THE PROTECTED BURIAL MOUND 'STORE VEJLHØJ', VINDERUP, DENMARK: FIRST RESULTS

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European Research Council
Established by the European Commission

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ABSTRACT

An archaeological excavation of the protected burial mound Store Vejlhøj in northwestern Denmark was carried out in October-November 2021. The excavation formed part of the ERC-funded research project called ANTHEA, focusing on the deep history of anthropogenic heathlands. It was conducted by Aarhus University in collaboration with Holstebro Museum and Moesgaard Museum. The aim was to test a new method of sampling pollen data from different construction stages in a burial mound and comparing them with pollen data from nearby lake sediments with a view to improving our understanding of prehistoric anthropogenic heathland dynamics. Prior to the excavation, soil cores were collected from two nearby peat sediments as well as six burial mounds (including Store Vejlhøj) within a 1 km range of Lake Skånsø, where previous pollen analyses had been carried out.

Based on these preliminary corings, Store Vejlhøj was selected for further archaeological investigation. A dispensation for excavating the protected mound was granted by the Danish Palaces and Culture Agency. The excavation was based on a 5 m long trench through the barrow, moving from its foot inwards. The surface vegetation and 40 cm topsoil were removed by an excavator, after which the remainder of the trench was manually dug in horizontal layers. Observation conditions were good. The excavation revealed a series of well-defined barrow construction stages, as well as unusually well-preserved turf structures. Only two archaeological finds could be related to the barrow, both of which were later than its initial construction: a secondary urn in the top layer, and the base of a second urn at the foot of the mound.

The burial mound was constructed using a minimum of three shells, which could be observed in the trench profile. Turfs were most probably collected locally in a landscape dominated by grass pastures, where no previous turf cutting had taken place. A total of 34 soil samples were collected for paleoecological analyses (pollen, Non-Pollen Polymorphs (NPPs), macrofossils) and geoarchaeological analyses (micromorphology, bulk samples). Preliminary pollen and macrofossil results from the burial mound revealed poor preservation conditions, which prompted a trench extension of 0.5 m by 0.2 m to find better preservation conditions. This extension resulted in the collection of a single final macrofossil sample, although there was no identifiable change in the *in-situ* preservation conditions.

The dating results of the mound have not yet been completed and will be included as appendix 4-6 in 2023.

APPENDICES

Appendix 1: Pedological desciption (Søren Munch Kristiansen)
Appendix 2: Macrofossil analysis (Marianne Høyem Andreasen)
Appendix 3: Resistance measurements (Bo Ejstrud)
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Appendix 5: ^{14}C date from Store Vejlhøj – to be added in 2023
Appendix 6: Pollen analysis from Store Vejlhøj and barrows from its surrounding landscape – to be added in 2023

Front picture by Rogví Johansen, Fotolab.

Published: February 2023.

DOI: 10.7146/aulsps-e.479
ISBN: 978-87-7507-538-6

AIMS

The excavation of Store Vejlhøj forms part of a larger research scheme in relation to Lake Skånsø. Lake Skånsø and its direct surroundings, including Store Vejlhøj to the west, comprise a selected case study area for detailed paleoenvironmental investigation and modelling, as part of the paleoecological investigations in the ANTHEA project (Løvschal 2021).

The palynological evidence from Lake Skånsø shows the existence of a pastoral-dominated landscape from the late third millennium BC, as well as continuous deforestation, grassland decline and heathland expansion in several stages (Odgaard 1994, fig. 122). Additionally, unpublished pollen sediments exist from two nearby basins. We wanted to use this unique location to test a new method, combining the existing LRA model with new paleo-environmental sampling. This included using pollen obtained from the six barrows to supplement pollen analyses of the lake sediments, providing spatially and temporally more fine-grained information about the surrounding landscape. And pollen stemming from the excavated barrow would provide an opportunity to relate overarching vegetation changes (from the lake sediments) to the local topography. This, we hoped, would enable us to produce a high spatiotemporal resolution insight into the local land-use dynamics of a specific heathland area, feeding into questions of the emergence, use and social organisation of heathlands, including past practices of grazing and burning.

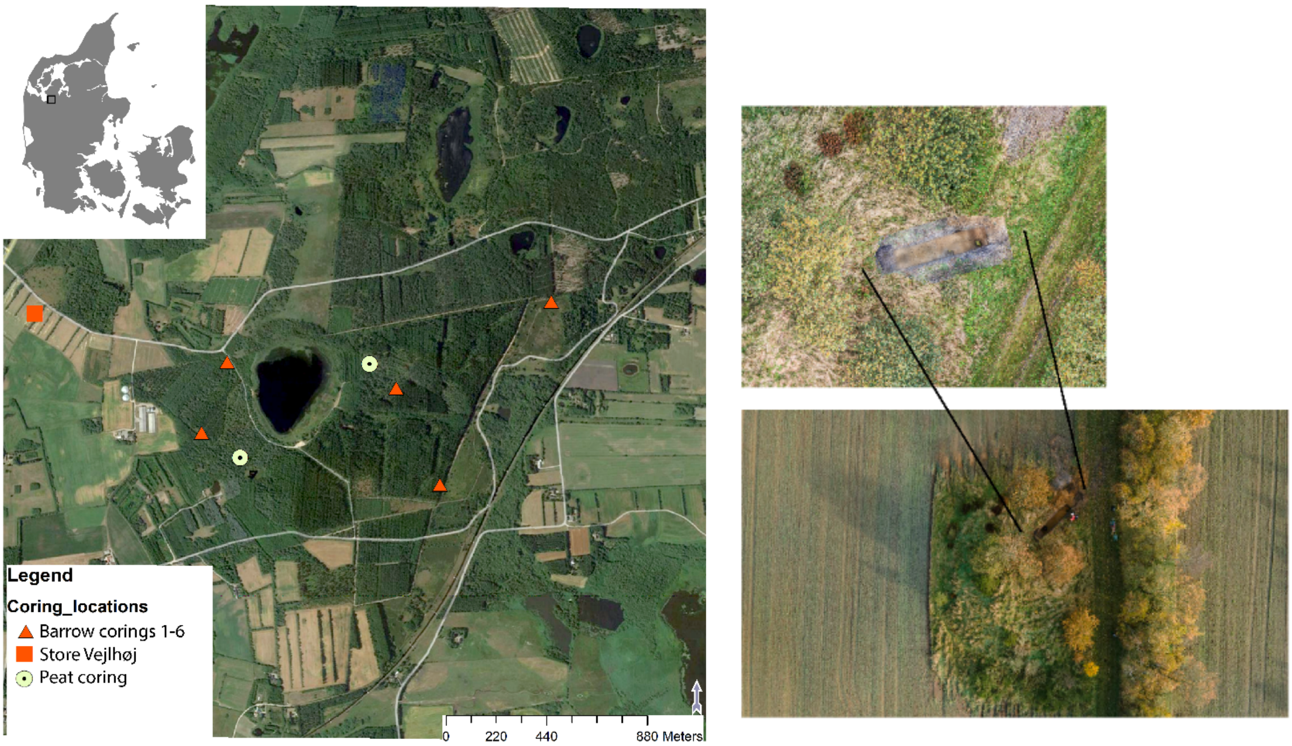

Figure 1. *Left: Our area of research, centred on Lake Skånsø with the excavated barrow, Store Vejlhøj (1905:16), indicated with a red square. Right: The excavated barrow taken with a drone, facing north. (Credit: aerial photos taken by Rógvi Johansen (right) and Google Maps (lef)).*

Lake Skånsø was selected owing to its fast and relatively undisturbed sedimentation. This provides rich opportunities to study species fluctuations with a sample resolution of down to a few years (Odgaard 1994), but may vary from one case to another. Palynological evidence (the last 11,000 years) and LRA (landscape reconstruction) modelling (the last 3,000 years) have already been produced at Lake Skånsø (Nielsen & Odgaard 2010), but the high time-resolution sampling scheme of the original study makes it possible to test hypotheses of recurrent interventions using even denser pollen records, such as those that can be obtained from barrows.

BARROW EXCAVATION AND SAMPLING METHOD

Store Vejlhøj was selected for excavation based on three criteria. First, the relatively silty-sand sediments in comparison to those of the more coarse-sandy remaining five barrows suggest both better preservation conditions and the use of turf to create Store Vejlhøj. Second, its relatively large dimensions suggested a Bronze Age origin and a relatively undisturbed context, apart from an old plundering hole. Third, we selected Store Vejlhøj because the estimated disturbance from vegetation growing on top of the barrow was far less than the disturbance caused by vegetation on other barrows situated within the pine plantation.

Here, we describe the barrow excavation method, as introduced by the ANTHEA project, with adjustments made where appropriate. The method aimed to better integrate archaeological knowledge within paleoecological work, through a more careful selection of contexts for the sampling of pollen and additional paleoecological data informed by prior hypotheses. Sampling contexts from this landscape include those already available of sediments from Lake Skånsø itself (Odgaard 1994), Store Vejlhøj (corer and excavation trench), five additional barrows (cored) and two peat sediments (Figure **1**). All the sampling contexts are situated within a 1 km range of Lake Skånsø.

Moreover, we will attempt to establish a profile through one barrow from which a vertical series of turf sediments can be obtained. It is our hope that this will enable us to correlate the lake sediments with the potentially even finer scale data pertaining to different stages of barrow construction and their relation to the surrounding local landscape. The soil samples obtained by barrow excavation will be subject to pollen analysis as well as a study of plant macrofossils, non-pollen palynomorphs (NPPs), charcoal and insects together with micromorphology, radiocarbon dating & optically stimulated luminescence (OSL) dating. The samples will be used as the basis for carrying out statistical measurements of the frequency, intensity, season and spatial dimensions of fires, including land-use cycles and strategies. For example, after burning, a germination phase with lingonberry and grass species will normally commence (Odgaard 1994, 160). After the stripping of heather turfs, sheep's sorrel (*Rumex acetosella*) quickly dominates, but is then replaced by heather within a regeneration period of 5-40 years (Gimingham 1972). Therefore, the presence of particular species, such as *Rumex acetosella* or *Vaccinium*, can be used to indicate particular stages in heathland rejuvenation.

Detailed excavations of Bronze Age barrows in Jutland have shown that they were built from sequences of grass/heath turf shells (Holst & Rasmussen 2013; Frost et al. 2017). Barrow building projects also took place according to 4-, 6- or 8-part radial division, each organised by an individual team of builders, as well as coming from different areas of the landscape. It is also assumed that a total of 2-4 ha of land was required for the construction of one barrow (Holst et al. 2013). At Skelhøj, detailed investigations of the turfs suggest that turfs placed centrally in the barrow were obtained at the site itself, whereas turfs further away from the centre were more differentiated, suggesting that they were obtained further away from the barrow.

This allowed us to hypothesise that the further advanced the barrow-construction process, the further away from the barrow the turf sediments were probably collected. Therefore, sampling from shells and sediments belonging to different stages in the building process is important. We also assumed that the construction of the barrow was delimited in time, and estimated that construction lasted about three months (Holst et al. 2013).

The barrow excavation method aimed to make a narrow section from the periphery of the barrow, heading towards the centre. The transect required manual excavation from the centre of the mound towards the foot of the mound. We aimed to limit the width of the trench in order to disturb the mound's stratigraphy and *in situ* preservation conditions as little as possible.

STUDY BACKGROUND

ARCHAEOLOGICAL BACKGROUND OF THE AREA SURROUNDING STORE VEJLHØJ

Several registrations of Store Vejlhøj can be found in the Danish Sites and Monuments Register (*Fund og Fortidsminder*). An old record of Store Vejlhøj from 1900 describes the barrow as "tall, 3.5 m in height and 26 m in width. A few minor flat and overgrown disturbances are present near the summit" (translated from Danish). Up until its demolition in 1910, a second, smaller burial mound (Lille Vejlhøj) was present northeast of Store Vejlhøj. Descriptions in *Fund og Fortidsminder* from 1905 about an earlier excavation of Lille Vejlhøj documented the presence of many urns. Additionally, bronze and bone artefacts were found in the urn graves, such as needles, razor blades, buttons and blades. The first registrations of both mounds date from 1880, when Store Vejlhøj is described as "large and suitable for studying".

Currently registered archaeological features are those of the protected and ploughed burial mounds within the vicinity, as well as a few archaeological finds dated to the Neolithic. In the last decade, several flint flakes, pottery sherds and a sharpened axe fragment have been found in the agricultural field directly surrounding the barrow. On the northside of Store Vejlhøj, a network of hollow roads was initially registered in 1995 in *Fund og Fortidsminder* and recorded a second time in 2014. The approximately fourteen hollow roads have a total length of 60-200 m and a total width of 40-150 m (Figure **2**).

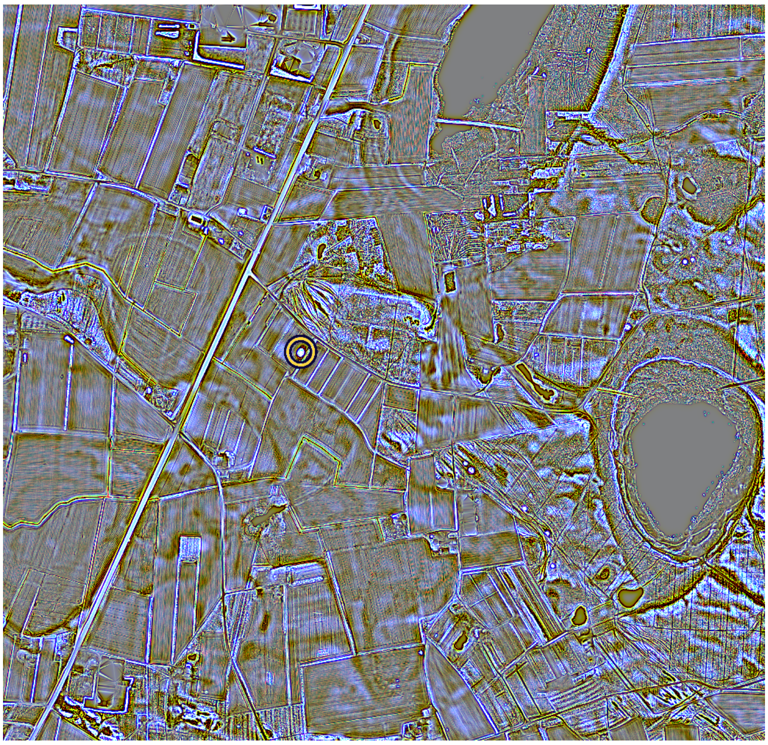

Figure 2. *Digital elevation model-based residual relief model surrounding Store Vejlhøj (1905:16). Marked with a yellow circle is the burial mound (Credit: model from Stott et al. 2019). The ancient hollow-way road system to the north of the burial mound can be seen in the form of fine streaks that continue towards the southeast of the map, while the major dead-ice depressions, some with contemporary lakes, are visible as larger, more or less round features. Lake Skånsø is located in a major kettle hole to the right.*

One of the longest known remains of a Bronze Age longhouse plan from Denmark is situated just 3.6 km to the east of Store Vejlhøj, with a total length of 50 m (Figure **3**).

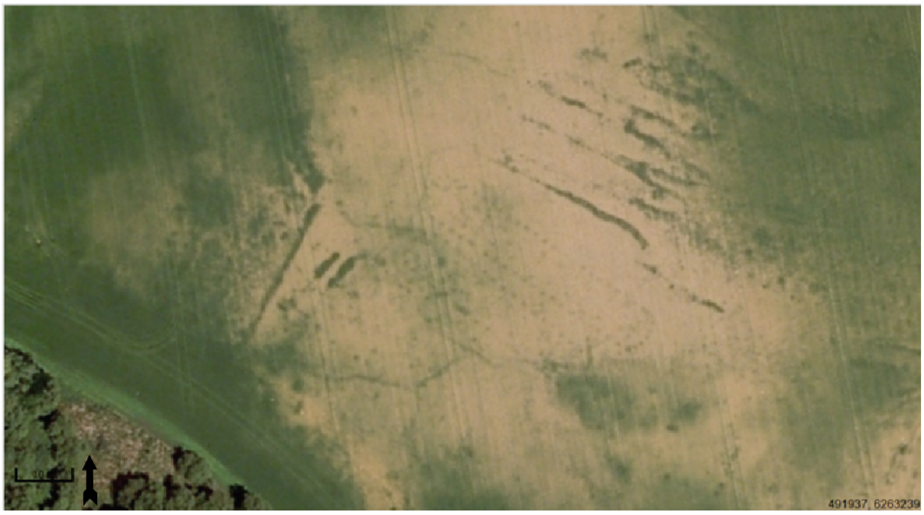

Figure 3. *Aerial photo from 2010 of the 50 m long Bronze Age house floor plan, centred. (Credit: Danish Centre for Aerial Archaeology, identified by Mathias Broch, Holstebro Museum). 56.512960° / 8.870406°.*

BACKGROUND AND ADMINISTRATIVE DATA

THE GEOGRAPHY OF STORE VEJLHØJ

The prehistoric burial mound Store Vejlhøj is situated in northwest Jutland, within 1 km of Lake Skånsø (Figures **1-2**). In Danish the word "vejl" means a crossing in a wetland, while "høj" denotes a hill of some kind. Store Vejlhøj is situated high in a landscape dominated by a fluvioglacial outwash plain and kettle holes of the late Weichselian age. The parent materials in the area are primarily meltwater sand, but with patches of clayey till and aeolian sand according to the geological map (*Jordartskortet*, GEUS). The mound is situated at the intersection between two significant burial mound lines and is surrounded by an archaeologically extremely rich landscape, including burial mounds from the Neolithic, the Bronze Age and the Iron Age. During the 19th and 20th centuries, the landscape surrounding the barrow was mainly cultivated, whereas the fluvioglacial sand deposits to the east were dominated by heathlands (Odgaard 1994). Coniferous plantations have replaced past heathland surrounding Skånsø since the 19th century and are situated within approximately 450 m to the east of Store Vejlhøj.

PERMISSION

Upon request to the Danish Palaces and Culture Agency (case no. 21/00303), dispensation from the laws relating to the protection of monuments *§29e and §29j* was received for the coring of six barrows (1905:30, 1905:31, 1905:32, 1905:35, 1906:12, 1905:16), alongside an additional excavation of barrow 1905:31. Additionally, dispensation from the nature protection law *§*3 was received for the coring of the peat sediments. However, results from the initial coring of the mounds showed that barrow 1905:16 (Store Vejlhøj) had a much higher potential for the presence of evidence of turf layers, as well as for the preservation of pollen and macrofossils. A request to excavate this barrow instead of barrow 1905:31 was approved by the Danish Palaces and Culture Agency, based on the sediments and large size difference between the two burial mounds. Approval by landowner Kristian Mølgaard (matrikel 1c), on which barrow 1905:16 is located, was received subsequently. This permission was given on the condition that the trench would remain as narrow as practically achievable and within a section of the barrow causing the least potential threat of damage to any possible contents present. A second permission followed the initial findings of the excavation, which showed low amounts of preserved plant macrofossils. Furthermore, it was believed that the first or inner shell had not been reached yet, which could potentially contain better preservation conditions, in particular if an iron pan had been preserved.

RESPONSIBILITIES

Aarhus University was responsible for the initial coring of the six barrows, peat sediments, paleoecological sampling and dating of the trench-excavated barrow. All managerial tasks surrounding the trench-laying in the excavated barrow were entrusted to Holstebro Museum. This included resistance measurements and post-excavation processing of any finds, as well as the photogrammetry of all floor plans and profiles.

The excavation of the trench was led by Mette Klingenberg and Astrid Jensen from Holstebro Museum, with assistance from Mette Løvschal, Havananda Ombashi, Mads Hougaard Nielsen and Victoria Tissot Lyder from Aarhus University.

Resistance measurements were carried out by Bo Ejstrud from Holstebro Museum.

Photogrammetry processing was carried out by Axel Hee from Holstebro Museum and later completed by Casper Skaaning Andersen from Moesgaard Museum.

Profile interpretations were carried out by Mette Løvschal and Mette Klingenberg, following consultation with Marianne Rasmussen from Slots- og Kulturstyrelsen, Lise Frost from Moesgaard Museum and Malene Refshauge Beck from Østfyns Museum.

Palynological samples were taken by Havananda Ombashi in collaboration with Bent Vad Odgaard, Aarhus University, and Renée Enevold, Moesgaard Museum.

Macrofossil samples were taken by Havananda Ombashi, assisted by Victoria Lyder Tissot, Aarhus University and scanned by Marianne Høyem Andreasen, Moesgaard Museum.

Geological samples, micromorphology samples and soil descriptions were carried out by Søren Munch Kristiansen, Aarhus University, and Nina Helt Nielsen, Silkeborg Museum.

MEASURING SYSTEM

All points were measured with RTK GPS in UTM32 (Euref89_DVR90) and processed in ArcGIS and Metashape. Each find in the floors or profiles was measured as a single point. All geological and paleoecological samples were measured with four points (one point for each corner). The measuring of all profiles was based on equally distributed points across the profile lengths and heights.

SAMPLE STORAGE

Peat cores have been subsampled and stored in the Moesgaard Archaeo-science Laboratory (4215-039).

The cores from the barrows (x60-x65) have been put in small sample bags and stored in a cardboard box in the Vådlaboratorium (4215-112) named "Havananda Ombashi - pollen samples".

ADDITIONAL INFORMATION

The excavation of the main trench and the extension trench was carried out between 25 October and 27 November 2021 (Figure 4). The coring of the six barrows prior to the excavation was carried out over several days during May and June 2021. Sampling of the two additional peat sites was carried out on 15 November 2021.

The week following the excavation and sampling, the barrow was returned to its original shape and its vegetation was replaced.

Weather conditions remained consistently dry, partially cloudy and foggy (about 10 degrees C) throughout the excavation of the main trench and on the day of peat-sediment coring. In the following week leading up to the trench extension, heavy rainfall occurred. The weather was largely dry and sunny during the coring of the additional five barrows.

Figure 4. *The archaeological interpretation of the western profile. Credit: Rógvi Johansen.*

METHODS

BARROW CORING METHOD

Prior to the excavation, Store Vejlhøj and five additional barrows (1905:30, 1905:31, 1905:32, 1905:35, 1906:12) (Figure **1**) were sampled with a soil corer in the centre of each barrow, or as near to the centre as possible if there were any signs of previous disturbance. The coring was aimed at the old vegetation surfaces, preferably anaerobic and/or wet preservation conditions with the purpose of obtaining pollen. Moreover, we used the coring as an initial scanner for the most suitable barrow for excavation.

Since a soil corer was used, a full undisturbed sequence was not obtainable from any of the six barrows. Instead, every 10 cm was cored separately with 5 cm disturbance in between each coring. Sample collection ceased upon finding the subsoil. The soil corer was rinsed with distilled water after each use, and the soil was collected in a portable glove box to prevent any potential influx of modern pollen present on site.

We subsequently selected all sediments belonging to what we identified as the old soil surfaces in the six barrows, including x43 in layer 9 of Store Vejlhøj, for pollen analyses. The results will be presented in Appendix 5.

ELECTRICAL RESISTIVITY TOMOGRAPHY

In preparation for the excavation, electrical resistivity tomography (ERT) was performed with three parallel lines measured across the centre of the barrow, 1 m apart (Appendix 3). ERT is a non-destructive method that can outline vertical sections of the barrow by mapping variations in the electrical resistivity of its layers.

The two main results of this work were the detection of an inner mantel some 2 m from the foot of the barrow, and evidence of plundering vertically down from its top. The latter result is important, as any inner iron-pan would have been broken already by the time of our investigation. Therefore, there was no risk of the present excavation damaging pristine conditions. There is some evidence of a radial construction of the barrow, although more lines would be needed across the width of the barrow to fully outline its construction. Such an investigation was beyond the scope of the present work.

TRENCH-EXCAVATION METHOD

An initial trench of 90 cm in width and 5 m in length, measured from the foot towards the centre, was established over the course of three days. Under supervision, the grassy vegetation growing on top of the barrow and the underlying 40 cm of the barrow soil were carefully removed using an excavator. Subsequently, the trench was dug purely by hand using shovels, spades and trowels, remaining within the 90 cm width limit, and reaching a maximum height of approximately 2.10 m. A total of 11 floor plans were photographed, measured for photogrammetry, and described and interpreted throughout the digging process. The subsoil consisted of yellow, coarse sand, which was clearly distinguishable from the material used for barrow construction (Figure **4**). Due to the relatively low frequency of stones in both the barrow and the subsoil, the trench could be excavated with good precision. Upon completion of the trench and profile preparation, the two side profiles and back profile were documented by a team of archaeologists (Figure **5**) and subsequently sampled for macrofossil analyses, pollen analyses, bulk sediment analyses and micromorphology.

Figure 5. *The completed trench photographed from northwest (left). Archaeological interpretation of the eastern profile (right). Credit: Nicolai Hildebrandt.*

The analysis results indicated low estimates of macrofossil and pollen preservation. Based on these results, a trench extension of 50 cm in length was manually excavated to reach and sample an older shell layer with potentially better preservation conditions. This proved insufficient, as no new shell or barrow construction layer could be identified in the new profiles.

All soil samples were registered with an X-number, and their sampling location was documented with photographs and GPS measurements.

A total of 29 samples for paleoecological analysis were taken from the trench profiles (x7-x24, x26-x32, x36-x38, x40-x43, x59-x65). These can be divided into 7 geological samples, 4 macrofossil samples and 22 pollen samples (x7-x25, x40-x43).

Samples x7-x25 were collected directly from turfs in small glass vials. x40 consists of a longer core, collected from the back profile. Samples x41-x43 are 10 cm long to 5 cm wide samples taken alongside x40, with slight overlaps. The glass vial samples x7-x12 were taken from the same layers or structures as those from x13-x24.

All samples can be located in the digitised profiles presented in Figure **6**. However, x36 and x59 were not measured with a GPS and have therefore been excluded from Figure **6**. These samples were collected from the extended trench and floor during the excavation process. Geological samples were collected for future analyses and are thus not discussed in further detail below.

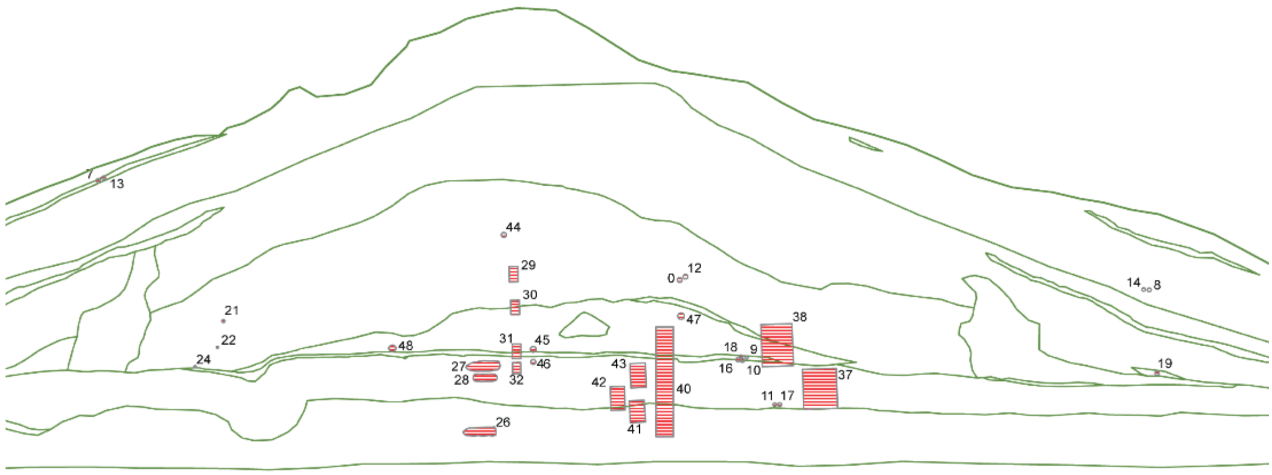

Figure 6. *All samples collected in the barrow profiles of Store Vejlhøj (1905:16), including x7-x24, x26-x32, x37-x38, x40-x48, x60-x65. x36 and x59 are not present in this figure. Each sample number refers to the finds list.*

PEAT SEDIMENT CORING METHOD

Peat sediments were collected in an attempt to find and analyse peat stemming from late prehistoric times, ideally in alignment with the erection of one or more of the barrows that are included in this report. Due to the nature of the peat and its ideal locations in relation to the barrows, as well as its short distance from the lake, pollen stemming from the peat sediments would have been an ideal inclusion to obtain local interpretations of the vegetation within roughly 100-200 m in the surrounding landscape. Furthermore, pollen and NPP preservation in peat can be expected to be of much higher quality than that found in the sand-dominated barrows. Therefore, analyses of one or both peat sediments would have provided opportunities to reconstruct not only the local vegetation, supplementing the information of the cored and excavated barrows, but also any possible presence of grazing and/or burning regimes by analysing pollen, micro-charcoal and NPPs. Any indications of such regimes are of importance to create a more detailed understanding of the local interaction between past populations and grasslands or heathlands around Lake Skånsø and Store Vejlhøj.

Two short peat sediment sequences were collected in the immediate vicinity of Lake Skånsø (Figure **1**) using a Russian corer, in order to investigate local grazing and/or burning patterns that may have taken place within roughly a 100 m radius of these locations. At peat site 1, a corer was uitilised twice in two locations across the same 1 m long peat bank, with alternative depths to provide overlap in the peat sequence that is otherwise disturbed by the bottom of the corer. At the second peat site, one corer sufficed to reach the bottom of the peat, and no additional holes were necessary. Stratigraphy of all sediments was recorded directly in the field and is presented in the results section.

The first sequence (labelled "peat coring 1" in Figure **1**) stems from a 2 m by 0.5 m large peat bank, which is centred in a depression of roughly 15 m in diameter, roughly 120 m south of Lake Skånsø. This small depression is currently situated in the pine tree plantation and is likely to have been subjected to peat cuttings during the last century.

The second peat sequence (labelled "peat coring 2" in Figure **1**) is also situated within a depression of roughly 20 by 25 m within the pine tree plantation that surrounds Lake Skånsø. This depression is located on the western side of the lake, roughly 150 m from the lake. Sample coring was carried out at the southern edge of the depression with a 3 cm narrow soil sampler, in order to test for the presence of peat sediments. When peat was found in the soil sampler at the greatest depth, the 5 cm diameter Russian corer was used to obtain a relatively short sequence.

Two 5 cm^3 sediments were subsamples from the peat sequence of site 1, for the purpose of radiocarbon dating. The upper sample was collected at 22-26 cm depth above a visible sediment change that may represent a hiatus in the peat sequence. The bottom radiocarbon sample was taken from the base of the peat sediment at a depth of 45-50 cm.

Sample preparation for pollen analysis: laboratory method

A total of 12 (sub)samples from the barrows were prepared in the laboratory with a view to performing an initial scan for the presence of pollen, NPPs and charcoal. Six of these stem from Store Vejlhøj (x7 - x12). The remaining six samples stem from six other cored barrows (x60-x65), which were subsampled from the soil collected at depths of 140, 130 and 80 cm, respectively, just above the subsoil (Figure **8**). The method of choice included a simplified preparation method, suitable for the first phase of analysis, which was replaced by a more thorough preparation method when the result was positive.

Subsamples were measured to 1 cm^3 volume and initially treated with a 10% HCL dilution. Subsamples were then boiled for 10 minutes in a 10% NaOH mixture, left overnight at 50°C in a 99.9% ethanol solution and mixed into silicon oil. No further chemical or heat treatment was applied to the samples.

RESULTS - THE TRENCH EXCAVATION

The final trench was 5.5 m in length, measured from the foot of the mound, and just over 2.4 m in height. Approximately 20 cm beneath the surface soil, a 5 cm thin, dark, sediment was present in all three profiles. Three distinctive layers associated with construction shells were identified directly beneath the dark sediment. A white-grey sandy layer of layer number 15 (interpreted as eluviated residue) was recognised in the floor plans early on and remained present throughout all profiles. The layers that have been identified and interpreted are presented below in table **1**, where the layer numbers relate to Figure **7**.

Layer no.	Interpretation	Description
1	Barrow (shell 2)	Medium-dark brown soil, some white sand, humus, no/few and ephemeral turf structures. Some small stones
2	Barrow (shell 1)	Dark brown-grey sandy soil. Clear traces of turf structures. Outwash layers with light-grey humus bands. Small fragments of ceramic sherds and charcoal observed inside turf traces. Some small stones.
3	Leaching residue (from shell 1)	Dark-medium grey sand, organic rich outwash towards the end profile with micro-lamination towards the end of the ditch. Some traces of turf structures. Some turfs with clearly discernible vegetation horizons. Few/no stones.
4	Leaching residue	Thin, white-grey sand layer sloping down on either side of layer 3.
5	Leaching residue	Same as 4 with slightly more yellow sand (subsoil sand?)
6	Possible stone traces/temporary construction	Major occurrences of highly heterogeneous yellow-orange sand with some brown-grey sand and yellow flecks of clay/subsoil sand. The layer could be observed in the horizontal layers as a band connecting the east to west profile.
7	Pit/depression	Highly heterogeneous grey-light grey and orange sand.
8	Subsoil	Yellow-orange sand, no stones.
9	Buried soil surface (Ab-horizon)	Medium-dark grey sandy soil. Small fragments of ceramic sherds. Unusually thick horizon.
10	Leaching residue	Wedge of fine white sand. From layer 2?
11	Bioturbation	Dark-grey/black soil filled with charcoal. Possible mouse tunnel.
12	Leaching residue	Same as 10.
14	Burning horizon, former barrow surface	Thin layer of distinct dark-grey/black sandy soil with much charcoal.
15	Leaching residue	Heterogeneous medium-light grey sand. From possible downpour during construction.
17	Barrow (shell 3)	Thin layer of medium-dark brown sandy soil.
18	Topsoil	Dark-brown and grey heterogeneous sand. Significant bioturbation.

Table 1. *Description of all identified layers and surfaces from the profiles in the final trench. Layer numbers refer to those presented in Figure **6**.*

INTERPRETATION

Based on the profile, a rough interpretation of the barrow construction process can be outlined:

(1) PRIOR TO BARROW CONSTRUCTION

Some human activities took place on the site, as witnessed by 1-2 depressions (7) observed in the western profile.

(2) BARROW CONSTRUCTION STARTS (SHELL 1)

Based on the geophysical information available, a ring, possibly of stones (6) or yellow sand, was constructed to mark out the initial size and form of the barrow. Subsequently the construction of the barrow commenced, using large grass turfs taken from the vicinity of the barrow, where a similar thick A-horizon existed. During the construction phase, a heavy shower or freeze-thaw conditions resulted in the erosion of soil from the unprotected turfs and a division into sand and fine organic matter respectively along the foot slope of the barrow (3, 4, 5, 10, 12).

We did not reach the core of the barrow in the trench, so we probably did not uncover the primary barrow phase.

(3) BARROW CONSTRUCTION CONTINUES (SHELL 2)

A secondary shell is commenced shortly after shell 1, as witnessed by the lack of observable vegetation horizons. Soon after, the stones stabilising the turfs in shell 1 are removed (6). The shell construction continues until it covers shell 1 completely. A possible pause in the construction process can be observed as layer 17.

(4) AFTER BARROW CONSTRUCTION

After an unknown amount of time, the vegetation growing on the barrow was burnt (14), probably as part of heathland management. Subsequently, site formation processes including chemical weathering and bioturbation eradicated any signs of turfs or other construction features in the upper 60 cm of the burial mound.

Figure 7. *Photogrammetry of Store Vejlhøj (1905:16): the barrow trench profiles (right) and digitised version of the archaeological interpretation (left). Layers (green lines) are described in Table* ***1****, blue lines refer to interpreted evidence of turfs. Dashed lines represent trench corners. Credit: The authors and Casper Skaaning Andersen.*

THE BURIED SOIL SURFACE (AB-HORIZON, LAYER 9)

Geoarchaeological samples (x26-x32) were collected in the southern profile (centre back profile).

The well-preserved paleosol on a very well-drained site represents a soil surface that has not been disturbed by erosion or deposition before the mound was built and since the Holocene began. This interpretation is supported by a combination of features: 1) a diffuse stone layer and its depth, 2) a fragipan and its depth, 3) the very deep, well-developed organic rich epipedon (Ahb, currently an umbric epipedon), and 4) a subsoil with deep brownification (Bwb; not a Cambic horizon due to the sandy texture, but instead a Brunic horizon). See Table **2**.

The soil type prior to burial is difficult to assess due to continued leaching for millennia. However, the buried Ab-horizon is now classified as an Umbric horizon, although it is unusually thick, dark and organically rich (chroma/value 3/2), despite the nutrient-poor and sandy parent material. Consequently, it is likely that the soil before burial would have met the requirement of a “base saturation (by 1 M NH4OAc, pH 7) of ≥ 50% on a weighted average” in the WRB (2022) system, and hence would have been a Mollic horizon. In this case it would classify as a Brunic Phaeozem and not as a Brunic Umrisol. A Phaeozem is a very fertile soil type that is unexpected on a nutrient-poor parent material as at Store Vejlhøj; and no matter what the exact soil classification might be, the properties of the buried soil are unlike any other paleosol described in Denmark hitherto.

In order to form and maintain such a highly bioturbated and brownified soil as a Brunic Phaeozem or Brunic Umrisol, the vegetation type before the burial mound must have supported a neutral to slightly acidic soil. This is even though the parent material is fluvioglacial sand with 2-4% clay, <10% silt, and an expected calcium carbonate content of 2-4%, as seen in contemporary deep coring in fluvioglacial sand in the area. Consequently, acidifying and complex-binding plant species, such as *Calluna vulgaris* or *Pinus Sylvestris*, could not have been present for millennia before the mound was constructed. The unusually deep and homogenous A-horizon also reflects the fact that the site had a strong bioturbating fauna that ameliorated the soil and included deep dwelling earthworm (endogeic) species. Examples of such a vegetation type could be a lime (*Tilia cordata*) dominated woodland (Kristiansen & Dalsgaard 2000), an open shrub-land or a steppe-like grassland. The colours of the soil organic matter in the A-horizon are not of the black, biochar type (Kristiansen & Dalsgaard 2022) when observed under binoculars only. Slash-burn management of the soil prior to the construction of the burial mound is unlikely, as otherwise observed in Neolithic azonal paleosols in northwest Europe (Gerlach et al., 2012), while the charcoal piece at a depth of 25 cm could derive from burning, either wildfires or managed fires (Dalsgaard & Odgaard 2001).

The dark-brown organo-mineral bands seen commonly from c. 80-100 cm of depth and until the upper part of the buried paleosol surface (Figure **2**) are a secondary phenomenon. They are due to water dispersion followed by the irreversible illuviation of fine clay-sized organo-mineral complexes. So the bands are caused by the vertical transport of colloidal material when the soil water leaches down through the burial mound’s micro-pore system. In some cases, these socalled “clay-humus” bands follow the sedimentary structures, thereby underlining the surfaces of the turfs. In other cases, the illuvial features are chaotic and do not follow textural or structural features. The time period when the clay-humus bands were formed is not clear, but it is a common feature, similar to other investigated burial mounds like Hohøj and Himlingøje in Denmark (Dalsgaard et al. 1995; Kristiansen et al. 2003). The formation of such eluvial-illuvial features was only possible because the stacked turfs had a neutral to slightly acidic pH, i.e. around or slightly above pH 6, as the dispersion of organo-mineral complexes requires moderately low ionic strength in the soil water.

Horizon	Depth (cm)	Description
Ab	0-27	Moderately well-sorted, medium sand; massive structure; diffuse stone layer from 15 cm; one piece of charcoal at 25 cm; clay-humus bands from the very top, where they follow the original soil surface, while they become more chaotic and faint in the rest of the horizon, some stones at 2-5 cm; more white sand grains in the top; some fine vertical roots; fluvioglacial sand with <2-3%; 10YR 3/2; boundary clear (3-5 cm).
Bwb	27-75	Poorly sorted medium sand; massive structure; a diffuse stone layer until ca. 45 cm; 10YR 5/6; not roots; some bioturbation seen as Ab material in a few crotovinas (infilled, e.g. mole or mouse channels); fluvioglacial sand, some stones at 5-7 cm; diffuse boundary.
Cb	>75	Like Bwb, besides 10YR 7.5/6; some stones >10 cm; no crotovinas; and massive to medium-sized platy structure (fragipan) from ca. 75 cm;

Table 2. *Profile description of the buried soil horizons in Store Vejlhøj. Notice that depths are measured from the original, pre-burial mound surface (Figure* ***5****).*

Figure 8. *Soil profile of the buried surface below Store Vejlhøj (1905:16). The buried soil begins at 110 cm, as measured on the tape. The illuvial organo-mineral bands are clearly seen in the mound's turfs as dark-brown streaks and bands. The profile is described in table 2 and in attachment 1. Credit: Søren Munch Kristiansen.*

FINDS – STORE VEJLHØJ

URNS

During the early stages of laying the excavation trench, an urn was found in the southwest half of the back profile. This urn was situated just 40 cm below the surface and became the decisive factor in establishing the limits of the back profile of the initial trench. The urn appeared in good shape and included a stone gasket. Across the middle of the urn (30 cm in height, 25 cm in width), a circumferential band with slanted lines forming a triangular pattern was found. In accordance with the directions of the Danish Palaces and Culture Agency, any encountered graves or grave structures were not to be removed, excavated or otherwise damaged. Therefore, the urn has remained within the burial mound. However, part of the urn became unintentionally exposed during the trench extension (Figure **9)**. Based on the appearance of the exposed side of the urn, it can be categorised as either a tripartite, softly rounded, curved vessel, or a tripartite vessel with straight or rounded biconical form, or a combination of both. The size of the urn suggests that it was created for an adult, and it most likely stems from the Late Bronze Age.

Figure 9*. The partial exposure of a Late Bronze Age urn located just underneath the surface of the western profile of Store Vejlhøj. Credit: Havananda Ombashi.*

OTHER ARTEFACTS FOUND DURING THE TRENCH EXCAVATION PHASE

Throughout the entire trench excavation process, several fragments and shards of pottery were found. No ornamentation or other potential features were present on any of these finds. The dates of these finds range between the Neolithic and the Iron Age. In addition to pottery sherds or fragments, small flint deposits that lacked any signs of retouching were found in several floor layers. Small pieces of charcoal were also found in the floor and profiles throughout the excavation process, but were not frequent. Overall, no signs of association between any of the finds and any potential structures in the floor or profile soils were identified, meaning there were no special contexts within the mound related to any finds.

A total of nine pottery fragments were recognised near the foot of the mound during the manual phase of the excavation. Together, these fragments are presumed to belong to the remains of a single urn. One of the fragments shows evidence of a base notch, whereas the remainder show side notches. No ornamentation or additional characteristics could be recognised. Despite a lack of burnt bones, charcoal or other material being found with these sherds, their location in addition to the finding of the urn described earlier has led to the assumption that these sherds belong to an urn. The sherds were measured with the GPS and are stored by Holstebro Museum.

MACROFOSSIL RESULTS – STORE VEJLHØJ

Four samples were taken for macrofossil analysis (x36-x38, x59). An initial macrofossil sample (x36) was collected from a floor layer, containing the outwash layer (no. 15) and multiple small charcoal fragments. Two more samples (x37-x38) were collected from the southern profile upon trench completion, as well as a third sample (x59) from the extended west (back) profile. x37-x38 and x59 were selected for initial lab scans at the Department of Conservation and Natural Sciences, Moesgaard Museum.

The scans showed several nearly dissolved stems or roots in x36. In addition, several carbonised fragments of glume bases from wheat, several possible *Calluna* stems and charcoal were found. Sample x59 also contained a charred twig of *Ericaceae*, which has been submitted for ^{14}C-dating. Due to the bad preservation conditions and low number of macrofossils in the assessed samples, further macrofossil analysis was discontinued.

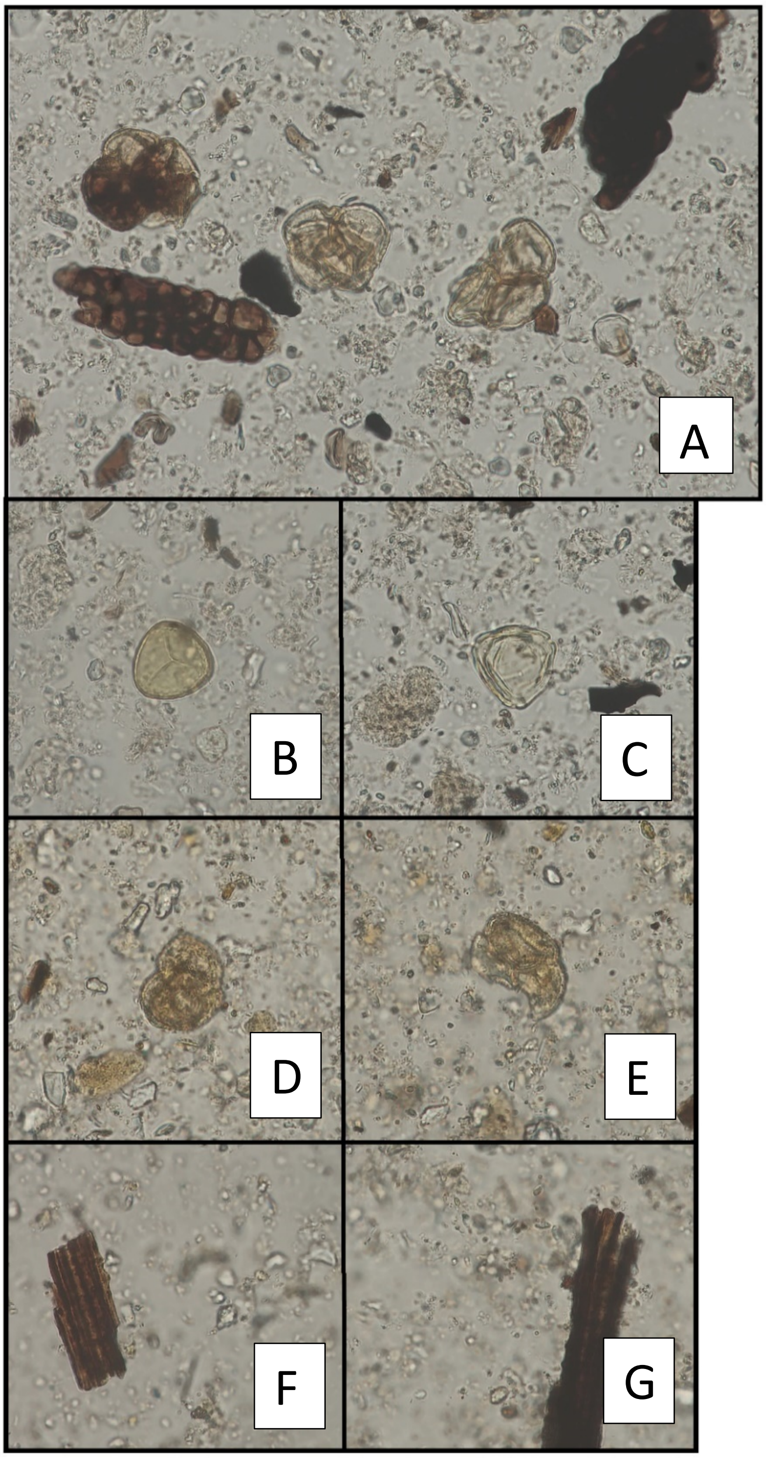

Figure 10. *Initial results of pollen scans from x7-x12 (all at magnification x40).* ***A****: Ericaceae/Calluna pollen and organic material from x7.* ***B****: Sphagnum spore.* ***C****: Corylus pollen (right) from x7.* ***D*** *&* ***E****: Ericaceae pollen from x8.* ***F*** *&* ***G****: Examples from x10 and x11, suggesting the absence of pollen, but the presence of organic material.*

Results from samples x7-x12 showed an overall lack of pollen and NPPs. Only sample x7, originating from layer 14 towards the top of the mound, contained a normal amount of well-preserved pollen, NPPs and micro-charcoal (Figure **10**). Sample x8 contained few pollen and spores, but suggested the presence of micro-charcoal fragments. The remaining four samples (x9-x12) showed few to no pollen, NPPs or charcoal. Photos of these samples show that this was not due to a preparation bias, as other forms of plant material were indeed present in the prepared microscope slides (Figure **10**). In combination with the poor results from the macrofossil analyses, the pollen samples point to overall poor preservation conditions for organic material in the barrow.

Due to the poor preservation conditions, we only selected x43 for further pollen analyses from Store Vejlhøj (Appendix 6).

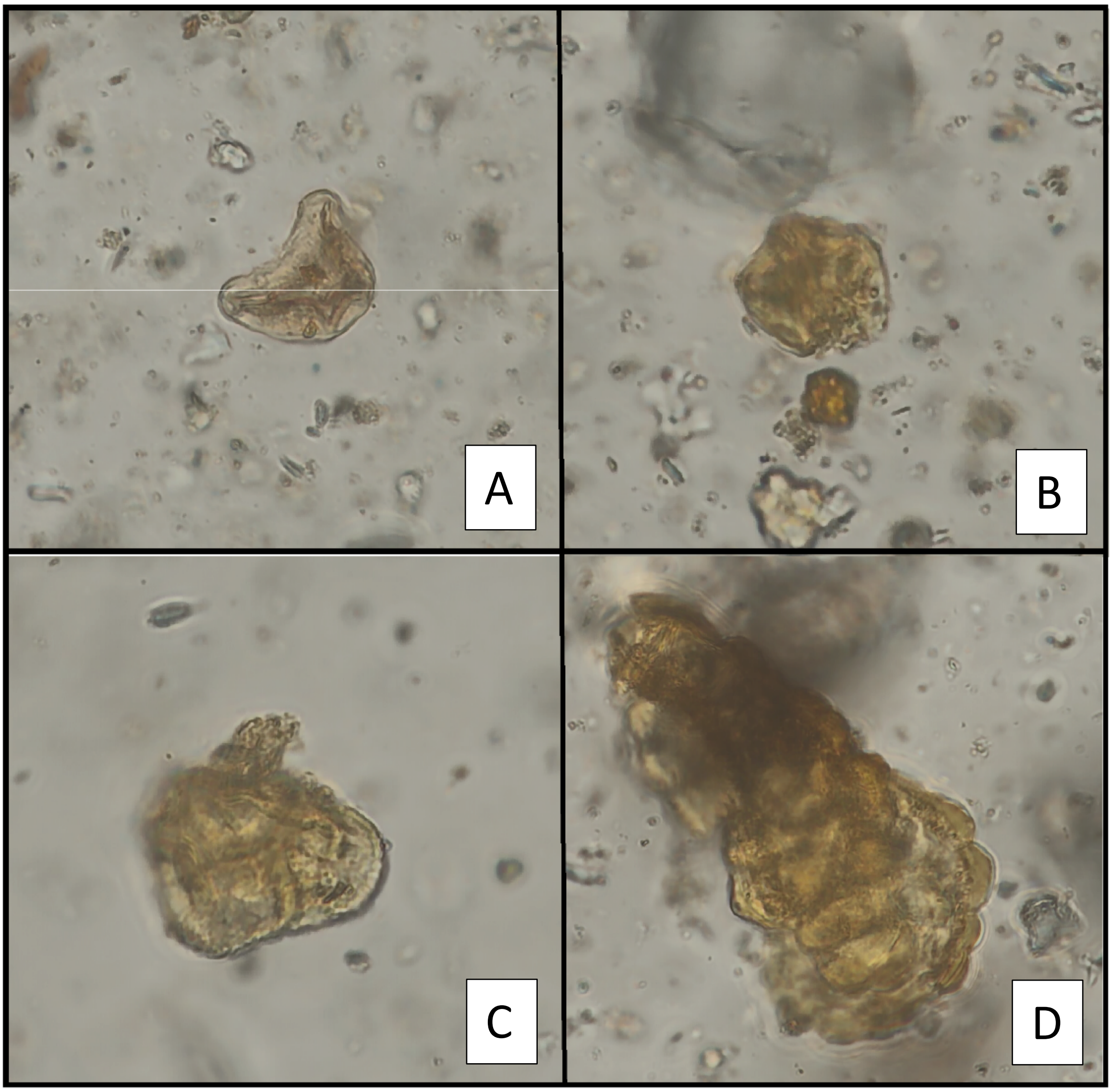

Figure 11. *Pollen samples taken from barrows 1950:31 and 1950:35, magnification at x40.* ***A****: unidentifiable pollen/spore.* ***B****: heavily degraded Alnus pollen from barrow 1950:31.* ***C****: Broken* Ericaceae *pollen.* ***D****: magnified photo of broken* Polypodium *spore from barrow 1950:35.*

Results from samples x60-x65 (cored barrows) suggested a presence of pollen in samples from barrow 1950:31 (x62) and 1950:35 (x64) (Figure **11)**. In comparison to those of sample x8 from Store Vejlhøj, there are significantly more pollen present in these samples, but they display more degradation, which in turn may suggest an interpretation bias. No scanned sample contained NPPs or micro-charcoal fragments, yet other organic remains were present, similar to samples x9-x12 from Store Vejlhøj.

The presence of bioturbation in all profiles may be an additional sign that the soil used for the mound construction provided too much opportunity for aeration. A second possibility is that despite an additional extension of the trench, the necessary preservation conditions for plant fossil analyses can only be found closer to the centre of the mound.

We have selected x43 for further pollen analyses, the results of which will be included in Appendix 6.

RESULTS - OTHER

BARROW SEDIMENTS

The cored soil from Store Vejlhøj was in comparison much finer in texture, and overall, more consistent after the first 50 cm and further down. The remaining barrows followed similar stratigraphies, with minor differences based on their location and overall size. However, none of them suggested good preservation conditions, due to their (coarse) sandy sediments and the frequent occurrence of small stones throughout almost every depth.

Soil corings from barrow 1905:35 (in the pine forest, southeast of Lake Skånsø) proved highly disturbed by the pine plantation, and there was severe disturbance from roots of a nearby tree. Due to the lack of undisturbed soil, the (absent) stratigraphy from this barrow was not included in Figure **12** below.

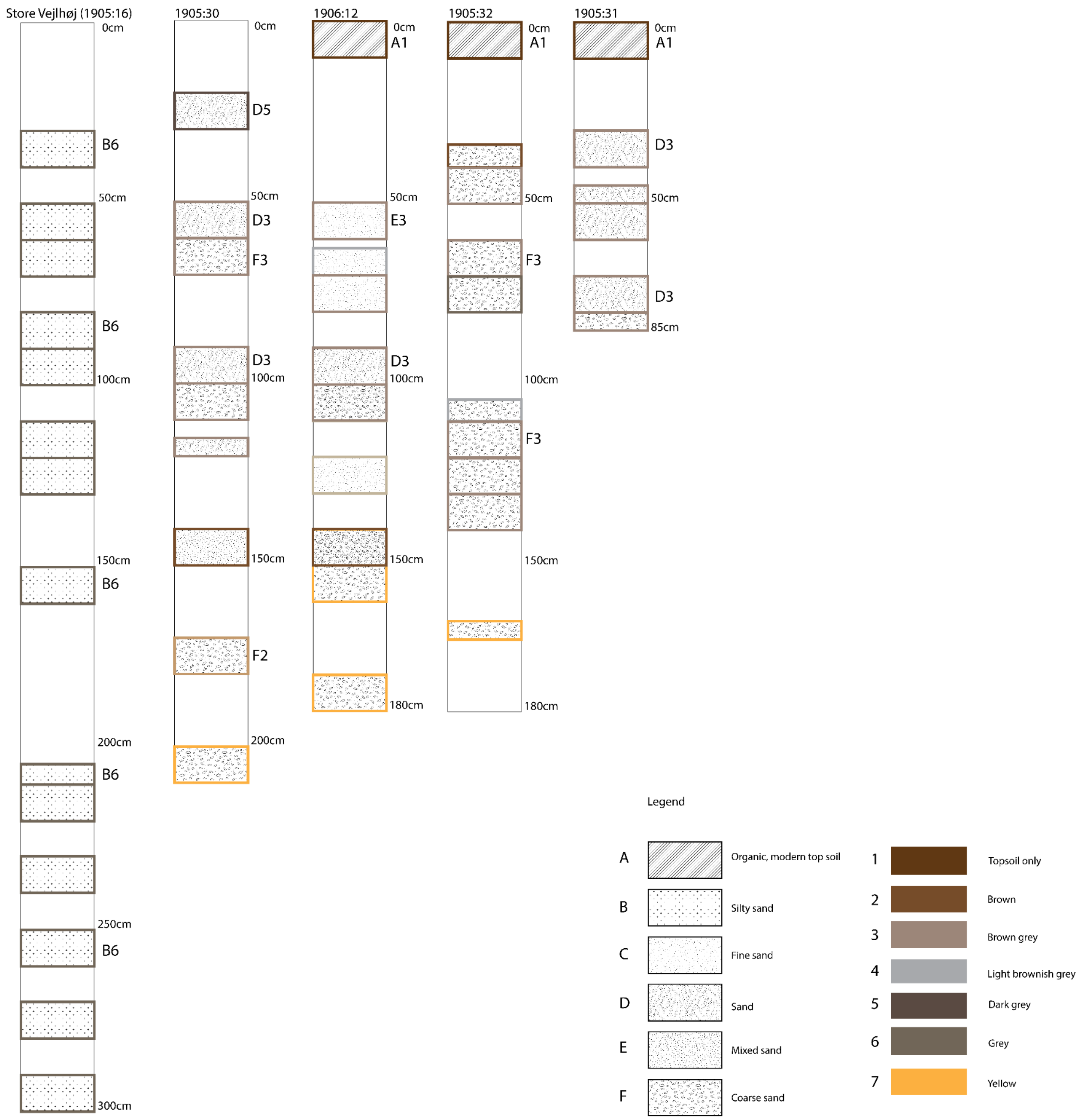

Figure 12. *Sediment description of all collected barrow sediments during the barrow coring process. Barrow 1905:35 is not included.*

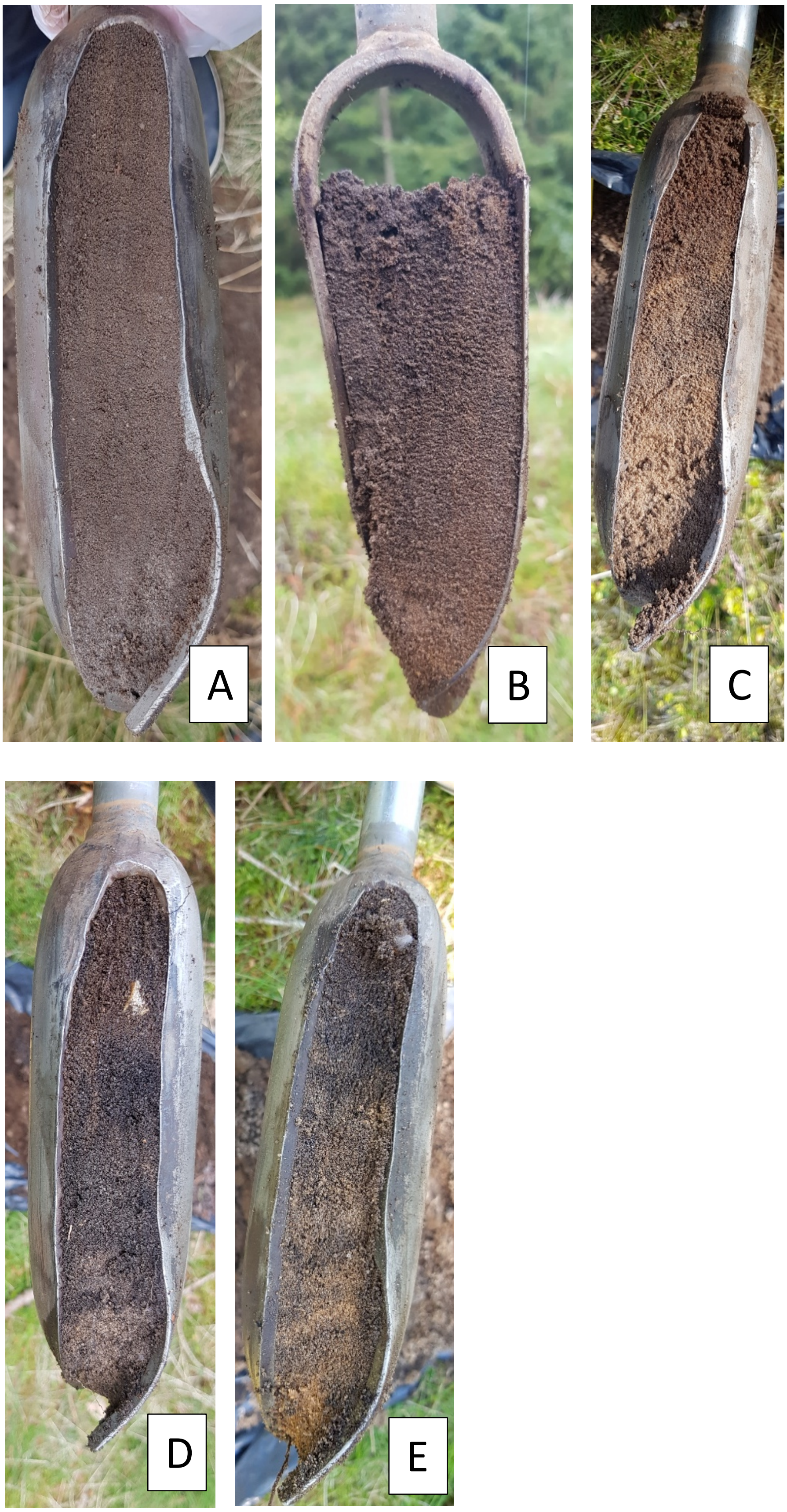

Figure 13. *Examples of cored soil above the transition into subsoil: Store Vejlhøj (A), barrow 1905:30 (B), barrow 1905:32 (C), barrow 1905:31 (D), barrow 1906:12, with a small influx of subsoil at the base (E) .*

Although several samples were collected from each barrow centre across an increasing depth, for the sake of simplicity only a single find number is assigned to each barrow. This means that each X number refers to several samples from the same barrow. Find numbers related to these cored barrow centres include x60-x65.

We have selected x61-x65 for further pollen analyses. They will be included in Appendix 6.

INITIAL POLLEN SCREENING RESULTS – PEAT SEDIMENTS

The radiocarbon dates (^{14}C) and recorded stratigraphy of the peat core from peat site 1 are shown in Figures **12-13** and suggest one or more peat cuttings within the area, resulting in disturbed and complex, short peat sequences. None of the sampled peat sediments could be linked chronologically to the time of the estimated date of barrow construction (c. 1600-1100 BC).

The visible sediment interruption, marked at 28-29 cm depth of core 1, was also recognised in the core of peat site two, albeit at a somewhat higher depth of 15 cm. This marked sediment line and the overall short sequence of peat site 2 suggest an even more disrupted and limited peat chronology at site 2. In combination with the results from peat site 1, no further sampling and dating of the peat site 2 core was considered useful for the research project.

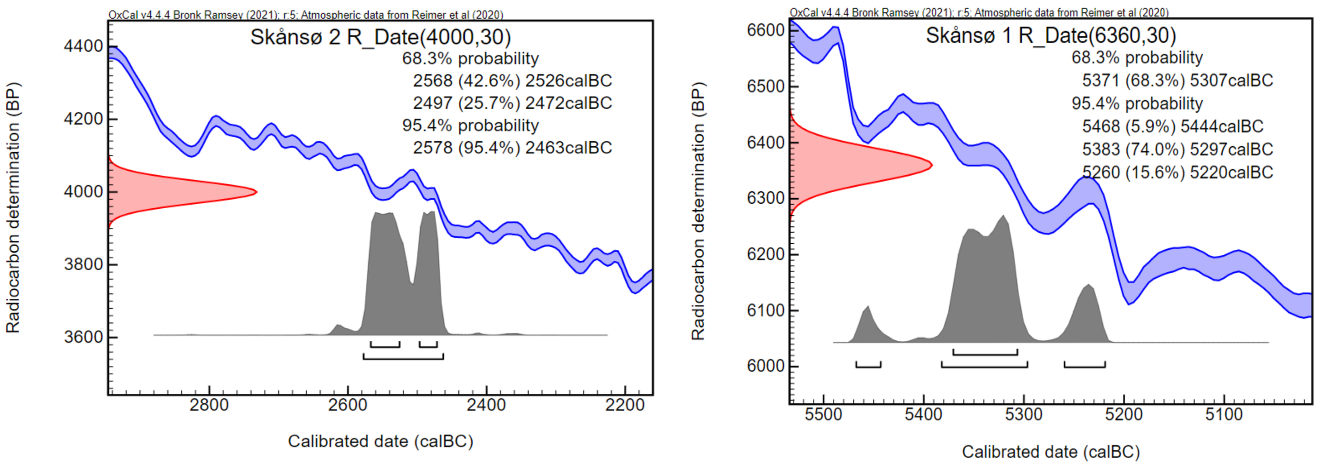

Figure 12. *The two radiocarbon dates of the peat core from site 1, located to the south of Lake Skånsø. Left: radiocarbon date result from the 5 cm long sample taken at the depths between 22 cm and 26 cm. Right: radiocarbon date result from the 5 cm long sample taken at the depths of 45-50 cm, at the base of the sequence. Dates were modelled using OxCal (Reimer et al. 2020).*

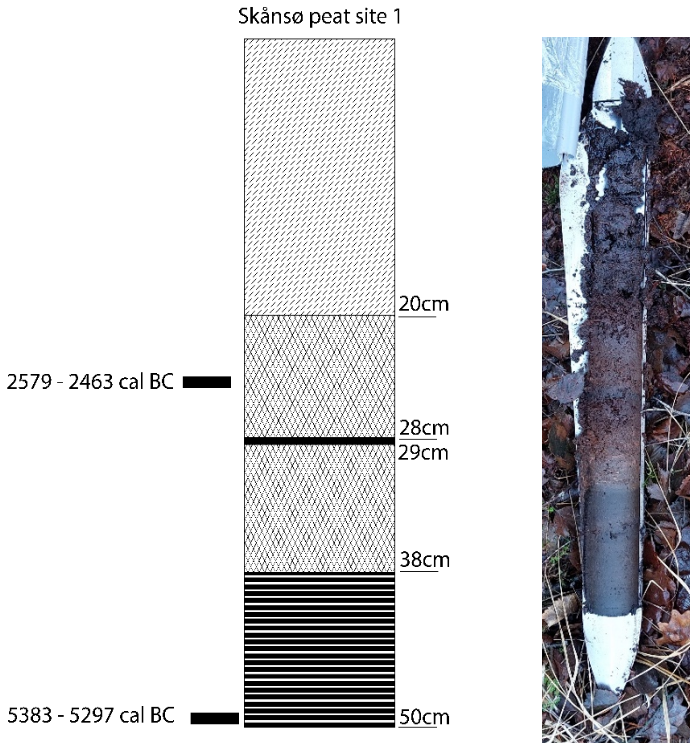

Figure 13. *Stratigraphic schedule of the peat sediment from site 1 (left) and photo taken during fieldwork (right), showing the clear sediment change indicated at 38 cm depth.*

CONCLUSIONS

The sampling of Store Vejlhøj, although based on a very delimited intervention in the barrow, produced a good deal of new information about land use and barrow construction at the site.

The original landscape surface was unusually well preserved in the barrow and showed no evidence of cultivation, erosion or ploughing on the spot prior to barrow construction. The turfs had been obtained from a highly homogenous soil with the same vegetation history, probably within a few metres of the barrow. As the turfs have the BW horizon in them, they had also been taken from an area where there had been no prior cutting of turfs. In a few turfs, white quartz grains could be observed, suggesting patches of acidifying vegetation, such as *Calluna*.

The main construction principles identified at the site parallel what we know from other Bronze Age barrows in Jutland. For instance, a shell construction method was used, possibly by using a temporary support in the shape of a large stone or a wooden construction. Furthermore, yellow subsoil may have been added intentionally as a visual marker of the planned extent of the barrow, like other barrows with kerb rings. One or several rain episodes have caused water perculation through the barrow and the formation of a wash layer horizon on top of the A horizon.

The poor preservation of pollen and macrofossils at Store Vejlhøj was something of a disappointment for the project, as it prevented a more detailed analysis and comparison with Lake Skånsø. However, we still hope that this will be possible elsewhere. Moreover, the cultural landscape around Lake Skånsø holds the potential for further archaeological and paleoecological investigation, including a closer dating of the nearby hollow-ways as well as better understanding of the use of the site for settlement, grazing and other activities.

ACKNOWLEDGEMENTS

The excavations were carried out as part of the ANTHEA project, funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement no. 853356). The authors would like to thank the Danish Palaces and Culture Agency for granting us permission to carry out the investigations. We would also like to thank landowners Kristian Mølgaard (†) and Margrethe Mølgaard, for kindly letting us work on their property. Finally, a warm thanks to everyone who took part in the excavation, registration and interpretation, including Astrid Toftdal Jensen, Lise Frost, Malene R. Beck, Axel Hee, Mads Hougaard Nielsen, Victoria Lyder Tissot, Mads K. Holst, Marianne Rasmussen, Mathias Broch and the ANTHEA research team.

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FINDS LIST (X)

X-no.	Material	Object	Profile	Amount
X1	Ceramic	Sherds, not ornamented	Western profile	1
X2	Ceramic	Small fragment	Floor	1
X3	Flint	Flake	Floor	1
X4	Ceramic	Clad	Floor of the mound	1
X5	Ceramic	Small fragment	Western profile	1
X6	Ceramic	Small fragment	Western profile	1
X7	Pollen sample	Vial sample	Eastern profile	1
X8	Pollen sample	Vial sample	Western profile	1
X9	Pollen sample	Vial sample	Western profile	1
X10	Pollen sample	Vial sample	Western profile	1
X11	Pollen sample	Vial sample	Western profile	1
X12	Pollen sample	Vial sample	Western profile	1
X13	Pollen sample	Vial sample	Western profile	1
X14	Pollen sample	Vial sample	Western profile	1
X15	Pollen sample	Vial sample	Western profile	1
X16	Pollen sample	Vial sample	Western profile	1
X17	Pollen sample	Vial sample	Western profile	1
X18	Pollen sample	Vial sample	Western profile	1
X19	Pollen sample	Vial sample	Eastern profile	1
X20	Pollen sample	Vial sample	Western profile	1
X21	Pollen sample	Vial sample	Eastern profile	1
X22	Pollen sample	Vial sample	Eastern profile	1
X23	Pollen sample	Vial sample	Western profile	1
X24	Pollen sample	Vial sample	Eastern profile	1
X25	Ceramic	Small fragment	Western profile	1
X26	Geological sample	Bulk sample	Western profile	1
X27	Geological sample	Bulk sample	Western profile	1
X28	Geological sample	Bulk sample	Western profile	1
X29	Geological sample	Micromorphology sample	Western profile	1
X30	Geological sample	Micromorphology sample	Western profile	1
X31	Geological sample	Micromorphology sample	Western profile	1
X32	Geological sample	Micromorphology sample	Western profile	1
X33	Charcoal	Small fragment	Western profile	1
X34	Charcoal	Small fragment	Western profile	1
X35	Charcoal	Small fragment	Western profile	1
X36	Macrofossil sample	Test sample	Floor during excavation	1
X37	Macrofossil sample	Original sample	Eastern profile	1
X38	Macrofossil sample	Original sample	Eastern profile	1

X39	Charcoal	Small fragment	Eastern profile	1
X40	Pollen sample	Long sequence	Western profile	1
X41	Pollen sample	Monolith tin	Western profile	1
X42	Pollen sample	Monolith tin	Western profile	1
X43	Pollen sample	Monolith tin	Western profile	1
X44	OSL sample	Tube sample	Western profile	1
X45	OSL sample	Tube sample	Western profile	1
X46	OSL sample	Tube sample	Western profile	1
X47	OSL sample	Tube sample	Western profile	1
X48	OSL sample	Tube sample	Southern profile	1
X49	Charcoal	Small fragment	Western profile	1
X50	Charcoal	Small fragment	Western profile	1
X51	Ceramic	Small fragment	Extension, southern profile	1
X52	Ceramic	Small fragment	Extension, southern profile	1
X53	Ceramic	Small fragment	Extension, southern profile	1
X54	Ceramic	Fragment, unornamented	Loose soil, following collapse western profile	1
X55	Ceramic	Fragment, unornamented	Loose soil, following collapse western profile	1
X56	Ceramic	Fragment, unornamented	Loose soil, following collapse western profile	1
X57	Ceramic	Fragment, unornamented	Loose soil, following collapse western profile	1
X58	Flint	Flake	Loose soil, following collapse western profile	1
X59	Macrofossil sample	Original sample	Trench extension, western profile	1
X60	Barrow coring sample	Sequential samples combined	Barrow 190612	1
X61	Barrow coring sample	Sequential samples combined	Barrow 190532	1
X62	Barrow coring sample	Sequential samples combined	Barrow 190531	1
X63	Barrow coring sample	Sequential samples combined	Barrow 190530	1
X64	Barrow coring sample	Sequential samples combined	Barrow 190535	1
X65	Barrow coring sample	Sequential samples combined	Barrow 190516	1

PHOTO LIST (F)

*Initials mentioned in the final column: H.O. - Havananda Ombashi; M.L. - Mette Løvschal; M.J.O - Michael Johansen, N.H. - Nicolai Hildebrand; R.J. - Rógvi Johansen; A.H. - Axel Hee and A.T.J. - Astrid Toftdal Jensen.

Photo no.	Conte xt	Seen from	Sample no.	Photo type	Date taken	Taken by
F1	Situation	East		Digital picture	25-10-2021	H.O.
F2	Profile	Northeast		Digital picture	25-10-2021	H.O.
F3	Profile	Northeast		Digital picture	25-10-2021	H.O.
F4	Profile	Southwest		Digital picture	25-10-2021	H.O.
F5	Profile	North		Digital picture	25-10-2021	H.O.
F6	Profile	Northeast		Digital picture	25-10-2021	H.O.
F7	Profile	Northeast		Digital picture	25-10-2021	H.O.
F8	Profile	Northeast		Digital picture	25-10-2021	H.O.
F9	Profile	Northeast		Digital picture	25-10-2021	H.O.
F10	Situation	North		Digital picture	26-10-2021	H.O.
F11	Situation	Northeast		Digital picture	26-10-2021	H.O.
F12	Profile	Northeast		Digital picture	26-10-2021	H.O.
F13	Profile	North		Digital picture	26-10-2021	H.O.
F14	Situation	North		Digital picture	26-10-2021	H.O.
F15	Profile	Northeast		Digital picture	27-10-2021	H.O.
F16	Profile	Northeast		Digital picture	27-10-2021	H.O.
F17	Floor	Southwest		Digital picture	27-10-2021	H.O.
F18	Floor	North	X36	Digital picture	27-10-2021	H.O.
F19	Floor	Southwest		Digital picture	27-10-2021	H.O.
F20	Floor	North		Digital picture	27-10-2021	H.O.
F21	Profile	Northeast		Digital picture	27-10-2021	H.O.
F22	Profile	West		Digital picture	28-10-2021	H.O.
F23	Profile	North		Digital picture	28-10-2021	H.O.
F24	Profile	Northeast		Digital picture	28-10-2021	H.O.
F25	Floor	Northeast	X4	Digital picture	28-10-2021	H.O.
F26	Profile	Northeast		Digital picture	28-10-2021	H.O.
F27	Profile	North		Digital picture	28-10-2021	H.O.
F28	Profile	Northeast		Digital picture	03-11-2021	H.O.
F29	Profile	Northeast		Digital picture	04-11-2021	H.O.
F30	Profile	Northeast	X26, X27, X28, X29, X30, X31, X32. X33	Digital picture	04-11-2021	H.O.
F31	Sample	East	X38, X40	Digital picture	04-11-2021	H.O.

F32	Sample	East	X39	Digital picture	04-11-2021	H.O.
F33	Situation	East		Digital picture	04-11-2021	H.O.
F34	Profile	Northeast	X41, X42, X43, X44, X48	Digital picture	05-11-2021	H.O.
F35	Profile	Northeast	X26, X27, X28, X29, X30, X31, X32. X33, X47	Digital picture	05-11-2021	H.O.
F36	Profile	Northeast	X26, X27, X28, X29, X30, X31, X32. X33, X41, X42, X43, X44, X47, X48	Digital picture	05-11-2021	H.O.
F37	Profile	East	X38, X39	Digital picture	05-11-2021	H.O.
F38	Profile	Northeast	X26, X27, X28, X29, X30, X31, X32, X33, X38, X41, X42, X43, X44, X45, X46, X47, X48, X49	Digital picture	05-11-2021	H.O.
F39	Sample	East	X48	Digital picture	05-11-2021	H.O.
F40	Sample	North	X49	Digital picture	05-11-2021	H.O.
F41	Sample	North	X49	Digital picture	05-11-2021	H.O.
F42	Profile	North		Digital picture	17-11-2021	H.O.
F43	Profile	North		Digital picture	18-11-2021	H.O.
F44	Profile	North		Digital picture	18-11-2021	H.O.
F45	Find	North		Digital picture	18-11-2021	H.O.
F46	Find	East		Digital picture	18-11-2021	H.O.
F47	Find	East		Digital picture	18-11-2021	H.O.
F48	Profile	North		Digital picture	18-11-2021	H.O.
F49	Profile	North		Digital picture	18-11-2021	H.O.
F50	Find	East		Digital picture	18-11-2021	H.O.
F51	Find	East		Digital picture	18-11-2021	H.O.
F52	Profile	North		Digital picture	26-10-2021	M.L.
F53	Profile	North		Digital picture	26-10-2021	M.L.
F54	Profile	North		Digital picture	26-10-2021	M.L.
F55	Profile	Northeast		Digital picture	26-10-2021	M.L.
F56	Profile	North		Digital picture	26-10-2021	M.L.
F57	Profile	Northeast		Digital picture	26-10-2021	M.L.
F58	Profile	North		Digital picture	26-10-2021	M.L.
F59	Profile	North		Digital picture	26-10-2021	M.L.
F60	Profile	Southeast	X25	Digital picture	28-10-2021	H.O.
F61	Situation	Northeast		Digital picture	02-11-2021	M.J.O.

F62	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F63	Situation	North		Digital picture	02-11-2021	M.J.O.
F64	Profile	North		Digital picture	02-11-2021	M.J.O.
F65	Profile	North		Digital picture	02-11-2021	M.J.O.
F66	Profile	North		Digital picture	02-11-2021	M.J.O.
F67	Profile	East		Digital picture	02-11-2021	M.J.O.
F68	Profile	Northeast		Digital picture	02-11-2021	M.J.O.
F69	Profile	East		Digital picture	02-11-2021	M.J.O.
F70	Profile	Northeast	X34	Digital picture	02-11-2021	M.J.O.
F71	Profile	North		Digital picture	02-11-2021	M.J.O.
F72	Profile	North		Digital picture	02-11-2021	M.J.O.
F73	Profile	North		Digital picture	02-11-2021	M.J.O.
F74	Profile	North		Digital picture	02-11-2021	M.J.O.
F75	Profile	North		Digital picture	02-11-2021	M.J.O.
F76	Profile	Southeast	X25	Digital picture	02-11-2021	M.J.O.
F77	Profile	Southeast		Digital picture	02-11-2021	M.J.O.
F78	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F79	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F80	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F81	Situation	North		Digital picture	02-11-2021	M.J.O.
F82	Situation	North		Digital picture	02-11-2021	M.J.O.
F83	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F84	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F85	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F86	Situation	North		Digital picture	02-11-2021	M.J.O.
F87	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F88	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F89	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F90	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F91	Situation	East		Digital picture	02-11-2021	M.J.O.
F92	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F93	Situation	Southwest		Digital picture	02-11-2021	M.J.O.
F94	Profile	Northeast		Digital picture	02-11-2021	M.J.O.
F95	Profile	Northeast		Digital picture	02-11-2021	M.J.O.
F96	Profile	Northeast		Digital picture	02-11-2021	M.J.O.
F97	Profile	Northeast		Digital picture	02-11-2021	M.J.O.
F98	Profile	Northeast		Digital picture	02-11-2021	M.J.O.
F99	Profile	Northeast		Digital picture	02-11-2021	M.J.O.
F100	Profile	East		Digital picture	02-11-2021	M.J.O.
F101	Profile	East		Digital picture	02-11-2021	M.J.O.
F102	Profile	East		Digital picture	02-11-2021	M.J.O.

F103	Profile	East		Digital picture	02-11-2021	M.J.O.
F104	Profile	East		Digital picture	02-11-2021	M.J.O.
F105	Profile	East		Digital picture	02-11-2021	M.J.O.
F106	Profile	North		Digital picture	02-11-2021	M.J.O.
F107	Profile	North		Digital picture	02-11-2021	M.J.O.
F108	Profile	North		Digital picture	02-11-2021	M.J.O.
F109	Profile	North		Digital picture	02-11-2021	M.J.O.
F110	Profile	North		Digital picture	02-11-2021	M.J.O.
F111	Profile	North		Digital picture	02-11-2021	M.J.O.
F112	Profile	North		Digital picture	02-11-2021	M.J.O.
F113	Profile	North		Digital picture	02-11-2021	M.J.O.
F114	Profile	North		Digital picture	02-11-2021	M.J.O.
F115	Profile	North		Digital picture	02-11-2021	M.J.O.
F116	Profile	North		Digital picture	02-11-2021	M.J.O.
F117	Profile	North		Digital picture	02-11-2021	M.J.O.
F118	Profile	North		Digital picture	02-11-2021	M.J.O.
F119	Profile	East		Digital picture	02-11-2021	M.J.O.
F120	Profile	East		Digital picture	02-11-2021	M.J.O.
F121	Profile	East		Digital picture	02-11-2021	M.J.O.
F122	Profile	East		Digital picture	02-11-2021	M.J.O.
F123	Profile	East		Digital picture	02-11-2021	M.J.O.
F124	Profile	East		Digital picture	02-11-2021	M.J.O.
F125	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F126	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F127	Situation	West		Digital picture	02-11-2021	M.J.O.
F128	Situation	Southeast		Digital picture	02-11-2021	M.J.O.
F129	Situation	Northeast		Digital picture	02-11-2021	M.J.O.
F130	Situation	East		Digital picture	02-11-2021	M.J.O.
F131	Situation	Northeast		Digital picture	02-11-2021	N.H.
F132	Situation	North		Digital picture	02-11-2021	N.H.
F133	Profile	Northeast		Digital picture	02-11-2021	N.H.
F134	Profile	Northeast		Digital picture	02-11-2021	N.H.
F135	Situation	West		Digital picture	02-11-2021	N.H.
F136	Situation	East		Digital picture	02-11-2021	N.H.
F137	Situation	Northeast		Digital picture	02-11-2021	N.H.
F138	Profile	North		Digital picture	02-11-2021	N.H.
F139	Profile	Northeast		Digital picture	02-11-2021	N.H.
F140	Profile	Northeast		Digital picture	02-11-2021	N.H.
F141	Profile	Northeast		Digital picture	02-11-2021	N.H.
F142	Situation	South		Digital picture	02-11-2021	N.H.
F143	Situation	North		Digital picture	02-11-2021	N.H.

F144	Situation	North		Digital picture	02-11-2021	N.H.
F145	Situation	Northeast		Digital picture	02-11-2021	N.H.
F146	Situation	North		Digital picture	02-11-2021	N.H.
F147	Situation	South		Digital picture	02-11-2021	N.H.
F148	Situation	South		Digital picture	02-11-2021	N.H.
F149	Situation	South		Digital picture	02-11-2021	N.H.
F150	Situation	South		Digital picture	02-11-2021	N.H.
F151	Situation	Southwest		Digital picture	02-11-2021	N.H.
F152	Situation	Southwest		Digital picture	02-11-2021	N.H.
F153	Situation	West		Digital picture	02-11-2021	N.H.
F154	Situation	East		Digital picture	02-11-2021	N.H.
F155	Situation	North		Digital picture	02-11-2021	N.H.
F156	Situation	North		Digital picture	02-11-2021	N.H.
F157	Situation	Northeast		Digital picture	02-11-2021	N.H.
F158	Situation	Northeast		Digital picture	02-11-2021	N.H.
F159	Situation	Northeast		Digital picture	02-11-2021	N.H.
F160	Situation	Northeast		Digital picture	02-11-2021	N.H.
F161	Situation	North		Digital picture	02-11-2021	N.H.
F162	Situation	Northeast		Digital picture	02-11-2021	N.H.
F163	Situation	East		Digital picture	02-11-2021	N.H.
F164	Situation	West		Digital picture	02-11-2021	N.H.
F165	Situation	North		Digital picture	02-11-2021	N.H.
F166	Situation	Northeast		Digital picture	02-11-2021	N.H.
F167	Situation	Northeast		Digital picture	02-11-2021	N.H.
F168	Situation	Northeast		Digital picture	02-11-2021	N.H.
F169	Situation	South		Digital picture	02-11-2021	N.H.
F170	Situation	South		Digital picture	02-11-2021	N.H.
F171	Situation	South		Digital picture	02-11-2021	N.H.
F172	Situation	North		Digital picture	02-11-2021	N.H.
F173	Situation	North		Digital picture	02-11-2021	N.H.
F174	Situation	North		Digital picture	02-11-2021	N.H.
F175	Situation	Northwest		Digital picture	02-11-2021	N.H.
F176	Situation	North		Digital picture	02-11-2021	N.H.
F177	Situation	Northeast		Digital picture	02-11-2021	N.H.
F178	Situation	North		Digital picture	02-11-2021	N.H.
F179	Situation	Northeast		Digital picture	02-11-2021	N.H.
F180	Situation	Northeast		Digital picture	02-11-2021	N.H.
F181	Situation	Northeast		Digital picture	02-11-2021	N.H.
F182	Situation	Northeast		Digital picture	02-11-2021	N.H.
F183	Situation	Northeast		Digital picture	02-11-2021	N.H.
F184	Situation	Northeast		Digital picture	02-11-2021	R.J.

F185	Situation	North		Digital picture	02-11-2021	R.J.
F186	Situation	Northeast		Digital picture	02-11-2021	R.J.
F187	Situation	Northeast		Digital picture	02-11-2021	R.J.
F188	Situation	Northeast		Digital picture	02-11-2021	R.J.
F189	Situation	North		Digital picture	02-11-2021	R.J.
F190	Situation	West		Digital picture	02-11-2021	R.J.
F191	Situation	Southwest		Digital picture	02-11-2021	R.J.
F192	Situation	Southwest		Digital picture	02-11-2021	R.J.
F193	Situation	South		Digital picture	02-11-2021	R.J.
F194	Situation	Southeast		Digital picture	02-11-2021	R.J.
F195	Situation	East		Digital picture	02-11-2021	R.J.
F196	Situation	East		Digital picture	02-11-2021	R.J.
F197	Situation	Northeast		Digital picture	02-11-2021	R.J.
F198	Situation	Northeast		Digital picture	02-11-2021	R.J.
F199	Situation	North		Digital picture	02-11-2021	R.J.
F200	Situation	North		Digital picture	02-11-2021	R.J.
F201	Situation	Southwest		Digital picture	02-11-2021	R.J.
F202	Situation	Southwest		Digital picture	02-11-2021	R.J.
F203	Situation	South		Digital picture	02-11-2021	R.J.
F204	Situation	Southeast		Digital picture	02-11-2021	R.J.
F205	Situation	East		Digital picture	02-11-2021	R.J.
F206	Situation	North		Digital picture	02-11-2021	R.J.
F207	Situation	North		Digital picture	02-11-2021	R.J.
F208	Situation	Northeast		Digital picture	02-11-2021	R.J.
F209	Situation	Northwest		Digital picture	02-11-2021	R.J.
F210	Situation	West		Digital picture	02-11-2021	R.J.
F211	Situation	Southwest		Digital picture	02-11-2021	R.J.
F212	Situation	Southwest		Digital picture	02-11-2021	R.J.
F213	Situation	South		Digital picture	02-11-2021	R.J.
F214	Situation	Southeast		Digital picture	02-11-2021	R.J.
F215	Situation	South		Digital picture	02-11-2021	R.J.
F216	Situation	Southwest		Digital picture	02-11-2021	R.J.
F217	Situation	West		Digital picture	02-11-2021	R.J.
F218	Situation	Northwest		Digital picture	02-11-2021	R.J.
F219	Situation	North		Digital picture	02-11-2021	R.J.
F220	Situation	Northeast		Digital picture	02-11-2021	R.J.
F221	Situation	North		Digital picture	02-11-2021	R.J.
F222	Situation	North		Digital picture	02-11-2021	R.J.
F223	Situation	East		Digital picture	02-11-2021	R.J.
F224	Situation	North		Digital picture	02-11-2021	R.J.
F225	Situation	Northeast		Digital picture	02-11-2021	R.J.

F226	Situation	Northeast		Digital picture	02-11-2021	R.J.
F227	Situation	North		Digital picture	02-11-2021	R.J.
F228	Situation	Southwest		Digital picture	02-11-2021	R.J.
F229	Situation	Northeast		Digital picture	02-11-2021	R.J.
F230	Situation	North		Digital picture	02-11-2021	R.J.
F231	Situation	North		Digital picture	02-11-2021	R.J.
F232	Situation	Northeast		Digital picture	02-11-2021	R.J.
F233	Situation	Northeast		Digital picture	02-11-2021	R.J.
F234	Situation	East		Digital picture	02-11-2021	R.J.
F235	Situation	Southeast		Digital picture	02-11-2021	R.J.
F236	Situation	South		Digital picture	02-11-2021	R.J.
F237	Situation	Southwest		Digital picture	02-11-2021	R.J.
F238	Situation	Southwest		Digital picture	02-11-2021	R.J.
F239	Situation	North		Digital picture	02-11-2021	R.J.
F240	Situation	North		Digital picture	02-11-2021	R.J.
F241	Situation	East		Digital picture	02-11-2021	R.J.
F242	Situation	East		Digital picture	02-11-2021	R.J.
F243	Situation	Southeast		Digital picture	02-11-2021	R.J.
F244	Situation	South		Digital picture	02-11-2021	R.J.
F245	Situation	West		Digital picture	02-11-2021	R.J.
F246	Situation	North		Digital picture	02-11-2021	R.J.
F247	Situation	Southwest		Digital picture	02-11-2021	R.J.
F248	Situation	Northeast		Digital picture	02-11-2021	R.J.
F249	Situation	Northeast		Digital picture	02-11-2021	R.J.
F250	Situation	North		Digital picture	02-11-2021	R.J.
F251	Profile	Southeast		Digital picture	na	A.H.
F252	Situation	Southeast		Digital picture	na	A.H.
F253	Profile	North		Digital picture	na	A.H.
F254	Profile	Northeast		Digital picture	na	A.H.
F255	Profile	Southeast		Digital picture	na	A.H.
F256	Profile	North		Digital picture	na	A.H.
F257	Profile	Northeast		Digital picture	na	A.H.
F258	Tomography set up.	Northeast		Digital picture	18-10-2021	B.E.
F259	Barrow prior to trench	Northwest		Digital picture	25-10-2021	A.T.J.
F260	Barrow prior to trench	Northwest		Digital picture	25-10-2021	A.T.J.
F261	Profile/floor level 1	Northwest		Digital picture	25-10-2021	A.T.J.
F262	Profile/floor level 1	Northwest		Digital picture	25-10-2021	A.T.J.
F263	Profile/floor level 3	Northwest		Digital picture	25-10-2021	A.T.J.

F264	Profile/floor level 3	Northwest		Digital picture	25-10-2021	A.T.J.
F265	Back profile during trench setting	Northwest		Digital picture	25-10-2021	A.T.J.
F266	Situation	East		Digital picture	25-10-2021	A.T.J.
F267	Situation_excavation sign	Northwest		Digital picture	25-10-2021	A.T.J.
F268	Floor_possible turf	North		Digital picture	25-10-2021	A.T.J.
F269	Floor_possible turf below level 4	Northeast		Digital picture	25-10-2021	A.T.J.
F270	Floor_possible turf below level 4	Northwest		Digital picture	25-10-2021	A.T.J.
F271	Floor_possible turf below level 4	Northwest		Digital picture	25-10-2021	A.T.J.
F272	Profile_trench	Northeast		Digital picture	26-10-2021	A.T.J.
F273	Finished trench	North		Digital picture	28-10-2021	A.T.J.
F274	Finished trench	North		Digital picture	28-10-2021	A.T.J.
F275	Finished trench	North		Digital picture	28-10-2021	A.T.J.
F276	Finished trench	North		Digital picture	28-10-2021	A.T.J.
F277	Finished trench	North		Digital picture	28-10-2021	A.T.J.
F278	Re-establishment barrow	NA		Digital picture	30-11-2021	H.K.

APPENDIX 1: DESCRIPTION OF SOILS

By Søren Munch Kristiansen

This profile description is based on soil science observation in the open excavation in the burial mound Store Vejlhøj: https://projects.au.dk/anthropogenic-heathlands/

Field notes:

- Sampling date: 2021.11.05
- Description of soils: Søren M. Kristiansen with help from Nina H. Nielsen (Museum Silkeborg)
- The day was very dark and foggy, although the site was visited around noon.
- No artefacts or charcoal described in details.
- During the visit, a narrow deeper pit was dug from the excavated level to reveal the entire soil profile of the paleosol beneath the mound.
- None of the sods in the burial mound was studied in details, only the paleosol is described.
- The described soil profile was at the very end of the excavation, e.g. where the exposed profile in the mound was tallest.
- The suffix “b” means buried while a prefix “2” is not used as the paleosol’s parent material is the same as in the overlying burial mound.
- Figures 1-4 below show the profile that was described.
- Fig. 5 shows a burial mound at Lund, northeast of Skive Fjord, as an analogue and as contrast to the soil processes observed at Store Vejlhøj. Notice that Kristian Dalsgaard struggles a bit with locating the exact mound excavation he visited back in the 1980s, and we have not followed up in the museums records to locate the precise location for this mound.

Images – Trench A

Figure 1. *The described soil profile in Store Vejlhøj. The image is taken towards west on November 5th 2021 by Søren M. Kristiansen.*

Figure 2. *The described soil profile in Store Vejlhøj. The image is taken towards west on November 5th 2021 by Søren M. Kristiansen.*

Figure 3. *The described soil profile in Store Vejlhøj. The image is taken towards west on November 5th 202 by Søren M. Kristiansen.*

Figure 4. *The described soil profile in Store Vejlhøj. The image is taken towards west on November 5th 202 by Søren M. Kristiansen.*

Figure 5. *For comparison, a profile in a burial mound at Lund, Nordfjends, near Skive Fjord. The images were taken on 12 and/or 17 September 1982 by Kristian Dalgaard in the form of 6x6 cm colour slides (personal communication). The buried paleosol is here clearly a Podzol. Turfs from the same soil type were used to construct this mound, but loose subsoil consisting of reddish-brown Bs/Bw turf material was evidently also used for its construction.*

APPENDIX 2: MACROFOSSIL ANALYSIS

By Marianne Høyem Andreasen

Moesgaard d. 10/5 2022

Review of three barrow samples with archaeobotanical material from Store Vejlhøj (FHM 4296/3714)

Background
Samples were collected by Mette Løvschal and Havananda Ombashi from the burial mound Store Vejlhøj and analysed at the department of conservation and nature science of Moesgaard Museum. Subsequently, the samples were reviewed by Marianne Høyem Andreasen at the department of conservation and nature science of Moesgaard Museum.

Research
The soil in the samples was initially soaked and then floated to separate the heavy part of the samples from the light part. The flotation of the wet samples took place in the laboratory at the Department of Conservation and Nature Science. The samples were treated with water, allowing the organic material to flow through a sieve with a mesh size of 0.25 mm. The reviewed material was saved and stored after the review. The assessment is based on 50 ml of material.

The samples were analysed with a stereomicroscope, with up to X 40 magnification. The analysis includes the estimated number of grain kernels, seeds and the amount of charcoal. The amount of charcoal is stated with 'X' as the smallest and 'XXXXX' as the largest content of charcoal, respectively.

Results
Columns two and three of table **1** indicate an immediate assessment of the individual plant's potential for a macrofossil analysis and wood analysis in relation to the number of macrofossils and charcoal pieces, the degree of conservation and the context. It is important to emphasize that even if a sample has not been found suitable for an analysis, it can in an overall analysis review be important for the understanding of the site's function and resource utilization.

The samples preferably contained charred root / stem fragments and charcoal lumps. Only x59 contained a charred twig from the heather family (Ericaceae), which probably contains enough material for a possible 14C dating. In addition, fragments of stems / roots, some moss and insects were found in the samples, some of which may be mites. Only x59 contains a piece of wood.

Recommendation
Due to the lack of seeds and identifiable pieces of charcoal, neither an archaeobotanical, nor a wood analysis can be carried out. In relation to the 14C dating, the heather-family twig from x59 can possibly be used. It should be noted, however, that the heather family can, firstly, have a relatively high age (up to 50 years) and, secondly, that charred heather twigs can be preserved for a long time in the soil and thus may be older than the mound itself, as it may have been in the peat / soil from which the mound has been built up for many years.

If you want a selection for 14C dating, please contact the department.

Marianne Høyem Andreasen, mag.art.
Afdeling for Konservering og Naturvidenskab
Moesgaard Museum

	Suitable for			Amount			
X-NO	Macro fossil analysis?	Analysis?	^{14}C-DATE	Cereal	Seeds	Charcoal	Other Comments
x37	No	No	No			x	50 ml. Få uforkullede rødder-/stængelfragmenter
x38	No	No	No			x	50 ml. Få uforkullede rødder-/stængelfragmenter
X59	No	No	Possibly*			1 piece + x	50 ml. Få uforkullede rødder-/stængelfragmenter. *Forkullet Ericaceaekvist - stor nok til datering

Table 1. *Results from the initial assessment of the burial mound samples.*

APPENDIX 3: RESISTANCE MEASUREMENTS

By Bo Ejstrud

Rapport vedr. modstandsmåling af udateret rundhøj

Store Vejlhøj

Ejsing sogn, Holstebro Kommune, tidligere Ginding Herred, Ringkøbing Amt.

Sagsnr. DKM 21.038
Stednummer: 180201-31. Fredningsnummer 1905:16 Bo Ejstrud
2021

Indhold

Resumé

Ved hjælp af modstandsmåling blev der udarbejdet tre tomogrammer ned gennem en rundhøj. Arbejdet afgrænsede højens indre lag, og påviste, at højen har en tydelig plyndringsskakt ned gennem centrum. Det antages derfor ikke, at der sker væsentlige skader på centralanlæg eller evt. beskyttende lag (:jernkappe) i forbindelse med fortsatte arkæologiske undersøgelser på lokaliteten.

Undersøgelsens forhistorie

Som del af nye undersøgelser af Skånsø skal gennemføres prøvetagning fra Store Vejlhøj, der ligger tæt på søen. Holstebro Museum varetager udgravningen, og i den forbindelse blev det besluttet at gennemføre en tomografisk undersøgelse af højen. Det blev aftalt at lægge tre snit gennem højen med en meters mellemrum. Udgravningen planlægges at foregå nogle meter ind i højen fra nord.

Administrative oplysninger

Arbejdet er udført for Århus Universitet, ved lektor, ph.d. Mette Løvschal, Institut for Kultur og Samfund - Afdeling for Arkæologi og Kulturarvsstudier. Sagen har journalnummer DKM 21.038, og alle data opbevares på museet under dette nummer. Kopi af data fremsendes også til Aarhus Universitet ved Mette Løvschal.

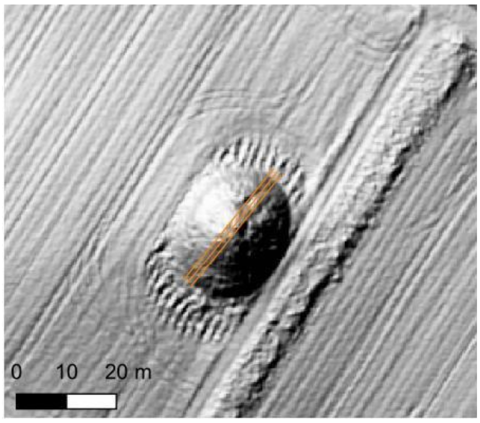
Undersøgelsen er gennemført af museumsinspektør, ph.d. Bo Ejstrud, Luftfotoarkæologisk Center ved Holstebro Museum (Museumsvej 2B, 7500 Holstebro). Feltarbejdet blev gennemført lørdag 16. oktober 2021. Dagen blev valgt af hensyn til vejret, som bød på tørvejr.

For yderligere oplysninger, se beretning for højens udgravning under samme journalnummer.

Topografi og terræn

Højen ligger lige under en kilometer fra Skånsø, og er del af en højrække, der løber ret syd for Skånsø i retning mod Ejsing. Syd for højen er et typisk og markant dødislandskab. Mod nordøst ligger et omfattende vådområde, mens den nordvestlige kvadrant er et relativt fladt plateau. Højen har været omtrent 27 m i diameter, men er i dag helt nedslidt mod SØ og NV, så den har en oval form.

Da højen er stærkt tilgroet, er mikrotopografien vanskelig at afkode på pladsen, ligesom vegetationen skaber usikkerhed i højdemodellen. Der er næppe tvivl om, at der er foretaget afgravninger på højen, da der er flere markante terrassekanter på højen, foruden sliddet i siderne. Det kan dog ikke sikkert afgøres, hvilke morfologiske træk, der er originale.



Figur 1. Højde fra DHM, samt de tre målelinjer. © Styrelsen for datadeling og effektivisering.

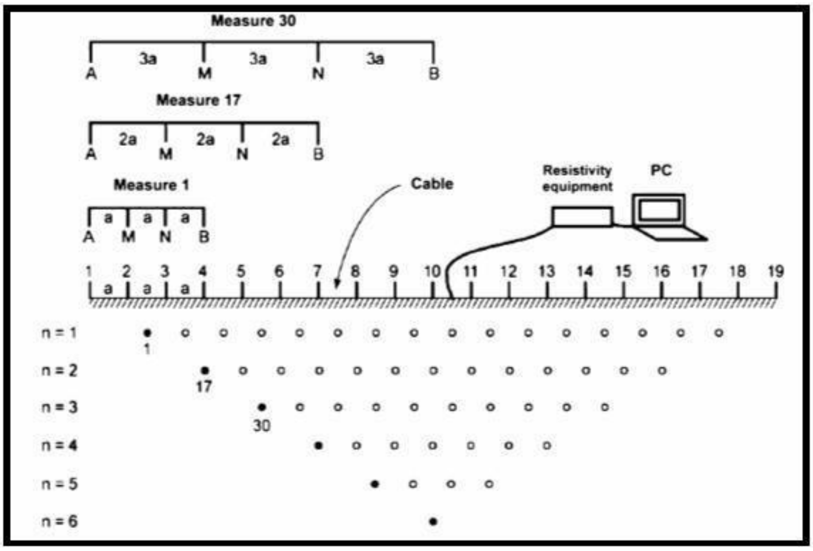
Målesystem

På grund af omfattende vegetation på højen måtte den forud planlagte hovedlinje tværs over højen opgives. I stedet blev der udlagt en hovedlinje i felten, som ramte bedst mulige kurs i forhold til at undgå buske og træer. Det betød, at hvor linjen var planlagt til at være 30 m, med en afstand mellem prøvepunkterne på 1 m, så blev den i praksis en anelse kortere - 28,64 m- med en afstand mellem de enkelte punkter på 0,955 m. Af hensyn til læsbarheden i det følgende refererer vi stadig til afstande som "meter", selvom de formelt skal læses som "måleenheder af 0,955 m". De endelige data er korrigeret for dette.

Udlægningen af hovedlinjen gennem en tæt græsvegetation betød, at det især på sydsiden var vanskeligt at måle gennem et usædvanligt tykt rodnet, og skabe elektrisk kontakt med højfylden under vegetationslaget. Derfor kunne målingerne på centerlinjen ikke fuldføres mod syd. De to parallelle linjer blev udlagt vinkelret ud fra hovedlinjen, med en afstand på 1 m til hver side. Ved hovedlinjens to endepunkter er der efterladt røde målesøm, der angiver start og slutpunkt. Disse kan fjernes i forbindelse med udgravningen.

Hovedlinjens endepunkter (UTM 32N, Euref89):
Mod nord: 488335,308E /
6263127,858E Mod syd:
488317.381E /
6263105,456N

Metode
Den tomografiske undersøgelse er gennemført ved modstandsmåling. Med denne metode ledes elektrisk strøm ned i jorden gennem et bestemt system. I dette tilfælde er der brugt en Wenner-α opsætning, hvor fire sonder sættes på række med ens afstand. De to yderste sonder (A-B eller C1-C2) leder en strøm, mens de to inderste (M-N eller P1-P2) måler spændingsforskellen. Dermed kan modstanden i jorden måles. Ved systematisk at øge afstanden mellem sonderne, øges dybden af målingen, og dermed kortlægges et lodret snit ned gennem objektet. I dette tilfælde er der målt med afstande på mellem 1 m og 7 meter mellem hver af de fire sonder.



Figur 2. Princippet i en modstandsmåling. På Store Vejlhøj er der målt med afstande op til 7a.

For at lette arbejdet i felten blev forbindelsen til hvert målepunkt skabt ved hjælp af kabler med varierende længder og en stålsonde i jorden for hvert målepunkt. Disse kabler blev forbundet med apparatet ved hjælp af en samleboks, hvorfra målingerne blev dirigeret. Alternativet er at flytte sonderne manuelt mellem hver måling, men med denne opstilling kunne opmålingstiden reduceres med 75-80% til omtrent en time per linje. Dertil en times bearbejdning af data efter hjemkomst fra felten.

Det anvendte apparat, TAR-3 fra Frobisher Ltd., er konstrueret til opmålinger i fladen. Men med en anden hardware og med efterfølgende konvertering af data, er resultatet gemt i et format egnet til analyse med programmet RES2DINV. Dette program gennemfører alle nødvendige beregninger, og viser resultatet grafisk. Grundstenen i at omregne fra den målte resistivitet til en potentiel profil er en matematisk proces, der kaldes inversion. Erfaringsmæssigt giver denne proces et godt, om end ikke detaljeret, billede af lagene under overfladen. Metoden er veletableret i geofysisk prospektering, og bruges til generel kortlægning af geologiske lag, samt af særlige træk som jordfaldshuller og forkastninger, men også til at finde vand og olie langt nede i undergrunden.

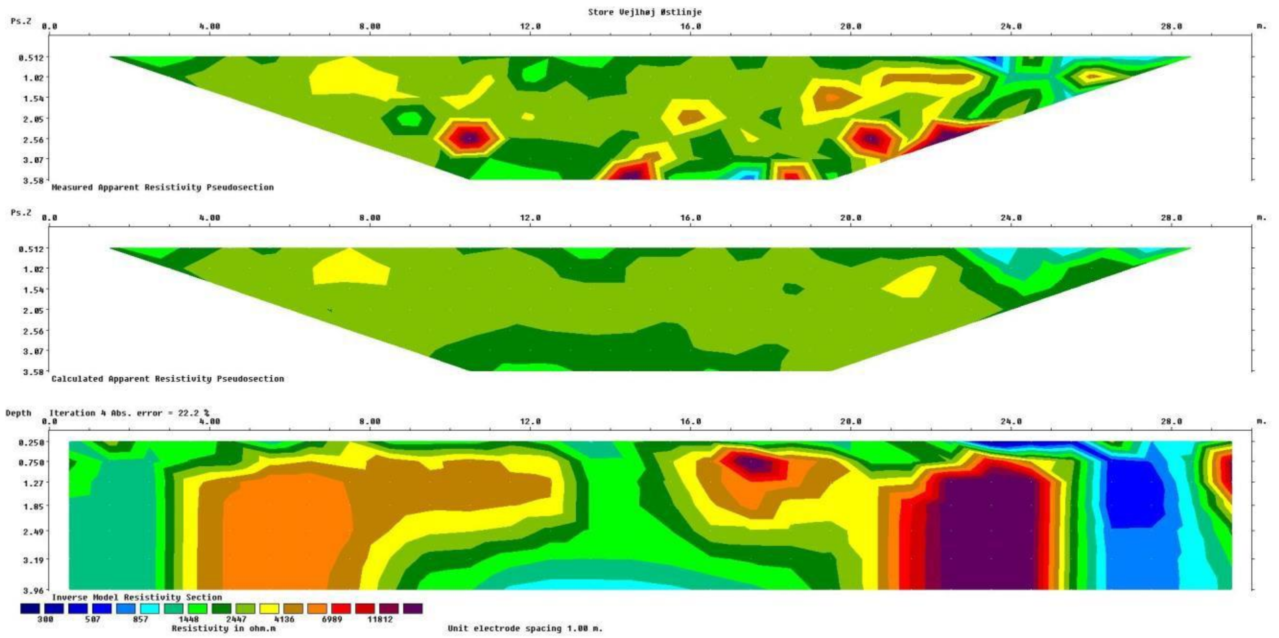
Figur 3. Opstilling i felten. Hvert kabel går til et målepunkt tværs over højen med en meters afstand. Samleboksen forbinder ledningerne med selve måleapparatet, der dog ikke ses her. Målebåndet viser det omtrentlige forløb af hovedlinjen, der løb lige vest for egetræet. Set mod syd.

Resultater

Med tre opmålte linjer betegnes de her som østlinjen, centerlinjen og vestlinjen. Som nævnt måtte forløbet tilpasses den tætte vegetation på stedet. Spredningen på en meter blev aftalt for om muligt at påvise en eventuel centralgrav. Der er målt med horisontalt nulpunkt nord for højen, mens højderne er koter, opmålt med GPS.

ØSTLINJE

I sin grundform ser analysen af data ud som vist på Figur 4. Øverst ses de opmålte data, herefter en beregnet udjævning af data, og til sidst inversionen, som bedst beskriver fordelingen i data. Det er dermed nederste figur, som er den endelige tolkning. Bemærk dog, at eftersom stor dybde kræver stor afstand mellem målepunkterne, så vil det kun være på midten af målefeltet, at man når helt ned. I dette tilfælde mellem 10,5 og 19,5 m. I den endelige model ses, hvordan lagene danner lodrette skygger ned under det faktisk målte: Disse dele er blot en artefakt af interpolationen, og bør ignoreres. Dette kunne have været undgået ved at måle en længere linje, f.eks. ekstra 15 m på hver side af højen. Fordoblingen af antallet af målepunkter ville dog også have flerdoblet antallet af udførte målinger, og gør ikke megen praktisk forskel for resultatet.



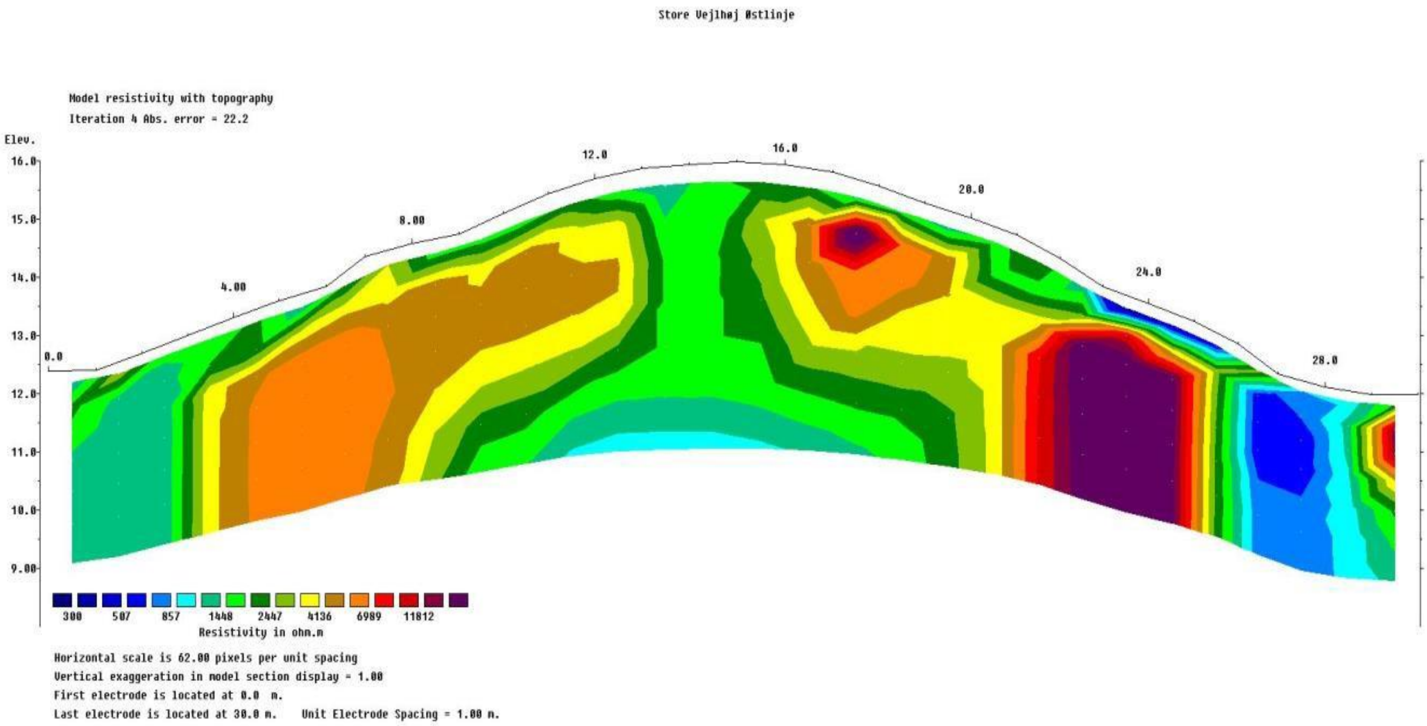
Figur 4. Inversionen er her vist i sin grundproces. Øverst de målte data, herefter beregnede data, og nederst det endelige resultat.

Det er lettere at læse resultatet på en model, som er korrigeret for topografi (Figur 5). Det ses her, hvordan højfylden ses som områder af høj modstand (rødlige, gule og mørkegrønne farver). Især mod nord danner lagene konvekse former, der kunne tolkes som højskaller. Mod syd er den konvekse form mindre tydelig, sikkert på grund af et lokalt område med høj modstand højt oppe i højfylden, omkring 17-19 m, med centrum omkring 17,5 m.

Det mest interessante resultat er måske, at dette lag brydes lodret ned fra toppen, af et lag med lavere resistivitet (grønne farver). Der kan naturligvis være tale om en særlig højkonstruktion, men den mest åbenlyse forklaring på dette gennembrud er, at der er tale om et plyndringshul. Der er således næppe bevaret en intakt centralgrav i denne høj. En eventuel jernkappe vil derfor også være gennembrudt.

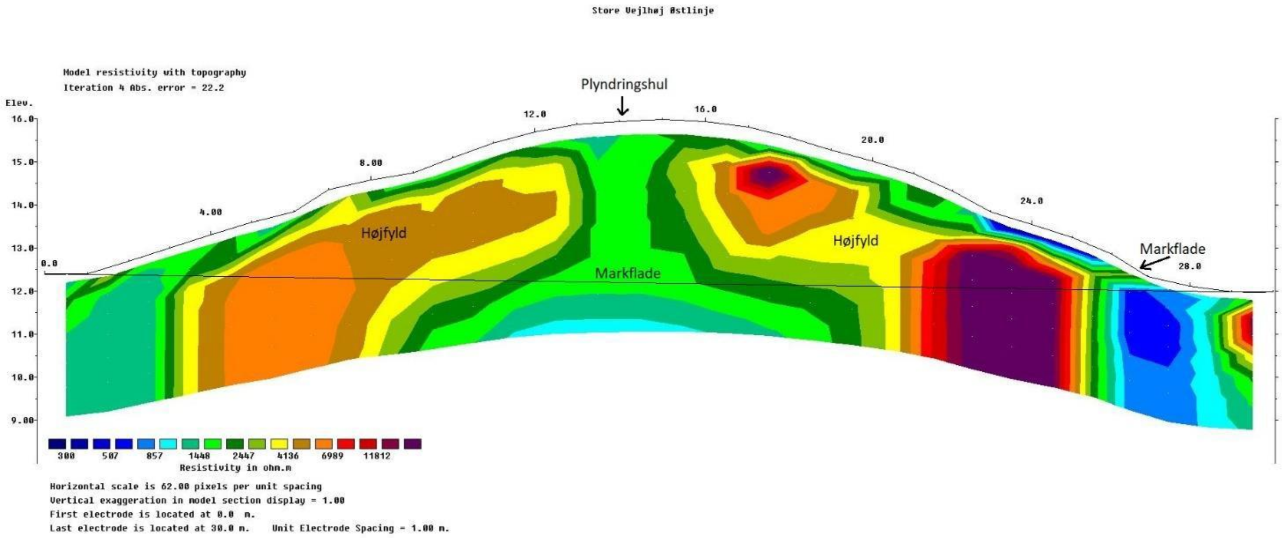
Under plyndringshullet breder det grønne lag sig mere vandret ud. Den øverste del svarer omtrent til højden på den oprindelige markflade. Bemærk, hvordan dette lag stopper, hvor de faktiske målinger også stopper, omkring 10,5 m og 19,5 m. Havde der været lavet et antal målinger ud fra højen, er det rimeligt at antage, at dette lag ville have fortsat i begge retninger, og dermed skåret den røde og gule højfyld af ved markoverfladen. Bemærk også, hvordan markoverfladen markeres af en skarp gradient ved den sydligste kant af gravhøjen.

Længst mod syd ses med blå, hvad der kan være en nedgravning ret udenfor højen. Dybden heraf er med sikkerhed overdrevet i denne gengivelse.



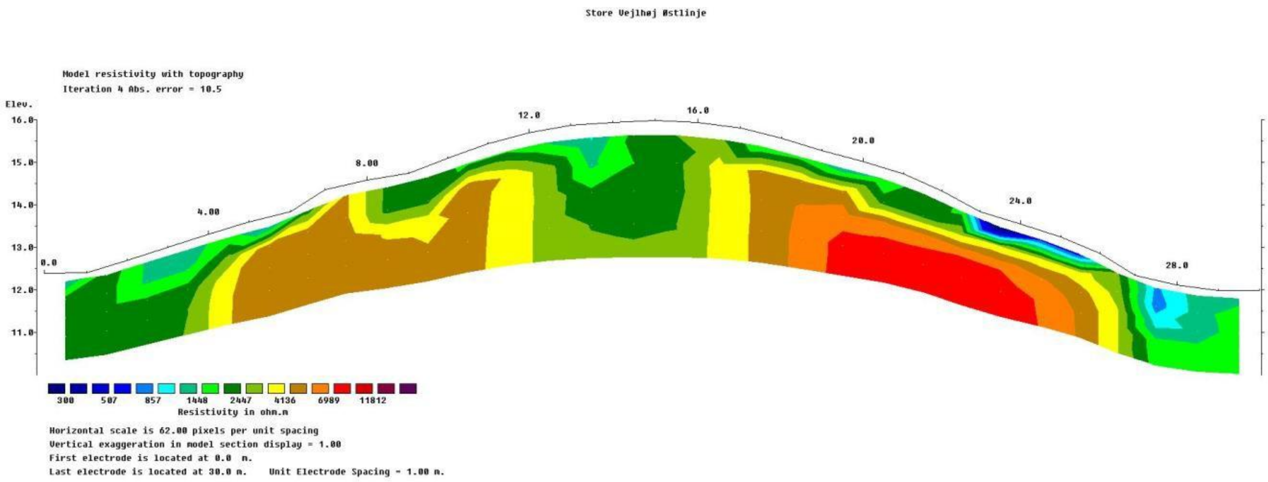
Figur 5. Østlinjen. Endelig model vist med topografi. Områder med lodrette gradienter er en interpolationsartefakt, og bør ignoreres.

En tolkning af resultatet kan derfor se ud som på Figur 6.



Figur 6. Østlinjen. Endelig model med tolkning.

Farvesætningen på disse profiler er en gradient over spredningen af data. For at kortlægge toppen bedre, blev der foretaget en ny analyse af data, kun ud fra de øverste to målinger (1 hhv. 2 m separation mellem sonderne.) Det ses her, hvordan plyndringshullet danner en trugformet formation, hvis bund omtrent rammer det gamle markniveau. Det ses også, hvordan der synes at være nedgravninger langs højfoden, tydeligst omkring 27-28 m, men muligvis også omkring 3-4 m. Der kan også være tale om nedflydning fra højen. Bemærk, hvordan lagene i øvrigt igen dykker lodret ned ret tæt på overfladen. Det er igen en beregningsmæssig artefakt, som skyldes, at de underliggende målinger mangler i denne analyse.



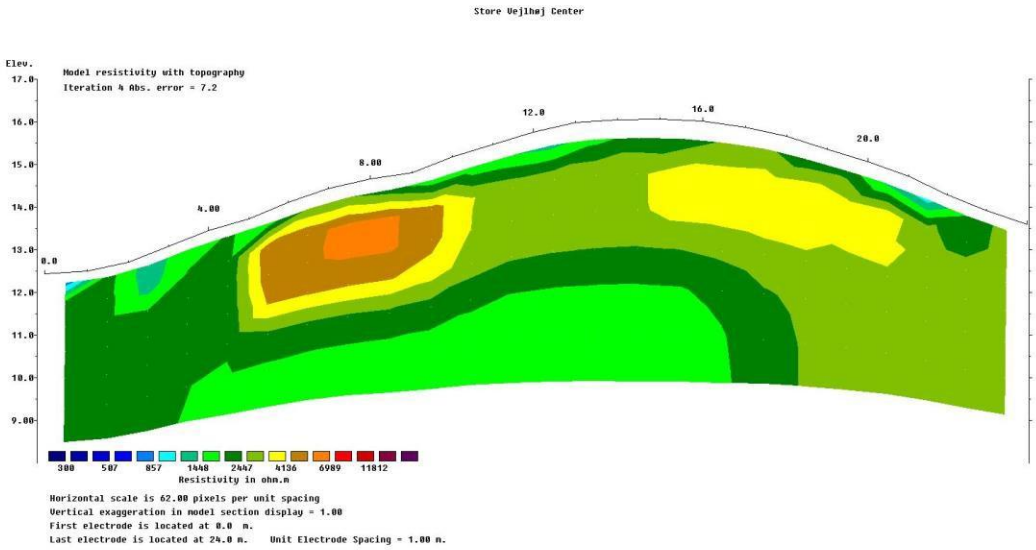
Figur 7. Tomogram baseret på de to øverste målesæt (a=1 m og a=2 m) fra østlinjen. Bemærk, at farveskalaen her ikke er sammenlignelig med de øvrige billeder.

CENTERLINJE

Som nævnt blev centerlinjen lagt i forhold til at skabe en åben linje tværs over højen, der undgik buske og træer. De to andre linjer er målt en meter vinkelret ud fra denne linje. Ulempen var at det meget kraftige græsdække var vanskeligt at gennemtrænge, især på højens sydside. God elektrisk kontakt med højfylden under rodlaget ville kræve nedgravning i højen. Det betyder, at det måtte opgives at måle den sydlige den af dette felt.

Det betyder, at detaljeringsgraden på opmålingen er betydeligt formindsket i forhold til de øvrige, og at tomogrammet kun bør tolkes frem til højens toppunkt. Det giver dog stadig meningsfulde resultater: Hvis man måler den sydligste udstrækning af den gule farve på nordsiden på tværs af de tre tomogrammer, så danner de en næsten ret linje, der går omtrent radialt ud fra højens midte. Der er for kort mellem linjerne til en klar tolkning, men retningen minder om den opbygning i radiale 'lagkagesnit', som kendes fra andre gravhøje.

Det er samtidigt vigtigt at understrege, at det, som ses på disse figurer, ikke er arkæologiske lag, men konturlinjer i en gradient af værdier. Den gule farve afgrænser i sig selv ikke et lag, men markerer blot en konturværdi, her svarende til en resistivitet på 4135 Ohm-m. Alligevel tegnes en klar tendens, og med flere målelinjer hen over højen ville dens samlede opbygning formentlig kunne kortlægges med relativ god præcision.



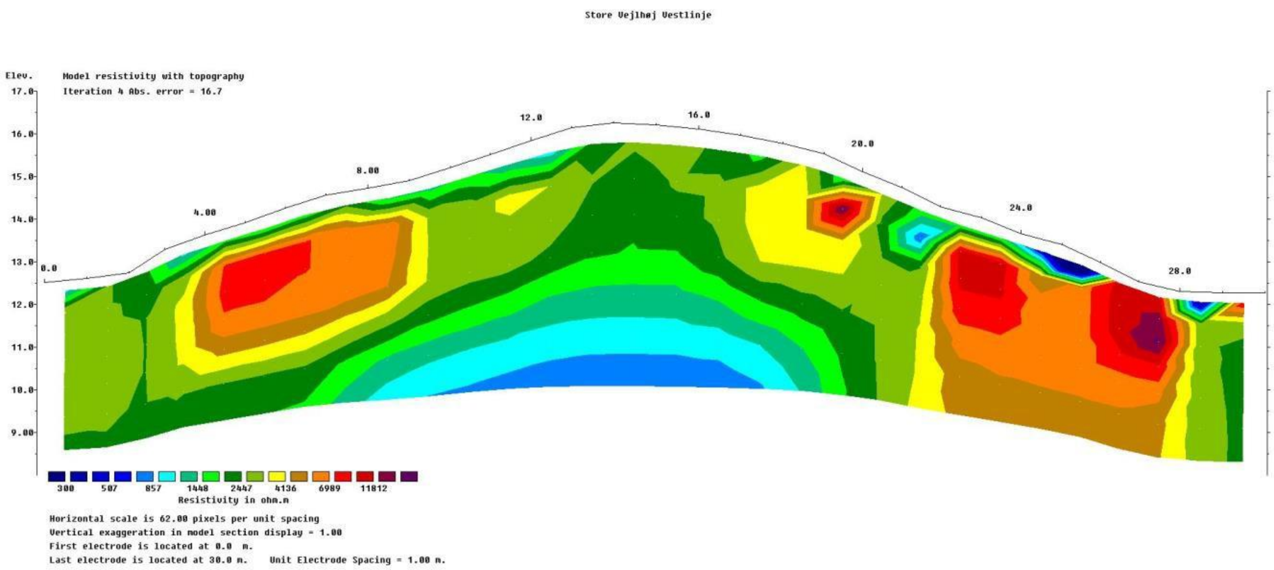
Figur 8. Centerlinjen. Endelig model med topografi. Bemærk, at resultatet kun er retvisende nord for toppunktet, dvs. venstre side af illustrationen.

VESTLINJE

På vestlinjen står højfylden mere brudt. Den oprindelige markoverflade ses klart i midten af feltet, men står ikke så tydeligt vandret, som var tilfældet for østlinjen. Midten af højen brydes af en struktur, der for så vidt kunne være den indre del af en radial trekant ud mod vest, men også kunne markere en indre højkerne.

Forskydningen af de højeste værdier ud til begge sider ville passe med gennemskæringen af en radialt opbygget høj. Det er tydeligt på tværs af målingerne, at sydsiden står datamæssigt mere uroligt end nordsiden. På centerlinjen i en grad, så det ikke lykkedes at få gode målinger på den sydligste del.

Tilsammen tegner de tre tomogrammer dog et godt billede af højens indre opbygning.



Figur 9. Vestlinjen. Endelig model med topografi.

Sammenfatning og perspektivering

Med disse opmålinger er højens indre opbygning oversigtligt karteret. Flere målelinjer ville have givet et bedre overblik over den samlede høj, men er næppe relevante i den konkrete undersøgelsessammenhæng.

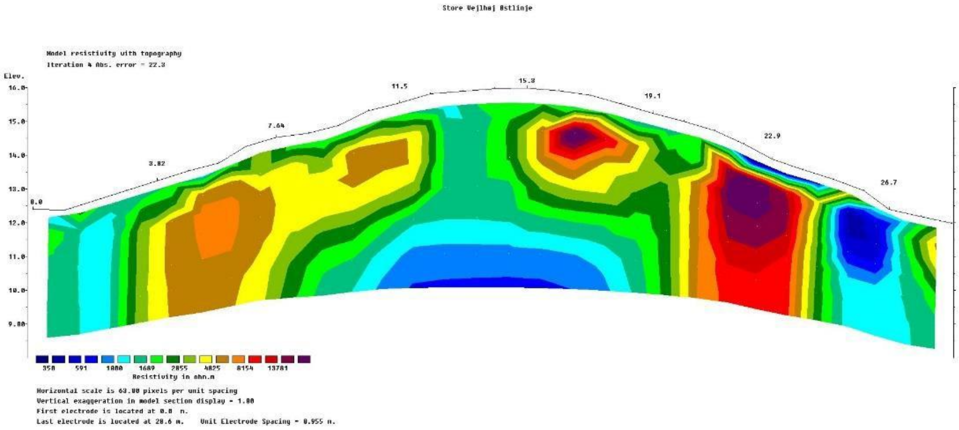
Påvisningen af et plyndringshul demonstrerer, hvordan den centrale del af højen er forstyrret, og at en egentlig arkæologisk udgravning ind i højsiden dermed ikke risikerer at forstyrre centrale anlæg. Ved nærmere eftersyn på højdemodellen ses i øvrigt et trugformet hul i højen lige øst for østlinjen. - Det er også en erfaring fra andre geofysiske projekter, at resultaterne skærper opmærksomheden på mikrotopografien, og at de to datasæt supplerer hinanden godt.

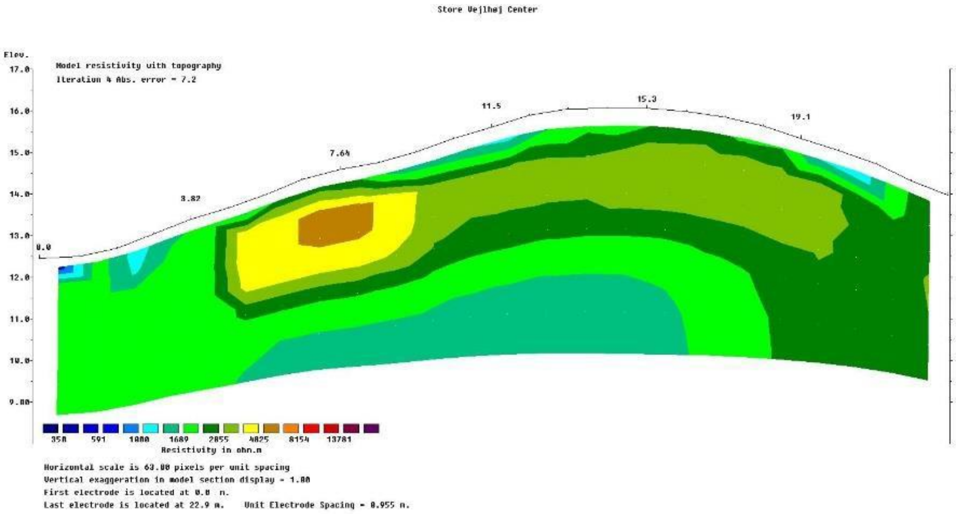
Linjerne ligger for tæt til en fuld tolkning, men ved analogi fra andre høje synes resultaterne at pege hen mod en radialt opbygget høj. Dette kan være væsentligt for den efterfølgende prøvestrategi, idet højens forskellige sektorer dermed formentlig vil være hentet fra forskellige områder i nærheden af højen.

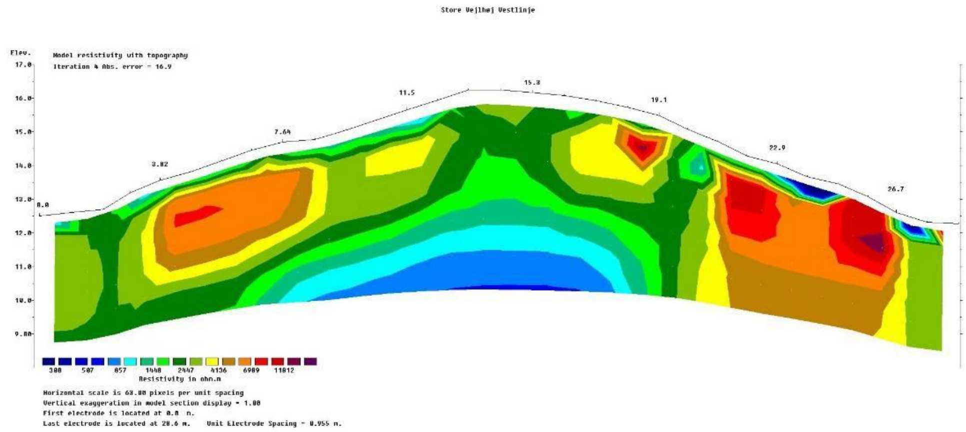
Vi kender ikke til, at der tidligere er foretaget en undersøgelse af denne type på en dansk gravhøj. Resultaterne peger dog på, at dette arbejde bør fortsættes og udvikles yderligere, idet resultaterne synes særdeles lovende. Ikke mindst fordi dette er en ikke-destruktiv metode. Med en relativ begrænset indsats i felten, og uden fysiske indgreb i fortidsmindet, vil det være muligt at kortlægge den samlede opbygning af hver høj. Ved undersøgelse af et større antal høje vil det være muligt at opbygge et bedre, statistisk repræsentativt, overblik over disse fortidsminders konstruktion.

19-10-2021
Bo Ejstrud

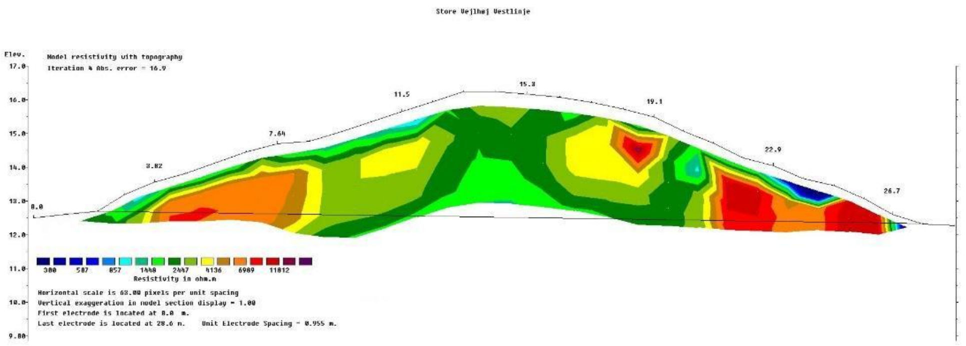
Endelige modeller







Figur 10. De tre modeller korrigeret for topografi og længdeforskydning (a= 0,955). Bemærk, at dette ændrer modellernes geometri en anelse. 1:200.



Figur 11. Vestlinjen korrigeret for topografi samt største faktiske måledybde (jf. figur 4.). 1:20