MILJÖARKEOLOGISKA LABORATORIET

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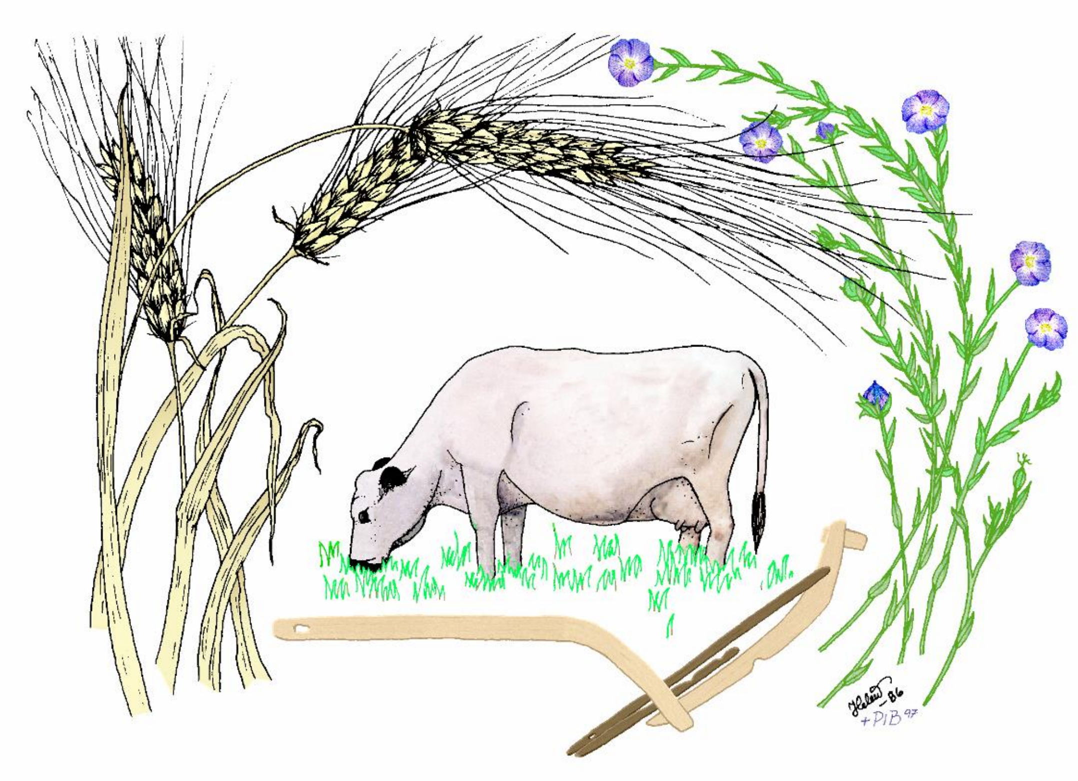

Environmental archaeological analysis from a Bronze Age site, Hjälpesten, L1959:4289, Raä 1502 Kville socken. Bohuslän.

Sofi Östman, Ivanka Hristova, Jan-Erik Wallin, Samuel Eriksson, Daniel Smeds, Johan Linderholm & Philip Buckland

INSTITUTIONEN FÖR IDÉ – OCH SAMHÄLLSSTUDIER

UMEÅ UNIVERSITET

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Site information

Five macro samples were collected in and next to a fire cracked stone layer on the clay bed next to a stream/brook. The site is situated on both sides of a brook and is dated to the Bronze Age, ca. 1000 BC. Among the archaeological finds are large ceramic vessels, parts of crucibles for bronze casting, unburned animal bones, flint, burnt clay, a glass bead and processed and unprocessed wood. Over time and environmental change, the archaeological context appears to have slid down into the brook. The fire cracked stones and all the archaeological artifacts have been exposed to water erosion.

Samples 18_0025_0002 (P6), 18_0025_0003 (P16) and 18_0025_0005 (P20) were collected within the fire cracked stone layer at different depths in squares (7, 11 & 6). In the area where sample 18_0025_0002 (P6) was taken, unburned bones and a goat skull were found. Sample 18_0025_0001 (P5) was taken from the clay directly under presumed place for bronze casting. Sample 18_0025_0004 (P18) was taken outside an area with a fire cracked stone layer with sub fossil plant material. All the macrofossil samples have been subsampled and analyzed for soil chemistry as well.

In addition to the macro samples, 16 samples were taken specifically for soil chemical analysis. Some of the soil samples come from a presumed alluvial sequence at the edge of the eroded part of sediments close to the stream/brook, and here the question is how the different layers have been affected by swelling sediment and human activity. The lower layers contain a lot of organic material and processed wood (see macro sample 18 and stock sequence).

Research questions connected to the analysis are mainly focused on finding out if there are any botanical or other organic remains preserved within the feature, and if the botanical material can say anything about seasonality and activities at the site. For the soil chemical analysis the questions are more focused on identifying sedimentation processes and human impact. An overview of sample locations is given in figure 1 and additional information is provided in tables 2a and 2b.

The samples have been provided for analyses by Stig Swedberg, Kulturlandskapet Fjällbacka.

Sample treatment

Macrofossil analysis

The samples arrived wet and in order to prevent contamination and mold, they were kept in a cold storage room (ca +4 °C). Before treatment, each sample's volume was measured; these were between 1,8 and 3 liters (see table 3). The bulk (macro) samples were carefully water sieved through 2 mm and 0,5 mm sieves to remove finer organic and mineral material and disaggregate the remaining material. After sieving, the samples were sorted for carbonized and waterlogged plant material as well as other archaeological finds such as bones, ceramics, etc. The identified plant material was stored in distilled water. The plant remains were identified with the help of reference literature for seeds (Cappers, Bekker, & Jans, 2006), the Nordic flora (Mossberg, Stenberg, & Ericsson, 1992), and the MAL laboratory reference collection. The archaeobotanical analysis was performed by Sofi Östman and Ivanka Hristova. Wood analysis was performed on three of the samples as part of a course in the Environmental Archaeology Masters' programme. The analysis undertaken by Masters student Daniel Smeds under the supervision of Ivanka Hristova.

Pollen analysis

A subsample for pollen analysis was taken from sample 18_0025_0001 (P5) and analysed by by Jan-Erik Wallin at Pollenlaboratoriet AB (a subcontractor to MAL). A full description of the preparation and analysis methods can be found in the appendix at the end of the main report. The results are presented in Swedish in the appendix, and have been incorporated into the results, discussion and conclusions in the main report.

Geochemistry

Prior to all analyses all samples were dried in a drying room at 30°C. Samples were then passed through a 1,25 mm sieve and the presence of any material of cultural significance noted (such as bone, charred material, ceramics etc.). The chemical methods employed here are the same as those used in Swedish soil chemical studies following the methodological approach of Engelmark and Linderholm (1996 and 2008). The parameters analysed and abbreviations used are explained in table 1

Table 1. Geoarchaeological methods and abbreviations as used in this report.

Abbreviation	Method	Description
MS	Magnetic Susceptibility	Magnetic susceptibility measured on 10g of soil, with a Bartington MS3 system with an MS2B probe (Dearing 1994). Data are reported as SI-units per ten grams of soil, (corresponding to X_{lf}, 10^{-8} m^3 kg^{-1}) (Thompson & Oldfield 1986).
MS550	Magnetic Susceptibility after burning at 550°C	Magnetic susceptibility after 550° C ignition (units as above)
LOI (%)	Loss On Ignition	Soil organic matter, determined by loss on ignition at 550° C, in percent (Carter, 1993).
Cit-P	Inorganic phosphate content (mg P/kg dry matter, ppm)	Extraction with 2% citric acid (corresponding to the Arrhenius method (Arrhenius 1934 and 1955))
Cit-POI	Total phosphate (mg P/kg dry matter, ppm) (inorganic & organic)	Extraction with 2% citric acid on ignited soil
P quota	**Cit-POI /Cit-P**	Ratio of inorganic & organic to inorganic phosphate

These methods have been developed and adapted for soil prospection and the bulk analysis of occupation soils and features. Analysed parameters comprise organic matter (loss on ignition [LOI], Carter 1993), two fractions of phosphate (inorganic [Cit-P], and sum of organic and inorganic [Cit-POI]) (Engelmark & Linderholm 1996, Linderholm 2007) and magnetic susceptibility (MS-χ_{lf}) and MS550-χ_{lf} (Clark 2000, Linderholm 2007, Engelmark & Linderholm 2008). These analyses provide information on various aspects concerning: phosphate, iron and other magnetic components and total organic matter in soils and sediments, and their relationship to phosphate.

Soil chemical analyses were undertaken by Samuel Eriksson.

Results

<u>Macrofossil and pollen analysis</u>

Five bulk samples from different parts of the study area were analysed. The samples contained only waterlogged (subfossil) macrofossils. The average preservation of the plant macro remains is about 200 items per sample. Almost all of the samples contain charred and uncharred wood but very small amounts of charcoal. Burnt clay/ceramic fragments are visible in some of the samples. There is a high probability that the plant remains represent the natural vegetation, and no definite traces of cultivated plants have been detected. For results from wood analysis and other finds, see tables 4 and 5.

A number of leaf fragments were found and noted during excavation. Unfortunately their condition was too poor for a reliable species identification to be obtained after water sieving.

18_0025_0001 (P5)
The volume of the sample before sieving was 3 litres, and 200 ml (0,2 liters) after sieving, 100 ml of which was sorted. The sample mainly consisted of uncharred wood such as twigs, bark and stems. Plant remains, including straw/stems from grasses and roots were also detected. A large part of the material consisted of broken and whole waterlogged hazelnuts. These were very small and are probably connected to the wild flora next to the water. The seeds are represented by 14 taxa and a total of more than 200 plant macrofossils. The most common ones are *Atriplex* sp. (Strandmålla), *Chenopodium album* (Målla) with more than twenty seeds. Other plants, including *Eleocharis* sp. (Säv), *Galeopis* sp. (Dån), *Polygonum aviculare* (Trampört) are also present in the sample, although less common. The species composition generally represents a mix of plants that prefer wet and moist areas, ditches, meadows, and weeds that are common to find in cultivated areas.

This sample contains a larger amount of charcoal than the other samples, as well as burnt and unburnt bones, a piece of flint (unclear if it is worked) and a large number of insect fragments and puparia.

Pollen analysis from sample P5
The sample contained abundant pollen, of which 983 grains were identified. Charcoal particles were noted on the pollen slides, potentially indicating burning in the region. The woodland signal is dominated by pine and birch, with indications of sparse local occurrence of oak, elm and linden/lime. Hazel thicket will have been present locally but a single grain of spruce pollen is most likely from long distance transport (wind).

Meadowland plant pollen dominates the non-tree flora, including grass, buttercups, Asteraceae (the large family of asters, composite etc.) and Chenopodiaceae (a large family including Chenopodium). Species suggesting disturbance occur within this group, but not to an extent that would indicate cultivation. The proportion of pollen grains from cultivated land (Spergula, mugwort, Chenopodium) is small, and only a single cereal pollen grain was found.

18_0025_0002 (P6)

The volume of the sample before sieving was 2 litres, and 300 ml after sieving, of which 200 ml was sorted. The sample mainly consisted of waterlogged plant remains, including roots, but also sand and gravel, small amounts of charcoal and a piece of ceramics. The seeds are represented by 19 taxa and a total of 63 plant macrofossils. The most common species, with number of preserved seeds between 4 and 11, are *Atriplex* sp. (Strandmålla), *Chenopodium album* (Målla), *Galeopis* sp. (Dån), *Persicaria lapathifolia/maculosa* (Pilört/ Åkerpilört), *Urtica dioica* (Brännässla), and *Alnus incana/glutinosa* (Al). The species composition generally represents a mix of plants that prefer wet and moist areas, ditches, meadows, and weeds that are common to find in cultivated areas.

18_0025_0003 (P16)

The volume of the sample before sieving was 1,8 litres, and 125 ml after sieving, all of which was sorted. The sample mainly consisted of waterlogged plant remains such as roots, twigs and mosses/sphagnum. The seeds include 208 preserved plant macrofossils representing 23 taxa. The most common species, with about 20 or more preserved seeds, are *Atriplex* sp. (Strandmålla), *Chenopodium album* (Målla), *Persicaria lapathifolia/maculosa* (Pilört/ Åkerpilört), *Polygonum aviculare* (Trampört), *Stellaria media* (Våtarv). Other species with lower numbers of finds but still well represented, are *Galeopis* sp. (Dån), *Solanum nigrum/dulcamara* (Nattskatta), and *Urtica dioica* (Brännässla). The species composition generally represents a mix of plants that prefer wet and moist areas, ditches, meadows, and weeds that are common to find in cultivated areas.

In addition to the plant material, the sample also consisted of a smaller amount of sand and gravel, a few charcoal pieces, insects, unburnt bones and a piece of ceramic.

18_0025_0004 (P18)

The volume of the sample before sieving was 3 liters, and 650 ml after sieving, of which 300 ml was sorted. The sample mainly consisted of uncharred twigs, bark and pieces of wood. The seeds represent 18 taxa and more than 206 plant macrofossils were preserved. The tree species alder, *Alnus incana/glutinosa* (Al) is overrepresented with more than 100 macrofossils. Other common species found were *Bidens tripartita* (Brunskära), *Persicaria lapathifolia/maculosa* (Pilört/ Åkerpilört), *Rubus ideus* (Hallon) and *Silene dioica* (Rödblära). The species composition generally represents a mix of plants that prefer wet and moist areas, ditches, meadows, and weeds that are common to find in cultivated areas.

A particularly interesting find is that of two seeds (outer coat/shell) of hops, *Humulus lupulus* (Humle). The seeds are fragile, and rarely recovered from deposits of this age in this region. The plant can be found growing in the wild and prefers moist, nutrient rich soils similar to those preferred by many of the other species in this material. Cultivation started in the 1200's in Sweden, and it is generally connected to beer brewing. In a different context, with undisturbed and clearly identifiable anthropogenic sediments (see later site & sampling discussion), this could be interpreted as traces of human activity. However, at a Bronze Age site it is most likely part of the natural background flora. Unfortunately the material recovered is most likely not enough for radiocarbon dating.

18_0025_0005 (P20)

The volume of the sample before sieving was 3 litres, and 300 ml after sieving, of which 150 ml was sorted. The sample mainly consisted of waterlogged plant remains, including roots, but also small amounts of charcoal. The seeds represent 19 taxa and more than 258 plant macrofossils were preserved. The more common species include *Atriplex* sp. (Strandmålla), *Chenopodium album* (Målla), *Galeopis* sp. (Dån), *Persicaria lapathifolia/maculosa* (Pilört/ Åkerpilört), *Rubus ideus* (Hallon) and *Stellaria graminea* (Grässtjärnblomma). The species composition generally represents a mix of plants that prefer wet and moist areas, ditches, meadows, and weeds that are common to find in cultivated areas.

Geochemistry (see Table 1 for explanation of abbreviations)

Sample P5 contains high amounts of phosphate (CitP) and a moderately high MS, a clear indication of human disturbance. P6 shows the opposite, with a high MS and lower CitP. P16, P18 and P20 are all a bit lower in phosphate response and MS, indicating a lower degree of human impact. Samples P22, P23, P24 show even less phosphate input, but this can be explained by them being more affected by soil-stream water activity (especially P22).

Figures 2 and 3 show a compilation of the analysed parameters in the profile sequence S4. The upper part (above 23,75 meters above sea level) shows very clear phosphate enrichment (layers 4-7, see Table 2a). Layers 5 and 6 show higher MS values that are most probably related to heating. The organic content is above 2% in the upper part of the profile, and significantly each dip in LOI in the lower part (layers 10, 12 and 14) may reflect erosional phases related to the stream.

Figures 4 and 5 provide a spatial perspective to the CitP and MS responses. The variation visible, in connection with the archaeological evidence, suggests that a larger spatial grid sampling would probably give a good overview on the spread of what is probably a settlement site, with related activities in the surrounding areas.

Summary and conclusions

The macrofossil results (Table 3) provide a list of species which describe the expected natural vegetation of the region, including plants which grow in wet areas, nutrient rich soils, on meadows and in cultivated fields. No remains of plants *specifically* connected to human activities (for this time period) were identified, although some have known cultural usage (e.g. hazel, raspberry, Chenopodium). Several of the species are wetland plants (*Alnus, Eleocharis*, *Carex*) and representative of the modern day environment of the studied area. The plants which may indicate cultivated lands are also common to naturally disturbed environments, and so cultivation cannot be confirmed in the immediate area of the site. The presence of roots in several of the samples may indicate intrusion from younger vegetation, and thus material for radiocarbon dating should be selected with particular caution.

The results of the pollen analysis support those of the macrofossil analysis. Meadows were to be found close to the site, with local occurrence of deciduous trees (including hazel) but birch-pine woodland dominating the regional vegetation. The pollen evidence indicates that cultivated land was probably not located close to the site, but that cereal cultivation was most likely conducted in the region.

The results from wood analysis show that only sample 18_0025_0001 (P5) contained charcoal fragments suitable for identification. The rest of the samples primarily contained waterlogged wood, with the only identified species being alder (*Alnus* sp.). Alder was also reasonably well represented in the pollen results, and is a species which grows close to streams and rivers, preferring wetlands, and to be expected in area of the site. Interestingly, the identified charcoal fragments (Table 4) are more species diverse than the waterlogged wood. A potential explanation could be that the charcoal originates from cultural deposits, whilst the waterlogged material is part of the natural vegetation. On this basis any results from this sample should be interpreted with extreme caution, as the macrofossil results suggest the possibility of post depositional mixing. Such mixing is common on floodplains and at the edge of wetlands, and may have been caused by the nearby stream or periodic flooding, as is indicated in the lower half of the geochemistry results. Thus contamination of the samples with material of a younger date than the time of occupation is a real possibility.

The geochemistry provides a clear indication of human activity at the site. The results demonstrate a disturbed environment with clear settlement traces in 18_0025_0001 (P5) and the upper part of the Trench 4 sequence (Figure 3). The stratigraphic relationship between the upper layers of the trench sequence and subsequently dated material should be examined in more detail in order to identify the (relative) age of the cultural layers.

Leaves were noted during the excavation but not identified in the macrofossil results. Leaves often preserve well in undisturbed waterlogged sediments, but they also float, and as with any water deposited sediment must be interpreted with caution. They may indicate environments present further upstream, and the resolution of archaeological sampling (a sample usually represents more than one year of activities and deposition) makes interpretation of seasonality almost impossible in the type of sediments found at this site. However, we recommend that sediments containing well preserved leaves are sampled carefully and separately, clearly labelled for possible identification without standard macrofossil processing, if the importance of the site warrants special consideration of this material.

Future analyses could target the insect remains to obtain more information on the local depositional environment and potentially anthropogenic contexts. However, the complex stratigraphy and potential mixing suggests that these results should also be interpreted with caution.

Caution when interpreting alluvial sediments

Sediments deposited by water should always be interpreted with caution, and the potentially broader source area for the macrofossils found considered. This is especially the case for material deposited by flowing water (streams, rivers) and seasonal flooding, where remains from a considerable distance upstream will be mixed with local material. In extreme cases, indications of Arctic or mountain vegetation may be found in coastal deposits, and the analyst must carefully consider the possibility for the local presence of each species when interpreting. The use of geochemistry to identify potentially 'washed out' material is demonstrated above, but these layers rarely preserve waterlogged macrofossils, as the water action and repeated wetting-drying sequences both physically and chemically damages organic remains. Such layers may be relatively easy to differentiate in profiles in the field, and always sampled separately from others, as was done in this excavation.

Sediments which contain a mix of carbonised and waterlogged material may indicate a number of depositional scenarios, including the incorporation of anthropogenic remains into natural sediments (e.g. the throwing of waste into a peat bog), middens (waste deposits) in cold environments, or the post-depositional mixing of sediments of different origin (e.g. a hearth with eroded peats). If the waterlogged material is very well preserved, then it is extremely difficult to separate older from younger plant macrofossil remains, and thus even contamination with modern material cannot be differentiated from that from the Bronze Age or anywhere in between. In some circumstances, however, it may be possible to see different levels of decomposition or damage to seeds (and in particular insect remains), and thus identify mixing, but this was not evident in this case. If upstream deposits are eroded and then rapidly deposited at the site, there may be no damage to macrofossils.

As environmental archaeology relies on natural science methodologies, our interpretations lean towards the cautious - if there is too little evidence, or confounding evidence, then we are reluctant to make definite statements. The results and interpretations presented in this report reflect this theoretical point of view, and it should be reflected in any further archaeological interpretations which build on the results presented here. Larger samples from a wider range of contexts, more methods (such as fossil insects, spectroscopy), and an inclusion of radiocarbon dating results would most likely help understand the complexity of this site in relation to future excavations. It might also be useful to sample a nearby peatbog or lake sediment in order to confirm the nature of the regional background vegetation, which is at present only implied by the samples from the archaeological site.

Postscript

Since the original version of this report was authored, new results have come to light which could be used to secure some of the uncertainties presented above. In particular, the radiocarbon dating of worked deciduous wood pieces to Bronze Age periods 3 and 4 indicate the presence of these trees during the period of human activity at the site. Some of these dates were obtained from waterlogged material in the water deposited sediments, suggesting that at least some of the subfossil material should be considered as contemporaneous with human occupation. This does not, however, preclude the mixing of sediments which is common in flowing water environments and where seasonal flooding is common. Thus, whilst the indications of human activity at the site are now considerably stronger, any further interpretation of the seeds should still proceed with caution.

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Figures

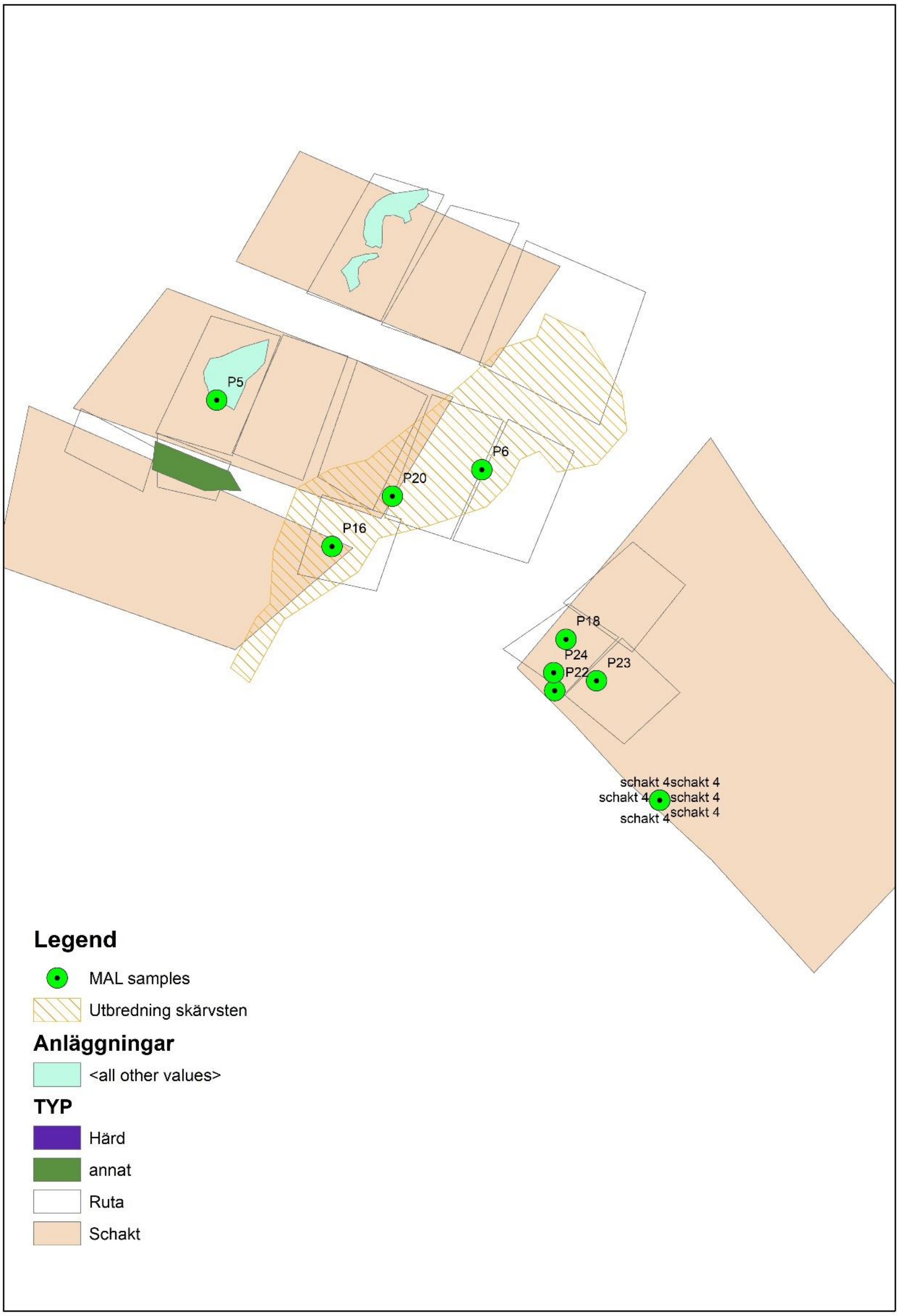

Figure 1. Overview on sample location.

Figure 2. Overview Trench 4 (photo Kulturland).

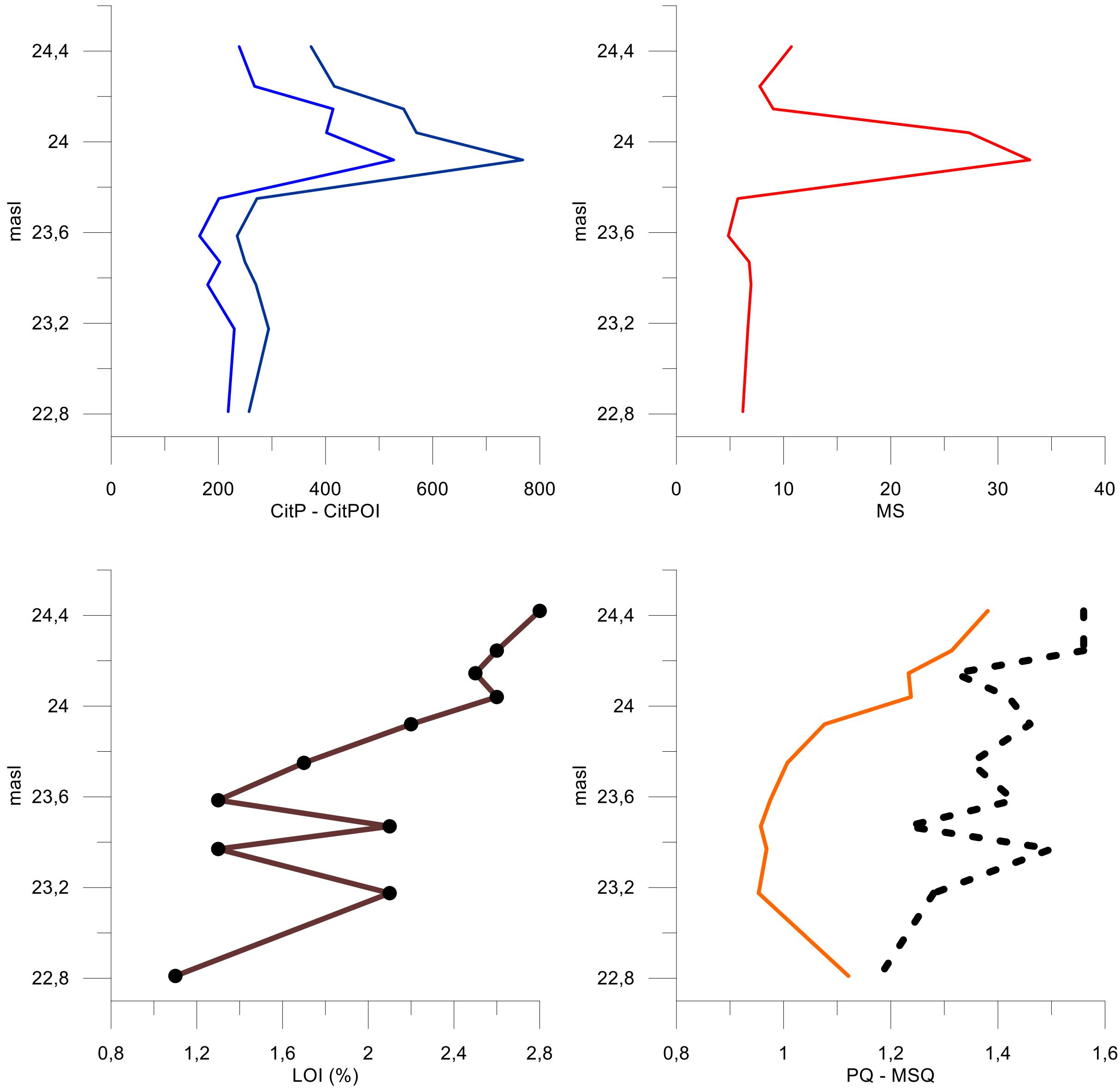

Figure 3. Depth variation in analysed parameters in trench 4 (sequence S4) (see Table 1 for abbreviations).

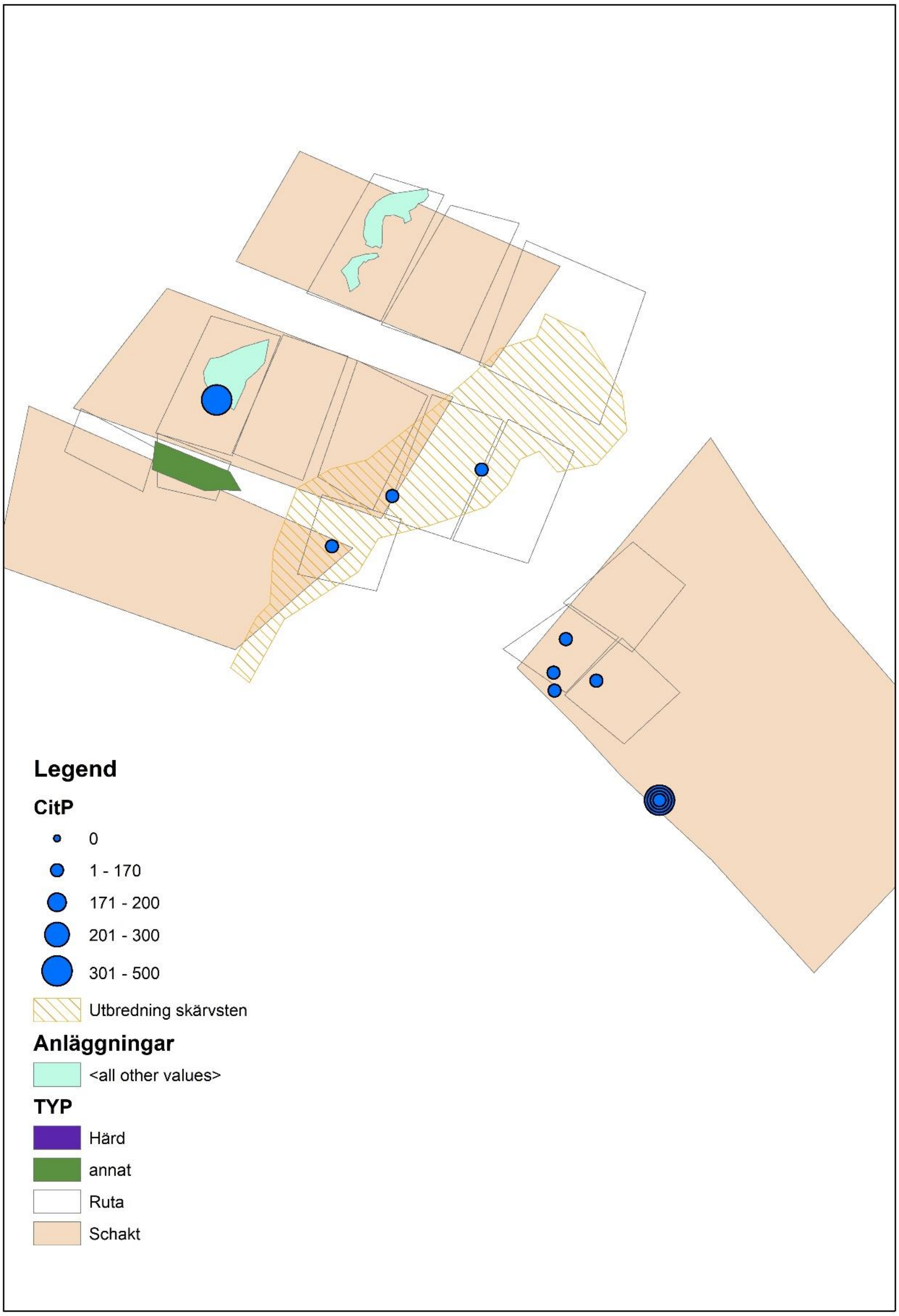

Figure 4. Spatial variation in CitP in analysed samples.

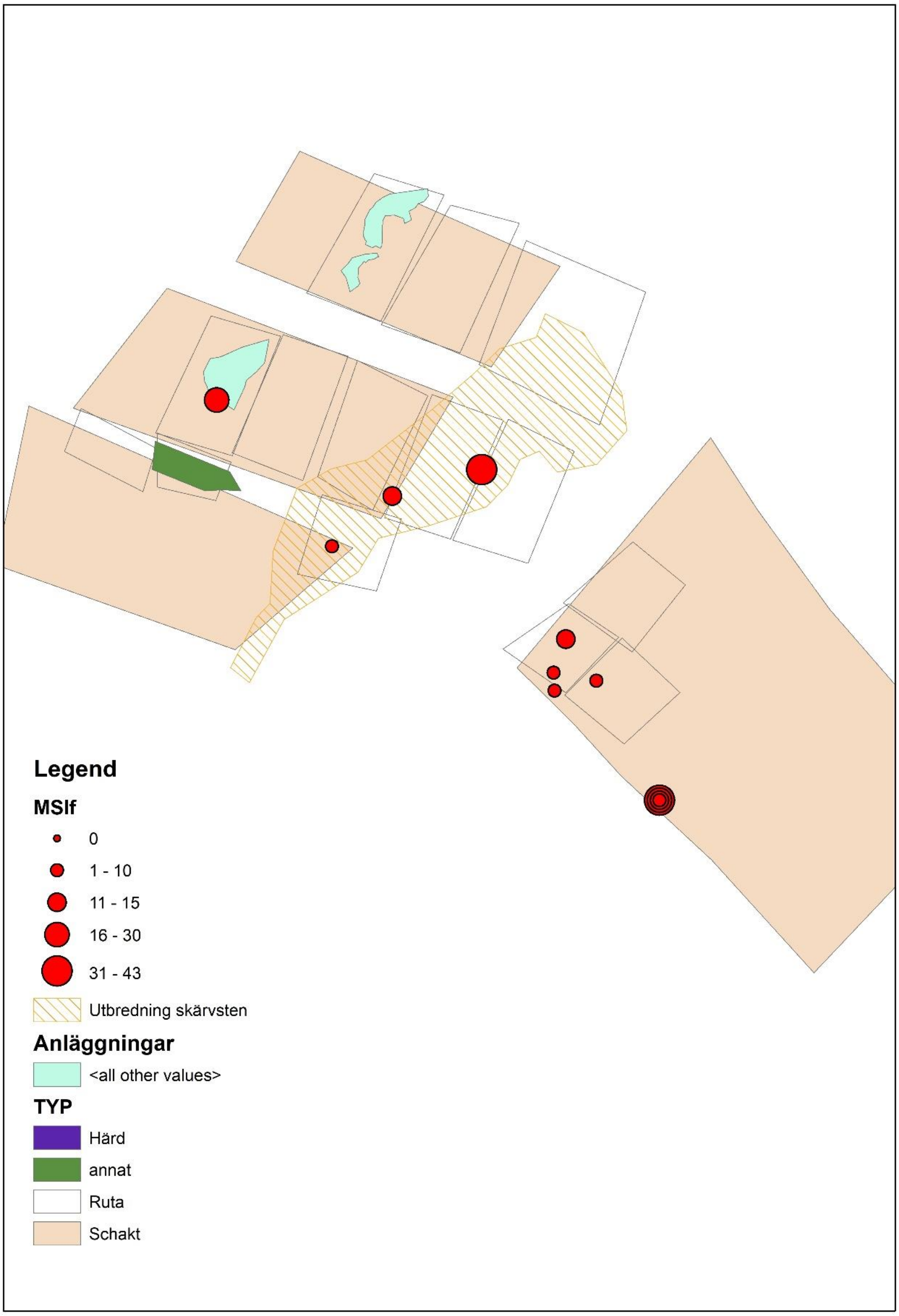

Figure 5. Spatial variation in MS in analysed samples.

Additional tables and data

Table 2a. Soil chemical results

MALNo	FieldNo	Northing	Easting	Z	Area	DepthFrom_cm	DepthTo_cm	Layer
18_0025_0001	P5	6501748,86	290486,74	23,16				
18_0025_0002	P6	6501747,99	290490,08	22,80	Ruta 7			
18_0025_0003	P16	6501747,02	290488,19	22,81	Ruta 11			
18_0025_0004	P18	6501745,85	290491,13	22,73				
18_0025_0005	P20	6501747,65	290488,95	22,73	Ruta 6			
18_0025_0007	schakt 4	6501743,83	290492,31	24,72	schakt 4	0,00	0,30	1
18_0025_0008	schakt 4	6501743,83	290492,31	24,42	schakt 4	0,30	0,50	2
18_0025_0009	schakt 4	6501743,83	290492,31	24,25	schakt 4	0,50	0,55	3
18_0025_0010	schakt 4	6501743,83	290492,31	24,15	schakt 4	0,55	0,60	4
18_0025_0011	schakt 4	6501743,83	290492,31	24,04	schakt 4	0,60	0,66	5
18_0025_0012	schakt 4	6501743,83	290492,31	23,92	schakt 4	0,66	0,74	6
18_0025_0013	schakt 4	6501743,83	290492,31	23,75	schakt 4	0,74	0,90	7
18_0025_0014	schakt 4	6501743,83	290492,31	23,59	schakt 4	0,90	0,97	8
18_0025_0015	schakt 4	6501743,83	290492,31	23,47	schakt 4	0,97	1,03	9
18_0025_0016	schakt 4	6501743,83	290492,31	23,37	schakt 4	1,03	1,07	10
18_0025_0017	schakt 4	6501743,83	290492,31	23,18	schakt 4	1,07	1,32	11
18_0025_0018	schakt 4	6501743,83	290492,31	22,81	schakt 4	1,32	1,70	12
18_0025_0019	P22	6501745,21	290490,99	22,98	PpB			
18_0025_0020	P23	6501745,33	290491,52	21,80	PpC			
18_0025_0021	P24	6501745,43	290490,98	22,80	PpE			

Table 2b. Soil chemical results

MALNo	FieldNote	MS lf	MS550 lf	MSQ	CitP	Cit POI	PQ	LOI
18_0025_0001	under bronsgjutningplats	17,0	19,0	1,12	310	413	1,33	2,0
18_0025_0002	fynd av gethorn/kranium	43,1	93,2	2,16	169	262	1,55	2,6
18_0025_0003		8,8	20,3	2,30	159	259	1,63	3,2
18_0025_0004	utanför skärvstensflak	12,1	134,2	11,09	159	286	1,8	7,5
18_0025_0005		10,6	22,6	2,14	160	255	1,59	3,1
18_0025_0007	L1) 0-0,3 grästorv o ploglager ljusröd silt.	10,7	45,8	4,29	191	348	1,83	3,2
18_0025_0008	L2) 0,3-0,5 röd silt m inslag av kolfragment. Enstaka små röda klumpar järnutfällningar o ev br lera.	10,7	14,8	1,38	239	373	1,56	2,8
18_0025_0009	L3) 0-5-0,55 lerig rödbrun silt, m samma inslag av kol o rött som ovanliggande.	7,8	10,2	1,31	268	416	1,56	2,6
18_0025_0010	L4) 0,55-0,6 siltig sand samma färg o inslag.	9,0	11,2	1,23	414	546	1,32	2,5
18_0025_0011	L5) 0,6-0,66 som L3.	27,3	33,8	1,24	402	570	1,42	2,6
18_0025_0012	L6) 0,66-0,74 grov lerig röd sand m samma inslag.	33,0	35,5	1,08	527	768	1,46	2,2
18_0025_0013	L7) 0,74-0,9 lerig gråbrun silt samma inslag.	5,7	5,8	1,01	201	272	1,35	1,7
18_0025_0014	L8) 0,9-0,97 fin siltig lerig ljusgrå sand samma inslag.	4,8	4,7	0,98	165	235	1,43	1,3
18_0025_0015	L9) 0,97-1,03 ljusgrå lerig silt samma inslag.	6,8	6,5	0,96	203	250	1,23	2,1
18_0025_0016	L10) 1,03-1,07 som L8.	7,0	6,7	0,97	180	270	1,5	1,3
18_0025_0017	L11) 1,07-1,32 brungrå lera enst inslag kolfnas.	6,7	6,4	0,95	230	294	1,28	2,1
18_0025_0018	L12) 1,32-1,7 mörkgrå lera. / AÖ	6,2	7,0	1,12	218	257	1,18	1,1
18_0025_0019	lerigt organiskt lager	5,3	27,8	5,22	135	254	1,88	5,4
18_0025_0020	renare varvigt lager	4,8	9,3	1,94	147	212	1,44	3,0
18_0025_0021	grov sand	6,8	8,4	1,24	111	155	1,39	1,3

Table 3. Archaeobotanical results

	18_0025_0001	18_0025_0002	18_0025_0003	18_0025_0004	18_0025_0005
Taxa/ Context	P5	P6	P16	P18	P20
volume before sieveving (L)	3	2	1,8	3	3
volume after sieveving (ml)	200	300	125	650	300
Aethusa cynapium (Vildpersilja)			1	1	
Alnus incana/glutinosa (Al)		4		>100	6
Atriplex sp. (Strandmålla)	20	8	40	4	13
Betula sp. (Björk)	1				
Bidens tripartita (Brunskära)	2	1		19	
Carex tri (Starr)		1			5
Cerastium sp. (Arvar)			3		
Chenopodium album (Målla)	40	11	30	4	30
Corylus avellana (Hasselnöt)	>100			5	
Eleocharis sp. (Säv)	5	1	1		
Fallopia convolvulus (Åkerbinda)	2	3	4	1	4
Filipendula ulmaria (Älggräs)				1	
Fragaria vesca (Smultron)			3		
Galeopis sp. (Dån)	8	5	9	3	26
Glechoma hederace a (Jordreva)		2	4		8
Humulus lupulus (Humle)				2	
Persicaria lapathifolia/maculosa (Pilört/ Åkerpilört)	3	10	19	32	47
Plantago major (Groblad)	1		2		
Polygonum aviculare (Trampört)	5		33		8
Prunus padus (Hägg)		1	1		
Ranunculus sp. (Ranunkelväxter)	1	1	4	2	3
Ranunculus cf. *ficaria* (sannolik svalört) - root bulb				1	
Rubus ideus (Hallon)	2	1	6	10	19
Rumex crispus (Krusskräppa)		1			
Scirpus sylvaticus (Skogssäv)				2	3
Silene sp.			1		
Silene dioica (Rödblära)		1		19	10
Solanum nigrum/dulcamara (Nattskatta)	2	2	9		12
Spergula arvensis (Åkerspärgel)			1		
cf. *Stachys* sp. (Syskor)				1	
Stellaria media (Våtarv)	2		19		4
Stellaria graminea (Grässtjärnblomma)		2	6		37
Stellaria sp. (Stjärnblommor)				1	
Torilis japonica (Rödkörvel)			1		2
Urtica dioica (Brännässla)		6	9	3	
Sparganium sp. (Igelknoppar)					2
Apiaceae		2	2		1
Indet	4				18
	>198	63	208	>206	258

Table 4. Wood analysis results

Genus	Modifications	18_0025_0001 (P5)	18_0025_0002 (P6)	18_0025_0003 (P16)
Alnus	charred	2		
Alnus	waterlogged		2	14
Fraxinus	charred	1		
cf. Prunus	charred	1		
Pine	charred	3		

Table 5. Other materials

MAL nr	18_0025_0001	18_0025_0002	18_0025_0003	18_0025_0004	18_0025_0005
Context	P5	P6	P16	P18	P20
Charcoals	xx	x	x		x
Uncharred wood	x	x	x	x	x
Charred bones	x				
Uncharred bones	x		x		
Ceramics		x	x		
Insects	xx				
Others	flint				

Appendix - Pollenanalys, Kville, Bohuslän (in Swedish)
Mal-2018-0025-001

INLEDNING
1 prov har analyserats på polleninnehållet.

METODER
Pollenanalys
Provet är insamlad av utgrävningspersonal, i samband med den ordinarie utgrävningen. Provet behandlades enligt standardmetoden för pollenanrikning beskriven i t.ex. Moore et al. (1991). Återstoden, det koncentrerade pollenmaterialet, färgades med saffraninfärgad glycerin. Vid identifiering av pollentyperna användes bestämningsnycklar av Beug (1961) och Moore et al. (1991). Vid pollenanalys av jordprover finns en viss risk för att vissa växtarter med tjockskaliga pollenkorn får en överrepresentation i analysen (t. ex korgblommiga växter). Att pollenkornen har ett tjockt skal minskar risken för nedbrytning jämfört med tunnskaliga pollenkorn. Analysresultatet visar att det är en jämn fördelning mellan tunnskaliga och tjockskaliga pollenkorn. Ingen överrepresentation av tjockskaliga pollenkorn förekommer i detta prov.

RESULTAT

Provet innehöll rikligt med pollen. Även kolpartiklar förekom i provet.

Trädvegetation
På undersökningslokalen dominerade tall- och björkskog. Ädellövträd såsom ek, alm och lind förekom sparsamt på lokalen. Hasselsnår förekom på gynnsamma växtplatser.
Ett granpollen har hittats i provet (troligen fjärrtransport).

Ängsmark/åkermark
Förekomsten av pollen från växtarter som representerar ängsmark dominerar, såsom gräs, smörblomma, korgblommiga växter och målla. Andelen pollenkorn från växter som indikerar åkermark är lågt (spärgel, gråbo och målla). Ett pollenkorn från sädesslaget korn har hittats i provet.
Ängsmarker har förekommit på provtagningslokalen. Åkermark torde inte har funnits i direkt anslutning till provtagningslokalen. Odling av sädesslaget korn torde ha förekommit inom regionen.

REFERENSER
Beug, H.J. (1961) Leifaden der Pollenbestimmung fur Mitteleuropa und angrenzende Gebiete. Lief. 1. 63 pp. Stuttgart.
Moore, P.D., Webb, J.A. & Collinson, M.E. (1991) Pollen analysis. Oxford.

Tabell 1: Pollenkoll, Kville, Bohuslän

Art/prov nummer **MAL 18-0025**	**001**
Andel pollen i procent (%) Exkl. sporer	
Al (Or)	8.2
Björk	25.5
Tall (Furu)	50.5
Gran	0.1
Lind	0.4
Ek	1.4
Alm	1.9
Hassel/Pors	2.3
Ljung (Lyng)	0.4
Sälg/vide (Vier)	0.7
En	0.1
Gräs (Gras)	2.7
Korgblommiga växter (rörf.), (Turf)	0.3
Korgblommiga växter (Tungf.) (Tistel, Lövetann)	0.1
Smörblommor (Soleie)	1.0
Rosväxter (Mure)	0.3
Gråbo (Burot)	0.9
Målla (Meldestokk)	2.4
Vicker	0.1
Spärgel (Bendel)	0.1
Humle/Hampa	0.2
Summa störnings indikerande växter **(exkl. gräs) %**	**5.3**
Korn (Bygg-typ)	0.1
Vete/Havre– typ (Hvete-typ)	
Summa odlade växter	**0.1**
Starr	0.3
Älgört (Mjödurt)	
Kovall (Marimjelle)	
Sporer	
Lummer (Kråkefot)	
Ormbunkar (Telg)	1.5
Pollenanalys **Antal räknade pollen**	**983**
Analys Jan-Erik Wallin **Nov. 2018 Pollenlaboratoriet i Umeå AB**	

Tabell 2: Vilken vegetation indikerar dom olika växt-arterna

	Lövskog	*Barrskog*	*Ängsmark*	*Åkermark*
Al (Or) *Alnus*	X			
Björk *Betula*	X			
Tall (Furu) *Pinus*		X		
Gran *Picea*		X		
Lind *Tilia*	X			
Ek (Eik) *Quercus*	X			
Alm *Ulmus*	X			
Ask *Fraxinus*	X			
Hassel/Pors *Corylus-type*	X			
Ljung (Lyng) *Calluna*			X	
Risväxter (ex Blåbär) *Ericaceae*				
Sälg/vide (Vier) *Salix*				
En (Einer) *Juniperus*			X	
Gräs (Gras) *Poaceae*			X	
Korgblommiga växter (rörf.), (Turf) *Asteraceae undiff.*			X	
Korgblommiga växter (Tungf.) (Tistel, Lövetann) *Cichoriaceae*			X	
Blåklint (ex Kornblom) *Centaurea type*				X
Smörblommor (Soleie) *Ranunculus type*			X	
Rosväxter (Mure) *Rosaceae undiff.*				
Gråbo (Burot) *Artemisia vulgaris*				X
Groblad *Plantago media/major*			X	
Syror (Syre) *Rumex*			X	
Målla (Meldestokk) *Chenopodiaceae*			X	X
Nejlikväxter (Smelle, tjärnblom) *Caryophyllaceae*			X	X
Mjölkör (Geitrams) *Epilobium*			X	
Spärgel (Bendel) *Spergula*				X
Nässla (Nesle) *Urtica*				X
Måra (Maure) *Galium*				
Humle/Hampa *Humulus-type*				X
Skallra (Engkall) *Rhinanthus*			X	
Vicker (Vikke) *Vicia cracca type*				X
Korn (Bygg-typ) *Hordeum*				X
Vete/Havre – typ (Hvete-typ) *Triticum type*				X
Råg (Rug) *Secale*				X
Starr (Storr) *Cyperaceae*			X	
Älgört (Mjödurt) *Filipendula*				
Kovall (Marimjelle) *Melampyrum*			X	
Käx (Kjeks) *Apiaceae*			X	
Sporer				
Lummer (Kråkefot) *Lycopodium*				
Ormbunkar (Telg) P*olypodiaceae*				
Dvärglummer (Dvergjamne) *Selaginella*				

MAL
ENVIRONMENTAL
ARCHAEOLOGY LAB.

MAL
Miljöarkeologiska laboratoriet
Umeå Universitet
901 87 UMEÅ
090-786 50 00
https://www.umu.se/mal/
mal@umu.se

Jan-Erik Wallin Pollenlaboratoriet i Umeå AB
Sågställarvägen 2A 907 42 Umeå
070-66 15 101
pollenlaboratoriet@ume.se