Here be Reindeer: Geoarchaeological Approaches to the Transspecies Lifeworlds of the Sámi Reindeer Herder Camps on the Tundra

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Abstract

In this paper we present ongoing geoarchaeological research of Sámi reindeer pastoralist campsites. The discussion is based on three case study sites situated at the Lake Gilbbesjávri region (Finland) in northern Sápmi. All the sites are historical-period reindeer herder camps, likely used as temporary summer encampments by the nomadic herders in the 17th–19th centuries. The sites were prospected with systematic soil sampling and geoarchaeological analyses, which have been previously successfully applied in the study of Sámi habitation sites on both intrasite and intra-dwelling levels. The changes in the soil phosphate, pH and electric conductivity values were analysed and interpreted based on ethnographic analogies. These allow insight into the outwardly invisible taskscapes and spatialities of the herders and their animals at the campsites. The different geoarchaeological factors highlight differing aspects of the use of space at the historical Sámi reindeer pastoralist campsites, such as potential reindeer corralling areas, and provide comparative material for the analyses of prehistoric Sámi hunter-gatherer-herder sites.

1 Introduction

The materialities of soils and their geochemical and geophysical properties can act as an archive and proxy for past human and animal activities. In this paper, we approach the archaeological remains of historical Sámi reindeer pastoralists in northern Finnish Lapland from a geoarchaeological perspective. Nomadic reindeer pastoralism and the connected long-distance mobility developed in northern Fennoscandia over the course of the 14th–19th centuries CE from the previous small-scale draught and decoy reindeer herding practiced in a hunter-gatherer-herder society (e.g. Hansen & Olsen 2014). This change took place at a differing pace and with differing details in the various parts of Sápmi, the homeland of the Sámi people covering the northern reaches of Norway, Sweden, Finland and Russia (Fig. 1).

In this paper we present three geoarchaeological case studies from the Mountain Sámi habitation sites situated in the Arctic tundra environment in northernmost Finnish Sápmi in the Lake Gilbbesjávri area (Fi. Kilpisjärvi; Northern Sámi placenames are used throughout). These aim at assessing the outwardly invisible, transspecies taskscapes of the herders and their animals at the campsites through systematic soil sampling and geoarchaeological analyses. The ana-

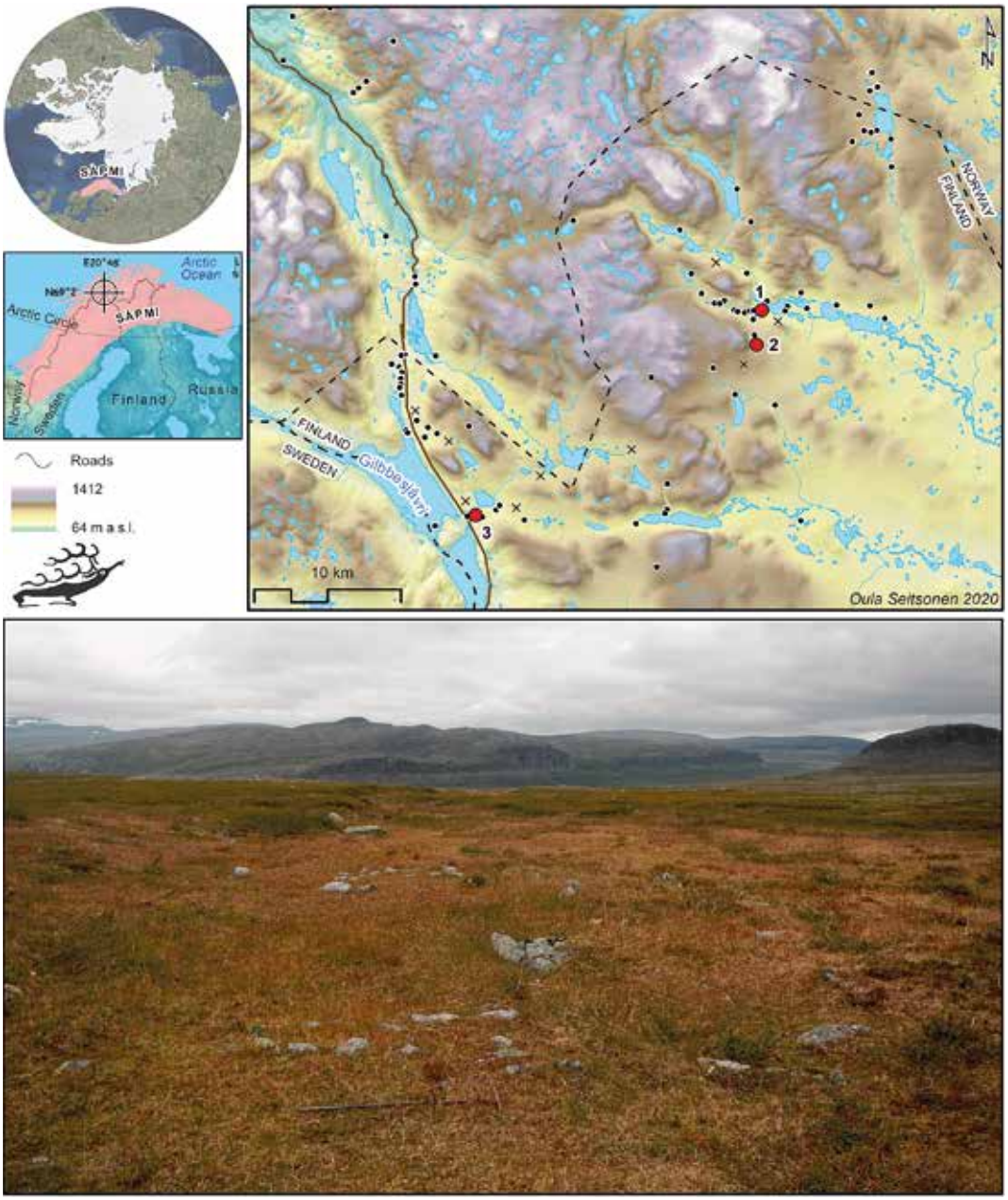

Figure 1. Top: Location of the studied sites in Sápmi. Studied sites in red, other Sámi sites in black, and background samples with black crosses. Map: Oula Seitsonen; Bottom: View over the 18th–19th century pastoralist campsite Gahperusvárri itä 2, on the foreground a *bearpmet* hearth. Photo: Oula Seitsonen.

lysed geoarchaeological soil factors, such as phosphate concentrations and electric conductivity, have potential to highlight different aspects of the spatialities of the historical Sámi reindeer pastoralist camps, e.g. the use of space inside the dwellings or potential reindeer corralling areas. In many parts of Sápmi, reindeer pastoralism has remained an important livelihood and cultural practice to this day, such as in the Lake Gilbbesjávri

region. However, herding practices have changed considerably over the last century, influenced by the emerging aspects of modernity such as permanent housing, all-terrain vehicles, helicopters and satellite navigation (see Nykänen & Valkeapää 2016; Näkkäläjärvi 2013; Seitsonen 2021a).

Geoarchaeological soil analyses have been successfully applied in the study of the Sámi reindeer herders' camps and sacred *sieidi* sites for decades (e.g. Äikäs 2015; Carpelan & Lavento 1996; Halinen 2009; Nuñez 1977). Soil phosphate analysis is one of the most commonly used geochemical approaches in archaeology globally (e.g. Lavento 2003; Linderholm 2010; Trinks 2014) and has often been applied for the intra-dwelling and intrasite studies of Sámi sites (e.g. Halinen 2016; Jerand et al. 2016; Karlsson 2006). Magnetic susceptibility and loss on ignition values are also commonly used analyses (e.g. Jerand & Linderholm 2019; Tolonen 2013), on top of which Nuñez (1977) has analysed pH values from medieval Sámi winter camps and Tolonen (2013) from the sacrificial Sámi *sieidis*. Recently, Jerand and Linderholm (2019) have developed advanced analytical approaches in phosphate analysis by assessing separately both inorganic and organic phosphate contents and their interrelation. The previous studies have assessed, for instance, the intra-dwelling organisations of Sámi tents (Sán. *lávvu* and *bealjegoahti*) and turf huts (Sán. *darfegoahti*) (e.g. Halinen 2016; 2019; Jerand et al. 2016), and the intrasite patterns, such as potential reindeer corralling and gathering areas at the sites (e.g. Jerand & Linderholm 2019; Karlsson 2006).

Our study is part of an ongoing research on the effects that the reindeer domestication and herding have had on the materialities of soils in northern Fennoscandia, as part of the wider project Domestication in Action which studies the human-reindeer relations from multidisciplinary perspectives. This paper provides geoarchaeological case studies from three seasonal pastoralist campsites dated to the 17th-19th centuries. These likely functioned as transitionary summer camps related to the movement of the reindeer herds and herders from their inland winter pastures to the coastal summer pastures (Fig. 1:1–3). In our soil analyses, we have analysed the phosphates, pH and, as a new variable, the electric conductivity (EC) values from these sites. EC analysis of soils was included in the study as an exploratory factor to assess how it might mirror past activities, such as fires or waste disposal, that can alter the EC properties of the soils (e.g. Trinks 2014). Both the intra-dwelling and intrasite patterning of the studied geoarchaeological factors are used to assess human and animal activities and their spatial configurations. The spatialities are approached from a phenomenological perspective as part of the lived-in, transspecies lifeworlds (Husserl 1970 [1936]: 103; Seamon 1979; von Uexküll 1992 [1934]), taskscapes (Ingold 1993) and meshworks (Ingold, 2011: 63–97) of the herders, their reindeer, and the other beings. Intra-dwelling organisations are compared with the well-known and often-cited ethnographic analogies related to the floor plans of the Sámi dwellings (e.g. Itkonen 1948a: 183–184; Jerand et al. 2016; Solbakk 2007: 74). Intrasite spatialities are interpreted based on the historical waste disposal and reindeer handling patterns at the Sámi sites. In addition to being expressive of the lifeworlds of the historical nomadic pastoralists and their animal companions, our study provides also analogies and new comparative data for assessing the spatialities of the Iron Age and medieval hunter-gatherer-herder Sámi campsites (e.g. Halinen 2009; 2019; Halinen et al. 2013; Jerand & Linderholm 2019; Karlsson 2006).

2 Studied reindeer pastoralist sites

We discuss here three systematically sampled and analysed historical Mountain Sámi reindeer pastoralist encampments: Nuvkkágieddi (Fig. 1:1; Fig. 2A), Gahperusvárri itä 2 (henceforth Gahperusvárri; Fig. 1:2; Fig. 2B) and Čáhkaljohka etelä 2 (henceforth Cáhkaljohka; Fig. 1:3; Fig. 2C) (Table 1). These are all situated in the barren roadless

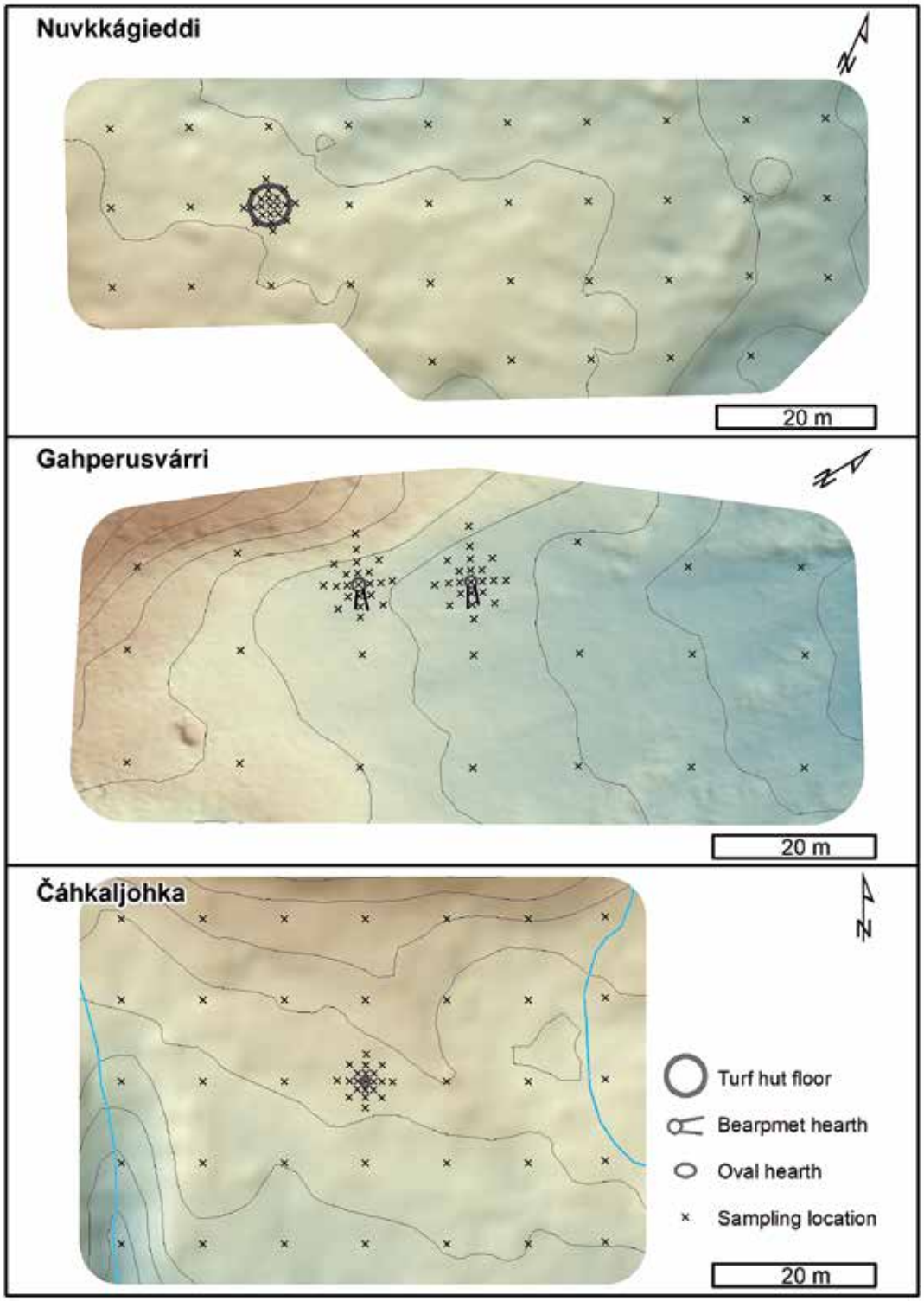

Figure 2. Studied sites, structures and soil sampling locations, elevation contours at 0,5-metre intervals. Maps: Oula Seitsonen.

Site	Type	Environmental context	Meters a.s.l.	Radiocarbon dates	Lab. Code	CalAD (2-sigma)			
						BP	Max	Min	Median
Gahperusvárri	Three hearths	Alpine tundra	760	Oval hearth	D-AMS-036582	204±26	1656	...	1775
Gahperusvárri	Three hearths	Alpine tundra	760	Bearpmet hearth	D-AMS-035325	143±22	1679	1939	1804
Čáhkaljohka	Single hearth	Mountain birch forest	500	Oval hearth	D-AMS-035338	100±22	1690	1926	1841
Nuvkkágieddi	Turf hut foundation	Alpine tundra	603	-	-	-	-	-	-

Radiocarbon dates calibrated with Oxcal v. 4.3.2 (Bronk Ramsey 2017) and IntCal13 atmospheric curve (Reimer et al. 2013)

Table 1. Site characteristics and the radiocarbon dated contexts.

landscape east of Lake Gilbbesjávri (N69°2'/E20°48') that is still an important reindeer herding country for the local *siidas* (*siida* is a traditional Sámi social and herding unit typically consisting of family and friends) (Fig. 1). Čáhkaljohka is situated in the upper edge of sparse mountain birch forest, whereas the two other sites are in the open Alpine tundra environment (Fig. 1; Table 1).

There are usually few visible material traces on the surface at the mobile Sámi pastoralist campsites, most often only some scattered hearth stones or round hut floors with shallow remains of turf walls (Fig. 1). Then again, vegetation at the sites is often notably different from their surroundings, with more graminoids and less shrub (Fenger-Nielsen et al. 2019; Karlsson 2006: 163; also Itkonen 1948a: 274, for ethnographic examples of the vegetation change). We chose sites with different types of archaeological features connected to reindeer pastoralism to compare their geoarchaeological characteristics (see Karlsson 2006). At Nuvkkágieddi the visible remains consist of a round turf hut foundation, at Čáhkaljohka of an oval hearth, and at Gahperusvárri of two *bearpmet* hearths and one round hearth (with the last one situated outside the area mapped in Fig. 2C) (Table 1). B*earpmetárran* are hearths that typically have two stone 'arms,' *uksabearpmet*, leading from the corners of the hearth to the doorway of the tent, related to the traditional floor plan of the Sámi dwellings. Sometimes logs were used instead of stone lines for the internal division of the dwellings (Itkonen 1948a: 183–184; Ränk 1949), as is still done nowadays at the seasonal herding sites (Seitsonen 2020).

Local transgenerational memories suggest that two of the sites, Nuvkkágieddi and Čáhkaljohka, acted as pastoralist summer camps in the 19th century, and probably already earlier. An oval hearth at Čáhkaljohka was radiocarbon dated to the mid-19th century (Table 1), in agreement with the local oral histories. These sites likely acted as stopover points along the seasonal migration routes between the winter pastures in the Finnish interior and the summer pastures on the Norwegian coast before the national borders were closed from the migrating Sámi after the mid-19th century (e.g. Itkonen 1948b: 225–26; Seitsonen 2021a). After the border closures, many families were forced to move in search of new pasturelands in the southern and eastern reaches of Sápmi (e.g. Heikkinen et al. 2005; Valtonen 2016).

Based on the indigenous histories of one Sámi family, Nuvkkágieddi was used by them before the family was forced to migrate several hundred kilometres southeast in search of new reindeer pastures in another part of Sápmi and adapt to a completely different, forested herding environment in the late 19th century. According to them, they lived at the site in the summers for some time after the borders were closed and the *siidas* were still adapting to the new territories (personal communication with the family representa-

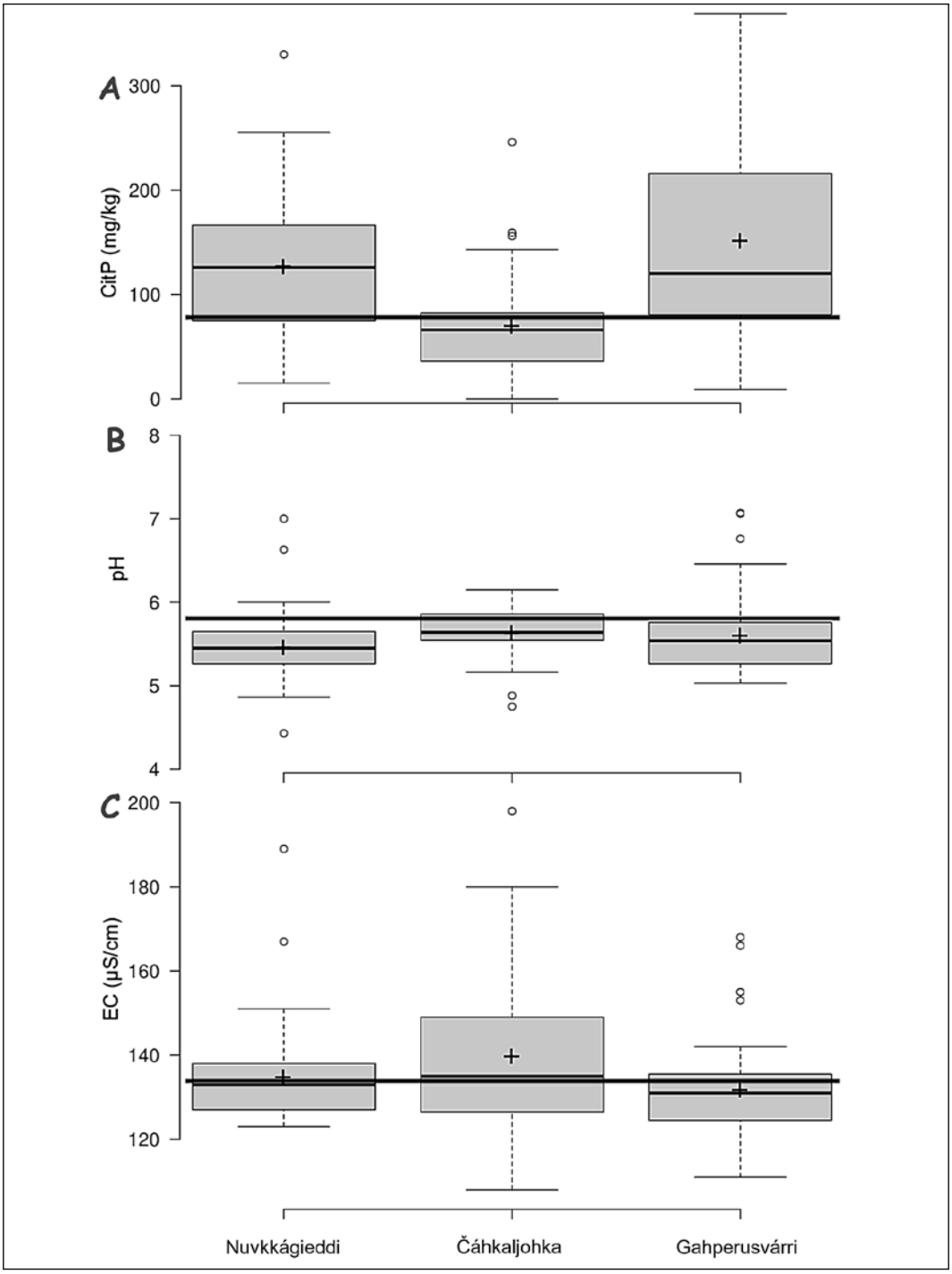

Figure 3. Box-and-whisker plots of the measured geochemical values at each site: A. Phosphates. B. pH. C. Electric conductivity. The boxes illustrate the first quartile, median and third quartile, the whiskers show the 1.5 times interquartile range, and the open dots are outliers. Median values of the background control samples are shown with a thick horizontal line. Figure: Oula Seitsonen.

Phosphate (mg/kg)	Nuvkkágieddi	Čáhkaljohka	Gahperusvárri	Background
Median	126	66	120	76
Mean	126	69	151	77
Min	15	0	9	15
Max	330	246	369	127
pH				
Median	5,5	5,6	5,5	5,8
Mean	5,5	5,6	5,6	5,7
Min	4,4	4,8	5,0	5,1
Max	7,0	6,2	7,1	6,3
EC (µS/cm)				
Median	133	135	131	136
Mean	135	140	132	126
Min	123	108	111	48
Max	189	198	168	142

Table 2. Descriptive statistics of the geoarchaeological factors measured at the studied sites (Fig. 1:1–3) and at the background samples (Fig. 1) (full results of the analyses are presented in Seitsonen 2021b).

tive). The Gahperusvárri site was tentatively connected by the locals to the former *Pienni siida* that herded their reindeer in this area before they merged with the current *siidas* in the early 20th century (also Itkonen 1948a: 230; 1948b: 159, 166). At Gahperusvárri, a round hearth was radiocarbon dated to the late 18th century CE and a *bearpmet* hearth to the early 19th century CE (Table 1).

3 Materialities of soil: geoarchaeological analyses of the sites

Soils offer an archive of past human and animal activities that can be approached e.g. by studying the chemical and biochemical properties of archaeological sites (Égüez and Makarewicz 2018; Jerand & Linderholm 2019). Soil samples were taken at all three sites with a borer at 10-metre intervals across the whole site and at 1-metre intervals around the hearth structures (Fig. 2). All soil samples were taken from the top part of the enriched B-horizon of the shallow podzol soils. The archaeological deposits at all sites are less than 8 centimetres thick, starting immediately under the turf layer that is only a couple of centimetres thick. The soils at all sites are fine-grained sands underlain by more gravelly material. The phosphate values of the samples were analysed using a citric acid method analogous to that described by Jerand et al. (2016). This allows cautious, relative cross-site comparisons, keeping in mind that the soil properties are highly dependent on various local factors. pH and EC values were measured from sieved samples diluted into distilled water using a Hanna Instruments HI98129 Combo meter (with an HI 73127 pH electrode, and calibrated using the HI7007 and HI7031 solutions; each sample was measured three times and a mean of these measurements was calculated). Nine background control samples were collected from randomly selected localities in the wider landscape (see Fig. 1), providing comparison to the values measured at the archaeological sites. The spatiality of the studied values was visualised using the natural neighbour interpolation of the data points.

The measured geoarchaeological variables from each site and background samples are summarised in Table 2 and illustrated as box-and-whisker plots in Figure 3. Čáhkaljohka stands out from the other two sites, partly due to its differing envi-

ronmental setting. However, the phosphate values also suggest less intensive use of the site. Most phosphate values at Čáhkaljohka are below the median of the control samples, whereas at the other sites the majority are above it. Compared to the Iron Age and medieval Sámi winter campsites (Halinen 2016; 2019; Jerand et al. 2016), the phosphate values from all our sites are considerably lower. On the other hand, they are reminiscent of the readings from the Utsjoki Kalddasjohka 4 site with a single round Iron Age hearth (Halinen 2008a), the even lower phosphate values measured at the Utsjoki Jeagelveijohka 1 site with several *bearpmet* hearths (Halinen 2008b), and the low values from the pastoralist sites studied by Karlsson (2016: 96–98). These sites with low phosphate values were likely settled seasonally for relatively short durations (see Jerand et al. 2016).

The majority of the pH values from all the archaeological sites are below the background control samples' median value. This is in line with the observations made by Nuñez (1977: 57) of more acidic soils at the Sámi winter camps than in their surrounding natural soils. It is noteworthy that the highest pH readings at all three sites are encountered in and immediately around the hearths, likely related to the alkaline wood ash disposal and perhaps the processing and accumulation of the alkaline bone waste in these areas (Lavento 2003: 52). EC measurements from all sites are close to the background values, with the highest values encountered inside the hearths, and likely linked to both fire keeping and bone waste disposal. Fragments of burnt bones are often located inside the hearths studied in this area, as also elsewhere in Sápmi (see Halinen 2008b; Halinen et al. 2013).

4 Intrasite spatialities

The distribution maps of the measured geoarchaeological readings are presented in Figures 4–6. These illustrate clearly how the dwellings stand out at all sites, with the highest values of all the components originating from inside the hearths. A strong correlation has been noted between the archaeologically deposited bone material and high phosphate values at Sámi sites (Jerand et al. 2016: 365; Jerand & Linderholm 2019: 33). Likewise, the high pH values appear to relate to the deposits that are rich in bone material and ash (Lavento 2003), such as hearths. Thus, the correlations between higher phosphate and pH values at the sites could point to areas where bone waste was handled and dumped, and likely also wood ash.

Areas with both high phosphate and pH values appear e.g. at Nuvkkágieddi about 30 metres in front of the turf hut floor, at Čáhkaljohka northeast of the hearth, and at Gahperusvárri west of the hearths (Fig. 4–6). At both Čáhkaljohka and Gahperusvárri the potential bone handling areas are situated behind the dwellings, as inferred from the setting and structure of the hearths and the geoarchaeological values surrounding them (see below). This is comparable to the observations made at other Iron Age and medieval Sámi sites where garbage dump zones appear typically behind the tents and turf huts (Halinen 2008b; 2019; Hedman & Olsen 2009; Jerand et al. 2016). Also, the ethnographic observations about the waste management in the mobile Sámi pastoralist camps in the early 20th century suggest that both garbage dumps and toilet areas were situated behind the dwellings, often on the right side as seen from the entrance, and the men moved there around the right side and the women around the left side of the dwelling (Itkonen 1948a: 185). Then again, at Nuvkkágieddi the areas with higher phosphate and pH values are about 30 metres in front of the turf hut floor. Some differing waste management pattern might have been practiced at this site, with a more permanent turf-covered hut, than at the hearth sites where mobile tents were used (see Halinen 2019; Carpelan & Lavento 1996; for studies of medieval Sámi winter camps with turf huts).

Areas with high phosphate and low pH readings are also found at all sites. These might relate to other human and animal ac-

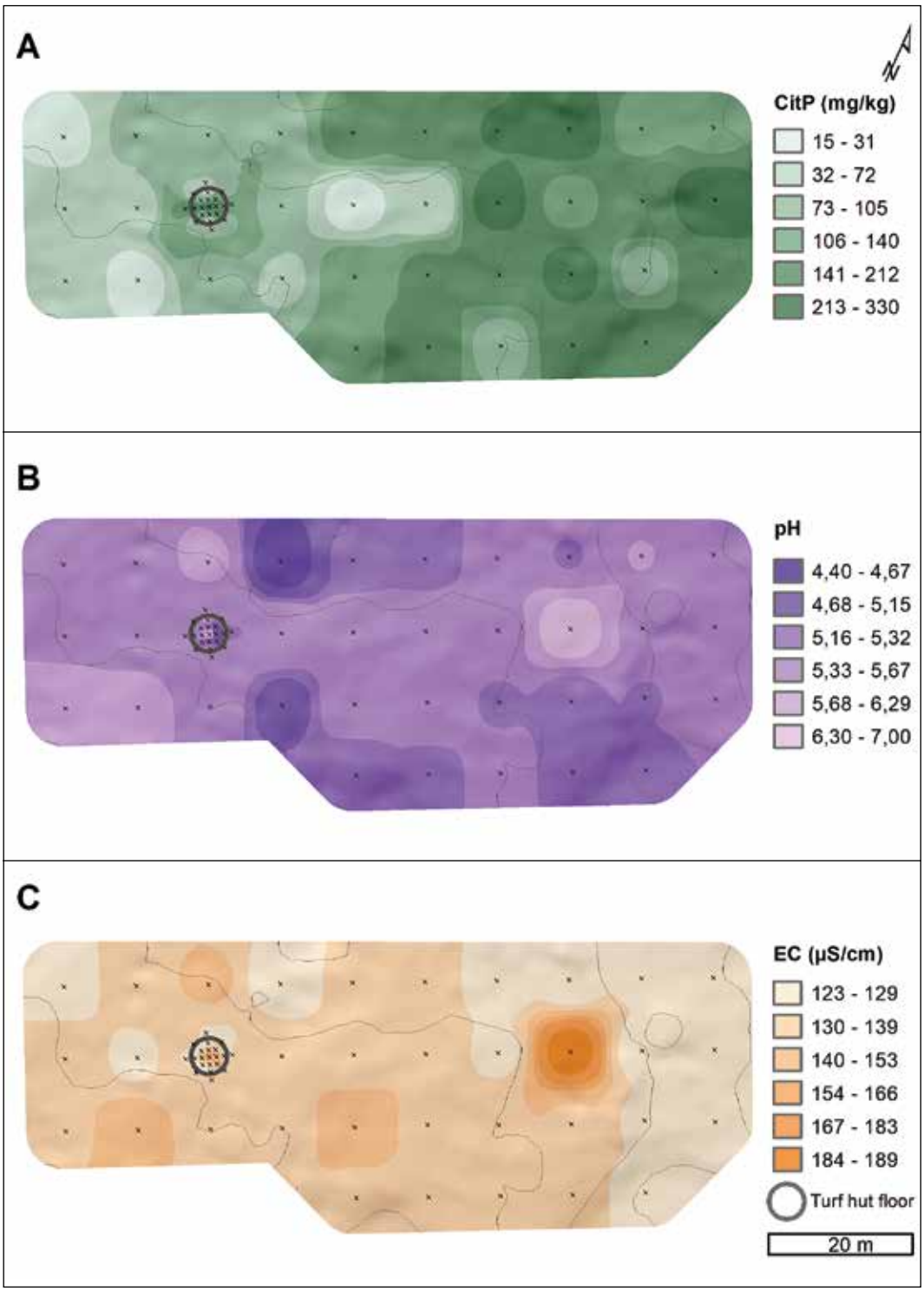

Figure 4. Measured geochemical values at Nuvkkágieddi: A. Phosphates. B. pH. C. Electric conductivity. Sampling locations with crosses, elevation contours at 0,5-metre intervals. Maps: Oula Seitsonen.

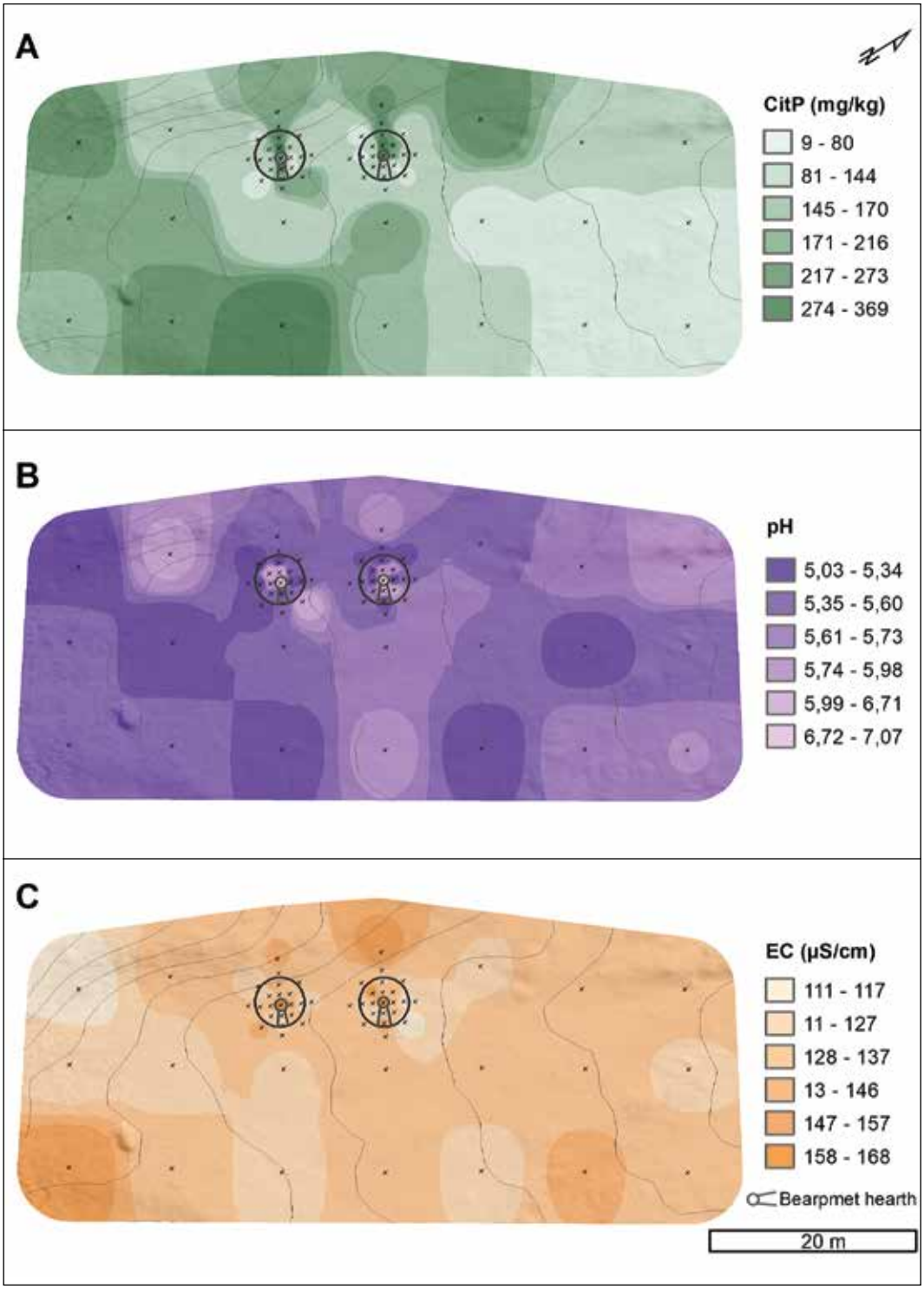

Figure 5. Measured geochemical values at Čáhkaljohka etelä 2: A. Phosphates. B. pH. C. Electric conductivity. Sampling locations with crosses, elevation contours at 0,5-metre intervals. Maps: Oula Seitsonen.

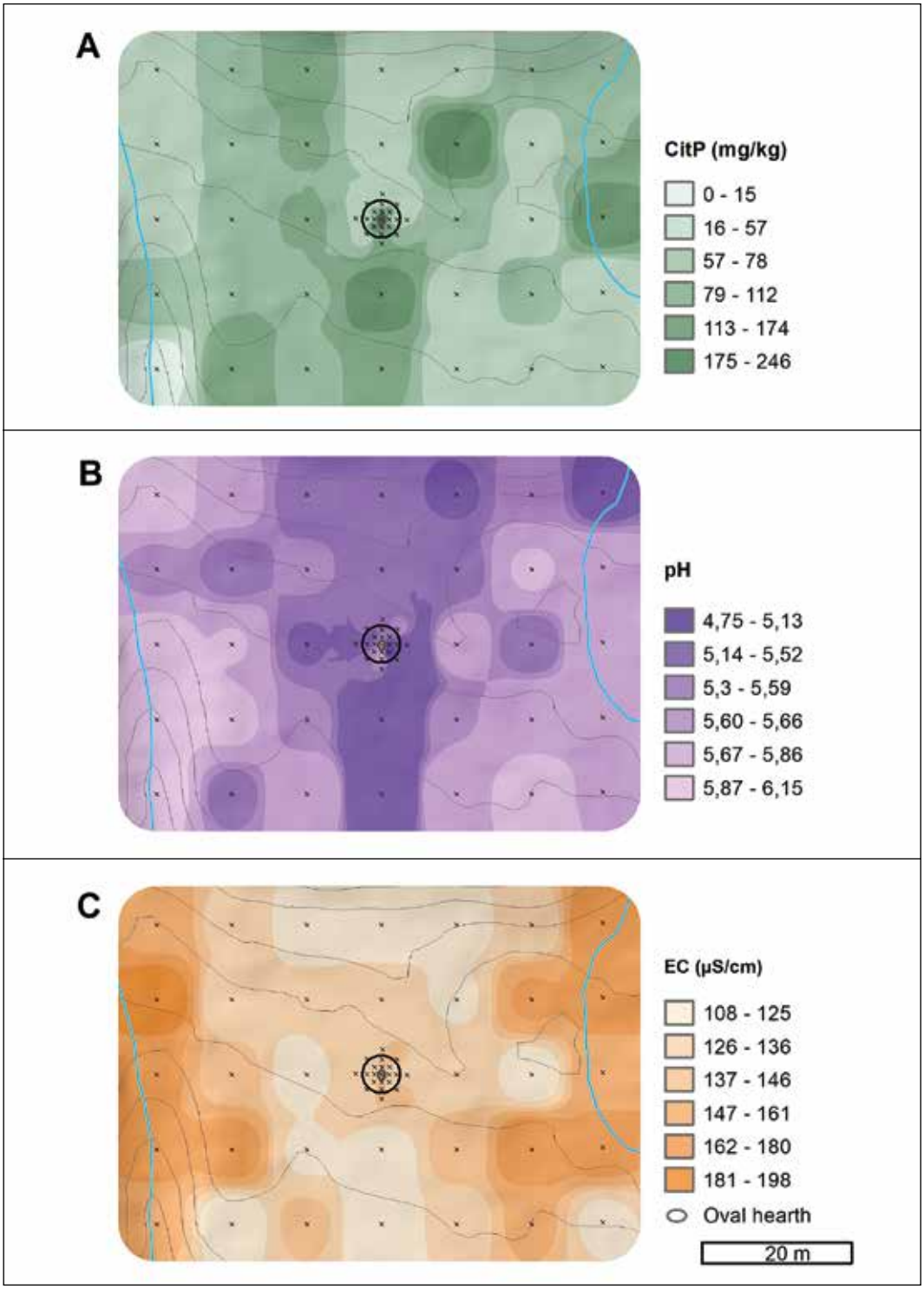

Figure 6. Measured geochemical values at Gahperusvárri itä 2: A. Phosphates. B. pH. C. Electric conductivity. Sampling locations with crosses, elevation contours at 0,5-metre intervals. Maps: Oula Seitsonen.

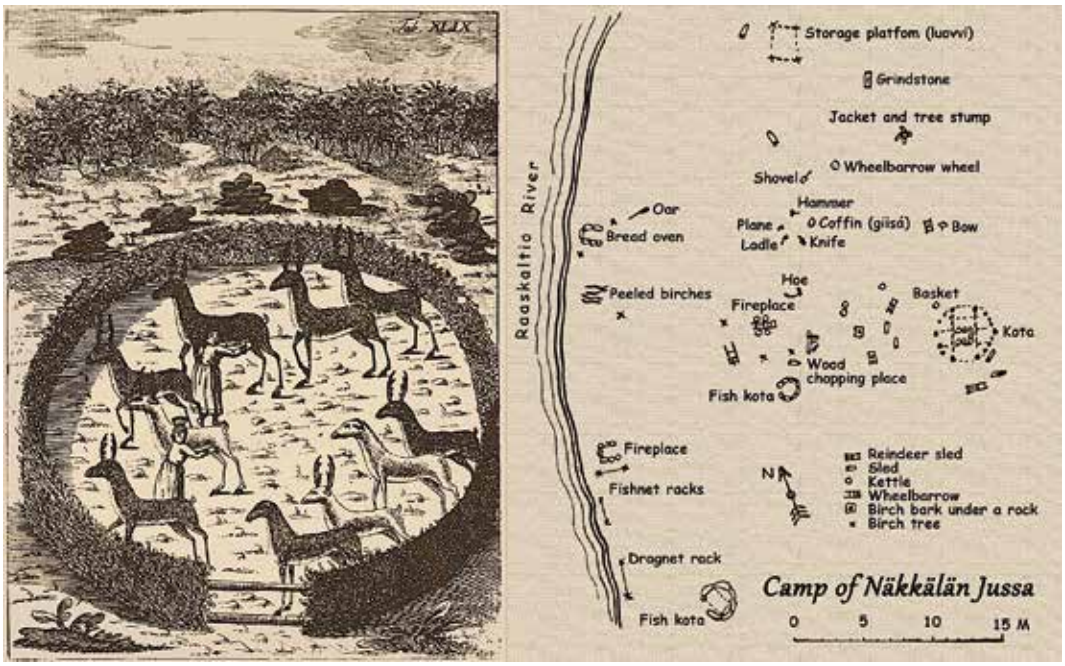

Figure 7. Left: Sámi women milking reindeer in a branch-built corral in the 18th century (after Leem, 1767: Plate XLIX, public domain), notice the ládjogahpir horn hats worn by the milking women: based on transgenerational memories these hats were forbidden by the Christian priests, alongside the noaidi drums, as material expressions of the traditional indigenous Sámi cosmology and folk religion (Pieski & Harlin 2020); Right: Mountain Sámi reindeer herding camp of Näkkälän Jussa (Jussa Näkkäläjärvi) in the early 20th century; note that the tent place (Kota) on the right shows the intra-dwelling division (modified after Paulaharju 1922: 94).

tivities than waste disposal. The high phosphate levels are indicative of increased human and animal activity (e.g. Karlsson 2006), and the lower pH could tell, for instance, of areas where animals have been gathered and where they have recurrently urinated, making the soils more acidic (Lungu & Dynoodt 2008). Based on the elevated phosphate values, Karlsson (2006) and Jerand and Linderholm (2019) have staked out potential reindeer gathering, and perhaps corralling, areas adjacent to the dwelling remains at the sites they have studied (Jerand & Linderholm 2019: 36; Karlsson 2006: 163). Such animal handling areas could have existed on both sides in front of the turf hut at Nuvkkágieddi (with low pH values) and in front of the dwellings at Čáhkaljohka and Gahperusvárri (with high phosphate levels and low pH).

Besides hearths, the highest EC readings come from the more fine-grained moist soils encountered along the edges of the Čáhkaljohka and Gahperusvárri sites, and thus likely relate more to natural processes than to human or animal activity. However, there is one spot with an exceptionally high EC value at Nuvkkágieddi about 40 metres northeast from the turf hut floor towards the shore of the adjacent lake, accompanied by a high pH reading. This could indicate the existence of an outside fireplace, although no charcoal or hearth stones were observed at the spot, or some metal deposit. Ethnographers have documented both open-air fireplaces and so-called fish-huts used for storing fish at Sámi camps, often towards the shoreline from the dwellings (Fig. 7) (e.g. Paulaharju 1922: 94). For example, a fish-hut might have been such a lightweight

structure that it has left only high EC and pH values in the soil instead of visible surface traces. In addition, smoky open-air *suovas* fires without any structures have been used to help evade the swarms of mosquitoes and other insects plaguing the reindeer (e.g. Itkonen 1948b: 149, 165, 274). These kinds of fires could also show up as anomalously high EC values within the sites, although in this case there are no high phosphate readings that would link with wood ash deposition.

5 Intra-dwelling spatialities

The geoarchaeological properties of the soils within the turf hut floor and around the hearths were examined with a higher resolution to compare them against the often-used ethnographic analogies about the division of space inside the dwellings (e.g. Itkonen 1948a; Leem 1767; Rheen 1897). Here it suffices to note that these floor plans mirror in various ways the Sámi cosmologies and symbologies (e.g. Fossum 2006; Ränk 1949; Rydving 1995; Yates 1989).

The floor space was typically divided into five main portions along a mid-passage on the central axis of the dwelling from the doorway to the back (e.g. Ränk 1949). This could be further divided into altogether nine parts (Fig. 8; Itkonen 1948a: 184–186, 196; Mulk 1994: 205). In the ethnographic cases the floor plan was often visibly laid out with logs (Itkonen 1948a: 183), like some herders still do today (Seitsonen 2020), or with the stone lines visible at the *bearpmet* hearths which were used still in the early 20th century. In the archaeological cases where stones or other visible remains of the floor partitioning are absent, geochemical analyses have proven to be a fruitful approach for studying the use of space inside the dwellings (see Halinen 2009; Hedman & Olsen 2009; Karlsson 2006: 164). Based on these and spatial analyses, the floor plans inside Sámi dwellings appear to have been roughly analogous in different parts of Sápmi already during the Iron Age (e.g. Halinen 2016; 2019; Jerand et al. 2016; Nilsen 2015).

The five main parts of a Sámi dwelling are (Fig. 8):

1. *Uksa*: The doorway, entrance part of the hut where also firewood was stored

2. *Árran*: The fireplace in the centre of the dwelling, typically outlined with rocks, sometimes packed with smaller stones

3. *Boaššu*: The back of the hut, the kitchen area where food was prepared and kitchen utensils stored, and in pre-Christian times also the sacred space where the *noaidi* (shaman) drum and hunting equipment were stored; in part of Sápmi in pre-Christian times the kitchen area was limited to a constricted space between the *árran* and the *boaššu*, called *luops* (Huttunen 2015)

4–5. *Loaidu*: The side sections of the dwelling where people lived and slept on both sides of the mid-passage; the side sections can be further divided into three portions

Ethnographic source material often highlights the gendered divisions attached to the dwelling space (Mulk 1994: 205), although there are rather contradicting examples about the use of social space in different parts of Sápmi (Fellman 1906; Graan 1899; Itkonen 1948a: 184; Leem 1767; Ränk 1949; Rheen 1897; Schefferus 1673; Yates 1989). The gendered spatial restrictions of the social space mirror some widespread Pan-Arctic customs ranging from Europe to Siberia and the American Arctic, such as the male-related rear and female-related entrance areas (e.g. Haakansson 2001; Mulk 1994: 205; Nilsen 2015; Ränk 1949). In the Sámi dwellings, the sacred *boaššu* zone in the back is said to have been reserved for men and their activities, and the *boaššouksa*, a sacred backdoor of tents and turf huts mentioned in ethnography and used at places until the 19th century (Itkonen 1948a: 196), was also reserved for men and hunting-related activities, such

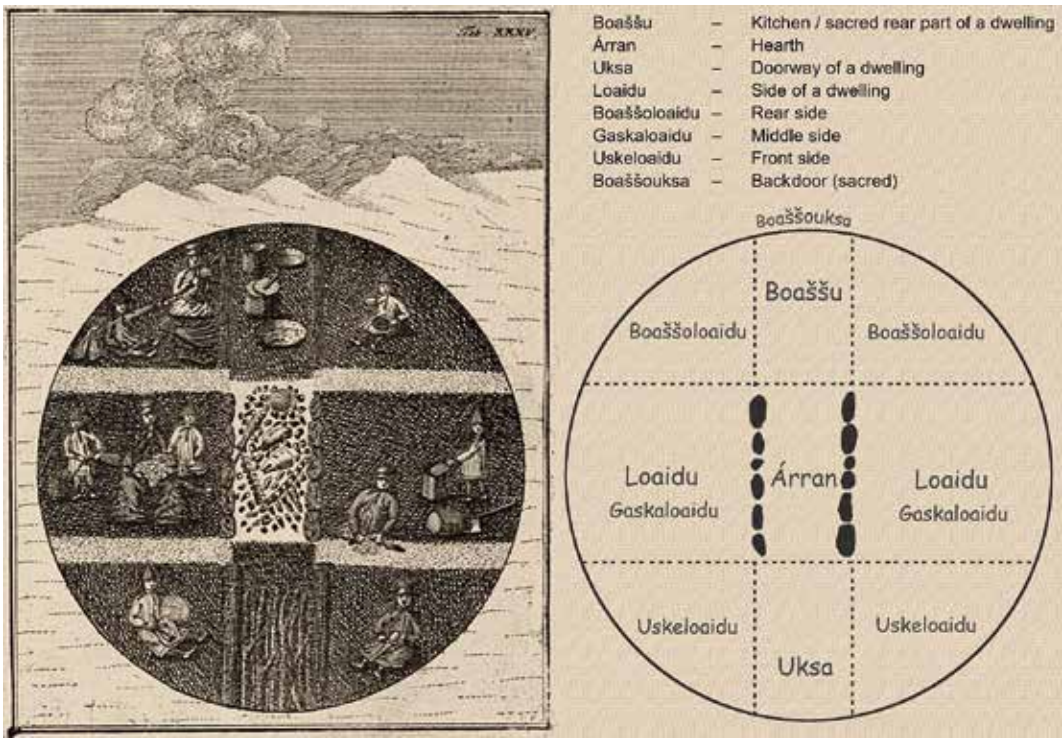

Figure 8. Left: The nine-part internal division of a Sámi dwelling in the 18th century (after Leem, 1767: Plate XXXV, public domain); Right: Schematic presentation of the different sectors inside a dwelling (based on Itkonen 1948a; Ränk 1949; Solbakk 2007).

as bringing in the wild game and fish (Halinen 2019; Mulk 1994: 205; Ränk 1949; Rheen 1897). In contrast, the frontal *uksa* area was related to the female deities and female activities, female utensils were stored there, and it was used for bringing in the domestic and dairy products (Mulk 1994: 205; Ränk 1949). However, spatial analyses of archaeological assemblages have shown that artefacts related to men's and women's activities are often found in different sectors than what the ethnographic sources direct to expect and suggest a fluid use of the social dwelling spaces (Halinen 2019; Inkiläinen 1999; Mulk 1994: 214).

The geoarchaeological values measured within the turf hut floor at Nuvkkágieddi and around the hearths at Čáhkaljohka and Gahperusvárri are illustrated in Figure 9. All of these show correlations to the schematic Sámi dwelling floor plans superimposed on them, centred on the hearth structures based on the ethnographic examples. Hearths and their immediate surroundings stand out with the highest readings in all the geochemical components. Spatial analysis suggests the presence of the *boaššouksa* backdoor, the sacred entrance known from the ethnographic sources but left out of use in the 19th century at the latest, at all the dwellings except perhaps at Čáhkaljohka (Fig. 9: B1–3).

At Nuvkkágieddi, high phosphate values, accompanied by low pH values, suggest entrances on both the southwest and northeast sides of the turf hut (Fig. 9: A1–3) (see Carpelan & Lavento 1996; Halinen 2009; Karlsson 2006: 142). A shallow depression is visible on the wall on the northeast side and could mark either the *uksa* or the *boaššouksa* (see Halinen 2019: 118). The area inside this depression and extending to both *loaidu* has low pH values, perhaps indicative of human

activities making the soils more acidic. Low phosphate values were recorded on the turf walls, whereas outside the hut is surrounded on three sides by higher readings. This might relate to waste management, such as the dumping of bone waste along the walls of the turf hut (Halinen 2019: 114).

At Čáhkaljohka, based on the spatiality of the geochemical readings, the *uksa* seems to have been directed south, and there might have been no backdoor. The area around the hearth has higher phosphates in all the floor plan sectors, the highest pH readings are found in the *árran* and *uksa* sections and to some extent in the *boaššu*, and high EC values are found along the mid-passage (Fig. 9: B1–3). The low pH measured in the eastern loaidu might relate to human activities. Then again, the high pH and EC immediately outside the assumed wall-line on the northeast side could originate from the dumping of bone waste and burnt material behind the dwelling (Itkonen 1948a: 185), although the phosphate values are lower than inside.

In the *bearpmet* hearths at Gahperusvárri, the *uksabearpmet* stone lines mark that the entrances of the tents faced southeast. The phosphate and pH values of both hearths suggest the presence of the *boaššouksa* on the rear (Fig. 9C1–3; 9D1–3). The *Boaššu* and *árran* of both hearths are characterised by high pH and phosphate values, as is also the area on the right side of the entrance of hearth 1, probably indicating the handling and disposal of bones and other waste in these areas. Contrary to the entrances of all the other studied structures, the *uksa* area of the Gahperusvárri hearth 2 has low phosphate values. The spatiality of the geochemical readings from the Gahperusvárri hearth 1 conforms most closely to the stereotypical pattern that might be expected based on the ethnographic examples: high phosphate values along the mid-passage and extending outside through the doorways in the front and the back, low phosphate values in both *loaidu*, high pH readings in the *árran* and *boaššu*, and high EC values in the *árran* (see Karlsson 2006: 142).

6 Transspecies lifeworlds of the historical reindeer herder camps

The materialities of soil at the studied Sámi reindeer herder camps has been shaped by the transspecies human-animal interaction in their overlapping embodied lifeworlds. Lifeworld has been described by geographer David Seamon (2017: 248) as the 'everyday realm of experiences, actions, and meanings typically taken for granted…' This enables the animal or human subject's perceptual and pre-cognitive bodily immersion in and intertwining with their surrounding world (Russell 2016; Seamon 2013). The transspecies spatial theory, as advocated by geographers Andrea Bolla and Alice Hovorka (2012), perceives animals as another social group that engages in an active and dynamic relationship with people (also Tuan 1984; Wolch et al. 1995). The human-animal sociospatial practices are always bidirectional, and the animals may exercise their own power and agency over the humans, e.g. by accepting or averting their care and handling (Hovorka 2020). This is well in line with the Sámi environmental perception and cosmology that approaches the landscape as a relational, inclusive and cognitively controlled unity that evades the 'Western' dualistic oppositions of nature and culture (e.g. Ruotsala 2002: 331; Seitsonen 2020: 16). Sámi pastoralists perceive the landscape in its entirety as their extended home; like one of our informants expressed: 'Home is all our fells.'

The studied sites form one small portion of the vast meshwork of relations that shroud the Sámi pastoralists' home range and form their various taskscapes on the tundra (Ingold 1993; 2011). Archaeologist Tiina Äikäs (2017: 217) has noted that Sámi perceive their landscape through motion, activity and participation, and these 'activities produce different ways of experiencing and structuring the world' into multiple overlapping and relationally entangled taskscapes, or *meahcci* (see Joks et al. 2020; Mazzullo & Ingold 2008; Schanche 2002). *Meahcci* is a Northern Sámi word that signifies the areas where

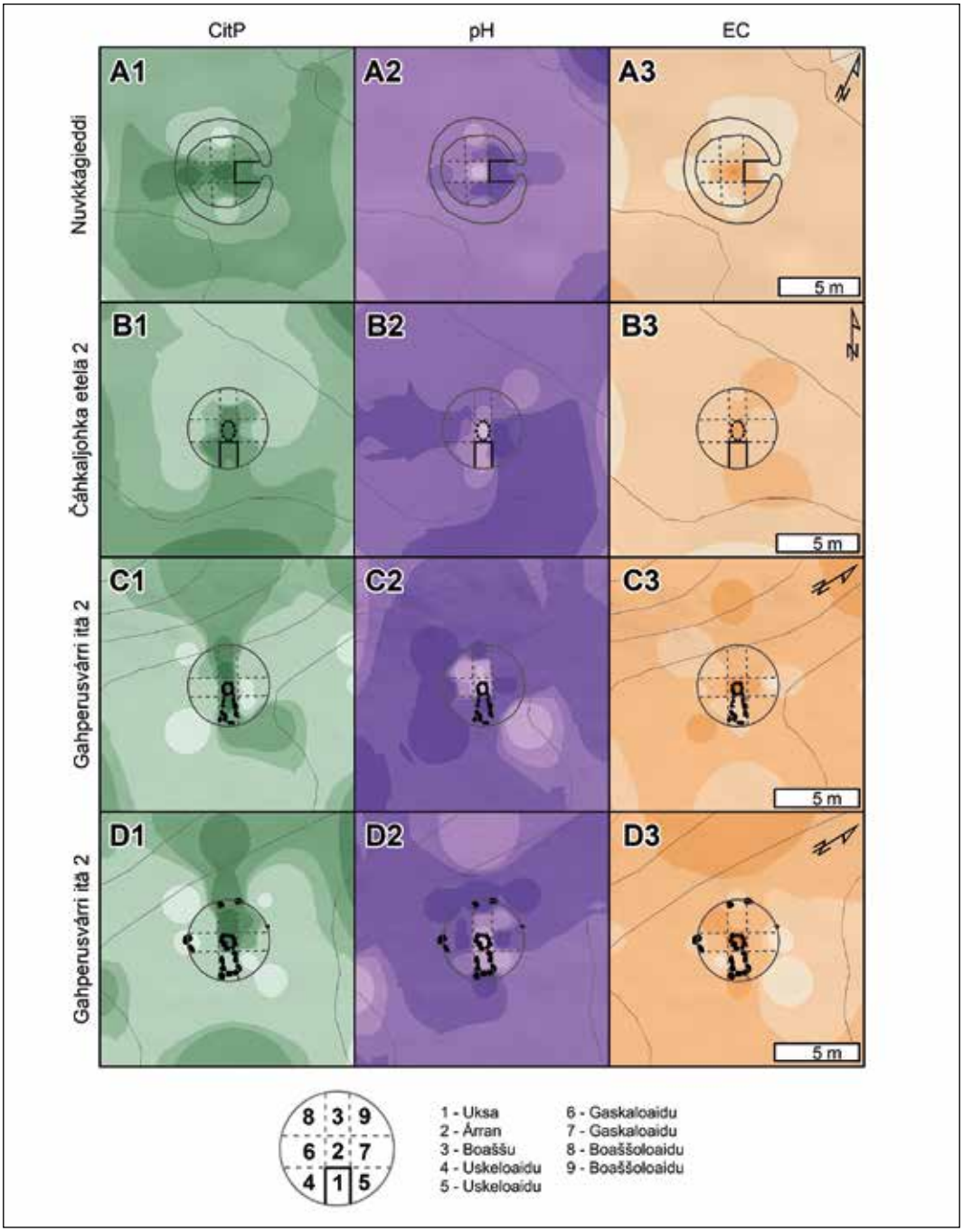

Figure 9. Intra-dwelling geoarchaeological values and suggested internal divisions: A1–3. Turf hut floor at Nuvkkágieddi, shallow depression on the wall to the right, possibly an entrance. B1–3. Oval hearth at Čáhkaljohka etelä 2, entrance likely towards the bottom. C1–3. Bearpmet hearth 1 at Gahperusvárri itä 2, entrance towards the bottom. D1–3. Bearpmet hearth 2 at Gahperusvárri itä 2, entrance towards the bottom. See Fig. 4–6 for the sampling locations and legends of the phosphate, pH and EC values, and Fig. 8 and the text for further explanation of the intra-dwelling division. Elevation contours at 0,5-metre intervals. Map: Oula Seitsonen.

varying spatiotemporal tasks are performed but where people do not live (Tervaniemi & Magga 2019; Joks et al. 2020; Seitsonen & Moshenska 2020). Thus, *Meahcci* contrasts with *báiki*, which signifies a place where seasonal or permanent dwellings and storage structures are located. *Meahcci* starts from where these constructions are no longer observable (Mazzullo & Ingold 2008; Seitsonen & Moshenska 2020). However, the boundaries between *meahccit* (plural) and *báikkit* (plural) are flexible, intersecting and seasonally shifting, but all are part of a cohesive herder home landscape (Länsman 2004: 99). Sámi taskscapes are also shaped by the '*unfolding encounters* with other more or less powerful actors' (Joks et al. 2020: 308, original emphasis) including all ecological life, both breathing and non-breathing things, as well as invisible and occult entities, such as sacred places, story places or visions, and mirror an inclusive, communicative and negotiating 'sentient ecology' (Anderson 2000: 116–117; Ingold 2000: 25; Joks et al. 2020).

Based on documentary evidence from the 18th–19th centuries, the *báikkit* represented by our study sites could have been inhabited in the spring (May–June) during the northward migrations, and again in the autumn (August–September) on the way back south (Itkonen 1948b: 225–226). Snow cover lasts in this area usually from September–October to May–June. The sites would have been immediately surrounded e.g. by the *boazomeahcci* pasturelands, *muorrameahcci* firewood gathering areas, *guollemeahcci* fishing lakes and *luomemeahcci* cloudberry picking swamps (Joks et al. 2020). Other *meahcci* taskscapes included in the herders' annual sphere would at least have been their winter pastures in the forested *vuovdi* lands nearly 100 kilometres to the south, their summer camps and pastures on the Norwegian coast over 50 km to the north (before the border closures in the mid-19th century), and the spring calving and autumn rutting grounds on the fells in between (e.g. Itkonen 1948b: 225–226). Other, overlapping *meahcci* would have included the fishing, hunting and gathering grounds of the different families and *siidas* based on the *vuoigatvuohta* ancestral rights defined by the Sámi common law (e.g. Helander 2000; Joks et al. 2020; Schanche 2002).

Owing to the transitional character of the studied *báikkit*, it is not surprising that their phosphate readings are much lower than those from the Iron Age and medieval winter camps that were likely inhabited throughout the long winter months (Carpelan & Lavento 1996; Halinen 2009; Jerand et al. 2016; Karlsson 2006). The archaeological remains and associated geoarchaeological values result from the past, overlapping temporalities of the human and animal place-ballets, the 'interaction of individual bodily routines rooted in a particular environment' (Seamon 2013: 206), collapsed into the landscape (Mlekuž 2014). These intertwining place-ballets would have been shaped and directed by topography, soils, vegetation cover and the built environment, characterised by tents, turf huts, corrals, storage racks, garbage dumps and so on (Fig. 7). At the same time, the mobilities and actions of humans and animals mutually shaped all of these. The hearths and turf huts, and any other standing structures such as storage racks or corrals, visible from the distance in the open landscapes, could have acted as anchors for the spatial configuration of the sites. Both human and animal activities and mobilities likely took place in relation to these.

Based on the geochemical analyses, it appears that the waste management at the studied sites was analogous to the excavated Sámi localities, where the bone waste was typically deposited along the walls and especially behind the dwellings, and inside the dwellings at the *boaššu* and *árran* zones (e.g. Carpelan 1992; Halinen 2009; 2019: 114; Hedman & Olsen 2009; Olsen 2019). This is also reminiscent of the ethnographic accounts about waste management (Itkonen 1948a: 185). Inside the dwellings, the spatial configuration of space and place-ballets of the inhabitants were guided by the cultural rules and customary activities that then shaped the materialities of soil. All the

other studied dwellings except the hearth at Čáhkaljohka clearly suggest the presence of a *boaššouksa* backdoor (Itkonen 1948a: 196; Ränk 1949).

At all the sites, the phosphate and pH readings suggest that reindeer gathering and handling took place in front of the dwellings, within 20–40 metres from them. The dairy economy formed an important part of the Mountain Sámi subsistence as recently as the early 20th century (Itkonen 1948a: 273), and these areas might represent the daily reindeer milking zones. In the early 20th century, milking places were typically near the dwellings (Itkonen 1948b: 148) as also suggested by Karlsson's (2006: 163) archaeological studies, either in the open or inside branch-built milking corrals (*gárdi*) (Fig. 7) (Itkonen 1948b: 143, 148, 274; Karlsson 2006: 163). According to ethnographer Toivo I. Itkonen (1948a: 273–274), the milking of reindeer was in earlier times done primarily by men, though women could also do it, but later it became increasingly a female task.

It is known from the ethnographic sources that the daily reindeer mobilities and their place-ballets were at least sometimes directed by the initiative of the animals themselves, e.g. by their grazing needs and the mosquitoes and other bugs pestering them (Paulaharju 1922: 99). The reindeer moved on their own incentive in the warmest time of the day from their highland pastures to the camps, where they knew that the smoky *suovas* fires lit by the herders offered them respite from the swarms of insects, and also to the windy capes, followed and, if needed, guided by the herders and their dogs (Paulaharju 1922: 98–99). At the camps they were milked, and in the evening, when the worst insect pestilence eased, the animals started again moving to their pastures on the surrounding fells followed by the dogs and herders for the night (Paulaharju 1922: 100–103). Thus, the transspecies spatialities of the herder camps included at least two more major actors besides reindeer and humans, namely the reindeer dog, *boazobeana*, and the various flying insects. Both have their own role in directing and affecting the reindeer and human mobilities and behaviour. The herding dogs contributed directly to the geochemical signals at the sites, but the insect contribution to the archaeological record is indirect and mostly invisible. However, the insects have even received praise for their participation in herding by the reindeer herders, like one joik (traditional Sámi song) declares:

> 'Mosquito drives the reindeer to the fells, herds the reindeer together out from the valleys. You wouldn't get along with the reindeer, if no mosquitoes existed. It is a small creature, but in front of it a large herd will escape.' (Paulaharju 1922: 99, our translation)

7 Conclusion

The geoarchaeological analyses of the three studied sites emphasise the high potential that soil studies have in examining the spatialities, use length and intensity of the historical Sámi reindeer herding camps. The previous soil-based analyses of Sámi sites (e.g. Carpelan & Lavento 1996; Halinen 2009; Karlsson 2006; Nuñez 1977; Tolonen 2013) have highlighted the suitability of different geochemical and geophysical variables for intrasite studies. In this study we analysed the phosphate values, which have been most commonly used in the studies, pH, which is a more rarely analysed property, and electric conductivity, which is a new variable that has not been previously assessed in a Sámi context. All the studied elements illustrate different aspects of the spatial configurations of the campsites. Based on comparisons with the ethnographic examples (e.g. Itkonen 1948a; Paulaharju 1922; Ränk 1949) and excavated localities (e.g. Jerand & Linderholm 2019; Jerand et al. 2016; Halinen 2019), our analyses illustrate the culturally demarcated floor plans of the dwellings, waste management and potential reindeer handling areas at the studied sites. These allow important advancements for the study of intrasite patterns and use of space at the Sámi pastoral-

ist campsites in the little studied Gilbbesjávri region, and also more widely in Sápmi. In the future, in-situ field-based or ex-situ laboratory-based portable X-ray Fluorescence (pXRF) analyses could offer a cost-effective way forward for analysing multiple elements from the soils (see Hunt & Speakman 2014; Williams et al. 2020).

Materialities of soil at the studied sites were shaped by the transspecies human-animal interplay (Hovorka, 2020), which included at least the Sámi, their reindeer and herding dogs, and, indirectly, different bugs pestering both humans and animals. The reindeer agency and initiative in the habitual place-ballets that shaped the soil geoarchaeologies is documented in the ethnographic literature and was motivated e.g. by the smoky *suovas* fires lit by the herders to offer respite from the swarms of insects plaguing their animals. Studying the overlapping and intertwining lifeworlds of the different social groups, including human and animal actors (see Äikäs et al. 2021; Nyyssönen & Salmi 2013; Salmi & Heino 2019) such as reindeer, dogs, mosquitoes and parasitic flies (Kynkäänniemi 2020), allows approaching and interpreting the spatialities of reindeer herder camps more holistically.

Acknowledgements

We want to thank all the locals in Gilbbesjávri who have assisted in our studies, especially the reindeer master Juha Tornensis of the Käsivarsi paliskunta and Antti Ohenoja of the National Board of Forestry, the Sámi Parliament and Sámi Museum Siida for the continued cooperation, and the reviewers and editors for their comments on an earlier draft. This research is part of the project Domestication in Action (Academy of Finland grant 308322; European Research Council grant 2017 756431).

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