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A causewayed enclosure near Ermelo?

Hans Kamermans, Joanne Mol, Eric Dullaart and Miranda de Kreek

Causewayed enclosures are large earthworks dating from the period 4500 - 3500 cal BC. They are quite common in Europe, and only one is known from the extreme southern part of the Netherlands. Shortly after the introduction of the AHN (Actueel Hoogtebestand Nederland), a LIDAR image of the whole of the Netherlands, a structure looking like a causewayed enclosure was discovered on the image of the Veluwe (Central Netherlands). Precise measurements in the field and geological research showed however that the structure for the largest part has a natural origin.

1 Introduction

Causewayed enclosures, or "Erdanlagen" in German and "enceintes interrompues" in French, are large earthworks dating from the period 4500 – 3500 cal BC and are quite common in Europe. They belong to the Michelsberg and contemporaneous cultures. Examples are known from South Scandinavia, Germany, Belgium, France and the British Isles (Andersen 1997; Burgess *et al*. 1988). Only one is known from the Netherlands (Schreurs 2005, 311).

A causewayed enclosure is oval in form, often close to a circle, between 0.4 and 10 hectares in extent and (most of the time) consists of one or more concentric ditches and banks at intervals interrupted by gaps (causeways) (Oswald 2011). They can be situated both on hilltops and in lowland areas, often on sloping ground and near watercourses. They are the earliest example of the enclosure of a large open space. In general no features are found in the interior, only a few pits and postholes, but from the banks and ditches various objects have been recovered, like pottery, flint, food remains and in some cases human bones in the form of skulls. Often the form of the enclosures has been frequently modified and the banks and ditches recut. Often recurrent deposition took place during recutting.

The function of these enclosures is still under debate (Gibson 2002). They were not habitation sites, nor was defence their primary purpose. Some researchers see them as trade centres, cattle compounds or fairgrounds. Others argue that the construction of the enclosure itself was the main purpose of building them. In any case, in the Michelsberg culture they are considered by most researchers as communal ceremonial centres of a society on a higher level than the individual settlements.

2 Discovery

The introduction in 2003 of the AHN (Actueel Hoogtebestand Nederland), a LIDAR image of the whole of the Netherlands, proved to be a treasure trove for archaeologists (Waldus and van der Velde 2006). LIDAR stands for Light Detection And Ranging. It is a remote sensing technique that, in the case of the AHN, measures the distance between an airplane or a helicopter and the surface of the earth using pulses from a laser. These measurements can be transferred into a Digital Elevation Model (DEM). Many features like barrows (De Boer 2007) and Celtic fields are easily recognized on these DEM images. In 2004 de Kreek wrote her MA thesis on the use of LIDAR images for the recognition of Roman structures in the Dutch landscape (de Kreek 2004). While searching in the AHN data for a Roman marching camp from the 2nd or 3rd century AD, known to be situated on the heath near Ermelo (fig. 1, Ermelosche Heide, the Netherlands), a large oval feature was discovered that resembles a causewayed enclosure (fig. 2).

The Limes, the frontier of the Roman Empire, was situated along the river Rhine, but the Roman army would now and then venture into enemy territory. In the evening the Romans constructed a temporary camp with rampart and ditch. The camp on the heath near Ermelo is situated 35 km north of the Limes along an important route from the border to the Flevo Lake. It has the shape of a rhombus with sites of *c*. 300 to 350 metres. The enclosed area is *c*. 9 hectares. The rampart is *c*. 6 metres wide and less than a metre high; the ditch is 3 metres wide and 50 cm deep (Klok and Brenders 1981, 9-10). Part of it was excavated in 1923 (Holwerda 1923). Additional research has been carried out in 1987 (Bechert and Willems 1995, 79; Hegener 1995, 48). The camp is clearly visible on the LIDAR image, but it intersects a much larger, oval-shaped structure (fig. 3).

This oval structure measures 50 hectares and resembles a causewayed enclosure with one bank, a number of times interrupted. The banks are 6 to 8 metres wide and several decimetres high. In the northeast the bank is missing, a small river valley (Leuvenumse Beek) forms the boundary of the

Figure 1 The location of Ermelo in the Netherlands.

enclosure. A part of it is covered by forest. A road (Flevoweg) cuts through the structure. In order to establish the nature of the large structure, fieldwork was carried out during the summer of 2004.

Only part of the enclosure was available for field research. The part NE of the road Flevoweg is private property and research in that part of the structure was not possible. The part SW of the road is a former military training area. In this part we tachymetrically measured more than 2,400 elevation points and augered 60 boreholes up to a depth of 2 meters.

3 The landscape

The present, undulating landscape is the result of glacial deformation by large ice masses that dominated the northern and central part of the Netherlands during the Saalian glacial stage. While in the northern part of the Netherlands glacial till was laid down, the front of the ice cover in the Central Netherlands was dominated by glacial erosion. Glacial surge of the ice lobes created deep glacial basins and ice-pushed ridges several tens of metres high. Underlying fluvial deposits were pushed forward by the advancing ice and ridges with imbricated fluvial deposits were the result.

The study area is located on the eastern slope of the Garderen ice-pushed ridge, which is part of the larger Veluwe ice-pushed ridge system. To the west lies the

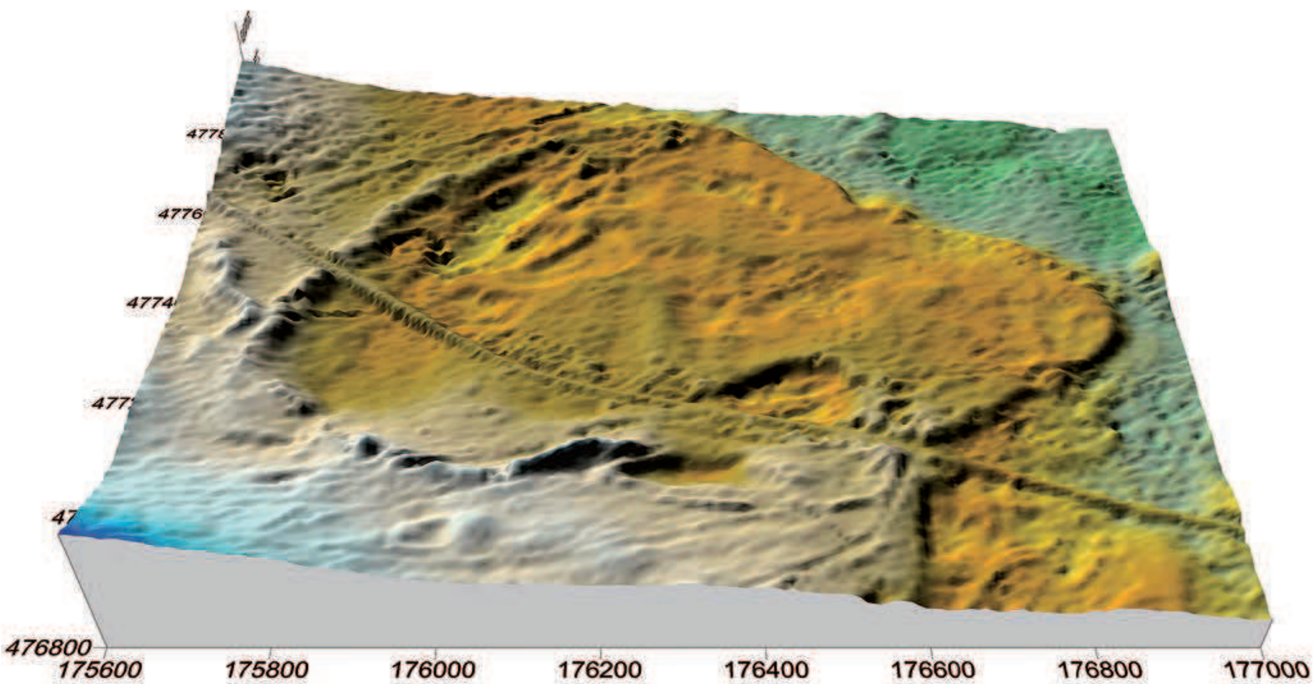

Figure 2 Oblique Digital Elevation Model of the Ermelosche Heide, based on the LIDAR-image (AHN) of the Netherlands. Both the Roman March Camp (the rhombus on the left) and the supposed causewayed enclosure (the oval shape) are visible.

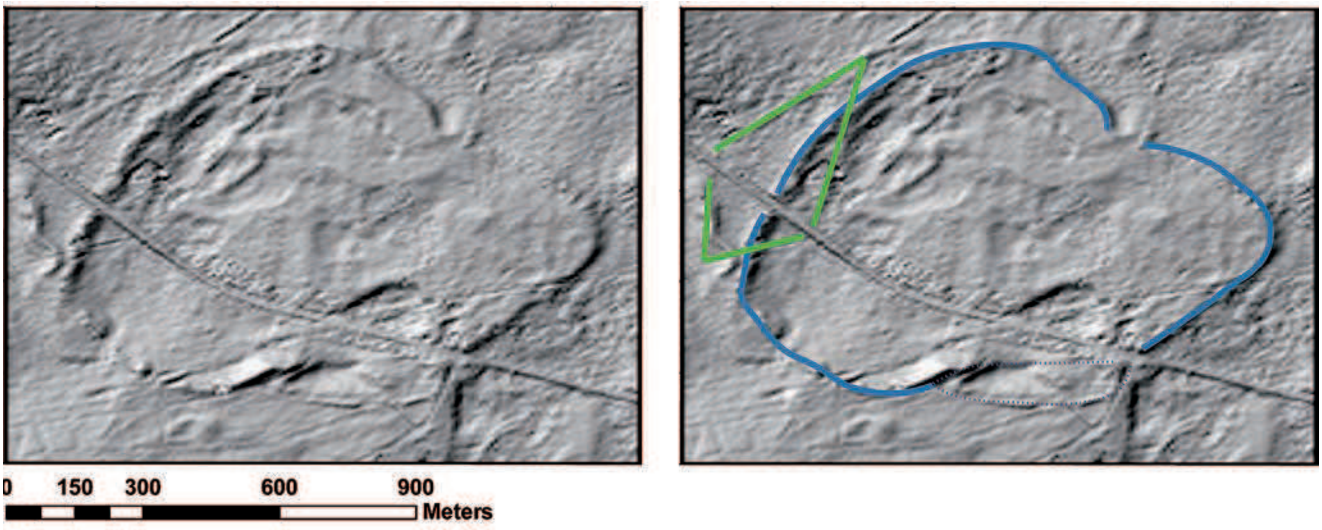

Figure 3 Digital Elevation Model of the possible causewayed enclosure, based on the LIDAR-image (AHN) of the Netherlands. On the left the Roman March Camp.

extensive glacial basin of the Gelderse Vallei. The area is marked by the presence of an eastward sloping kame terrace, composed of gravelly glaciofluvial deposits. It was formed during a melting phase, when an ice lobe formed a small glacial basin in the present valley of the Leuvenumse Beek. The meltwater became trapped between the high Garderen ice-pushed ridge and the ice lobe, resulting in the deposition of an extensive sheet of glaciofluvial sand and gravel between the ice lobe and the Garderen ridge (Eilander *et al*. 1982, 15; Berendsen 2005, 47). More eastward in the small glacial basin, meltwater clay was deposited (van der Straaten 2008). The latter resulted in wet conditions, because this clay blocked the percolation of the rain water and groundwater flowing in from uphill. This created a damp depression with small streams, at present occupied by the Leuvenumse Beek. It is a very uncommon phenomenon in this dry, sandy region.

During the Weichselian, the kame deposits were partly redeposited as solifluction lobes on both sides of the valley of the Leuvenumse Beek. More uphill aeolian sand sheets and dunes were deposited (Eilander *et al*. 1982, 18).

The present surface in the study area is characterized by a gentle east-sloping terrain with low, elongated ridges. For a long time, the ridges were interpreted as eskers, but nowadays they are regarded as aeolian in origin (Berendsen 2005, 47).

4 Geology and soil formation

The Garderen ice-pushed ridge is composed of Early and Middle Pleistocene fluvial deposits of the river Rhine and an eastern river system, called 'Eridanos'. These sediments are the source for both the glaciofluvial and the aeolian deposits. The study area is located in an area in which both fluvial sediments can occur (Eilander *et al*. 1982, 13). The Rhine deposits are slightly richer in minerals and clay content than the deposits of the Eridanos system, which are very poor in nutrients and clay. It results in the formation of different types of soils, 'normal' podzol soils in the deposits of the Eridanos system and brown podzol soils in the deposits of the Rhine river. The glaciofluvial and the aeolian deposits are characterized by 'normal' podzol soils (Eilander *et al*. 1982).

Normal podzol soils can be distinguished by their typical white-grey eluviation horizon (also referred to as 'ash-layer') and a dark, mull-type humus-enriched B-horizon. The brown podzol soils generally contain more gravel than the normal podzols and have a less visible eluviation horizon and a less well-defined brown B horizon, due to a more intense biological activity (Locher and de Bakker 1990, 117).

According to the soil map, the normal podzol soils are present in the study area, while *c*. 1 km to the west brown podzol soils developed (fig. 4).

At present the study area is a nature reserve. Google Maps reveals parallel stripes on the present surface. This indicates stripping of the upper vegetation layer (cutting of sods, Dutch: plaggen) to encourage heath growth in this nature reserve. The upper soil horizons were probably either removed, or disturbed by this recent disturbance.

5 Fieldwork

The fieldwork comprised of two parts. The first part was the measurement of the topography, the second part of the fieldwork was the mapping of the subsurface.

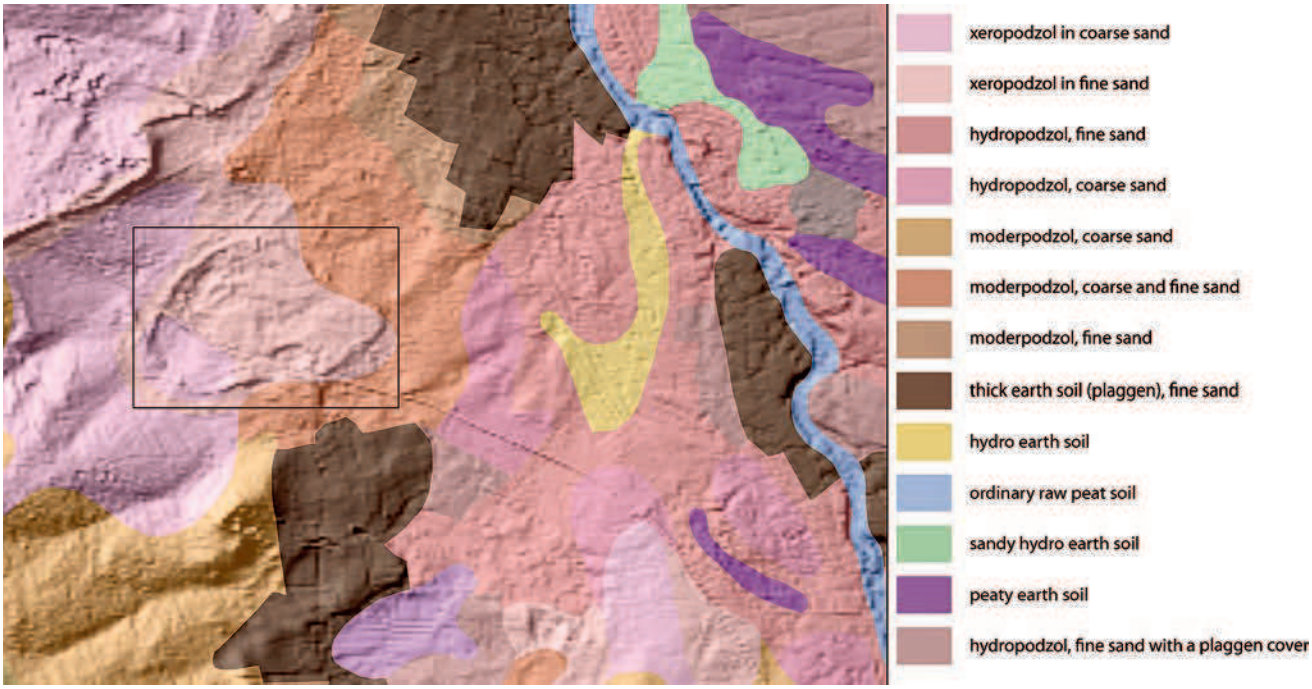

Figure 4 The soil map of the Ermelose Heide; the rectangle indicates the location of the supposed causewayed enclosure.

5.1 Digital Elevation Models

The LIDAR-based Digital Elevation Model of the south-western corner of the Ermelo enclosure has been verified in the field with the use of a Total Station. We took more than 2400 measurements and created one DEM on the basis of these measurements and one on the basis of the LIDAR data (fig. 5). A visual comparison of the two resulting DEMs shows little difference between the two models; the Total Station data shows slightly more detail. In fact, the difference in quality must be considered too small to compensate for the enormous amount of handwork needed to gather Total Station data of this, relatively small, part of the structure. Additionally, at the time of this investigation only the first version of the AHN, AHN1 was available. Future comparison of the tachymetric model with the AHN2 data set might even tip the balance of quality towards the LIDAR data.

A cross section along several axes of the structure hint at the existence of a (double?) ditch, at least in the south-western part. This feature however may have a vast number of possible causes and any suggestion of its relationship to the enclosure must be verified by further investigation (see below).

Another interesting detail of the structure is the occurrence of two depressions near the banks on the inner side of the north-western and southern parts of the structure. The depression in the south seems to have been larger in the past and its mid-section is now filled to accommodate the Flevoweg. If some of the banks are indeed man-made, the material to create them must have come from somewhere. Further investigation may shed a light upon whether the material of the banks originated from these depressions or elsewhere.

5.2 The transects

The mapping of the subsurface was focused on the mapping of soil horizons. By augering up to a depth of 2 metres, the soil horizons, but also the sediment type were established.

The interpretation of the sections is based on the assumption that the soils differ in a natural and a man-made elevation. An increase in thickness of the top soil, the A-horizon, indicates a anthropogenic cover, since a natural A-horizon is never thicker than 30 cm in the Netherlands (Locher and De Bakker, 1990). On the other hand, the absence of the top soil horizon(s) indicates that the original surface has been lowered, either by natural erosion (aeolian deflation) or removal by humans.

Five different transects (fig. 6) show the various sediments and the soils that were formed in the top.

Transect 1 shows the sedimentary sequence (fig. 7). Sedimentologically, the transect can be subdivided into two main units: fine sand with occasional gravel that is well

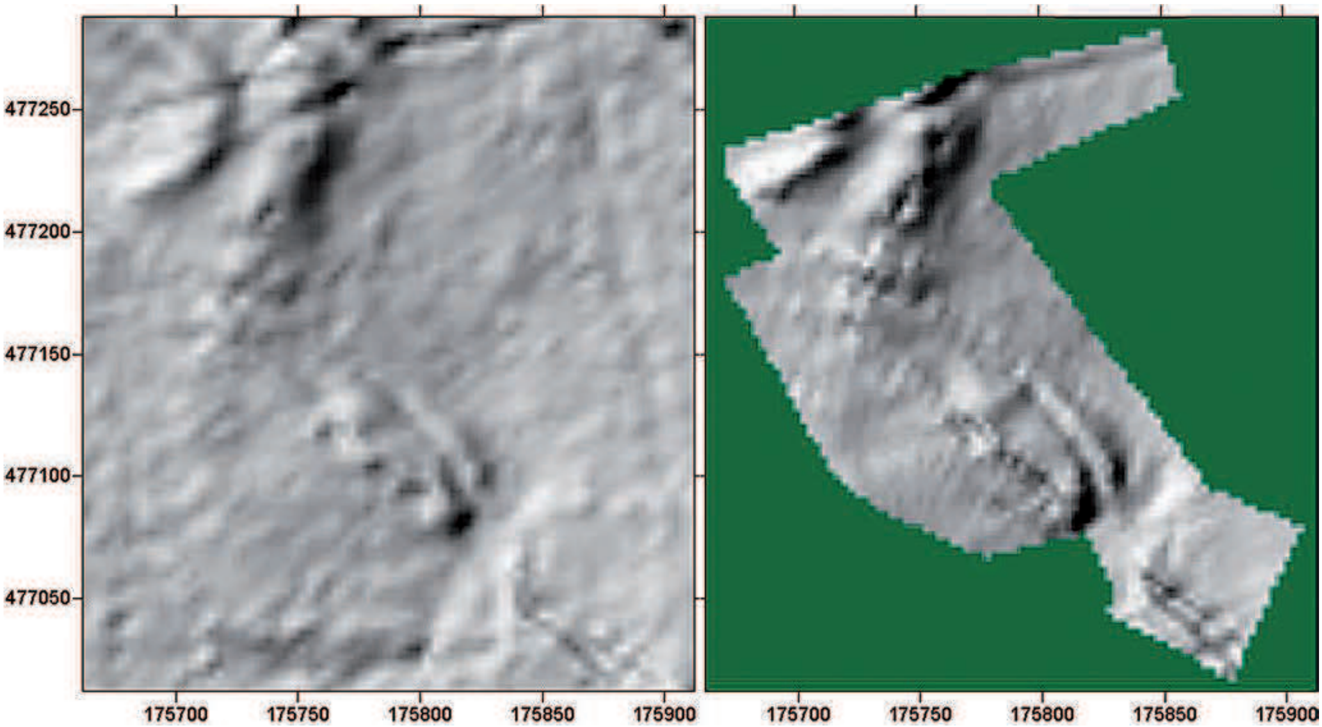

Figure 5 Digital Elevation Models. The one on the left is based on the AHN, the one on the right on Total Station measurements.

sorted, on top of medium to coarse sand with slightly larger gravel (up to 1.5 cm) that is poorly sorted. The well-sorted sand is interpreted as aeolian (cover)sand, the poorly sorted sand is likely to be fluvial in origin.

The difference between the glaciofluvial meltwater deposits and the glacially deformed fluvial deposits is difficult to establish, based on these data. However, the transect shows the slope of the topography well. The top of the lower unit slopes downvalley towards the Leuvenumse Beek. Therefore, the lower unit is most likely to have a glaciofluvial origin, forming a kame terrace (*cf*. Eilander *et al*. 1982).

Furthermore, since the ridge is mainly composed of the top unit, the aeolian deposits, this transect undisputedly indicates an aeolian origin for this part of the structure.

In general the soils in transect 1 are well developed and have thicknesses of 50 cm on average. The soils are characterized by well-developed leached (E-)horizons, usually mixed with the A-horizon, and humus and iron-enriched B-horizons. The soils in this transect could all be characterized as humuspodzol soils.

Boring 31 is located in a depression that could have pointed to the presence of a ditch, as postulated above. However, it shows no podzol soil formation. Therefore, it is likely to be caused by a recent disturbance, possibly related to the military practices of several decades ago.

Boring 33 shows a rather thick A-horizon, of which the top is interpreted as a plaggen soil. This soil will be discussed below, in transect 5.

Transect 2 shows a similar sequence, poorly sorted glaciofluvial sediments at the base and aeolian deposits on top (fig. 8). Here, the aeolian deposits not only form the ridge, but also cover the glaciofluvial deposits towards the centre of the structure. The soils in the top of the aeolian deposits are well developed, though almost all A- and E-horizons have been mixed (except in core 12).

Transect 3 confirms the picture of transects 1 and 2: the ridge consists of aeolian deposits, located on top of glaciofluvial deposits (fig. 9). The northern slope in this transect has a thin top soil, which is probably due to slope erosion. The southern slope is disturbed: the natural soil is absent and a cover of dark brown, humic poorly sorted medium sand with a spotted appearance is present on top of a finer grained aeolian sand cover. This disturbance can be explained by the presence of a former military tank-road nearby.

Transect 4 has a similar topography as transect 1: a small depression or ditch within the ridge (fig. 10). Also this depression is relatively recent: soil formation is limited, there

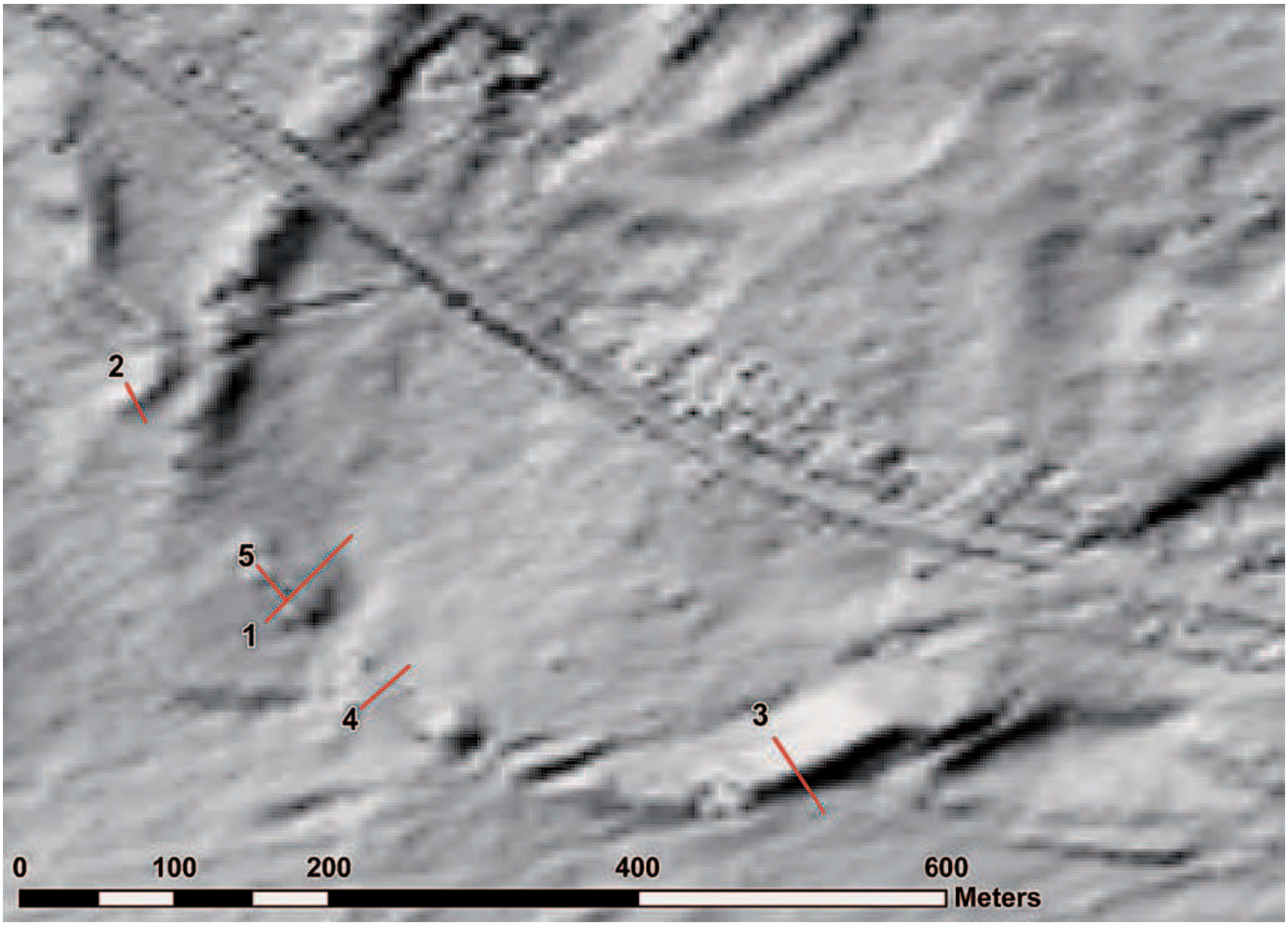

Figure 6 The location of the five transects.

is no podzol-B horizon. The ridge has a similar formation as well: it consists of well-sorted sand that lies on top of poorly sorted sand. A well-developed podzol soil is present in the top.

Also this ridge can be regarded as formed by aeolian deposition on top of the glaciofluvial deposits. A thin plaggen cover is present on its top. This cover though is likely to be the pile that was formed during the digging of the ditch, since it shows no soil formation in the top.

Transect 5 shows the top of the same ridge as transect 1, but perpendicular to boring 33 of transect 1 (fig. 11). In this transect, the A-horizon lies directly on top of the humus B-horizon and is thicker than usual: its thickness ranges from 35-50 cm. It has a light brown colour and shows several humic intervals. The ash-grey E-horizon is missing (fig. 12). This thick horizon does not appear natural. It is interpreted as an anthropogenic (plaggen) horizon that covers the top of this part of the structure.

6 Discussion

The Ermelo enclosure partially fits the characteristics of a Neolithic causewayed enclosure. The structure is lying on sloping ground near a watercourse (the Leuvenumse beek). The shape is oval but nearly a circle, and it looks as if the form has been modified. It is an area surrounded by a bank and a rather steep slope with gaps in the bank. However, no clear traces of ditches were found and the enclosed area is vast (50 hectares).

Extensive, circular enclosures, surrounded by walls are common phenomena in Germany, Belgium and Northern France. The enclosures of Mayen and Urmitz (Germany, both close to Koblenz) are remarkably similar to the structure near Ermelo. The Mayen enclosure is oval in shape and measures circa 290 × 170 m, and was surrounded by a ditch and a palisade (Andersen 1997, 188; Meyer 2002). The enclosure in Urmitz is considerably larger (1275 × 840 m) and consisted in its earliest phase of a palisade with two ditches

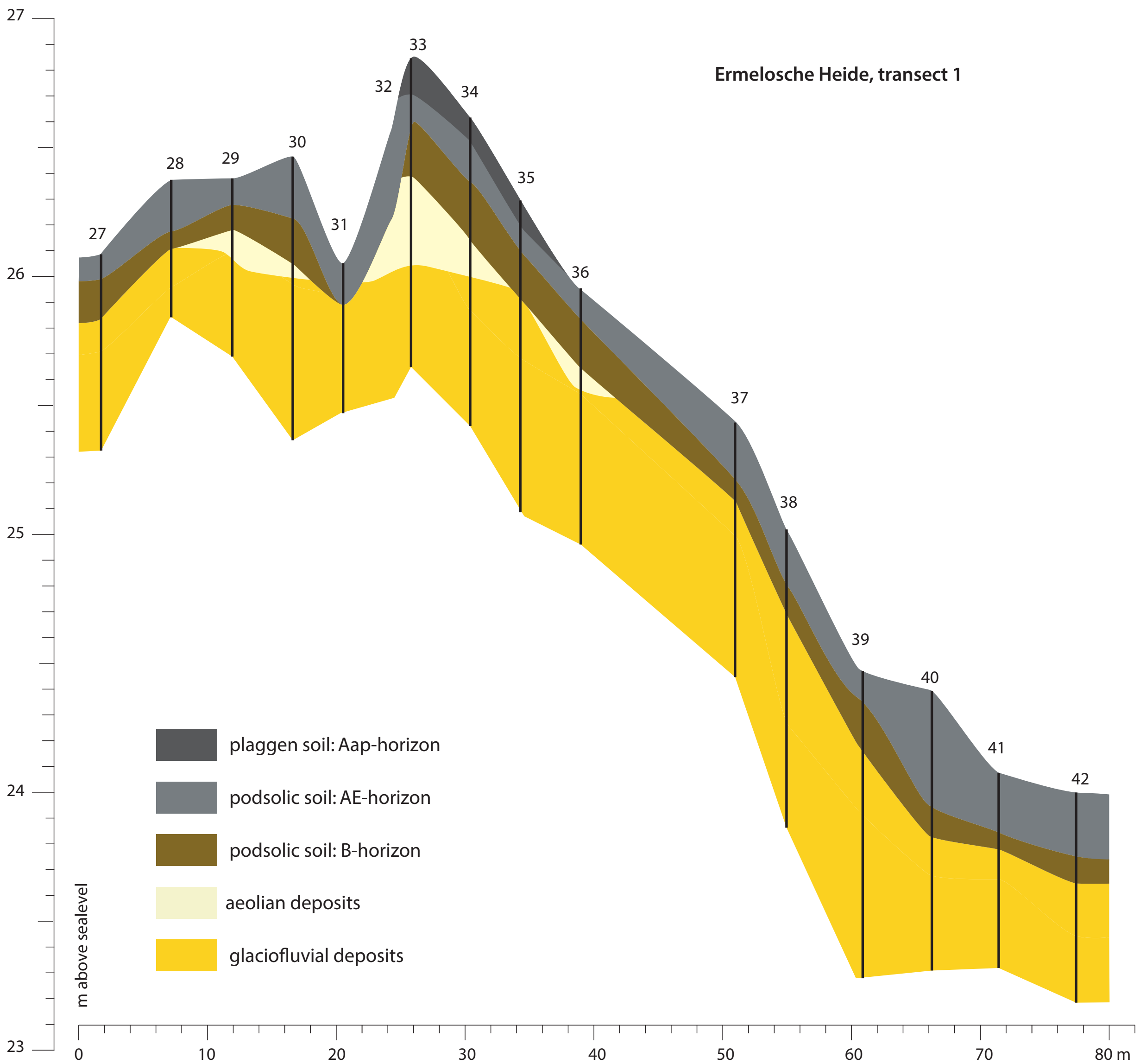

Figure 7 Transect 1, the south-east of the structure.

(Boelicke 1977; Andersen 1997, 188; Meyer 2002). Both enclosures date from the German 'Jungneolithikum 1' and belong to the Michelsberg culture. Other enclosures from the Michelsberg culture in the vicinity of the Netherlands are Ottenburg near Brussels (50 hectares) (Vanmontfort 2003) and Thieusies (also in Belgium) (Andersen 1997, 188). In the Netherlands, sites from the Michelsberg culture are known all along the Meuse river in the province of Limburg. However they are lacking enclosures, except one site (Schelsberg) in the löss zone near Heerlen (Schreurs 2005, 311).

The geological fieldwork shows that the NW and SE banks are natural phenomena dating from the Weichselian. All five transects undisputedly point to an aeolian origin of the ridges. The aeolian deposits cover the kame terrace only partly. Towards the centre of the structure, the aeolian sands become thinner or even disappear (transect 1, fig. 7).

Man-made modification has been established in three transects (figs 7, 10 and 11). The modifications in transect 4 (fig. 10) are likely to be recent. Figures 7 and 11 show that the banks in the SW are man-made. It shows the presence

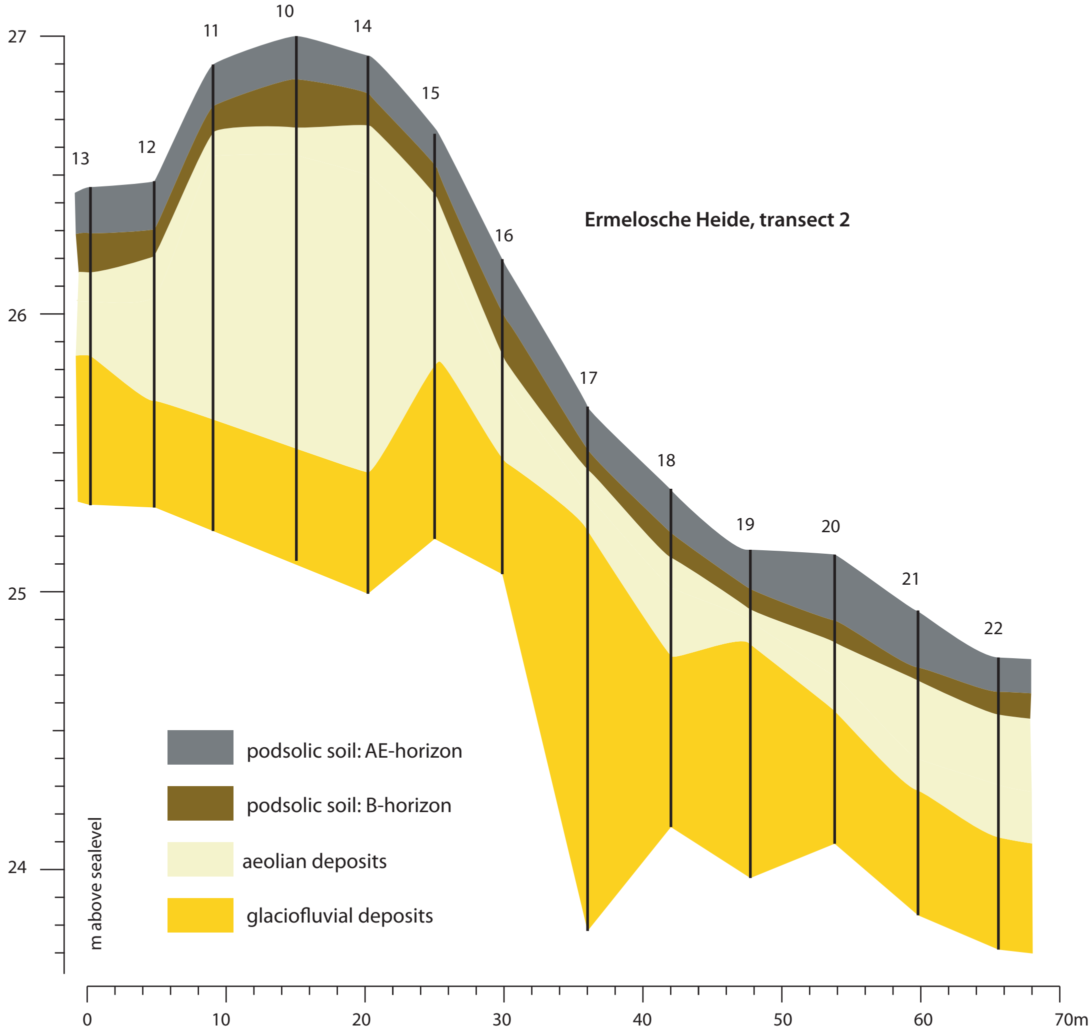

Figure 8 Transect 2, the north-west of the structure.

of a plaggen cover. It is impossible to date these banks; they could be prehistoric, they could be constructed by the military in the 20th century or at any time in-between. However, a very old origin is not likely, because in that case one would assume a clear podzol in the top of the plaggen.

7 Conclusion

All causewayed enclosures in north-west mainland Europe are situated on the löss. Given the fact that the Ermelo structure is not situated on the löss, that it is very large, has no clear ditches, and consists for the largest part of natural ridges, an identification as a causewayed enclosure is not very likely. However, there are examples of causewayed enclosures that are as large (Ottenburg is also 50 hectares) or even larger (Urmiz is 100 hectares), and there are more enclosures that used natural phenomena as part of the circuit. Sometime in the past, the building of banks in the south-east closed the structure and it is unfortunate that it was not possible to date the construction of these banks in a reliable way. To be able to do this an excavation of sections of the banks will be necessary.

So, without further research it is impossible to come to a final conclusion. Although it is unlikely that we discovered the second causewayed enclosure on Dutch soil, we cannot rule out the possibility that it is one of these strange phenomena dating from the transition phase from hunter-gatherers to sedentary farmers.

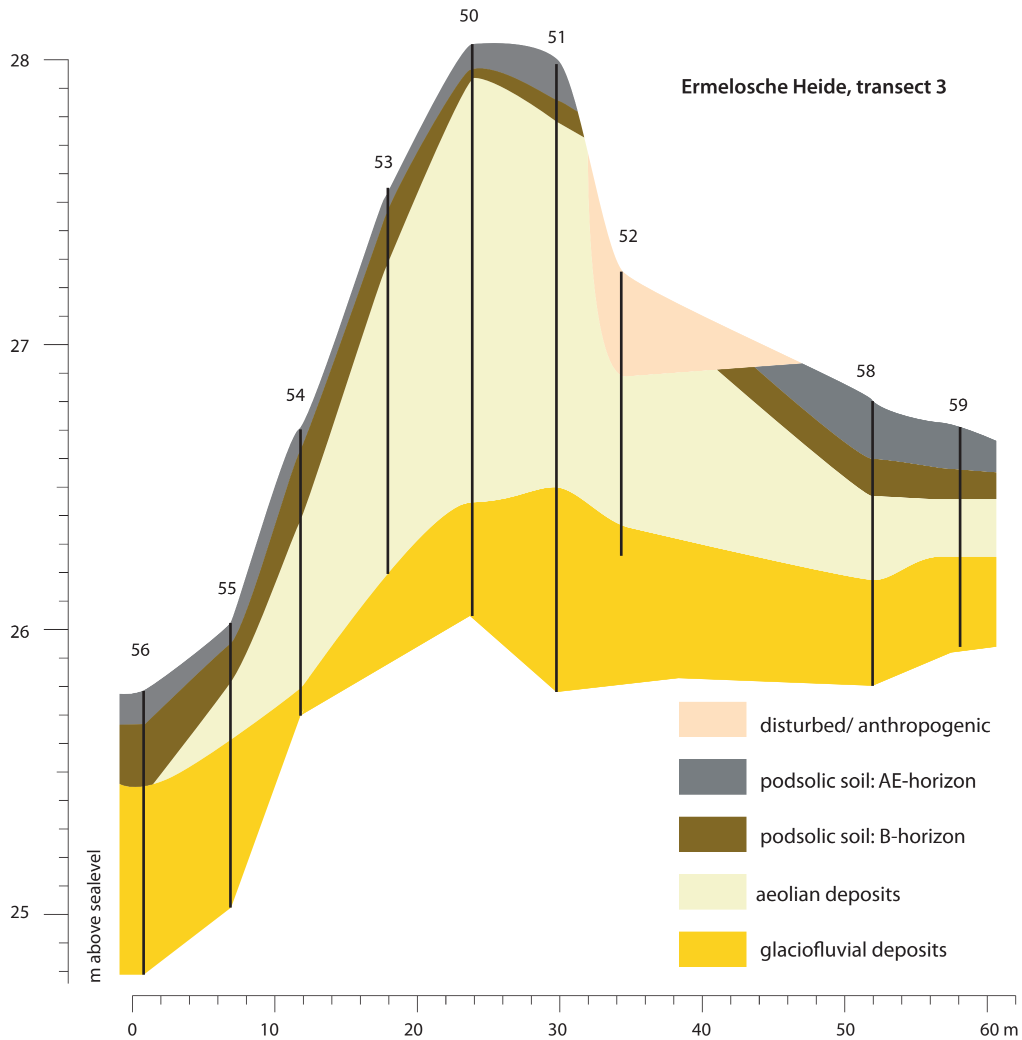

Figure 9 Transect 3, the south of the structure.

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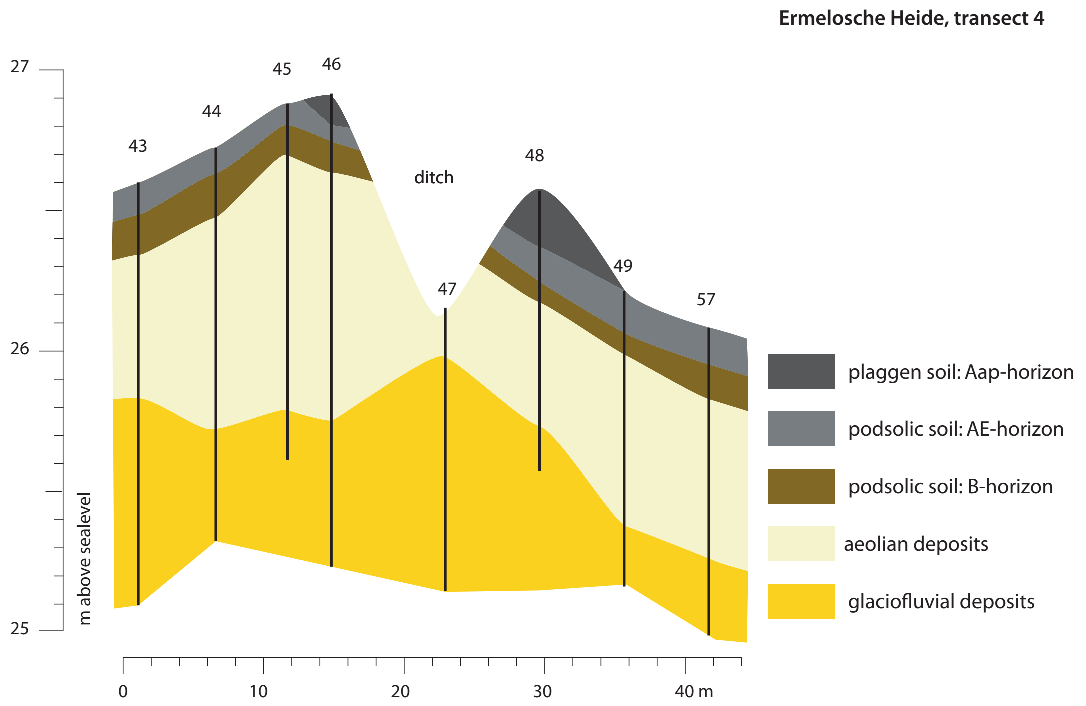

Figure 10 Transect 4, the south-western corner of the structure.

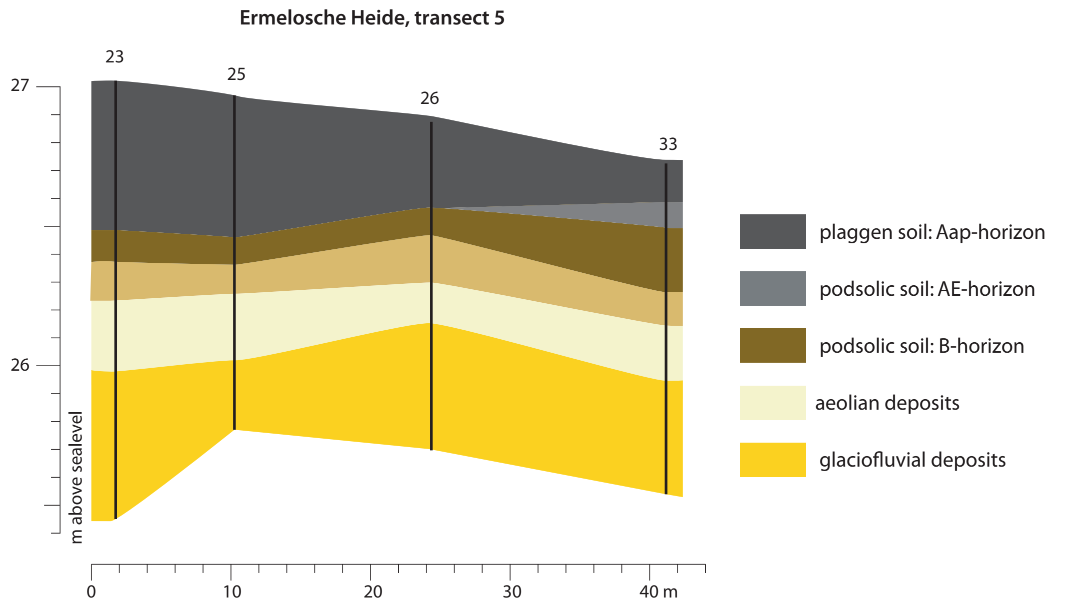

Figure 11 Transect 5, the south-west of the structure.

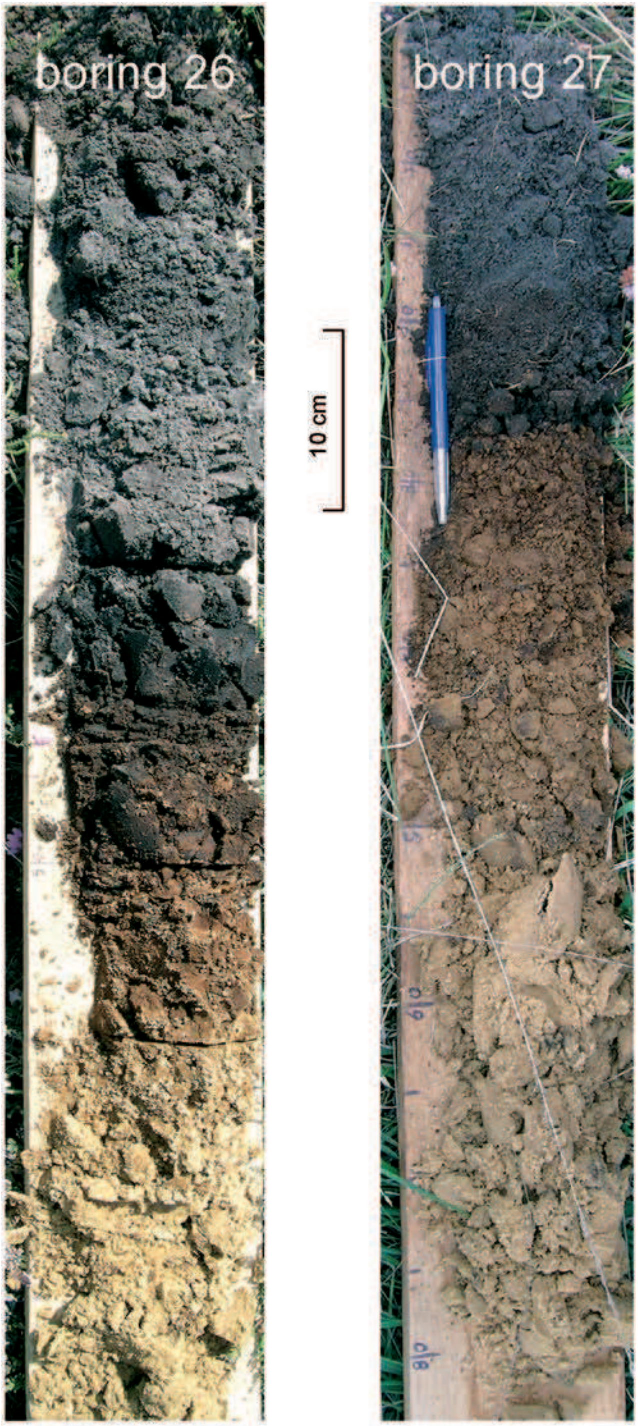

Figure 12 Boring 26 (transect 5) on the left shows a thickened A-horizon on top of a clear B-horizon, with humus and iron. It points to a plaggen cover. Boring 27 on the right shows the normal type of podzol, as often encountered during the field work. Here, a veldpodzol is shown.

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