The lost landscape of Borgring: geoarchaeological investigations into the navigation to, and location of, the Danish Viking Age ring fortress

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ABSTRACT

Geoarchaeological investigations at Borgring, a recently identified Danish Viking Age ring fortress, reconstructs the original landscape showing how the site was expanded and modified to accommodate a structure of pre-defined size, and how this large-scale project demonstrates the willingness to invest significant resources in its precise positioning. The investigations also assess the possibility of navigating along the nearby stream from the coast and show that access by anything larger than a dinghy was impossible, hence navigability was not important for the location and function of the fortress. This has implications for the functional interpretation of all Danish Viking Age ring fortresses.

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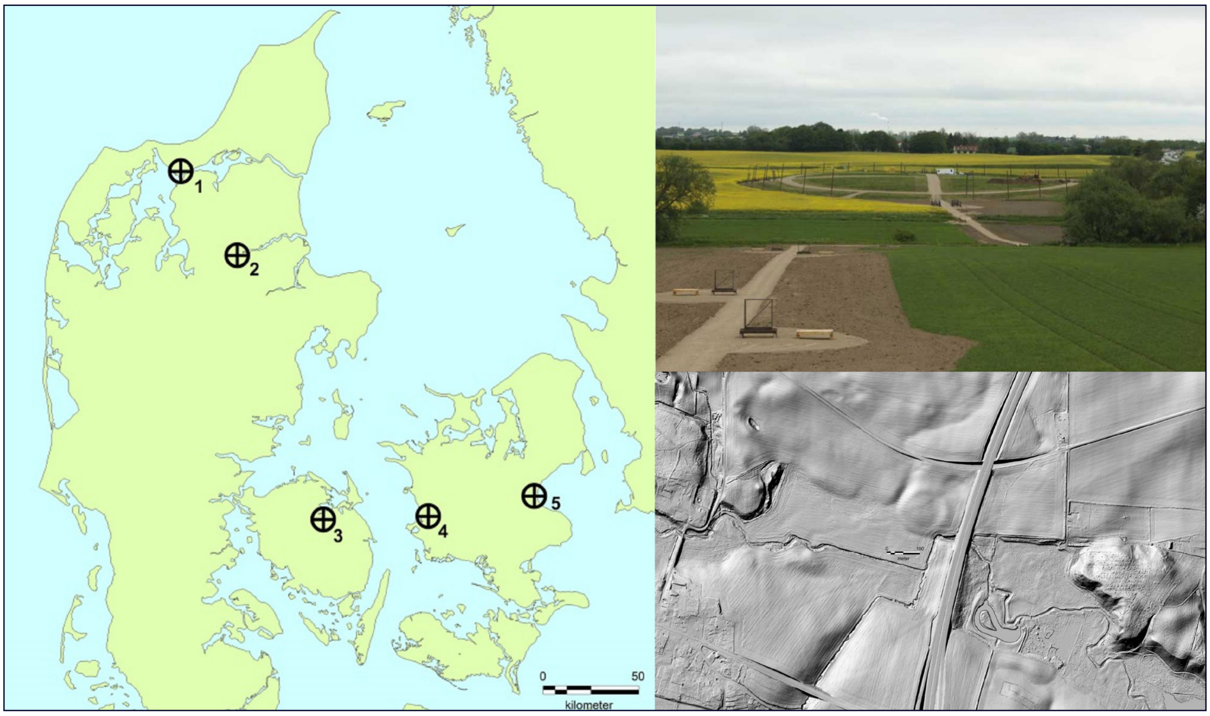

Figure 1. Map of Denmark (left) showing the five ring fortresses, 1) Aggersborg, 2) Fyrkat, 3) Nonnebakken, 4) Trelleborg and 5) Borgring. View of Borgring from the south (top right) showing the site during excavations (Photo: Museum Southeast Denmark) and LIDAR image of Borgring (bottom right) showing remaining ramparts and its position in the landscape.

Introduction

The role of the Danish ring fortresses has long been a source of speculation among scholars of the Viking Age. Until recently, we had evidence for four fortresses, two in Jutland (Aggersborg, Fyrkat) and one on both Zealand (Trelleborg,) and on Funen (Nonnebakken). A fifth fortress, Borgring, was recently identified on Zealand (Goodchild, Holm and Sindbæk 2017). All the fortresses were established within a short period of time during the AD 970s (Figure 1). The ring fortresses show construction standards of remarkable precision and geometry, forming an exact circle with an inner diameter of between *c.*120 and *c.*240 m. Four equidistant gates in the turf walls lead onto straight roads cutting the circle into four equal parts and in three (Trelleborg, Aggersborg and Fyrkat) of the five fortresses, there are remains of carefully planned houses of equal shape and size.

Ring fortresses are absent from contemporary and later written sources despite their monumental size and layout. Consequently, scholars have speculated on their function since the excavations of the first ring fortress, Trelleborg, in the 1930s and 1940s (Nørlund 1948). They seem to have been short-lived constructions with the remains of houses showing only limited use-wear and with negligible amounts of occupation debris (Olsen and Schmidt 1977, 97-100; Roesdahl and Sindbæk 2014, 255). While some scholars have suggested that the ring fortresses functioned as royal centres for administration and supply (Roesdahl 1977, 175; Roesdahl and Sindbæk 2014, 455) or as garrisons for external forces (Dobat 2009, 92), others suggest that they served a primarily symbolic function, cementing the power of kingship and its territorial rights (Ulriksen, Schultz and Mortensen 2020, 16-17). Function of the ring fortresses aside, the majority of their scholars have suggested that they were accessible by ship (Dobat 2013, 238-240; Nielsen 1990, 146; Nørlund 1948, 10; Olsen and Schmidt 1977, 40). Others disagree (Christiansen et al. 1989) and even though the difficulties of navigating Danish streams have been discussed (Ulriksen 2008, 163-167; Ulriksen 2011, 194-195), the idea has however persisted. This is perhaps due to the perception of a Viking culture, which was tightly intertwined with seafaring and ships, leading to the suggestion that access by ship to important, high-status sites located inland must have been possible. Many of these sites are positioned close to modern streams which are presently too narrow and/or too shallow to be navigated by all but the smallest of the known Viking vessels. Whether these streams were navigable during the Viking Age as a consequence of a) higher sea-levels and/or b) wider/deeper stream channels has been widely discussed (Andersen 1986, 12-14; Christiansen et al. 1989; Dobat 2013, 33-52; Nielsen 1990, 145-146; Nørlund 1948; Roesdahl and Sindbæk 2014, Ch. 8.2; Runge and Henriksen 2018, 5; Ulriksen 2008, 164; Ulriksen 2011, 192-194; Ulriksen, Schultz and Mortensen 2020, 10-12).

The recent identification of Borgring (Figure 1) has allowed an extensive excavation and survey of the site and its surroundings (Christensen et al. 2021; Goodchild, Holm and Sindbæk 2017; Ljungkvist et al. 2021; Mortensen et al. 2021; Ulriksen, Schultz and Mortensen 2020). This has provided the unique opportunity to address some of the long-established questions around the navigability of Danish streams during the Viking Age and contribute to the wider debate regarding the relationship between ring fortresses and seafaring. We therefore partly focussed our investigations at Borgring on a thorough assessment of the possibility of navigating the 4.5 km inland up Køge Stream from the Viking Age coastline to Borgring.

During the investigations on the fortress itself it became clear that there had been significant landscape modifications of the site prior to construction. Pre-construction modifications have already been documented at Fyrkat (Olsen and Schmidt 1977, 48) and Trelleborg (Nørlund 1948, 21) and this led our investigation to further focus on the Viking Age shape and form of the landscape and why this particular site was chosen as the location for the fortress.

Here we present the results of our geoarchaeological investigations relating to navigation, the Viking Age landscape and the required pre-construction modifications associated with the location of the Borgring ring fortress in the Køge Valley. We also discuss the research hitherto undertaken on the four other ring fortresses and we assess the implications of our results for our understanding of all Danish Viking Age ring fortresses.

Sea level change and the fluvial system of the Køge Valley

The modern streams associated with inland Viking Age monuments in Denmark are neither wide enough nor deep enough to allow navigation for even a modest-sized transport and cargo ship. These include Skuldelev 3, which was 14 m long, 3.28 m wide with a draught of 0.9 m (Crumlin-Pedersen

2002, 227) and the equally modest-sized warship, Skuldelev 5, 17.3 m long, 2.47 m wide with a draught of 0.54 m (Crumlin-Pedersen 2002, 276; Ravn 2016, 155). It is therefore essential to assess whether these streams were substantially wider or deeper during the Viking Age either due to higher relative sea-level or due to changes in the form and capacity of the stream.

Relative sea-level curves show the combined isostatic (post-glacial uplift/subsidence) and eustatic (sea-level) changes and account for the differential land uplift north and south of the hinge line in Denmark (Hansen, Aagaard and Binderup 2012). A relative sea-level curve produced through extensive analyses of sediments and the geology of the area around Præstø Fjord, southern Zealand suggested that relative sea-level in the Viking Age was ~1 m higher than present (Mikkelsen 1949). This sea-level curve has been used as an argument for how larger vessels could access the ring fortresses both at Trelleborg and Fyrkat (Christiansen et al. 1989) and other important Viking sites (Holmberg and Madsen 1998, 212). It appears to be the root of the perception that inland navigation in Denmark was possible. The only dating tool available in 1948-1949 to date the transgressions/regressions was biostratigraphic correlation using pollen zonation along with some consideration of the known archaeology and place names. There are, however, serious limitations and errors inherent in building a relative sea-level curve based on biochronostratigraphy and, although the work is extensive and well-argued, the 'Præstø' curve is neither as reliable, nor as secure, as more recent sea-level curves which are built on larger data-sets and AMS radiocarbon dating. These do not reproduce the higher sea-level seen around the Viking Age (Hansen, Aagaard and Binderup 2012; Hansen et al. 2016; Vink et al. 2007) and therefore offer no evidence that ships could navigate substantially further inland during the Viking Age than at present.

Even in the absence of raised relative sea-level it is still important to determine the form and capacity of the Køge Stream during the Viking Age and therefore whether it was possible to navigate to the fortress. Borgring sits on the northern bank of the Køge valley. This large valley was formed by the very high water discharges of the termination of the last glacial period. The modern stream between the ring fortress and the open sea meanders in the wider parts of the valley and is tightly confined in the narrower parts, making it impossible to navigate with a vessel longer than around 6-7 m. The valley is thus a relict formation and the present water discharge is only able to form a meandering river through the tunnel valley. Since the last glacial period the valley has filled with deposits (gravel, sand, silt and clay) concomitant with the fluvial system and organic material (peat and gyttja) associated with wetlands and lakes. Documenting how and when these sediments were deposited in certain locations determines whether the stream was navigable during the Viking Age. Our work therefore involved describing, mapping and dating the remaining valley sediments, assigning them a process, and therefore an environment, at a particular point in time.

The Viking Age stream

Figure 2 shows the sediments and stratigraphy seen in five transects with the most likely interpolation between 40 boreholes drilled. The major fluvial sediment types seen in the boreholes are channel and levee deposits (sands and gravels) and proximal flood plain deposits (organic silts and clays), along with wetland peat growth further away from the channel and lake deposits in cut-off former channels (gyttja). The channel and levee deposits can appear to stretch over many metres in the transects and could imply a large river system but these are the remnants of fluvial sedimentation in a laterally migrating meandering system rather than a deep and/or wide channel.

In the transects closest to the coast in the open, flat area (GKG-T1 and GKG-T3), expansive and thick layers of gyttja show the earlier presence of a lake. Peat growth above the gyttja shows that the lake gradually shallowed and infilled. The intermittent migration of the channel with associated erosion and infilling with sands and gravels is clearly seen in GKG-T3. The upper few sediments of the gyttja and peat units are dated to the Late Neolithic or Early Bronze Age (LuS 12254, 12255, 12898, 12899) (Table 1, Figures 2 and 3) indicating that the lake basin was infilled by this time and no longer open water. The lake deposits and wet-

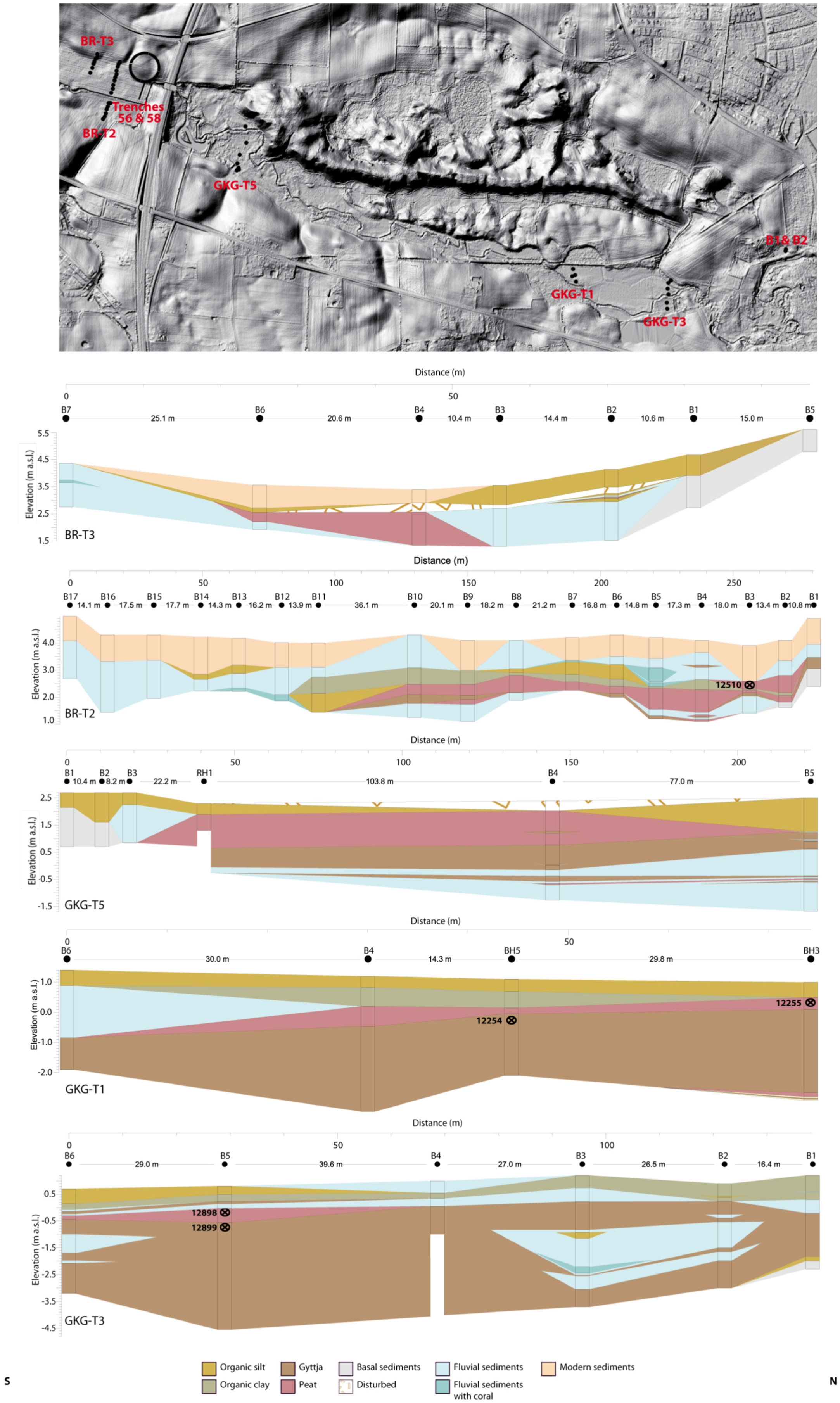

Figure 2. LIDAR image (top) of Borgring (black circle) and surroundings showing transect, trench and borehole positions south of the fortress and in the valley to the east. Borehole sediment data are also shown for each of the five transects with stratigraphic interpolations. Position ⊗ and 'LuS' code for radiocarbon ages are shown.

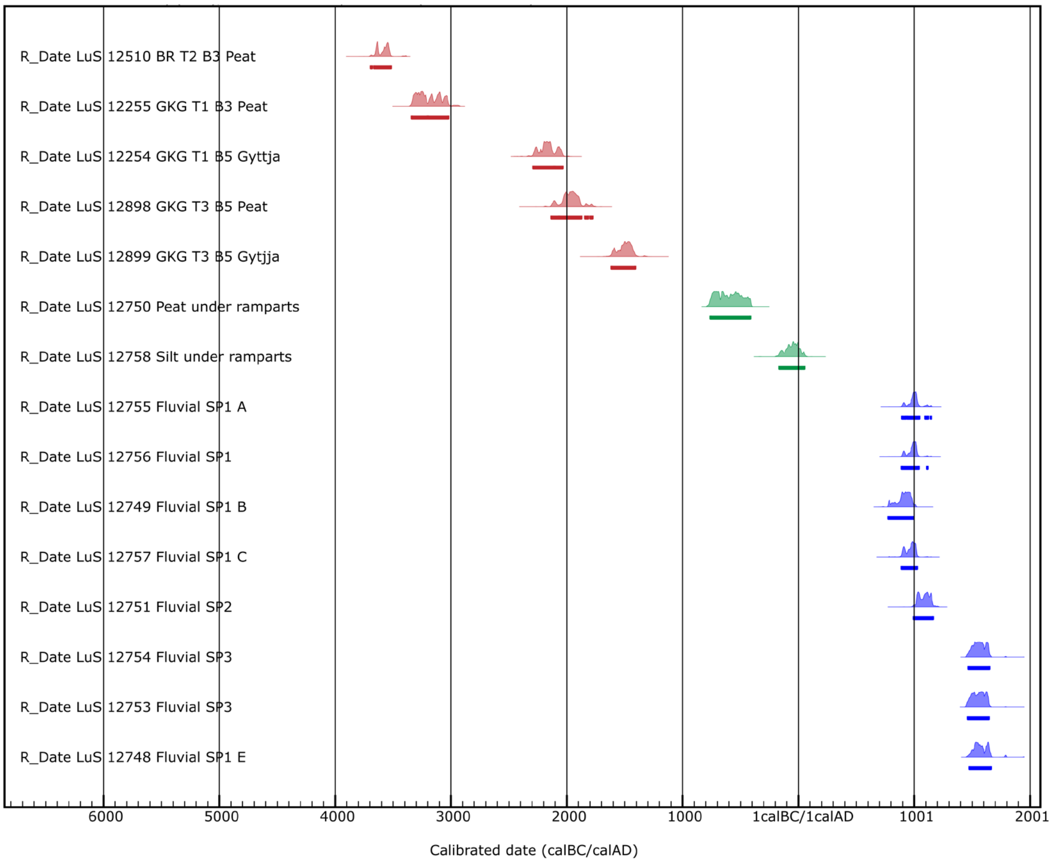

Figure 3. Calibrated age probability distributions of the 15 radiocarbon dates using OxCal v4.3.2 (Bronk Ramsey, 2009; Reimer et al., 2004). Colour groups refer to a focus on navigation (red), Viking Age land surface (green) and the stream position (blue).

land peats were then overlain by channel and proximal fluvial deposits and represent the meandering stream and the probable seasonal flooding of the valley. This was the most likely landscape context during the Viking Age.

Transects BR-T3 and BR-T2 (Figure 2) in the valley immediately south of the fortress show a more complex stratigraphy, partly due to cultural disturbance, partly due to more frequent boreholes. Transect BR-T2 stretches over the whole valley bottom and shows that in the south, erosion and infilling by fluvial sediments has removed any earlier sediments. Wetland, flood plain and some open water deposits are preserved in the north of the valley and the top of a peat from this position dates to 3665-3515 cal BC (BR-T2 B1).

It was only possible to locate the exact position of the migrating stream during a particular time period in one area. Immediately adjacent to the ringfort an 80 m long trench stretching south from the rampart into the valley (Trenches 56 and 58) traces the movement of the stream towards the ramparts between the Late Bronze Age/Early Iron Age until the Medieval Period (Figures 4 and 5, Table 1). Peat at the base dates to 760-410 cal BC (LuS 12750) above which there is a layer of organic silt. This same organic silt layer is found beneath the ramparts (not shown) and dates to cal 170 BC-cal AD 55 (LuS 12758). Four phases of incision by the stream encroaching from the south into these two sedimentary units were identified (Stream Phases (SP) 1-4). The incisions are infilled by organic silts with unevenly laminated sand layers typical for this type of environmental context. The age of this series of stream movements is dated by material found within their infill. SP1 is seen at four points in the trench (Figures 4 and 5, A, B, C and D). At Position A (Figure 4) a piece of oak timber found in the infill of SP1 is dated by dendrochronology to after 966 AD (Daly 2017). Also at Position A and from SP1 are numerous flax (*Linum usitatissimum*) stems and seed capsules dating to cal AD 890-1120 (LuS 12755) and beech (*Fagus sylvatica*) seeds dating to cal AD 890-1040

Lab. no. (LuS)	Sample	Position	Material	Sample weight (mg)	^{14}C age (BP)	Calibrated age (2 std interval)
Navigation						
12510	BR-T2 B3	Peat 132-137 cm	Unidentified twig	1.6	4815 ± 40	3665-3515 cal BC
12255	GKG-T1 B3	Peat 67-72 cm	Terrestrial seeds	0.7	4465 ± 35	3340-3020 cal BC
12899	GKG-T3 B5	Gyttja 140-145 cm	Terrestrial seeds	4.0	3220 ± 50	1615-1405 cal BC
12898	GKG-T3 B5	Peat 83-88 cm	*Alnus* seeds	6.9	3605 ± 50	2135-1775 cal BC
12254	GKG-T1 B5	Gyttja 86-91 cm	Terrestrial seeds	1.3	3755 ± 40	2290-2035 cal BC
Viking Age land surface						
12750	Profile 58 P171	Peat under ramparts	Terrestrial seeds	5.9	2460 ± 40	760-410 cal BC
12758	Profile 58 P187	Silt under ramparts	*Fagus* charcoal	8.1	2040 ± 40	cal 170 BC-cal AD 55
Stream position						
12755	Profile 58 P176A	Fluvial SP1. Pos.A	*Linum usitatissimum* seeds	3.1	1035 ± 40	cal AD 890-1120
12749	Profile 56 P156	Fluvial SP1. Pos.B	*Sparganium* seeds	10.6	1125 ± 40	cal AD 775-995
12757	Profile 58 P186	Fluvial SP1. Pos.C	*Linum usitatissimum* seeds	12.3	1065 ± 40	cal AD 890-1025
12756	Profile 58 P176B	Fluvial SP1	*Fagus sylvatica* seeds	16.9	1045 ± 40	cal AD 890-1040
12751	Profile 58 P172	Fluvial SP2	*Scirpus maritimus* seeds	15.4	960 ± 40	cal AD 995-1165
12754	Profile 58 P175	Fluvial SP3	*Linum usitatissimum* seeds	3.9	320 ± 40	cal AD 1465-1650
12753	Profile 58 P174	Fluvial SP3	*Rumex* sp. seeds	5.6	335 ± 40	cal AD 1460-1645
12748	Profile 35 P22	Fluvial SP3. Pos.E	*Secale cereale* seeds	13.4	300 ± 40	cal AD 1470-1665

Table 1. AMS radiocarbon dates calibrated using OxCal v4.3.2 (Bronk Ramsey, 2017; Reimer et al., 2013).

(LuS 12756). At position B numerous bur-reed (*Sparganium* sp.) seeds date to cal AD 775-995 (LuS 12749) and at position C, flax stems date to cal AD 890-1025 (LuS 12757). Additionally, a Viking Age-type timber wheel hub was found at Position D. Although it is unclear if the oak timber and wheel hub are redeposited from upstream, the flax stems with attached seed capsules could not

Figure 4. Position of excavated profiles and trenches (green) together with the rampart outline (black). The background map from AD 1897 (Kortforsyning, 2019) is superimposed upon a modern, spring satellite image. The lower image shows one of the profiles (position X) with the base of the modern sediments (green line) and base of the levelling material which, in this case, is also the Viking Age land surface (pink line) (Photo: Museum Southeast Denmark).

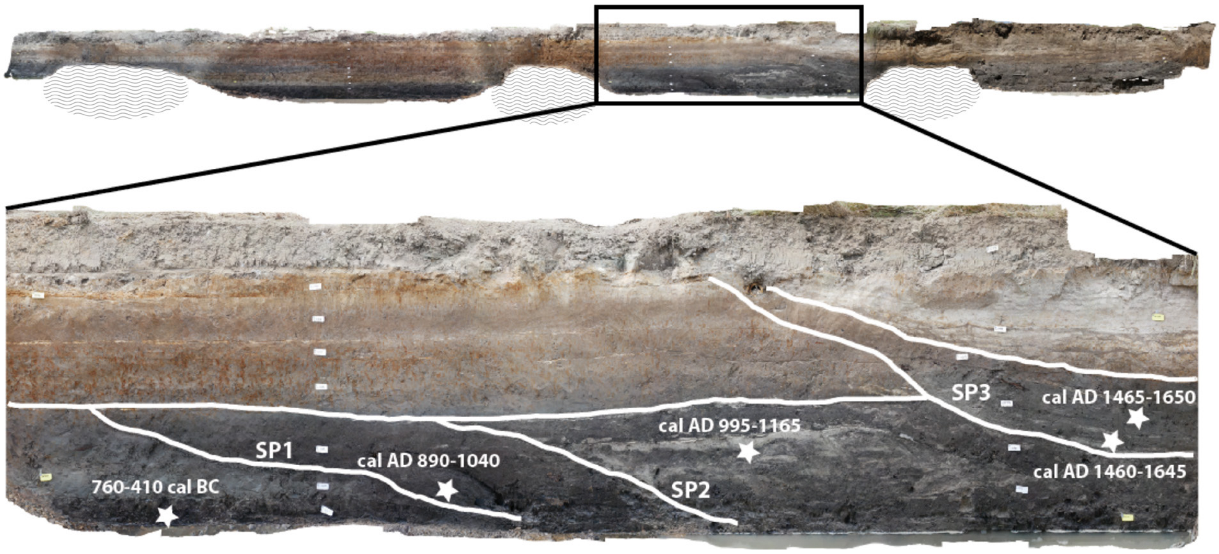

Figure 5. Upper image shows Trench 58 (see Fig. 4). The enlarged section in the lower image shows Stream Positions 1, 2 and 3 and the positions of the calibrated ages. The wavy lines indicate drain positions (Photo: Museum Southeast Denmark).

Figure 6. The possible stream course during the Viking Age (Photo: SDFE, Agency for Data Supply and Efficiency).

survive redeposition and must therefore be in their original position.

Further incisions showing the stream moving towards the fortress at SP2 (cal AD 995–1165 (LuS 12751)) and SP3 (cal AD 1465–1650 (LuS 12754)) are separated by a clay-rich layer seen in the boreholes as covering much of the valley in front of the fortress. The latest incision (SP4) seen in the trench is filled with sandy sediments and close to the stream position seen in a cadastral map from 1805 (Geodatastyrelsen, 2019). These same sediment layers were also identified at Position E (Figure 4) and dated to cal AD 1470-1665 (LuS 12748).

The above evidence allows a tentative conclusion on the position and dimensions of the stream in front of the fortress at the time of its construction. The extant stream most likely ran close to the northern edge of the valley cutting the sediments in BR-T2 B1 (Figure 6), crossed the trench at positions A and B, then doubled back to cross it again at position C and once again at D (Figure 4). Stream dimensions seen in Trench 58 resemble

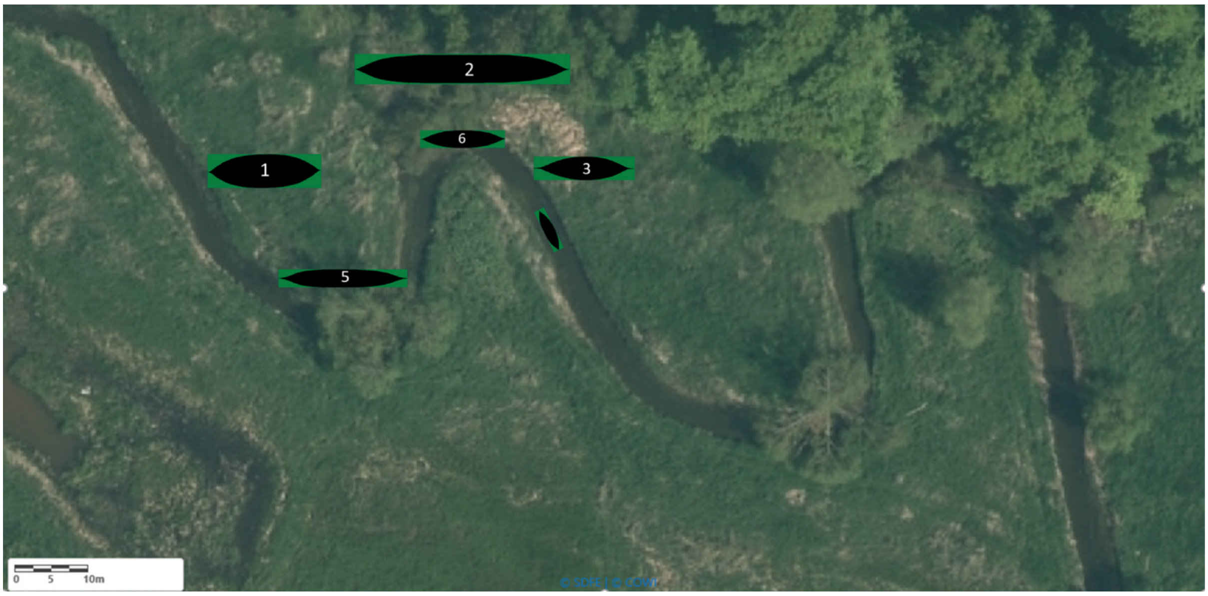

Figure 7. Modern image of the meandering stream Køge Å with the relative size of some of the known Viking ships. The Skuldelev ships: 1 (16.0 m long), 2 (29.2 m long), 3 (14 m long), 5 (17.3 m long), 6 (11.2 m), and the smaller Gokstad dinghy (6.5 m long) (Photo: SDFE, Agency for Data Supply and Efficiency).

those of the freely meandering lengths of the present-day stream.

The sediments and stratigraphy investigated for navigational potential further downstream in the Køge valley and the sediment ages obtained for the infilling of the lake basin also indicate that the stream was neither wider nor deeper during the Viking Age than it is today. The present stream is 3-5 m wide and no more than 0.5-1 m deep with tight meander turns. During winter the whole valley bottom is generally under up to 0.5 m water and the stream is only constrained within its channel in dry seasons. Figure 7 shows a typical section of the stream upon which are scaled images of the Viking ships from the 11th century Skuldelev-barrier in Roskilde Fjord (Crumlin-Pedersen 2002) and the small dinghy from the c. 900 AD Gokstad ship grave in Norway (Nicolaysen 1882). It is clear that only the dinghy could fit in the channel, though rowing would have been impossible. Towing a boat upstream was probably only rarely an option as waterlogged conditions in most years prevented a firm surface underfoot (Ulriksen 2011, 195). In conclusion, the stream in the Køge Valley was no wider nor deeper in the Viking Age than it is today and it would not have been possible to navigate to the Borgring ring fortress.

Reconstructing the Viking Age landscape of the fortress and the pre-construction modifications

The setting of Borgring ties in with the question of the function of the Viking Age ring fortresses. Our investigations considered both the landscape in which Borgring was located and the modifications of the landscape needed to construct it in this position.

The modern geomorphology of the immediate area around Borgring is heavily influenced by ploughing and without LIDAR imagery the ring fortress is almost invisible in the landscape. It is positioned on the northern bank of the valley, with a gully of a former stream (now controlled by a buried drain) to the west and a depression to the northeast. These features are for the most part not especially pronounced and the whole area was under cultivation until recently. The motorway and its construction debris limits access to the areas east of the eastern gate (Figure 1).

Careful observations of the sediments from cores and profiles have allowed their separation into six main units: 1) pre-Holocene deposits; 2) channel and levee deposits; 3) floodplain deposits (including peats); 4) oxbow lake deposits; 5) Viking Age levelling layers and 6) post-Viking Age deposits. These

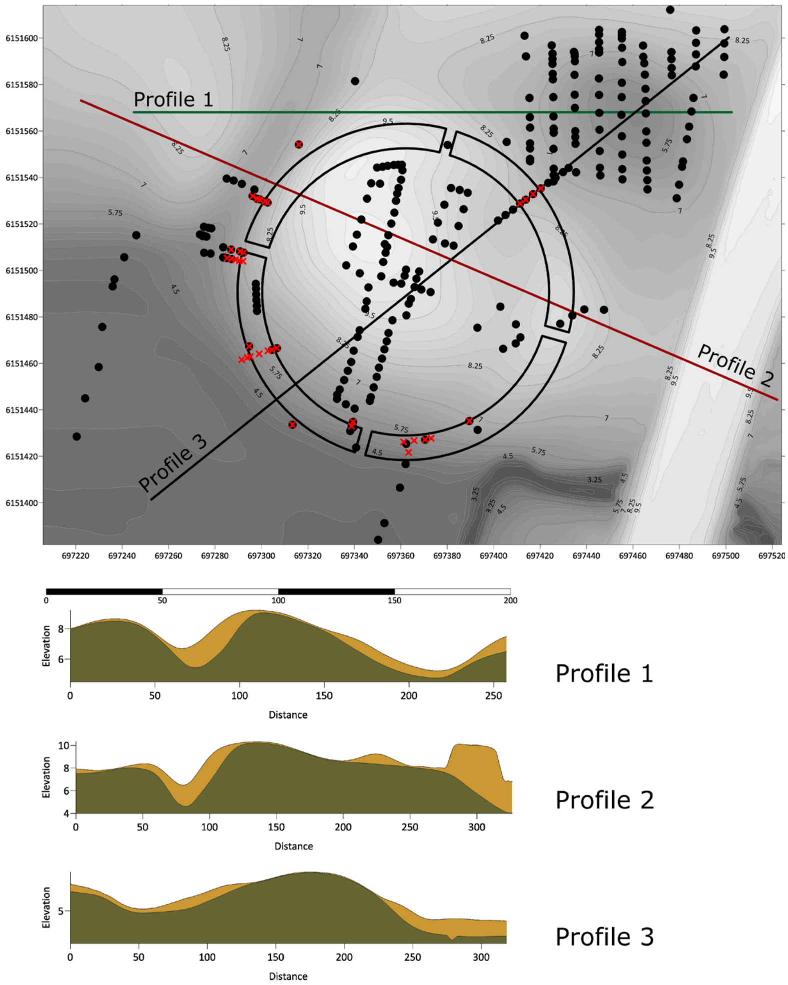

Figure 8. Contour map of the modern landscape showing data points for the Viking Age land surface (black circles) and levelling layer (red crosses). The position of the ramparts and gates are indicated by the black circle. Profiles 1, 2 and 3 show the Viking Age land surface (green) and the modern sediments (brown). The levelling layers are not shown.

units in each of the profiles and cores were designated as either Viking Age land surface, levelling layers, or post-Viking Age deposits based on field observations, radiocarbon dating and stratigraphic succession. XYZ coordinates for each of the land surfaces were fed into modelling software (Surfer v.16) and gridded using the kriging option which interpolates between the irregularly spaced data points and generates a contour map. The resulting contour model was then checked against observed levels and adjusted in some areas, e.g. the extension of the depression in a south-easterly direction (see below).

Figures 8 and 9 show the landscape reconstruction in both cross-section and 3D image along with the data points used for the Viking Age land surface and the pre-construction levelling modifications.

The Viking Age land surface

The Viking Age land surface in the valley bottom was identified as either the surface of the channel and levee deposits (sands and gravels) or the surface of the floodplain deposits (silts and clays), including the peat growth in wetlands further away from the channel. On the slopes of the tunnel valley the Viking Age land surface was identified as the surface of peat growth in the depression to the northeast, as the base of the gully to the west and as the modern surface where only thin soils covered the Pre-Holocene clays (Figure 9b). All of the dated material from these layers give a pre-Viking Age date (LuS 12510, 12758 and 12750) (Figures 2 and 3 and Table 1).

Whether the area outside the eastern gate was a ridge continuing eastwards was important with regard to access to the ring fortress. Although no data is available for this area, as it is now beneath the modern motorway, the topographical map drawn in 1897 (Kortforsyning 2019) shows that the depression to the northeast continued in a south-easterly direction. It is highly likely that this was also the case during the Viking Age. This is supported by evidence from a borehole located close to the modern stream channel and outside of the modelled reconstruction (Figure 4, B1) where basal sediments are positioned at an elevation of +3.24 m (DVR90). The resulting Viking Age surface to the east of the eastern gate (Figure 9) is therefore an estimation based on the elevation of the depression to the northeast of the ring fortress, the borehole elevation data and the necessary slope towards the reconstructed Viking Age stream position.

The resulting model shows greater landscape relief than at present. To the south, northeast and east the ramparts lay directly adjacent to the wetland areas of either the depressions or the valley, both of which restrict ease of access. The valley was also likely to have been flooded for much of the winter. To the west the gully, together with the ramparts, would have created a very steep and deep barrier to access. Taken together, the evidence suggests that the only year-round dry access to the ring fortress was from the north, through the northern gate.

Pre-construction levelling modifications

The Viking Age land surface did not allow for a ring fortress of 144.5 m external diameter (Goodchild, Holm and Sindbæk 2017) without expanding the area. To create this additional space and a solid foundation for the ramparts, a clay-rich levelling material with variable quantities of inclusions (coarser silt, sands, ceramics and flint knapping debris) was laid directly beneath the ramparts to the northeast, east and south where the ground was sharply sloping and/or waterlogged (Figures 8 and 9). These clays were probably collected locally and in some profiles are very similar to the post-Viking Age sediments. We estimate that ~1900 m^3 clay was used for the levelling layer.

The modern land surface

The elevation of the present land surface (Figure 9a) was modelled using LIDAR data points (not shown). In the post-Viking Age period the landscape was smoothed by intentionally depositing material (up to 1.5 m thick) in the depressions and the valley, presumably to improve conditions for cultivation (Figure 8). The relative invisibility of the fortress in the landscape is, along with the collapse of the ramparts, due to the deposition of these post-Viking Age deposits and later ploughing.

Discussion

Our investigations in the Køge valley show that it was not possible to navigate to Borgring in anything larger than a dinghy. We can, therefore, rule out navigability as a factor in the location of Borgring. Recent investigations have also ruled out sailing to the ring fortress at Nonnebakken (Figure 1) (Runge and Henriksen 2018, 4-6) but research regarding navigability to the remaining ring fortresses has, excepting Aggersborg, been mainly inconclusive. The navigability of Trelleborg, Fyrkat and Aggersborg has recently been examined (Dobat 2013). Aggersborg lies on the Limfjord coast and direct or nearby access by ship was possible. At Fyrkat, it was argued that the Onsild Stream may have made navigation possible during the Viking Age, though there are indications that swamping of the stream began in this period, making the evidence inconclusive (Dobat 2013, 236). The 1808 cadastral map (Geodatastyrelsen, 2019) depicts the stream 2 km downstream from Trelleborg (Tude Å) as 8-10 m wide with tight meander turns. A dam across the stream, forming a barrier during the Medieval Period, may (Christensen 2014, 321; Christiansen et al. 1989, 41) or may not (Dobat and Mandrup 2014, 330; Mandrup 2013, 65-68) have existed during the time of the ring fortress. A layer of Roman Iron Age brushwood beneath this dam (Christiansen et al. 1989, 36) and possibly belonging to a ford, indicates that the stream was shallow at this time. Together the data suggests that the stream passing Trelleborg was narrow, shallow and with tight meander turns and thus unsuitable for navigation. The mouth of the stream formed a natural harbour (Nørlund 1948, 8) and if navigability was a priority for the function of Trelleborg, it could have been placed north of the valley and closer to this harbour. Similarly, the coastline around Fyrkat offers several potential locations with sea access and placing Fyrkat further inland suggests that navigability was not important here either. Apart from Aggersborg, none of the Danish ring fortresses provide definite evidence for being accessible by ship.

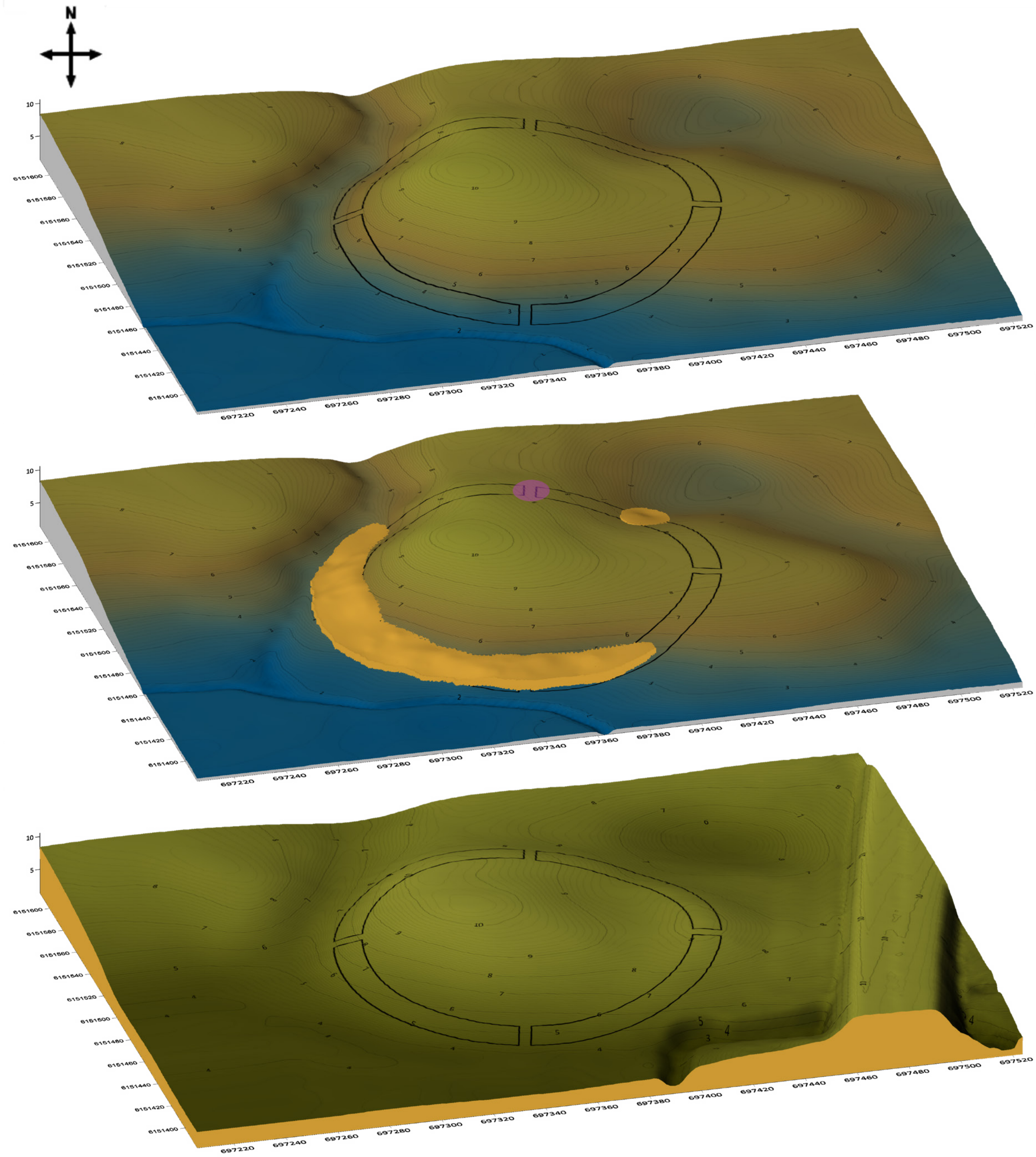

Figure 9. Results of the landscape model showing the Viking Age land surface and stream position (top), the Viking Age land surface with levelling layers in orange (middle) and the modern land surface and stream position (base). The black circle indicates the ramparts. The pink area shown together with the levelling layers indicates further probable levelling beneath the northern gate, which was observed during the excavation, but not included in the model.

The positioning of all ring fortresses was clearly premeditated and carefully chosen. Their remarkable precision and stringent layout corresponds to the observed large-scale pre-construction modifications of the landscape. As we have seen at Borgring, the site chosen had to be expanded even though other less labour-intensive positions were available in the immediate vicinity. Considerable landscape modifications were also observed at Fyrkat and Trelleborg. At Fyrkat, the top of the hill was levelled to make an even surface for the construction of houses (Olsen and Schmidt 1977, 48) and the south-facing slope was infilled to create sufficient surface area. Similarly, a massive levelling layer was added to the southwest at Trelleborg (Nørlund 1948, 21), infilling it downslope. All three ring fortresses could have been placed at a number of locations in the nearby region where pre-construction modifications were unnecessary. The exact location clearly played an important role.

We suggest that the function of the ring fortresses was unrelated to navigation but tightly tied to specific locations. An element of defence may have played a role, as can be seen from their construction, but the strict layout, short use-life, and especially the importance placed on location to the extent of modifying the landscape extensively, all suggest that the ring fortresses primarily served a symbolic role. Ulriksen, Schultz and Mortensen (2020, 16-17) propose that they were likely manifestations of a new societal order following the conversion to Christianity of King Harold Bluetooth. They were placed near major routes of transportation, meant to be highly visible, and were prominent reminders of the presence of the King. It is notable that their abrupt disuse and, in the case of Borgring, Fyrkat and Trelleborg, their partial deliberate destruction by fire, occurred shortly after the violent death of King Harold in AD 986/987.

Conclusions

These investigations have unambiguously concluded that Køge Stream was unfit for navigation during the Viking Age. Evidence from Fyrkat, Trelleborg and Nonnebakken indicates that navigation was also unlikely. Only the position of Aggersborg offered easy access by ship. In conclusion, navigability was not essential for the function of the Viking Age ring fortresses.

Our investigations around Borgring show that the landscape has been drastically altered since the Viking Age. The original shape of the building ground was reconstructed from our investigations along with the large-scale levelling required to accommodate the ring fortress. Similar construction works were observed at Fyrkat and Trelleborg. The resources invested in the construction of the ring fortresses show that the builders vested specific locations with particular importance, regardless of the character of the landscape. Visibility near major routes of transportation and magnate residences appear to have been decisive factors in choosing locations.

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