

Continued geoarchaeological research at the Moervaart palaeolake area (East Flanders, B): field campaign 2011

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Summary

Within the framework of a multi-disciplinary research project at Ghent University, geophysical survey and coring was undertaken to map the palaeolandscape in order to gain more insight in the choice of settlement location by prehistoric man. The continued research in the area of the Moervaart palaeolake revealed that part of the northern bank of the palaeolake at Moerbeke and Klein-Sinaai became covered with aeolian sands, on top of which Final Palaeolithic surface sites were found. To the south of the palaeolake, at Daknam, a palaeochannel of the Durme river was mapped. At all research locations, samples were taken for dating purposes and for geomorphological and palaeo-ecological analyses.

Keywords: East Flanders, Belgium, Moervaart palaeolake, Sandy Flanders, Moerbeke, Klein-Sinaai, Daknam, palaeolandscape, geophysical survey, coring.

1. Introduction

Past three years, comprehensive research took place in the area of the Moervaart palaeolake, between Wachtebeke and Stekene (Eastern-Flanders, Belgium) in the framework of the multi-disciplinary project “Prehistoric settlement and land-use systems in Sandy Flanders (NW Belgium): a diachronic and geoarchaeological approach” at Ghent University. This article includes a further update on the fieldwork reported in two previous editions of *Notae Praehistoricae* (Bats et al., 2009; Bats et al., 2010) and some preliminary results.

2. Research aims

The general aims of the research project have been discussed in previous editions (Bats et al., 2009; Bats et al., 2010). The fieldwork presented here concentrates on two research topics within the project. Firstly, the clustered presence of Final Palaeolithic *Federmessers* sites along the northern bank of the Moervaart palaeolake is examined. Furthermore, the detailed reconstruction of the palaeoriver system that crosses the study area is taken on. Therefore, three research areas were selected for fieldwork: (i) Klein-Sinaai - *Boudelo*, near the eastern extension of the palaeolake, (ii) Moerbeke-*Driehoek*, located on the great cover sand ridge Maldegem-Stekene and (iii) Daknam - *Daknamse Meersen*, located to the south of the depression (Fig. 1).

2.1 Final Palaeolithic sites

At the northern dry bank of the Moervaart Palaeolake, which coincides with the southern border of the large cover sand ridge Maldegem-Stekene, several surface sites containing Final Palaeolithic (*Federmesser*) lithic artefacts are known (Fig. 2; Crombé et al., 2011; Crombé & Verbruggen, 2002; Van Vlaenderen et al., 2006). The presence of these Late

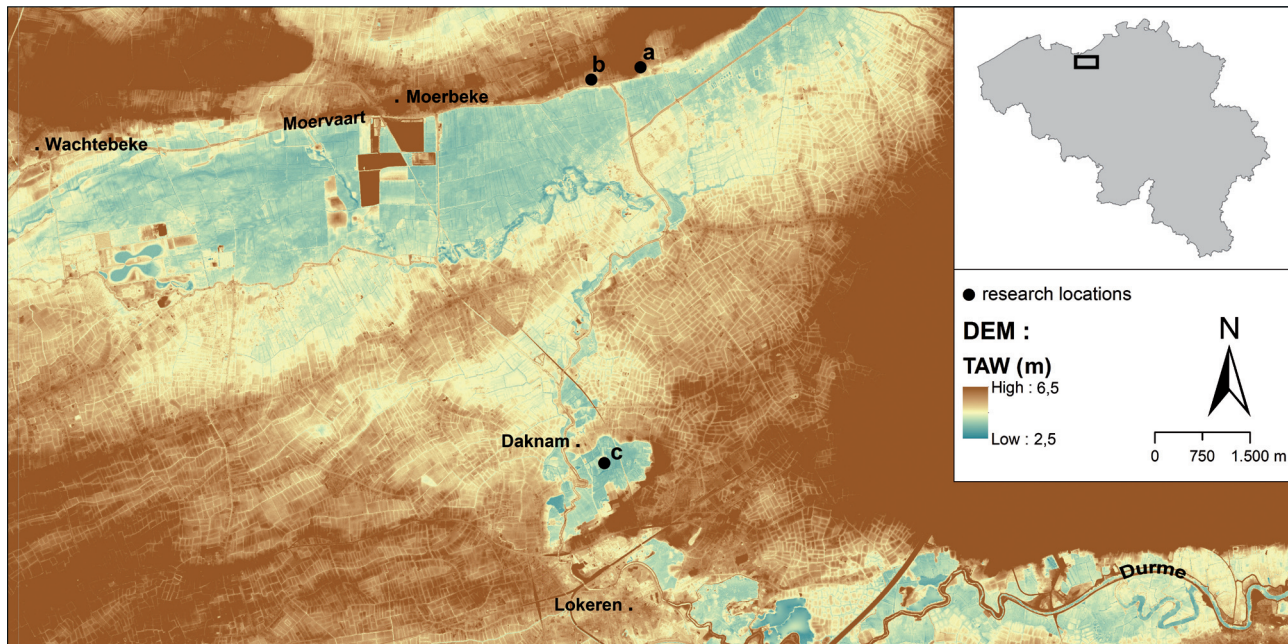


Fig. 1 – Localization map of the three fieldwork areas: a. Klein-Sinaai - Boudelo, b. Moerbeke-Driehoek, c. Daknam - Daknamse Meersen.

Glacial sites close to the present surface is remarkable since thick layers of aeolian sands (up to 2 m) dating to the Younger Dryas have been deposited on top of the Allerød surface in the area e.g. at the nearby sites of Wachtebeke-Heidebos (Bats et al., 2010; Derese et al., 2010) and Rieme-Noord (Bos & Verbruggen, 2011). It is unclear why such deposits seem to be lacking near the northern bank of the palaeolake as the Federmesser sites are found on or near the present surface. However, at one location, Klein-Sinaai - Boudelo, several Final Palaeolithic lithic concentrations were found *in situ* during rescue excavations of the medieval abbey - in 1971 (Vanmoerkerke & De Belie, 1984). Although many artefacts were found *ex situ*, at least five lithic concentrations were found *in situ* at a depth of maximum 0.5 m within the cover sand deposits. Some Late/Final Neolithic and Late Mesolithic artefacts were also discovered but the vast majority of the lithic finds belongs to a typological homogeneous group, containing burins, backed points and bladelets, that can be dated to the Final Palaeolithic (Van Vlaenderen et al., 2006; Vanmoerkerke & De Belie, 1984).

In order to assess whether there is still a potential to find similar covered *Federmesser* sites along the southern edge of the great ridge Maldegem-Stekene it was decided to organize further fieldwork. First more insight into the genesis of the transition zone between the sand ridge and the lake was needed. To investigate this, the location of Moerbeke-Driehoek was chosen because of the presence of a surface site discovered by Luc Van Vlaenderen in 1990 (Van Vlaenderen et al., 2006). The Final Palaeolithic dating of at least part of the surface finds is based on the presence of several burins and backed points and the usage of typical raw material ('black' flint). The site is located directly at the border of the palaeolake, on a (hardly visible) small, elongated sand ridge at the southern border of the great ridge. Today, the palaeolake and the sand ridge are separated by the (sub) recent Moervaart canal.

2.2 Palaeochannels at the Kale/Durme river

The third focus area for fieldwork is Daknam - Daknamse Meersen, a nature reserve area within the alluvial plain of the Durme river. It is generally assumed that the palaeorivers



Fig. 2 - Localization on the DEM of the Final Palaeolithic (surface) sites in the eastern part of the Moervaart palaeolake area. The site of Moerbeke-Driehoek lies on top of a smaller aeolian sandridge.

of the Kale and Durme were connected but this still has to be confirmed. In the past, sequences of the Kale and Durme palaeoriver have been analyzed for pollen. Based on pollen analyses of the Durme palaeoriver, Deforce (2007) places the lowest part (3.65-3.40 m below present surface [BPS]) of the sampled sequence at this location in the Younger Dryas period. The Kale palaeoriver was sampled at Vinderhoute, where a palaeochannel of 30 m wide and 6 m deep was found. The base of the peat (4.60 - 4.98 m BPS) was ^{14}C dated at $12,655 \pm 70$ BP (GrN-6062).

More recently and within this project, more sequences of the palaeochannel have been sampled at three locations. The first two are currently being analyzed (pollen, LOI, MS) and the last was analyzed for pollen as part of a master's thesis (Peleman, 2011). For all three of locations ^{14}C dating results are expected in the near future. All presented sequences display a similar profile, with a dark organic gyttja at the bottom which is covered with a thick layer of (often strongly decomposed) peat. At two locations, Wachtebeke-Kalve and Moerbeke-Peerdemeers, the upper 1.5 m of peat was extracted, probably during the Middle Ages (Peleman, 2011).

Despite the above mentioned palaeoecological data, a good link between these three locations in the Moervaart Depression is still needed for a better understanding of the palaeoriver system. Hence the purpose of the fieldwork at Daknam was to localize a well preserved and intact sequence of a palaeochannel of the Durme for palaeoecological study. The location was chosen because at Daknam, a large palaeomeander system is still visible in the present landscape and palaeochannels can thus be expected.

3. Methods and techniques

For the reconstruction of the palaeolandscape, three field techniques were combined: (i) manual coring, (ii) mechanical coring and (iii) geophysical survey. Manual coring was conducted with a 7 cm Edelman auger and/or a 3 cm gouge auger, depending on the sediment. At the Moerbeke and Daknam site, mechanical Begemann coring took place (see below). The geophysical surveys were conducted with an electromagnetic induction (EMI) sensor measuring both the soil apparent electrical conductivity and magnetic susceptibility of four soil volumes simultaneously (Bats et al., 2009; De Smedt et al., 2011; Saey et al., 2009).

3.1 Klein-Sinaai - Boudelo

The palaeolandscape of the area surrounding the old excavation was mapped by means of manual corings and geophysical survey. An area of approximately 20 ha was surveyed with the EMI sensor to reveal the palaeotopography of the study area, starting on the slope of the sand ridge and extending further south over the entire width of the palaeo-lake. Three north-south auger transects were made near the Final Palaeolithic sites to add detailed stratigraphical information. Two transects (transect 1 and 2) were set out across the slope of the cover sand ridge to the border of the lake and one (transect 3) from the foot of the cover sand ridge deep into the palaeolake.

3.2 Moerbeke-Driehoek

Manual corings were undertaken here to gain more insight in the palaeolandscape. Three north-south transects were made, one starting at the border of the Moervaart canal to trace the lake border, and two across the known surface site to evaluate the soil profile. The manual corings were completed with two mechanical corings, so-called Begemann corings¹ (6.6 cm Ø), to a depth of 6.40 m BPS. The Begemann technique of high quality continuous corings provides undisturbed samples for palaeoecological, geomorphological and dating purposes (Berendsen, 2005; Hissel et al., 2005). The continuous sample is cut into pieces of 1 m and are stored in a fridge in sealed pvc tubes until further analyses.

Next, a limited archaeological sampling campaign was carried out with a 15 cm Edelman in a 5 × 5 m grid. All samples were taken beneath the plough soil into the top of the C-horizon, with a maximum of two full auger 'heads' per sample. The maximum auger depth reached was 1.22 m BPS.

1 All Begemann corings were executed by Fugro (www.fugro.nl).

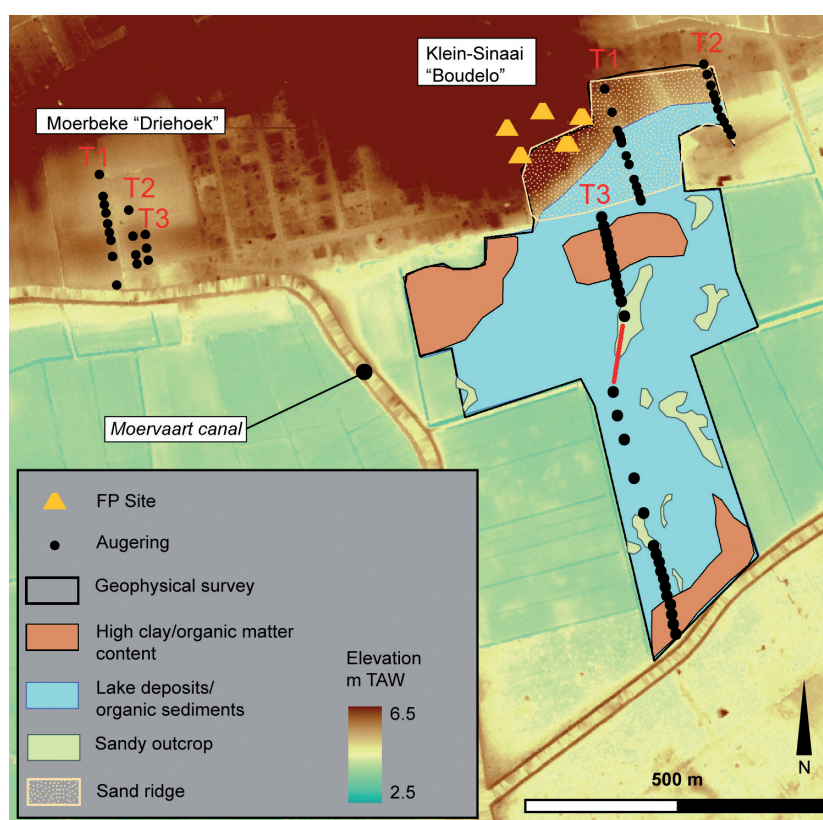


Fig. 3 - Localization map of the research sites Klein-Sinaai - Boudelo and Moerbeke-Driehoek with localization of the auger transects corings and excavated sites; projected on the topographic map and the DEM.

3.3 Daknam

As previously described (Bats *et al.*, 2010), a combination of geophysical survey and coring was applied in this area to find a palaeomeander of the river Durme. Emi survey was conducted in the northern part of the study area, covering a total of approximately 8 ha. A 370 m long transect was set out for manual coring in the northwestern part of the alluvial zone, from its border to the centre of the palaeolake. Subsequently, the results from the geophysical survey were checked with manual corings and at one suitable location high quality Begemann samples (see above) were taken to a depth of 5,40 m BPS for further analyses.

4. Preliminary results

4.1 Klein-Sinaai - Boudelo

In the palaeolake, the geophysical data showed the morphology of a marshy area, with occasional small sandy outcrops (Fig. 3). Over the entire width of the palaeolake, organic sediments and calcareous lake deposits were attested. Surprisingly, these lake deposits can be traced under the sand ridge. As most of the area around the Final Palaeolithic sites at *Boudelo* was destroyed by building activities (and preceding archaeological excavations), augering transects were set up just east of the Final Palaeolithic sites (Fig. 3), where the digital elevation model (DEM) shows a lower zone. The excavated sites were situated between ca. 6.50 and 7.70 m TAW² while the surface level at the location of transect 1 varied between 6.20 and 4.90 m TAW (from north to south).

2 Tweede Algemene Waterpassing: reference height for height measurements in Belgium. 0 m TAW equals the average sealevel at low tide in Ostend.

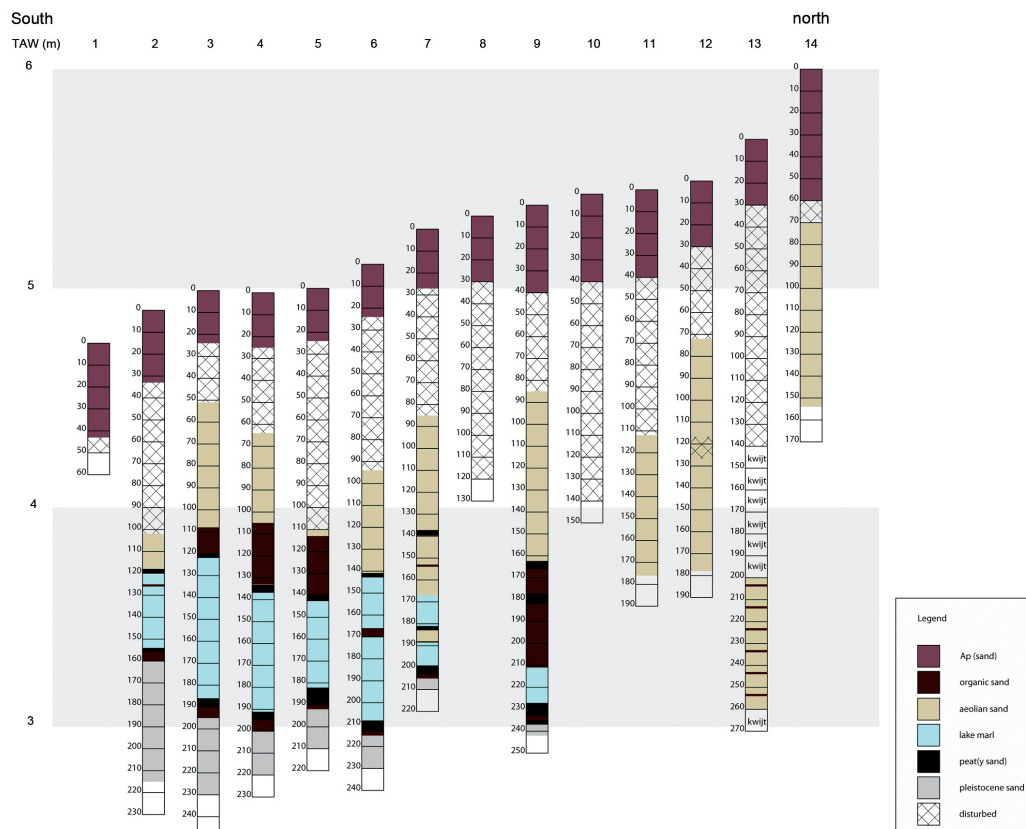


Fig. 4 – Klein-Sinaai - Boudelo, transect 1.

The soil profile of transect 1 (Fig. 4) shows that this lower zone corresponds with the presence of lake marl underneath a thick layer of sand deposits. Unfortunately, the soil profile is not complete as not all cores reached sufficient depth to confirm the presence of the lake sediments. Often the upper soil was disturbed up to a depth of more than 1 m and contained so much stone debris that manual coring was made impossible. In other cores, the sandy sediments washed out with the ground water before they reached the surface.

The second transect (Fig. 5) revealed a palaeochannel with a peaty infilling that cuts through the lake marl. This lake marl was again found at a depth of 2 m below the cover sand. The peat in the palaeochannel was heavily decomposed, probably due to later disturbance (or peat extraction?) up to 1.5 m deep. The longer third transect runs through the shallower part of the palaeolake which is intersected at the south and the north end

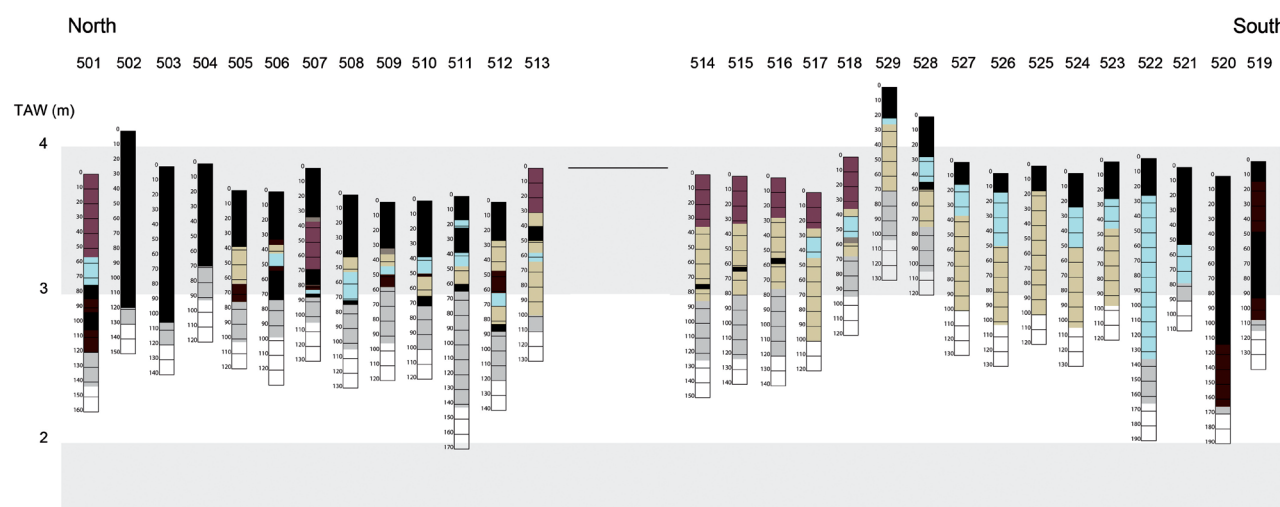


Fig. 5 - Klein-Sinaai - Boudelo, transect 3 (for the legend, see fig. 4).

by (sub)recent ditches; possibly these are connected with the medieval abbey. The location of a deeper part in the palaeolake, indicated by a lake marl layer of 1 m thick, and of a sandy outcrop in the second half of the transect corresponds well with the geophysical data (Fig. 3).

4.2 Moerbeke-Driehoek

At Moerbeke-Driehoek, access to the field was limited because of the newly sown crops. Three north-south transects were made, one longer transect (transect 1) and two short transects (transects 2 and 3). Manual coring was difficult and sometimes even impossible beneath the ground water level (0.80-1.15 m BPS). Transect 1 (Fig. 6) is 185 m long and starts at the bank of the present Moervaart Canal, which is a man made (medieval) canal that runs over the lower sand ridge at the foot of the great sand ridge. Although deep coring was problematic, in two cores (no. 5 & 6, Fig. 6) a layer of lake marl and peat (y sand) was found under a thick layer of aeolian sand at a depth of ca. 3.4 m TAW. This is about the same level as the top of the lake sediments excavated in the trench at Moerbeke (see: Bats et al., 2010). The lake sediments were found at the same level in the two shorter transects as well (no. 2, 14, 15 & 16, Fig. 8). This means that the lake at a certain moment became covered with two meters of sand deposits. It could be expected (but still has to be confirmed) that this event took place in the Younger Dryas as was the case at the top of the large cover sand ridge at Wachtebeke-Heidebos (Bats et al., 2010; Derese et al., 2010). Remarkable, though, is the fact that the artefact assemblage

of the surface site found here was (at least partly) dated to the Final Palaeolithic. The palaeolake on the other hand, was formed during the two warmer phases of the Late Glacial, the Bølling and the Allerød. The dating of the lake however is still based on the traditional literature (e.g. Crombé, 2005; Verbruggen, 1979) and preliminary results of the fieldwork within the project however these datings are currently being updated with new ^{14}C datings and a palaeoecological study. Two Begemann cores were taken at Moerbeke-Driehoek. These cores have recently been opened, described, photographed and sampled for further analyses and dating.

The northern part of transect 1 also runs through the lower lying zone between the great sand ridge and the smaller elevation near the Moervaart canal. Unfortunately, manual coring proved to be very difficult (significant loss of sediment during coring) as three of the four corings showed important disturbance of the sediments up to nearly 2 m BPS.

The short transects 2 and 3 revealed the presence of a partially preserved podzol profile on top of the lower sand ridge, exactly at the location where in previous years surface finds were collected. This is surprising, as podzol profiles are often subject to ploughing activity, especially on higher elevations. Unfortunately, because of the recently sown crops the surveyed area was limited so that, at this moment, it remains unclear if podzol profiles are present at other parts of the field as well.

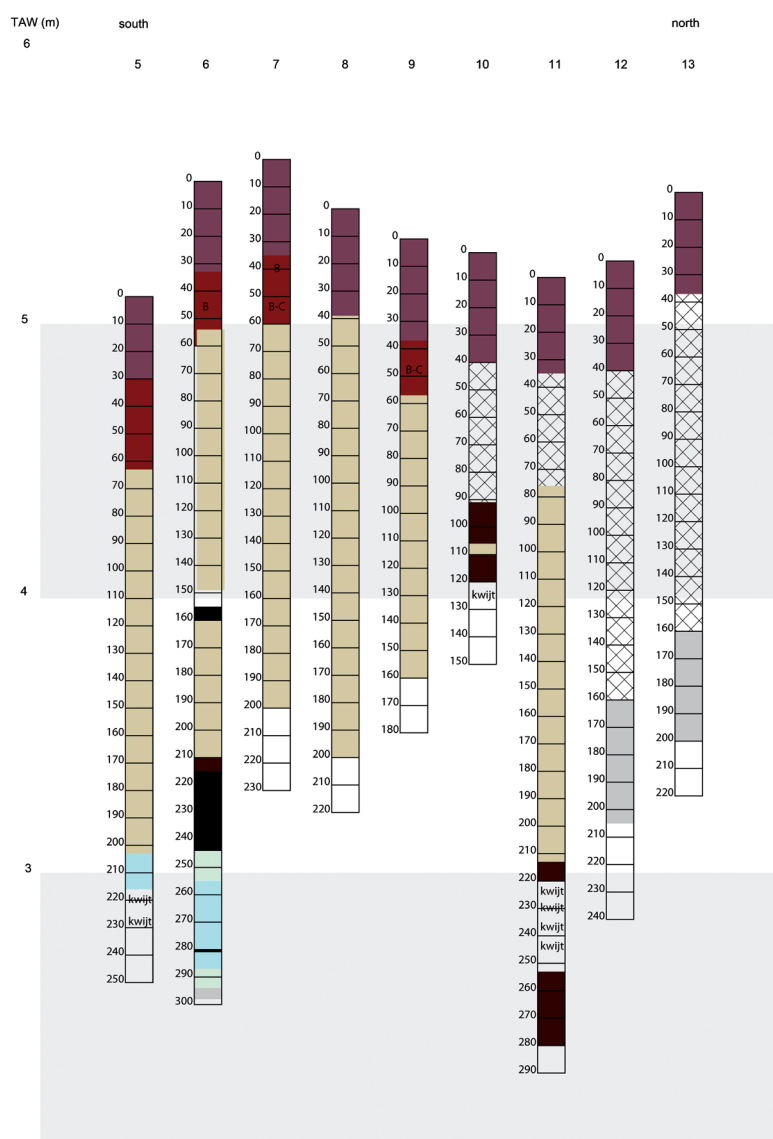


Fig. 6 – Moerbeke-Driehoek, transect 1
(for the legend, see fig. 4).

A limited archaeological coring campaign was set up to test whether *in situ* archaeological sites were still preserved within this (partial) podzol profile (Fig. 7). Because of the crops, only 0.4 ha (119 auger holes) could be sampled in a tight 5 × 5 m grid. A total of 449 samples were wet sieved over 1 mm meshes and after drying searched for archaeological indicators. Results, however, are rather disappointing as only 11 samples contained such indicators. All positive samples contained lithic artefacts, mostly one flint microchip per sample. One sample contained a flint microchip and a fragment of a burnt hazelnut shell and one contained a chip in Tienenquartzite. Also a core fragment, made on a local nodule, was found. Such results do not allow extensive interpretations of the site. Therefore, the archaeological sampling campaign will be extended in the coming winter season.

Fig. 7 - Map of the archaeological sampling results at Moerbeke-Driehoek with indication of the preservation of the podzol, projected on the orthophoto (2003).



4.3 Daknam - Daknamse meersen

Although the outline of the floodplain and the DEM of the area (Figs. 1-8) indicated that palaeochannels could be expected in the northern part, none were found through coring. On the other hand, several point bar elevations and shallow depressions were mapped, suggesting that possible former palaeochannels were cleared and/or buried by later point bar activity.

However, in the central part of the study area, where the DEM data did not indicate significant palaeotopographical variability, geophysical mapping revealed a palaeochannel (Fig. 8). Even though only a small segment of the palaeochannel was found, augering showed that the preservation of the sequence was of very high quality. A Begemann core was recently taken in the deepest part of the palaeochannel. This core confirmed the presence of a palaeochannel more than 5 m deep, and is currently being analyzed and sampled for ^{14}C dating to link it to the palaeohydrological system of the Moervaart Palaeolake area.

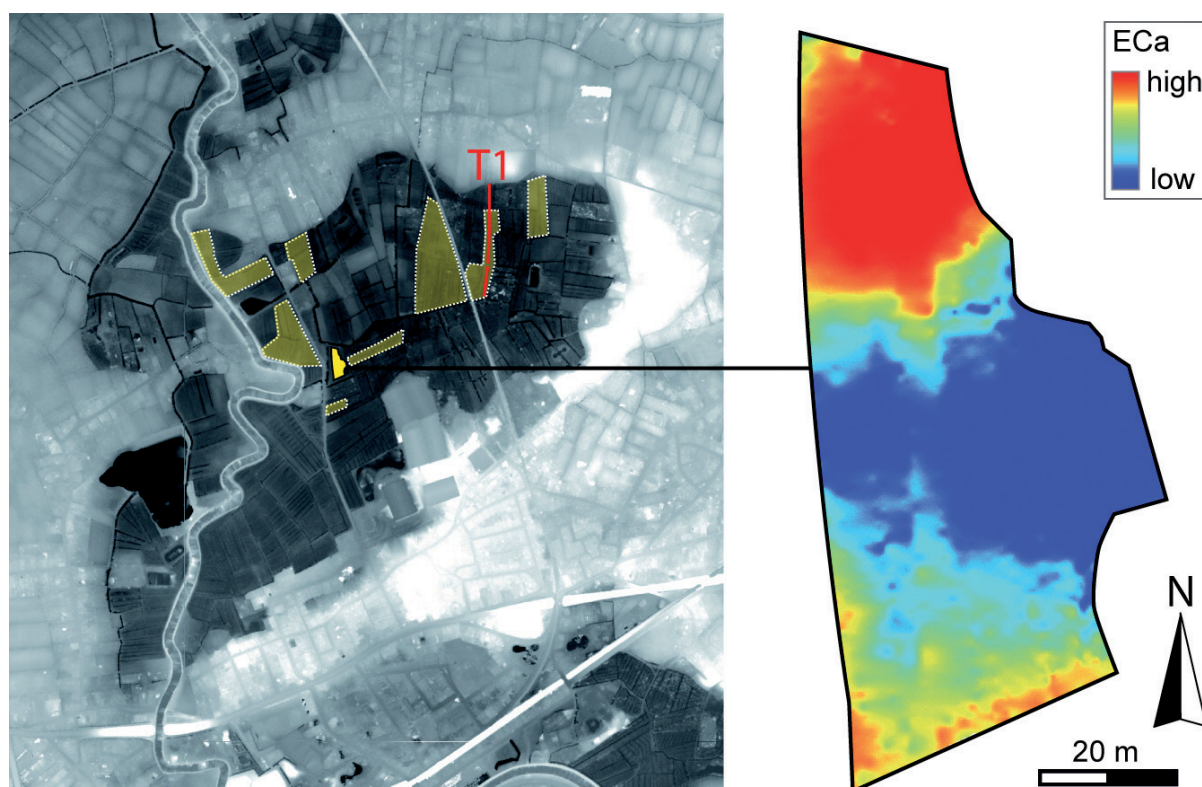


Fig. 8 - Localization of the fieldwork actions at Daknam - *Daknamse Meersen*, the yellow zones delineated by the white dashed lines were surveyed geophysically; the red line indicates auger transect1 (left). On the right the ECa plot of the field where the palaeoriver segment (visible as the elevated ECa values) was found is shown.

5. Conclusions

This season, the fieldwork of the GOA project primarily focused on sampling for palaeoecological and dating purposes. Valuable sequences were found at Moerbeke-*Driehoek* and Daknam - *Daknamse Meersen* by combining geophysical methods with manual and mechanical coring and digital elevation data. Again, this proved to be an effective combination to gather accurate and detailed information about the palaeolandscape.

The presence of Final Palaeolithic sites at the northern bank of the Moervaart palaeolake, such as Moerbeke-*Driehoek* and Klein-Sinaai - *Boudelo*, remains a difficult issue as they seem to be situated on top of a thick layer of aeolian sands covering lake sediments. Samples taken during the recent fieldwork should, after palaeoecological analyses and absolute dating, give more insight into the chronology of these events that had such an impact on the past landscape. However, until now archaeological sampling didn't yield enough new information and therefore will be continued.

It is expected that the Daknam sequence can be linked with the sequences of Moerbeke and Daknam, thus forming one large meandering palaeoriver(-system). Based both on older data and preliminary results, the incision of this large river took place before or during the Younger Dryas. How exactly this is related with the genesis of the Moervaart palaeolake, is yet unsolved. Hopefully, the ongoing pollen analyses and ^{14}C dating programme will provide us with more insight in this matter. The newly gathered information might help us understand the choice of settlement location of prehistoric man in Sandy Flanders.

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