A LATE BRONZE AGE SHEEP FARM NORTH OF THE ARCTIC CIRCLE?

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ABSTRACT
In this article, we present a discussion of Late Bronze Age farming close to the northern cereal limit in Norway based on archaeological and palaeobotanical evidence from Sandvika, Tromsø municipality, Troms County. Here, a three-aisled longhouse was constructed on a meadow close to the marine shoreline between 1000 and 800 BC. We propose that the site represents a short-term settlement with Nordic Bronze Age characteristics and, based on the presence of bone fragments found in association with a fireplace, an economy relying on both animal husbandry and fishing/hunting. No clear evidence of cereal cultivation was found at the site, although the climate at this time would have been suitable and indications of cereal growth are seen in the palaeobotanical records of other sites in the vicinity. However, there is evidence that the site was exposed for several hundreds of years after its abandonment, and the absence of proper indicative plant macrofossils might also be explained by taphonomic loss.

INTRODUCTION
The discovery of a three-aisled longhouse in context with other archaeological features and artifacts typically associated with Nordic Bronze Age settlement as far north as 69°36' N (Arntzen 2015a) adds a new dimension to the debate on farming as part of a sustainable economy and a possible prerequisite for permanent settlement in this region. However, with the exception of burnt bone fragments identified as sheep or goat, possibly predating the house remains by c. 200 years, there is no unequivocal evidence of farming from the house site. The lack of cereal grains in the botanical subfossil records and absence of other features directly related to agriculture (e.g. traces of primitive ploughing or well-developed field layers), does not strengthen a hypothesis of intra-site cultivation. In this publication, we will discuss the empirical data from the site with a particular emphasis on examining the plausibility of farming, and will, in this respect, relate our results to other comparable investigations in the region.

The main focus will be on the archaeological and botanical finds.

Previous research involving perspectives on Bronze and Early Iron Age agriculture in northern Norway was limited by the type and quality of evidence available. Archaeologists have discussed the small amount of bronzes, rock carvings, cairns, and asbestos ceramics within the region as a possible link to southern farming communities, although in the main they have been understood as evidence of only a slight cultural influence amongst otherwise hunter-fisher-gatherer settlements (Munch 1966; Bakka 1976; Johansen 1982; Jørgensen 1986; Olsen 1988; Andreassen 2002). The older evidence in most cases consists of finds lacking a reliable context, therefore the Sandvika site, along with other new evidence (cf. Arntzen 2013a), nuances and expands the basis for interpretation in studies of Bronze Age farming.

The most reliable botanical evidence of cereal growth is ^{14}C-dated cereal grains retrieved from field layers or other archaeological features, preferably in a context with other objective proof of cultivation to correct for import. Very few investigations meeting these criteria have been carried out in northern Norway. The empirical foundation for research on early agriculture in the north is dominated by indirect proofs, such as stray finds of cereals in a context dated by archaeological typology or charcoal, or from pollen analyses performed on mire or lake sediments with varying stratigraphical and chronological control. The general pattern regarding the development of the cultural landscape is nevertheless strikingly comparable with results from coastal areas further south in Norway, particularly from the Late Bronze Age and Pre-Roman Iron Age onwards when the impact from grazing and subsequent mowing is an essential driving force. The most controversial issues of the debate concentrate on the interpretation of early observations of cereals and cereal pollen types among other anthropogenic indicators from contexts dated to the Neolithic and Bronze Age (Vorren 1986, 2005; Vorren et al. 1990; Sjögren and Arntzen 2012; Jensen 2012; Lahtinen and Rowley-Convy 2013). These overlap in time with the introduction and consolidation of agriculture in both southern (e.g. Høgestøl and Prøsch-Danielsen 2006; Prøsch-Danielsen and Soltvedt 2011; Hjelle et al. 2012) and central Norway (Solem 2002), and may be seen as evidence of attempts to introduce a new economy.

An archaeological survey project at Sandvika in 1994 (Helberg 1994), resulted in the surprising finds of asbestos tempered ceramics, part of a bronze casting mould, a piece of a thin-walled soapstone vessel, and palynological indications of farming impact on a nearby mire (Tveraabak and Alm 1997). A single ^{14}C-date of charcoal, now known to derive from the "collapse context" of a house, indicated activity in the Late Bronze Age/Pre-Roman Iron Age. Detailed information about the subsequent archaeological research excavation in 2013 is given in Arntzen (2015a).

STUDY AREA AND SITE DESCRIPTION

Sandvika (18°5'30"E, 69°36'40"N) is a north facing shallow bay situated on the southwestern coast of a large island, Kvaløya, west of the town Tromsø in northern Norway (Figs. 1, 2). The landscape is coastal alpine where the tallest mountain on this part of Kvaløya is 566 m a. s. l. and an outer archipelago somewhat shields against the open ocean. The present settlement in this area is located on the strandflat, scattered or in small fishing villages, typical of the traditionally dominant economy of fishery in combination with small-scale farming. There is no permanent settlement in Sandvika today. The climate is markedly oceanic and the site lies within the vegetation ecological region classified as northern boreal, or the northern conifer-birch zone (Moen 1999). The mean annual temperature during the last

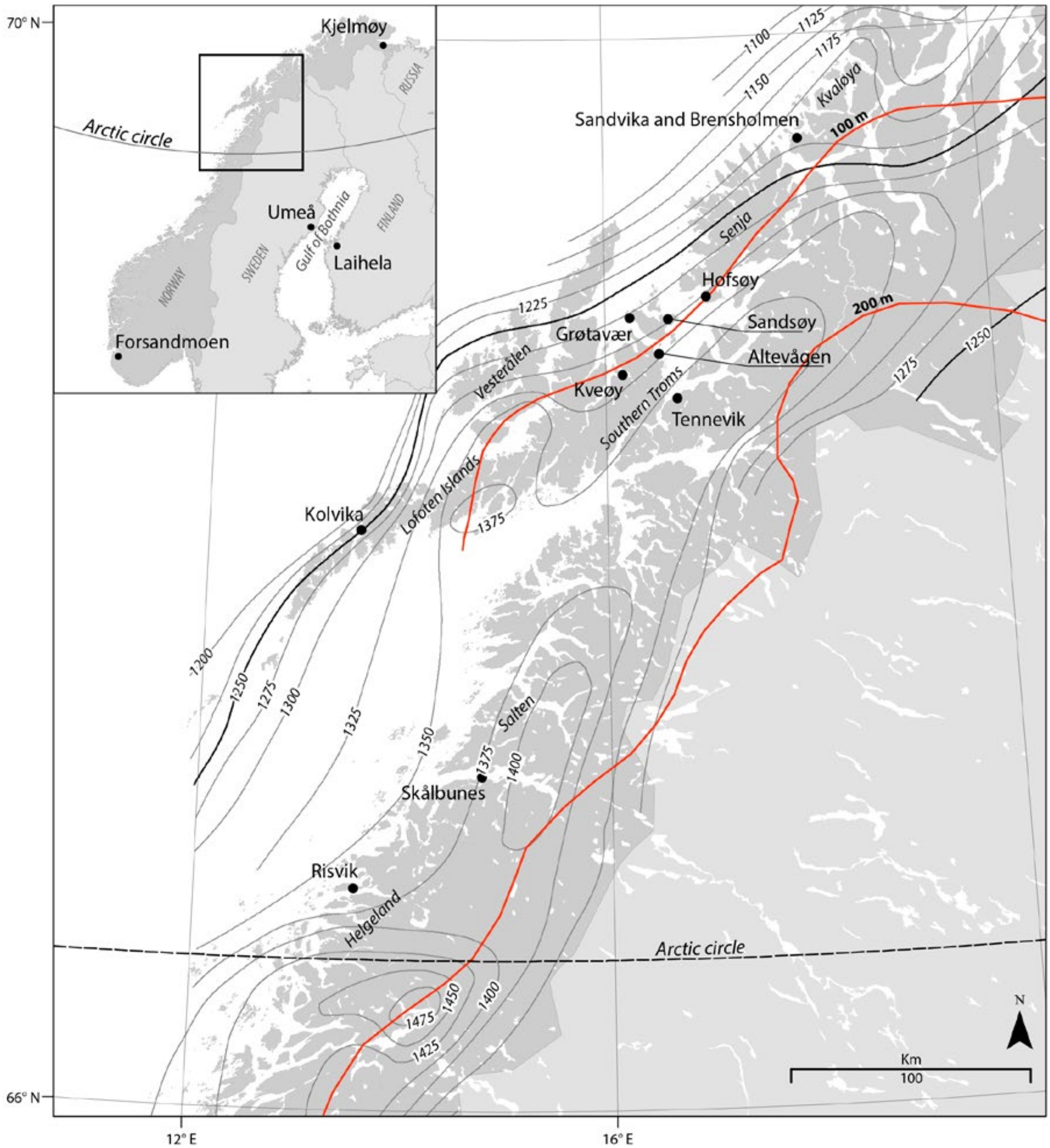

Figure 1. Map of the geographical region comprising the northern limit of cereal growth in Norway with Sandvika and other sites mentioned in the text included. The midboreal altitudinal limit is shown with red countours (Moen 1999), while day degree isotherms are marked with grey contours (Fjærvoll 1961). The 1250-isotherm is highlighted in black.

Figure 2. The Sandvika excavation site, Tromsø. Photo towards north 17.3.2013.

normal period (1961-1990) at Sommarøy, c. 3 km NW of Sandvika, is 3,9 °C, July and January mean temperatures are 11.9°C and -1.9°C respectively (Aune 1993), while the mean annual precipitation is 940 mm (Førland 1993).

The excavation site is located 360 m south of the present marine shoreline, at 10 m a. s. l., which is close to the local maximum sea level of the Tapes transgression. The marine limit is 40 m a.s.l. (Vorren et al. 2013). A tentative sea level curve for the Sandvika area, calculated with software developed by Møller and Holmeslet (2002, see also Møller 1989), renders a sea level of c. 5 m a. s. l. around 3000 years ago (Vorren et al 2013). The present vegetation consists of herb-rich tidal meadow behind the sandy beach, while dwarf shrub heathland, birch woodland and extensive mires with two main brooks dominate the area between the tidal meadow and the excavation site.

MATERIAL AND METHODS

Based on the hypothesis that the find types present in Sandvika could indicate agrarian settlement, a research-initiated excavation was conducted in 2013 (Arntzen 2015a). Experience gained from previous excavations in the region, particularly the Kveøya investigations (Arntzen and Sommerseth 2010; Sjögren and Arntzen 2012; Arntzen 2013b), favoured an interdisciplinary approach including botanical, phytolithic and entomological analyses.

Due to an unexpectedly high water table, two large drainage ditches had to be excavated around the site before the excavation could commence. Two drier areas with positive finds of settlement remains

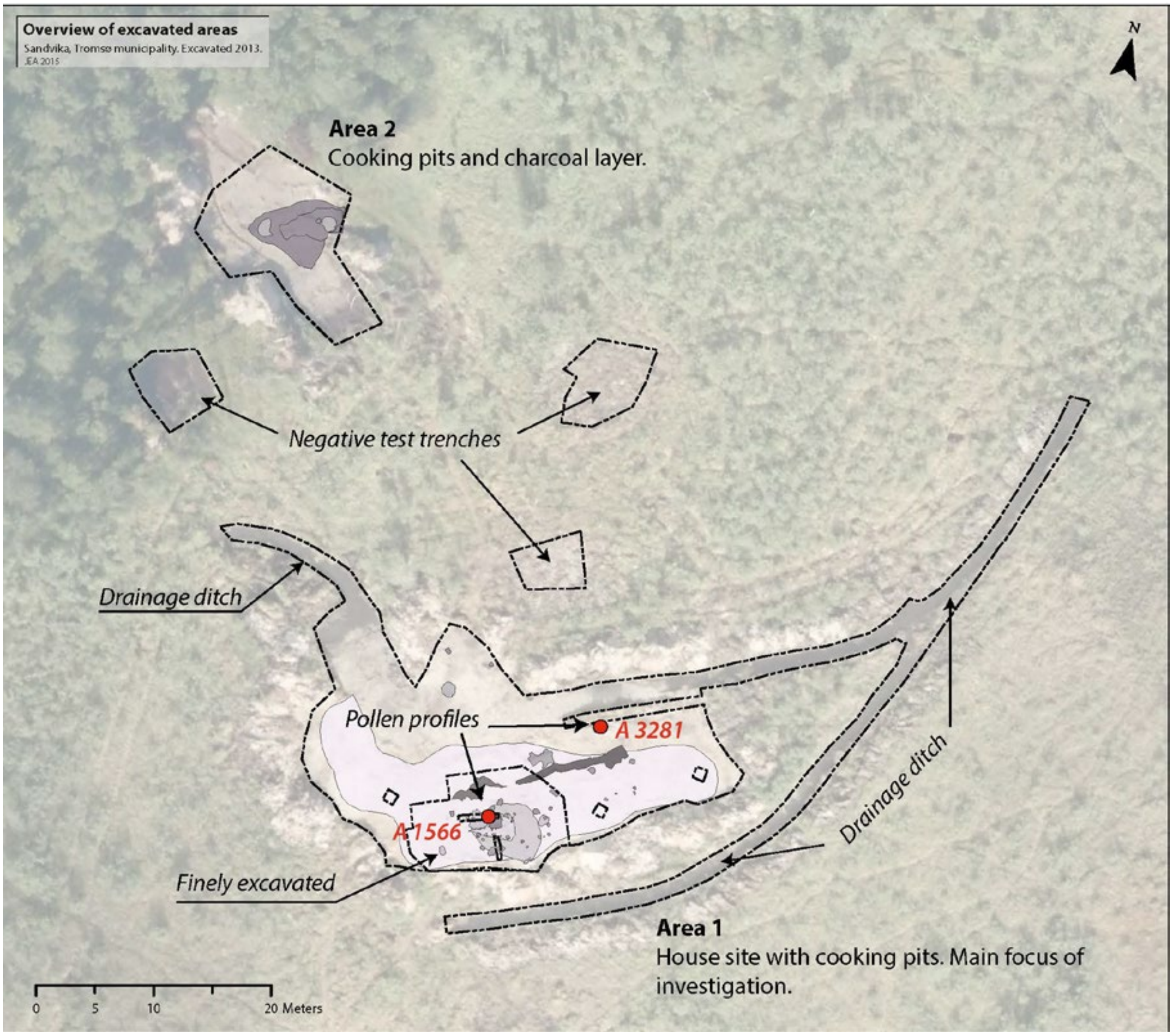

Figure 3. Overview of the excavated areas in Sandvika. Ortophoto © Geovekst**.**

were thereafter stripped of topsoil by a mechanical excavator. Area 1 had a total extent of 688 m^2, and resulted in the location of a longhouse, two cooking pits, as well as the large majority of the artifacts recovered. Area 2, which was situated 30 meters north of Area 1, covered 140 m^2 and resulted in the identification of charcoal mixed deposits as well as two cooking pits (Figs. 3, 4). The main effort during the fieldwork was focused on Area 1. Here a 100 m^2 grid was laid out enabling detailed excavation (Arntzen 2015a).

Plant macrofossil samples were gathered from all features and the floor layer of the longhouse. Vertical soil profiles through the central part of the collapsed house as well as from the outskirts of the activity area were subsampled in the field, primarily for microfossil

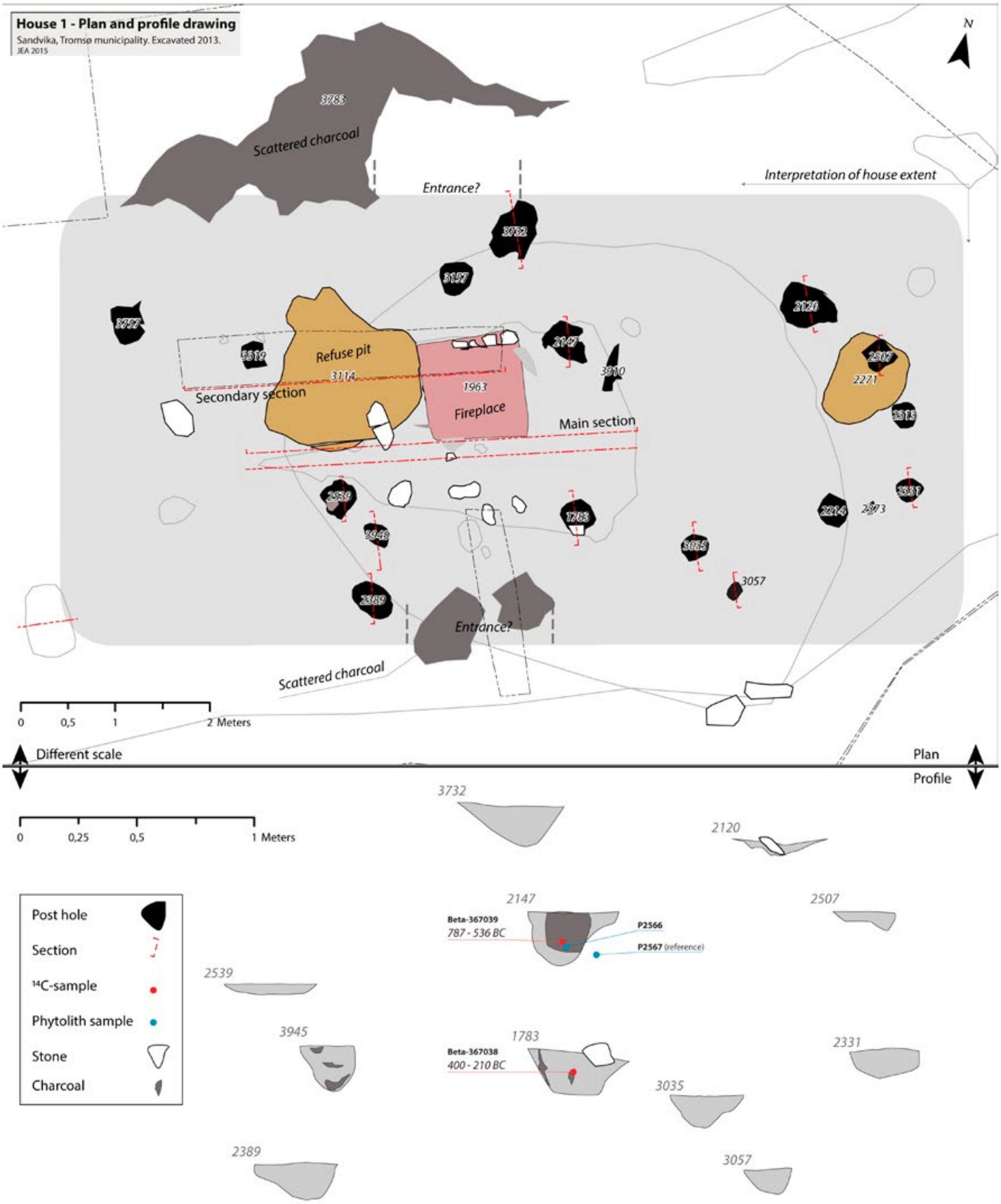

Figure 4. Plan- and profile drawing of House 1 in Sandvika.

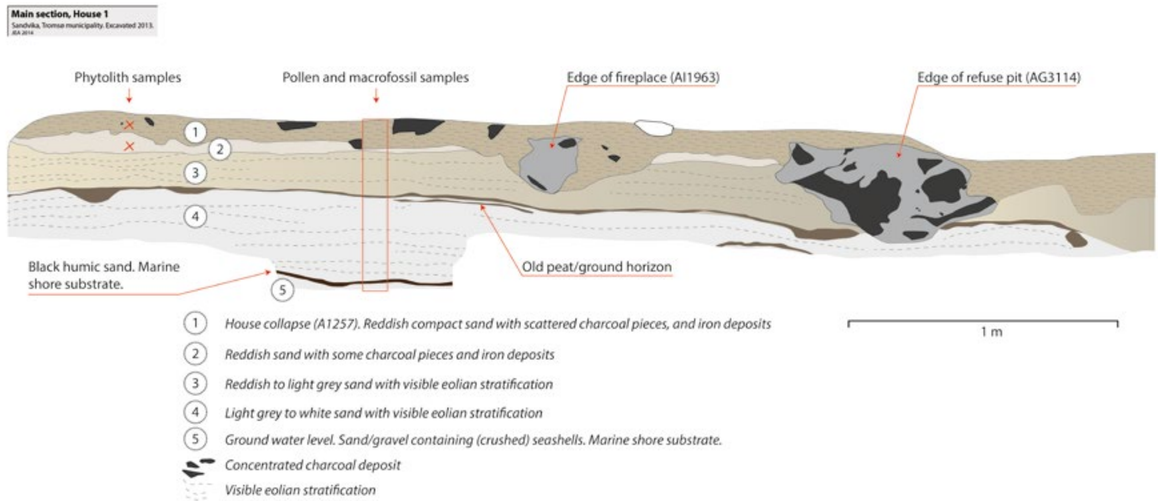

Figure 5. The main section of the excavated house in Sandvika, marking the place of botanical sampling.

(pollen) analysis, but also for macrofossil analysis (Figs. 4, 5). Laboratory preparation of pollen samples involved treatment with hydrofluoric acid (HF) and potassium hydroxide (KOH) in addition to standard acetolysis according to Fægri and Iversen (1989). For the calculation of pollen concentration, 2 tablets of *Lycopodium clavatum* spores were added prior to the acetolysis. The pollen content was too low to justify the calculation of percentages, and results are thus presented as concentration, i.e. numbers per unit of volume. The pollen identification follows Fægri and Iversen (1989), Moore et al. (1991) and Beug (2004), while plant macrofossils were identified with the help of Cappers et al. (2006), the reference collection at the University of Stavanger and personal communications. Calibrated radiocarbon ages are given as calendar year ranges at a 2σ level and all calibrations have been performed by the authors using Calib 7 (Stuiver and Reimer 1993) and the INTCAL13 dataset (Reimer et al. 2013). Deviations from these reporting and calibration standards will be noted in the text as necessary.

RESULTS AND INTERPRETATION

The house

Perhaps the most important find from the Sandvika excavation was the remains of a longhouse. The evidence took the form of 18 features interpreted as postholes as well as a fireplace, a refuse pit, and an artifact-bearing layer interpreted as the collapse context or floor of the building. The archaeological remains were covered by a topsoil layer consisting of up to 15 cm of white sand below 15-40 cm of turf. The sand layer may be contemporary with a white sand layer recorded in the mire nearby, whose deposition has been radiocarbon dated to between c. 600 and AD 700 (Tveraabak and Alm 1997). If so,

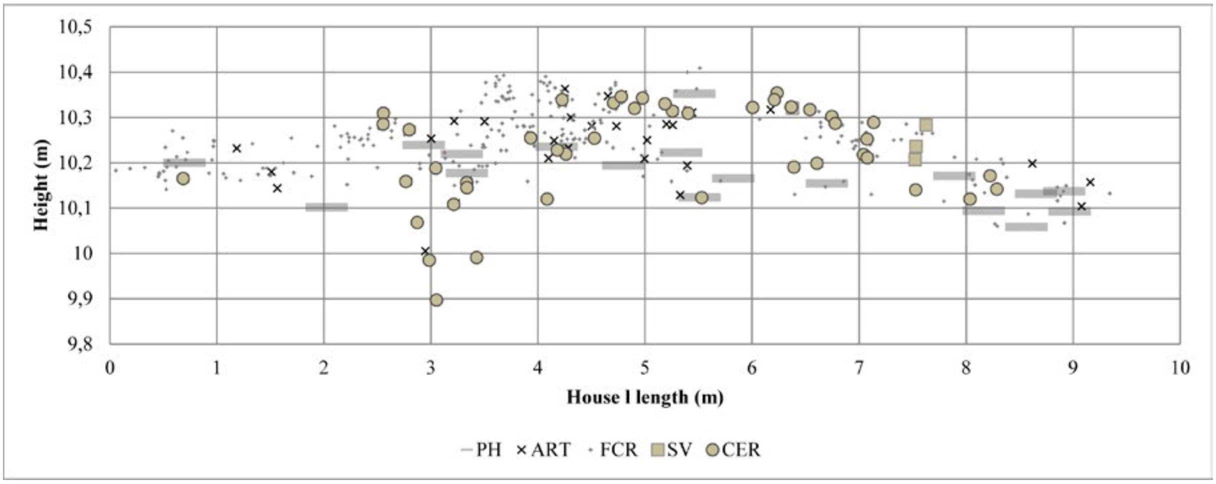

Figure 6. Plot showing the height-levels at which postholes (PH), artifacts (ART), fire-cracked rocks (FCR), soapstone vessel sherds (SV) and ceramics (CER) were documented. The diagram includes features and artifacts found within the delimitation of the house floor (interpretation), as shown in Fig. 5. The lowest outliers are artifacts found within the refuse pit.

this would leave us with a time gap of 1500-1600 years where the archaeological site may have been exposed to sand drift and erosion.

Many of the postholes were poorly preserved, and affected by sand drift activity. The best preserved examples are three features interpreted as remains of roof bearing posts and located in the centre of the house. Two of these form an opposing pair at right angles to the long axis of the house, with a distance of 1.82 meters (measured from the centre). One of these postholes was lined with stone and contained two pieces of asbestos ceramics, two pieces of quartzite debris, and a piece of burnt animal bone. The third feature lies 2 meters to the west of the pair, along the long axis of the building.

A rectangular fireplace was documented slightly off centre, towards the north and west of the floor area. The feature measured 1 x 1 meter, had parts of a stone lining preserved, and was filled with a fine ash deposit from which 150 grams of burnt animal bones were recovered. Adjacent to the fireplace, a pit of 1.6 x 1.7 meters in size was documented, stratigraphically contemporaneous with the fireplace. The pit, which was up to 40 cm deep, contained a dark, sticky, charcoal-mixed fill different from that of the fireplace. In addition to 14 liters of fire-cracked rocks, the feature contained 44% of the ceramics uncovered during the excavation (64 g) as well as 38 grams of burnt animal bone and two pieces of retouched chert debris. Although the pit contained fire-cracked rocks, it cannot be reliably interpreted as a cooking pit. Its position right next to the fireplace indicates a joint function, probably as a refuse pit or some form of storage.

In order to reliably delimit the house area, all pieces of fire-cracked rock above 5 cm in diameter found outside of individual features were recorded. The total comprises c. 70 liters and 277 find spots all clearly concentrated within the house floor. The interpretation of the house is also strengthened by the distribution of the ceramics and the soapstone artifacts, all of which were recovered within the expected delimitation of the house.

When the vertical distribution of postholes, fire-cracked rocks, thin-walled soapstone vessels and ceramics are plotted against the house's length, a rounded ridge is formed (Fig. 6). This plot further illustrates how sand drift has particularly affected features towards the edges of the house ground. The range of the level at which postholes were documented was 29 cm, a clear explanation for the variation in depth when sectioned. The vertical distribution also shows that all of the above mentioned categories are evenly distributed, supporting the idea that the totality of the evidence likely belongs to a single settlement phase.

Although there is considerable uncertainty when assessing the impact of post depositional processes, it is likely that the construction at Sandvika was a three-aisled building. Several of the features have probably been erased by sand drift, while others are markedly obscured, making any detailed architectural interpretation impossible. However, there is sufficient evidence to suggest that the building was c. 10 x 4 meters in size and that it had roughly centred entrances situated along its long walls. This form of construction resembles the late Bronze Age house from Kveøy, which was three-aisled, somewhat more than 12 meters in length, and c. 5–7 meters in width (Arntzen 2013b). The size and placement of entrances also roughly resembles Late Bronze Age constructions from Forsandmoen in Rogaland, where this particular type is interpreted to be a combined dwelling and barn (Løken 1998).

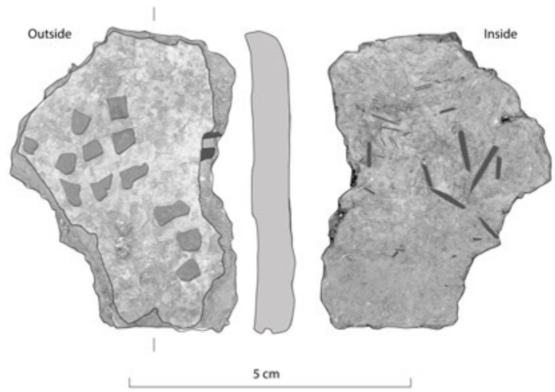

Figure 7. Pin-stamp-decorated asbestos tempered ceramics from House 1.

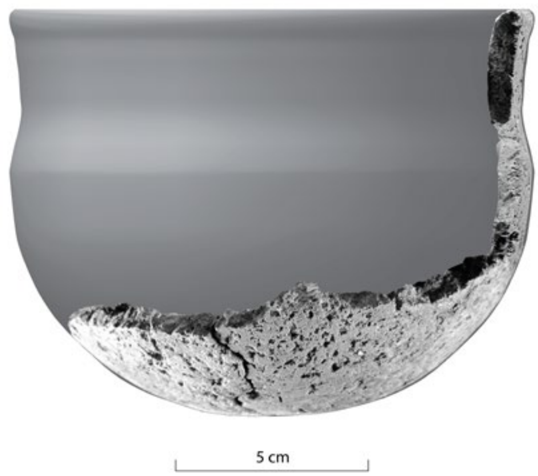

Figure 8. Reconstruction of the thin-walled soapstone vessel found within the floor area of House 1. The sherds used in the reconstruction are included in the illustration.

Artifacts

The most numerous artifact category associated with the Sandvika house comprised 90 sherds of asbestos ceramics, weighing 144 grams, with a high degree of fragmentation and in a generally poor state. Their thickness averages only 4.4 mm and ranges between 1.7 and 7.5 mm. Only a single rim sherd is present which, although small, could indicate a vessel of c. 17 cm in diameter. The tempering is varied, with both long, thin and short, thick fibers present. Three sherds have irregularly placed pin stamp decorations and the aforementioned rim sherd has small dot decorations (Fig. 7). The assemblage is varied to such a degree that at least two to three different types must have been in use, neither of which fit plainly within any of the six known "groups" of asbestos ceramics in use in northern Norway during the Late Bronze Age and Early Iron Age (Jørgensen and Olsen 1988). The question of how the Sandvika find relates to the ceramic typology will be further dealt with below.

A find that did fit clearly into an established typology related to the south was a large part of a thin-walled soapstone vessel uncovered within the floor area of the house (Fig. 8). In addition to a large portion of the base, four conjoinable sherds were discovered, making the reconstruction of a complete vessel possible. Based on the reconstruction, the vessel was bowl-shaped, c. 10.5 cm in height and 13.5 cm in width with a 2.5 cm wide band below the rim and no decoration. The thickness varied between 1.5 cm at the bottom to only 0.9 cm at the thinnest parts of the walls. The bowl-shaped form as well as the band beneath the rim corresponds with Pilø's (1989) type I, dated to the Late Bronze Age. A charred film or food crust on the inside of the vessel has been dated to 896–802 BC (Beta-389928, 2680±30 BP), affirming the typological date.

The corner of one of the valves for a soapstone bi-valve mould, measuring only 2 x 5 cm, also found within the house floor, is of great importance when discussing a connection to the Nordic Bronze Age. Although a small find, the so-called core-prints, used to lock the clay core into place when casting hollow objects, gives a hint as to what has been cast. These are located above the internal casting cavities in the preserved part of the mould, and have a stepped design element only paralleled in a Nordic soapstone mould for casting a socketed axe, found in Grøtavær in Southern Troms (Munch 1966; Engedal 2010). It is therefore likely that the Sandvika mould was also designed to cast a socketed axe or a similarly sized hollow object of Nordic Bronze Age type. Although not analyzed in detail, a magnetic piece of slag found within the house floor could indicate that bronze casting took place in Sandvika.

Other finds from the excavation include 18 pieces of lithic debris, several pieces of pumice with grinding marks, a fishing sinker, a hard hammerstone as well as a single edged slate knife stemming from a context dated to the Neolithic.

Burnt animal bone and plant remains

With only a handful of find spots for bone material connected to early agriculture in the region, the discovery of 188 grams of burnt animal bone within the fireplace and a refuse pit belonging to the house was of great importance. Although butchery practice, burning and post depositional destruction makes the assemblage very fragmented, osteological analysis successfully identified sheep/goat, fish, bird and seal (Denham 2014). The sheep/goat bones, which were the most numerous of the few identifiable fragments, are considered typical butchery waste fragments. The small and fragmented data set does not allow for any quantitative assessment, but there are some qualities worth mentioning. The degree of burning is rather low, something that could indicate that the bones were not deliberately used as fuel, but discarded. With the possible exception of a single fragment, evidence for larger fauna is lacking. If interpreted as general food waste this implies that the people in Sandvika were neither hunting nor keeping larger animals. It must however be taken into account that meat bearing elements could have been deposited elsewhere and that preservation conditions, perhaps related to the degree of burning, might be a factor.

A macrofossil sample recovered beneath the largest piece of the soapstone vessel contained one burnt seed of chickweed (*Stellaria media*). This is a common weed that may have been part of a local food resource. Burnt seeds from crowberries (*Empetrum nigrum*) and saltbush (*Atriplex* sp.) were found in the hearth and postholes. Crowberry is edible, and is a common species of the local heath and mire vegetation, while saltbush is a common species on the sea shore. Phytoliths from grasses were present in samples taken within the habitation area; this could imply that grass was used as animal fodder (Zurro 2014).

Dating

Since no reliable types were found, the ceramics from Sandvika provide a wide chronological time-frame of c. 2100 BC–AD 1. The Risvik type, with which the Sandvika assemblage has its closest parallel, is (based on directly dated food crusts) placed at c. 1100–270 BC (Jørgensen and Olsen 1988; Andreassen 2002). The bowl-shaped, thin-walled soapstone vessel is typologically dated to the Late Bronze Age (1100–500 BC, see Pilø 1989) and the mould fragment most likely belongs to period V-VI (950–500 BC, see discussion with references in Arntzen 2015a) of the Bronze Age.

A total of 9 ^{14}C-dates from the site give an age range of 1400 BC–AD 200 (Table 1). While two dates from the building's postholes produced results stretching into the Pre-Roman Iron Age, this is most likely a reflection of later use and contamination related to colluvial activity. The dates stem from charcoal particles retrieved from the fill of the postholes.

A probability summation of all the dates (excluding the Neolithic result connected to the slate knife) indicate the main period of settlement to be 1120–799 BC within 2σ and 1054–804 BC within 1σ (Fig. 9). The determination from the food crust on the

Lab nr.	Context	Material	^{14}C-age BP	1 σ	2 σ
Beta-367037	Cooking pit (AK1138). Area 1	Charcoal (*Betula*)	1900±30	AD 71 - 129	AD 29 - 213
Beta-367038	Posthole (AS1783). House 1, area 1	Charcoal (*Betula*)	2270±30	395 - 237 BC	300 - 210 BC
Beta-367039	Posthole (AS2147). House 1, area 1	Charcoal (*Betula*)	2500±30	767 - 550 BC	787 - 536 BC
Beta-367040	Refuse pit (AG3114). House 1, area 1	Charcoal (*Betula*)	2780±30	991 - 895 BC	1003 - 844 BC
Beta-367041	Cooking pit (AK3668). Area 2	Charcoal (*Betula*)	2750±30	916 - 843 BC	975 - 823 BC
Beta-389928	Soap stone vessel. House 1, area 1	Food crust	2680±30	889 - 804 BC	896 - 802 BC
Beta-389929	Pit with slate knife (A3091)	Charcoal (*Betula*)	3860±30	2454 - 2236 BC	2461 - 2209 BC
Beta-389930	Ceramics. House 1, area 1	Soot layer/food crust	2870±30	1109 - 1003 BC	1187 - 930 BC
T-11620	Collapse/floor layer, House 1, area 1	Charcoal (*Betula*)	2415±90	748 - 400 BC	794 - 362 BC
Beta-399126	Burnt sheep/goat bone from fireplace (AI1963). House 1, area 1	Burnt animal bone	3030±30	1374 - 1226 BC	1395 - 1135 BC

Table 1. Radiocarbon datings from Sandvika. With the exception of T-11620, all are AMS-determinations.

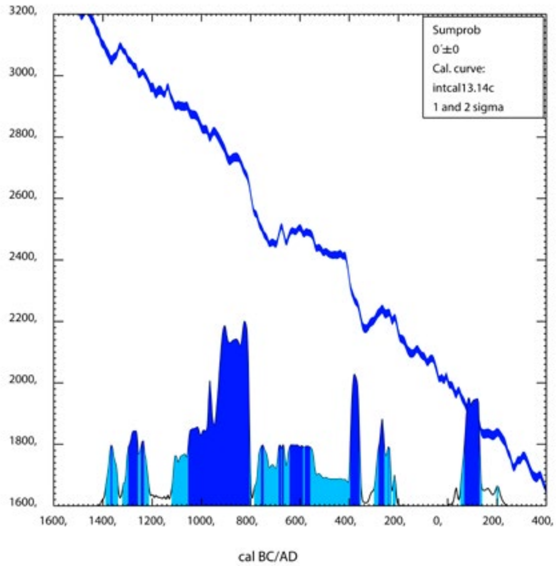

Figure 9. Probability summation based on nine ^{14}C-dates from the excavation (Table 1).

thin-walled soapstone vessel yielded of 896–802 BC. This determination is regarded as one of two dates from the excavation where the contextual control is good and the potential sources of error low. The other one, a charcoal determination (single piece of *Betula*) from the bottom deposits of the refuse pit, yielded a result of 1003–844 BC (Beta-367040). Considering these two dates in connection with the probability summation, it seems safe to place the main period of settlement between c. 1000–800 BC. A cooking pit in the western portion of Area 1, which was dated to the years around BC/AD, shows that the site has been in use during later times and could explain some of the contamination from more recent charcoal. When taking into account the features interpreted as belonging to House 1 as well as the artifact types and their amount, it is probable that the house represents a single settlement phase and that the later activity had its main settlement areas elsewhere.

Bone fragments found in the fireplace of the house (Figs. 4, 15) were identified as parts of the lower leg of sheep/goat (Denham 2014) and radiocarbon-dated to 1390–1335 BC within 2σ (Beta-399126, table 1). This deviating result will be further discussed below.

The litho- and biostratigraphy of the site

The lithology and pollen- and macrofossil content of the two sediment profiles sampled within the central part of House 1 (Figs. 3, 10) and at the border of Area 1 (Figs. 3, 11), show several similar features. Both profiles extend down to a marine shore substrate consisting of coarse coral sand and gravel, probably covering bedrock or moraine. The basal peat overlaying marine sediments in the nearby mire (Fig. 12, mire lok 2) is radiocarbon-dated to 4095±115 BP, which is in accordance with the proposed local sea level curve showing a regression from 9 m a.s.l. during the last c. 4500 years (Vorren et al. 2013).

In the A 1566 profile beneath House 1, the upper part of the stratified sand layer (Fig. 10, Layer 4) appeared less marine and is probably an aeolian deposit. A distinct thin organic layer (subsoil), covered by light grey drift sand, is interpreted as a former terrestrial ground surface based on its strongly humic character and the content of charcoal and pollen (Fig. 10, Layer 3). No macrofossils were identifiable to species level, but a *Hordeum*-type pollen was found in addition to pollen from mustards (Brassicaceae) and meadowrue (*Thalictrum*). It fulfills the identification criteria regarding size and morphology of *Hordeum* –type according to Fægri and Iversen (1989) and Beug (2004), but the thickness and foveolation of the cell wall does not satisfy the criteria of the cereal *Hordeum* (barley). The close vicinity to the marine shore makes the large native grass *Leymus* (former *Elymus*) *arenarius* (blue grass) a plausible alternative on a sandy seashore.

In our tentative interpretation of the soil stratigraphy, the corresponding level of the A 3281 soil

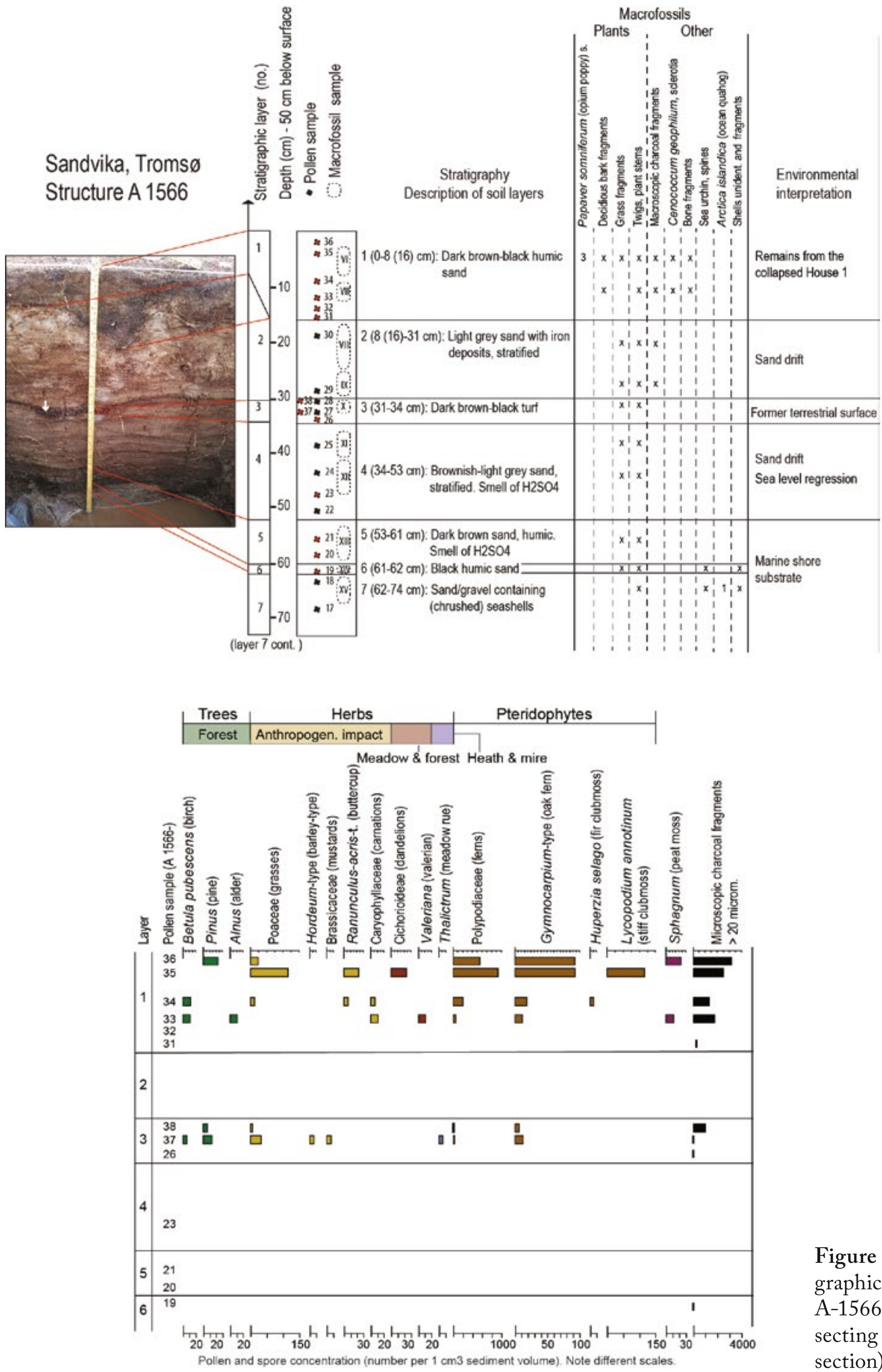

Figure 10. Litho- and biostratigraphical description of the A-1566 sediment profile intersecting the central axis (main section) of House 1, Sandvika.

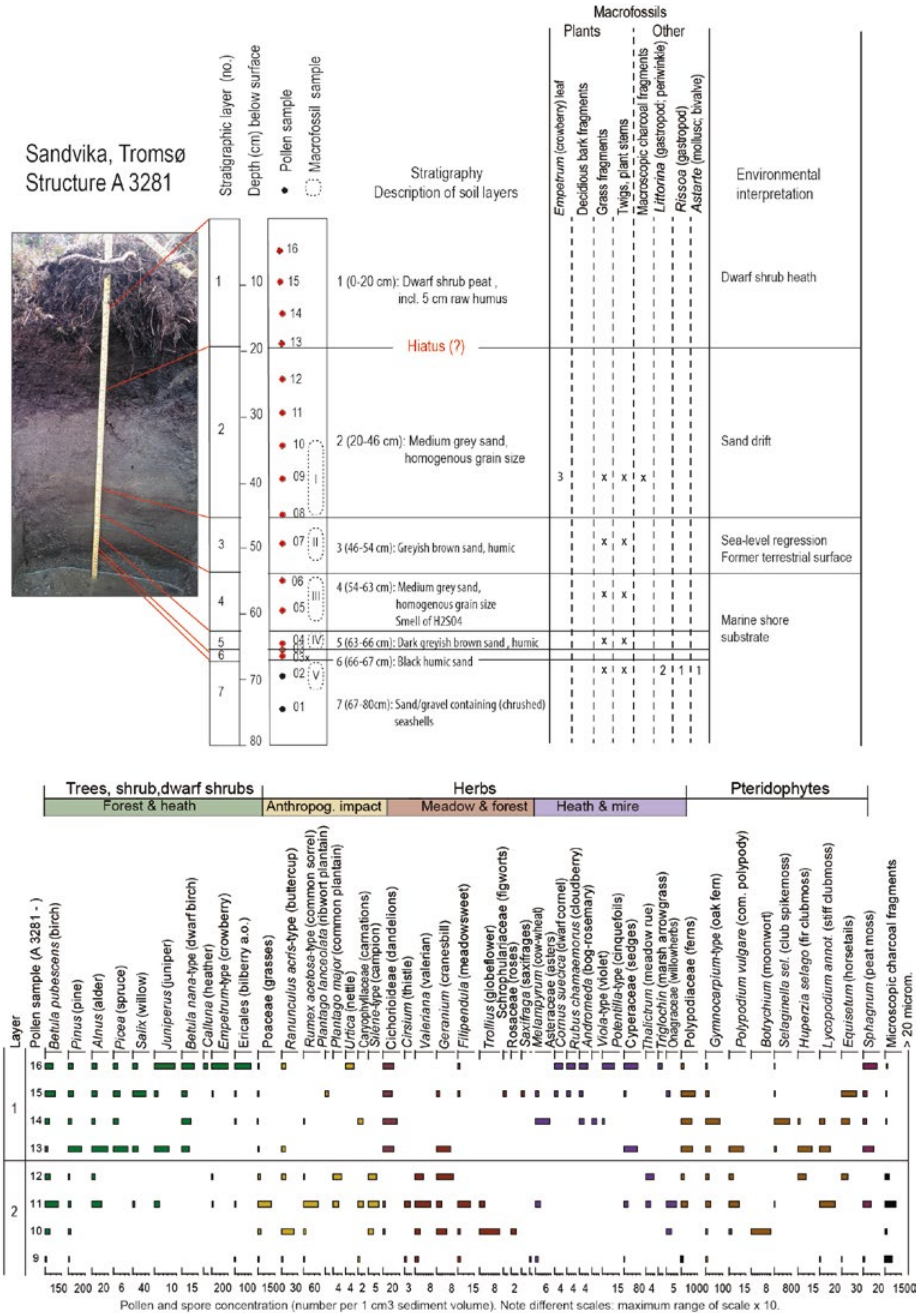

Figure 11. Litho- and biostratigraphical description of the A 3281 sediment profile at the western border of the excavation area with House 1, Sandvika.

profile has a much less distinct organic layer (Fig. 11, Layer 3), and is believed to represent a former seashore rather than an anthropogenic environment. The homogenous greyish sand "package" overlaying the organic layer in this profile may be contemporary with the drift sand below House 1 (Fig. 10, Layer 2). The pollen content of A 3281 displays a flora indicating the possibility of anthropogenic plant communities nearby. A pollen assemblage consisting of a combination of buttercups (*Ranunculus acris*-type), sorrel (*Rumex acetosa*-type), ribwort plantain (*Plantago lanceolata*) and grasses (Poaceae) connects with northern grazed meadows (e.g. Vorren 1986). Species belonging to the carnation family (Caryophyllaceae, *Silene*-type) are also a characteristic feature of such meadows. Tall herbs like meadowsweet (*Filipendula ulmaria*), thistles (*Cirsium*), valerian (*Valeriana*), cranesbill (*Geranium*) and dandelions (Cichorioideae) are native to mesic forest or woodland, but could also characterize the medium successional stages of fallow grazed land. Common plantain (*Plantago major/media*) is characteristic of ruderal anthropogenic habitats, like paths and trampled areas. The finds of spores from the pteridophytes moonwort (*Botrychium*) and northern spikemoss (*Selaginella selaginoides*) add to the picture of an anthropogenic impact on the flora, as these species are particularly responsive to the environment created by grazing.

The distinction to the upper heathland turf in A 3281 is marked, and there may be a hiatus due to erosion, perhaps related to the settlement activity at House 1 and erosion processes following its abandonment. The pollen assemblage of the upper part of A 3281 Layer 2 is comparable with the pollen content of A 1566 Layer 1 (the collapsed House 1), and may represent the same phase of activity. Although care should be taken in interpreting the indicative value of the pollen types present, as they may also be part of non-anthropogenic plant communities, the overall image of the palynological assemblages points to an environment influenced by humans and animals. This is supported by the compliance with pollen assemblage zone SA 2-3 in the pollen diagram from the nearby mire (Fig. 13).

The presence of three partly carbonized seeds of opium poppy (*Papaver somniferum*) is a peculiarity of the upper part of the collapsed house remains (Figs. 10, 16). This species has not been a part of the northern field flora, and to find such seeds in a Bronze Age context is surprising. No other early finds are known from Norway, but there are reports of Pre-Roman opium poppy seeds from Jutland in Denmark (Radoslaw Grabovski pers. comm. 07.11. 2014, Jensen 1985) and southern Sweden (Artelius 1989; Viklund 1989; Lindahl-Jensen et al. 1995). Late Neolithic and Pre-Roman finds are recorded in the Dutch archaeobotanical database, but none from a Bronze Age context (Otto Brinkkemper, pers. comm. 07.11.2014). Additionally, considering the generally low content of macro- and microfossils in the Sandvika material, it is not likely that the poppy seeds are in original situ, and are most probably a result of a more recent intrusion.

As documented by the archaeological features and the sediment stratigraphy, House 1 is probably the remains of one single phase of settlement between c. 1000 and 800 BC. The early date associated with the sheep/goat bones found within the fireplace, reaching as far back as 1395–1135 BC, could be marred by contamination. The dated portion of the bones, which is the carbonate fraction, provides for uncertainties as to the origin of the carbon. Since the result conforms poorly to all other observations, it could be explained as an effect of migrating carbon from an older fuel source, possibly driftwood (Hüls et al. 2010; Van Strydonck et al. 2010; Olsen et al. 2013). The sheep/goat bone is hence considered as derived from the settlement of House 1.

		Plant macrofossils, burned				Plant macrofossils, not burned								Other macrofossils				
Sample	Feature	Volume	*Empetrum* (crowberry) fruit	*Stellaria media* (chickweed) seed	*Atriplex* cf. *littoralis* (saltbush) seed	*Empetrum* (crowberry) leaf	Poaceae (gras) seed	Poaceae (gras) flower (fl) + spikelet (sp)	*Taraxacum officinale* (dandelion) seed	Seed unidentified	Cyperaceae (sedge) fruit	*Equisetum* (horsetail) sporangium	*Equisetum* (horsetail) stalks	Charcoal	*Cenococcum geophilum* (fungus) sclerotia	Burned bone	*Mytilus edulis* (blue mussel) shell < 1mm	Gastropod shell
1617	Posthole	1,5 l/10 ml			1			1 fl, 1 sp			1							1
1892	Soapstone filling	1 l10 ml		1		1	1			1							1	
2087	Hearth, bulk sample	10 l/100 ml	1		0,5	1						1		I	I			
2116	Hearth, bulk sample	10 l/200 ml										1	I	I	II			
2194	Cooking pit	1,5 l/10 ml												II		I		
2212	Posthole	11,5 l/80 ml							2				I					
2464	Posthole	1,5 l/50 ml												I	I			
2524	Posthole	2,5 l/200 ml					1					1	I	I	III			
2859	Hearth	1,5 l/10 ml													I			I
2925	Hearth	1,5 l/50 ml												I	I	I		
2945	Hearth	2 l/50 ml												I	II			
2957	Hearth	2 l/30 ml												I	I			
2963	Posthole	1,6 l/30 ml												I				
2968	Hearth	1,8 l/40 ml												I	I			
2988	Hearth	2,5 l/60 ml													I	I		
2999	Hearth	2,5 l/60 ml												I	I			
3074	Posthole	3 l/110 ml												I	I			
3370	Pit	6 l/50 ml												III	III	I		
3782	Posthole	2,5 l/10 ml											I	I	II			
1574 A		?/10 ml												I				
1939	Hearth	?							1					I	II	I		

Table 2. Macrofossils from soil samples within House 1, Sandvika, presented as numbers or abundance according to this scale: I=present, II=common, III=abundant**, IV=dominant. Sample volume before/after flotation (0,5 mm).

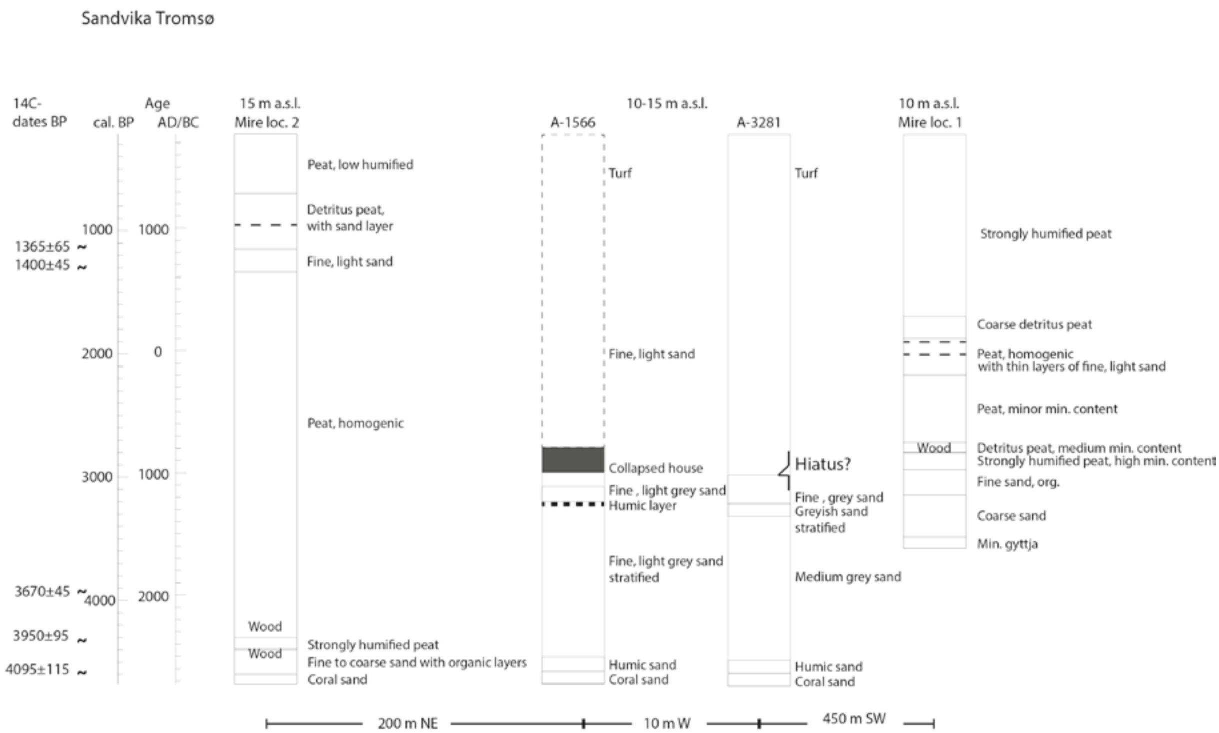

Figure 12. Correlation of sediment profiles from Sandvika. The main chronology is based on Bayesian radiocarbon calibration (Buck et al. 1999) and a linear age-depth model (Bennett 2005). The chronological placement of the stratigraphic layers of A-1566 (except Collapsed house) and A-3281 is tentative.

The pollen diagram from the nearby mire (Fig. 13) reveals a peak in relative charcoal dust that may be associated with the House 1 settlement. According to the chronologies depicted in the pollen diagram (Fig. 13) and by Bayesian calibration (Fig. 12), the charcoal peak falls within a period of time that overlaps with the probable use of the House 1 settlement. The date of this event in the pollen diagram is achieved by linear interpolation between the two ^{14}C-dates 3670±45 BP and 1400±45 BP over a peat sequence of 28 cm. Tveraabak and Alm (1997) describe the peat stratigraphy of this sequence as homogenous, which in this case may render an adequate chronology by linear interpolation. The deviation in age may therefore not be large. The resulting sedimentation rate of 105 years per depth cm is, however, high for peat, even if the degree of humification is itself moderately high. Although not observed in the stratigraphical records, we may consider the possibility of a hiatus, caused by natural or anthropogenic erosion, within the dated peat sequence. The pollen assemblage correlated with the charcoal peak shows no indication of agriculture or husbandry (grazing). The vegetation signal is more of a low-herb, birch woodland. Might the charcoal peak represent an initial burning of woodland, and the subsequent, somewhat lower charcoal curve be the actual reflection of the settlement? Immediately following the charcoal peak there is a marked change in the observed pollen flora with a strong indication

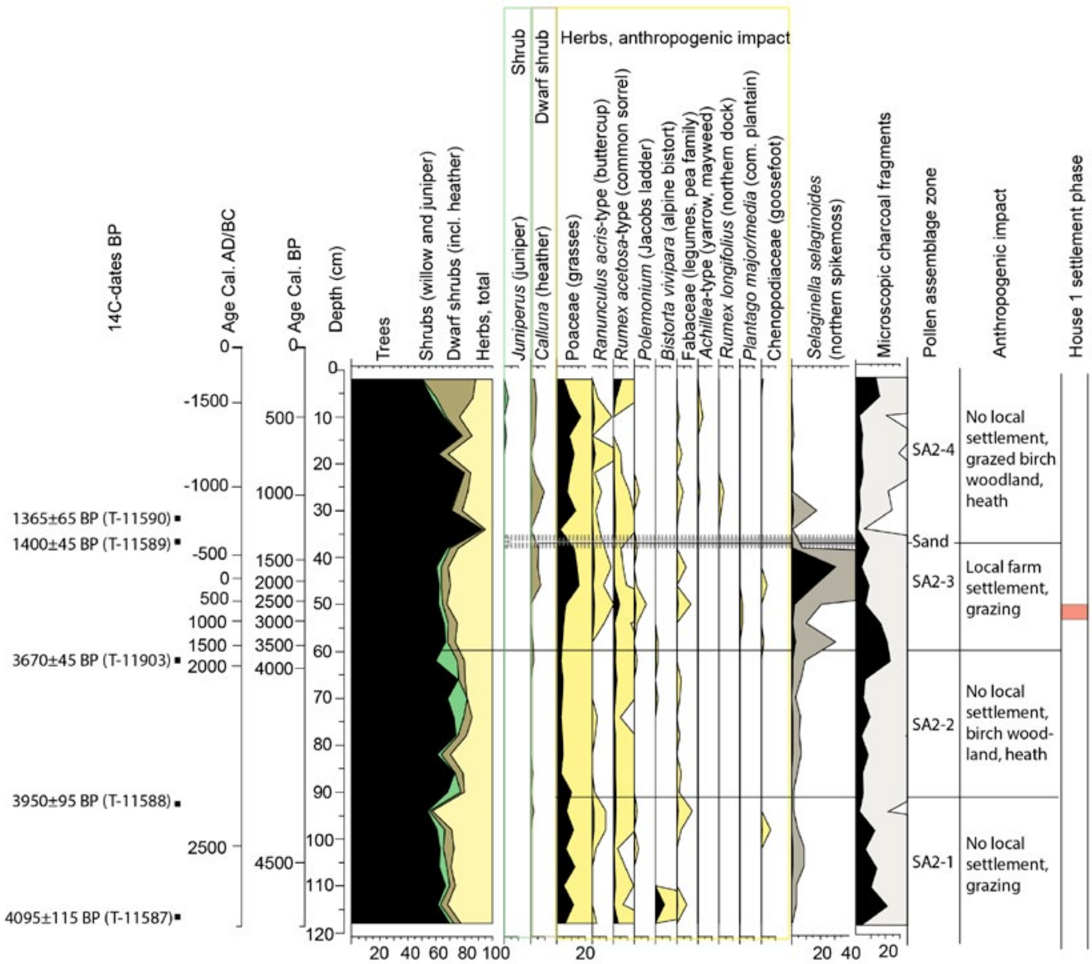

Figure 13. Percentage pollen diagram from Sandvika, mire locality 1. Modified after Tveraabak (1997), presenting taxa indicating anthropogenic impact (farming). Pollen assemblage zones and interpretation of anthropogenic impact is according to Tveraabak and Alm (1997). The estimated period of House 1 (present investigation) is marked.

of human impact, presumably the effects of grazing, as seen by the increase in grass (Poaceae) and the diversity of herbs connected with pasture. A peak in *Selaginella selaginoides* spores leads to the conclusion that the mire has been grazed, not only the surrounding upland. This tiny pteridophyte benefits from fertilization by animal dung and is a characteristic species on grazed minerotrophic mires. The upper limit of this grazing event is set by the sand layer that represents an episode of sand drift between c. 560–687 AD and 544–851 AD. The grazing impact is lower after the event of sand

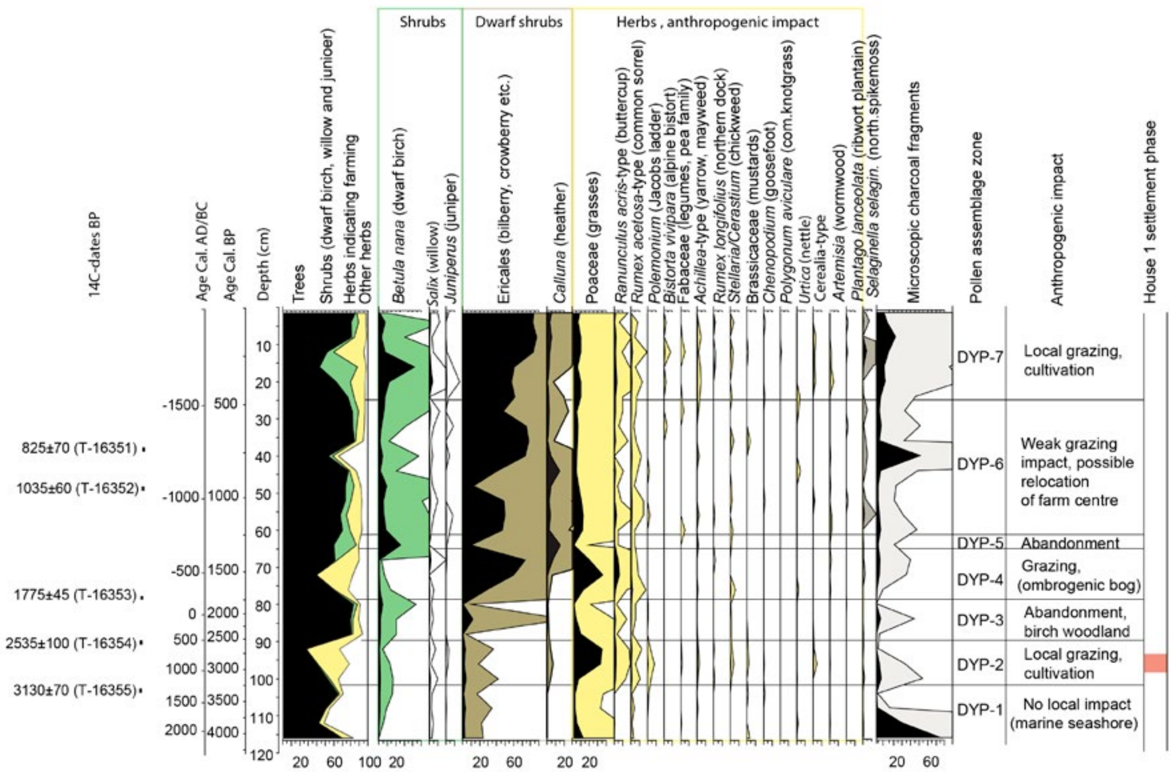

Figure 14. Percentage pollen diagram from Dypingen, Brensholmen. Modified after Vorren (2005), presenting taxa indicating anthropogenic impact (farming). Pollen assemblage zones and interpretation of anthropogenic impact is according to Vorren (2005). The estimated period of House 1 (present investigation) is marked.

drift and the character of the mire changes towards a regime dominated by sedges and grasses. In view of the observed increase in birch pollen and fern spores, the mire and near surroundings seems to be subject to abandonment and regrowth.

The Dypingen site at Brensholmen, only 3-4 km south of Sandvika, shows a comparable anthropogenic impact on vegetation during the Late Bronze Age and subsequent periods (Vorren 2005). The pollen diagram (Fig. 14) contains assemblages indicating grazing impact and possible cereal growth during the period 1150–550 BC, overlapping with the House 1 settlement phase in Sandvika, and followed by a period of abandonment until c. AD 200. The abundance of grass pollen and start of a more or less continuous presence of taxa like buttercups (*Ranunculus acris*-type) and common sorrels (*Rumex acetosa*-type) are typical features of meadow pastures. The presence of Jacobs ladder (*Polemonium*) is another attribute connected with northern coastal meadows subjected to long term grazing or mowing. *Polemonium caeruleum* occurs

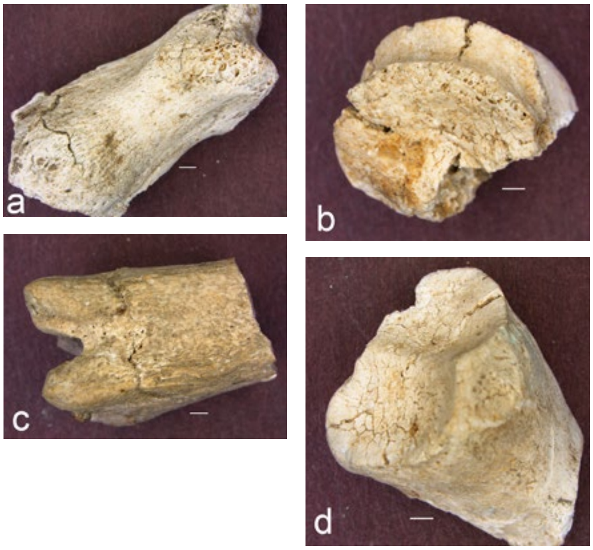

Figure 15 a-d. ^{14}C-dated bone fragments (phalanges, metapodials) from sheep or goat. The scalebar is 1 mm.

in association with tall grasses like downy oat-grass (*Avenula pubescens*), false oat-grass (*Arrhenatherum elatius*) and tall herbs within mesic meadows as well as dry meadows on calcareous/alkaline ground (Fremstad 1997, Vorren 1986). Such meadows may develop as an intermediate stage between natural and anthropogenic plant communities. *Polemonium* pollen occurs at Sandvika as well, and this type of grassland seems to have been a general aspect of the Bronze Age landscape. Cerealia-type pollen recorded at Dypingen from this period is interpreted as possibly *Hordeum*- and *Triticum*-type. The sandy well-drained river terraces may have been well suited for cereal growth. The Bronze Age anthropogenic impact at Dypingen decreases around 550 BC, and is interpreted as abandonment followed by regrowth of birch woodland. Note that the peat profiles of the Sandvika and Dypingen mires are not contiguously analysed, containing stratigraphical gaps, and this event may be contemporary with the abandonment of House 1 in Sandvika.

DISCUSSION

Taphonomy

A striking feature of the empirical data from the natural scientific analyses is the very low amount - and for some samples even lack of - explanatory finds. One reason may be that the sampling procedure was not sufficiently extensive, i.e. the number and volume of samples taken for macrofossil analysis were too low. However, when comparing with investigations of three-aisled house foundations from southern Scandinavia, the abundance of botanical macrofossils retrieved from even a small number of soil samples is generally sufficient to establish whether or not agriculture was part of the economy. Uncharred organic remains are best preserved in anaerobic environments. A prerequisite for the recovery of plant macrofossils in a terrestrial minerogenic soil type like that at Sandvika is that they are charred, and have thus undergone a mineralization process making them resistant to biological decay. The house in Sandvika was probably abandoned without being burned, which may have reduced the possibilities of preservation. Pollen, however, is more resistant to biological and aerobic decay due to the content of sporopollenin in the cell wall. Although pollen production is low at the coast and this far north (Jensen et al. 2007), a higher concentration of pollen was expected. Given the indications of long-term exposure of the house ground after abandonment, biological and chemical decay in addition to washout of material during rainfall may be a likely explanation. The ground water table is high in the area at present, but appears to have been lower at the time of the House 1 settlement, although local mires existed in the vicinity.

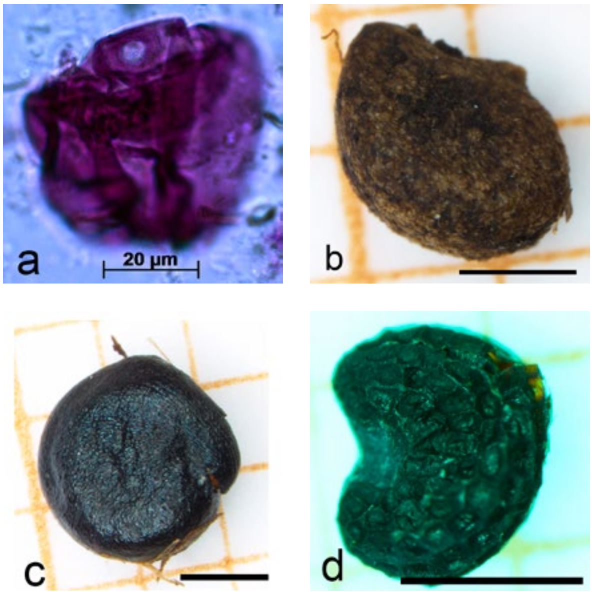

Figure 16 a-d: Selected identified pollen and seeds. Scale bars of pollen and seed photos are 0, 010 m and 1 mm, respectively. **a:** *Hordeum*-type pollen from sample A 1566-37. The measurable diameter of the grain is 49 µm. The diameter of the pore annulus is 12 µm, while the width of the annulus is 3,7 µm. **b:** *Empetrum nigrum* (crowberry) from sample PJ 2087-A1566 (fireplace), **c:** *Atriplex* cf. *littoralis* (saltbush) from sample PJ 1617.1574-1475 (posthole) and **d:** *Papaver somniferum* (opium poppy) from sample A 1566-VI.

Climatic conditions for agriculture

In general for Norway, the mid-boreal bioclimatic zone (Moen 1999) defines the geographical distribution of profitable cereal growth, i.e. where it is possible to achieve a more or less stable harvest of ripened cereals. It is associated with a climate favorable for mature conifer forest and temperate deciduous tree species. For Troms County, which is north of the Holocene natural distribution area of spruce, the relevant indicator species are pine (*Pinus sylvestris)* and grey alder (*Alnus incana)*.

At present, we find that for northern Norway the mid-boreal zone has a fragmented areal distribution in the coastal lowlands, and for Troms and Finnmark it is mainly found in the sheltered fjord districts. As for the southern part of Kvaløya, we find ourselves in a transitional area between the northern boreal and mid-boreal bioclimate. Pine is extinct in this area today, probably due to exploitation by man. Elverland and Vorren (2009) found palaeobotanical evidence of local pine forest at Lillevardhaugvatnet, 112 m a.s.l. 10 km SE of Sandvika, between c. 3600 BC and c. AD 600, with a climate related decrease from c. 350 to 0 BC. They suggest a mean July temperature of at least 12.6 ˚C (0.6˚C above modern temperature) during the period of local pine growth. Their findings are supported by a dendrochronological study of a maritime pine enclave 20 km to the east (Kirchhefer 2001).

A mid-boreal climate regime is thus likely to have extended further north during the period of longhouse settlement in Sandvika. This means that another common presupposition of stable cereal growth – the 1250 day degree isotherm as a mean temperature requirement for the relevant types of cereals - was met as well. This is calculated by summing up individual mean diurnal temperatures during the main growing season; June 1^{st} –September 30^{th} (Fjærvoll 1961). This isotherm (Fig. 1), correlates well with modern and historical knowledge about agriculture in the region. It is possible to get ripe cereals north of this limit where the local climate is good, such as in the fjord districts, but not every year. Historical records show that cereal cultivation has been a part of the economy in northern Norway, even in periods when the climate was less favourable. The vulnerability of this farming practice is however, unquestionable. The keeping of animals, particularly the small cattle species like sheep and goat, combined with exploitation of marine resources, provides a more stable economy.

Several pollen analytical investigations from coastal area of northern Norway show indications of temporary farming practice including possible cereal growth during the Bronze Age. The discontinuity in botanical agricultural indices during the last millennium BC, may be linked to the regional climatic deterioration observed by several independent climate proxies as a change to a cooler and more humid climate (Vorren et al. 2007). Based on palaeobotanical reconstructions of Holocene July mean temperature from lake sediments in the interior of Troms and northern Finland, Jensen and Vorren (2008); Bjune et al. (2004) and Seppä et al. (2001), postulate a summer temperature 1-1.5 °C higher than today during the period covering the Late Neolithic and the Bronze Age. The start of a successive temperature decline is, however, observed from the Late Bronze Age until the Pre-Roman Iron Age. Several wet shifts (transition from high to low peat humification) possibly related to a regional climate shift are seen in the Sellevoll bog at Andøya during the Late Bronze Age (Vorren et al. 2007).

Bronze Age settlement sites near the northern cereal limit

The Bronze Age is usually referred to as the Early Metal Age (1800 BC–AD 1) within northern Fennoscandia, although metal itself only is represented by very few finds (cf. Jørgensen 1986). Compared to the south, the differences are striking in terms of house types, material culture, settlement organization and the availability of resources. Asbestos ceramics do however form the basis for most discussions surrounding the period. While asbestos tempered ceramics occur in the form of Comb Ceramics in the Neolithic of eastern Finland, their chronological lower limit in northern Norway is drawn at c. 2100 BC (Jørgensen og Olsen 1988; Carpelan 1979). For Finnmark, Olsen (1994) has used the transition between the earliest Textile ceramics and the later Kjelmøy ceramics to suggest a Textile ceramic phase (1800–900 BC) and a Kjelmøy ceramic phase (900 BC–AD 1). Jørgensen and Olsen (1988) have so far provided the broadest review of asbestos ceramics in the region, dividing the material into six distinct groups.

For the present study the two latest types are most relevant, namely the aforementioned Kjelmøy type and the Risvik variety. Several scholars (e.g. Hansen and Olsen 2014) see the differences in find contexts and geographic distribution as markers of different ethnic groups. The Risvik type is defined by a smoothed band beneath the rim and an otherwise crude outer surface with short, thick asbestos fibers. The vessels are generally thought to have been bowl-shaped, rather small (an average diameter of c. 20 cm) and with little or no decoration (Andreassen 2002). The Kjelmøy type on the other hand, is tempered with finely crushed asbestos, is thinner and has marked geometric decorations. When it comes to these types, it must be emphasized that the variation within categories is vast, and being far beyond of the scope of the present article, the typology cannot be explored to any length. The differences between wall thickness, tempering, color of the ware and especially the decorations do, however, make the division between the Kjelmøy variety and the coarser asbestos ceramics found further south (including the so-called Risvik type) sound.

That the two broad ceramic categories represent different processes is especially clear when studying their geographic distribution. The Kjelmøy type is mainly found within coastal and interior Finnmark, as well as in northern Sweden and Finland (here called Säraisniemi 2 ceramics), while the Risvik type is found in the coastal areas further south without any clear parallel in the neighboring countries. Links between the latter type and the Nordic Bronze Age have, traditionally, been established based on material from five graves situated between Stad in Sogn og Fjordane county and Skjeggesnes in the Helgeland area (Bakka 1976). At Skjeggesnes, the northernmost professionally excavated barrow with Nordic bronzes (Lund 1963), a bronze razor was found together with a pin and large parts of an asbestos ceramic vessel in a double grave dated to period V.

In recent years, there have been several new discoveries that confirm the relationship between Risvik type ceramics and agricultural settlements. (Arntzen 2013a). One such find comes from the previously mentioned Kveøy excavations, where ceramics were recovered from the postholes of a Pre-Roman longhouse. Further south, in the Salten region at Skålbunes, several additional sherds were found in the wall ditch of a longhouse of similar date (Arntzen 2012). There are several find spots for ceramics south of northern Norway, of so-called Northwest-Norwegian asbestos ceramics, where the type has appeared in connection with ard marks, field layers, palynological indications of cereals as well as other artifacts pointing towards agriculture (Ågotnes 1986). This type is similar to what is found in northern Norway, and could in all likelihood represent the same phenomenon. A somewhat older category of asbestos ceramics, bucket-shaped and with thinner walls than the later types, is also known from some settlement, grave and rock shelter contexts in Southwestern and Western Norway, even as far south as the Agder area (Hop 2011).

Thin-walled soapstone vessels are chronologically isolated from later Iron Age types, and are mainly linked to the Late Bronze Age and to the Pre-Roman Iron Age. Their distribution is restricted to the coast and mainly concentrated in Rogaland and Hordaland counties in Southwest Norway. Here, a large number of the vessels are associated with burials, while further north many of the finds come from settlement contexts and several occur together with asbestos ceramics. While the first typological treatment involving this artifact type puts them within a chronological timeframe from the Pre-Roman Iron Age up to and including the Migration period, more recent studies assign the artifacts to the former period (Møllerup 1960; Schetelig 1912). Pilø (1989), who in a reassessment of dated contexts also finds evidence for a Late Bronze Age type, has done the latest treatment. While the Pre-Roman type is spherical in shape, the earlier varieties are bowl-shaped. This corresponds to the find from Sandvika, which is the most complete and largest find north of the Helgeland region.

Until the late 2000s, ceramics and soapstone vessels from along the northern Norwegian coastline were the most important body of evidence related to Bronze Age settlement in the region. As this material in many cases originated from sand dunes where stray finds had been uncovered by amateurs, it has been impossible to reliably interpret any details of the settlements themselves.

One example is the Kolvika site in Vestvågøy, a locality topographically similar to Sandvika, where small-scale archaeological investigations were carried out in 1969 and 1978 (Jørgensen 1989). Ceramics, slate implements and two halves of bi-valve soapstone moulds had previously been collected from the site by amateurs and the excavations documented the presence of charcoal-mixed layers as well as two rectangular stone lined fireplaces similar to the one found within the house in Sandvika. Important to note about Kolvika is that the ceramics and slate implements were located on two separate terraces, with the slate portion of the assemblage spread over the highest lying areas. ^{14}C-dates from the locality span between c. 2000 BC–AD 400, while much of the artifact material clearly points to the Bronze Age. Unlike Sandvika, this site had not been covered up and protected by wetland, but stood open to massive erosion and sand drift throughout the years. Today it stands out as a crater in the landscape with little archaeological potential left.

A site with a considerable research potential, and with great similarities to Sandvika, is the Hofsøy locality on the southern tip of Senja. The site is located next to the seashore, in a sandy area partly covered by wetland. Although excavations here in the late 1970s and early 1980s were focused on the remains of a 40 meter long house from the Roman Iron Age, both Bronze Age and Neolithic finds were recovered. A refuse pit, not unlike the one from Sandvika, containing five cattle teeth as well as a tooth from sheep or goat, was uncovered beneath the wall of the house construction (Johansen 1976; Lahtiperä 1980). In addition to the animal remains, both asbestos tempered ceramics and a slate knife appeared in the feature, which was dated to 1498–1059 BC (T-3028, 3060±80 BP) (Johansen 1982).

Unfortunately the excavations at Hofsøy were limited to two one meter wide trenches laid out at right angles to the long axis of the house ground, and it is therefore not possible to evaluate whether or not the refuse pit belonged to a Bronze Age house construction.

Deggemyra, a mire located next to the site, was subject to one of the first palynological investigations that indicated Late Bronze Age/Pre Roman Iron Age agriculture in northern Norway (Vorren 1986). The impact of Iron Age farming is clearly visible in the pollen stratigraphy by a marked temporary increase in grasses, barley *Hordeum*-type and apophytic taxa during the Roman period and into the Viking Age, but an early stratum with a find of *Hordeum*-type pollen associated with the introduction of apophytic taxa is dated at c. 480–50 BC (T-2863, 2240±80 BP). Interestingly, a comparable pollen assemblage zone, with *Hordeum*-type, grasses and apophytic meadow plants, was observed in another pollen profile closer to the border of the bog and rendered an even earlier age, i.e. ca. 1520–850 BC (GX-3822, 2995 +/-140 BP) thus suggesting the presence of a Late Bronze Age farming culture.

The empirical basis for research has greatly improved since the introduction of mechanical topsoil stripping to north Norwegian archaeology in the early 2000s. The investigation at Kveøy in Southern Troms in 2008-2009, which still stands as the largest excavation of this type in the region, provided important evidence of Bronze Age agricultural settlement in the region (Arntzen and Sommerseth 2010; Sjögren 2010; Sjögren and Arntzen 2012; Arntzen 2013b). A c. 12 meter long three-aisled longhouse, field layers, the possible remains of cremation graves and several cooking pits were found. The site also provided evidence for a full-scale farm structure in the Pre-Roman Iron Age, including a 23 m long longhouse (with asbestos ceramics), a utility building, a clay built oven, several cooking pits and cremation graves.

A single carbonized grain of barley (*Hordeum)* was directly ^{14}C-dated to the late Neolithic (3936±30 BP, Wk-26504). The find context, an oblong pit with charcoal rich sandy fill, superimposed by massive Pre-Roman field layers, is regarded as uncertain by the authors (Arntzen 2013b) due to the lack of corresponding dates from any other area of the excavation. A new ^{14}C-dating, performed by Beta-Analytic on another grain identified as barley (*Hordeum)*, was performed as part of our present investigation. The find context was a posthole belonging to House 1 at Kveøya, interpreted as a Late Bronze Age house. The ^{14}C-date of the barley grain, however, rendered a much younger age: 1550±30 BP (Beta-399667), calibrated at AD 420–575. This cereal grain, dated to the Migration period, raises questions about contextual control on the site and consequently, the assumption of cereal cultivation during the Late Bronze age. Yet the large number of features dated to this period from the excavations at Kveøya, including cooking pits, possible flat graves, field layers, and postholes, do indicate the presence of a settlement similar to what is found in Nordic Bronze Age contexts further south.

At Nordsand on the Sandsøy Island, 30 km northeast of Kveøy, an excavation in 2013 resulted in the discovery of a three-aisled longhouse tentatively dated as Pre-Roman, or possibly as far back as the end of the Late Bronze Age. The majority of the Sandsøy material, however, belongs to the later stages of the Iron Age. Farm houses were constructed during the Roman Iron Age and probably remained in use until the Merovingian Period (Cerbing 2016). Evidence of cereal growth and animal husbandry (impact from grazing and fertilization) during the period from the Late Roman Iron Age to the Migration/Merovingian period has been documented by the botanical analyses (Jensen and Ahlquist 2015). A toe bone from sheep or goat was dated to the Merovingian Period, and was found in the same context as a grain of awned barley (*Hordeum vulgare* ssp. *vulgare)* dated to the Migration Period. Hence, there is no direct evidence of farming associated with the Pre-Roman (or earlier) structures in the botanical or osteological material from Sandsøy.

The southern Troms region, where these sites are situated, is also home to two find spots for Nordic bronzes and, additionally, the previously mentioned mould from Grøtavær. The bronzes include one crescent-shaped neck collar found beneath a rock outcrop near a field at Altevågen in Trondenes and two very similar collars, found in a joint in an outcrop at Tennevik in Skånland only 20 km from the former find spot (Munch 1966; Bergum 2007, Arntzen 2015b). Such finds are very rare in a Nordic Bronze Age context, only paralleled by two collars from Skåne in Sweden and a fragmented soapstone mould from Vilsted on Jylland in northern Denmark (Engedal 2010: 56). Based on the Swedish and Danish material, the collars should be dated to period V.

South of the southern Troms, Lofoten and Vesterålen districts in northern Norway, evidence of Bronze Age settlement is even scarcer due to a lower frequency of archaeological investigations. South of Kveøy we find the next longhouse reliably dated to the period as far south as the Trondheim area (Grønnesby 2005; Rønne 2012). Graves with dateable bronzes, rock carvings and other features do, however, clearly indicate that both North-Trøndelag and southern Nordland had been integrated into the Nordic Bronze Age (Bakka 1976; Sognnes 1989; Grønnesby 1998; Fyllingen 2003; Rønne 2012).

In spite of recent excavations, the overall picture of the Bronze Age in northern Norway remains dominated by stray finds of ceramics, thin-walled soapstone vessels and a few bronzes. Based on Arntzen's (2013a) recent review of prehistoric settlement sites related to agriculture in northern Norway it is clear that dates from the Pre-Roman Iron Age are much more common when excavating or surveying within the northern Norwegian agricultural landscape. The low number of documented Bronze Age sites does, however, still correlate well with the lack of archaeological investigations within the region. The Sandvika site strengthens the impression that stray finds of ceramics and thin-walled soapstone vessels may reflect settlements with links to the Nordic Bronze Age or the Pre-Roman Iron Age, and that these links can include both architectural commonalities and similar communal or ritual frameworks (e.g. the use of cooking pits).

Looking eastward, recent investigations at the mouth of the Umeå River in Västerbotten, northern Sweden, recovered the hitherto oldest and northernmost evidence of cereal cultivation in Sweden (Heinerud and Larsson 2013; Lindquist and Granholm 2016). From the site Klabbölevägen (63°49'N 20°7'E), seven samples of barley, found in postholes, cooking pit and fireplace were ^{14}C-dated and returned corresponding ages in the range of 1400-1120 BC (Östman 2014 a; Ellinor Johansson pers. comm. 12.01.2016). A bone fragment from sheep/goat rendered a date overlapping with the cereals, c. 1400–1130 BC. This site is situated on the southern bank of the river, which would have been a strait in the Bronze Age.

Two settlements were excavated on the northern river bank. The larger of these, Sockenvägen, produced traces of several longhouses and large amounts of cereal grains (mostly barley). The oldest ^{14}C-dates from the site span the period 840–560 BC (Persson 2014; Östman 2014 b). The other site, Klockarbäcken, contained a probable single-aisled building and is associated with finds of barley in postholes and pits (Lindquist and Granholm 2016; Östman 2014 c). The ^{14}C-dates of these cereal grains fall in the range 1260–810 BC (Johansson pers.comm. 12.1.2016), the same time frame as the Sandvika site.

These settlements are detectable in the paleorecords from the adjacent mire Prästsjömyren (Engelmark 1976; Wallin 2011). Wallin (2011) identified two periods of Bronze Age barley cultivation from pollen- and charcoal analysis. The older period is set to 1400–1000 BC, and the younger one to 1300–800 BC, both are in good accord with the dates of cereal grains from the nearby settlements. The microfossil assemblages of both periods indicate burning close to the mire, especially during the later period, and the presence of weeds confirms cultivation.

On the Finnish side of the Gulf of Bothnia, at the site Jätinhaudanmaa in Laihia, small-scale excavations and soil sampling in relation to Bronze Age burial cairns have yielded indications of an agrarian economy (Holmblad 2010). Seeds of hulled barley (*Hordeum vulgare* var. *vulgare*) from a hearth and a cultural layer at this site have been ^{14}C-dated to the Late Bronze Age; 1000–830 and 840–540 BC, respectively. These dates correspond well with the age of a cultivation phase detected in a nearby mire, which is estimated to take place c. 1000–400 BC. The level where a *Hordeum*-type pollen emerges in connection with a rise in sedges and charcoal, produced a ^{14}C-date of 1040–840 BC (Wallin 2009; Holmblad 2010).

But, as in northern Norway, the number of large scale archaeological excavations in northern Sweden and Finland are few. The empirical indices of early agriculture are botanical, mainly from pollen analyses, and frequently documented as a combination of animal husbandry and cereal growth. A review covering northern Fennoscandia is given in Josefsson et al. (2014). The results of our investigation adds to the general picture that animal husbandry was established as part of a sustainable economy during the Bronze Age at the high northern latitudes, possibly prior to cereal cultivation and as the dominant farming activity.

CONCLUSIONS

The Sandvika settlement was inhabited during the last period of the Nordic Bronze Age and shows similarities with southern Scandinavian agrarian settlements from this period. Animal husbandry is documented by the finds of bones from sheep or goat, and signs of grazing impact on the local vegetation. Clear evidence of cereal growth is lacking, but this may be due to taphonomic loss during a long period of exposure after the settlement was abandoned.

This investigation raises the possibility that early coastal-bound permanent settlements were sustained by a farming economy based on animal husbandry (primarily sheep and/or goat) in addition to the exploitation of marine resources. Unstable climatic conditions during the Late Bronze Age may partly explain the fragmentary evidence of farming activity in the region. Erosion and sand drift caused by increased storm activity, and possibly exacerbated by the impact of grazing, may have led to periods of abandonment.

Both large scale rescue-excavations as well as strategic, interdisciplinary research projects are needed to further illuminate the agrarian Bronze Age settlements of the region.

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