (Blamey and Grey-Wilson 1989, 449; Meijden 1983, 29; Weeda *et al.* 1991, 259-260). This species makes its appearance only twice in the samples. Sample 1 and sample 5 contain one fossil of *Potamogeton pectinatis* each. The presence of this species in these samples confirms the presence of a waterbody in both periods.

***Salvinia natans* (Floating Fern)**

Salvinia natans prefers shallow freshwater as habitat (Meijden 1983, 58). It is not abundant in the sample, only appearing twice in sample 3. Although this is the only aquatic taxon found in this sample, it does confirm the presence of a waterbody, presumably shallow.

3.3.2 Damp ground taxa

***Berula erecta* (Lesser Wate-parsnip)**

Berula erecta grows next to nutrient rich, calcareous rich, brackish to freshwater. The plant can also be present in shallow freshwater or swamp forest areas. The soil it grows on varies (Blamey and Grey-Wilson 1989, 272; Meijden 1983, 58; Weeda *et al*. 1987,

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[2] A thallus is a plant body that is not differentiated into stems and leaves and lacks true roots and a vascular system. Thalli are typical for this genus.

263). This species appears in the samples 2 and 3, though not very abundant. *Berula erecta* can be successful in various wet habitats, thus not giving any more specific ecological information.

***Cladium mariscus* (Great Fen-sedge)**

This plant grows next to water in various conditions from brackish water to freshwater, from calcareous to basic to weak acid conditions. It can live in circumstances with diverse nutrient abundances. *Cladium mariscus* often grows in a sandy soil or a sandy peat soil (Meijden 1983, 148; Stace 1997, 802; Weeda *et al*. 1994, 272-273). This species appears in the fossil record first in sample 4, where it is not too abundant. In sample 5 however, *Cadium mariscus* becomes very abundant, with a total of 311 fragmented and 124 whole fossils of this species. Though the plant grows in a wide variety of conditions, a waterbody has to be present for it to grow. The presence of this species does thus confirm the presence of brackish or freshwater during the period these fossils have been deposited.

***Eupatorium cannabinum* (Hemp-agrimony)**

Eupatorium cannabinum grows on a various amount of soils, except heavy clay and nutrient poor sand. The plant often grows on lake or trench banks where much organic material washes up (Blamey and Grey-Wilson 1989, 394; Weeda *et al*. 1991, 34). Asidefrom watersides, *Eupatorium cannabinum* is also present in reed lands, dune valleys and swamp forests (Meijden 1983, 591). This species is present in samples 4 and 5. Due to the variety of environments where this plant is able to grow, it does not provide much specific ecological information.

***Lycopus europaeus* (Gipsyworth)**

This plant thrives in wet habitats. It is present in wet woodlands, swamp areas and stream, pool and canal margins (Blamey and Grey-Wilson 1989, 342; Meijden 1983, 511). On nutrient rich grounds *Lycopus europaeus* is able to grow fast in height, making it able to compete with larger swamp vegetation (Weeda *et al*. 1988, 176-177). Only once a fossil of this species occur in sample 4. *Lycopus europaeus*can occur in various environments, all having in common that the conditions are wet. It does not provide any further ecological information.

Mentha cf.[3] aquatica (Water Mint)

Mentha aquatica is common in waterside areas and marsh areas (Blamey and Grey-Wilson 1989, 344; Van der Meijden 1983, 512). However, it is not sure whether these *Mentha* fossils are *Mentha aquatica*, or another variant of *Mentha. Mentha* is a plant which is present in damp areas on soil varying from nutrient rich to brackish. It often grows at watersides (Van der Meijden 1983; 512). The nature of the results from the sample do support that these are *Mentha aquatica* though, since this variant of *Mentha* is to be expected more in this environments than other variant of *Mentha*. However, since the determination is not based on the fossils, but on the ecology, we cannot be sure that this is *Mentha aquatica*. *Mentha cf aquatica* is present in samples 2 and 3, suggesting a change to damp conditions in this area.

Cf. Phragmites (Perennial Grasses)

This genus often grows in water or in wet, fresh to brackish, waterside conditions. It is often found in swamps, salt marshes and light swamp forest areas (Meijden 1983, 239; Weeda *et al.* 1994, 190). Most of the *Poeaceae* in the samples were unidentifiable. However, some were strikingly similar to the *Phragmites* shown in *Bestimmungsschlüssel für subfossile Juncus-Samen und Gramineen-Früchte* (Koerber-Grohne 1964, plate 9), with the hilium[4] . These are identified as *Cf. Phragmites*. Though *Poeaceae* are present are present from sample 2 and onwards, only sample 2 had inividuals that could be identified as *Cf. Phragmites*. The presence of this species would be coherent with the other damp ground taxa present in this sample.

Ranunculus scleratus (Celery-leaved Crowfoot)

Ranunculus scleratus is a pioneer species that often appears at watersides or in dried up places. It can also grow in water (Meijden 1983, 257; Weeda *et al.* 1985, 246). This

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[3] Cf. stands for confer. This an abbreviation used in biology used to imply the identification of a certain species, without having the absolute certainty that these fossils indeed belong to the implied species.

[4] A hilium is a scar left on a seed coat by the former attachment to the ovary wall. It is characteristic for *Phragmites* that the hilium is far from the base.

species is only present in sample 1, hinting a change of very wet conditions to damp ground waterside conditions at the end of this period.

***Scirpus lacustris* (Lakeshore Bulrush)**

This species grows on various soils, varying from peat to clay to sand (Weeda *et al.* 1994, 251). It is common in fresh to brackish watersides (Meijden 1983, 145). This species only appear twice in the fossil records, once in sample 3 and once in sample 4. Presence of this species does suggest a waterbody nearby.

***Typha* sp.**

Thypha is commonly found next to watersides and marsh environments that are rich in nutrients (Meijden 1983, 129). *Typha* is rooted in the water or in damp grounds (Weeda *et al.* 1994, 242). The seeds of these plants are easily recognizable, however hard to identify to species level. *Typha* is present in all five sampes, but especialy common in sample 1 and 2. The wet to damp ground conditions it prefers must have been present during these periods, while the later periods did not offer the perfect environmental conditions for this genus.

3.3.3 Grassland taxa

***Polygonum lapithafolium* (Pale Persicaria)**

This species is common next to river banks, where it grows plentiful, especially on wet sandy soils (Weeda *et al*. 1985, 138). The plant also grows in other waterside environments, as long as there is no dense vegetation present. However, the plant can grow in other various conditions as well. *Polygonum lapithafolium* is only present in sample 5. Since it can grow in various conditions, it does not provide very specific ecological information. However, the presence of this species does suggest that the vegetation during this period was not dense.

3.3.4 Woodland taxa

***Cenoccocum geophilum* (Ascomycete Fungal Species)**

Cenoccocum geophilum is an omnipresent and often abundant type of fungus in forest environments that is the only member of the *Cenococcum* genus. This fungus has a broad host and habitat range. Being distributed global, the dynamics of this species plays an important and relevant role in forest ecosystems (Fernandez *et al*. 2013, 141), suggesting the fungal biomass of *Cenoccum geophilum* represents a considerable litter input into woodland biogeochemechical cycles. Fossils of this species are present in samples 4 and 5. Due to the important role these fungi play in forest ecosystems, presence of this species is a strong clue for a change towards a woodland environment.

***Urtica diocia* (Common Nettle)**

This species is present in many different environments, as long as it is nutrient rich (Weeda 1985, 126). Hunt (1998, 159) argued that the presence of *Urtica dioica*, might suggest that large mammals were also present. Decomposition of their bodies would create a nutrient rich soil, which is heavily preferred by *Urtica dioica.* The seeds of this species are often easy to identify. The shape of the seeds is characteristic and the part of the seeds that is attached to the fruit often preserves. This species is present in samples 2, 4 and 5. Due to *Urtica dioica* growing in various habitats, no specific ecological information but the presence of nutrient rich soils, is provided by the presence of this species.

3.3.5 Unclassified taxa

***Carex* sp. (Sedge)**

Carex are hard to identify further. Individuals can have several deviations (Meijden 1983, 150). The *carex* genus exists out more than 2000 species. Members of the *Carex* genus are present in various habitats. Though *Carex* is present in all samples except sample 4, it does not provide any specific ecological information.

***Cirsium* sp. (Thistles)**

In the northern hemisphere, more than 100 species placed in this genus occur (Blamey and Grey-Wilson 1989, 422). One fossil of this genus has been found in sample 5. Presumably the *Cirsium* found preferred a wet environment, cohering with the abundance of *Characeae* and *Typha* in this sample. However, the fossil was preserved poorly and could thus not be identified to species level.

***Dryopteris* sp. (Wood Fern)**

This genus contains about 250 species, making it hard to identify it further. *Dryopteris* is distributed widely, occupying various habitats (Meijer 1983, 63). Fossils are found in all samples with exception of sample 1. Because *dryopteris* can grow in so many different habitats, no further ecological information is provided by fossil presence of this genus.

***Musci* sp. (Mosses)**

Musci is a synonym for their division *Bryophyta*, which contains approximately 12.000 species. Bryophytes play an important role in many modern wetland ecosystems. The capacity to store huge amounts of water of peat mosses (*Spaghnales)* is the sole reason that peat bogs can exist (Hübers and Kerp 2012, 755). However, members of the *Bryophyta* grow in various other environments as well. It is impossible to identify the fossils found in sample 2, 3 and 5 further. The broadness of this division makes it impossible to provide any specific ecological information based on these finds.

***Poaceae* sp. (Grasses)**

This is a large family containing approximately 780 genera and 12.000 species. *Poaceae* are present in various habitats (Meijer 1983, 171). The fossils belonging to this family present in samples 2, 3, 4 and 5 are poorly preserved, making further identification possible, except for a few individual fossils in sample 2, which were identified to *Cf. Phragmites* (see *Cf Phragmites* earlier this chapter for more information). The species belonging to the *Poaceae* family are widespread, occupying various habitats. No further ecological information can be drawn from the presence of these fossils.

3.4 Environmental reconstruction

In sample 1, *Characeae* and *Typha* were the most common fossils retrieved. Both indicate a wet, aquatic local environment. Faunal remains, mollusks and pollen recovered from this layer give the indication that the area surrounding this local aquatic environment was an open landscape without dense vegetation (Hérisson 2016, 4). All these indicators are coherent with what was expected to be found in the tuffaceous bed leading up to the start of the Eemian stage.

However, no true aquatic taxa are present in sample 2. *Dryopteris* becomes very abundant in this layer. However, little ecological data can be subtracted due to the fact *Dryopteris* appears in various habitats. The presence of *Berula erecta*, *Mentha* Cf. *Aquatica*, Cf. Phragmites and *Typha* indicate a wet waterside area during this period. Furthermore, one fossil of *Urtica dioica* is present in this layer, suggesting this was a nutrient rich environment.

In sample 3, *Poaceae* is the most abundant botanical macro fossil present. Not being identified further, these fossils give little information about the environment. *Mentha* Cf. *Aquatica* and *Scirpus lacustris* are present here, implying the presence a fresh waterbody or swamp like conditions in the area. The presence of *Salvinia natans* in this sample confirms the presence of a waterbody during this period, presumably shallow. Dampness of this area during this period is confirmed due to aquatic mollusks becoming dominant in this peat layer. Furthermore, various snail species typical for interglacial stages are present in this layer (Hérisson 2016, 4), indicating a warm and humid temperate climate. From this layer and onwards, evidence for hominin activity in the area is present.

Moreover*, Lemna* becomes present in sample 4, indicating the presence of a still-movinf waterbody. *Cladium mariscus, Eupatorium cannabinum* and *Lycopus europeus* confirm the area is still very wet. *Urtica dioica* is also found in this sample, indicating the soil was nutrient rich during this period. Furthermore, *Cenoccocum geophilum* makes it first appearance in this sample. This fungus, having a broad host and habitat range, is especially important in forest environments. No tree taxa are present in the botanical macrofossil record, but pioneer tree species are found in the pollen record (Hérisson 2016, 4).

Finally, in sample 5, aquatic taxa such as *Lemna* and *Potamogeton pectinatis* become less abundant than in the previous sample. Presence of these taxa and presence of

Cladium mariscus and *Eupatorium cannabinum* do still give the suggestion this area was very wet. *Urtica dioica* becomes more abundant, signifying the nutrient richness of the soil. In this sample, *Cenoccocum geophilum* becomes more common as well, indicating a more towards woodland environment. This is confirmed in the pollen record, which contains tree taxa common for swamp forests record (Hérisson 2016, 4).

All in all, diagram 1 shows there has been environmental change in the local around the Scarpe during the Eemian stage. The area around the Scarpe has always been wet, shifting between aquatic and damp ground environments. Taxa present in the sample imply that there was a lake or pond present next to the Scarpe, presumably an oxbow lake. During the Eemien, sedimentation of this fluvial lake was accompanied with environmental change. Starting in an aquatic environment without dense vegetation, the area became moister and swamp like. The end result was a drier, but still moist, swamp forest environment.

4. Absence of hominins in Great Britain

As briefly discussed in the introduction, the nature of occupation of interglacial Europe is still not completely understood, even though it has been a topic of debate for a long time. Evidence of early hominin activity dating to the Eemian stage in northern France has become important for our understanding of hominin absence in Great Britain during this period.

In the mid 1980's, Gamble (1986) published an article wherein he stated that interglacial northern Europe was a hostile environment for early hominins. He based this hypothesis on the work of Kelly (1983), who stated most of the primary biomass available in woodland environments is inedible for hominins. However, Roebroeks and colleagues (1992) demonstrated that there were archaeological sites in north-western Europe during the Paleolithic in both glacial and interglacial periods, disproving Gamble's hypothesis.

Even though Roebroeks and colleagues (1992) provided evidence for early hominin occupation of north-western Europe during interglacial periods, they also noted that during the last interglacial Great Britain appeared to have remained occupied by hominins. Ashton (2002) proposed two possible hypotheses to explain the absence of archaeological evidence in Great Britain dating to MIS 5e. His first model he named the ''Insularity of Britain''. Rapid sea level rise during the last interglacial is used in this model to explain the absence hominins in Britain. The English Channel between Britain and the mainland formed a physical barrier. The first isolation of Great Britain could perhaps have coincided with the more temperate conditions during the last interglacial (Ashton and Lewis 2002, 392). The water barrier formed would have discouraged further expansion of *Homo neanderthalensis*, explaining the absence in Great Britain during MIS 5e (Ashton 2002, 96-97). However, this model does not explain the absence of evidence for *Homo neanderthalensis* in northern France. His second model explains the absence of by the increasing specialization towards mammoth steppe-environments by *Homo neanderthalensis* (Ashton 2002, 97-100), thus favoring the eastern regions of Europe. Ashton (2002, 100) stated that this model would be immediately appealing, based on the presence of Last Interglacial archaeological sites in these environments. Furthermore, specialization towards mammoth steppe-environments would explain the absence of archaeological evidence in northern France, which lacked such an environment. However, there was no convincing evidence to support this hypothesis.

Only recently evidence has been found of human occupation during the Eemian interglacial in northern France. In 2002 the first archaeological site attributed to the Eemian stage in northern France was discovered at the base of a tufa sequence in the Somme valley at Caours (fig 8). The earlier discussed archaeological site of Waziers has only been the second evidence of *Homo neanderthalensis* activity during the Eemian stage in northern France.

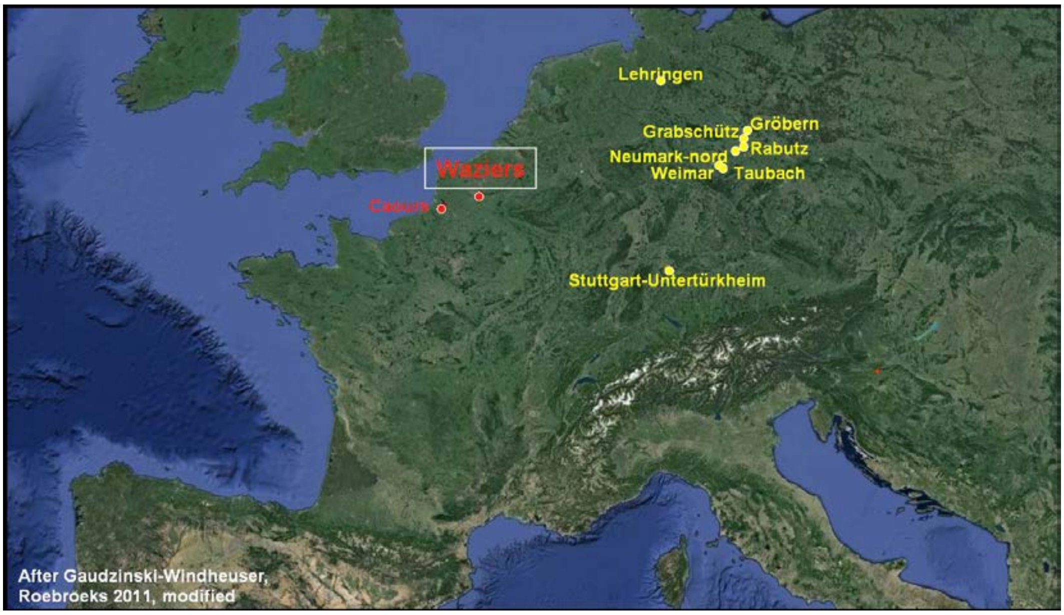

Figure 8: Distribution of the sites attributed to the Eemian stage in North-West and Centra Europe (after Gaudzinski-Windheuser and Roebroeks 2011 in Hérisson *et al*. 2017, 51).

Excavations at Caours from 2005 to 2010 have revealed four archaeological layers separated by sterile tufa deposits. More than 10.600 large mammal remains and 3.200 flint artefacts have been collected from these layers (Antoine 2012, 21). Researching the faunal remains, Antoine abnd colleagues (2006, 292) identified 67 different taxa. They conclude that the identified fauna is typical for a temperate interglacial phase, indicating an Eemien age for the site. This has been supported by U/Th dates, averaging 123±3 kya (Antoine *et al*. 2006, 306-307; Antoine 2012, 21) and an ESR/U-series age of 124±15 kya obtained on a deer molar (Bahain *et al*. 2010, 373).

Using the paleomagnetic signal of the Blake Event, Sier and colleagues (2011) managed to correlate high-resolution terrestrial records to the marine record. Their data showed that the Eemian stage in northern and central Europe starts and estimated 5.000 years later than in South Europe (Sier *et al*. 2011, 217). Evidence for the Blake Event was also found in Caours (Sier *et al*. 2015a, 156). Sier and colleagues (2011; 2015b) linked the Blake Event to the pollen record and correlated the Blake Event this way with the MIS record. The Blake Event started approximately 121,5 kya and lasted to at least 113.5 kya (Siet *et al*.2015b, 26). The Eemien sets on at approximately 121.0 kya in Northwest Europe, just after the start of the Blake Event. The Blake Event, and thus the archaeological occupation layers of Caours, is placed after the MIS 5e peak (Sier *et al*. 2011; Sier *et al*. 2015b). This would imply that when the first Neanderthals occupied Caours the sea level already had risen and formed a physical barrier between northern France and Great Britain (Sier *et al*. 2015a, 156).

5. Discussion

Caours and Waziers are the only archaeological sites yet found that provides information about occupation of northern France by *Homo neanderthalensis*. These sites are located directly south of the English Channel and can thus provide information about the absence of hominins in Great Britain during the last interglacial (Ashton and Lewis 2002), and can presumably generate support one of the hypotheses presented by Ashton (2002). The botanical macrofossil data presented in this thesis provide evidence of early hominin occupation at Waziers in damp to swamp forest like conditions. However, it is still not clear if *Homo neanderthalensis* preferred these conditions or if there are other factors involved.

The presence of flint artefacts and faunal remains at both sides, backed up by dating methods (e.g. Antoine *et al*. 2006; Bahain *et al*. 2010), place both sites without doubt in the Eemien stage. Evidence for the Blake Event has, for now, only been found at Caours, placing it after the MIS 5e peak (Sier *et al*. 2011; Sier *et al*. 2015b). Since the sites are so close to each other, there is a high possibility they were occupied for the first time at the same period. This would provide support for Ashton's (2002) ''Insularity of Britain'' hypotheses, implying Great Britain was highly inaccessible for hominins when they first reached the area.

It is appealing to explain the absence of hominins in Great Britain using this hypothesis. The evidence, however, is still marginal. Many questions about Neanderthal migration patterns and the preferred habitat of Neanderthals remain unanswered. Ongoing research on the materials of Waziers might provide more exact details of the Neanderthals were active in this area before the MIS 5e peak or at the same times as in Caours. Site density in northern Europe remains very low, possibly because of poor preservation (Ashton 2002, 100). Future discoveries can shed more light on the environmental preferences and migration patterns of *Homo neanderthalensis*.

6. Conclusion

The first goal of this paper was to present and environmental reconstruction of the area around Waziers. Extensive research on botanical macrofossils sampled at Waziers has been carried out. In this thesis new data has been provided and combined with already existing environmental data based on faunal remains and palynology.

The researched samples have provided data and on the local vegetation at Waziers. Among the identified taxa were various aquatic and waterside species, species tolerant to damp conditions, unclassified taxa and a few species typical for forest environments. The data showed that the environment was ongoing several changing from the start to end of the Eemian stage. Coherent with the pollen and faunal data, the botanical macrofossil data imply the sedimentation of a fluvial lake. The aquatic, open landscape at the end of the Saalien changed to damp wetlands during the start of the more temperate Eemian. The final result was a swamp forest. Though no tree taxa have been discovered in the botanical macrofossil samples, this is heavily implied by the presence of *Cenococcum geophilum* in the botanical macrofossil and the presence of several tree taxa common in swamp forests in the pollen record.

Relatively poor preservation of most of the fossils made it hard to identify most taxa to species level. Some plants produce more seeds than or others or are generally better preserved. This can cause under- or overrepresentation of a certain species. Therefore, conclusions made based on these samples were not only concerned with the frequency of taxa, but as well on the presence of less frequent species.

This study proves that the reconstruction of the local of environment by studying botanical macrofossils and using them as a proxy is a valuable field of study by providing valuable information on what the local habitat exploited by *Homo neanderthalensis* at Waziers looked like. More follow up research on botanical macrofossils sampled at Waziers can provide an even clearer idea of what the environment the early hominins at Waziers exploited looked like. The combination of several sources of environmental data and archaeology can provide information that leads better understanding of eary hominins.

The second goal of this paper was to add to the discussion why early hominins appear to not have crossed the North Sea Canal during Marine Isotope Stage (MIS) 5e. Caours and Waziers have provided undisputed evidence that *Homo neanderthalensis* exploited forest environments during the Last Interglacial. By presenting evidence of the Blake being present in Carours, (Sier *et al*. 2011; Sier *et al*. 2015b), Sier and colleagues (2015a, 156) have made a strong case that the water level of the English Channel already was high when the first hominins exploited the area. For now, Waziers provides no clear information on why *Homo neanderthalensis* appears to be completely absent in Great Britain during the Last Interglacial. However, it does provide clear evidence that hominins were able to migrate to the higher northern European latitudes.

Abstract

On a low-lying plain on the southeast border of the Scarpe, the rare archaeological site of Waziers, dating back to the Eemian stage, was discovered. At this site several flint artefacts and faunal remains have been discovered. Concerning this site, several research studies have been conducted. Excavations at Waziers in 2017 have provided botanical macrofossil samples for study. Analysis of botanical macrofossils has been carried out to make an environmental reconstruction of the area early hominins exploited at Waziers during the Eemian stage. The data produced during this study has been combined with faunal and palynological data. The botanical macrofossil data shows a changing environment from end of the Saalien stage and during the Eemian stage. The sedimentation of a fluvial lake is implied. The aquatic, open landscape at the end of the Saalien changed to damp wetlands during the start of the more temperate Eemian. The final result was a swamp forest. This is supported by the faunal and palynological data. Researching the environment of Waziers is used to help us understand early hominin behavior and gain information on why to early hominins appear to not have crossed the North Sea Canal during MIS 5e.

Samenvatting

Op een laaggelegen vlakte op de zuidoost grens van de Scarpe, is deze zeldzame archeologische site Waziers ontdekt. Deze site is naar het Eemien gedateerd. Verschillende vuursteenartefacten en fauna resten zijn in deze site gevonden. Verschillende onderzoeken zijn uitgevoerd met betrekking tot deze archeologische site. Opgravingen in Waziers in 2017 hebben botanische macrofossiel samples aangeleverd voor onderzoek. Deze botanische macrofossielen zijn geanalyseerd met als doel een omgevingsreconstructie te maken van het gebied that vroege hominiden exploiteerden bij Waziers gedurende het Eemien. De data geproduceerd tijdens dit onderzoek is gecombineerd met fauna en palynologische data. De onderzoeksresultaten van de botanische macrofossielen analyse tonen aan dat er een veranderend landschap vanaf het eind van het Saalien en gedurende het Eemien. De data implicieert de sedimentatie van een fluviaal meer. Het aquatisch, open landschap wat aanwezig was tijdens het eind van het Saalien veranderde in een vochtig drasland tijdens het begin van het meer gematigde Eemien. Het eindresultaat was een moerasbos. Deze concusie wordt ondersteund door de fauna en palynologische data. Omgevingsonderzoek bij Waziers wordt gebruikt om ons het gedrag van vroege hominiden te helpen begrijpen en om inzicht te krijgen op waarom het lijkt dat vroege hominiden niet het Noordzeekanaal hebben overgestoken gedurende MIS 5e.

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List of figures

List of tables

List of diagrams