MILJÖARKEOLOGISKA LABORATORIET

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Environmental archaeological analyses of samples from the site Tanum 665/ L2020:2561, Tanum Socken, Bohuslän

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Sample information

Analysis type: Makrofossil analysis of unfloated samples, soil chemical analysis
Number of samples: 8 macrofossil samples, 31 soil chemical samples

Introduction

Eight macrofossil samples and 31 soil chemical samples from the excavations of the site Tanum 665/ L2020:2561 were analyzed at the Environmental Archaeology Laboratory (MAL) at Umeå University.

More than 60 archaeological features were registered during the excavations of the site: hearts, cooking pits, fire cracked stone features, post holes and settlement pits which could be related to the metal periods. Furthermore, ten features, pits and cultural layers were interpreted as a part of the Mesolithic use of the area.

The archaeological artifacts consist of burnt clay, ceramics, burnt and unburnt bones, slag, flint fragments, grindstones and an amber bead.

Samples P37, P40 and P78 were probably dated in the Mesolithic period while samples P3, P10, P21, P28 and P92 in the metal periods. The area, where the features from the metal periods are located is approximately 100-150 meters north of Tanum 2463 and 3 km west of Tanum 2017 where a grain storage was found.

The results from the analyses try to answer questions concerning the use of the area, agriculture practices and food preparation. Can the organic material preserved in the Mesolithic period samples show a later date? Are there bones in those samples? How the analyses can contribute for the interpretation of the surface organization, food preparation, housing, etc.

As the samples from the later/ metal periods are situated close to a previously found grain storage, the main question is if the currently excavated area was also included in the metal periods' landscape and how it was cultivated.

Materials and Methods

Macrofossil analysis

Before the analysis the samples were stored in a drying room (+30°) until the moisture has disappeared. After that, the samples were floated using sieve meshes of 0,5 mm and 2 mm. The samples volume before flotation was between 1,6 and 2,1 liters and after it between 5 and 350 ml. The sieved material was sorted and identified under stereomicroscope. The carbonised plant remains were extracted from the samples and the amount of woody charcoal was estimated as relative proportion of the floated sample volume as follows: x = up to 25 %, xx = up to 50 %, xxx = up to 75 %, xxxx = about 100 % of the floated sample volume.

The identification of plant remains was conducted via reference literature for plant seeds (Cappers et al. 2006) and cereals (Jacomet, 2006) as well as the laboratory reference collection. The charcoal fragments selected for 14 C were identified with the help of reference literature for wood (Schweingruber 1978; Schweingruber 1990) and the laboratory reference collection. The names of the identified plants are given according to the Nordens flora (Mossberg and Stenberg 2018) and the Virtual Flora (Anderberg and Anderberg, u.d.). The results from the analyses have been presented in Table 3. The selected for 14C dating material is presented in Table 4.

Samples processing and identification was done by Ivanka Hristova, Eirini Anagnostou.

Soil chemistry

Prior to all analyses the samples were dried at 30°C. Samples were then passed through a 1.25 mm sieve and any presence of 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).
Cit-P	Inorganic phosphate content (mg P/kg dry matter, ppm)	Extraction with 2% citric acid (corresponding to the Arrhenius method (Arrhenius 1934)

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 and Linderholm 2008, Linderholm 2007) and magnetic susceptibility (MS-χ_{lf}) and MS550-χ_{lf} (Linderholm 2007, Engelmark and 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 relation to phosphate.

Soil chemical analyses were undertaken by Johan Linderholm, Samuel Eriksson and Kristian Hristov.

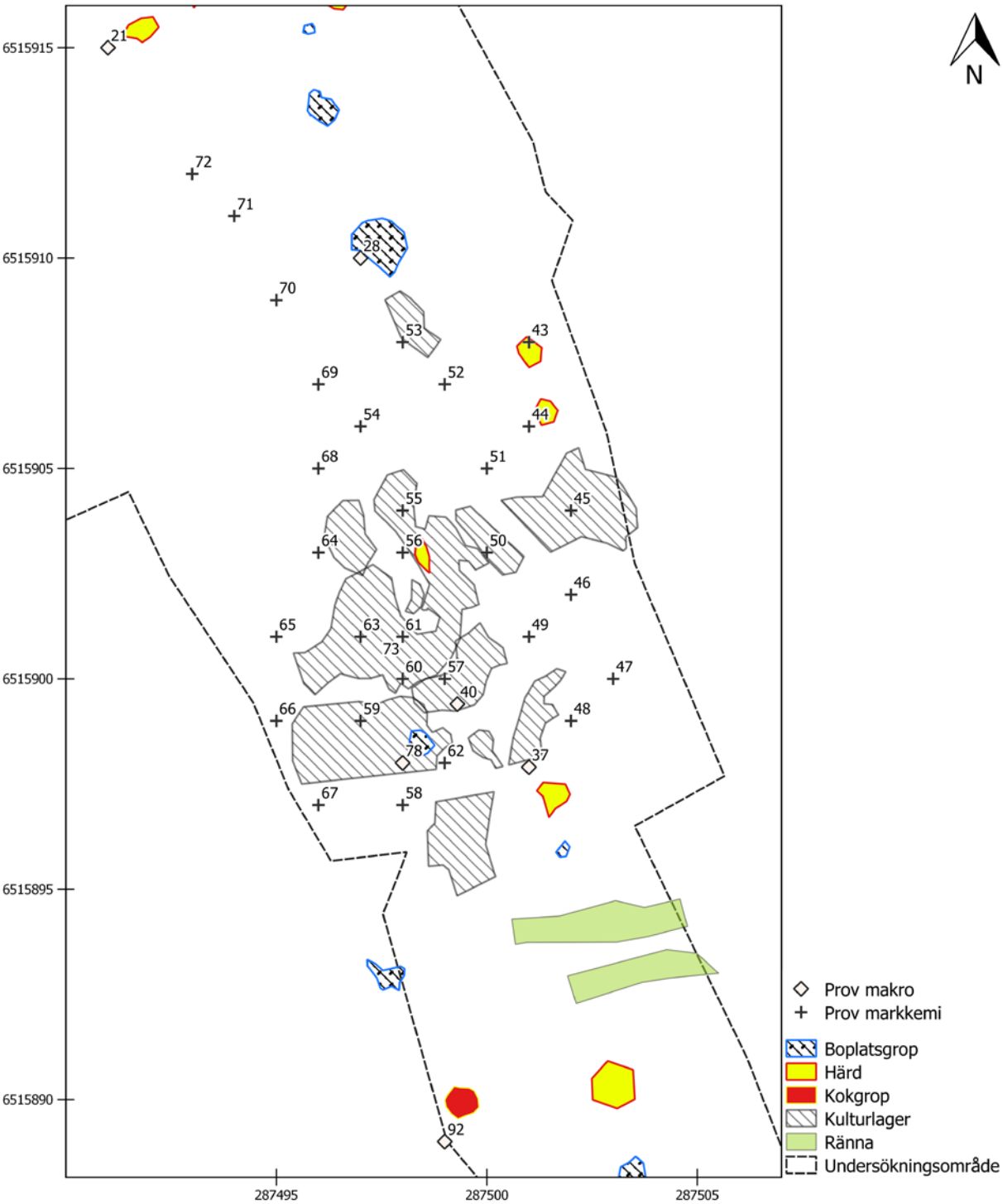

Fig 1. Samples for macrofossil and soil chemistry analysis.

Results

Macrofossil analysis

Sample 20_0016_0001/ P3
The sample volume before flotation was 1,8 liter and after flotation it is 350 ml. The floated sample consists entirely of charcoals. The majority of them are very small (1 - 2 mm) but some bigger charcoal fragments were also recognized (0,5 – 1 cm). One wood fragment (565mg) was selected for 14 C dating and determined as *Alnus* sp. (alder/ alar).

Sample 20_0016_0002/ P10
The sample volume before flotation was 1,8 liter and after flotation – 75 ml. The sample consists entirely of charcoals. The identified macros were four seeds of *Stellaria graminea* (lesser/ grässtjärnblomm), one of *Chenopodium album* (fat-hen/ svinmålla) and one of *Spergula arvensis* (corn spurrey/ åkerspärgel). One piece of black slag (ca. 3- 5 cm) and five fragments of unburnt bones were also found. A charcoal fragments defined as *Alnus* sp. (alder/ alar) - 43 mg was selected for 14 C dating.

Sample 20_0016_0003/ P21
The sample volume before flotation was 1,1 liter and after flotation is 75 ml. The charcoal fragments represent about 100% of the floated sample volume. Among the charcoal about 15 bark fragments and one piece of black slag (5 mm) were registered. The identified macros are represented by cereals and weeds/ wild growing plants. The only identified cereal crop was barley (*Hordeum vulgare*) and one of the barley grains was defined as hulled barley (*Hordeum vulgare* var *vulgare*). The hulled barley grain (7mg) was sorted for 14 C dating. The rest of the cereals are badly preserved and determined as Cerealia (unidentifiable cereal crops). The preserved wild growing species are: *Spergula arvensis* (corn spurrey/ åkerspärgel), *Stellaria graminea* (lesser/ grässtjärnblomm), *Stellaria media* (common chickweed/ våtarv), *Persicaria* cf. *amphibian (amphibious bistort/ vattenpilört)*, *Persicaria lapathifolia* (pale persicaria/ pilört), and *Galium spurium* (false cleavers/ småsnärjmåra).

Sample 20_0016_0004/ P28
The sample volume before flotation was 1,8 liter and after it – 40 ml. The amount of charcoals comprises of approximately 75 % of the floated sample volume. The preserved plant remains consist of two seeds of weeds/meadow plants: *Chenopodium album* (fat-hen/ svinmålla) and *Medicago* sp. (burclover/ luserner). Additionally four fragments of black slag (2- 4 mm) were also found. A charcoal piece (76 mg) identified as cf. *Corylus avellana* (hazel/ hassel) was selected for 14 C dating.

Sample 20_0016_0005/ P37
The sample volume before flotation was 1,8 liter and after flotation – 10 ml. No archaeobotanical material was preserved in the floated sample. The sample consist mainly of modern plant vegetative parts. Small unburned bone fragments were preserved, eight bigger ones (1 – 5 mm) were selected. Although there was no visible charcoals in the sample under screening few very small ones were detected. One of them (18,5 mg) defined as *Corylus avellana* (hazel/ hassel) was selected for 14 C dating.

Sample 20_0016_0006/ P40
The sample volume before flotation was 2,1 liter and after flotation is 10 ml. Just very few charcoals were preserved in the floated sample and no other plant remains. One of the charcoal fragments was picked up for 14C dating, defined as cf. *Corylus avellana* (hazel/ hassel) – 6,2

mg. Two pieces of Cenococcum (a fungi typical for forest environments) were found. The rest of the sample comprises of modern plant material such as stems/ roots and lots of unburned bones, some of which were recognized as fish bones. Only the bigger than 2 mm bone fragments were picked up (ca 1 ml).

Sample 20_0016_0007/ P78
The sample volume before flotation was 2,1 liter and after flotation is 5 ml. Charcoals were not visible in the floated sample but during sorting very few small fragments were detected. One of them identified as cf. *Juniperous* (juniper/ enar) – 19,1 mg was selected for 14 C dating. No other botanical remains were preserved in the sample. The sample was represented by modern stems and roots, and unburned bones. Only the bigger bone fragments (bigger than 2 mm) were collected (ca 1 ml). Again two Cenococcum pieces were found.

Sample 20_0016_0008/ P92
The sample volume before flotation was 1,6 liter and after flotation is 200 ml. The whole sample was represented by small charcoal fragments most of them between 1 and 2 mm. The biggest ones are about 5 mm. No other macrofossil remains were found in the sample. One of the wood fragments was defined as Pomoideae (43 mg) and selected for 14 C dating. Pomoidea could represent species such as apple, pear, rowan.

Soil chemistry

A total of 31 soil chemistry samples were analysed. All samples are surface samples, collected in the area interpreted as representing mainly Mesolithic activities. The results from the analysis is presented in Table 5. The analysed parameters are represented as a scatter plot in figure 2 and as spatial interpolations in figures 3 and 4.

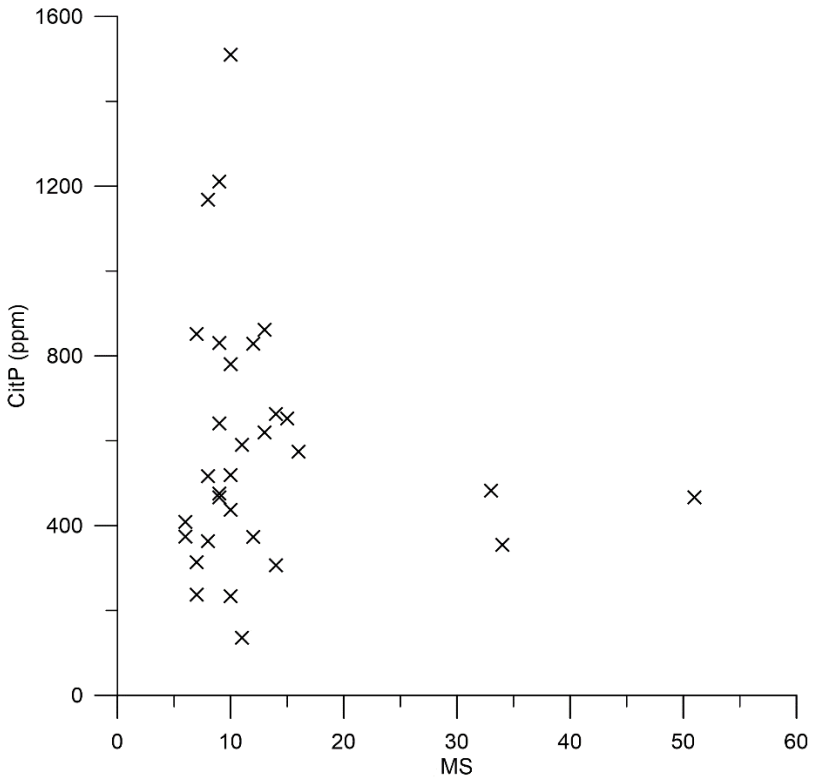

Fig. 2. Results for MS and CitP analysis.

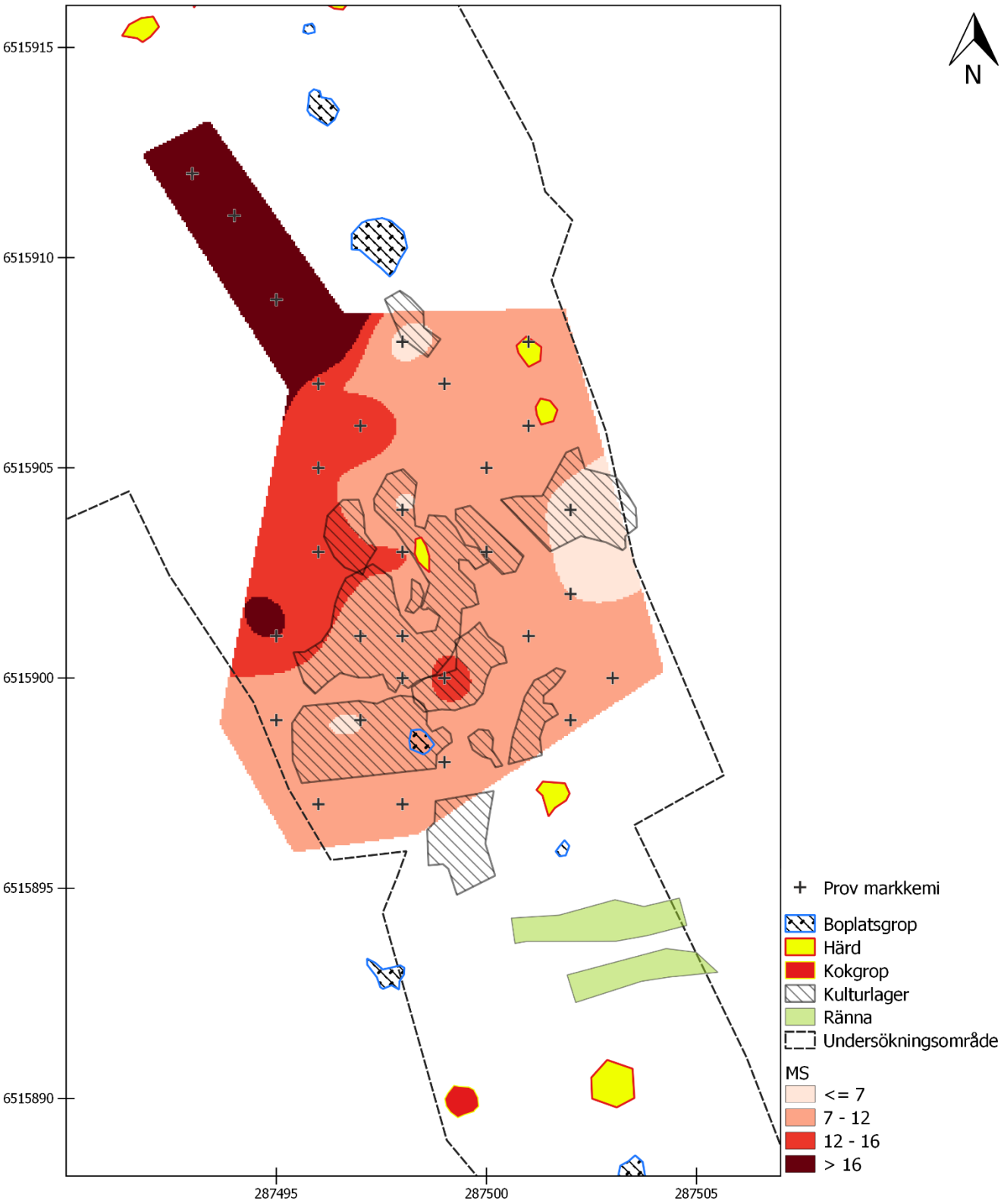

Fig. 3. MS analysis results as a spatial interpolation

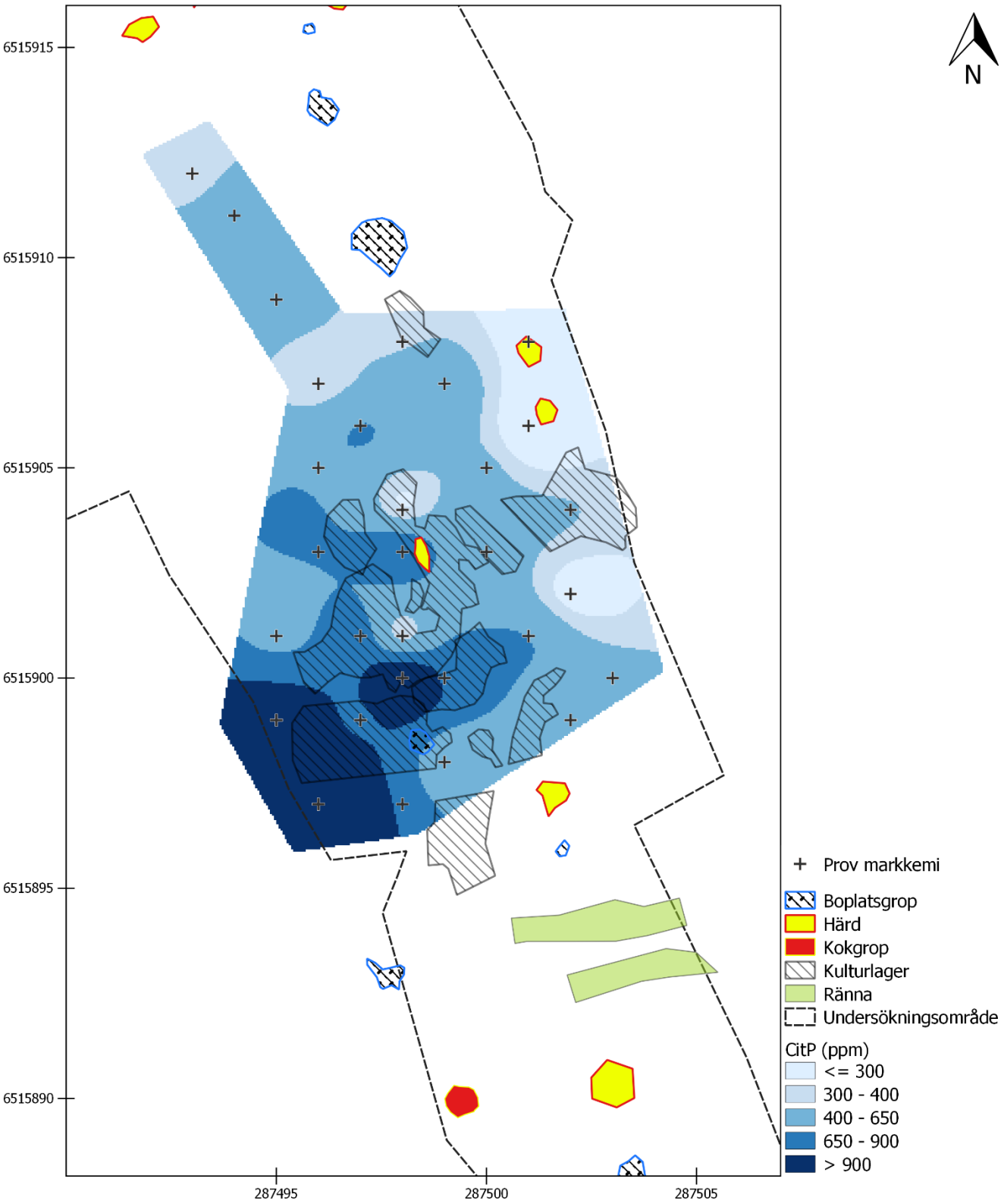

Fig. 4. CitP analysis results as a spatial interpolation

Discussion and Conclusions

Five of the analyzed samples (P3, P10, P21, P28 and P92) belonging to later periods consist mainly of charcoal fragments, which indicates intensive burning in the studied structures. Samples P3 and P92 did not contained any other plant material than charcoals. Only one of the samples contain cereals (P21) represented by barley which is the most common cereal crop for the studied area and periods. The rest of the samples contain few seeds of wild growing plants as weed/ruderals and meadow plants. It is difficult to answer questions regarding agricultural practices and food preparation by just few studied samples. Still the presence of cereals and weeds gives evidence for cultivation areas in the close proximity.
Samples P37, P40 and P78 differ from the rest of the samples as they did not contain any visible charred material but all of them are rich in bones. This could be linked to the fact that they belong to another time period – the Mesolithic and give a hint for different functions of the studied structures comparing to the later ones. Dating of the found charcoals and bones can help for the precision of the time period.

The soil chemistry results indicates intense and likely prolonged phosphate accumulating activities in the south western part of the sampled area. The amount of accumulated inorganic phosphates are very high compared to most Mesolithic contexts and probably represents processing and deposition of bones and other parts of animal carcasses. The results from the MS analysis indicates a low impact of heat generating activities in the southern part of the sampled area. The impact in MS is higher in the northern part which might indicate different activities and use of space, it might also be connected to the bronze/iron age features further north.

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Figures and tables

Table 3. Archaeobotanical results from the studied sites.

MAL nr	**20_0016_0001**	**20_0016_0002**	**20_0016_0003**	**20_0016_0004**	**20_0016_0005**	**20_0016_0006**	**20_0016_0007**	**20_0016_0008**
Prov nr	P3	P10	P21	P28	P37	P40	P78	P92
Feature	A12	A19	A25	A30	Klager 2	Kulturlager 5	A114	A126
Hordeum vulgare (barley/ korn)			4					
Hordeum vulgare var. *Vulgare* (hulled barley/ skalkorn)			1					
Cerealia (unidentified cereal crops)			3					
Cerealia fragm. (cereals fragmets)			1					
Chenopodium album (fat-hen/ svinmålla)		1		2				
Galium spurium (false cleavers/ småsnärjmåra)			1					
Medicago sp. (burclover/ luserner)				1				
Persicaria cf. amphibia (amphibious bistort/ vattenpilört)			2					
Persicaria lapathifolia (pale persicaria/ pilört)			1					
Spergula arvensis (corn spurrey/ åkerspärgel)		1	2					
Stellaria graminea (lesser/ grässtjärnblomm)		4	1					
Stellaria media (common chickweed/ våtarv)			1					
Fabaceae (bean family/ ärtväxter)			3					
Indet (unidentified)							1	
Cenococcum						2	2	
Charcoals	xxxx	xxxx	xxxx	xxx				xxxx
Unburnt bones		5			8	1 ml	1 ml	
Black slag/amorphous fragments		1	1	4				
Bark fragments			15					
Volume before floation (L)	1,8	1,8	1,1	1,8	1,8	2,1	2,1	1,6
Volume after floation (ml)	350	75	75	40	10	10	5	200

Table 4. Botanical material selected for 14 C dating.

MAL nr	**P.nr**	**Hemvist**	**Material**	**Vikt**	**Comments**
20_0016_0001	3	A12	*Alnus* (charcoal fragment)	565 mg	
20_0016_0002	10	A19	*Alnus* (charcoal fragment)	43 mg	
20_0016_0003	21	A25	*Hordeum vulgare* var *vulgare*	7 mg	
20_0016_0004	28	A30	cf. *Corylus avellana* (charcoal fragment)	76 mg	badly preserved
20_0016_0005	37	klager 2	*Corylus avellana* (charcoal fragment)	18,5 mg	
20_0016_0006	40	kulturlager 5	cf. *Corylus avellana* (charcoal fragment)	6,2 mg	very small and badly preserved
20_0016_0007	78	A114	cf. *Juniperus* (charcoal fragment)	19,1 mg	badly preserved
20_0016_0008	92	A126	Pomoideae (charcoal fragment)	43 mg	

Table 5. Soil chemical analysis.

MALNo	FieldNo	Northing	Easting	Z	MS	CitP
20_0017_0001	p43	6515908	287501	43,53	10	234
20_0017_0002	p44	6515906	287501	43,65	11	136
20_0017_0003	p45	6515904	287502	43,71	6	409
20_0017_0004	p46	6515902	287502	43,78	7	237
20_0017_0005	p47	6515900	287503	43,88	9	475
20_0017_0006	p48	6515899	287502	43,98	9	466
20_0017_0007	p49	6515901	287501	43,86	9	640
20_0017_0008	p50	6515903	287500	43,75	10	519
20_0017_0009	p51	6515905	287500	43,64	10	437
20_0017_0010	p52	6515907	287499	43,58	11	590
20_0017_0011	p53	6515908	287498	43,45	6	374
20_0017_0012	p54	6515906	287497	43,63	15	653
20_0017_0013	p55	6515904	287498	43,73	7	313
20_0017_0014	p56	6515903	287498	43,82	12	829
20_0017_0015	p57	6515900	287499	43,89	13	861
20_0017_0016	p58	6515897	287498	44,12	9	831
20_0017_0017	p59	6515899	287497	44,01	7	852
20_0017_0018	p60	6515900	287498	43,95	9	1211
20_0017_0019	p61	6515901	287498	43,91	8	363
20_0017_0020	p62	6515898	287499	44	8	516
20_0017_0021	p63	6515901	287497	43,9	10	781
20_0017_0022	p64	6515903	287496	43,8	14	663
20_0017_0023	p65	6515901	287495	43,99	16	574
20_0017_0024	p66	6515899	287495	44,02	8	1168
20_0017_0025	p67	6515897	287496	44,13	10	1509
20_0017_0026	p68	6515905	287496	43,69	13	620
20_0017_0027	p69	6515907	287496	43,5	14	307
20_0017_0028	p70	6515909	287495	43,31	51	467
20_0017_0029	p71	6515911	287494	43,16	33	482
20_0017_0030	p72	6515912	287493	42,95	34	354
20_0017_0031	p73	6515901	287498	43,76	12	374

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