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Continued geoarchaeological research at the Moervaart palaeolake area (East Flanders, Belgium): preliminary results

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Abstract

The area of the Late Glacial Moervaart lake is currently the subject of a multi-disciplinary study. This article presents some preliminary research results from GIS-based historic-geographical research, auger survey, geophysical survey and palaeo-ecological analyses.

Keywords: Moervaart palaeolake, East Flanders (B), Sandy Flanders, palaeochannel, Late Glacial, Holocene.

1. Introduction

In 2008, the multi-disciplinary research "*Prehistoric settlement and land-use systems in Sandy Flanders (NW Belgium): a diachronic and geo-archaeological approach*" project was started at Ghent University. The aim of the project is the study of prehistoric settlement and land-use systems in the area of Sandy Flanders. The applied multi-disciplinary methods and first results were presented in the previous edition of *Notae Praehistoricae* (Bats *et al.*, 2009). In this article a short update is presented on the ongoing research in the area of the Moervaart palaeolake. This includes GIS-based historic-geographical research, analyses of the earlier collected field data and further fieldwork.

2. GIS-based historic-geographical research

An important component of the project is the GIS-based historic-geographical research. The objectives of this research are twofold: first, high precision LiDAR elevation data was transformed into a practical and clean Digital Elevation Model (DEM) which facilitates an optimal visualization and interpretation of the micro-topography. This DEM will serve as the main data source for the realization of a Historical Landscape Characterization (HLC). Another data source providing unique information about landscapes of the past are toponyms, being the names of parcels, area's, settlements, etc. which are gathered from historical maps and diverse literature sources. The toponymical database is subdivided in polygon and point toponyms and gives a detailed localisation and interpretation. Additional data sources are comprehensive, historical and topographical map series from 1775 to 2000 which show the most important transformations resulting in the contemporary landscape, fragmentary historical maps which are not covering the entire area but date from former periods, aerial orthophotos, regional literature and data from other research groups. All these sources are integrated in a GIS-environment.

In the second phase, the HLC is performed by delineation of holistic landscape units based on vertical relations between differentiating land components being macro- and micro-topography, soil characteristics and land-use. To each polygon a historic landscape type is assigned by the interpretation of numerous data sources.

The overlay and integration of these different sources in a GIS-environment not only provides an overall overview of the numerous data sources but also makes patterns more easily observable and thereby revealing new information about interaction between human activities and natural conditions.

3. Palaeoecological analyses: preliminary results

During the previous fieldwork campaign, five north-south transects were made in the central part of the Moervaart palaeolake by means of manual coring (Bats *et al.*, 2009). Geophysical survey, combined with manual coring was mainly applied in the western part of the palaeolake. The combined techniques show a complex history and genesis of this Late Glacial lake and several narrow palaeochannels/gullies were recognised within the lake marl deposits. These probably belong to a braided river system of small, shallow gullies probably dating to a later stage of the Late Glacial.

A second palaeochannel system, consisting of a single but large channel that crosses the palaeolake in the central part, was located as well. This large meandering river cuts deep through the lake sediments thus creating point bar elevations on which lithic artefacts were found. The palaeochannel is over 6 m deep and is filled in with gyttja, clayey and peaty material. Locally, the upper part of the peat was extracted, probably during the Middle Ages. The palaeochannel was sampled at two separate locations by means of mechanical coring (fig. 1:1). At each location two cores of 5 to 7 m deep were collected. The cores were described in detail, photographed and sampled for palaeoecological research. Preliminary results of the pollen analyses date the lower sediments of the channel to the Younger Dryas.

In the deepest part of the palaeolake, a 70 m long trench was dug to gain more insight into its complex stratigraphy (fig. 1:2). The trench profile was elaborately sampled for palaeoecological analyses and dating purposes. The sequence is actually being studied in detail and preliminary results, mainly based on palynology, micromorphology and the study of diatoms and molluscs, show a sequence from the Pleniglacial to the beginning of the Holocene (fig. 2).

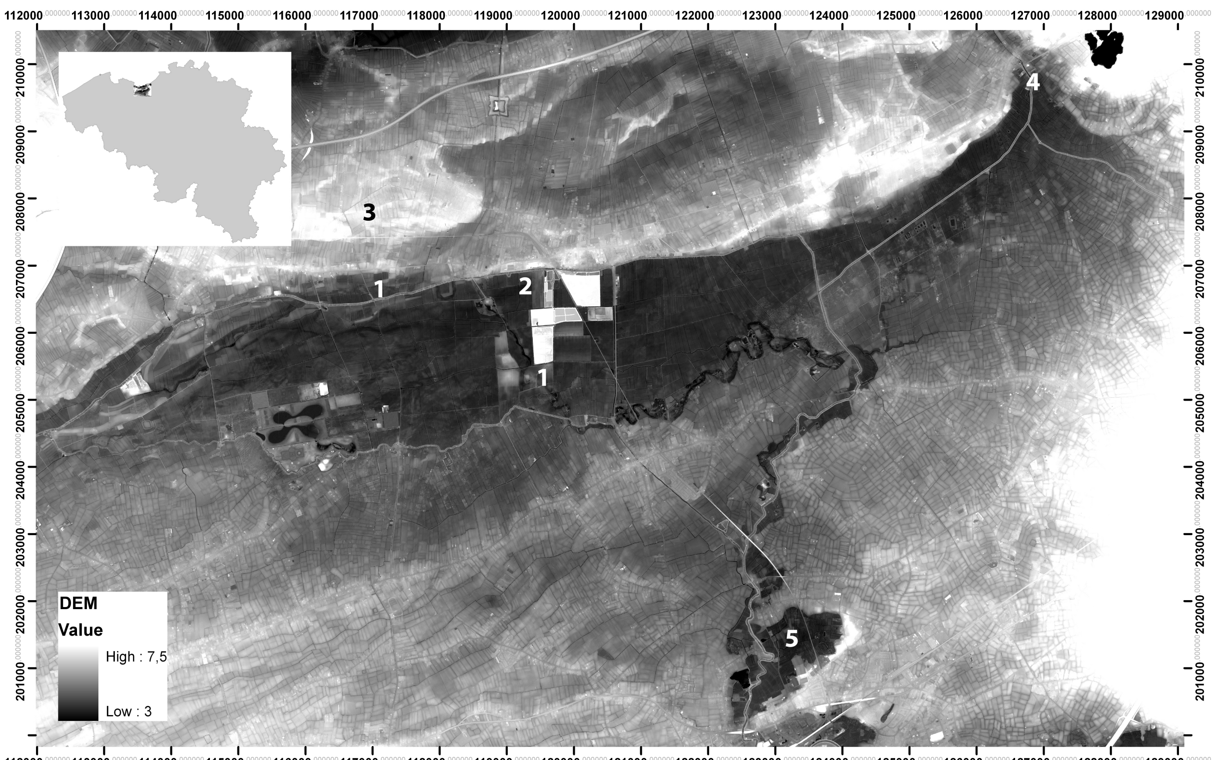

Fig. 1 – Location of the study area (DEM) with indication of the sites mentioned in the text.

During the Oldest Dryas an extensive marshland developed with eutrophic and lightly brackish percolating water and a local vegetation characterized by *Equisetum* (horsetail) but also *Myriophyllum spicatum* (water-milfoil) in the deeper open water zones (fig. 2:A). Regionally the landscape is very open, dominated by herbs and steppe elements (*Cyperaceae*, *Chenopodiaceae*, *Artemisia*); some shrubs however already started to develop (*Salix*, *Betula*). From the start of the Bølling chronozone onwards, a gradual increase in temperature and water level took place, creating a permanent lake with a well vegetated littoral zone and well oxygenated slow to still waters (fig. 2:B). The pollen assemblages show a development of an open *Betula* forest, while among the herbs *Cyperaceae* are replaced by *Poaceae*. Despite these apparently favourable conditions, no proof of human occupation could be attested so far. Major changes took place locally in the Older Dryas, with a steep drop of temperature and a progressive lowering of the water level (fig. 2:C). The lake, however, never dried out and the water was never less than 1 m deep. The lake water was well oxygenated and mesotrophic, colonized by water plants such as *Myriophyllum spicatum*, *Nymphaea* and *Nuphar*, whereas *Sparganium* and *Menyanthes trifoliata* hydrophilous plants developed on the shores. The environment surrounding the lake became more open with a decrease in *Betula* and a rise of steppe plants (*Cyperaceae*, *Artemisia*). During this period, aeolian activity must have taken place which resulted in the deposition of thin layers of windblown sand in the lake. Renewed climate amelioration followed in the Allerød chronozone, with an important temperature rise. The lake expanded with well vegetated, well oxygenated water (fig. 2:D). Possibly the lake reached its maximum extent of approximately 25 km^2 at the end of this phase. During the Allerød a rather dense birch forest was present around the lake which evolved to a closed *Betula*-*Pinus* cover. The very cold Younger Dryas period is only represented by a thin sediment layer in the upper part of the marl deposits (fig. 2:E). It is characterized by a sharp decrease in tree pollen (*Betula*, *Pinus*) and the development of a rich herbaceous vegetation (*Poaceae*, *Cichorioideae*, *Aster* type, *Plantago* sp., *Artemisia*, *Cyperaceae*). The lake water level still should have been rather high during this phase, since the aquatic vegetation (*Nuphar*) is well represented as shown by the pollen analyses. At the onset of the Holocene the lake dried out quite suddenly and peat started to grow, turning the lake into a marshland or damp grassland, dominated by *Equisetum* and *Sparganium* (fig. 2:F). Regional vegetation was dominated with a dense pine forest, while mesophilous trees appeared (*Corylus*, *Quercus*, *Ulmus*) and hazel expanded rapidly with the climatic amelioration.

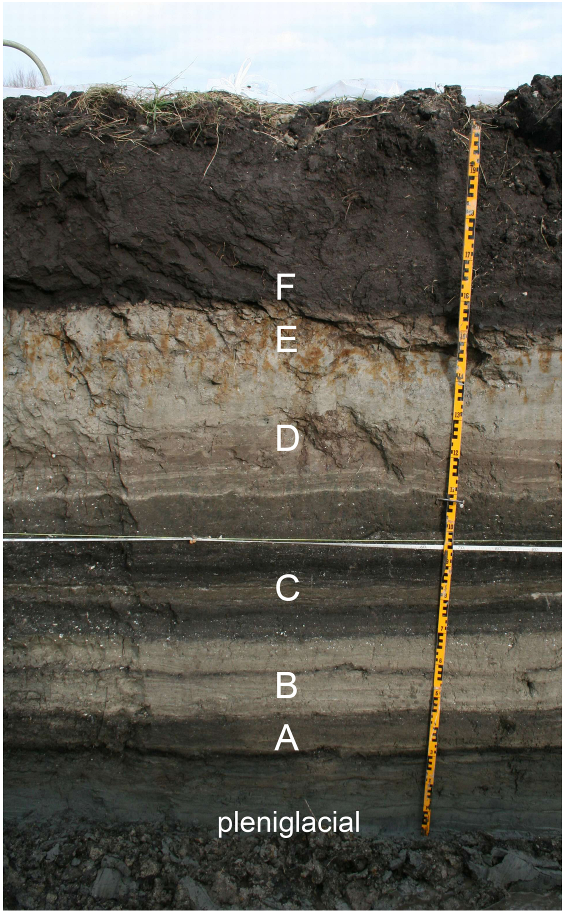

Fig. 2 – Profile of the Moervaart palaeolake.

To study the genesis of the coversand ridge north of the palaeolake, two 7 m long cores were mechanically retrieved next to each other from the top of the coversand ridge at the location 'Heidebos' at Wachtebeke (fig. 1:3). One core has been described in detail, photographed and sampled for pollen, macro-remains and radiocarbon dating as well as measured for magnetic susceptibility (MS), gamma-density, loss-on-ignition (LOI) and sediment grain size. From the second core, a total of eleven samples were collected for quartz-based SAR-OSL dating (Derese *et al.*, in press). The optical ages are internally consistent and distinguish at least two distinct phases of aeolian sand deposition during the Late Pleniglacial and the Late Glacial. The latter caused an accumulation up to 5 m of cover sands on top of the Pleniglacial sediments (fig. 3). This means that during the Late Glacial major aeolian activity led to the formation of this massive sand dune. Several humiferous layers could be observed within the Late Glacial aeolian sediments, indicating periods of stabilization. The thickest organic layer in the core, at ca. 3,5 m below present surface, is dated to the Allerød chronozone by means of pollen analyses and OSL-dating (fig. 3:A). This layer was covered with a thick layer of sand (more than 2 m), implying that important aeolian activity took place during the Younger Dryas. At a depth of 1 m, another fine organic layer was found which showed an strong increase in MS, possibly indicating a fire event (fig. 3:B). This layer was dated by pollen analyses to the Late Atlantic/beginning of the Subboreal and it could be the first indication of human interference with the natural vegetation in the area. However, the exact origin of this magnetic anomaly still needs to be confirmed. Afterwards, approximately 1 m of sand was deposited on top of this level, pointing to renewed aeolian activity during the second part of the Holocene.

4. Further fieldwork

Further fieldwork aims at reconstructing the palaeolandscape within its hydrological system in order to understand the evolutionary history of the lake and enable the modelling of the past landscape which will locate possible areas amenable for prehistoric settlement. The continued fieldwork comprises manual coring and geophysical survey.

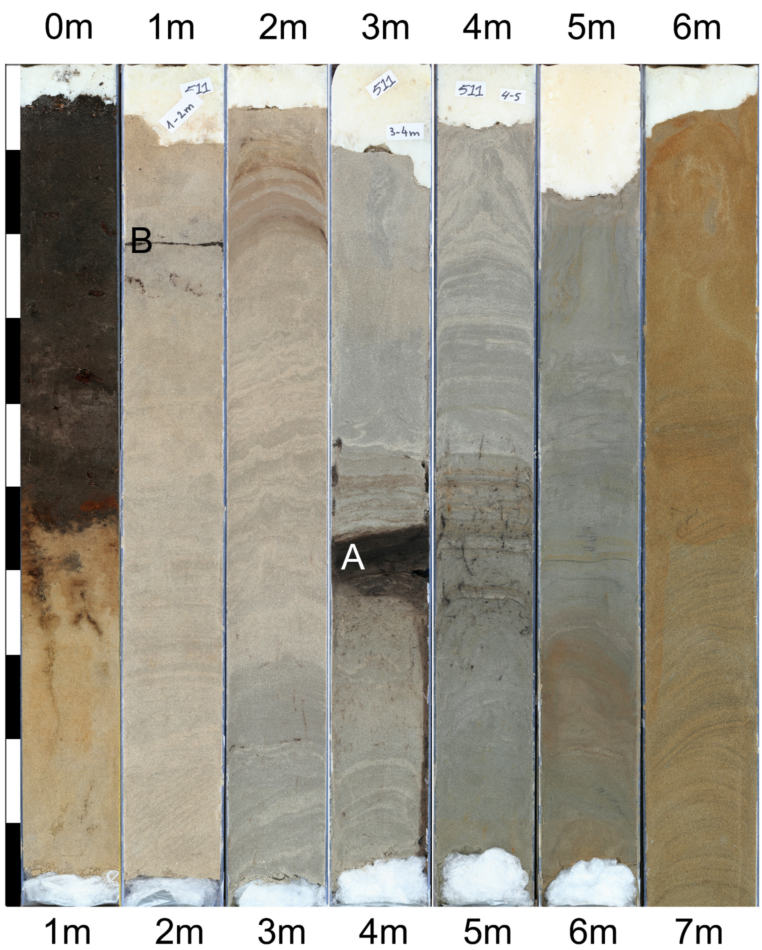

Fig. 3 – Core collected from the top of the coversand ridge at Heidebos, Wachtebeke.

The large palaeochannel described above was sampled for detailed study. But, due to later peat extraction the samples are all lacking the top level of the channel infill. Recent fieldwork revealed a location close to the present Zuidlede river, where a supposedly complete sequence of the channel was found. The sequence probably survived in a bank in between two peat extraction pits and will be sampled and analysed in the near future.

The central aim of the fieldwork is the acquisition of data yielding insight into the natural drainage system of the palaeolake. The specific question rises if the outflow of the lake happened to the northeast, as is often assumed (fig. 1:4). In the 16th century a channel, the so-called Stekense Vaart or Parmavaart, was dug by the duke of Parma, Alexander Farnèse, to create a direct connection between Ghent and Kallo (Guns, 2008). The channel ran from the Scheldt river at Kallo to Stekene where it was linked with the Moervaart. According to historic documents, the 15 km long canal was dug between October 1584 and February 1585. It is almost impossible to finalise such a construction in such a short period, so it can be assumed that Farnèse made optimal use of the geography of the area. The massive coversand ridge of Maldegem-Stekene that runs from the Belgian coast towards Antwerp is intersected by a shallow valley which lies against the northwestern edge of the Waasland cuesta (De Moor & van de Velde, 1995). The Stekense Vaart was dug in this valley but it is unclear if a natural palaeogulley preceded the canal. According to De Moor and Heyse (1978), this shallow area functioned - together with the Durme river - as a drainage system for the Moervaart palaeolake. In his master thesis Van Eetvelde (1980-1981) already studied the possibility of this north-eastern drainage making use of geomorphological maps and corings. Although the author concludes that fluvial outflow through the shallow depression took place during the Late Glacial, his core descriptions never show any hard evidence of such activity other than the presence of a depression. In contrast with the central and the western part of the palaeolake area (Bats *et al.*, 2009), the DEM shows no traces of (a) palaeochannel(s) here. With the recent fieldwork we tried to find evidence of a palaeochannel in the valley of the Stekense Vaart that could have functioned as a drainage to the north. This was done by manual coring and geophysical survey. The coring was executed in five transects from one end of the valley to the other, thus creating several cross sections through the valley. None of these transects, however, showed evidence for the existence of a palaeochannel. It is yet unclear whether this proves the absence of a palaeo-channel, or whether its remnant is very small or deeply buried and therefore not detected in the field campaign. To verify the presence or absence of a paleochannel, a mobile electroma-gnetic induction (EMI) survey (Saey *et al.*, 2008), will be conducted throughout the valley.

The combination of geophysical survey and coring was also applied in a palaeomeander of the Durme river at Daknam (Lokeren) (fig. 1:5). The purpose of this fieldwork was to find a well preserved palaeochannel to sample for palaeoecological analyses. It is assumed that the large palaeo-channel, which was registered in the last field campaign and is currently being analysed (see above), could be linked with the original course of the Durme river. The combined fieldwork clearly showed several point bar elevations separated from each other by shallow, peaty depressions. So far a deeper structure, possibly a palaeochannel, was detected by EMI survey at two locations, but this has to be confirmed as the fieldwork is still ongoing.

5. Conclusions

The aim of this article is to provide an overview of the ongoing research and preliminary results of the multi-disciplinary project "*Prehistoric settlement and land-use systems in Sandy Flanders (NW Belgium): a diachronic and geo-archaeological approach*". Although a lot of work is still in progress, the first results already give interesting new insights in the evolution of both the Moervaart palaeolake and the coversand ridge. During the Late Glacial, a large aeolian sand ridge developed in several dynamic stages, interrupted by stabilisation pha-ses. A thick aeolian layer was deposited during the Younger Dryas. An organic layer, dated to the

Late Atlantic, covered by at least 1 m of sandy sediments indicates that important aeolian activity took place after that period as well. At the southern edge of this sand ridge a shallow palaeolake started to develop during the Oldest Dryas but it only reached a large extent during the warmer phases of the Bølling and Allerød. At the end of the very cold Younger Dryas, the lake dried out and never recovered afterwards. A large gulley developed at this time, possibly creating a flow out system for the lake. A drainage system to the northeast, if existing, has not (yet) been found.

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