Per H. Ramqvist & Greger Hörnberg

BURIAL MOUNDS AS SETTLEMENT INDICATORS: ARCHAEOLOGICAL AND PALYNOLOGICAL INVESTIGATIONS AT SANGIS, NORTHERN SWEDEN

Abstract
Grave mounds established during the 1st millennium AD in northern Sweden are common in central Norrland, up to northern Ångermanland. There are, however, two grave mounds located 350 km further north, close to the villages of Sangis and Espinära, that stand out as anomalies. These mounds rise questions regarding who established them and why? We hypothesised that they were established close to sedentary settlements, just as the ones found further south. To identify old settlement remains and traces of ancient land use, an archaeological excavation was performed of the sand ridge where the Sangis grave mound is located, and a palynological study was conducted to identify local vegetation changes. The results show that no sedentary settlement accompanied the mound. The area had, however, two phases of land use; as an occasionally visited site from calAD 600 to 800 when the grave mound and possibly a cooking pit was established, and; from calAD 1070 when human impact on the ridge restarted, probably associated to permanent settlements nearby.

Key words: cooking pit, forging, grave mound, permanent settlement, northernmost Sweden

Per H. Ramqvist, Department of Historical, Philosophical and Religious studies, Umeå University, SE-90187 Umeå, Sweden, per.ramqvist@umu.se; Greger Hörnberg, Institute for Sub-Arctic Landscape Research, The Silver Museum, Torget, SE-93821 Arjeplog, Sweden, greger.hornberg@silvermuseet.se.

Received: 9 Apr 2015; Accepted: 8 Jul 2015; Revised: 24 Aug 2015

INTRODUCTION

Within the research programme *Recalling the Past* (Bergman 2014), we have tried, among other things, to understand the establishment of agrarian settlements along the coast of the old County of Västerbotten (i.e. the present-day coastal areas of the Counties of Västerbotten and Norrbotten in Sweden). The interaction between the communities of Samis, Finns and settled agrarians is of the utmost importance to the research programme. In this article, however, the focus is on the establishment of the agrarian lifestyle. Our starting points were questions raised by the two northernmost known grave mounds found in Sweden. One of these, in Sangis, Nederkalix parish, was robbed in 1920 and a scramasax and a shield boss from the Merovingian Period were found. The grave and its contents raise questions about who erected the mound and why. Therefore, archaeological and palaeoecological investigations were carried out around the mound during the period 2012–14. We hoped that the type of settlement or activity attached to the mound could be interpreted in terms of provenance, lifestyle, activities and chronology.

THE RESEARCH PROBLEM

Although agriculture and animal husbandry have long been known and used in Västerbotten and other parts of northern Norrland (Josefsson et al. 2014), their early use was complementary in character. The main subsistence strategies used in this area were game hunting, fishing and gathering. But over time systems of agriculture and animal husbandry became integral and subsequently started to dominate and change the lifestyle of the inhabitants of the coastal areas of Västerbotten. This raises two major questions: when did this agricultural system start and what factors induced its establishment?

Fig. 1. Map of the Bothnian area showing present-day cities, county names and the Lapland border. Dots show location of Iron Age cemeteries with mounds in central Norrland and the only known mounds in Norrbotten, Sangis and Espinära. Map: P.H. Ramqvist.

Knowledge is sparse regarding the establishment of the earliest sedentary agricultural systems north of Ångermanland. This is largely because of the lack of visible monuments in the landscape that can be connected unequivocally to the early agricultural lifestyle and culture. Despite intensive and professional surveys carried out from the 1980s (Liedgren & Hedman 2005), no clear traces of farming structures have been detected. Nor have more recent large-scale archaeological excavations along the northern coasts of Bothnian Bay yielded any clear traces of sedentary settlements. During these excavations, several sites with evidence of Late Iron Age activity have been found (Bennerhag 2012), but none can be related directly to sedentary farming. It appears, as discussed previously by Ramqvist (2014a), that practically all traces of probable early sedentary and sparse settlements around the mouths of the rivers have been destroyed by intensive Medieval and later settlement expansion. Stray finds, i.e. artefacts emanating from settlements and/or graves, found for instance during ploughing or by coincidence, corroborate this scenario.

In central Norrland, which has been much more intensively studied than the north, sedentary agricultural societies were established during the centuries before and just after the start of the Gregorian calendar (e.g. Selinge 1977; Ramqvist 1983; 2007; Liedgren 1992). This kind of agrarian settlement is easily detectable because the farms, in most cases, are accompanied by clearly visible groups of grave mounds or cemeteries. Liedgren (1992: 193) has shown that in 88% of known cases the graves occur within 50 m of the house foundations. Therefore in central Norrland the distribution of graves clearly shows the distribution of the agrarian settlements.

A very clear border concerning this kind of settlement lies in northern Ångermanland (cf. Fig. 1). This border is well-known and represents a northern boundary of various Iron Age phenomena, such as the mounds, certain artefact types like spade-shaped currency bars, place names ending with -*sta* and palynological evidence (e.g. Ramqvist 1983; 1998; Baudou 1986; Westerdahl 1989). This very clear cultural border existed during the whole of the 1st millennium AD.

Intriguingly, the two northernmost burial mounds apparently from the Late Iron Age found to date are far north of that clear border in northern Ångermanland: the grave mound at the village of Sangis and the unexcavated mound at the village of Espinära situated at the mouth and slightly upstream, respectively, of the River Sangisälven, not far from the border with Finland (Fig. 1). They raise vital questions for our research. What are their cultural and historical implications? How should they be interpreted, and are they unique, being more than 350 km north of the mounds in northern Ångermanland?

EARLIER THOUGHTS REGARDING ESTABLISHMENT OF THE AGRARIAN SETTLEMENTS

There are several theories about how the agrarian settlements were established, the most common being that there was a vast colonisation, largely encouraged by the Swedish Crown, during the 14th and 15th centuries AD (cf. Westin 1962; Wallerström 1995: 39ff; Myrdal 2011). Not much is known about events preceding the historically documented expansion of the agrarian settlements. Earlier researchers, such as Westin (1962: 120), emphasised eastern and western, but not so much southern, influences along the Bothnian west coast during the Late Iron Age, drawing from the sparse evidence available at the time. However, several new studies have altered views of the complexity of the early agrarian society emerging in coastal central Norrland during the Iron Age (e.g. Selinge 1977; Ramqvist 1983; 1992; 1998; Liedgren 1992) and the Medieval Period (e.g. Mogren 2000; Grundberg 2006) and many new pollen analyses have been conducted during the last 50 years (cf. Josefsson et al. 2014). These latter analyses concern not only the central Norrland area, but also the northern part of inland and coastal Sweden.

During the 1960–70s, several pollen analyses were conducted during the project *Early Norrland* (Baudou & Biörnstad 1968), mostly in central Norrland but also some in Västerbotten. At least one of these analyses provided indications that permanent agriculture began in southern Västerbotten during the 6th–7th centuries AD (Engelmark et al. 1976).

In connection with the so-called *Luleälvs-projektet* (En. River Luleälven project), new, mainly palaeobotanical, investigations were carried out along the valley of the River Luleälven. The project is summarised in the volume *Att leva vid älven* (En. Living by the river; Baudou 1996a). The findings, largely based on the new palaeobotanical results (Segerström 1996), led to substantial modifications of the colonisation theory, as discussed by Baudou (1996b). The main conclusions were that sparse agricultural settlements were established along the coast during the period AD 800–1323.

Fig. 2. A – The scramasax, and B – shield boss found in 1920 in the Sangis mound. Photo: The Swedish History Museum.

Within the research programme *Recalling the Past*, we have conducted several pollen analyses at hotspots along the coast of the Bothnian Bay. The results are soon to be published, but the preliminary results indicate that establishment of the agrarian sedentary settlements began, albeit sparsely, before the Viking Age (Josefsson et al. unpublished data).

THE SANGIS MOUND

In 1923, Gustaf Hallström visited Sangis, close to the River Sangis in northern Norrbotten. Grave robbers showed Hallström artefacts that comprised a c 85-cm long *scramasax* (one-edged iron sword) and a shield boss (Figs. 2A & B), found in a sandy mound, 7 m in diameter and 1 m high.

According to the notes made by Hallström (1923), he was told by the robbers that unburnt, almost totally decomposed human vertebrae and foot bones were found in the burial. These bones were probably not recovered and are lost. Hallström was also told that there had been a depression in the top of the mound, oriented approximately northwest-southeast, that was probably the traces of a collapsed coffin or something similar. In that depression the grave robbers found three stones, each roughly the size of a child´s head, lying in a straight row (northwest-southeast). Hallström himself noted that there was a furrow constructed around the foot of the mound, which we know today is typical of mounds from the Late Iron Age.

The robbers also said that the sword was found beside the dead person and that silver threads could be seen by the sword´s handle; however the threads were so corroded that it was not possible to recover them.

Later, in 1937, Odenkrants conducted an excavation from which he concluded that the inhumation (probably a coffin) had been placed on the original ground surface and then covered with sand (cf. Serning 1960: 139–40). No more artefacts or bones were found by Hallström in 1923 or by Odenkrants in 1937. The documentation of the site is poor; much more probably could have been documented, had it been excavated using present-day archaeological methods.

The artefacts and the construction of the mound indicate to us a possible date of 7th century AD. Serning (1960: 34–5) and others have dated the grave to the Late Merovingian Period/Early Viking Age, c 800 AD, but we think that date is a little too late, as practically all similar large scramasaxes are dated before the Viking Age (e.g. Petersen 1919; Sjövold 1974: 267ff). As we outline below, there is more support for a date from the Early Merovingian Period.

About 15 km up the River Sangisälven is another grave mound, at Espinära, Nederkalix parish (Fig. 1). This mound has not been excavated or dated, and like the mound at Sangis, it has morphologically identical counterparts in central Norrland. To the east, there are no examples of burial mounds with sand/earth filling. Instead, different kinds of cairns dominate the burial tradition in Ostrobothnia (Kuusela 2009; Holmblad 2010). Furthermore, the types of artefacts found in the Sangis mound are found less often in Finland than in Norway and east Sweden (cf. Serning 1960: 34–5). However, the closest counterparts in Norway are 400–500 km away to the west-northwest and northwest, in the Lofoten and southern Troms regions. Travelling to and from these regions would have been more demanding in comparison to the relatively easy southern route, along the coast. Therefore, it seems plausible that the mound was erected by people from coastal central Norrland. Such an assumption is also supported by other somewhat older finds dating to the Migration Period, such as a central Norrland relief brooch and a spade-shaped currency bar, found to the north in the Rovaniemi and Torneå area, respectively (Ramqvist 2014a).

As the Sangis and Espinära mounds are unique (in the currently available records), we wanted to determine whether these two single mounds were associated with farms, like the counterparts in central Norrland (Liedgren 1992). We chose to apply different kinds of methods to investigate the Sangis site (Ramqvist 2013; 2014b), since the mound itself already had been 'excavated' and dated. During three campaigns in 2012–14, we conducted phosphate analyses, georadar investigations, archaeological excavations and palynological analyses close to the Sangis mound in order to find settlement or other traces of activity. In Espinära we have only performed phosphate mapping around the unexcavated grave mound itself.

THE ARCHAEOLOGICAL INVESTIGATIONS AT SANGIS

The geographical setting

The Sangis mound is situated c 14 m asl on a heath-dominated ridge of sorted soil, mainly sand, c 3 km southwest of the village of Sangis. It was situated at the narrow and steep inlet to a lagoon-like part of the sea, which can be seen as a very strategical position in the landscape (Fig. 3). There are no natural stones or boulders on the ridge and it is limited by the Creek Kvarnbäcken in the north. The creek meanders from the Bog Vallmyran to the west of the ridge for 1.5 km out to the present-day sea. Approximately 90 m south-southwest of the mound, there is a rectangular (3 x 1 m) cooking pit of traditional Late Iron Age type (Figs. 3 & 4). Along the western slope, parallel to the edge of the Bog Vallmyran, there are four natural oblong, c 10 x 4 m, depressions (Figs. 4 & 5). These depressions were also noticed by Hallström (1923) during his visit. They could probably be artificial constructions for boats (see the results below). The higher parts of the sand ridge are dominated by acid heath vegetation, with Scots pine (*Pinus sylvestris*), dwarf shrubs (Ericaceae) and reindeer lichens (*Cladina* spp.), but the eastern slopes are lush.

A crucial consideration when studying northern parts of Scandinavia is the speed of shore line displacement. The speed is maximal, close to 9 mm/year during the two last millennia (Berglund 2004), in the area around the present-day towns of Örnsköldsvik, Umeå and the Finnish Vaasa (Fig. 1). This area was the epicentre where the inland ice sheet was thickest and caused the largest depression in the earth's crust. From the epicentre the shore line displacement rates slows down in all directions. So, as far north as the Sangis area, about 300 km north of Umeå, the speed is about 7–7.5 mm/year (Ågren & Svensson 2007). It also seems that the rate has been relatively constant during the last five millennia (Lindén et al. 2006). As the burial mound and the highest parts of the heath lie at 14 m asl, it means that the top of the ridge became dry between 2000 and 1870 calBP, i.e. 50 calBC–calAD 80. The surface of the Bog Vallmyran, in which we took the pollen probe (see Fig. 4 and below), is situated at 11 m asl. In the 1-m deep profile, the transition zone between sediment and organic material was consequently located at c 10 m asl. This, in turn, means that peat started to accumulate at that level in the sheltered bay between 1330 and 1430 calBP, i.e. calAD 520–620 according to the land uplift rate. This is in accordance with the radiocarbon dating of mosses from the bottom of the peat core indicating that peat accumulation begun around 1307–1528 calBP; calAD 422–643 (Table 1).

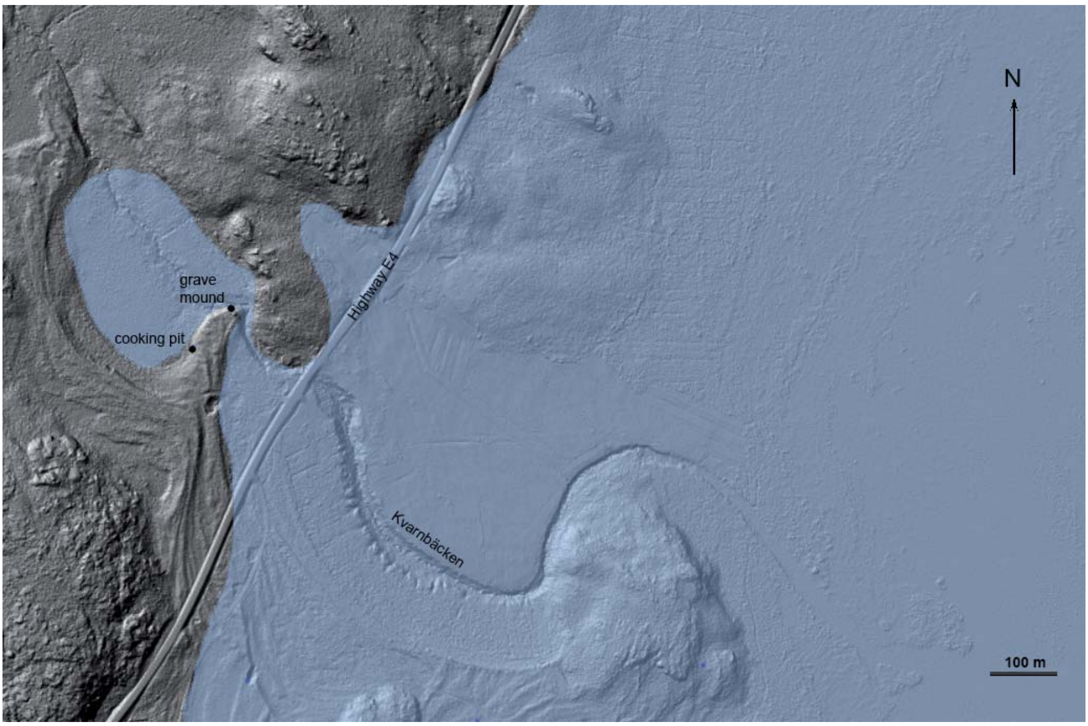


Fig. 3. A general map of the shore line around the middle of the 1st millennium AD, (the line is an approximation of levels between 10 and 12 metres above present sea level), when the first signs of human activities were found close to the Sangis grave mound. The mound was clearly built in an extremely strategic location, directly by the narrow inlet to the lagoon-like bay of present day Vallmyran. Under the approximated sea level the present day map is visible. The Sangis grave mound (Sv. Sangishögen) and the cooking pit are both marked on the map. Map by P.H. Ramqvist based on a map from Lantmäteriet, Sweden.

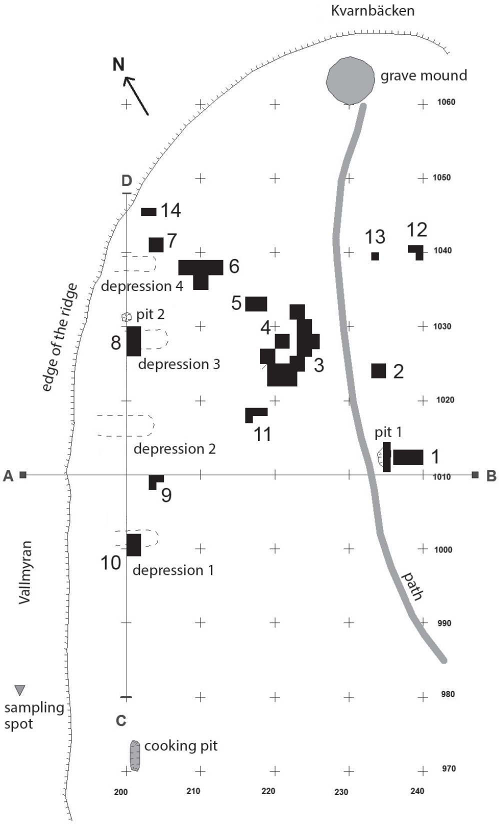
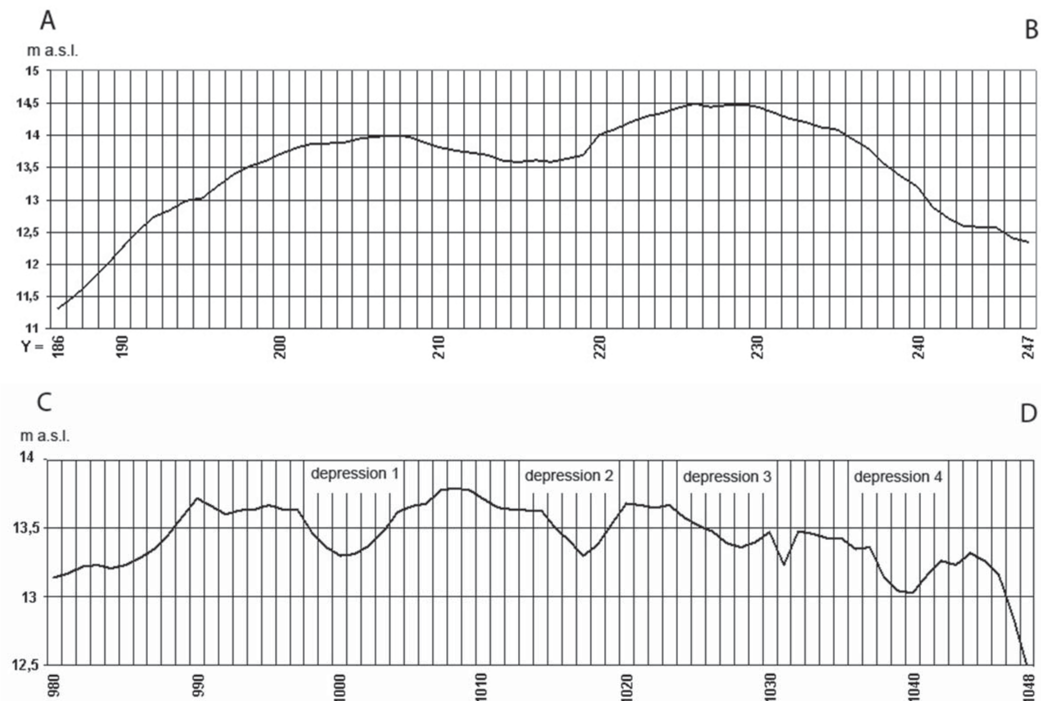


Fig. 4. Map over excavation area close to the Sangis grave mound. Numbered black squares show where excavation trenches were placed. The sampling spot for the pollen sample in Vallmyran is shown on the low left. A–B and C–D represent the profile lines showed in Figure 5 below. The grave mound has the official National Heritage Board number Nederkalix parish no. 81:1 and the cooking pit no. 676:1. Scale: 10 metres between the crosses. Illustration: P.H. Ramqvist.

Fig. 5 (below). Profiles of the sand ridge: A–B show the profile at Y=200 and C–D the profile at X=1010. For the location of the profile lines, see Figure 4. Illustration: P.H. Ramqvist.



Excavation methods and results

Neither the phosphate nor georadar investigations showed any clear traces of settlement. However, in the phosphate mapping we observed what we interpreted as cultural layers or, more accurately, indications of settlement in the form of small amounts of charcoal and soot particles in the samples. These few indications provided the base for our excavations, and we subsequently found scattered burnt stones in the excavation trenches, signalling human activity. We also noticed, unusually many traces of fire, i.e. charred remains of roots and similar evidence. Whether they were results of human agency or frequent natural forest fires could not be determined during the excavations.

At the beginning of the campaign, the stones on the sand ridge were located using a 'stone-finding-stick' (Fig. 6) and accurately mapped. Because the ridge is totally stone-free, every single stone had been carried to the site and was therefore viewed as an artefact. There were no particularly large concentrations of burnt stones, but an area c 50 m south of the mound had more stones.

We excavated 14 trenches covering 110 square metres in total, mainly around the sites of the burnt stones (Fig. 4). The soils were sieved (4 mm mesh) and the trenches were excavated down to the C-horizon (i.e. 0.2 m), since no stratigraphic layers were detected. All features were numbered and investigated individually. The most interesting features found were a forge, in trench 3 (Figs. 4 & 7), scrap iron (Fig. 8) and forge residues in the form of different kinds of slag (Fig. 9).

The forge was indicated by a red burnt almost square (1.0 x 0.9 m) area, with soot and charcoal present. Beside it, 466.9 g of slag was found (Fig. 7). Most of the slag consisted of bottom pieces (Sv. bottenskållor), c 10 mm thick with an approximate diameter of 80 mm. The rest of the slag comprised drop-shapes and iron shells (Sv. glödskal). Directly south of the slag concentration most of the scrap iron was found (Figs. 7 & 8). Two of the iron pieces were rivet washers and there were also some fragments of nails or rivet shafts and other fragmented iron pieces (Fig. 8). Close to the forge a white burnt piece of (firing-) flint was found.

According to metallurgical analyses of the material (Ogenhall & Hjärtner-Holdar 2014), the residues indicated skilled secondary forging of a soft, carbon-free iron. The small amount of slag also showed that the intensity of the forging had been low, as indicated by the small and incomplete bottom pieces. During the forging process, sand had been used either for protection or for welding work. The iron artefacts contained extremely few slag residues, showing that the rivets and nails were very well forged.

We estimated that there were three or four bottom pieces, indicating how many times forgings had been cleansed. The bottom pieces in Sangis were considerably smaller than those at other sites,

Fig. 6. Intensive investigation with the 'stone-finding-stick' was the most effective method to detect traces of human activities on the stone-free sand ridge. Photo: S. Nilsson.

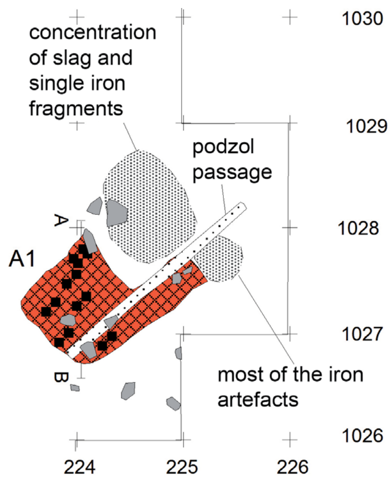


Fig. 7. Plan drawing of the forge A1 in trench 3 (cf. Fig. 4) where the different residues were found. Illustration: P.H. Ramqvist.

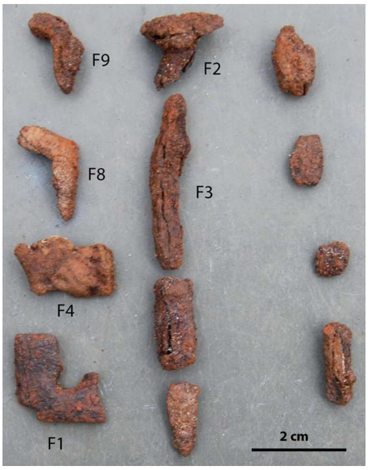


Fig. 8. Some of the iron artefacts found close to the forge A1 in Sangis. F1 and F4 are fragmented rivet washers and F2, F3, F8 and F9 fragments of nails or rivet shafts. Photo: P.H. Ramqvist.

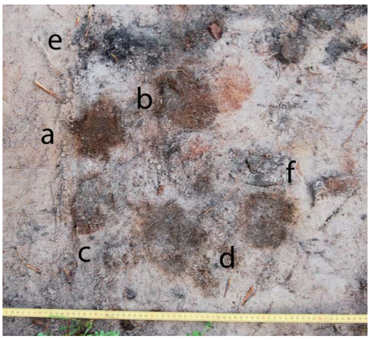


Fig. 10. Feature A2 found in trench 6 (cf. Fig. 4). All of these shallow but distinguished colorations were covered with burnt stones and they all are different in character with grey, brown, red and black colours. No artefacts or calcinated bones were found in any of these of features. Photo: P.H. Ramqvist.

for example the sedentary farm in Gene in coastal Ångermanland (Ramqvist 1983; Ramqvist et al. unpublished) where primary, as well as secondary forging had been conducted.

The scattered concentrations of burnt stones were occasionally accompanied by hearth-like features (like the one shown in Fig. 10), for example directly south of the forge in trench 3 as well as in trenches 6 and 14 (cf. Fig. 4). The function of these features is unknown as they did not contain any material

Fig. 9. Some of the slag residues found in forge A1 in Sangis. To the right some almost intact bottom pieces (Sv. bottenskållor) and to the left drop-shaped slag. Photo: P.H. Ramqvist.

except burnt stones, some charcoal and soot. The red colouration in and around some of the features, indicated firing at high temperatures.

In all the excavated trenches, only one single bone was found, in square X=1023, Y=221 in trench 3 (cf. Fig. 4), namely a 1-g calcinated bone fragment of reindeer, *Rangifer tarandus*, (Vretemark 2014). The bone was found in the B-horizon and adjacent to burnt stones, which indicate its connection to the other residues on the site. Such sparse amount of calcinated bones is very unusual on an ordinary Late Iron Age settlement and supports the conclusions presented below of low-intensity use of the site. The reindeer bone was accelerator dated (Ua-48587) to 1475±30 BP, i.e. calAD 560–620 (68.2%) and calAD 540–645 (95.4%); a good working date is therefore c AD 600.

The four depressions in the west part of the ridge (cf. Figs. 4 & 5), also were of interest. Trenches in two of them (trenches 8 and 10; Fig. 4) detected no signs of artificial constructions, showing they were natural depressions. However, they could still have been used by people, for instance as sheltered ship landing places, because of their convenient position close to the former shore.

THE PALAEOBOTANICAL INVESTIGATIONS AT SANGIS

Sampling, radiocarbon dating and pollen analysis

Peat profiles were sampled for pollen analysis from an ombrotophic part of the Peat bog

Vallmyran (90 x 280 m) located just west of the sediment ridge underlying the Sangis grave mound (Fig. 4).

The sampling site (23°26'10"E, 65°50'32"N) was located at an elevation of 11 m asl with a peat depth of 1 m. The rate of the postglacial rebound for this area (Lindén et al. 2006; Ågren & Svensson 2007) indicates that peat accumulation in the lowest part of the core (10 m asl) began between 1330 and 1430 years BP (AD 520–620). The local vegetation at the sampling site was characterised by downy birch (*Betula pubescens*), Scots pine (*Pinus sylvestris*), willow (*Salix* spp.) and grey alder (*Alnus incana*) in the tree layer, and the forest floor was dominated by wood horsetail (*Equisetum sylvaticum*), water horesetail (*E. fluviatile*), bog-rosemary (*Andromeda polifolia*), cloudberry (*Rubus chamaemorus*), dwarf birch (*Betula nana*), crowberry (*Empetrum nigrum* spp. *hermaphroditum*), bog bilberry (*Vaccinium uliginosum*), bilberry (*V. myrtillus*), cranberry (*V. ocycoccus*), *Sphagnum girgensohnii* and *Hylocomium splendens*. Given the size of the mire and that the sample was taken right at the edge of the sediment ridge, the pollen record should mainly reflect a local pollen source area (Sugita 2007). Two cores were taken, spanning 1–100 cm depths, using a Russian peat corer (Jowsey 1966). The top 50 cm consisted of weakly decomposed peat; the 50 to 80 cm strata comprised moderately decomposed peat with pieces of wood; the 80 to 99 cm strata comprised highly decomposed peat, with a sand layer at 92–93 cm; and the final 99–100 cm layer consisted of sandy sediment. The cores were wrapped in plastic and aluminium foil and placed in a freezer at the laboratory. Five samples were cut out, they were cleaned with a scalpel to avoid contamination and put in petri dishes with water. Plant remains were identified, by the use of a microscope with low magnification, and picked out with a tweezer. The remains were cleaned from fine roots and put in glass tubes to dry in +70°C for 24 hours. All samples were then weighted (>5 mg) and sent to the Ångström Laboratory in Uppsala for accelerator mass spectrometry (AMS) dating (Table 1). All dates were calibrated using the IntCal13.^{14}C calibration curve (Reimer et al. 2013) in Clam 2.2 (Blaauw 2010). An age-depth model was constructed using the non-Bayesian Clam model package (Blaauw 2010) in the statistical software package R (R Development Core Team 2013). All dates are expressed as calibrated age anno Domini (AD) and before present (BP), where 'present' is defined as AD 1950.

Forty three contiguous 1 cm^3 samples, covering the 55–98 cm depth interval, were cut out for pollen and charcoal analysis. *Lycopodium* tablets (Batch 177745, Lund, Sweden) were added for pollen concentration and influx calculations (see Stockmarr 1971). All samples were treated with water and HCl to dissolve the tablets, then with KOH (5%) to dissolve the organic material, followed by acteolysis according to Moore et al. (1991), and finally mounted in saffranine-stained glycerine.

Pollen and spores in all samples were analysed, and a minimum of 500 terrestrial pollen grains was counted at each level. Pollen percentages were calculated based on the sum of terrestrial pollen, and spore percentages were based on the total sum of terrestrial pollen and spores. For identification, the pollen keys presented by Moore et al. (1991) and a reference pollen collection at the Swedish University of Agricultural Science were used. The anthropochore and apophyte groups included pollen of cereals, weeds, large grass pollen (> 40 µm) and pollen of types of naturally occurring plants whose abundance is positively affected by distur-

Depth (cm)	Lab ID	Material	^{14}C-age (BP)	Calibrated age, BP (2σ)	Calibrated age, AD (2σ)
60	Ua-48234	Leaves, seeds, mosses, needles	882±39	710–914	1036–1240
70	Ua-47163	Mosses, needles, seeds	906±31	745–914	1036–1205
80	Ua-48235	Mosses, seeds, leaves, needles, charcoal	983±32	796–958	992–1154
93	Ua-47164	Mosses	1248±30	1080–1272	678–870
98	Ua-47165	Mosses	1513±62	1307–1528	422–643

Table. 1. Radiocarbon ages of macrofossil samples from Vallmyran processed at the Ångström Laboratory in Uppsala, Sweden, and calibrated using the IntCal13.^{14}C calibration curve (Reimer et al. 2013) in Clam 2.2 (Blaauw 2010).

bance, especially human impact, and therefore used as indicators of such activities (Behre 1981; 1988; Hicks 1988; Josefsson et al. 2009). Charcoal particles (> 50 µm) were recorded and are presented as percentages of the total sum of terrestrial pollen. Accumulation rates for pollen (PARs; pollen/cm^2 and year) were calculated for alder, birch, pine and apophytes. Charcoal accumulation rates (CARs; particles/cm^2 and year) were also determined. Pollen diagrams were constructed using the programs TILIA and TILIA GRAPH (Grimm 1991; 2004). Based on major changes in the pollen percentage diagram, it was subjectively divided into five pollen assemblage zones (PAZ SI to SV).

Results

The radiocarbon ages and calibrated dates are presented in Table 1, and the age-depth model is shown in Figure 11. The results indicate that the peat accumulation had been rapid from 80 to 60 cm, where the three calibrated dates seemed to overlap. The dates 882±39 BP (60 cm) and 906±31 BP (70 cm), and 906±31 BP (70 cm) and 983±32 BP (80 cm), are not significantly different, but the 882±39 BP (60 cm) and 983±32 BP (80 cm) dates are (t-test, 95%). The results of the pollen analysis are presented in Figure 12, and major changes in the pollen record are summarised in Table 2. PAR values for alder, birch, pine and apophytes, and CAR values for charcoal are shown in Figure 13. The values are rather high, due to the rapid peat accumulation.

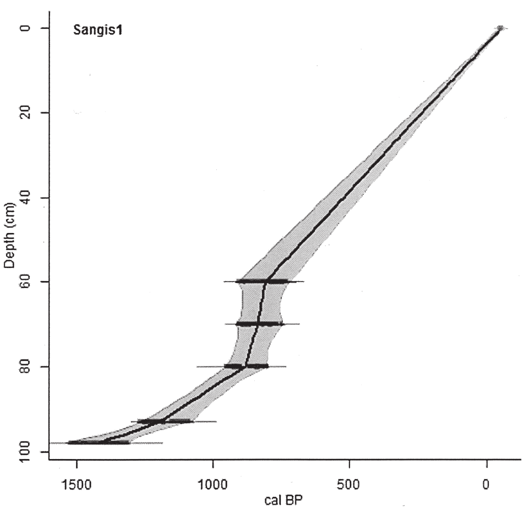


Fig. 11. Age-depth model (linear interpolation) for the peat stratigraphy at Vallmyran, located close to the Sangis grave mound. Shaded area shows the 95% confidence interval of the model (Blaauw 2010).

Interpretation of vegetation development and methodological difficulties

Based on major changes in the pollen percentage and PAR record (Figs. 12 & 13, Table 2), we have interpreted the local vegetation's development. It should be noted that the seashores are characterised by recurrent disturbances because of shifts in water level and erosion by water and ice. Consequently, apophytes, which are naturally found in local vegetation and benefit from human impact, may also increase in abundance on naturally disturbed grounds such as seashores. Another issue is whether the pollen record reflects vegetation changes occurring on the ridge or on the mire. For example, the Rosaceae undiff. pollen type includes both terrestrial and wetland plants. This pollen type, including e.g. *Potentilla palustris*, *P. erecta* and *Geum rivale*, is here interpreted to mainly reflect changes in seashore and mire vegetation. It may also be difficult to evaluate the source area of pollen when a site has changed from open seashore conditions to a closed forest state because of the land uplift.

PAZ SI Open seashore vegetation and construction of the grave mound at 98–90 cm (1375–1120 BP; AD 575–830)

The sediment ridge was located just a few metres above the seawater line and did not have a permanent tree cover during this zone. This was also indicated by low tree pollen percentages and low PAR values for trees. The presence of willow, dwarf birch, grasses, sedges and Rosaceae plants, together with apophytes, other herbs and bracken fern, indicate nutrient-rich conditions and disturbed ground, typical for seashore line vegetation. In the sheltered bay west of the ridge, wetland plants could establish, and in the shallow part of this bay close to the shore line *Sphagnum* peat started to build up as a result of the land uplift. The age of the peat at 98 cm in the peat profile (1528–1307 calBP; calAD 422–643) fits very well with the calculated age based on the land uplift rate (1430–1330 calBP; calAD 520–620).

Moreover, the sand lens at 92–93 cm was dated, according to the age-depth model, to around 1200 calBP (calAD 750), indicating some kind of local erosion, probably from the ridge. This date is synchronous with the age of the archaeological finds in the grave mound, so this sediment lens could very well be the result of wind-drifted sand from the construction of the grave mound and the cooking pit close by. The distance between the cooking pit and the peat sample site is only 17 m and the first charcoal particles were recorded at the same time suggesting that the charcoal may be related to fire in the cooking pit. There are, however, few indications of human impact on the ridge in the pollen record during this zone.

PAZ SII Alder and birch forest at 90–80 cm (1120–880 BP; AD 830–1070)

The sand ridge and its surroundings then became covered, initially by alder and subsequently by birch, indicating a seashore succession from open to semi-open forest vegetation. Pine probably became more common on higher elevations in the surrounding area and spruce may have been present on more fine-grained soils in the region. These developments are supported by the PAR values for alder, which increased initially and then decreased, and the values for birch and pine, which slowly increased thereafter. Apophytes were not very abundant and may have grown scattered on the ridge. Willow, dwarf birch, sedges and Rosaceae plants probably grew in the wetland ecotone between the ridge and the open water, similar to the vegetation found in the previous zone, PAZ SI. In the sheltered bay wetland plants were still growing and ferns were present in more productive sites. The amount of charcoal particles was still low and scattered. The records for this zone indicate presence of deciduous tree

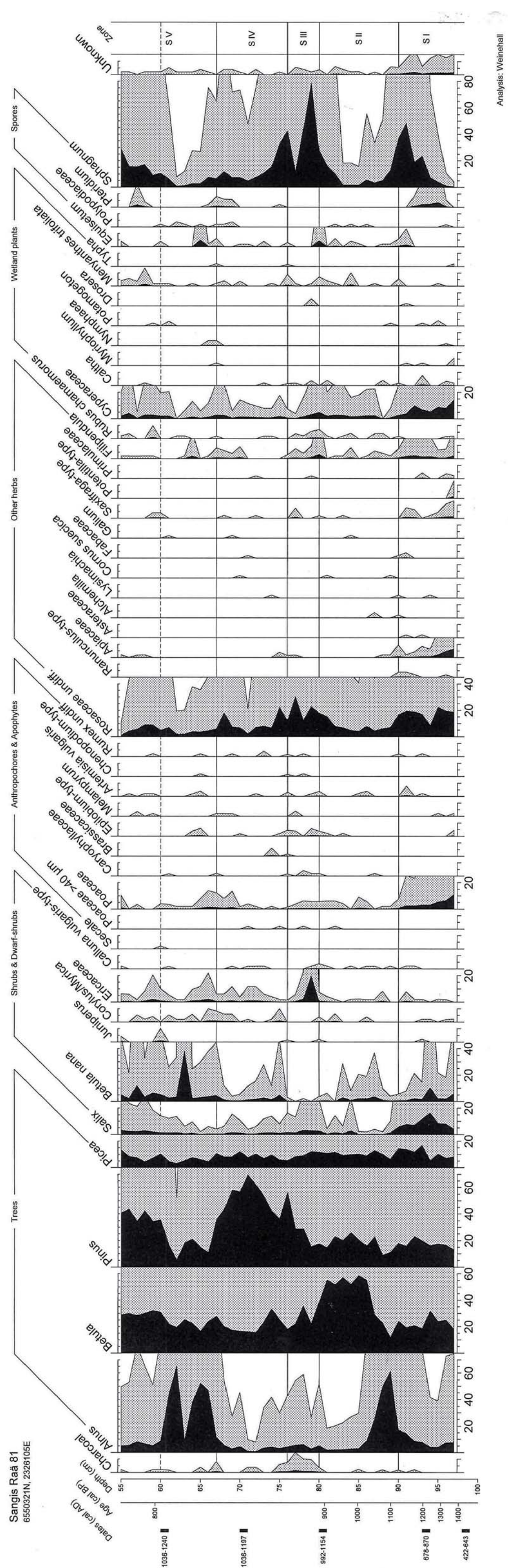


Fig. 12. Pollen percentage diagram from Vallmyran, located close to the Sangis grave mound. From left to right: calAD dates; interpolated ages from the calibrated ^{14}C-ages BP; depth (cm); microscopic charcoal (>50 µm), pollen and spore types as percentage (black shading) and at 10 x magnification (grey shading). The horizontal lines indicate boundaries between zones SI to SV; dashed line indicates first recording of cereal pollen. Analysis: A. Weinehall.

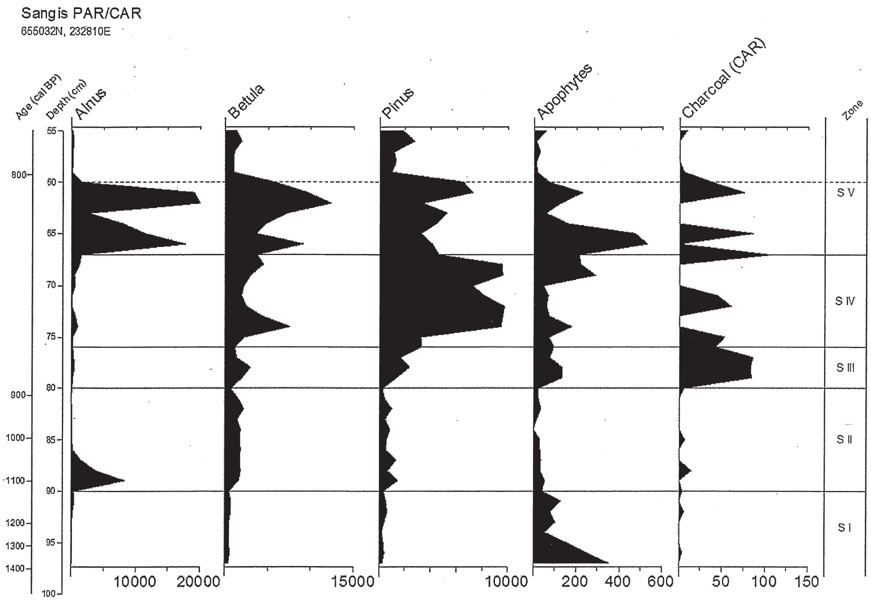


Fig. 13. Accumulation rate diagram of pollen (PAR) and charcoal (CAR) from the Vallmyran sampling site, located close to the Sangis grave mound. From left: calibrated ^{14}C-ages (BP); depth (cm); pollen accumulation rates (pollen/cm^2 and year) for tree and apophyte pollen types; charcoal accumulation rates (particles/cm^2 and year). The horizontal lines indicate boundaries between zones SI to SV; dashed line indicates first recording of cereal pollen. Analysis: A. Weinehall.

cover on the ridge, and minor disturbances that were probably due to natural factors rather than human impact.

PAZ SIII Clearance and activity at 80–76 cm (880–865 BP; AD 1070–1085)

In this zone the shares of charcoal particles were recorded continuously and CAR values peaked, indicating local fires on the ridge. Changes also occurred in the local vegetation. The trees on the ridge probably disappeared, while the shore lines were still covered by alder and willow. The PAR values for all trees decreased dramatically at the beginning of this zone (at 80 cm) and the values for birch and pine subsequently increased. On the ridge, apophytes (including fireweed, *Epilobium*), and ericaceous dwarf shrubs increased, as did Rosaceae plants on the mire. All these changes indicate clearance of the ridge that lasted for a rather short period of time involving some kind of human activity probably including controlled burning of vegetation on the ridge. In the vicinity, *Sphagnum* peat continued to accumulate in the sheltered bay, which now included peatland vegetation such as horsetail species and cloudberry.

PAZ SIV Activity on the ridge at 76–67 cm (865–830 BP; AD 1085–1120)

During this zone the vegetation on the ridge continued to be rather open with low tree cover of alder, birch and pine. The PAR values for birch increased initially then decreased, and the values for pine increased dramatically. Pine was probably growing on the ridge at this stage and in the surroundings, contributing to the high PAR values for pine at the sampling site. Ericaceous species, grasses and apophytes were still present on the ridge, and dwarf birch, sedges and Rosaceae plants were growing around its edges and on the mire. Charcoal particles were less abundant and more scattered than during the previous phase but the CAR values increased at 72–71 cm. All these changes indicated continued disturbances, probably from low-impact anthropogenic activities on the ridge.

PAZ, (depth, cm)	Age (BP)	Age (AD)	Zone description
SI (97–90)	1375–1120	575–830	Trees: *Alnus* increase 4–14%, *Betula* and *Pinus* fluctuating 18–32% and 13–23%, respectively, *Picea* 5–14%. Shrubs and dwarf shrubs: rise in *Salix* and *Betula nana* (94 cm) to 16% and 10%, respectively, and then decline, Ericaceae < 1%, *Corylus* intermittent < 1%. Anthropochores and apophytes: Poaceae decline 11–2%, *Epilobium*, *Melampyrum*, *Artemisia* and *Rumex* sporadic < 1%. Other herbs: Rosaceae (e.g. *Geum rivale*, *Potentilla* spp.) continuous 8–22%, Apiaceae decline 6–1%, *Saxifraga* type and *Filipendula* 2–1%. Wetland plants: Cyperaceae decline 14–3%. Spores: *Sphagnum* increase 1–48%, *Pteridium* 1–3%. Charcoal sporadic <1%.
SII (90–80)	1120–880	830–1070	Trees: *Alnus* increase 61% (89 cm) then decline, *Betula* increase 12–58%, *Pinus* fluctuating 9–26%, *Picea* 6–13%. Shrubs and dwarf shrubs: *Betula nana* 1–3%, *Salix*, Ericaceae and *Calluna* continuous < 1%, *Corylus* intermittent < 1%, *Juniperus* sporadic. Anthropochores and apophytes: Poaceae continuous < 1%, Poaceae > 40 μm, Caryophyllaceae, *Epilobium* and *Artemisia* sporadic < 1%. Other herbs: Rosaceae continuous 4–15%, *Filipendula* intermittent < 1%. Wetland plants: Cyperaceae 1–3%, *Menyanthes* intermittent < 1%. Spores: *Sphagnum* continuous 16–2%, *Equisetum* and Polypodiaceae intermittent < 1%. Charcoal sporadic < 1%.
SIII (80–76)	880–865	1070–1085	Trees: *Alnus* 6–3%, *Betula* decline 38–22%, *Pinus* increase 15–60%, *Picea* 12–5%. Shrubs and dwarf shrubs: *Salix* 1–3%, *Betula nana* < 1%, Ericaceae increase 20% (79 cm) then decline. Anthropochores and apophytes: Poaceae continuous < 1%, Caryophyllaceae and *Epilobium* intermittent < 1%, *Melampyrum*, *Artemisia*, *Chenopodium* and *Rumex* sporadic. Other herbs: Rosaceae 12–30%, *Filipendula* and *Rubus chamaemorus* continuous < 1%. Wetland plants: Cyperaceae decline 5–1%, *Caltha* and *Menyanthes* intermittent < 1%. Spores: *Sphagnum* increase 78% (79 cm) then decline. Charcoal continuous 1%.
SIV (76–67)	865–830	1085–1120	Trees: *Alnus* 5–1%, *Betula* decrease 33–16%, *Pinus* increase 36–70%, *Picea* 6–12%. Shrubs and dwarf shrubs: *Betula nana* decrease 5–1%, *Salix* and Ericaceae continuous < 1–2%, *Corylus* and *Calluna* intermittent ≤ 1%. Anthropochores and apophytes: Poaceae continuous < 1%, Poaceae > 40 μm, *Melampyrum* and *Rumex* intermittent < 1%, Brassicaceae, *Epilobium* and *Artemisia* sporadic < 1%. Other herbs: Rosaceae decrease to 2% (71 cm) then increase to 18% (68 cm), *Saxifraga* and *Filipendula* intermittently < 1%, Apiaceae, *Lysimachia*, *Cornus*, Fabaceae, *Galium* and Primulacea sproradic < 1%. Wetland plants: Cyperaceae continuous ≤1–2%, *Rubus chamaemorus* and *Menyanthes* sporadic < 1%. Spores: *Sphagnum* decrease 42–6%, *Equisetum* intermittent < 1%, Polypodiaceae and *Pteridium* sporadic. Charcoal intermittent < 1%.
SV (67–55)	830–740	1120–1210	Trees: *Alnus* increase to 52% (65 cm) and 65% (62 cm) then decline, *Betula* 22–33%, *Pinus* decrease to 5.2% (62 cm) then increase to 43%, *Picea* 3–13%. Shrubs and dwarf shrubs: *Salix* increase 1–3%, *Betula nana* rise to 38% (63 cm) then decrease, *Corylus* and Ericaceae continuous <1–2%, *Juniperus* and *Calluna* sporadic. Anthropochores and apophytes: *Secale cereale* sporadic (60 cm), Poaceae intermittent 1–2%, Caryophyllaceae, *Epilobium*, *Melampyrum*, *Artemisa* and *Rumex* intermittent < 1%, Chenopodiaceae sporadic. Other herbs: Rosaceae continuous 7–1%, *Filipendula* intermittent <1–2%, Apiaceae, *Galium* and *Saxifraga* sporadic. Wetland plants: Cyperaceae continuous ≤1–4%, *Nymphaea*, *Potamogetum* and *Menyanthes* intermittent < 1%. Spores: *Sphagnum* decrease <1% (59 cm) then increase to 30% (55 cm), *Equisetum*, Polypodiaceae and *Pteridium* intermittent ≤1–5%. Charcoal intermittent <1%.

Table 2. Major changes in vegetation composition in the PAZs at Vallmyran, close to the Sangis grave mound. Dates (BP, AD) are calibrated 'best'-weighted averages from the linear interpolation age-depth model (Blaauw 2010).

PAZ SV Fire, natural succession and human impact continues at 67–55 cm (830–740 BP; AD 1120–1210)

At the transition between zones IV and V, there was a peak in charcoal occurrences and a decrease in the forest cover of mainly pine. Subsequently alder and birch cover increased, according to high pollen percentages and PAR values, suggesting the presence of deciduous tree cover on the ridge and surrounding peatland, possibly after fire. The PAR values for pine decreased, although pine probably still grew sporadically on the ridge and covered the surrounding highlands. Apophytes, mainly grasses, were still abundant on the ridge and its surroundings, as seen in the PAR values, and Rosaceae species grew on the mire. Another peak in charcoal particles and CAR values was recorded between 61–59 cm, and around 800 BP; AD 1150 (at 60 cm) one single *Secale* (rye) pollen grain was recorded (dashed line in Figs. 12 & 13), possibly indicating some sporadic small-scale local cultivation or handling of the crop nearby (Hörnberg et al. 2015). This possibility is supported by the availability of suitable fine sediment areas southeast of the ridge at the time resulting from the land uplift. The distance from the seashore at that time (located approximately 5.6–6 m above its present level) to the sediment ridge was only 250–300 m. However, it is impossible to draw robust conclusions from a single pollen grain (Behre 2007). Ericaceous species were probably growing on the ridge again. During the second half of the time covered by this zone, the cover of alder decreased, but birch and pine cover increased. However, PAR values for all trees (and apophytes) were reduced, partly due to a reduction in the peat accumulation rate. Dwarf birch was probably growing on the edge of the peatland together with willow and sedges. The share of charcoal particles and CARs was low. These findings indicate that fire, natural succession and continued land use influenced vegetation on the ridge and its surroundings during this zone, especially the area to the southeast with sediment soils located between the ridge and the seashore.

DISCUSSION

The aggregated results show that there were two main phases of land use around the Sangis grave mound. The first was from 1350 to 1150 BP; AD 600 to 800, when the grave mound and probably the nearby cooking pit were constructed. The second phase began in c 880 BP; AD 1070, possibly due to the new availability of fine sediment soils resulting from the land uplift and suitable for grazing, fodder collection and cultivation (cf. Engelmark 1976; Wallin & Segerström 1994; Wallin 1996). The unusual amount of charred roots found during the excavation together with increases in charcoal particles and in the percentages of apophytes in the pollen record during PAZ SIII (Figs. 12 & 13) support the interpretation that the new land use during the second phase included controlled burning on the ridge. However, various factors related to these land use phases and their background requires further discussion.

No traces of houses or other settlement constructions were found around the grave mound. Despite careful and detailed surveys of the ground with georadar, soil probing and metal detectors neither hearths of Sami type nor stove cairns (Sv. härdpallar or spisrösen) for possible frame houses were detected. Neither post holes nor other ground marks connected to buildings were found at the site. Furthermore, no clear hearths (apart from the unexcavated rectangular cooking pit) or scattered calcinated bones (usually present at settlement sites) were found. Thus, although the site might have been visited frequently, there appears to have been no need for any permanent house or similar construction. If people stayed over-night, which is highly probable, it was done in mobile, temporary constructions such as tents. This, together with the absence of scattered warming and cooking hearths, strongly indicates that the site was visited during the summer, or at least not during the winter. If hearths were used in the tents, they were constructed without any pit digging or, for example, other stone arrangements. The main food preparation carried out on this site was probably done in the rectangular cooking pit. The almost total lack of scattered burnt bones, which are normally very frequent on settlement sites, and the relatively small amount of charred particles in the peat profile, support the interpretation that there was no permanent settlement.

The main use of this site is clearly manifested in the evidence of smithy activities. A simple forge was made on the ground, where temporary forging activities took place. There is reason to believe that the forging was concerned with mending ship rivets, as nail parts and washers were the only artefacts found in connection with the forge. The lack of settlement constructions found on the site is intriguing, particularly as people had still erected a burial mound and buried someone (presumably male) with a scramasax and a shield. This indicates that the site was important and used on a regular basis, possibly as a type of meeting place in a border zone and as a land mark pointing at the river system leading up to the grave mound at Espinära. As mentioned by the topographer Abraham Hülphers, during his journey in Norrland 1758 (Bringeus & Hvarfner 1978), the village Sangis by the mouth of the River Sangisälven marks a clear border between Swedish-speaking and, east of the village, Finnish-speaking people. This border was known, according to the historical records, from at least the 16th century (Elenius 2001: 265) and may well have already been a border zone in the Late Iron Age.

It is quite possible, from the radiocarbon dating of the reindeer bone and the accumulation of peat in the bog, that the site was used sporadically from AD 600 until AD 800 because we dated the grave goods to the 7th century AD and the sand lens found in the peat core that was from around AD 750. Together with indications of disturbances on the ridge vegetation, especially from AD 1070, this implies that the site may have been visited and used during two periods: AD 600–800, and from AD 1070 onwards.

The water level in Kvarnbäcken, just below the burial mound, is today at 9.1 m asl, implying that navigating from the sea into the lagoon would have been difficult from the time the sea was c 8 m lower and (hence) *the site probably lost its attraction as a seashore location during the 9th century* (AD 810–880). However, the ridge seems to have been used more intensively than during PAZ SI, from AD 1070 to 1120, when the sea line was 5.6–6 m above its present level and there are indications of human impact in the pollen record (PAZ SIII).

Concerning the provenance of the Sangis grave mound, it is important to note its close parallels with the very interesting cemetery at Holm in Överlännäs parish in Ångermanland (cf. Selinge 1977: 286–9). The latter, with its position at the River Ångermanälven, and numerous large mounds and rich grave goods, clearly demonstrates a connection with trade and exchange during the period c AD 500–1000 (cf. Ramqvist 2001). Generations of high-status males and females have been buried on this site. Mound no. 4 at Holm cemetery contained an almost identical scramasax and shield boss to those found at Sangis, and the mound was also the same size as the Sangis mound (7 m in diameter and 1 m high). These similarities could be coincidental, but may also indicate a connection. Along with other artefacts, such as spear- and arrow-heads, grave no. 4 at Holm is dated to the Early Merovingian Period, i.e. the 7th century AD (cf. Selinge 1977: 286–9). Interestingly there is also a very richly furnished female chamber grave at Holm, although some generations younger, containing an iron knife wound with silver thread. Another silver-wound knife was found in grave 12:I at the same cemetery, which brings to mind the testimony of one of the robbers of silver threads on the Sangis scramasax.

CONCLUSION

From the results of the investigations carried out around the burial mound at Sangis, it can be concluded that no sedentary settlement accompanied the mound. This differs greatly from the situation in central Norrland. However, the site was visited probably on a more or less regular basis, for a period of up to 200 years, c AD 600–800, i.e. the Merovingian Period. The evidence suggests that the visits took place during the summer, or at least non-winter seasons.

As the River Sangisälven probably formed a border between Swedish- and Finnish-speaking groups, we conclude that it was a suitable place for trade negotiations, rest and for mending boats on trading expeditions. As the best and closest parallels for the grave type occur in central Norrland, we assume that the trading entrepreneurs originated from there.

When the place on the heath in Sangis had been established, probably after a couple of generations, the burial mound may have been erected to indicate the importance and perhaps legality of this particular site and the activities conducted there. A second phase of land use was identified in the pollen record from AD 1070 that probably included the use of new land generated by continuing uplift. Events in this second phase may have included establishment of permanent farms in the vicinity, with cultivation in the newly uplifted area located between the ridge supporting the grave mound and the sea. However, the indications of the hypothesised events are subtle and this phase requires further investigation.

The two phases have clearly left quite different traces in the records analysed. The human activities during the oldest phase, when people occasionally stayed on the ridge, yielded specific types of archaeological residues. From the second phase, no visible archaeological traces have been detected (apart from numerous charred roots), but several traces appear in the pollen records that indicate a quite different type of land use, probably connected with economic utilisation of the ridge and its surroundings.

ACKNOWLEDGEMENTS

We would like to thank Pontus Johansson, Björn Ramqvist Lindqvist and Petter Sandström for assistance in the field, Anna Weinehall for doing the pollen analysis, our colleagues within the research program *Recalling the Past* for valuable discussions, and two anonymous referees for appreciated comments on an earlier version of the manuscript. The language has been corrected by Sees-Editing, UK. This study was financed by the Bank of Tercentenary Fund (grant no. M11-0361:1).

REFERENCES

Archival sources

Hallström, G. 1923. Hand written notes made by G. Hallström 4 Nov 1923 at the visit in Sangis. Handskrift 7A, D1:11 1923. The research archives, Umeå University Library. Umeå.

Unpublished sources

Josefsson, T., Hörnberg, G., Liedgren, L. & Bergman, I. unpublished. Cereal cultivation during Early Iron Age: Evidence from inland and coastal primary settlements in northernmost Fennoscandia. Unpublished article manuscript.

Ramqvist, P.H. 2013. Rapport: Fosfatprovtagning under september och oktober 2012 på lokalerna Raä 80:1 och 81:1 i Nederkalix sn, Kalix kommun, Norrbotten. Research report. Umeå Universitet, Umeå.

Ramqvist, P.H., Lindqvist, A.-K. & Hjärtner-Holdar, E. unpublished. Forging in Gene: New quantitative and qualitative analyses of the slag residues. Unpublished article manuscript.

Vretemark, M. 2014. Osteologisk analys av djurben från härdar i Västerbotten och Norrbotten. Ostelogical analysis. Västergötlands museum. Skara.

Software

Grimm, E.C. 1991. TILIA (v. 2.0. b.4). Illinois State Museum, Springfield.

Grimm, E.C. 2004. TILIA-GRAPH (v. 2.0.2). Illinois State Museum, Springfield.

R Development Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna. www.r-project.org

Literature

Ågren, J. & Svensson, R. 2007. *Postglacial Land Uplift Model and System Definition for the New Swedish Height System RH 2000*. LMV-Rapport 2007:4, Reports in Geodesy and Geographical Information Systems. Lantmäteriet, Gävle.

Baudou, E. 1986. Ortnamn och nordliga kulturprovinser under järnålder och medeltid. *Tre kulturer* 3: 7–39. Johan Nordlander-sällskapet. Umeå.

Baudou, E. (ed.) 1996a. *Att leva vid älven: Åtta forskare om människor och resurser i Lule älvdal*. CEWE-förlaget, Bjästa.

Baudou, E. 1996b. Arkeologi i Luleälvsområdet. In E. Baudou (ed.), *Att leva vid älven: Åtta forskare om människor och resurser i Lule älvdal*: 31–56. CEWE-förlaget, Bjästa.

Baudou, E. & Biörnstad, M. 1968. Forskningsprojektet Norrlands tidiga bebyggelse. *Fornvännen* 1968: 178–85.

Behre, K.E. 1981. The interpretation of anthropogenic indicators in pollen diagrams. *Pollen et Spores* 23: 225–245.

Behre, K.E. 1988. The role of man in European vegetation history. In B. Huntley & T. Webb (eds.), *Handbook of Vegetation Science, Volume 7: Vegetation History*: 366–72. Kluwer Academic Publishers, Dordrecht.

Behre, K.E. 2007. Evidence for Mesolithic agriculture in and around central Europe? *Veget Hist Archaeobot* 16(2): 203–19.

Bennerhag, C. 2012. Samhälle i förändring: Järnålder i Norrbottens kustland. *Arkeologi i Norr* 13: 45–73.

Berglund, M. 2004. Holocene shore displacement and chronology in Ångermanland, eastern Sweden, the Scandinavian glacio-isostatic uplift centre. *Boreas* 33(1): 48–60.

Bergman, I. 2014. Kulturarv, landskap och identitetsprocesser: Ett forskningsprogram mitt i samhällsdebatten. *Arkeologi i Norr* 14: 67–79.

Blaauw, M. 2010. Methods and code for 'classical' age-modelling of radiocarbon sequences. *Quaternary Geochronology* 5(5): 512–8.

Bringeus, N.-A. & Hvarfner, H. 1978. *Dagbok öfwer en resa genom Norrland 1758 af Abr. Abrab:son Hülphers: Med efterskrift och register utgiven av Nils-Arvid Bringéus och Harald Hvarfner.* LT, Stockholm.

Elenius, L. 2001. *Både finsk och svensk: Modernisering, nationalism och språkförändring i Tornedalen 1850–1939*. Kulturens frontlinjer 34. Umeå Universitet, Umeå.

Engelmark, R. 1976. The vegetational history of the Umeå area during the past 4000 years. In R. Engelmark, I.U. Olsson, I. Renberg & O. Zackrisson (eds.), *Palaeo-ecological investigations in coastal Västerbotten, N Sweden*:75–111. Early Norrland 9. Kungl. Vitterhets Historie och Antikvitets Akademien, Stockholm.

Engelmark, R., Olsson, I.U., Renberg, I. & Zackrisson, O. (eds.) 1976. *Palaeo-ecological investigations in coastal Västerbotten, N Sweden*.

Early Norrland 9. Kungl. Vitterhets Historie och Antikvitets Akademien, Stockholm.

Grundberg, L. 2006. *Medeltid i centrum: Europeisering, historieskrivning och kulturarvsbruk i norrländska kulturmiljöer*. Studia archaeologica Universitatis Umensis 20 & Kungl. Skytteanska samfundets handlingar 59. Umeå Universitet, Umeå.

Hicks, S. 1988. The representation of different farming practices in pollen diagrams from northern Finland. In H.H Birks, H.J.B. Birks, P.E. Kaland & M. Dagfinn (eds.), *The Cultural Landscape: Past, Present and Future*: 189–207. Cambridge University Press, Cambridge.

Holmblad, P. 2010. *Coastal Communities on the Move: House and Polity Interaction in Southern Ostrobothnia 1500 BC–AD 1*. Archaeology and Environment 26. Umeå University, Umeå.

Hörnberg, G., Josefsson, T., Bergman, I., Liedgren, L. & Östlund, L. 2015. Indications of shifting cultivation west of the Lapland border: Multifaceted land use in northernmost Sweden since AD 800. *The Holocene* 25(6): 989–1001.

Josefsson, T., Hörnberg, G. & Östlund, L. 2009. Long-term human impact and vegetation changes in a Boreal forest reserve: Implications for the use of protected areas as ecological references. *Ecosystems* 12(6): 1017–36.

Josefsson, T., Ramqvist, P.H. & Hörnberg, G. 2014. The history of early cereal cultivation in northernmost Fennoscandia as indicated by palynological research. *Veget Hist Archaeobot* 23(6): 821–40.

Jowsey, P.C. 1966. An improved peat sampler. *New Phytologist* 65: 245–8.

Kuusela, J.-M. 2009. Masters of the burial grounds: Elites, power and ritual during the middle Iron Age in Vähäkyrö. *Fennoscandia Archaeologica* XXVI: 39–52.

Liedgren, L. 1992. *Hus och gård i Hälsingland: En studie av agrar bebyggelse och bebyggelseutveckling i norra Hälsingland Kr. f. – 600 e.Kr.* Studia archaeologica Universitatis Umensis 2. Umeå Universitet, Umeå.

Liedgren, L. & Hedman, S.-D. 2005. *Utvärdering av fornminnesinventeringen, 1984–2002 och projektet Skog och Historia, 2000–2004, i Norrbotten med exempel på tillämpningar av det digitala registret och framtida inriktningar*. Silvermuseet Rapport 43. Silvermuseet, Arjeplog.

Lindén, M., Möller, P., Björck, S. & Sandgren P. 2006. Holocene shore displacement and deglaciation chronology in Norrbotten, Sweden. *Boreas* 35(1): 1–22.

Mogren, M. 2000. *Faxeholm i maktens landskap: En historisk arkeologi*. Lund studies in Medieval archaeology 24. Almqvist & Wiksell, Stockholm.

Moore, P.D., Webb, J.A. & Collinson, M.E. 1991. *Pollen analysis*. Blackwell, Oxford.

Myrdal, J. 2011. Farming and feudalism 1000–1700. In J. Myrdal & M. Morell (eds.), *The Agrarian History of Sweden 4000 BC to AD 2000*: 72–117. Nordic Academic Press, Lund.

Ogenhall, E. & Hjärtner-Holdar, E. 2014. *Järn och slagg från Sangis: Analys av fynd från en vikingatida smedja Norrbotten, Nederkalix socken, Raä 81*. Uv Gal Rapport 2014:19, Geoarkeologiska undersökning. Riksantikvarieämbetet, Uppsala.

Petersen, J. 1919. *De norske vikingesverd: En typologisk-kronologisk studie over vikingetidens vaaben*. Videnskapsselskapets skrifter, II Hist.-filos. Klasse No I. Dybwad, Kristiania.

Ramqvist, P.H. 1983. *Gene: On the Origin, Function and Development of Sedentary Iron Age Settlement in Northern Sweden*. Archaeology and Environment 1. Umeå University, Umeå.

Ramqvist, P.H. 1992. *Högom: Part 1: The Excavations 1949–1984*. Archaeology and Environment 13. Umeå University, Umeå.

Ramqvist, P.H. 1998. *Arnäsbacken: En gård från yngre järnålder och medeltid*. HB Prehistorica, Umeå.

Ramqvist, P.H. 2001. Utbytessystem under det 1:a årtusendet e.Kr.: Idéer utgående från tre i mellannorrländska älvar. *Fornvännen* 2001: 1–21.

Ramqvist, P.H. 2007. Fem Norrland: Om norrländska regioner och deras interaktion. *Arkeologi i Norr* 10: 153–80.

Ramqvist, P.H. 2014a. Om järnålderns och medeltidens bebyggelseetableringar i norr. *Arkeologi i Norr* 14: 81–105.

Ramqvist, P.H. 2014b. *Arkeologisk undersökning av boplatsspår vid Sangishögen, Raä 81:1, Nederkalix sn, Norrbottens län, 2013*. Silvermuseet Rapport 66. Silvermuseet, Arjeplog.

Reimer, P.J., Bard, E,, Bayliss, A., Beck, J.W., Blackwell, P.G., Ramsey, C.B., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Staff, R.A., Turney, C.S.M. & vander Plicht, J. 2013. IntCal13 and Marine13 radiocarbon age calibration curves 0-50,000 years cal BP. *Radiocarbon* 55(4): 1869–87.

Segerström, U. 1996. Naturmiljön, agrikulturen och människans påverkan på vegetationen i norra Norrland. In E. Baudou (ed.), *Att leva vid älven: Åtta forskare om människor och resurser i Lule älvdal:* 57–77. CEWE-förlaget, Bjästa.

Selinge K.-G. 1977. Järnålderns bondekultur i Västernorrland. In E. Baudou & K.-G. Selinge (eds.), *Västernorrlands förhistoria*: 153–459. Västernorrlands läns landsting, Härnösand.

Serning, I. 1960. *Övre Norrlands järnålder*. Skrifter utgivna av vetenskapliga biblioteket i Umeå 4. Umeå.

Sjövold, T. 1974. *The Iron Age Settlement of Arctic Norway: A Study in the Expansion of European Iron Age Culture within the Arctic Circle: II: Late Iron Age (Merovingian and Viking Periods)*. Tromsø Museums Skrifter X.2. Universitetsforlaget, Tromsø.

Stockmarr, J. 1971. Tablets with spores used in absolute pollen analysis. *Pollen et Spores* 13: 615–21.

Sugita, S. 2007. Theory of quantitative reconstruction of vegetation II: All you need is LOVE. *The Holocene* 17(2): 243–57.

Wallerström, T. 1995. *Norrbotten, Sverige och medeltiden: Problem kring makt och bosättning i en europeisk periferi: Del 1*. Lund studies in Medieval archaeology 15:1. Almqvist & Wiksell, Stockholm.

Wallin, J.-E. 1996. History of sedentary farming in Ångermanland, northern Sweden, during the Iron Age and Medieval period based on pollen analytical investigations. *Veget Hist Archaeobot* 5(4): 301–12.

Wallin, J.-E. & Segerström, U. 1994. Natural resources and agriculture during the Iron Age in Ostrobothnia, western Finland, investigated by pollen analysis. *Veget Hist Archaeobot* 3(2): 89–105.

Westerdahl, C. 1989. *En kulturgräns nolaskogs*. Örnsköldsvik museum småskriftserie 20. Örsköldsviks museum, Örnsköldsvik.

Westin, G.1962. Övre Norrlands forntid. In G. Westin (ed.), *Övre Norrlands historia: Del I: Tiden till 1600*: 1–122. Norrbottens och Västerbottens läns landsting, Umeå.