

## Seal Hunters, Fishermen and Sea-voyagers. Late Middle Neolithic (2600–2400 cal BC) Maritime Hunter-gatherers in the Baltic Sea Archipelago at Tråsättra, Sweden

05 September 2023  
doi 10.12766/jna.2023.4  
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### Abstract

Large scale excavations of Neolithic settlements and cemeteries along the Swedish east coast and on the islands of Gotland and Öland in the Baltic Sea during the last 30 years have produced a large amount of new information concerning the Funnel Beaker Culture, the Pitted Ware Culture and the Battle Axe Culture. Excavations of large areas in a number of sites have given us a much deeper understanding of how these societies were organized, how people made their living and how they buried their dead. Large scale studies of palaeoecological remains, lipids in ceramics and isotopes in animal and human bones have given us new information concerning differences in diet and economy, and studies of genetic material have produced new essential knowledge of ethnic and cultural affiliations. The excavation at Tråsättra covered the whole area of a permanent hunter-gatherer settlement that can be related to the late Pitted Ware Culture, ca. 2600–2400 cal BC. This gave us the opportunity to study the organization of the settlement, economy and diet, craftsmanship and ritual activities in detail. Also, finds of a large number of anthropomorphic and zoomorphic clay figurines, a cult building with ritual deposits and a small cemetery made a unique analysis of religious and ideological aspects of the hunter-gatherers in the archipelago of the eastern middle part of Sweden during the late Middle Neolithic B possible.

### Introduction

A number of large-scale excavations of Neolithic settlements and cemeteries along the Swedish east coast and in the islands of Gotland and Öland in the Baltic Sea during the last 30 years have produced a large amount of new information concerning the Funnel Beaker Culture (FBC), the Pitted Ware Culture (PWC) and the Battle Axe Culture (BAC)<sup>1</sup>. Excavations of large areas at several sites have given us a much deeper understanding of how these societies were organized, how people made their living and how they buried their dead<sup>2</sup>. Large scale excavations combined with water sifting also increase the likelihood that exotic and rare objects are discovered. The importance of such objects is that they have the potential to improve our understanding of cultural, cosmological and ritual aspects. Interpretation of rare artifacts, such as clay figurines, indicate that the religion and mythology of Neolithic hunter-gatherers were developed out of ancient animistic beliefs (Björck/Hjærtner Holdar 2008, 322 ff.; Mansrud/Berg-Hansen 2021, 880).

### Article history:

Received 22 April 2022  
Reviewed 01 February 2023  
Published 05 September 2023

Keywords: Sweden, Pitted Ware Culture, Hunter-gatherers, Settlements, Intra-site organisation

Cite as: Magnus Artursson, Niclas Björck, Karl-Fredrik Lindberg: Seal Hunters, Fishermen and Sea-voyagers. Late Middle Neolithic (2600–2400 cal BC) Maritime Hunter-gatherers in the Baltic Sea Archipelago at Tråsättra, Sweden JNA 25, 2023, 89–147 [doi 10.12766/jna.2023.4]

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<sup>1</sup> E.g. Björck 1997; 2003; 2007b, 34 ff.; Papmehl-Dufay 2006; Hallgren 2008; Artursson 1996; 2006; 2007a; 2007b; Gustafsson et al. 2003; Killstedt et al. 2007; Björck/Hjærtner Holdar 2008.

<sup>2</sup> Apel et al. 1996; Burenhult 2002; Fahländer 2003; Björck 2007a, 286 ff.; 2007c, 238 ff.; Wallin 2015; 2016.

Also, extensive studies of palaeoecological remains, lipids in ceramics and isotopes in animal and human bones have given us new information concerning differences in diet and economy between different groups (Isaksson 2009, 131 ff.; Fornander 2011; Lidén/Eriksson 2007; Ahlström/Price 2021; Fornander et al. 2008; Blank et al. 2021).

The settlement at Tråsättra just to the north of Stockholm (Figs. 1–2), is a typical example of a Pitted Ware Culture settlement from the late Middle Neolithic B, used during the time period approximately 2600–2400 cal BC (Björck et al. 2020). At this time it was situated in the outer domains of an extensive archipelago in a large sea bay, constituting a part of the brackish Baltic Sea. The inhabitants were specialised maritime hunter-gatherers using local resources and exploring the unique ecological conditions that the brackish waters provided.

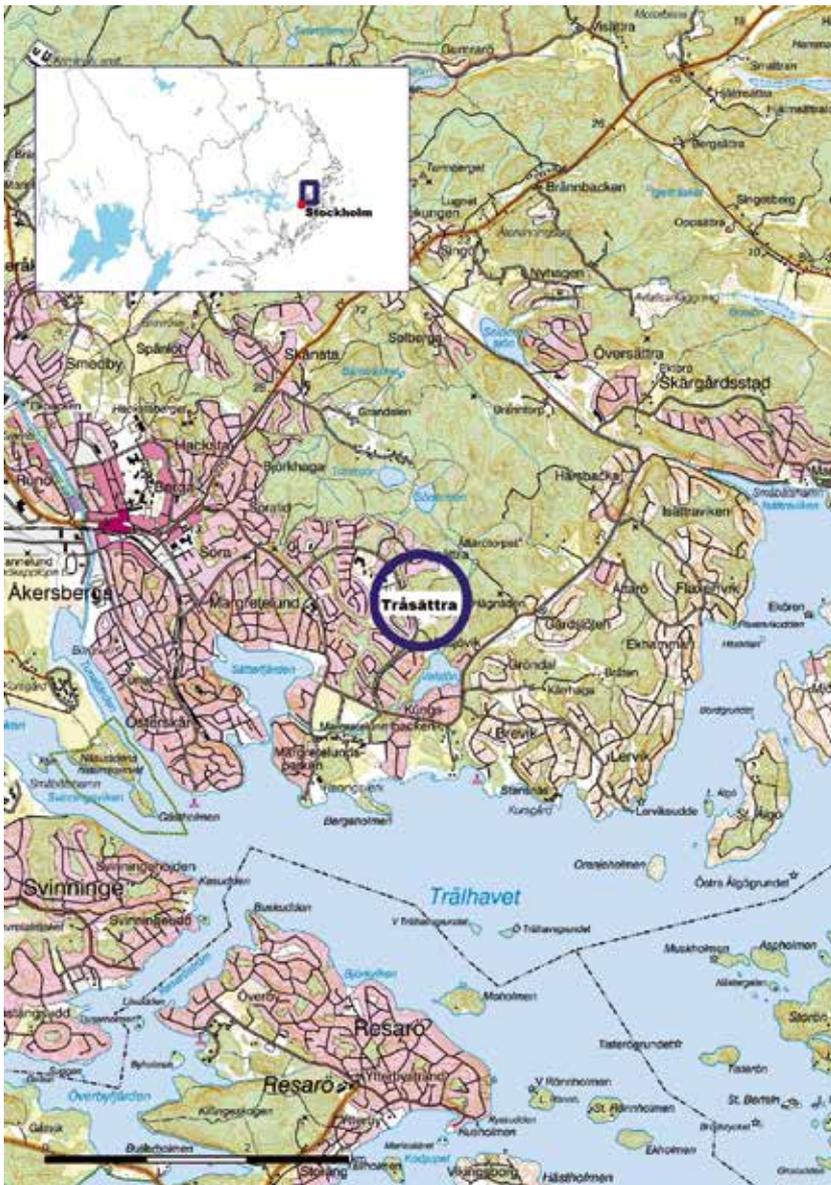


Fig. 1. Tråsättra. Location of the Pitted Ware Culture (PWC) settlement in Åkersberga, northeast of Stockholm (Base map: Terrain map 608 Värmdö; graphics: N. Björck/SHM Arkeologerna).



Based on the results of the excavation at Tråsättra we want to discuss site organisation and ritual and ideological aspects of the PWC, as well as aspects of exchange and interaction within social, cultural and economic networks in these coastal communities during the third millennium BC. The material culture of the Tråsättra settlement is very informative concerning the connections and long-distance networks created by the Neolithic hunter-gatherers across the Baltic Sea.

Fig. 2. Drone photo of the settlement at Tråsättra from northeast after the first cleaning by hand and machining. The Baltic Sea, the nearby city of Åkersberga and the archipelago can be seen in the background (Photo: SHM, Arkeologerna).

### **The Neolithic background – interaction between the Funnel Beaker Culture, Pitted Ware Culture and Battle Axe Culture**

The Pitted Ware Culture (PWC) probably had its origin along the Baltic coast to the north of the present day area of Stockholm. In this part of the Baltic Sea, groups of Late Mesolithic maritime hunter-gatherers interacted with Comb Ware groups in Finland and in the islands of Åland, and eventually also with Early Neolithic FBC groups in the eastern middle part of Sweden (Björck 1997; 2003; Björck/Hjärtner-Holdar 2008). The first FBC farmers reached the northernmost extreme of agriculture and husbandry in the eastern middle part of Sweden ca. 4000 cal BC (Hallgren 2008). A rapid change in climate in the region, where terrestrial pollen records show signs of relatively high summer temperatures in northeast Europe, probably enhanced the conditions for agriculture radically. The number of frost nights in spring and early summer grew fewer, improving the conditions for the cultivation of barley and wheat, and also making it easier to keep cattle, sheep/goats and pigs (Vanhanen et al. 2019).

Numerous studies of human mitochondrial and nuclear aDNA enable detailed discussions of biological and – by inference – also ethnic and cultural affiliations in Scandinavia during the Neolithic, although the equation of biological results with ethnic and cultural similarities have been questioned by some researchers (Furholt 2019). Recently, an ever increasing number of high-quality aDNA-analyses has strongly suggested that the expansion of agriculture to its northern extreme ca. 4000–3900 cal BC was caused by

migrating FBC groups from the European continent and southern Scandinavia (Skoglund et al. 2012; 2014). The FBC farmers formed regional polities during the Early Neolithic (4000–3300 cal BC) in the eastern middle part of Sweden, establishing a mixed farming economy cultivating different kinds of crops using manure and keeping domesticated animals for meat and milk. Thus, the economy was mainly based on agriculture and husbandry, but complemented with hunting, fishing and gathering (Hallgren 2008).

Several recently made aDNA-analysis of PWC individuals from the islands of Gotland and Öland in the Baltic Sea have shown that they have a completely different genetic profile compared with the FBC individuals in Scandinavia (Fraser et al. 2018; Sánchez-Quinto et al. 2019). This contradicts the earlier hypothesis that the PWC population originated directly from the FBC groups when climate worsened and agriculture was largely abandoned in the eastern middle part of Sweden ca. 3400–3300 cal BC (compare with discussion in Sundström 2003). Instead, the PWC must be seen as a completely separate ethnic group with an economy mainly based on maritime hunting and fishing, which is supported by results from isotope studies of PWC individuals (Fornander 2011; Fornander et al. 2008). It seems reasonable that these PWC groups are descendants of local Mesolithic hunter-gatherers that inhabited the same areas in an earlier phase, maybe also linked to interaction with Comb Ware groups in Finland and the Baltic area. This interpretation could cast doubt on the interpretation that Early Neolithic coastal sites in eastern middle Sweden should be viewed as remnants from FBC farmers. If these instead are seen as subneolithic sites used by local communities of Mesolithic hunter-gatherers, that at this time had included and integrated ceramic technology, the coastal Early Neolithic sites, at least north of the Mälars sea, could be seen as a link between the Mesolithic groups and the PWC. This interpretation explains both the similarities between the Mesolithic and PWC and the aDNA results that indicate a relatively close affinity between Mesolithic hunter-gatherers and PWC populations. PWC individuals on Gotland are genetically similar but not identical to Mesolithic Scandinavian hunter-gatherers (Coutinho et al. 2020; Skoglund et al. 2012; 2014). aDNA studies of two PWC individuals from mainland Sweden have shown that they have the same aDNA-profile as the analysed PWC individuals on Gotland, supporting the hypothesis that the PWC groups in this part of Scandinavia have a homogenous genome and that they probably have the same ethnic and geographic origin (Ayrdoğan 2019). Curiously, the interaction between the coastal hunters-gatherers and the farmers seems to have been very limited throughout the Neolithic period (Björck/Larsson 2007a; Björck 2003; 2007a; 2007b; 2007c; Björck/Hjærtner Holdar 2008, 315 ff.). However, indications of some, but low levels, of admixture that can be found in DNA from PWC individuals indicate interaction between hunter-gatherers and FBC-farmers that possibly explains the changes in the genetic profile that occur in the hunter-gatherer population over 1500 years, from the Early Neolithic to the final PWC (Mittnik et al. 2018; Skoglund et al. 2014).

The Swedish-Norwegian variant of the Corded Ware Culture (CWC), the so-called Battle Axe Culture (BAC), emerging in the region around 2900–2800 cal BC, can now be interpreted as immigrating groups originally originating from the steppe areas in southern Russia, quickly establishing a presence mainly in the interior of the region. Studies of aDNA from individuals in BAC burials have shown a clear genetic relationship to Yamnaya groups originating in southern Russia (Allentoft et al. 2015; Malmström et al. 2019), although this has also been questioned by some researchers (Heyd 2017; Furholt 2019).

As mentioned before, the PWC groups in eastern middle Sweden had an economy based on hunting of sea mammals and fishing. Nevertheless, recent studies of PWC settlements have shown the presence of limited amounts of charred wheat and barley, suggesting that the hunter-gatherers

at least had access to some crops, or alternatively had some small farming plots in favourable locations close by the settlements (Edenmo/Heimdahl 2012; Björck et al. 2020). One possibility is that the late PWC groups in the archipelago exchanged products made from seal, fish and wild game for crops and other food stuffs with BAC groups living in the relatively close vicinity. This could possibly explain the frequent presence of small amounts of BAC ceramics in the PWC settlements, maybe used as containers for transporting agricultural products out into the archipelago.

Despite this, nothing suggests that domesticated plants or meat from domesticated animals were an essential part of the PWC diet or economy. Isotope analysis of PWC individuals, from eastern middle Sweden and the island of Gotland, clearly shows that their diet was completely dominated by marine mammals and fish, though the diet of the PWC groups on Gotland also seems to have had an element of domesticated pigs and/or wild boar, but these were probably only consumed at special occasions, since  $^{13}\text{C}$  values of the pigs are terrestrial and the human  $^{13}\text{C}$  is marine (Fornander 2011; Wallin 2016, 412; Fornander et al. 2008; Ahlström/Price 2021). Therefore, agricultural products can be seen as an exclusive element



Fig. 3. Hypothetical regional division of known Neolithic coastal settlements in Southern Norrland and eastern middle Sweden. Sea level 30–35 m above the present (Graphics: N. Björck/SHM Arkeologerna).

in local exchange networks, probably constituting a rare and exotic part of the PWC groups' diet. Maybe the wheat and barley were used for making porridge, bread and alcoholic beverages like beer eaten and drunk at special occasions.

**Landscape, settlements and organization of space – structuring everyday life**

From the coastal areas in southern Norrland in the north to the large archipelago in the Mälars bay in the south, settlements seem to have been placed in well-defined regional groups with a diameter of approximately 20 km (Fig. 3). Some of these regional groups have a continuity from the late Mesolithic to the late Middle Neolithic, making them into permanent and basic organizational units in an ever shifting landscape, where the land rise constantly changed the conditions. The spatial continuity of the regional groups suggests that the PWC was developed out of the local hunter-gatherers groups. As the land uplift constantly changed the landscape, the group areas gradually moved towards the east. The land rise has been between 1.0 and 1.5 m per 100 years in this part of the Baltic Sea, which must have been quite noticeable for every generation of hunter-gatherers and farmers living in the area (Björck 1997; 2003).

The late PWC settlement at Tråsättra is situated in one of the regional groups in the northern part of the Mälars bay (Fig. 3). Based on the settlements level over the present sea level and the presumed rate of the land rise in the area, there are in total eleven known Mesolithic settlements and 38 settlements from the Neolithic (Fig. 4–5). The Neolithic settlements

Fig. 4. The archipelago in the Tråsättra region with eleven known Mesolithic settlements. Sea level at 40 m above the present, the site of Tråsättra is marked in black (Graphics: N. Björck/SHM Arkeologerna).

Fig. 5. The archipelago in the Tråsättra region with all known Neolithic settlements. Sea level at 25 m above the present, the site of Tråsättra is marked in black (Graphics: N. Björck/SHM Arkeologerna).



range from the Early Neolithic FBC groups to the late Middle Neolithic PWC groups, covering a time span between 4000 and 2300 cal BC.

As a general tendency, the amount of time that every settlement site of the PWC has been in use is relatively short in eastern middle Sweden and southern Norrland, due to the fast land rise in the area. The settlements' preferred position close to the beach has led to frequent migrations towards more sea-bound locations, why settlements placed along the coast or in the archipelago usually have not been in use more than 50–200 years. Short time of use has proven to be important with regard to the possibilities for intra-site analysis, as the traces are relatively undisturbed. Another aspect which is important in this respect is the fact that the excavated sites such as Tråsättra mostly have been situated in woodlands and grazing lands, and therefore they have almost been undisturbed by ploughing and other activities since the time the sea moved away and they were abandoned by the coastal hunters and gatherers. Sometimes, however, younger burials have been found in older sites, suggesting a reuse of ancestral dwellings as burial grounds during the Neolithic (Björck 2007a, 286 ff.; Wallin 2016, 413; Gustafsson et al. 2003).

### **The organisation and structure of the settlement at Tråsättra**

Three main phases could be identified at Tråsättra; one earlier settlement placed further up in the slope (phase 1), and a later phase placed further down the slope (phase 2). Finally, Tråsättra is transformed to a temporary settlement for special activities (phase 3). The area of the earlier settlement (phase 1) was transformed into a small cemetery containing six probable inhumation graves during phase 2 (Björck et al. 2020). The earlier phase was not as well preserved as the later one, but similarities in spatial organisation between them made it possible to make a fairly good interpretation of how the settlement was structured from the beginning and how it developed over time (Figs. 6–7).

The two permanent settlement phases (phases 1 and 2) that could be identified at Tråsättra had both a circular organisation. The early phase was harder to interpret due to six later burials placed on top of the settlement remains. The reuse of older settlements for burials could result in an organizational similarity between settlements and cemeteries, i. e. the structure of ritual mirrored other actions in the living society (Björck/Hjartner Holdar 2008, 327 f.; Wallin 2015, 50). The phenomenon seems to be a recurring theme among the PWC, perhaps the idea is a symbolic return of the dead to the ancestors (Björck 2007a, 304; Gustafsson et al. 2003; Wallin 2016, 413).

The small cemetery had been placed in this spot when the settlement was moved to the south, further down in the slope, following the retreating shore line. The land rise in Scandinavia has been substantial over a long time period after the retreat of the inland ice. According to the regional land rise curve, the shore line has moved quickly and land has risen from the sea in a relatively even pace. Presumably, the land rise has been ca. 1.0–1.5 m per 100 years during the Middle Neolithic in the eastern middle part of Sweden, and the move of the settlement at Tråsättra down the slope can be seen as a clear sign that the inhabitants wanted to be close to the shore line (Björck et al. 2020, 20–21).

### **<sup>14</sup>C-analysis, chronology and duration of use**

In total, 24 radiocarbon measurements are available from the Tråsättra settlement, and they were all processed at the Tandem Laboratory Department of Physics and Astronomy, Uppsala University. The analysis was made on

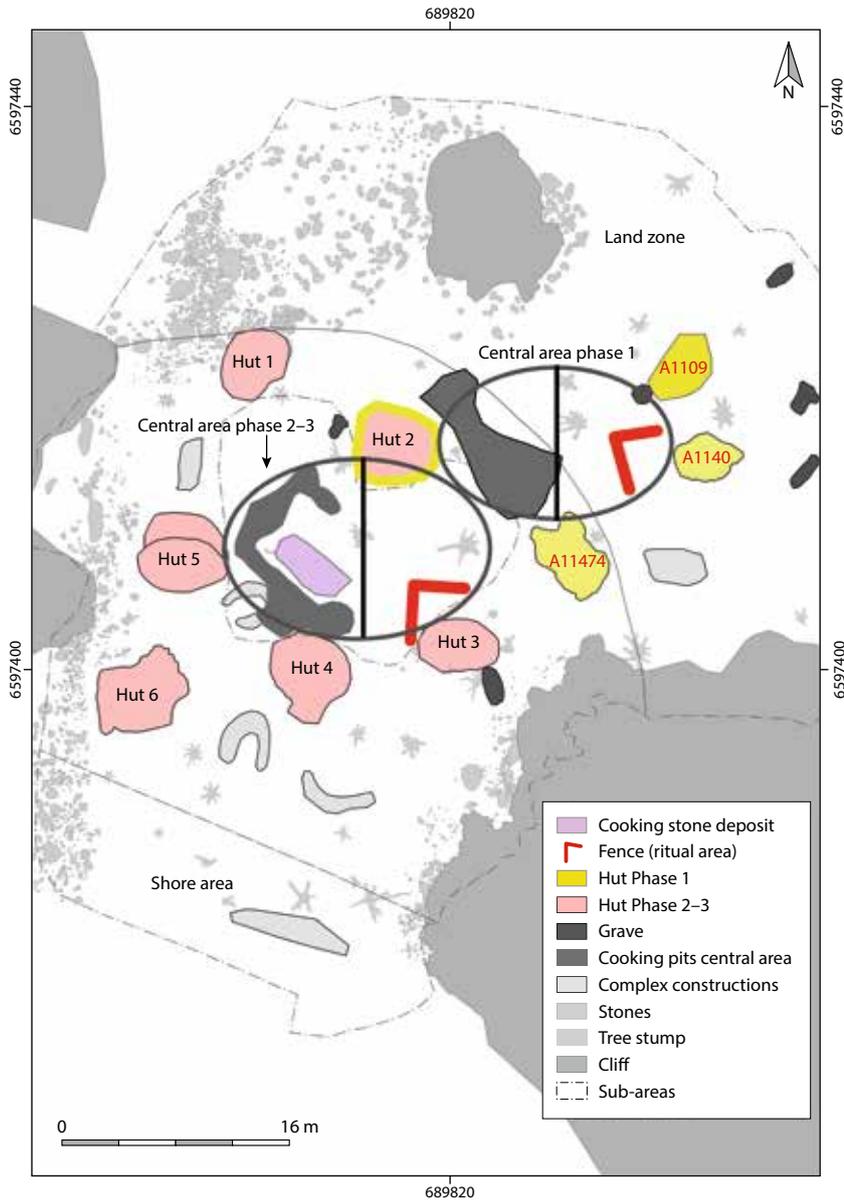


Fig. 6. Tråsättra. The two phases of permanent settlement (phases 1 and 2). The younger huts are not in all cases attributable to either phase 2 or phase 3 (Graphics: N. Björck/SHM Arkeologerna).



Fig. 7. Tråsättra. Reconstruction of the settlement during phase 2, when it was a base settlement (Graphics: N. Björck/SHM Arkeologerna).

charred hazelnut shells or cereals to minimize the problem with “old wood” (Table 1). In total, 19 hazel nut shells, 4 grains *hordeum* sp. and 1 grain *triticum aestivum* were analysed. One of these analyses (Ua-56217) gave a date of the Late Pre-Roman Iron Age–Early Roman Iron Age (40 cal BC–120 cal AD,  $2\sigma$ ), and is not included in the discussion (Björck et al. 2020).

The 23 analysed samples from the Middle Neolithic cover a maximal interval of 600 years (2890–2290 cal BC,  $2\sigma$ ), and a minimal interval of 160 years (2630–2470 cal BC,  $2\sigma$ ) (Fig. 8; Table 1). The calibration curve is relatively flat and irregular in this time frame, especially in the interval 2900–2600 cal BC which constitutes a problem when the results are interpreted. Due to this, the true duration of use has most likely been shorter than the maximum interval of 600 years (2890–2290 cal BC,  $2\sigma$ ) indicates, why the shorter interval of 160 years (2630–2470 cal BC,  $2\sigma$ ) probably is closer to the truth.

The earliest  $^{14}\text{C}$ -dates were found in the higher ground in the northern part of the settlement and the latest dates come from the lower part, in the south. This clearly indicates that the distribution of  $^{14}\text{C}$ -dated material reflects the chronological development of activities in the settlement correctly, following the gradually retreating shoreline from north to south.

A Bayesian analysis was conducted by B. Schulz Paulsson, Gothenburg University (Björck et al. 2020, suppl. 17). Two models were conducted; the first model just containing the analysis made on charred hazelnut shells and cereals collected from the huts at the site, to avoid contamination from the

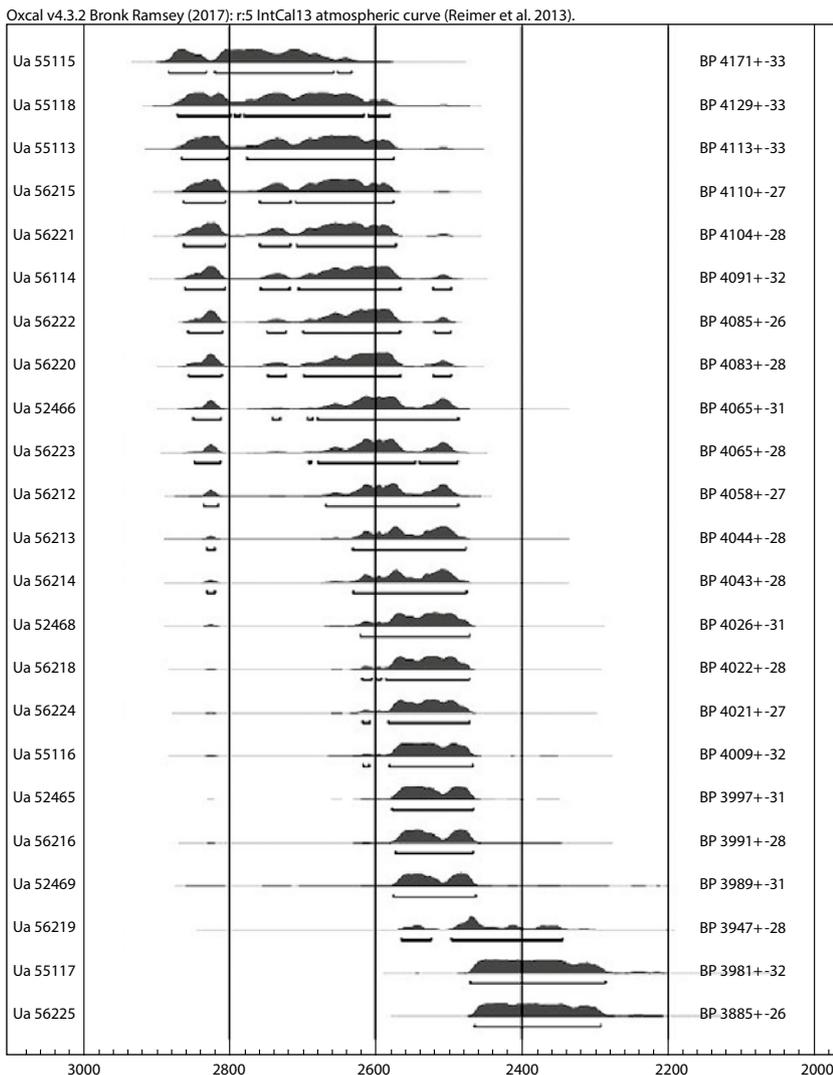


Fig. 8. Tråsättra. Calibrated  $^{14}\text{C}$  dates (Calibration with OxCal 4.3.2 [Bronk Ramsey 2017]).

Table 1. Tråsättra. <sup>14</sup>C dates. All short-lived samples (hazel nutshells and grains) analyzed at Uppsala university (Ua) (Calibration with OxCal 4.3.2 [Bronk Ramsey 2017]).

Sample no.	Lab. no.	BP	BC cal 1 $\sigma$	Feature	Construction/ context	Phases	Sample material
1	Ua-56224	4021 $\pm$ 27	2575–2485 cal BC	A3271	Hut 2	Phase 1–2	Hazel nutshell
2	Ua-55117	3981 $\pm$ 32	2565–2465 cal BC	A2425	Hut 5	Phase 2–3	<i>hordeum</i> sp.
3	Ua-55116	4009 $\pm$ 32	2570–2480 cal BC	A8457	Hut 3	Phase 2	<i>hordeum</i> sp.
4	Ua-56217	1957 $\pm$ 26	15–75 cal AD	A7385	Hut 6	Phase 2–3	Hazel nutshell
5	Ua-56219	3947 $\pm$ 28	2560–2340 cal BC	A1844	Hut 4	Phase 2–3	Hazel nutshell
6	Ua-56218	4022 $\pm$ 28	2575–2490 cal BC	A1844	Hut 4	Phase 2	Hazel nutshell
7	Ua-55113	4113 $\pm$ 33	2860–2580 cal BC	A10159	Central area	Phase 2	<i>hordeum</i> sp.
8	Ua-55118	4129 $\pm$ 33	2860–2620 cal BC	A11166	Pit	Phase 1–2	<i>hordeum</i> sp.
9	Ua-56222	4085 $\pm$ 28	2840–2570 cal BC	A643	Central area	Phase 2	Hazel nutshell
10	Ua-55115	4171 $\pm$ 33	2880–2690 cal BC	A8258	Central area	Phase 1	<i>triticum aestivum</i>
11	Ua-56216	3991 $\pm$ 28	2565–2470 cal BC	A773	Central area	Phase 2	Hazel nutshell
12	Ua-56220	4083 $\pm$ 28	2840–2570 cal BC	A5643	Central area	Phase 2	Hazel nutshell
13	Ua-56214	4043 $\pm$ 28	2620–2490 cal BC	A4294	Central area	Phase 2	Hazel nutshell
14	Ua-55114	4091 $\pm$ 32	2840–2570 cal BC	A4250	Central area	Phase 2	Hazel nutshell
15	Ua-56225	3885 $\pm$ 26	2460–2340 cal BC	A12043	Shore area	Phase 3	Hazel nutshell
16	Ua-56213	4044 $\pm$ 28	2620–2490 cal BC	A6339	Shore area	Phase 2–3	Hazel nutshell
17	Ua-56212	4058 $\pm$ 27	2830–2490 cal BC	A12328	Shore area	Phase 2–3	Hazel nutshell
18	Ua-56223	4065 $\pm$ 28	2840–2490 cal BC	A2660	Hut 3	Phase 2	Hazel nutshell
19	Ua-56221	4104 $\pm$ 28	2850–2570 cal BC	A9335	Central area	Phase 2	Hazel nutshell
20	Ua-56215	4110 $\pm$ 27	2850–2580 cal BC	A8971	Central area	Phase 2	Hazel nutshell
FU1	Ua-52465	3997 $\pm$ 31	2565–2470 cal BC	A1910	Hut 3	Phase 2	Hazel nutshell
FU2	Ua-52466	4065 $\pm$ 31	2840–2490 cal BC	A3970	Hut 4	Phase 2	Hazel nutshell
FU3	Ua-52468	4026 $\pm$ 31	2580–2485 cal BC	Test pit R2660	Cultural layer	Phase 2	Hazel nutshell
FU4	Ua-52469	3989 $\pm$ 31	2565–2470 cal BC	Test pit R2660	Cultural layer	Phase 2	Hazel nutshell

large amounts of charcoal and soot used in hearths and cooking pits, and model 2 containing all the <sup>14</sup>C-samples from the site.

After testing several possibilities, taking the horizontal and vertical stratigraphy into consideration, a three-phased interpretation for the settlement showed to be the best solution for the first model. It resulted in a time of use between 2577–2465 cal BC (1 $\sigma$ ), respectively 2855–2462 cal BC (2 $\sigma$ ), a duration of 112–393 years. As mentioned above, the calibrated ranges are encompassing a rather flat section of the calibration curve, extending to ~400 years in its 2 $\sigma$  interval. Therefore, the 1 $\sigma$  interval was preferred, since the probability is rather low that a large number of the events are positioned at the very small section in the beginning of the 2 $\sigma$  range. Three partly overlapping phases with a total duration of 112 years were therefore postulated according to model 1:

- **Phase 1 (2577–2503 cal BC 1 $\sigma$ ).** An all-year round settlement was in use in the northern part of the site.
- **Phase 2 (2525–2490 cal BC 1 $\sigma$ ).** An all-year round settlement with a small cemetery was in use in the central part of the site.
- **Phase 3 (2499–2465 cal BC 1 $\sigma$ ).** A small temporary settlement for hunting and fishing was in use in the southern part of the site.

Model 2, using all the <sup>14</sup>C-dates available in the Bayesian analyses, gave a duration of use of the settlement to 2828–2467 cal BC (1 $\sigma$ ) and 2834–2454 cal BC (2 $\sigma$ ), ranging over a much wider time span of 361–380 years.

Which of these interpretations are closest to the truth is hard to tell, but a shorter period of use is more likely. Model 1 in the Bayesian analysis is focusing on the sample material from the huts and the time interval for the duration of the settlement is considerably narrowed by excluding the data from the hearths and cooking-pits in the central area. Analyses based on the extent of the settlement remains, the character and construction of the huts and the relatively limited number of burials support a shorter time of use. Presuming that the all-year round base settlement and cemetery (phase 2) was in use for just 35 years (2525–2490 cal BC), and that the burials were constructed in this time frame only, the total number of burials (six burials in the cemetery and two in the settlement, close to two huts) at the site would actually fit quite well with the expected mortality rate in a hunter-gatherer group of 25–30 individuals during that time period (Ahlström 2015), supporting model 1 as the most likely interpretation. The rate of the land rise in the region also supports a shorter duration for the settlement. The difference between the presumed upper and lower shoreline is approximately 1.5–2.0 m (c. 29–27 m above the present shoreline), and, as stated above, the land rise can be estimated to 1.0–1.5 m per 100 years, which makes it likely that the settlement has been in use for not more than 100–150 years, probably somewhere in the interval ca. 2600–2400 cal BC (Björck et al. 2020, 20 f.).

### Settlement organisation – huts, cooking pits, hearths and waste deposits

As stated above, from the overall organisation of the settlement at Tråsättra, the size, construction and position of huts and other features like cooking pits, hearths and waste pits, the distribution of ceramics, stone tools, waste from stone working and disposal of waste (Figs. 9–10), two main permanent phases could be distinguished. Four dwelling huts could be identified in the first phase and five in the second (Tables 2–3). Some of the more simple huts or windbreaks can probably be attributed to the last phase, when Tråsättra presumably was used as a temporary hunting or fishing station.



Fig. 9. Tråsättra. Drone photo of the settlement (Photo: SHM Arkeologerna).

### The huts at Tråsättra

The six dwelling huts can be interpreted as central constructions in individual living areas, based on the overall organisation of the settlement and the size of huts and distribution of find materials and surrounding features (Figs. 11–17).

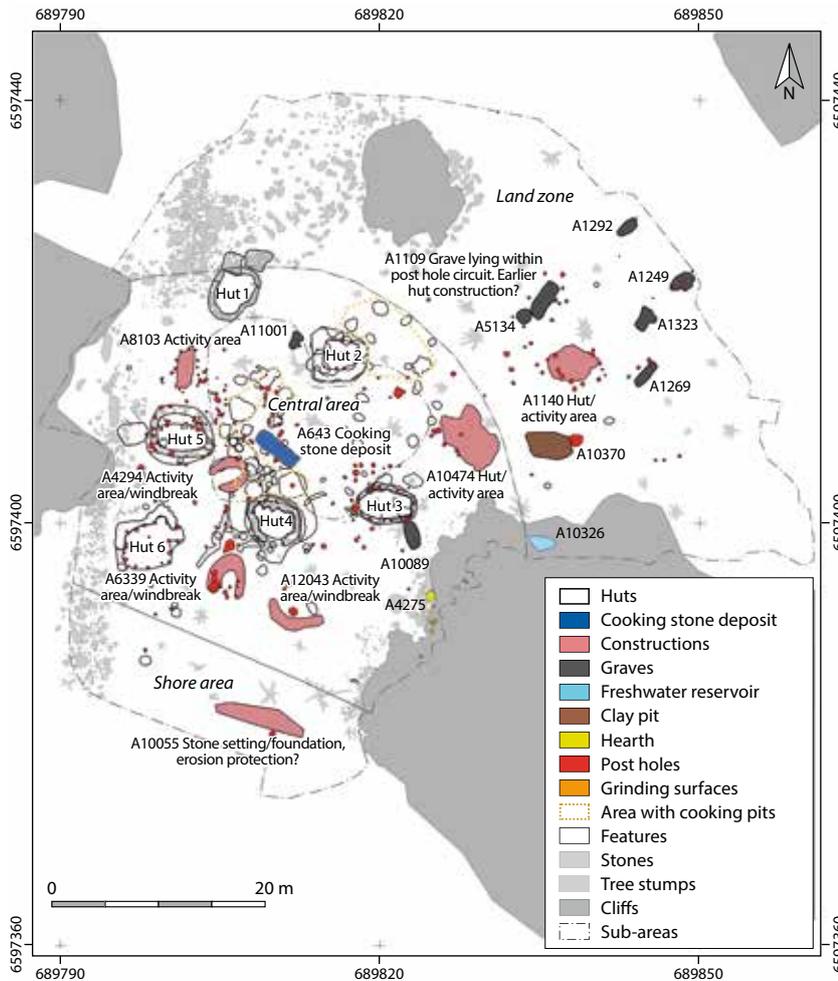


Fig. 10. Tråsättra. The settlement with the identified features, constructions, activity areas and postholes (Graphics: N. Björck/SHM Arkeologerna).

Additionally, in both main permanent phases a specialised hut/building for ritual activities could be identified. The huts, especially hut 3, have special traits in their construction and find material. It was separated from the dwelling area by an L-formed fence or screen of some sort. Also, the construction of hut 3 was completely different and much sturdier compared to the dwelling huts at Tråsättra; a wooden wall construction had been placed in stone filled postholes situated in a deep oval trench. Red ochre had been scattered over the whole construction, giving it a distinct and well delimited red colouring (Fig. 14). Also, right outside the entrance of hut 3 a large wooden pole had been placed in a deep posthole. Interestingly, the only two almost complete ceramic vessels found at Tråsättra were placed just beside the deep posthole, indicating a deposit of whole vessels close to the post. This separates the find from all other deposits of ceramics at Tråsättra, and it is a clear sign of some kind of offerings being performed just outside the hut. In addition, deposits of stone tools, ceramics, clay figurines and animal bones have been made inside the hut, clearly separating it from the tidy dwelling huts (Fig. 11). Just outside the hut, a grave (A10089) was found, even further emphasising the special character of the building.

The presumed ritually used building dated to phase 1, A1140, had a reddish colouring consisting of red ochre. Like hut 3 it had an L-formed fence or screen made of wooden posts placed in postholes. Regrettably, A1140 had been disturbed by later activities connected to the cemetery placed in this area, so its interpretation is more ambiguous.

In addition, three more simple huts or windbreaks were identified in the southern part of the settlement, probably used as shelters for crafts and/

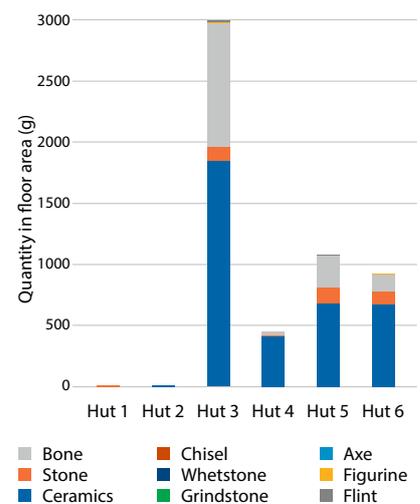


Fig. 11. Tråsättra. Amount of artefacts per hut (Graphics: N. Björck/SHM Arkeologerna).

or storage. They had been lightly built and mostly had a semi-circular or U-shaped form (Table 3).

Table 2. Tråsättra. Identified huts.

Building/ Hut	Type /shape/construction	Size	Inner area	Phase	Comments
1	Dwelling hut, entrance in the southern part. Rounded, stone-filled wall trench, 0.8 m wide and 0.15 m deep	5.3 × 4.4 m	12 m <sup>2</sup>	2	Excavated with a cross-section in 0.5 × 0.5 m units.
2	Dwelling hut, entrance in the southern part. Rounded, rectangular, dug into the relatively moderate slope. Encircled by a low wall embankment with moderate content of stones. Supported by wooden posts placed in postholes.	5.1 × 5.0 m	12.5 m <sup>2</sup>	1–2	Excavated with a cross-section in 0.5 × 0.5 m units.
3	Cult/death house, entrance to the west. Oval construction, wall consisting of postholes where wooden posts and planks had been placed in a 0.4–0.5 m deep trench.	5.7 × 3.8 m	12 m <sup>2</sup>	2	Ritual function, cult/death house. The whole construction was excavated in 0.5 × 0.5 m units.
4	Dwelling hut, entrance in the south. Oval, encircled by a low stone wall. Postholes placed in some parts of the stone wall.	5.1 × 4.4 m	12 m <sup>2</sup>	2–3	The whole construction was excavated in 1.0 × 1.0 m units, cross-section in 0.5 × 0.5 m units.
5	Dwelling hut, two phases. Entrance placed in south-east/east. Phase I: oval, stone filled wall trench with postholes. Phase II: oval, stone filled wall trench with postholes.	Phase I 5.0 × 3.2 m Phase II 5.9 × 4.9 m	15 m <sup>2</sup> 17 m <sup>2</sup>	2–3	The whole construction was excavated in 1.0 × 1.0 m units, cross-section in 0.5 × 0.5 m units.
6	Dwelling hut, entrance in the southeast. Oval, wall trench with stones and surrounding postholes.	6.5 × 4.7 m	16.5 m <sup>2</sup>	2–3	The whole construction was excavated in 1.0 × 1.0 m units.

Table 3. Tråsättra. Possible huts and windbreaks.

Hut/Windbreak	Type /shape/construction	Size	Inner area	Phase	Comments
A10474	Possible hut. Oval culture layer, max. 0.3 m deep. Postholes in southwest.	6.0 × 3.4 m	14.5 m <sup>2</sup>	1	Excavated in plan with a section.
A1140	Possible hut. Oval culture layer, max. 0.05 m deep. Postholes placed around the layer. Cooking pit placed in the southern part.	4.8 × 3.6 m	15 m <sup>2</sup>	1	Excavated in plan with a section.
Postholes around graves A1109 and A5134	Possible hut. Oval, 9 postholes placed around grave A1109 and A5134.	4.3 × 3.5 m	16.4 m <sup>2</sup>	1	Postholes excavated with section.
A4294	U-formed wall trench, entrance to the west. A few postholes and pits placed in or close by the trench.	3.4 × 3.3 m	4 m <sup>2</sup>	2–3	The whole construction was excavated in 1.0 × 1.0 m units.
A6339	U-formed wall trench with postholes and fire-cracked stones. Entrance to the south.	3.8 × 3.5 m	4 m <sup>2</sup>	2–3	The whole construction was excavated in 1.0 × 1.0 m units.
A12043	Slightly curved wall of fire-cracked stones combined with postholes and a pit. Opening towards the north.	5.4 × 1.2 m	4 m <sup>2</sup>	2–3	The whole construction was excavated in 1.0 × 1.0 m units.

## The PWC huts

The huts in PWC settlements in Southern Norrland and eastern middle Sweden have in general been quite simple constructions, with some variation in size, shape and basic design (Fig. 18). Simple constructions consisting of round posthole circles with the floor surface at ground level are concentrated in a coherent area from Småland to Uppland. Stone circles, on the other hand, are to be found in the far south of Norrland, in Småland and the Mälaren Valley. Dug-out huts or pit-houses belong, above all, to the Norrland region, but single examples of such huts are also to be found, for instance, in the province of Gästrikland (Björck 2007b; Halén 1994; Runesson et al. 2001). Built-up huts placed on low terraces have been recorded in the province of Hälsingland, but there are also examples from Uppland. The tendency is that the different constructions are found in small numbers all over Eastern Sweden. However, there is also a tendency towards local continuity in building tradition. Perhaps a combination of widely spread functional solutions in combination with local building traditions is a way to try to explain variation and similarity in the data.

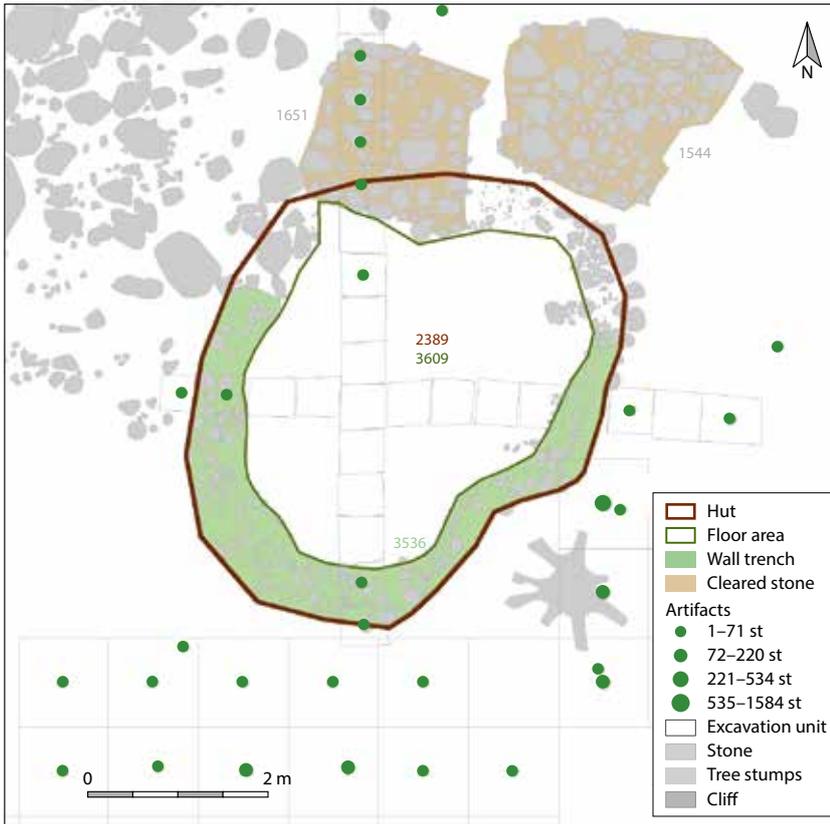


Fig. 12. Tråsättra, hut 1. Plan and photo from southwest (Photo and graphics: N. Björck/SHM Arkeologerna).



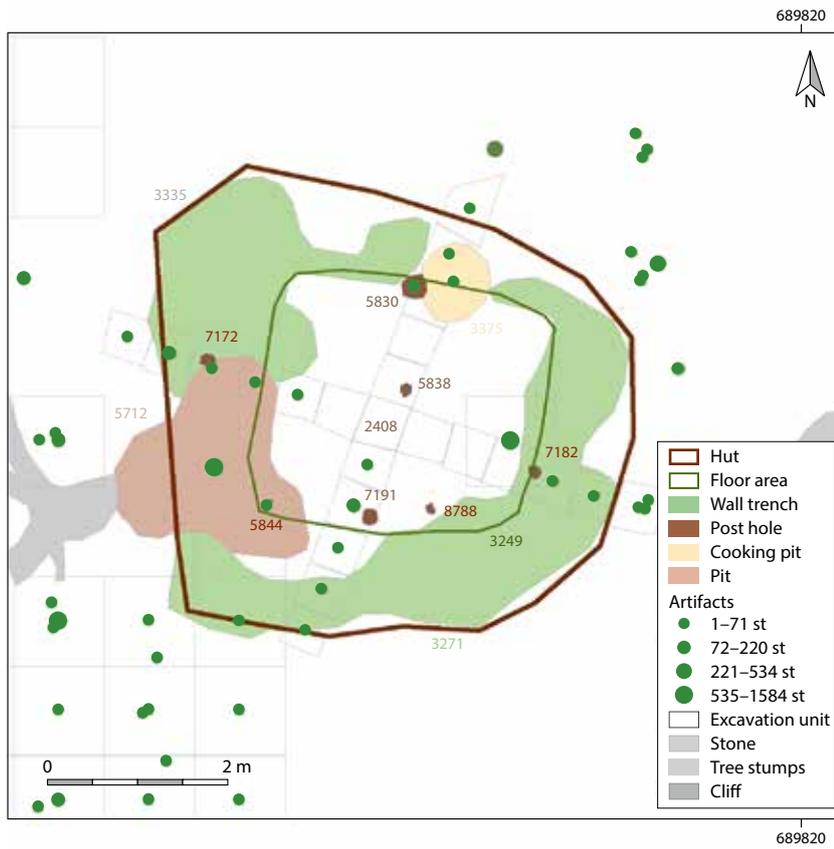


Fig. 13. Tråsättra, hut 2. Plan and photo from northeast (Graphics and photo: SHM, Arkeologerna).



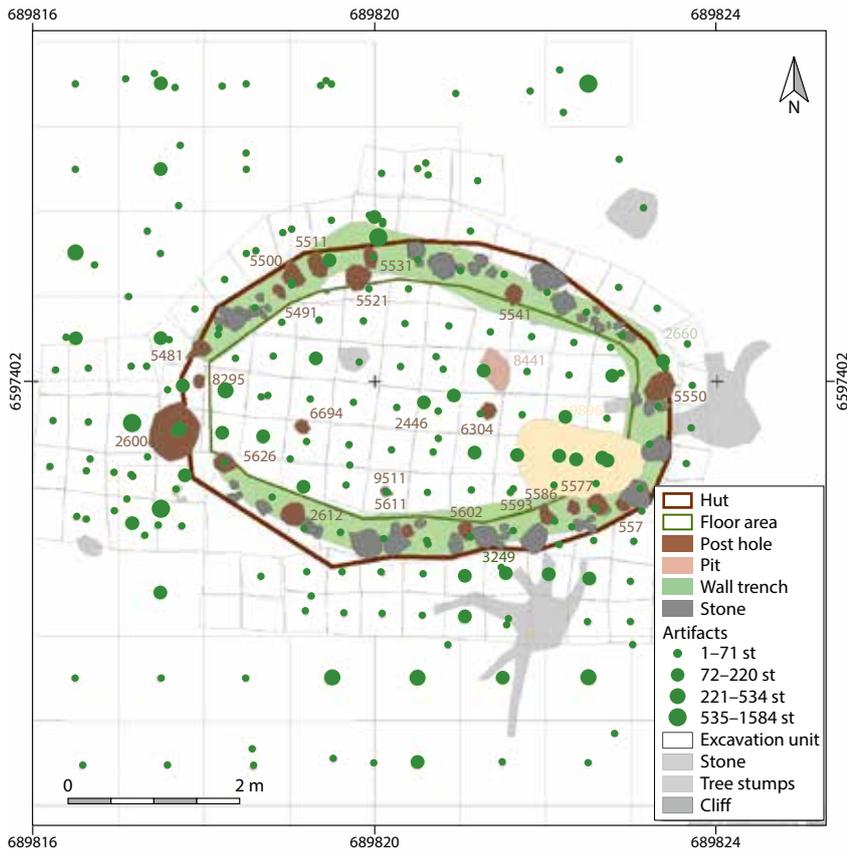


Fig. 14. Tråsättra, hut 3. Plan and drone photo (Graphics and photo: N. Björck/ SHM Arkeologerna).



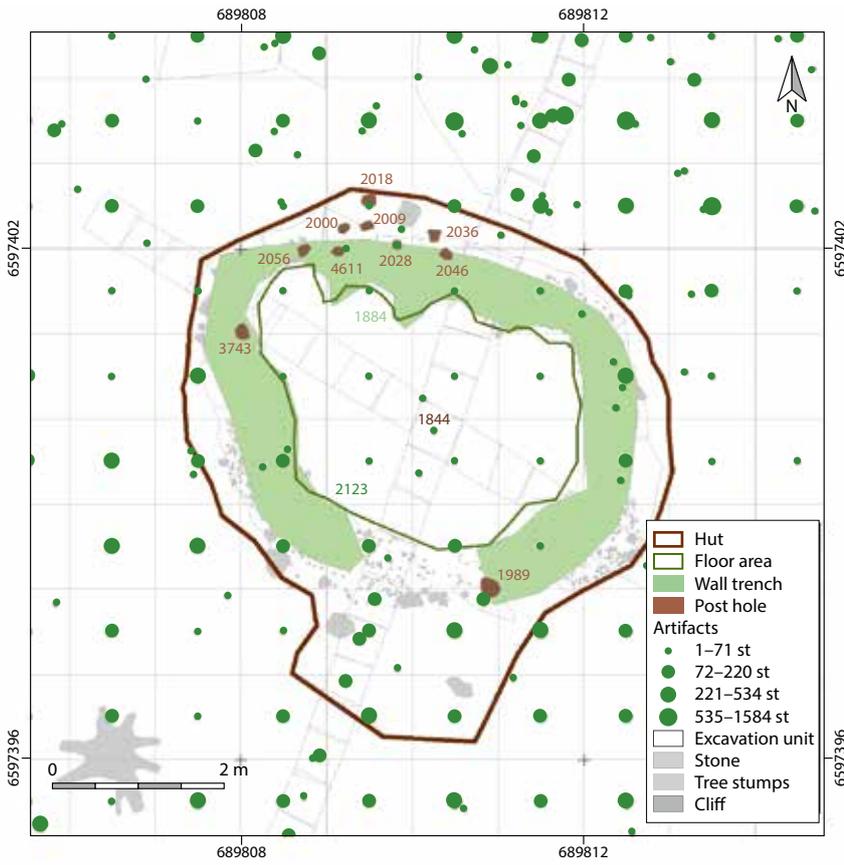


Fig. 15. Tråsättra, hut 4. Plan and photo from west (Graphics and photo: N. Björck/SHM Arkeologerna).



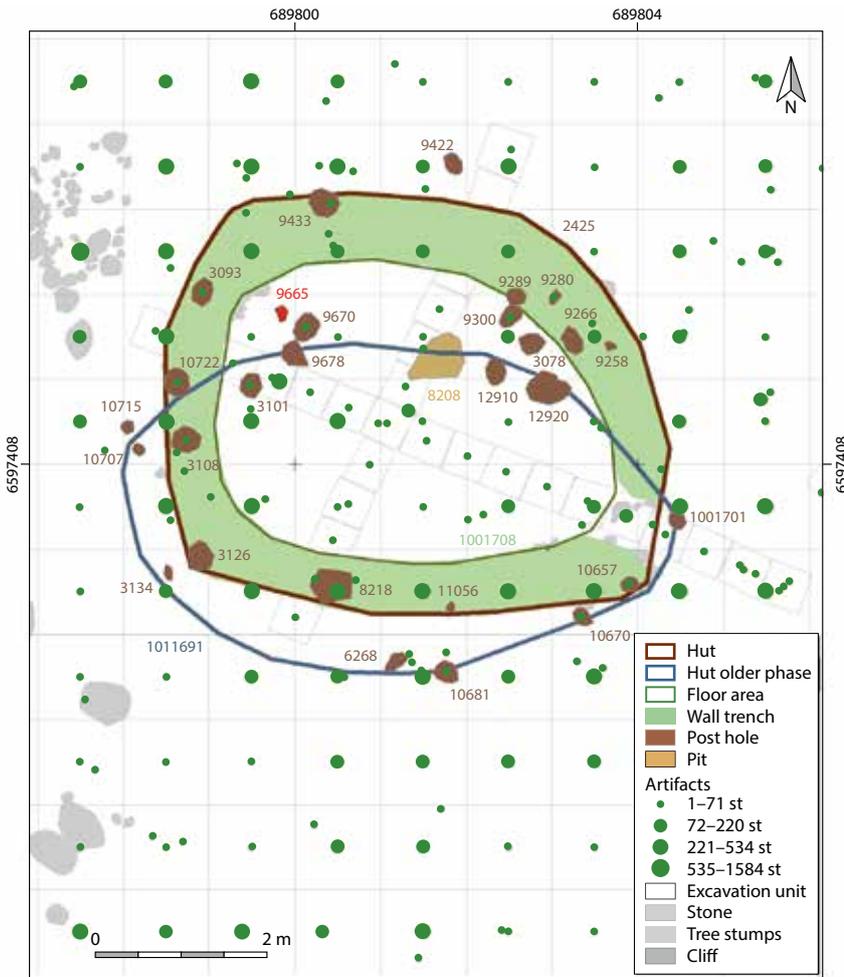


Fig. 16. Tråsättra, hut 5. Plan and photo from northwest (Graphics and photo: N. Björck/SHM Arkeologerna).



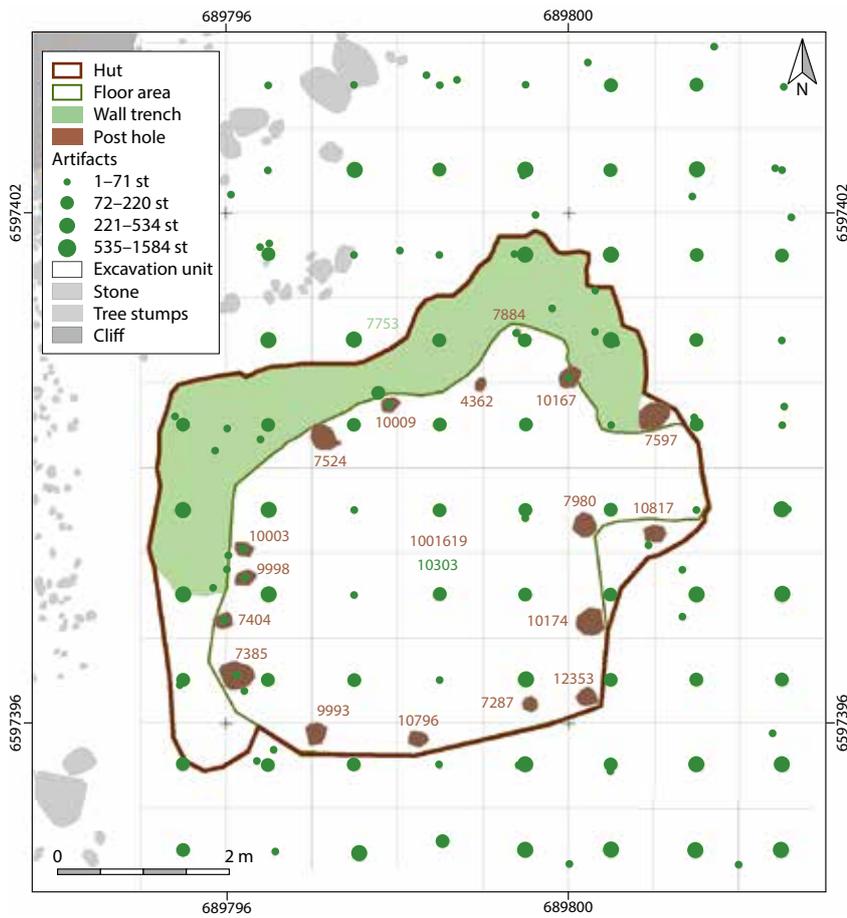


Fig. 17. Tråsättra, hut 6. Plan and photo from westsouthwest (Graphics and photo: N. Björck/SHM Arkeologerna).



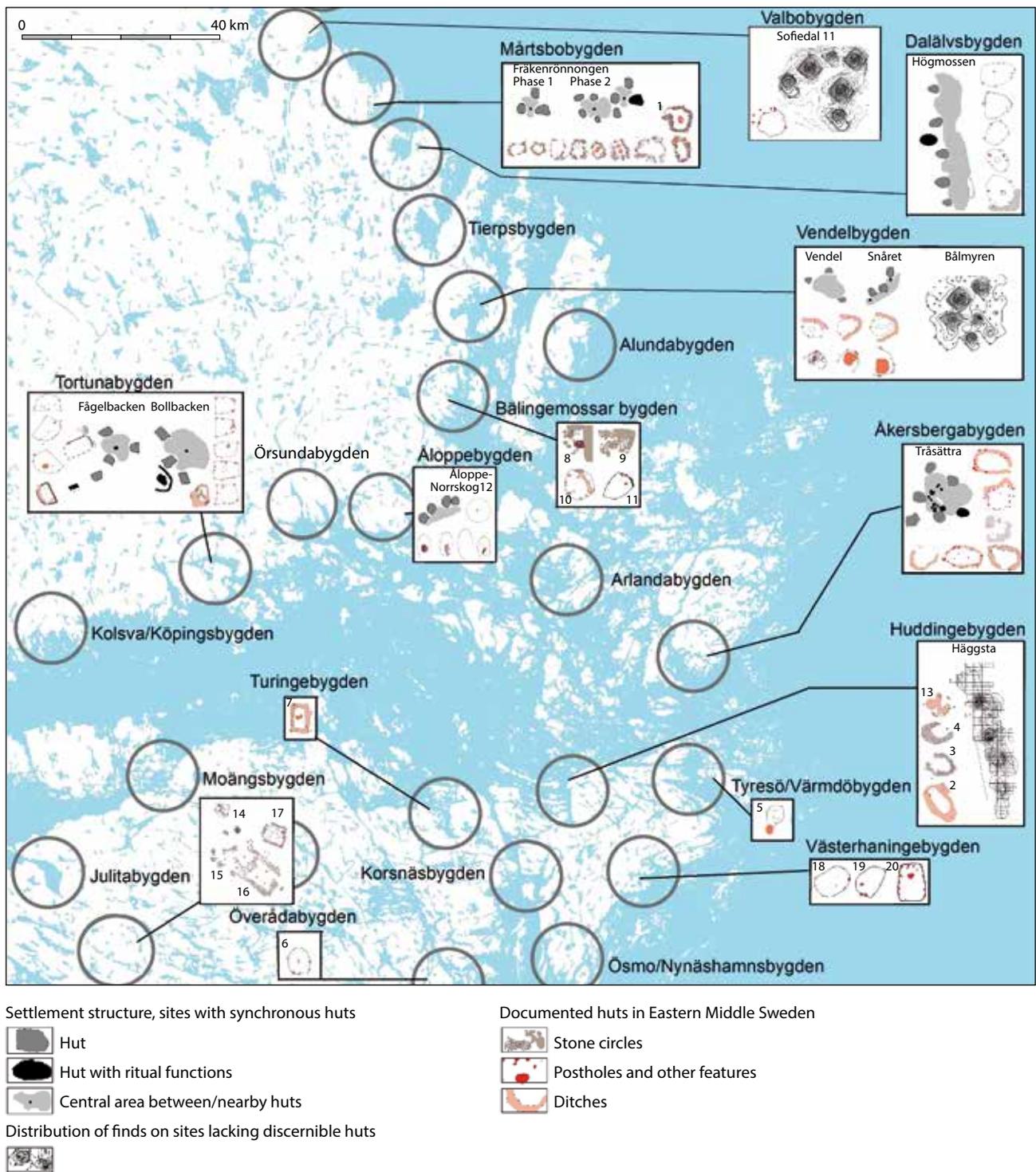


Fig. 18. The organization of sites with contemporary huts and the regional variation on the basic theme of hut construction in the Neolithic coastal settlements in the regional groups (cf. Fig. 3) of southern Norrland in the north to the large archipelago in the Mälarsjön bay in the south: 1 Västeräng; 2 Häggsta; 3 Björnkällan; 4 Kyrkorp 9B; 5 Återvall; 6 Överåda; 7 Gläntan; 8 Persbo; 9 Ytterby; 10–11 Brännpussen 1&2; 12 Rusthållskog; 13 Smällan; 14–16 Mogetorp 1–3; 17 Östra Vrå; 18–20 Sittesta (after Artursson 1996; Segerberg 1999; Björck 2007b; Björck/Hjärtner Holdar 2008; Kihlstedt et al. 2007; graphics: N. Björck/SHM Arkeologerna).

In most cases, the huts have had a rounded or oval shape, though there are some with a rectangular or trapezoid shape. The dwelling area varies between c. 7–20 m<sup>2</sup> (Artursson 1996; Björck 1997; 2003; 2007b; 2007c). Usually, the basic supporting construction of the PWC huts has probably consisted of branches and sticks anchored in small postholes, though there are huts, especially the ones with a rectangular or trapezoid shape, that have had a sturdier construction based on wooden posts placed in more substantial post holes. Depending on the character and sturdiness of the construction, different materials have been used to cover the supporting construction; the smaller, rounded or oval huts have probably been covered with either reed or skin, while the more sturdy huts could have had wooden walls based on planks or posts and a roof covered with reed. In a few cases, the wooden construction in huts with a rectangular or trapezoid shape seem to have been covered with wattle and daub (Björck 1997; 2003; 2007b; 2007c; Artursson 1996; 2006; 2007a; 2007b). There are also some evidence indicating that houses and huts could be timbered or frame-constructions built with logs (Halén 1994; Holback 2007; Leskinen 2002, 154 ff.). Smaller rounded huts could also have been constructed with the same methods but with weaker, branch sized, wood.

At Tråsättra most huts have a rounded or oval shape and an inner surface between 12–17 m<sup>2</sup> (Table 2). This would have made it possible to accommodate between 6–8 individuals in each hut (e.g. Cook/Heizer 1968). All the dwelling huts have had a simple construction consisting of a surrounding low stone wall or stone filled trench, in most cases combined with postholes for the supporting construction (Figs. 12–17). One of the huts in the northern part of the settlement, hut 2, was partly dug into the relatively moderate slope. Probably, all these dwelling huts had a dome-like wooden construction covered with reed or seal skin, although a lighter wooden construction is also a possibility. However, the ritually used hut 3 had a much sturdier construction consisting of a stone filled ditch where quite large posts and/or planks have been placed, implying a different design (Fig. 14). This is in consistency with other contemporary ritual buildings or cult/death houses connected to the PWC and BAC in eastern middle Sweden (Artursson 1996; 2006; 2007a; 2007b; Lindström 2006).

All dwelling huts associated with phase 2 have been kept clean and tidy inside, except hut 5 where the number of finds is larger, though this might depend on a more complex use with two phases identified. Each hut had a dump of waste placed in close vicinity, and the preserved material usually consists of stone tools, burnt bones and fragmented ceramics. The stone tools are usually broken, discarded implements such as burins, saws, scrapers, knives and grinding stones. The animal bones represent many different species, but often the composition differs slightly between huts, although fish and seal always dominate (see below). The ceramic vessels in these contexts can range in size from 3–50 cm in rim diameter, and often all sizes are present. Occurrence of food crust and lipids indicating food and heating are usually present only in middle sized vessels with a rim diameter of c. 10–23 cm. Vessels of this size could be used to prepare food to approximately 2–6 individuals. The lipids mostly indicate that different mixes of meat, fish and vegetables have been cooked in the vessels (see below), suggesting that different kinds of stews have been prepared, that could feed a family.

Signs of variation and difference in the presence and distribution of stone tools, ceramics vessels and waste in the form of animal bones and plant remains between huts could identify individual specialisation in hunting, fishing, gathering, craftsmanship and ritual activities. Some traces indicate the existence of specialisation in stone working, hunting, butchering, fishing and cooking. Every hut has a standardized set of ceramic vessels, indicating the existence of a formalized service for cooking, serving, eating, drinking and for processing and storage of food. All these factors support the

hypothesis that every single hut represents an individual household based on a family sized unit of 4–6 individuals (Björck et al. 2020, 11–30).

### The cooking pits, waste pits and hearths

The cooking pits were concentrated in the central area of the settlement in the space created by the six huts that belonged to Tråsättra phase 2 (Fig. 19). The central area has a clearly visible spatial organisation; in the middle was a rectangular stone setting, 4.5 × 1.4 m which has been interpreted as a special deposit of selected stones for use in cooking pits. It was oriented in a northwest–southeast direction, pointing directly towards the entrance of hut 3, the supposed ritual building in the site. The cooking stone deposit was surrounded by two concentric formations of features. In the inner formation there were five hearths, 0.7–1.3 m in diameter. Surrounding the hearths were cooking pits, at least 14–15, but these had been reused and it was often difficult to decide where one ended and another started (Björck et al. 2020, 11–30).

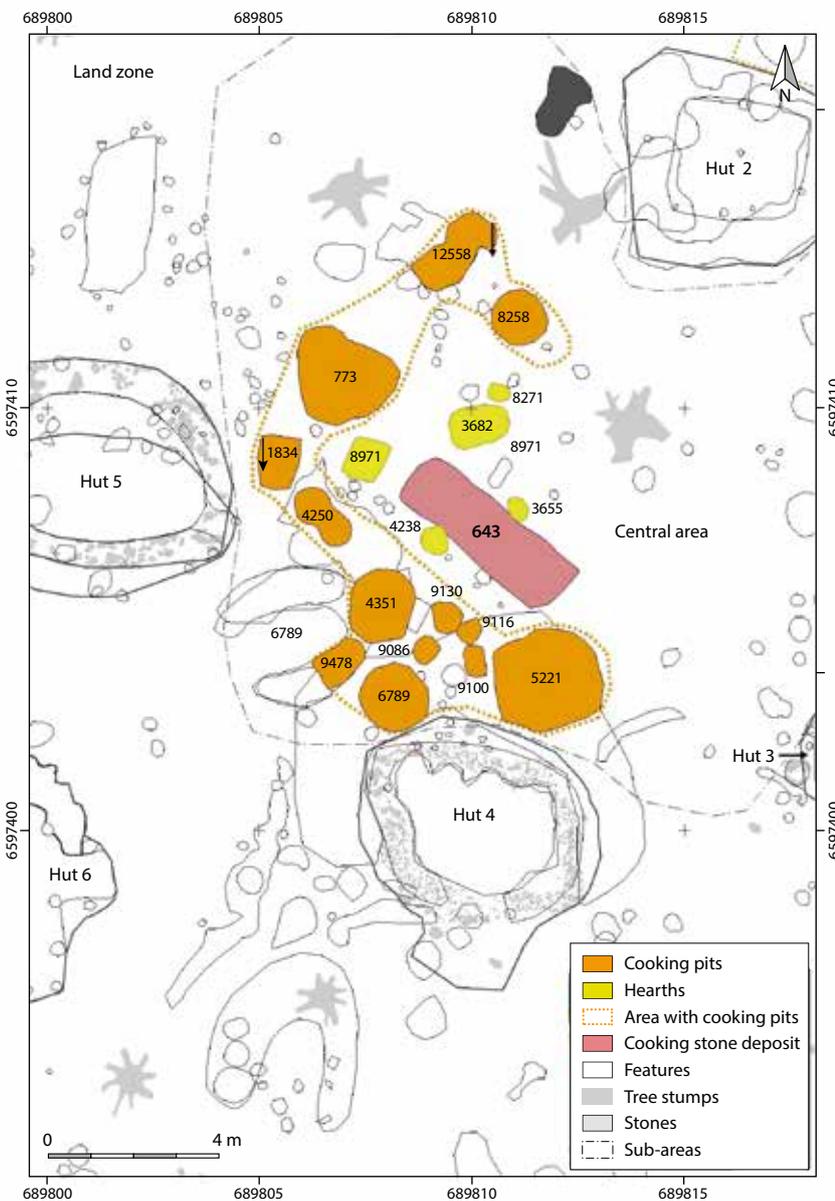


Fig. 19. Tråsättra. The western part of the central activity area with cooking pits, hearths and a deposit of stones for use in the cooking pits (Graphics: N. Björck/SHM Arkeologerna).

The cooking pits on the site usually ranged in diameter from 0.5–1.5 m although there are some examples that were 1.9–2.4 m in diameter. The cooking pits were usually 0.2–0.6 m deep. However, the more shallow ones could be a result of taphonomy as the pits were often difficult to see in the upper layers and therefore identified first towards the lower layers. The cooking pits on the site had been used repeatedly and it is probable that the large ones represent several cooking pits fused together so that it was impossible to distinguish between them. The interpretation was made even more difficult because almost all of them had a secondary use as waste pits for garbage disposal. Hence, several of the cooking pits were rich in finds. Usually, the cooking pits contained approximately 3–4 liters of fire-cracked stone, and fire-cracked stones were also found in surrounding layers and in the waste areas by the huts.

To sum up, the central deposit of cooking stones was surrounded by two semi-circular areas, the inner with hearths and the outer with cooking pits. Towards the southeast there was an open space where neither hearths nor cooking pits were found. Hence, the entire activity area was open towards the supposed ritual building, hut 3, situated in this direction. Artifacts are distributed in a similar way, large amounts in the semi-circular areas surrounding the storage of cooking stones and non in the storage and very few in the eastern area devoid of hearths and cooking pits. It seems likely that the hearths are connected to different households and that these have been used for cooking in ceramic vessels, and sometimes for heating stones used in the nearby cooking pits.

Most of the waste seems to have been deposited close to the dwelling huts, concentrated to the areas just outside the walls of the huts. Also, some of the waste have been deposited in the cooking pits when they have been taken out of use (Fig. 20). Most of the cooking pits seem to have been used several times, as there are multiple cuts visible in the features. No large concentrations of waste were found outside the central part of the settlement, which implies that secondary deposition of waste have been limited at Tråsättra (Björck et al. 2020). This is quite common and has been noticed at a number of sites, such as Fräkenrönningen, Högmossen or Bålmyren (Björck 1998; Björck/Hjärtner Holdar 2008; Sundström/Darmark 2005), but it differs from some of the other excavated PWC settlements, for instance Bollbacken, where large amounts of waste had been deposited outside the central part of the settlement (Artursson 1996; 2006; 2007a; 2007b).

### **Craftmanship and tool production – ceramics, flint, quartz, slate, stone and bone**

The material culture found in PWC settlements is generally very rich and it mirrors all the activities expected in the tool kit of hunters, fishers and gatherers. The everyday tools are often made of local stone materials like quartz, quartzite, granite and gneiss, but some use of imported materials from different areas in Scandinavia like slate, flint and greenstone can almost always be expected. Also, bone and horn from elk, deer and seal were used for making harpoons, needles, knives, fishing hooks etc.

The extensive use of ceramics is typical for the PWC in the Baltic Sea area (Larsson 2009a, 73–116). In spite of the extreme specialisation in hunting, fishing and gathering and the almost total lack of agriculture, different kinds of ceramic vessels in different sizes have been used. In this way, the PWC has similarities with the partly contemporary Comb Ceramic Culture (CCC) in Finland, which is also specialised in hunting, fishing and gathering (Stenbäck 2003, 61–73). Mostly, excavations of PWC settlements produce extremely large amounts of fragments and sherds of ceramic vessels, but in some cases also larger parts or whole vessels.

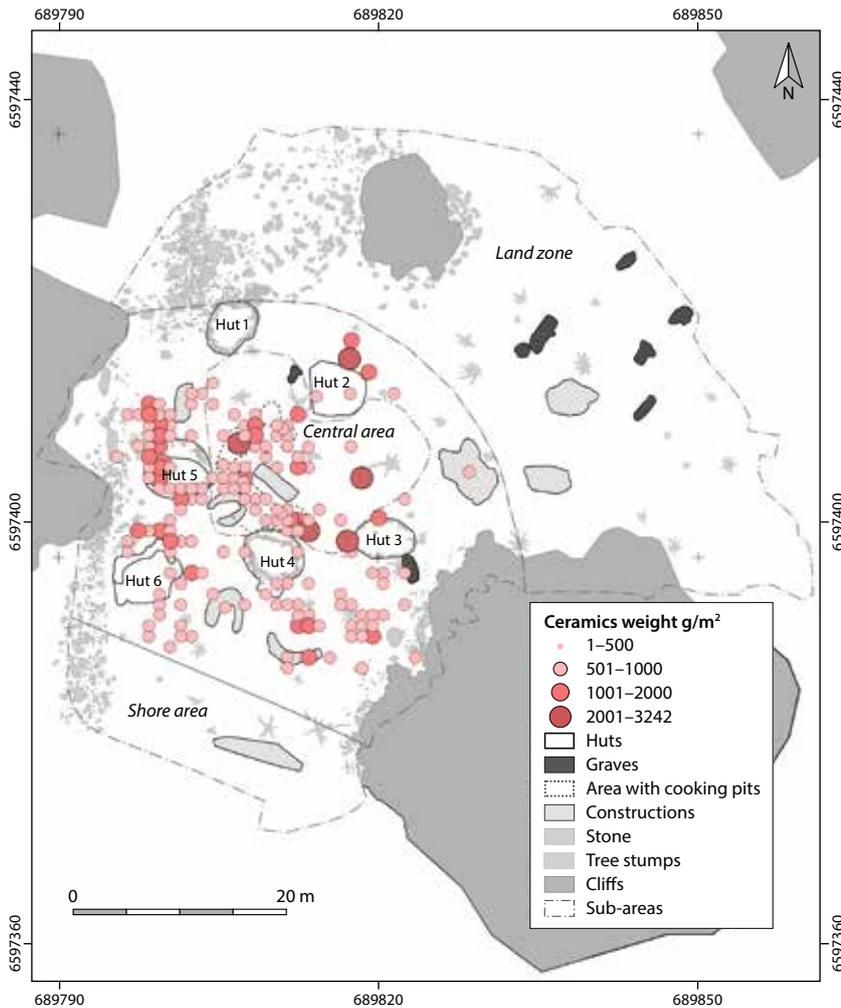


Fig. 20. Tråsättra. Concentrations of ceramics can be seen around the huts and in the central activity area where waste has been deposited in cooking pits when they have been transformed to waste pits after final use (Graphics: N. Björck/SHM Arkeologerna).

The ceramic vessels produced by the PWC communities in the Baltic Sea area have great similarities when it comes to design and decorations used, though the ceramic tradition seem to have allowed some freedom in style and composition. In general, the PWC ceramic handicraft gives the impression of being quite homogenous between different regions in the Baltic Sea area, but there are some differences in the clays and temper used, partly dependent on regional variation in geological conditions (Larsson 2009b, 260 ff.). This implies that the handicraft mirrors the existence of marriage networks between regional groups, transferring certain traits like forms of vessels, style and decoration, but allowing local adaptations when it comes to raw materials used.

## Ceramics

In total, 104 106 sherds with a weight of 267.2 kg were retrieved at Tråsättra. This represents approximately 3 828 vessels of different size, form, decoration and function (Figs. 21–24). Initially, all ceramics from Tråsättra were base-registered (type of ware, quantity and weight) during field work to get a picture of the distribution in the settlement. A secondary special-registration was done during the report phase including the registration of approximately 10–15 different variables per sherd, including information on which part of the vessel the sherd represents, thickness, type of mouth-rim, type and size of tempering, decoration, secondary burning, presence of food residue etc.

The extensive production and use of ceramics at most of the PWC settlements is interesting and causes some speculations and questions concerning economy and diet. Through studies of remains of lipides and burnt food crusts, it can be shown that the ceramic vessels of different shape and size have been used for cooking, serving, eating, drinking and storage and processing. The abundance of ceramics on PWC sites implies a delayed return economy with storage facilities (Woodburn 1980; 1982; Björck/Larsson 2007), pointing towards a sedentary population living in central base camps, supplemented by smaller settlements for special activities. The ceramics have in many cases been well made and lavishly decorated, indicating a keen interest in the handicraft and in the symbolic and ritual value of these vessels. In some cases the ceramics have been deposited as offerings and in burials, showing the ritual significance of some of the vessels.

The main body, 99.9%, of the ceramics found at Tråsättra consists of typical PWC vessels (Fig. 21A,B) from the late MN B, which from form, style and decoration can be characterised as Fagervik III and IV according to the traditional typology (Bagge 1951; Larsson 2009a, 89 ff.; Björck et al. 2020). Interestingly, in most PWC settlements in the eastern middle part of Sweden dated to the late MN B, small amounts of Battle Axe Culture (BAC) ceramics (Fig. 21C) can be found, and in some cases also ceramics of mixed form, style and decoration, constituting some kind of hybrids between the PWC and the BAC ceramics. This type of somewhat varied vessels are usually referred to as the "Third Group" or the "Bollbacken Group" (Larsson 2009a; Granér/Larsson 2004; Artursson et al. 1996).



Fig. 21. Tråsättra. Different types of ceramics: A Pitted Ware, Fagervik III; B Pitted Ware, Fagervik IV; C Battle Axe Culture and "Third group" ceramics (Photos: N. Björck/SHM Arkeologerna).

This typical mixture of ceramics with different design was also found at Tråsättra, where 0.02% could be assigned to the BAC and 0.08% to the "Third Group" or the "Bollbacken Group". What these types of vessels with mixed characters represent is not clear, but the combination of form, style and decoration of the late PWC and the BAC implies a hybridisation process, where contacts between two different ethnic groups have resulted in a mixture of cultural traits. In several cases, typical BAC flint axes, battle axes and ceramics have been found in PWC settlements and cemeteries, while the opposite is extremely rare (Artursson 2006; 2007a; 2007b).

This indicates a special relationship between the PWC hunter-gatherers and BAC farmers and agropastoralists, living in the same areas but at some distance between each other. Interestingly, a recent aDNA-study of PWC burials in the island of Gotland containing some objects and typical features that can be ascribed to the BAC, showed that all individuals had aDNA-profiles that are typical for the PWC (Coutinho et al. 2020). This shows that the PWC were open to cultural influences from the BAC, while the opposite seems to be extremely rare. What the implications of this are can be discussed, but evidently this type of one-way relationships between hunter-gatherers and farmers when it comes to cultural exchange seems to be quite common in historical and anthropological studies (for discussion see Spielmann/Eder 1994; Schier et al. 2021).

Reconstructions of vessels show a large variation and when it comes to decoration of the vessels several different tools and techniques have been used (Fig. 22). The most common decorations are comb impressions and pits of different size and depth, often in combination with each other.

A large portion of the ceramics at Tråsättra, 91.3%, are of a poriferous ware which is typical for the late PWC ceramics (phase Fagervik III and IV). The reason for the poriferous appearance is that the late PWC ceramics have been tempered with calcareous materials like crushed limestone, burnt animal or human bones or seashells. The calcareous materials have gradually leached over thousands of years in the acidic soils, creating this characteristic trait



Fig. 22. Tråsättra. Reconstruction of ceramic vessels (Drawing: S. Björck).

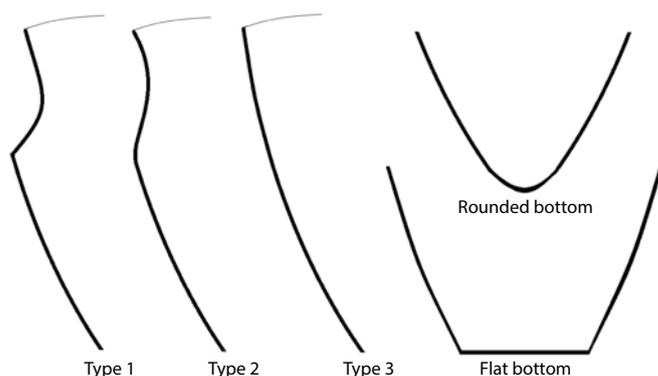


Fig. 23. Tråsättra. Shapes and profiles of ceramic vessels (Graphics: N. Björck/SHM Arkeologerna).

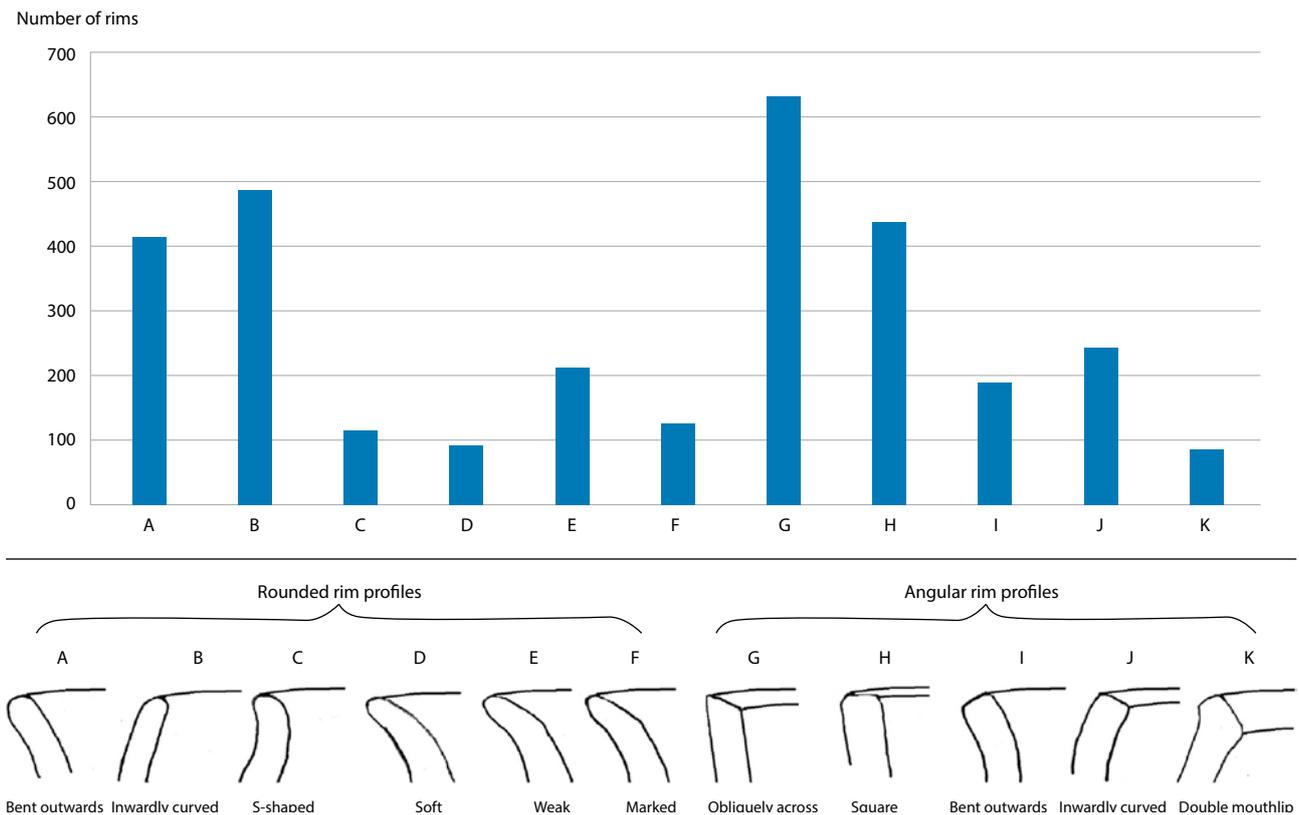


Fig. 24. Tråsättra. Rim types of ceramic vessels (Graphics: N. Björck/SHM Arkeologerna).

(Larsson 2009a; 2009b; 2009c). Most of the ceramics at Tråsättra have been tempered with a mixture of crushed seashells and crushed granitic rocks, and the rest, 8.7%, have been exclusively tempered with crushed granitic rocks. Interestingly, no tempering with grog could be confirmed. Grog is extensively used for tempering of BAC ceramics, and the absence of this characteristic trait at Tråsättra could imply a clear cultural borderline between the local PWC and BAC groups when it comes to the ceramic handicraft. Why the BAC ceramics at Tråsättra lack the typical tempering with grog is unclear, but it could imply that PWC tradition has influenced the BAC ceramic handicraft in some way.

The microscopic analysis of the clays and tempers used in the ceramics and the clay figurines, and the Inductively Coupled Plasma (ICP) analysis of the material, shows that the large majority have been produced from local post-glacial fine clays, and that it has been tempered with a distinctive composition of seashells and granitic rocks. According to the results from the analyses, a large portion of the clay used has probably been quarried in a 4.8 × 2.5 m large pit in the northeastern part of the settlement (Björck et al. 2020, suppl. 13).

The ceramic handicraft at Tråsättra seems to have been quite homogeneous, and no major differences in ware and tempering between vessels of different form, style or decoration could be identified. The limited number of vessels with a design and character that could be assigned to the BAC, the "Third Group" or the "Bollbacken Group" did not differ significantly from the typical PWC vessels, so the deviant pots probably have been manufactured in the settlement at Tråsättra or in the close vicinity.

However, one vessel characterised as belonging to the "Bollbacken Group" differed in the composition of the clay and temper that could imply a more distant origin, and two fragments of clay figurines had interestingly enough a distinctive ICP-signal (Björck et al. 2020, suppl. 13) placing them in the island of Åland, where contemporary local PWC groups produced identical

clay figurines, showing the exact same design and motive as the ones from Tråsättra (Cederhvarf 1912). This is a strong indication of a close cultural relationship between PWC groups separated by 80 km of open sea, showing the extent of the long-distance contacts among these hunter-gatherers.

The function of different kinds of vessels was investigated through lipid analysis of a selection of 20 sherds, and it showed that just the medium-sized PWC vessels had been used for cooking, and they were also the only ones that had some kind of food crust and showed signs of repeated secondary heating (Björck et al. 2020, suppl. 5). The vessels that could be characterized as belonging to the BAC or "Third group" all lacked traces of lipids, which means that vessels with these characteristics have not been used as cooking or storage vessels, the latter at least not for fatty food stuffs. Maybe the BAC vessels found at Tråsättra have been used as containers for transport of grain from the BAC-settlements in the neighbourhood to the PWC groups, exchanged for products like seal skin and blubber.

### The PWC tool box – tools made from quartz, stone, flint, slate, bone and antlers

All stone tools and waste from knapping were base-registered (type of stone material, type of tools, type of waste, quantity and weight) during field work to get a picture of the distribution in the settlement. A secondary special-registration was done during the report phase including the registration of size, knapping technique, signs of ware in tools etc.

The lithic material found at Tråsättra was rich and complex, consisting of a variety of materials and artefacts (Fig. 25; Tables 4–5). From technological aspects, raw materials used and trace wear analysis made on tools, an intra-site analysis could show how the site was organized concerning production and use of lithics (Fig. 25; see also below).

The most common material in Tråsättra is the locally abundant quartz, followed by porphyrite, other rock, sandstone, flint, quartzite, greenstone, slate and chert in that order (Tables 4–5). Quartz must be considered as the most important stone material for the PWC groups in eastern middle Sweden, and it was quarried in local bedrock outcrops and nodules picked from the exposed moraine, probably quite close to the settlement at Tråsättra.

Fig. 25. Tråsättra. Selection of the stone objects (Photo: N. Björck/SHM Arkeologerna).



Table 4. Tråsättra. Stone material.

Type	Number	Weight (g)	Note
Quartz	6,764	53,061	Quarried locally in bedrock outcrops and collected as nodules from the exposed moraine
Porphyrite	1,352	18,171	Imported from Åland
Other types of rock	626	27,121	
Sandstone	290	46,754	
Flint	104	181	Imported from southern Scandinavia
Quartzite	66	1,797	
Greenstone	46	1,996	
Slate	36	782	Imported from northern regions
Chert	8	90	

Table 5. Tråsättra. Type of tools and materials.

Material	Number	Weight (g)	Type of tools/use
Quartz	93	1,907	Drill, plane, hammer, knife, saw, scraper, awl
Flint	15	39	Arrowhead, scraper, knife
Sandstone	127	40,697	Grinding stones, whetstones
Slate	23	248	Whetstones, dagger, arrowheads, spearheads
Porphyry	10	489	Scraper, arrowhead
Other rock	29	12,495	Axe, chisels, grinding stones, sinker, hammer

Quartz was the main raw material for tools like knives, scrapers, burins, planes and drills (Björck et al. 2020, 149–167).

The porphyrite artefacts mainly consisted of cores and flakes and were fairly evenly spread on the site (Fig. 26). Two types of porphyrite were used at Tråsättra; red with black phenocrysts and black with dark grey phenocrysts. The second type has probably been imported from Åland, but no source has been found for the red porphyrite.

The majority of the flint artefacts was found in the central cooking area and in hut 3, which shows that it probably was of special importance or used for a special purpose. In many cases, polished flint axes from southern Scandinavia have been used as raw material by the PWC groups in eastern middle Sweden (e.g. Ahlbeck 1996; Artursson 1996). At Tråsättra, five flint artefacts had traces of polished surfaces, which shows that flint axes have been used as raw material at the site. Approximately 85 % of the flint material consisted of flakes and debris. Of the flint artefacts six arrowheads, two scrapers, one blade and a bead stood out.

Slate was used primarily to make different kinds of points for arrows and spears, and to make knives for skinning. Since slate was imported from the north and is quite rare in this region, and also mostly used to make highly visible and personal objects, it was probably of high value.

A common material in PWC sites is greenstone. In Tråsättra, a very small amount of production debris was found, which indicates that the four chisels and three axes of greenstone were imported to the settlement.

A large amount of sandstone artefacts in the shape of 103 grinding stones and 23 whetstones was found at Tråsättra. These artefacts are common on similar sites and used to shape and sharpen bone, wood, greenstone tools, and other stone tools. Some production debris was found, 163 flakes,

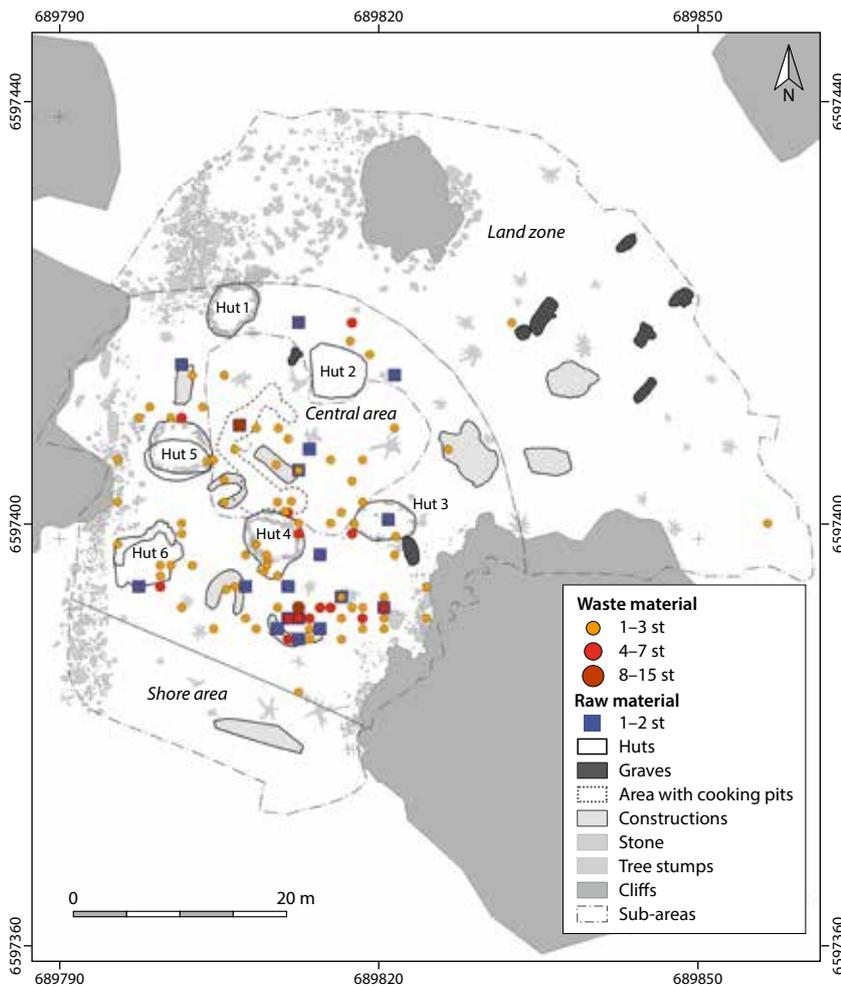


Fig. 26. Tråsättra. Distribution of raw material and waste from the initial steps of the processing of quartz (Graphics: N. Björck/SHM Arkeologerna).

that show that some reshaping of sandstone artefacts have taken place, although no regular production could be identified.

It appears that the settlement was organized around two different social constellations: the family group and the settlement community as a whole. At each hut, a tool kit was found consisting mainly of quartz tools; saws, knives, scrapers and burins. This pattern was noticed first at earlier excavations of PWC settlements at Högmossen and Snåret (Björck/Hjärtner Holm 2008, 141 ff.; Björck/Larsson 2005, 33 ff.; Lindberg 2009, 820 ff.). Also, in connection to each hut at Tråsättra, cores, flakes and debris of quartz were found, showing that each family group produced their own tool kit (Figure 28). The technological analysis revealed that both bipolar and freehand platform technologies were used, but in a few cases the platform-on-anvil method was applied.

At Tråsättra, production and crafting locations could also be identified at the shore, in the central area in connection with the cooking pits and hearths, and in the southeastern area, close to the bedrock outcrop. Production and crafting areas could also be identified in the northeastern and northwestern part of the settlement. Here, different constellations consisting of members from several family groups have probably been working together (Fig. 27).

In the central area (Fig. 27, area 1), tools and production debris is very similar to the material found in connection to the huts but the number of grinding and whetstones is larger. Another difference is the large numbers of artefacts of more rare imported materials such as slate and flint. Among these a slate dagger and two arrowheads can be mentioned.

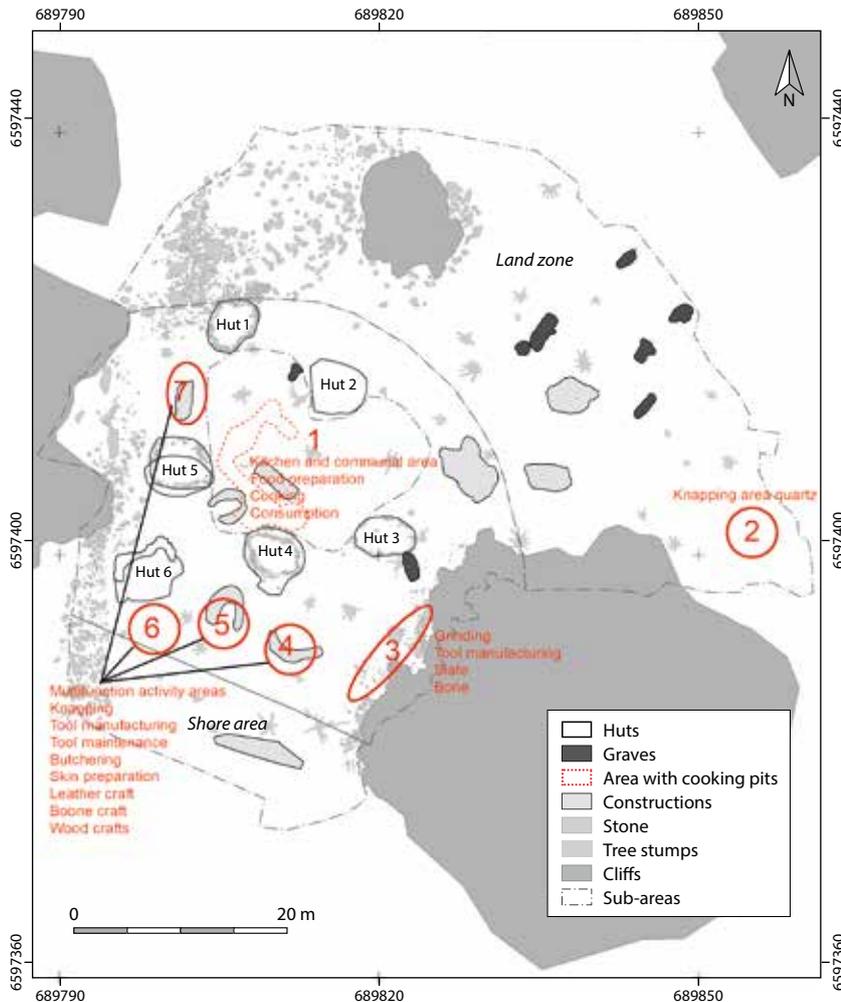


Fig. 27. Tråsättra. Interpretation of the organisation of the settlement based on the analysis of the distribution of different stone materials. Multifunction activity areas 4–7 contain varied sets of artifacts and waste associated with different types of crafts like knapping and grinding of different stone materials, tool production, tool maintenance, butchering, skin preparation and crafting of leather, bone and wood. Grinding stones of the type found within area 3 have probably been used for making implements with a polished finish in stone and bone. Also, in area 3 polished patches on the cliff itself were found, probably used in a similar function to grind tools and maybe to process plants, roots and seeds (Graphics: N. Björck/SHM Arkeologerna).

Three concentrations of lithic material can be recognised in the southern part of the settlement at Tråsättra, close to the neolithic shoreline (Fig. 27, areas 4–6). The two eastern concentrations were found in connection with two windbreakers, A6339 and A12043. The western concentration at the shore consisted of cores, flakes and debris of quartz. Of notice here were four scrapers of quartz and five grindstones made of sandstone, but with few other tools. Possible activities in these areas could be skin and leather preparation and also the finishing touches on different tools of stone and bone. Also, wooden objects like shafts for stone tools and skin canoes and boats could have been manufactured in these areas.

The central concentration at the shore (Fig. 27, area 5) consisted of a wide variety of tools, scrapers, knife, burin, knife/saw, grindstones and whetstones. Beside the tools, the normal artefacts of quartz like cores, flakes and debris were also found here. The wide array of tools indicates that crafting, probably of several different types occurred in this area.

The eastern concentration at the shore (Fig. 27, area 4) mainly contained quartz cores, flakes and debris. Here the main concentration of quartz with cortex was located, which indicates that the start of the processing of quartz cores was focused in this area. On earlier excavated PWC sites it has been noted that the location of the early stages of quartz tool production often took place in the outskirts or outside the settlement itself (Björck/Hjartner Holdar 2008; Lindberg 2009).

In the southeastern part of the settlement, placed close to a flat bedrock surface (Fig. 27, area 3) four loaf-shaped grindstones were found (Fig. 28). The grindstones had a concave working surface. On the flat bedrock surface

shallow depressions from grinding could be seen. A larger depression in the rock surface collected water, making it readily available for grinding. The separation between the grindstones and the depressions on the rock surface indicates the existence of four workplaces. Besides the grindstones, a scraper, a plane and a knife of quartz were found in the area. From the size and shape of the depressions in the rock surface and the size of the grindstones, a likely function of this working area was the sharpening of axes and chisels of greenstone.



Fig. 28. Tråsättra. Loaf-shaped grindstones (Photos: SHM Arkeologerna).



In the northeastern part of the settlement (Fig. 27, area 2) a knapping area for quartz was situated, and in the northwestern part a multifunctional activity area was identified, placed around a well-constructed stone platform, A8103, with an unknown function (Fig. 27, area 7).

Finally, hut 3 had a different collection of lithic artefacts compared to the dwelling huts. A huge array of different prestigious artefacts was found inside and in its surroundings; two axes, two chisels, a slate dagger, two slate spearheads, one slate arrowhead and a large amount of flint artefacts (Figs. 29–30). Besides this, the hut also had the normal tool kit of quartz cores, flakes and debris. Hut 3 has been interpreted as a specialised building for ritual functions, which could explain the presence of the high number of prestigious objects.

A wear analysis was conducted on 33 quartz artefacts, and of these twelve showed traces from use (Björck et al 2020, suppl. 7). The wear trace identified originated from different activities. Knives, planes, scrapers and undefined tools were noted and use on both hard and soft materials could be identified. Hard materials normally include bone, antler and wood and soft



Fig. 29. Tråsättra, hut 3. Chisels and an axe made from greenstone (Photo: SHM, Arkeologerna).



Fig. 30. Tråsättra, hut 3. A spear-head and two fragmented arrowheads made from slate (Photo: SHM, Arkeologerna).

materials include meat, skin and leather. However, it is important to note that this is a very small sample, and that a large number of different types of other tools probably can be found in the quartz material.

The different stone materials found at Tråsättra clearly indicate the existence of long-distance contacts in the Baltic Sea region. Contacts to the north, south and east are visible; the porphyrite is likely imported from the islands of Åland in the east, flint was imported from southern Sweden and Denmark, and the slate used at Tråsättra probably originated from Jämtland in the northwestern part of Sweden.

Complementing the stone tools, harpoons, fishing hooks, arrow heads, bone points, needles and flutes made of animal bone and antler were used by the PWC groups. These objects are usually not well preserved in eastern middle Sweden if not burnt, but in the island of Gotland rich finds have been made in burials, which shows the importance of these materials. Also, personal adornments like pierced seal teeth, bone beads and wild boar tusks seem to have been common judging from the burials (e.g. Burenhult 2002). At Tråsättra, fragments of burnt needles, harpoons, fishing hooks, bone points and beads made from bone and two fragments of burnt worked antler were found, showing that these materials also played an important role in the tool kit at the site (Björck et al 2020, 177 f.).

The lithic material found on Tråsättra is typical for the PWC in eastern middle Sweden in its composition and technology, but much richer than what one finds on most sites (Björck et al 2020, 149–167). Most of the raw material

is local, but contacts in all directions can be seen in the artefacts of flint, porphyrite and slate. Concerning the greenstone and sandstone, it is locally available but the lack of debris at Tråsättra show that the artefacts have been produced elsewhere and brought in.

The PWC differs from the earlier Mesolithic hunter-gatherers in the region in their use of lithic materials, mostly in the choice of stone materials and the technique used. The production and use of lithic tools seem to have been highly organized in PWC settlements, with different activities being clearly spatially separated. Through intra-site analysis it is possible to see how the production and use of different lithic tool kits was organized by different group compositions at Tråsättra; families, hunters and crafters. From a technological aspect, freehand platform technology gets more common, at the same time as the tools in general become larger and sturdier (Lindberg 2007). A lot of the tools have been made from bone and antler, probably continuing the Mesolithic craft tradition in the region.

Finally, our lack of knowledge when it comes to wooden objects, tools and constructions is problematic. Also, the lack of finds of other organic materials such as bark, bast and leather poses a problem. The fact that we know almost nothing about the skills in making and building wooden implements and constructions like handles for tools, paddles, canoes, boats and huts is an obstacle when we want to reconstruct the PWC way of living. We are usually left with just indirect evidence for the use of wood, interpreting the presence of certain types of tools in settlements and graves as indicative for wooden crafts, and indications in the form of wear use in stone and flint artefacts. Also, our knowledge of decorations of wooden tools and objects is very limited. As a result, we can just make informed assumptions about what the PWC people were capable of when it comes to wooden crafts. However, there are a few PWC sites where wooden objects and constructions have been preserved, mostly in wetlands and bogs like the pile-dwelling at Alvastra (Browall 2003) and the inland lake site at Kvarnsjön (Wertwein 2015), and some of the log-boats found in Scandinavia have a <sup>14</sup>C-dating to the Early Neolithic II and Middle Neolithic A–B. Here we can actually see that their skills were quite advanced.

## Economy and diet – hunting, fishing and gathering

Judging by the bones recovered at Tråsättra, the diet was mainly based on a variety of seal and fish species from the local area in the Mälaren Bay and the Baltic Sea archipelago. This was complemented by some species of large land mammals like wild boar, elk and deer (Table 6).

In total, 39,247 fragments and 11.2 kg of bone were retrieved, of which 8,827 fragments and 2.3 kg were selected for analysis which in turn resulted in 1,673 identified fragments, weighing altogether 1.5 kg. The material is highly fragmented which made identification difficult and 67 % is burnt (Björck et al. 2020, 167–176). In general, bones from large mammals were better preserved and easier to identify, so the percentage of these species might be somewhat overestimated. The distribution of bones shows the same pattern as for the ceramics (Fig. 20) with clear concentrations around the huts and the central activity area with cooking pits and hearths (Fig. 31). This demonstrates that waste has been deposited in cooking pits transformed to waste pits after final use, and in waste heaps close to the huts.

The most common seal species hunted at Tråsättra was ringed seal (*Pusa hispida*), constituting 67 % of the seal bones (Björck et al. 2020, 170–172). Judging from the age distribution of analysed bones, this species has mainly been hunted on sea ice in late winter or early spring, probably at the breathing holes and birth lairs (Storå 2001, 31). The other seal species hunted at Tråsättra, the harp seal (*Pagophilus groenlandicus*), constituted 33 % of the

Table 6. Tråsättra. Number and weight of animal bones.

Species	Number of fragments	Weight (g)
Seal ( <i>Phocidae sp.</i> )	744	546
Ringed seal ( <i>Pusa hispida</i> )	102	190
Harp seal ( <i>Pagophilus Groenlandica</i> )	50	93
Harbour porpoise ( <i>Phocoena phocoena</i> )	9	21
Pig ( <i>Sus domesticus/scrofa</i> )	55	546
Cattle ( <i>Bos taurus</i> )	2	3
Elk ( <i>Alces alces</i> )	5	7
Deer (Cervidae)	5	2
Dog ( <i>Canis familiaris</i> )	7	5
Fox ( <i>Vulpes vulpes</i> )	1	1
Bear ( <i>Ursus arctos</i> )	2	9
Pine marten ( <i>Martes martes</i> )	15	8
Ferret ( <i>Mustela putorius</i> )	2	1
Otter ( <i>Lutra lutra</i> )	14	12
Wild cat ( <i>Felis silvestris</i> )	1	1
Beaver ( <i>Castor fiber</i> )	21	10
Squirrel ( <i>Sciurus vulgaris</i> )	2	1
Hare ( <i>Lepus timidus</i> )	9	1
Great Crested Grebe ( <i>Podiceps cristatus</i> )	1	1
Duck (Anatinae)	13	3
Eurasian wigeon ( <i>Anas penelope</i> )	1	1
Northern Shoveler ( <i>Spatula clypeata</i> )	1	1
Eider ( <i>Somateria mollissima</i> )	1	1
Scoter ( <i>Melanitta nigra</i> )	1	1
Tufted duck ( <i>Aythya fuligula</i> )	1	1
Red-breasted merganser ( <i>Mergus serrator</i> )	1	1
Grey heron ( <i>Ardea cinerea</i> )	1	1
European eel ( <i>Anguilla anguilla</i> )	1	0.1
Herring ( <i>Clupea harengus</i> )	14	0.7
Cyprinide fish (Cyprinidae)	36	1.8
Roach ( <i>Rutilus rutilus</i> )	2	0.1
Whitefishes ( <i>Coregonus sp.</i> )	20	1
Pike ( <i>Esox lucius</i> )	278	28
Cod ( <i>Gadus morhua</i> )	14	0.7
Sculpins (Cottidae)	2	0.1
Perch ( <i>Perca fluviatilis</i> )	223	11
Sander fish ( <i>Stizostedion lucioperca</i> )	16	0.8
<b>Sum</b>	<b>1,673</b>	<b>1,512.3</b>

analysed seal bones, and judging from the age distribution, have probably been hunted during their migration from the breeding areas. Probably, the harp seals after breeding migrated from the areas around Gotland to other areas of the Baltic – the Åland Islands, the Estonian coast and the Polish coast, maybe also to the Bothnian Bay, which would have given the PWC groups in the Mälaren Bay good opportunities to hunt in open waters from canoes and boats (Storå 2001, 27).

However, more detailed studies of PWC materials have shown that the economic importance of seals probably has been overemphasized. The

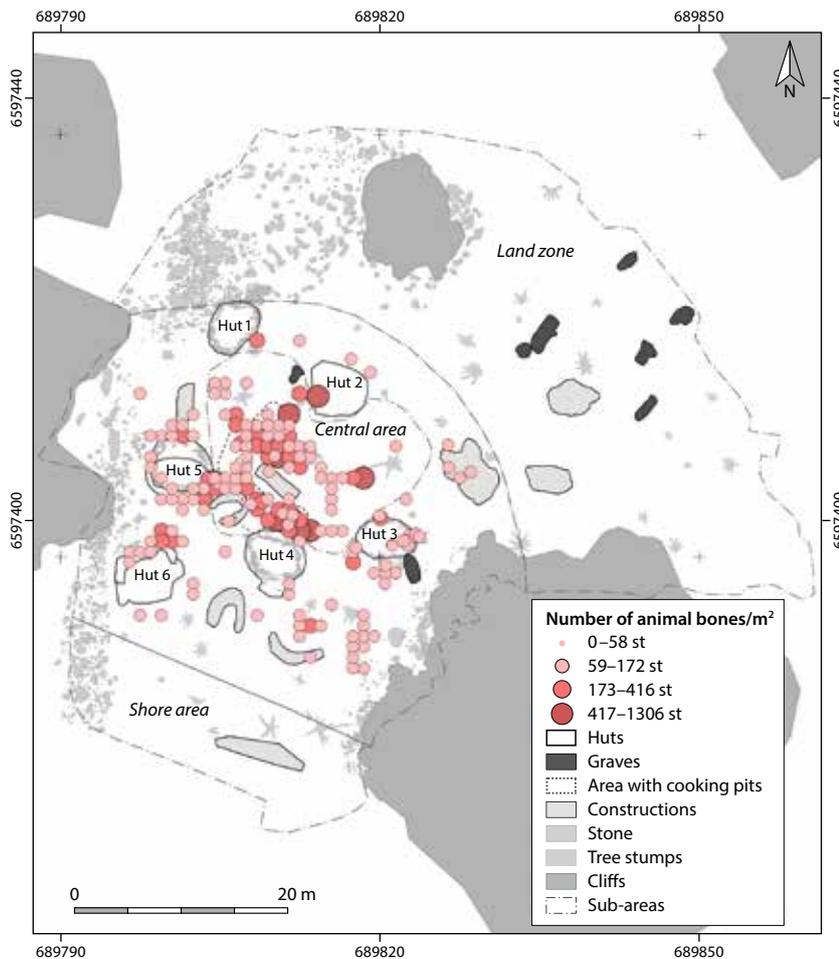


Fig. 31. Tråsättra. Distribution of bones at Tråsättra. It shows the same pattern as for ceramics with clear concentrations around the huts and the central activity area with cooking pits and hearths (Graphics: N. Björck/SHM Arkeologerna).

suggested importance of seals for subsistence has been questioned quoting preservational factors; the dense bones of seals are often better preserved than other bones, e.g. those of fish which rarely have been preserved well or recovered by using extensive water sifting. Differences in the recovery techniques employed can probably have contributed to biases in the composition of the faunal assemblages in PWC settlements (e.g. Segerberg 1999, 190; Olson 2008).

This has been confirmed by isotopic analyses of human remains from a number of PWC sites, showing that seal meat was not a dominating component in the diet (Ahlström/Price 2021). Instead, it seems that a variety of fish species was the major source of nutrition. Perhaps the driving force behind seal hunting should not be sought in dietary aspects only, seal skin was probably important for making clothes, shoes, boots and also for building skin canoes, skin boats and maybe also for the construction of huts. Other factors, like prestige and a drive for adventurous deeds, might also have been important to motivate perilous seal hunting expeditions into the open sea and over treacherous sea ice in late winter and early spring (Storå 2001, 3f.).

Also, the presence of a few bones from porpoise (*Phocoena phocoena*) indicate that this species occasionally was hunted in the brackish waters surrounding Tråsättra, or maybe further out into the open sea. Probably, this hunt was of a more opportunistic character, seizing the opportunity when it arises. All in all, the hunt for sea mammals in this part of the Baltic Sea, in archipelagos, in open sea waters and on treacherous late winter and spring sea ice, gives us a good indication of the experience and skill these PWC groups possessed as sea explorers and sailors, venturing far out in sometimes dangerous conditions in small crafts.

The hunting in the outer archipelago and at sea has also included different kinds of water fowls, like the common eider, complementing the sea mammals on a seasonal basis. In total, eight different species of water fowls are represented in the material. The hunt has probably been concentrated to spring and autumn when migrating birds have been available in great numbers in the archipelago. Also, the hunt for nesting birds and the collection of eggs in early summer on the surrounding island might have been an important contribution to the diet, based on ethnographic sources from the 19<sup>th</sup> and 20<sup>th</sup> century from the eastern middle part of Sweden and the island of Åland (Storå 2001).

As discussed above, fishing was an important part of the economy (36%), mainly focused on pike (*Esox lucius*) and perch (*Perca fluviatilis*), supplemented with herring and cod and some other more rare species like salmon, pike perch and eel (Björck et al. 2020, 172–173). Finds of fragments of fishing hooks made of bone and antlers indicate that fishing with live bait has been important, which is also indicated by the selective catch of quite large pikes. This method was probably complemented by fishing with nets, as shown by some finds of net weights made of stone. Fishing pots made of bast and thin twigs might also have been in use. Judging from the selection of species and the size of cods caught, fishing close to the beaches and islands have been the most common method, there are almost no signs of deep sea fishing.

This diet was to a lesser extent supplemented with meat from some large land-living species like elk, wild boar and bear, probably hunted in larger islands close by Tråsättra or on the more distant mainland. Some species, like beaver, utter, hare, squirrel, red fox, forest marten, iller and wild cat have probably primarily been hunted for their fur and skin, but in some cases the meat have probably also been consumed.

Indications of the presence of domesticated animals at Tråsättra consist of a few bones from dogs and two teeth from cattle. The dogs have probably been used for hunting and possibly also for tracking of sledges on the ice in wintertime. The remains from cattle could be an indication of a limited exchange of meat with BAC groups in the vicinity of Tråsättra.

Plants, roots, berries and nuts have probably been gathered in the vicinity of the settlement. To a limited extent, cultivated barley and wheat have been used at Tråsättra, but no indications of farming close by the settlement have been found. Therefore, it is highly likely that the grain has been imported from BAC-settlements in the vicinity. The finds of BAC ceramics at Tråsättra could be a sign of the transport of grain in these vessels. Probably, the grain has been considered as an exclusive part of the diet, maybe used to make exotic food like porridge and flat bread, and possibly alcoholic beverages consumed at seasonal feasting events.

The rich finds in ceramics representing a varied set of vessels of different forms and sizes at PWC settlements in the eastern middle part of Sweden indicates the importance of pottery. The presence of large vessels in the Tråsättra settlement shows the significance of storage of food stuffs, exploiting resources when they produced maximum exchange for invested efforts in hunting, fishing and gathering. Also, processing of different kinds of food in large vessels, like fermenting, probably played a crucial role in supporting livelihood during late autumn, winter and early spring. However, the evidence for fermenting in the lipid analysis of PWC pottery is still lacking, why new methods must be developed and applied in future research.

### Burial customs and the graves at Tråsättra

The area of the earliest settlement at Tråsättra (phase 1) was transformed into a small cemetery containing six inhumation graves during phase 2 (Fig. 32).

The cemetery at Tråsättra was placed on a small, sandy slope and consisted of six inhumation graves of different size, shape and depth (Table 7). Unfortunately, neither bones nor teeth were preserved, but the mutual position of the graves, the size and shape of the features, and the construction with stones placed along the edges, and in some instances also with stones placed on top of the features, implies that an interpretation as graves is highly likely. Also, the presence of a limited number of grave goods and colourings with red ochre in some of the features further supports this interpretation (Björck et al. 2020, 95–99). The reason why the human bones have not been preserved can probably be explained by the high acidity in the moraine. In contrast, the number of animal bones is relatively high in the central part of the settlement, probably due to the large concentration of bone material which has worked as a self-preservative factor, keeping the content of lime in the soil high over time. Also, 67 % of the animal bones had been burnt, improving the preservation conditions for the bones radically.

Grave A1109 (Fig. 33) and A5134 have been placed close together and can probably be seen as interconnected, maybe by family relationship or temporal proximity (cf. Wallin 2016). Surrounding the two graves were nine postholes, placed so that they formed an oval,  $4.6 \times 3.0$  m large shape. This has been interpreted as either the remains of a ritual, post-built construction erected at the burial, or a dwelling hut from phase 1. Maybe the two deceased had been living in the hut before it was transformed into a burial monument, left to decompose or actively destroyed as a part of the burial rituals. This could mean that A1109 and A5134 were the first graves constructed at the site, maybe when the main settlement, phase 2, was initiated.

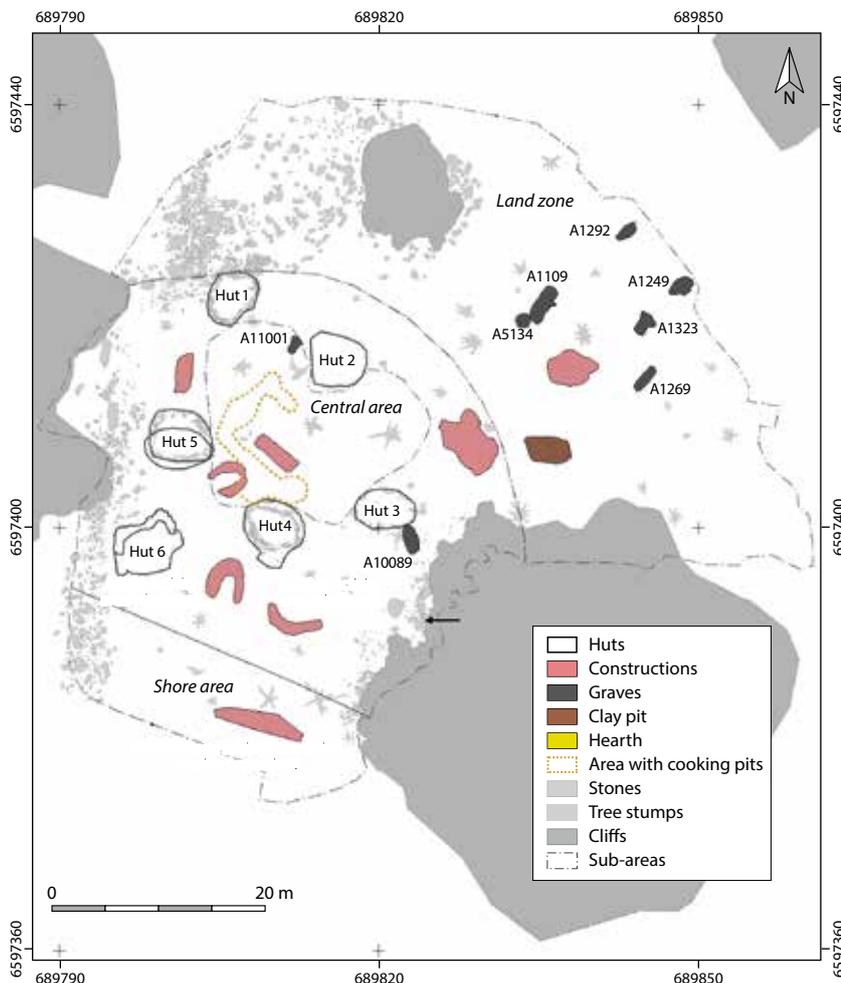


Fig. 32. Tråsättra. Distribution of human burials. Six graves were found in a small cemetery in the northeastern part of the site, and two were found close to huts in the central part of the settlement (Graphics: N. Björck/SHM Arkeologerna).



Fig. 33. Tråsättra. Grave A1109, layer 2 from southwest after the stone packing had been cleaned up (Photo: M. Artursson/SHM Arkeologerna).

Another burial that had postholes in close connection was A1249. Centrally in the grave a posthole, 0.43 m in diameter and 0.3 m deep, had been dug, probably in connection with the burial. Just to the north of the grave, yet another posthole, 0.2 m in diameter and 0.2 m deep, was identified.

Grave A1269 had a thin layer of red ochre in the bottom. It also had postholes placed in and close by the burial. In the northern part of the grave, a posthole with a diameter of 0.16 m and a depth of 0.16 m was found, and along the western long side three postholes, 0.18–0.4 m in diameter and 0.12–0.42 m in depth, placed in line were identified.

Centrally placed in the small cemetery, a 4.8 × 3.6 m large and 0.05 m thick cultural layer, A1140, was found. It had an oval shape, was surrounded by postholes and had a weak colouring of red ochre, giving it a hut-like impression (Fig. 6). The size and shape and the fact that it had surrounding postholes implies that this actually could be the remains of a hut, possibly constituting a part of the first settlement, phase 1, at Tråsättra. It is possible that this hut had a ritual function during the initial phase, based on the presence of an L-shaped post-built construction to the west of the hut, similar to the one close by hut 3, the ritual hut used during phase 2 (Fig. 6). The post-built construction would have demarcated the house from the rest of the settlement. A similar demarcation has been excavated at Bollbacken (Artursson 1996; 2006). Maybe the graves in the small cemetery had been placed with the old ritual building placed in the centre, connecting to the old settlement and the ritual activities of the ancestors?

In addition to the six graves in the cemetery, another two inhumations were found inside the main settlement itself, dated to phase 2. Close by hut 2 an inhumation, A11001, was found placed along the western wall, implying a close connection between the hut and the burial. The grave had a heavy colouring of red ochre and the cut was marked with stones of varying size (Fig. 34). Adjoining the eastern side of the grave, a black and sooty bulge interpreted as a hearth was found in the northern part, and a

Table 6. Tråsättra. Human burials.

Grave	Size	Depth	Direction	Finds	Comments
A1109	3.80×1.50 m	0.40 m	NE-SW	Miniature ceramic vessel, fragment of anthropomorphic clay figurine, worked quartz	On the eastern side of the cut for the grave a 0.5 m large bulge was identified. Centrally in the grave, a 0.67×0.65 m large concentration of red ochre was found. The grave is surrounded by a post-built construction.
A5134	1.40×1.35 m	0.24 m	-	-	Placed directly southwest of A1109, and probably closely connected to this burial. Both graves are surrounded by a post-built construction.
A1249	2.30×1.65 m	0.26 m	NE-SW	-	On the southern side, an interconnected bulge, 0.8 m in diameter was found. Placed centrally in the grave a post-hole, 0.43 m in diameter and 0.3 m deep, was identified. North of the grave, another posthole, 0.2 m in diameter and 0.2 m deep, was found.
A1269	3.00×1.10 m	0.22 m	NE-SW	One core of quartz and one of greenstone	A thin layer of red ochre was found at the bottom of the burial. In the northern part of the grave a posthole with a diameter of 0.16 m and a depth of 0.16 m was found, and along the western long side three postholes, 0.18–0.4 m in diameter and 0.12–0.42 m in depth, placed in line were identified.
A1292	2.00×1.00 m	0.10 m	NE-SW	-	Stones just placed along the cut of the grave. A posthole was identified 1.8 m to the south of the grave.
A1323	2.50×1.00 m	0.40 m	NE-SW	Fragment of a anthropomorphic clay figurine	Some colouring of red ochre in the fill. A separate, shallow pit, 0.6 m in diameter and 0.1 m deep, was identified in the northern part of the grave. Along the eastern long side, a 0.6×0.5 m large and 0.2 m deep bulge was identified. Just to the north of the cut a stake hole was found.
A10089	2.25×1.20 m	0.70 m	N-S	Two fragments of anthropomorphic clay figurines, greenstone fragment, unburnt and burnt animal bones.	Placed close by hut 3, interpreted as a cult/death house. Colouring of red ochre in the fill. Stones of varying size placed along the cut of the grave.
A11001	1.67×0.70 m	0.54 m	NE-SW	Large numbers of fragmented ceramics and burnt animal bones interpreted as secondary waste from the settlement deposited when the grave was refilled.	Heavy colouring of red ochre. The cut of the grave was marked with stones of varying size. Adjoining the eastern side of the grave, a black and sooty bulge interpreted as a hearth was found in the northern part, and a post-hole with the same colouring was identified in the south.

posthole with the same colouring was identified in the south. These two features can probably be interpreted as traces after the burial rituals. The number of finds in the fill was large, but they can all be interpreted as secondary waste from the settlement deposited when the grave was refilled. No *in situ* grave goods or human bones could be identified.

The other grave inside the settlement, A10089 (Fig. 35), was found close by the southwestern part of hut 3, which has been interpreted as a cult/death-house (see above).

As we have seen, almost all burials have postholes placed inside the graves or close by. In some cases, the postholes have been placed in a line or forming an oval construction of some kind. This implies that standing wooden poles and post-built constructions have played an important role in the burial tradition, and also in ritual activities in the settlement, in connection with the cult/death house. Interestingly, this is quite common in other PWC cemeteries and settlements in the Baltic Sea area, which shows that the erection, and maybe also the carving and decoration of standing wooden poles, must have been a common element in rituals and religious notions (e.g. Burenhult 2002; Artursson 2006; 2007a; 2007b).

Another interesting trait that could be identified in graves A1109, A1249 and A1323 was the presence of ca. 0.4–0.8 m large bulges on one of the long sides, constituting small, separate chambers attached to the graves (Fig. 33). Something similar could be identified in grave A11001, placed close by hut 2, but here the bulge was filled with black and sooty soil and some fire-cracked stones, and therefore interpreted as a hearth (Fig. 34). What these bulges have been used for has not been possible to clarify, but they might



Fig. 34. Tråsättra. Grave A11001 from southwest (Photo: M. Artursson/SHM Arkeologerna).

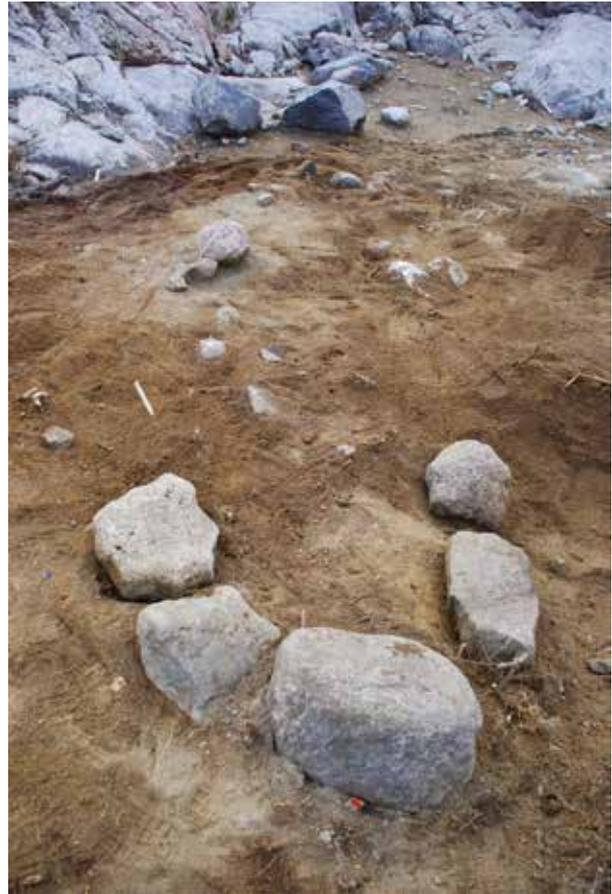


Fig. 35. Tråsättra. Grave A10089 from northwest (Photo: F. Larsson/SHM Arkeologerna).

have harboured some kind of grave goods, maybe food, placed there in honour for the deceased. Such additional deposits are common at the cemetery at Ajvide on Gotland where they mainly include pig bones or sometimes artefacts (Wallin 2016, 416–419).

Usually, there are human bones scattered in the culture layers in the PWC settlements and cemeteries (Andersson, H. 2004), but this was not the case at Tråsättra. In spite of the evidence of inhumation burials at the site, no human remains could be identified. This can probably be attested to the bad preservation of unburnt bones in the acid moraine soil in the region.

### The clay figurines – function, meaning and ritual importance

In total, 329 fragments of clay figurines with a weight of 1.76 kg were found at Tråsättra. These fragments represent at least 100 complete clay figurines. This is the largest number of clay figurines ever retrieved in a PWC settlement in Sweden. The material is large and varied and was found distributed over the whole central part of the settlement (Fig. 36). Three categories of clay figurines were found; humans, animals and mixed creatures with combined traits of both humans and animals. There are also more abstract figurines which cannot be identified. As no whole figurines have been found, they have probably intentionally been destroyed, maybe as part of rituals performed in the settlement. The finds of clay figurines in the graves at Tråsättra are few, just two fragments from the cemetery were recorded (Björck et al. 2020, 146–147).

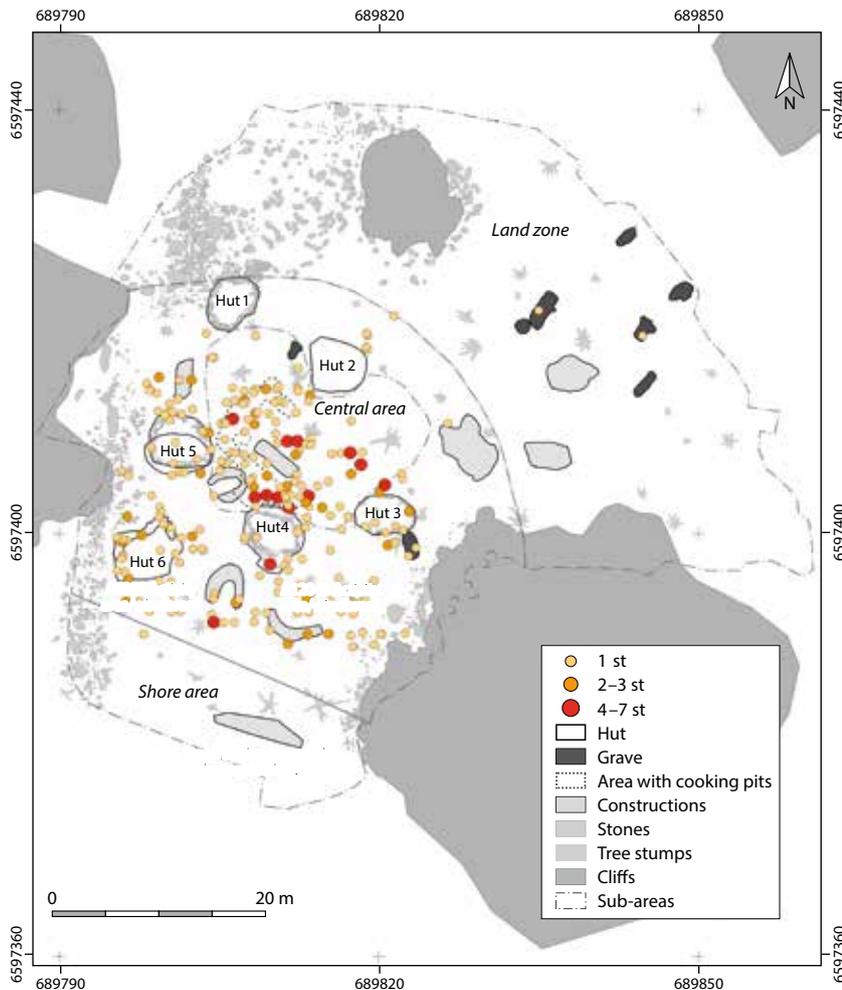


Fig. 36. Tråsättra. Distribution of parts and fragments of clay figurines (Graphics: N. Björk/Arkeologerna).

An unusually large number of the figurines from Tråsättra depict humans (Fig. 37). This distinguishes Tråsättra from other contemporary PWC settlements in eastern middle Sweden because it is usually zoomorphic figurines that dominate (Table 8). The only other settlement that shows almost the same number and variation when it comes to depictions of humans is Jettböle on the island of Åland (Cederhvarf 1912). Interestingly, identical depictions of humans have been found at these two sites, showing close cultural bonds between these regions. The distance between them is ca. 80 km over open sea, demonstrating the maritime knowledge of these regional groups.

A large number of the antropomorphic figurines presents images of men placed in an adoring position, looking up towards the sky (Figs. 38–39). This could imply that this type of figurines depicts shamans performing some kind of ritual, summoning spirits of the sky. An interesting detail in some of these figurines is that they have small holes, 1.0–1.5 cm deep, placed on top of the head. Some figurines have two and other up to eight holes. These holes have probably been used to attach some kind of decorations on the heads of these small depictions of humans. They could, especially in the cases with two holes, be depictions of horns, not uncommon in shamanistic settings (Björck 2003). Maybe, they stemmed from inserting bird feathers, at least judging from the pointed shape of the holes in one of the figurines (Fig. 40).

A fascinating figurine from Tråsättra depicts a woman with clearly marked breasts, clothes decorated with small impressions placed in lines that might represent some kind of beads or animal teeth attached to her dress as decorations, and a fishtail-like foot end (Fig. 41). An almost exact copy of this figurine has been found at Jettböle on Åland, which makes it likely that they are



△ Fig. 37. Tråsättra. Selection of clay figurines depicting humans or human-like creatures. From above right to left Fnr 77, 33, 93, 118, 133, 136, 62, 3, 24, 95, 17/70 and 55/54 (Photo: N. Björck/SHM Arkeologerna).



◁ Fig. 38. Tråsättra. Clay figurine, Fnr 3/98, depicting a human looking upwards. Notice the poriferous ware which is typical for the late PWC ceramics (Photo: N. Björck/SHM Arkeologerna).



Fig. 39. Tråsättra. Clay figurine, Fnr 95, depicting a human in an adorant position with eight small holes placed on top of the head (see Fig. 40) (Photo: N. Björck/SHM Arkeologerna).



Fig. 40. Tråsättra. CT-scan of the head of clay figurine Fnr 95 (cf. Fig. 39) with hole no. 4. The yellow shapes show the profile/shape of four of the small holes from CT-scanning. Notice the pointed shape of the holes, probably indicating that bird feathers have been attached here (Photo: C. Ericson, Interspectral AB/N. Björck, SHM Arkeologerna).

identical representations of some kind of common spirit or goddess worshipped by both these regional PWC groups (Cederhvarf 1912).

Generally, all anthropomorphic figurines have some kind of small impressions placed in lines or drawn lines on their bodies, probably representing details in clothes or decorations applied to the clothes. Also, several of the faces of the human-like figurines have lines drawn in clear patterns that could be representations of hair, beards or possibly tattoos. In many cases the chin of the adorants is very clearly marked and protruding, which could be representations of beards.

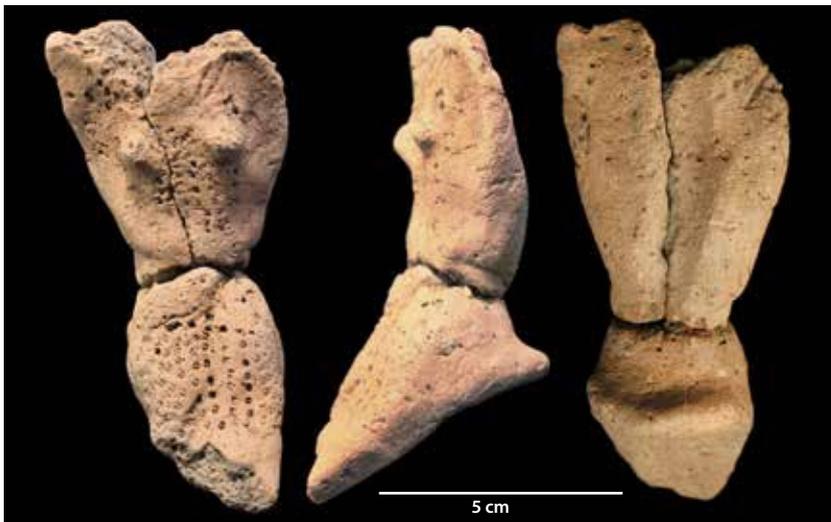


Fig. 41. Tråsättra. Clay figurine, Fnr 62, depicting a woman with clearly marked breasts, clothes decorated with small impressions placed in lines that might represent some kind of beads or animal teeth attached to her dress as decorations, and a fishtail-like foot end (Photo: N. Björck, SHM Arkeologerna).

Table 7. Tråsättra. Types and motives of clay figurines.

Motive	Number of fragments	Total weight (g)	Mean weight (g)
Human	204	1269	6.22
Seal	28	125	4.46
Pig	19	61	3.21
Elk	9	26	2.88
Bear	6	69	11.5
Seabird	4	11	2.75
Snake	3	2	0.66
Total	273	1563	5.73

The zoomorphic figurines are varied in motive and size (Fig. 42). The most common animal represented are seals, followed by pigs, elks, bears, sea-birds and snakes (Table 8). This set of figurines mirrors quite well the existing fauna in the archipelago and the animals hunted at Tråsättra during the late Middle Neolithic. Interestingly, no fishes have been depicted in spite of pike, perch and herring being important elements in the diet. Could it be that fish have not played any major role in the PWC religion and rituals? Also, there are no figurines clearly depicting dogs, which is quite strange considering that canines often get special treatment and even burials of their own in other hunter-gatherers groups (Larsson 2009a, 332–334).

Almost all the clay figurines are of a poriferous ware, which is also typical for the late PWC ceramics (see above), so the production of figurines seems to have followed the same technique and principles.

As mentioned earlier, the distribution of figurines is quite uniform over the whole central part of the settlement at Tråsättra, though a moderate concentration around the common cooking area could be discerned. Interestingly, there is no concentration of figurines at the ritual area or the cult/death house (Fig. 36). This makes it hard to interpret the meaning and function of the figurines, but as the anthropomorphic depictions seem to



Fig. 42. Tråsättra. Selection of zoomorphic clay figurines. From above, left to right Fnr 8, 51, 20, 113, 87, 91, 76/114 and 128 (Photo: N. Björck, SHM Arkeologerna).

portray some kind of stereotype set of shamans in an adorant position and a female spirit or goddess with a fishtail-like foot end, it is likely that these small clay representations had a religious and ritual function.

The mixed animal/human figurines often have a seal-like appearance, which could be interpreted as a sign of notions about a close relationship between man and seal, and maybe of a common origin in the sea, possibly playing a vital role in a mythological creation story (see discussion below).

As the set of zoomorphic figurines at Tråsättra seem to depict the actual fauna in the archipelago, though with some exceptions, it is likely that they have had some ritual function in hunting magic. Also, notions of totem animals could have played a role in the production and use of the figurines (Björck 1997; 2003; 2007a).

Interestingly, there is some variation in the composition of different types of figurines if the individual activity areas and huts are studied as separate units. Some of the huts have a varied set of figurines, while others have a more homogenous composition (Fig. 43). This could be interpreted as an indication of the existence of individual, family-based totem animals (Björck et al. 2020, 217 ff.).

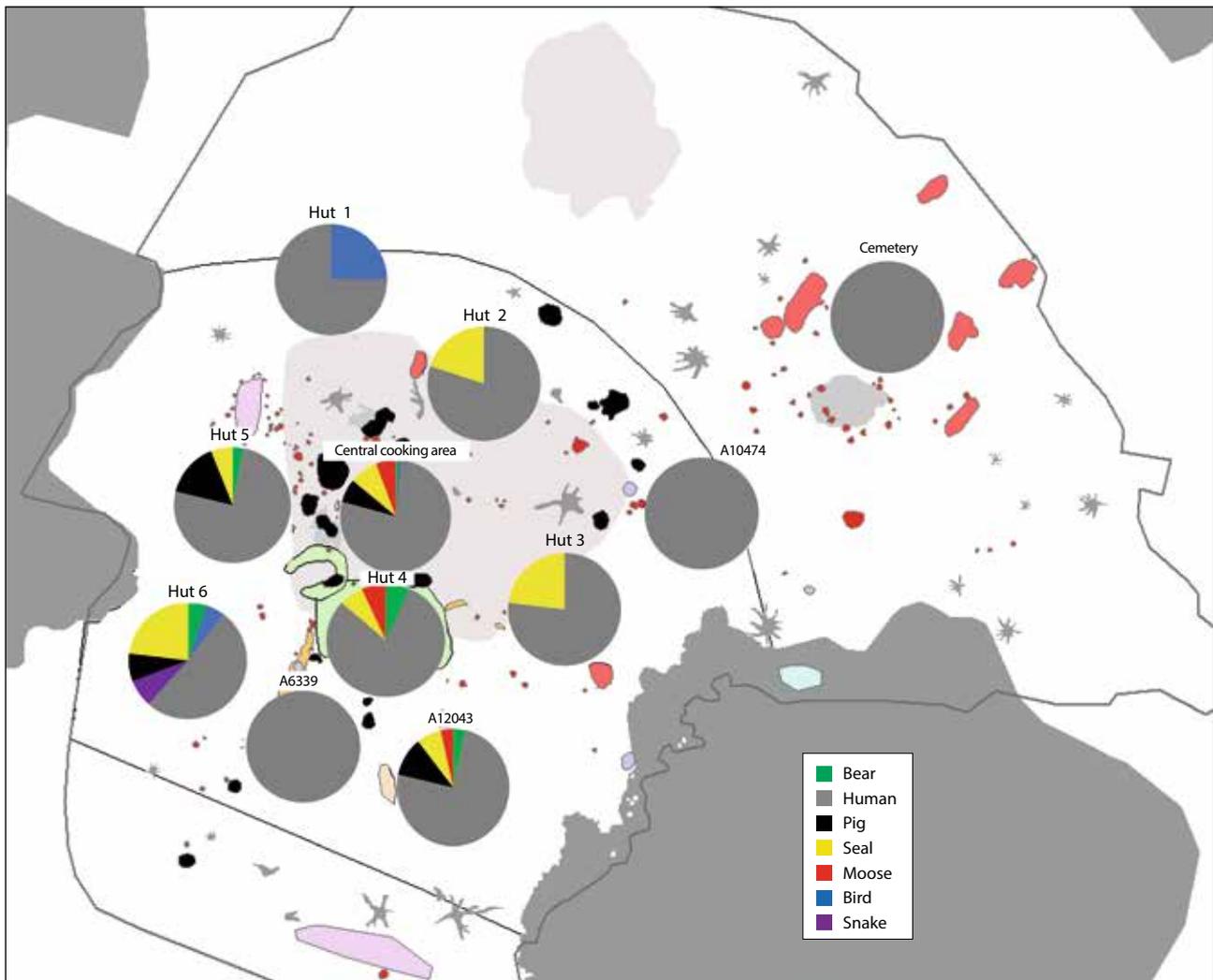


Fig. 43. Tråsättra. Distribution of clay figurines divided by individual activity areas and huts (Graphics: N. Björck, SHM Arkeologerna).

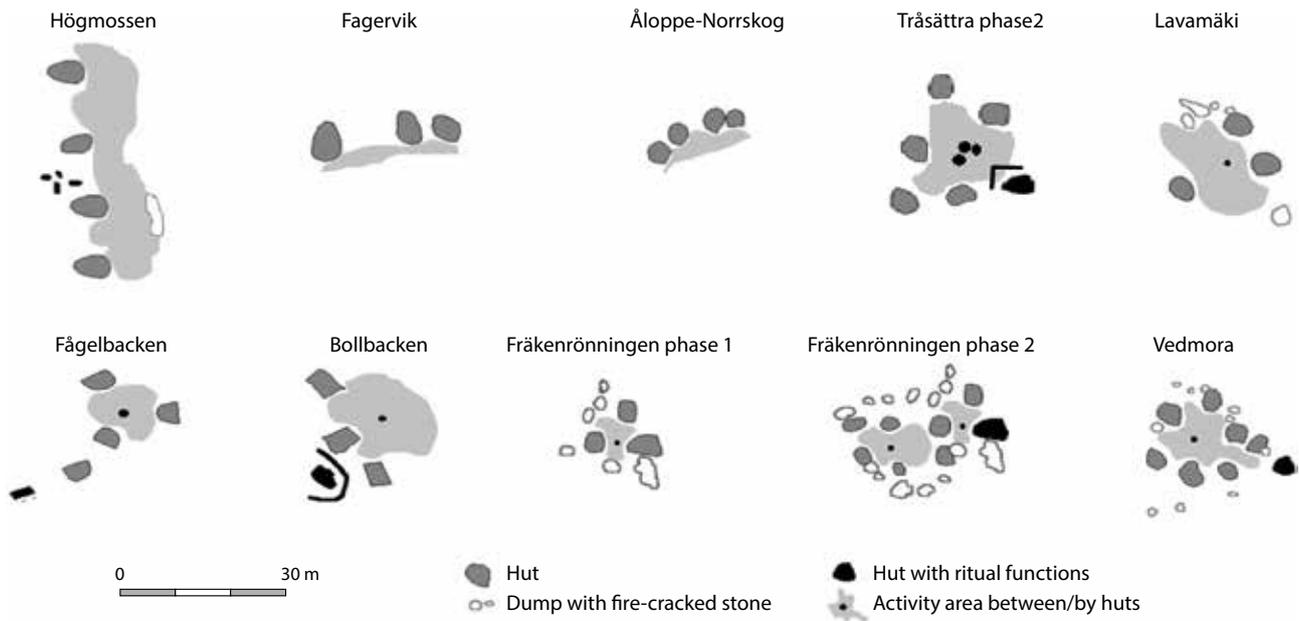
## Life and death in PWC societies

### Settlement patterns

Traditionally, Neolithic coastal settlements in the region have been assumed to suffer a total lack of spatial organisation, which otherwise commonly appear in more or less all cultures, based on anthropological research. The regularities one has in mind are those connected with the human ability to create types and achieve the same forms repeatedly, i.e. those conditions which are the basis of all typological reasoning. Such regularities can be observed in building traditions during most periods of prehistoric and historic times, as well as in settlement organisation among ethnographically recorded societies (Lindholm/Vogel 1996, 76 ff.; Lundberg 1997; Loeffler 1999; Tilley 1999, 46).

During the 1990s the image of Neolithic coastal settlements in southern Norrland and eastern Sweden as structureless occupation layers was fundamentally challenged based on results from large-scale research and contract archaeology excavations, and now there is much more material giving a completely different picture<sup>3</sup>. The coastal settlements excavated on a large scale usually consist of a number of freestanding huts, usually 3–8 dwellings grouped round a common open space with hearths and cooking pits or in a line (Fig. 44). Normally, it can be assumed that all the dwellings have been in use at the same time. When necessary, they have been

<sup>3</sup> Halén 1994; Artursson 1996; 2006; 2007a; 2007b; Björck 1997; 1998; 2003; Hallgren 1997; Pappmehl-Dufay 1999; Björck/Björck 1999; Hallgren et al. 1995.



repaired or replaced by new ones in roughly the same place, and this indicates that these sites have had a permanent organisation and that they in most cases have been in use for a considerable amount of time, approximately 100–150 years.

There are great variations in the way anthropologically recorded hunter-gatherer groups organise their settlements. If, however, one studies actions and behaviour in a more general way, it is possible to break down the variants in structures and make them comparable. Such a procedure shows that diversity is often a matter of variations on a common theme. Cross-culturally, fairly generally occurring characteristics are that settlements are formed by a combination of public spaces and individual family or household areas. The household, therefore, usually has a private sphere around the individual dwelling. These individual or family areas are orientated towards a public central area where the community spends much time together performing communal activities (Lindholm/Vogel 1996, 76). The settlement organisation observed among the PWC groups is thus a variation on a theme well known from anthropological studies.

Comparative anthropological material has shown that an important factor behind the form of dwellings used in a settlement is the length of time one plans to stay in a place. Small band communities aiming to live only for a short time in a place sometimes build a communal house for the whole group. If, on the other hand, one intends to stay for a longer period, each household usually builds its own dwelling (Lindholm/Vogel 1996, 76).

Osteological analysis from several Neolithic coastal settlements shows that fish, seal and wild game have been caught and hunted during all seasons of the year (Björck 1998; Björck/Hjärtner Holdar 2008, 190; Bäckström 2007, 174). The abundance of ceramics on large PWC sites like Tråsättra implies a delayed return economy with storage facilities like ceramic vessels, pointing towards a sedentary population living in central base camps, supplemented by smaller settlements with less finds for special activities. This assumption is also supported by the fact that hunter-gatherers/foragers in some ecologies, for example along coastlines and in archipelagos, like the ones PWC groups were living in, can more easily support all-year round settlements. Maritime resources are more predictable and less easily depleted, which means that they recover more quickly. Under these conditions hunter-gatherers/foragers typically show reduced mobility. Thus, it can be seen that high mobility correlates with lower population density,

Fig. 44. Three types of basic organisation of coastal settlements in southern Norrland and eastern middle Sweden: huts placed in a line, half circle or in a circle with an adjoining communal area with hearths and cooking pits (cf. Fig. 18; after Artursson 1996; Segerberg 1999; Björck 2007b; Björck/Hjärtner Holdar 2008; Kihlstedt et al. 2007; graphics: N. Björck, SHM Arkeologerna).

lower food availability and less dependence on fish and other maritime resources (Gallagher et al. 2019).

Three different types of basic spatial organisation of coastal settlements have been identified; huts placed in a circle, half circle or in a line with an adjoining communal area with hearths and cooking pits (Fig. 44). There is thus a basic structural similarity between all these coastal sites: the huts as the private sphere are grouped in a way which creates prerequisites for a common central sphere for communal activities centered around or close by hearths and cooking pits. Outside the circle, half circle or line of dwelling huts, there are in several cases specially constructed huts with a specialized ritual function (Artursson 1996; 2006; 2007a; 2007b; Björck 1997; 1998; Björck/Björck 1999). This could be interpreted as an indication that ritual activities were, at least to some extent, spatially separated from the everyday living space.

The housing discussed here indicates that the huts in the coastal PWC settlements in eastern middle Sweden were used by separate households. Almost no traces of fireplaces have been found inside the PWC huts, but heating might have been provided, when needed, by the use of heated-up stones carried in from the outside, maybe complemented with the burning of oil made from seal blubber, though no traces of this have been found so far (Storå 2001). Therefore, these small huts can be described as “sleeping spaces”, while the surrounding dwelling areas are, to judge by the evidence so far, just as much part of the dwelling space as the huts themselves. Activities such as cooking, eating and socializing can be assumed to have taken place in the areas surrounding the huts. This means that the huts, despite their relatively small size, probably have functioned as dwellings for family units, constituting the basic social units in the local PWC groups (Björck 1997; 2003; Artursson 1996; 2006; 2007a; 2007b). Excavations of graves connected to PWC have shown that they contain both children and men and women of all ages (Wallin 2015, 49; 53; Björck 2007a, 280). Also, both the character of the dwellings and the composition of the osteological material indicate that these settlements have been used by a demographically complete society all year round (Björck 1997; 2003; 2007c, 229 ff.; Bäckström 2007, 173 ff.).

Judging from the organization and structure of the base settlements, the fundament of society was the family unit living in individual huts. This was the basic social unit, organised into base settlements consisting of 5–6 family units, comprising ca. 30–35 individuals. The spatial distribution and the variation in size and organization of settlements as well as the wide range of animals and fish species found in the large PWC sites underlines the interpretation of them as all year round settlements.

### **Burials and cemeteries of the PWC**

A large number of PWC graves have been found, but the material is completely dominated by the burials found in large cemeteries on the island of Gotland, where the preservation is excellent due to the limestone bedrock and over 200 graves have been excavated (e.g. Burenhult 2002; Fahlander 2003; Wallin 2015; Sjöstrand 2022). The number of graves found in other regions is quite limited, which creates a range of problems. However, the graves excavated on the Swedish mainland seem to have large similarities with the majority of the ones found on Gotland.

The PWC burial tradition seem to have been quite homogeneous, however with some local or regional variation. The large majority of burials are single inhumations with the deceased placed in an extended position on the back in relatively shallow graves. Some double or triple inhumations have been found, mostly in cemeteries on Gotland (for more details on burial practises on Gotland see Wallin 2015). A few cremations have been

identified, closely connected to a cult/death house placed in a specialized ritual activity area in the late Middle Neolithic settlement at Bollbacken (Artursson 2006; 2007a; 2007b).

In several regional PWC groups in the Baltic Sea area, some graves have been placed inside the settlements, often inside or close by dwelling huts or other types of buildings with a specialized ritual function, though the majority of the deceased have been buried in cemeteries of varying size and complexity. The cemeteries have been placed both close by settlements and more separated from the world of the living (Björck 2007a). Why there are all these different types of locations for burials is hard to explain; the ones inside or very close by dwelling huts still in use and burials in separate small or large cemeteries might carry some contrasting and different religious and ritual meaning, depending on how the dwelling itself is perceived and interpreted ideologically in the individual culture (Hodder 1984).

Interestingly, in general there are actually several cases where deceased have been placed under floors in dwelling huts or very close by huts still in use during European prehistory (Bagge 1938; Knutsson 1995, 185–187). Why the dead have been placed so close to the living is hard to explain, but it is not unusual to see these kind of domestic burials of close relatives in ethnographic studies. The close proximity between the living and the dead seem to carry an important and significant universal human meaning, maybe attached to emotional and social notions closely connected to some kind of worship of ancestors and domestic spirits, good or evil (Carlie 2004).

Signs of manipulation of the dead have been documented in several PWC cemeteries. Some kind of skull cult and the use of human bones in rituals can be seen both in eastern middle Sweden and on the island of Gotland. In some of the burials on Gotland the heads of the deceased have been removed some time after the burial. Also, symbolic manipulation with teeth and human bones have been identified in one of the inhumations, where the skull of the deceased has been removed, his teeth chiseled out and put back in the grave in correct anatomical order, but with his canines replaced by small finger bones from seal or pig. Probably, these manipulations of human bones and especially human skulls can be attributed to some kind of ancestral cult. In combination with signs of butchering of human bodies and marrow splintering of bones, this shows that the PWC had an interest in processing the remains of their fellow group members in different ways after death and perhaps also that they were practicing some form of endo-cannibalism (Burenhult 2002; Andersson, H. 2004; Artursson 2006; Larsson 2009a; 2009b; 2009c; Samuelsson/Ytterberg 2003).

### Ritual buildings – cult and death houses

In some of the PWC settlements specialized areas for ritual activities and cult or death houses have been identified, similar to that at Tråsättra. The structure and organization of these ritual activity areas seem to follow a certain pattern which implies the existence of a common formalized ideology between the regional PWC groups. Often, these areas have been placed 5–10 m outside the central dwelling areas, and in some cases they have been separated with wooden poles or fences.

At Bollbacken, just outside the city of Västerås, a similar structure was excavated in 1993. An oval trench for the wall had been dug, and in this trench traces of postholes for wooden poles or planks with stone packings were identified (Artursson 1996; 2006; 2007a; 2007b). Inside the hut two sturdy postholes for wooden poles were found, placed away from the entrance, close to the far gable. In front of them, two flat stones had been placed, probably constituting some kind of small offering altars directly connected to the wooden poles. Inside the hut scattered, burnt animal and human bones were found. The hut

was placed in a specialized ritual area, separated from the dwelling area by a semicircular formation of wooden poles placed in postholes. Surrounding the detached hut, some cooking pits, hearths and deep postholes containing fragments of burnt animal and human bones were identified. Interestingly, just a couple of metres away from the hut, a cremation grave with the burnt bones from three or four adult humans and a mid-sized dog were found. The grave had been marked with a wooden post placed in an adjoining posthole. This is the only cremation grave connected to the PWC found so far. Maybe it was inspired by the BAC in the region; a somewhat similar and contemporary death/cult house with at least 16 cremation graves connected to the BAC was excavated at Gläntan, Turinge in Södermanland, approximately 65 km to the southeast of Bollbacken (Lindström 2006).

At Fräkenrönningen in Gästrikland, southern Norrland, a special type of ritual building, hut VII, was excavated in the eastern part of a PWC settlement. It was a part of a well preserved, large settlement with at least six contemporary dwelling huts placed around an open area. Hut VII had some similarities with the dwelling huts, but it was double the size. Inside the hut, along the western gable an inhumation grave with red ochre and fragments of tooth enamel had been placed. The hut has been interpreted as some kind of cult/death house (Björck 1998; 2003).

A similar hut interpreted as a cult/death house has been excavated in a PWC settlement at Vedmora in Hälsingland, southern Norrland. Interestingly, the Vedmora settlement had a similar lay-out as Fräkenrönningen: in this case seven dwelling huts were placed around an open space and the cult/death house was situated outside the central settlement area, to the east (Björck/Björck 1999).

Another feature found in some PWC settlements and cemeteries are buildings or other ritual constructions connected to certain animals, and at several sites animal bones have been used in a ritual or symbolic manner. For instance, at Högmossen and Fräkenrönningen cranial bones and antlers from elk were found in the shore area, and at Korsnäs in Södermanland, a dog skull with a clay bead inserted in one of the eye sockets was found in a pit together with a lower jaw from a human (Olsson et al. 1994, 22; Björck 1998; Björck/Hjärtner Holdar 2008). In a settlement at Brännpussen, Uppland, a special building with concentrations of cranial bones from beaver has been excavated. This settlement might have been a specialized site or a hunting station for beaver. Maybe the building had some kind of ritual function in connection with the hunting expeditions, possibly connected to notions about the beaver being a totem animal (Nilsson 2006, 57).

The so called "seal altar" at the Ajvide cemetery in Gotland is a possible parallel to death/cult houses or cult areas on the mainland (Burenhult 2002; Österholm 2002). Centrally placed in the large cemetery at Ajvide a large area, 22 × 10 m, consisting of black, greasy soil containing large quantities of soot, charcoal and fragmented animal bones and ceramics was excavated. It has been interpreted as a ritual structure of some kind, maybe an altar or building placed centrally in the Ajvide cemetery. Large numbers of postholes around the graves and the black central area have been presumed to be traces of wooden constructions or large standing wooden poles.

### Cosmology, ideology and religion – explaining the PWC world

Given the clearly visible land rise in the central Baltic Sea area, stretching indefinitely over generations, land was constantly being born out of the sea. Therefore, it is highly likely that the PWC groups in the region had some kind of notion about the sea as the origin and creator of everything, and the seals as important liminal land and sea living creatures, bridging the elements and the different realms of existence (e. g. Storå 2001, 49 ff.). Maybe,

seals were perceived as primeval creatures closely connected to the creation of the world and even as ancestors to man, why the hunt for seals might have been heavily embossed with rituals and hunting magic.

In this context, it is interesting to see that some of the clay figurines from Tråsättra have clearly mixed features of humans and seals and possibly also other animals, suggesting the existence of mythical creatures, spirits and gods appearing in a mixed human/animal harbor. Therefore, animistic notions where everything is interwoven and closely connected, probably were of great importance. Also, notions about totem animals could have played an important role in the ideology and religion of the PWC groups (Björck 1997; 2003; 2007a).

Ritual deposits of ceramic vessels, flint and stone tools and animal and human bones in PWC settlements imply a culture rich in religion and mythology. The formalised cult areas with special buildings for ritual activities and the cemeteries placed close by the world of the living give a vivid picture of the PWC people. Manipulation of the dead and the special treatment of certain body parts imply the existence of a skull cult and also perhaps ancestral veneration in combination with endo-cannibalism (Artursson 2006; 2007a; 2007b; Larsson 2009c; Samuelsson/Ytterberg 2003).

In band communities<sup>4</sup>, social relations are usually maintained in everyday life rather than through well-structured rituals and rules. Most anthropologically studied hunter-gatherers groups of less complex type therefore do not have special places or buildings for ritual use in settlements. We can, then, interpret this as an indication that the PWC societies in the studied region were more complex, and that the population in the coastal settlements would have had common ideological institutions and rituals, and probably also ritual specialists. Bearing in mind the lifestyle and, for instance, common artefacts such as clay figurines in the PWC groups, the existence of an animistic belief system and shamans should be considered (Björck 1997; 2003). The clay figurines appear to be a late technological innovation that probably is related to the introduction of ceramics into the hunter-gatherer groups in the early Neolithic. However, the cosmography has been widely in use already during the Mesolithic, but at this time carved in bone, amber, stone and probably most prominently in wood (Wyszomirska 1984; Lindqvist 1994; Björck 2007a, 294 ff.; Irsenas 2010). The use of this cosmography is another indication of the genealogy of PWC hunter-gatherer groups such as at Tråsättra.

The PWC can be seen as a ritual and cultural concept where shamanistic rituals and animistic religion in combination with more complex religious and ideological ideas have been of importance (Björck 2003; 2007a; Artursson 2006; 2007a; 2007b; Larsson 2009c; Andersson, A.-C. 2015; Wallin 2015). The use of ritual constructions like cult and death houses and standing wooden posts with ritual deposits of ceramic vessels close by shows the presence of a formalized and structured ideology in settlements and cemeteries.

Furthermore, the spatial separation of the cult- and death huts/houses from the dwelling huts and cooking areas could be a sign of the existence of religious and ritual specialist in the form of shamans in the PWC. This in turn could imply the existence of some kind of "secret societies" where exclusive knowledge was passed on to aspiring shamans and leaders (Hayden 2018). Interestingly, it has been shown in ethnographic studies that the development of food storage is directly related to the emergence of professional religious specialists and specialised ritual constructions among hunter-gatherers like the PWC. These findings are most consistent with the claim that the early stages of organised religion were the outcome rather than driver of increased socio-economic complexity (Watts et al. 2022).

The shamans' special knowledge of religion, myths and rituals could have been used by them to acquire and secure a high social position and power, especially if the political and religious tasks were combined in one and

<sup>4</sup> We are fully aware that the concept of "bands" has been discussed and contested by several researchers, but according to our view this concept does not presuppose an evolutionary interpretation of different hunter-gatherer groups. It is just a way to describe differences in the complexity of the social and political organisation, which are clearly visible in anthropological studies.

the same person. The existence of this kind of combined leadership is highly likely, as the size of the local PWC groups probably were quite limited. The spatial organization of the settlements suggests that not more than 5–6 families with 30–40 individuals in total were living in every base settlement, why it is highly likely that there was a leadership where social, political and religious powers were combined in one person. However, the level of social stratification was probably quite low, but in a regional perspective there might have existed a group of more powerful leaders and ritual specialists, maybe interacting in some sort of “secret society” to acquire a special position and to influence and force decisions in a favourable direction for them (for discussion see Hayden 2018).

### **The Pitted Ware Culture in action – seal hunters, fishermen and sea-voyagers**

The PWC people was the last specialized hunter-gatherers in southern and middle Scandinavia. They were a “sea people” living on the coasts and in the archipelagos of the Baltic Sea, hunting, fishing and gathering over large expanses and making long-distance voyages over open sea. Their world was a maritorium, a seascape where everything was based on a deep knowledge of the hunter-gatherers landscape and in seamanship and navigation. Yet, we know almost nothing about their seacrafts and life on the water, we just have small fragments of this nautical culture preserved, probably due to the fragile character of their crafts. Their canoes and boats were probably made of wood and seal skin, much like the crafts, the *kaiaks* and *umiaks*, of the Inuits on Greenland, and were not preserved for a long time after being abandoned. For some reason, they did not depict their seacrafts in any way, despite their keen interest in making figurative clay miniatures.

According to large-scale surveys and excavations, the PWC seem to have been organized in regional groups along the coasts and in the archipelagos of southern and middle Scandinavia (Björck 1997; 2003; Iversen 2010, 25 fig. 10). The geographic size of these groups tend to have a diameter of approximately 20 km if all data from Scandinavia is considered. Calculations based on the number of contemporary sites and their size suggest that every one of these regional groups consisted of ca. 300–400 individuals organized in 10–12 contemporary base settlements dispersed in every region. The base settlements were supplemented with smaller, temporary settlements used to exploit local resources when the conditions were optimal, and also large, central gathering sites where the PWC people met for social and ritual activities (Artursson 2006; 2007a; 2007b; Björck 1997; 2003).

During certain seasons, these base settlements were temporarily broken up into smaller units, going out to specialized settlements to take advantage of favourable peaks in important natural resources, like migrations of seals and certain fish species and nesting of sea birds in the archipelago. A number of small PWC settlements with a more limited find material and bone material, placed both in the inland at lakes and on the coast and in the archipelagos in the Baltic Sea, have been excavated, showing a varied settlement pattern in combination with the larger, more complex base settlements.

We know that the PWC people were well adapted to their environment and also skilled craftsmen in many areas. They were masters in using clay to make exquisite ceramic vessels and fascinating figurines, and in shaping animal bone, antler and different stone materials into different kinds of tools and other objects used in everyday life, but we know almost nothing about their skills in perfecting wooden constructions like handles for tools, paddles, canoes, boats, huts or in using animal skin to cover the canoes, boats and huts or to make clothes and boots. In general our knowledge of the PWC material culture is mainly limited to more durable materials like

burnt clay in different forms like ceramic vessels and figurines, and bone, antler and a variety of stone materials.

In spite of their skilled adoption to a life in the archipelago and to the seascape in the Baltic Sea, their existence finally ended around 2300 cal BC. Migrations of the PWC further out from the coasts and into the outer archipelagos during the late Middle Neolithic B can according to some researchers be interpreted as a sign of relocation due to competition and conflicts with the expanding BAC (e.g. Welinder 1978). Signs of acculturation between the PWC and BAC can be seen in the transition to the Late Neolithic ca. 2300 cal BC, giving place to the much more homogenous Late Neolithic culture in all of southern and middle Scandinavia. An interesting find is that a strain of *Yersinia pestis* has been identified in ancient DNA in human teeth from an individual connected to the BAC in Sope, Estonia (Rasmussen et al. 2015, 571 ff.; Saipio 2022). This introduces the possibility that perhaps the arrival of the new BAC groups in Scandinavia was connected with the spread of diseases to which the hunter-gatherer population had no immunity.

Such a development could also explain why the longest surviving PWC settlements are situated in the outer archipelago, areas that disease probably would reach last. Also, a diminishing hunter-gatherer population in combination with changing climate and landscape could explain the cultural changes that occur in the region during the beginning of the Late Neolithic ca. 2300 cal BC. Perhaps one or several of these factors – acculturation, epidemic, climate change – contributed to the end of the PWC hunter-gatherers in this part of Scandinavia. Only the causes behind the changes are in need of discussion since the nature of change and the quite different character of the Scandinavian Late Neolithic culture are well known. However, the PWC should not be viewed as just a transitional society on route to agriculture. Instead, they should be considered as an example of a very successful hunter-gatherer society that even, during the latter part of the Middle Neolithic, 3000–2300 cal BC, expanded towards the south into areas where agriculture was since long well established. But this was nevertheless the beginning of the end for the PWC hunter-gatherers in this part of Scandinavia, disappearing from our eyes ca. 2300 cal BC, and now they are just present and remembered in the archaeological record.

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## Imprint

ISSN 2197–649X

Layout draft: Agnes Heitmann  
Technical edition: Agnes Heitmann  
© 2023 Artursson et al./UFG CAU Kiel  
Published by the Institute of  
Prehistoric and Protohistoric  
Archaeology, Kiel University.  
For further information consult  
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