New Stone Age Sites to the North of Lake Ladoga in Karelia, Russia

Hannu Takala, Mark M. Shakhnovich, Anssi Malinen & Aleksey Yu. Tarasov

Hannu Takala, Department of Archaeology, University of Turku, FI-20014 Turun yliopisto, Finland / Museum of Lahti, P. O. Box 113, FI-15111 Lahti, Finland: hannu.takala@lahti.fi

Mark M. Shakhnovich, The National Museum of the Republic of Karelia, Pl. Lenina 1, RU-185035 Petrozavodsk, Russia: marksuk@onego.ru

Anssi Malinen, Oulu, Finland: anssi.malinen@gmail.com

Aleksey Yu. Tarasov, Institute of Linguistics, Literature and History, Karelian Research Centre, Russian Academy of Sciences, Ul. Pushkinskaya 11, RU-185035 Petrozavodsk, Russia: taleksej@karelia.ru

Abstract

In 2012, the Museum of Lahti and the Museum of Petrozavodsk completed a joint archaeological field project, begun in 2008, in present-day Russian Karelia for the purpose of studying the oldest postglacial settlement of the area between Lake Ladoga and Lake Onega.

During the five field seasons, altogether 19 new Stone Age sites were found. Test excavations were carried out at five sites. The finds consisted mostly of burned bone and flakes of quartz and other lithics. The oldest site was found in Harlu at the mouth of the Jänisjoki River, with a dating of ca. 7760 calBC.

1 Introduction

In 2007, the Museum of Lahti and the Museum of Petrozavodsk launched a joint archaeological project to study the oldest postglacial settlement of the area between Lake Ladoga and Lake Onega. The project's fieldwork lasted from 2008 to 2012. Scientific assistance was received from the Academy of Sciences, Moscow, and fieldwork in 2011 and 2012 was carried out jointly by the University of Petrozavodsk and the University of Turku, Finland.

The specific purpose of the project was to investigate the routes of settlement spreading from the south-east to the north-west in the region between Lakes Ladoga and Onega. The focus was purely on potential locations for the earliest postglacial sites according to shore displacement chronology. Eventually, the fieldwork concentrated on the area between the Jänisjoki River, flowing into Lake Ladoga, and the Tulemajoki River 55 km directly to the south-east (Fig. 1).

This article summarises the results of the whole project. The starting point and question framing of the project are presented in detail in another article, in which also a part of this text was published for the first time (Takala 2014). The detailed results of the oldest site excavated during the project, Hetuoja 1 in Harlu, have also been published earlier, but only in Russian (Shakhnovich et al. 2014). Therefore it is useful to publish the finds and datings here for a second time for Finnish and

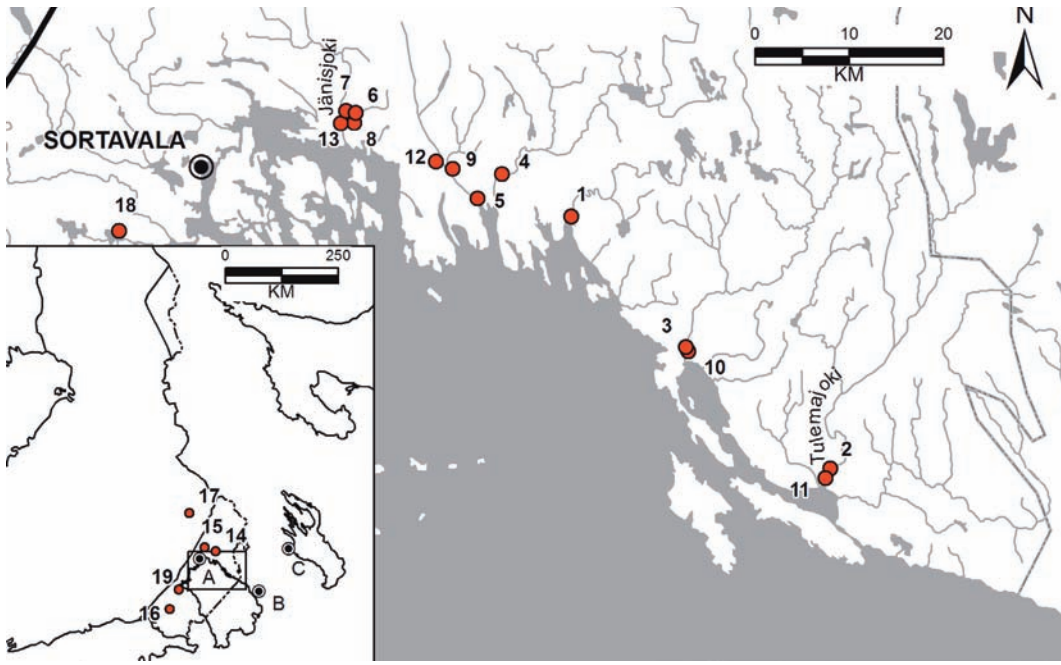

Figure 1. The location of the research area and sites discussed in this article. 1 – Koirinoja 1–4; 2 – Tulema; 3 – Uuksu; 4 – Kitelä and Hippolanjärvi; 5 – Hämäläisenmäki; 6 – Keto; 7 – Lehvosenmäki; 8 – Hetuoja 1; 9 – Sumeriajoki 3; 10 – Uuksu cemetery; 11 – Orthodox cemetery; 12 – Enkeläinen; 13 – Hiidenvuori 1–2; 14 – Suistamo; 15 – Kirkkolahti 1 and Värtsilä 4; 16 – Heinjoki; 17 – Eno; 18 – Meijeri; 19 – Hepojärvi; A – Sortavala; B – Olonets; C – Petrozavodsk. Drawing: E. Sorvali, Museum of Lahti.

international colleagues. A full analysis of the sites and finds presented here will be published later (Shakhnovich et al. 2015) – this article contains the summary of our results.

2 Research history

2.1 Archaeology of the Lake Ladoga region

During the last 15 years, more and more research has been done on the postglacial settlement of southern Finland, the Karelian Isthmus, and Karelia, as well as Lapland. The study of postglacial settlement and its contacts can be said, however, to have begun already in the 1960s. Since then, various views have been presented on the origins of the earliest settlement in Karelia and the present area of Finland (for a detailed research history, see Takala 2014: 193, 195–196 with references, and Pesonen et al. 2014; Rankama & Kankaanpää 2008; Tallavaara et al. 2014).

Almost all of the former Finnish Karelia had to be ceded to the Soviet Union after the Winter War in 1940, but before that, the Karelian Isthmus and Ladoga Karelia regions were studied by Finnish archaeologists. Before the War, only six Stone Age sites had been recorded at the north and north-east ends of Lake Ladoga. In 1917, J. Ailio investigated a Neolithic dwelling site at Koirinoja, Impilahti, and in 1937–1938, J. Voionmaa excavated five sites in the village of Tulema in the former municipality of Salmi at elevations of 15–20 m a.s.l. (Huurre 2003: 156; Uino 2003: 509; Voionmaa 1937). In addition to these sites, Finnish museums gathered tens of Mesolithic stray finds, such as primitive axes, Southern Finnish adzes, or globular maze heads, around the northern and eastern shores of Lake

Ladoga before the war (Huurre 2003; Takala 2012: 179–182; Uino 2003).

During post-war times, Stone Age archaeology in the area has been very sporadic. At the turn of the 1970s and 1980s, G. A. Pankrushev identified five Stone Age dwelling sites at elevations ranging between 15 and 20 m a.s.l. at the Uuksujoki River. I. F. Vitenkova found a small site on the southern shore of Lake Hippolanjärvi in 1991, and later K. E. German found the Neolithic site of Kitelä 1 on the Syskyänjoki River in 1997. In 1978, A. P. Zhuravlev had found some artefacts on sand dunes in Koirinoja. These artefacts may originate from the site discovered by Ailio (German 1997: 4; Kochkurkina 2007: 55, 156; Pankrushev 1982; Uino 2003: 509).

As said earlier, the purpose of the research project in 2008–2012 was to investigate when the area between Lakes Ladoga and Onega was settled by the earliest postglacial population and where the first sites were located. The oldest archaeological site known so far in the area north of Lake Ladoga is Kirkkolahti 1 on the western shore of Lake Jänisjärvi. It was excavated by a Finnish-Russian research team in 2006 and was dated to 9300±80 BP (8700–8350 calBC; Ua-24774) (Forsberg 2006). The fieldwork also revealed a number of other undated dwelling sites in the vicinity of Lake Jänisjärvi (Karjalainen 2005). The hitherto oldest dwelling sites on the Finnish side of the border are from the Sarvinki area in Eno, further to the north-north-west of Kirkkolahti. The oldest date from the Eno sites, excavated by P. Pesonen, is 9560±60 BP (9104–8666 calBC; Hela-2721) (Pesonen et al. 2014: 179).[1]

2.2 General remarks on shore displacement chronology

The relationship of the sites to the Baltic/Lake Ladoga shore displacement chronology is discussed in detail in another article (Takala 2014), but some considerations that apply for the dating of Stone Age sites around Lake Ladoga must also be noted here because they affected the starting points of the project. According to research on the Karelian Isthmus by Professor Matti Saarnisto, it is known that during the Ancylus transgression maximum, ca. 8150 calBC, the water level rose up to 27 m a.s.l. at the Heinjoki isobase (Saarnisto 2003; 2008; 2011; Saarnisto & Grönlund 1996; see also Subetto 2007). The dating for the isolation of Ancient Lake Ladoga is ca. 7800 calBC (Saarnisto 2011: 33).

The common direction of land uplift isobases in Karelia is 45°, although some variations have been presented (Hyyppä 1943: 140; see also Dolukhanov 1979: 118–120). During the transgression period of Lake Ancylus (ca. 8400–8150 calBC), the gradient of shorelines in southern Finland was ca. 42 cm/km (Saarnisto 1971: 384; see also Takala 2012: 148–149). Discrepancies, however, have been noted between shore displacement in southern Finland and the Lake Ladoga region. The irregularities have been explained by the existence a so-called hinge line in a zone of roughly 400 km from the Gulf of Finland to the northern parts of Lake Ladoga, with less abrupt land uplift to the south-east of this line (Donner 1970: 191–195; 1980: 292). For example, it has been shown that on the Karelian Isthmus, the gradient was only 22.4 cm/km during the Ancylus maximum (Hyyppä 1937; Saarnisto 2008; Takala 2012: 168–169).

The hinge line does not affect the shore displacement curves within each isobase from south-west to north-east, but it affects the gradient of land upheaval from north-west to south-east. This must be taken into consideration when shore displacement dating is used around Lake Ladoga.

3 Fieldwork

3.1 Prospecting

Earlier studies indicated that the shoreline of the Lake Ancylus transgression maximum was around 30 m a.s.l. at the estuary of the Jänisjoki River at the north end of Lake Ladoga. The

Figure 2. Survey in Harlu. Land use was minimal throughout the research area and opportunities to locate sites or to collect stray finds were modest in most of the potential Mesolithic places. Still, quartz flakes were found in this small opening at the Keto site. Photo: H. Takala, Museum of Lahti.

estuary of the Tulemajoki River at the south-east end of the research area discussed here lies 55 km south-east of the Jänisjoki River. In accordance with the gradient of 22.4 cm/km, the Lake Ancylus shoreline there would have been at approximately 17.5 m a.s.l., which is only slightly lower than previously suggested by Saarnisto and Hyyppä. Taking these elevations as starting points, the Lake Ancylus shoreline of the research area was drawn on a map, which was initially marked with the most potential locations of sites for the purposes of field survey (see Takala 2014: 196–200).

The terrain in the northernmost parts of the research area is rocky and contains steep hills, and the topography changes very quickly. The highest outcrops of bedrock rise to elevations of over 120 m a.s.l.; the present level of Lake Ladoga is approximately at 5 m a.s.l. Towards the south-east, the landscape becomes sandier and more suitable for prospecting – still, in most cases the most likely areas for finding Stone Age sites are on former fields, which are nowadays unused and overgrown (Fig. 2).

The field surveys of 2008–2012 identified a total of 19 hitherto unknown Stone Age sites in the area (see Table 1). In addition to this, three previously discovered groups of sites, consisting of a total of 12 individual dwelling sites, were inspected. With regard to their specific environments, five of the newly discovered sites were on the shores of inland lakes, six were on bays and inlets, and eight were in river mouth settings (Takala 2014: 200). The most interesting finds are the six sites and site clusters located above the transgression maximum level of Ancient Lake Ladoga (Hämäläisenmäki, Keto, Lehvosenmäki, Hetu-

oja, Sumeriajoki, and Koirinoja).

Two sites (Uuksu cemetery and Orthodox cemetery) were in places that the transgression of Lake Ladoga reached ca. 3700 calBC, although the shoreline had already been at the same elevation during the regressive stage of Lake Ancylus, ca. 8000 calBC. The sites of Enkeläinen and Hiidenvuori 1 and 2 were at elevations reached and even slightly exceeded by the transgression of Ancient Lake Ladoga. The finds from Hiidenvuori included a Neolithic arrowhead. Ceramics were discovered at the sites of the Uuksu cemetery and the Orthodox cemetery. Only further excavation can establish the possible multiperiod nature of these sites. For the time being, they can be dated to the post-Mesolithic periods.

One short reconnaissance trip was also made inland to acquire material for comparative studies. Immediately, four sites were discovered on the shores of lakes over 20 km from the coast, with rivers providing access to Ancient Lake Ladoga and/or Lake Ancylus. There are no dates from these sites located in Suistamo, but one of them revealed sherds of asbestos-tempered ceramics, placing it in the Pöljä period, ca. 3000–2400 calBC (Carpelan 1979: 9–11; cf. Zhul'nikov 1999).

Of all the sites found during the prospecting from 2008 to 2010, five were selected for small test excavations. They were assumed to be located on Ancylus shorelines, and also in locations where recent land use had not affected the cultural layers.

3.2 Excavations

3.2.1 Harlu, Hetuoja 1

The site is located on top of a contour line running at 30 m a.s.l. in the middle of a long and narrow terrace. Altogether 11 m^2 were excavated, but according to the test pitting, the site it-

Site	Finds	Elevation
Harlu, Keto	Quartz, burnt bone	30 m a.s.l.
Harlu, Lehvosenmäki	Quartz, burnt bone	25 m a.s.l.
Harlu, Hiidenvuori 1	Quartz, burnt bone, Pyheensilta type arrowhead	15–20 m a.s.l.
Harlu, Hiidenvuori 2	Quartz, burnt bone	20 m a.s.l.
Harlu, Hetuoja	Quartz, flint	30 m a.s.l.
Impilahti, Hämäläisenmäki	Quartz, burnt bone	30 m a.s.l.
Impilahti, Enkeläinen	Quartz	20 m a.s.l.
Impilahti, Sumeriajoki 3	Quartz, Pyheensilta type sinker	30 m a.s.l.
Impilahti, Koirinoja 1	Quartz	25 m a.s.l.
Impilahti, Koirinoja 1A	Quartz, burnt bone, pottery	25 m a.s.l.
Impilahti, Koirinoja 2	Quartz, burnt bone, pottery, slate	25 m a.s.l.
Impilahti, Koirinoja 3	Quartz, burnt bone, pottery, slate	25 m a.s.l.
Impilahti, Koirinoja 4	Quartz	27 m a.s.l.
Salmi, Orthodox cemetery	Quartz, pottery	20 m a.s.l.
Salmi, Uuksu cemetery	Quartz, burnt bone, pottery	20 m a.s.l.
Suistamo, Salmenjärvi 1	Quartz, burnt bone, pottery	99 m a.s.l.
Suistamo, Salmenjärvi 2	Quartz	101 m a.s.l.
Suistamo, Sirkoinjärvi 1	Quartz	100 m a.s.l.
Suistamo, Sirkoinjärvi 2	Quartz	100 m a.s.l.

Table 1. Stone Age sites found within the project in the research area.

self is ca. 22 x 7 m in size. The edge of the terrace is very steep to the north-west, that is, in front of the site. At the back of the site, the terrace ends at an upright bedrock cliff, in which traces of quartz quarrying were seen. The cultural layer was clear in the sandy soil. At the bottom of the layer, some disturbances were recorded in the north-western part of the excavation area. These traces were interpreted as logs belonging to a building (see Shakhnovich et al. 2014: 43, 47–48), but as the excavated area was very small, this interpretation must be treated with care.

The excavation revealed two clear hearths made of small stones. The first one was located ca. 20 cm underneath the topsoil, the stone setting itself being a 15-cm-deep rectangular construction. Charcoal was found, but no burned bones were discovered. The dating of charcoal gave the result 8721±56 BP (Hela-3059), with a calibrated age of 7815–7605 calBC and a mean value of 7760 calBC.[2] The second hearth was roundish, 62 cm in diameter, and located immediately underneath the turf. Dating proved it to be a recent construction: 437±29 BP (1430–1465 calAD; Hela-3060).

Finds consisted of quartz, slate, and flint. The quartz is mainly debitage: only six cores and four tools (scrapers, points, and worked flakes) were found. A complete analysis of the lithics was carried out by A. Tarasov and has been published elsewhere (Shakhnovich et al. 2014: 44–47). The flint finds included one round scraper, one double-end scraper, one combined tool (burin-knife), one retouched blade, and two flakes (Fig. 3). One of the flakes was heat-treated, as indicated by visible changes due to burning, and the type of flint – carboniferous or cretaceous – cannot be determined. All the other flint finds consisted of carboniferous flint. The combined tool has a small fragment of cortex left on the upper part of the tool, and it was struck from a single platform core. The slate find is a flake of greenish material, most likely metatuffite.

The flint raw material of the Hetuoja finds indicates an eastern origin for the flint. The nearest outcrops of carboniferous flint lie

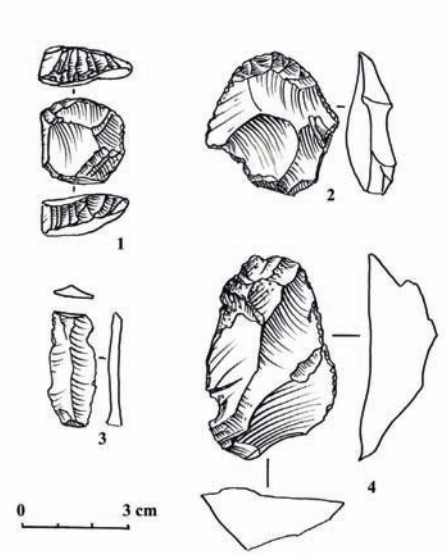

Figure 3. Flint artefacts from the Hetuoja site. 1–2 – scraper; 3 – retouched blade; 4 – combined tool. Drawing: I. Heglund.

some 250 km east of the site. There were no flint finds of cretaceous flint, which is present in outcrops in a narrow belt stretching from Lithuania to Belarus (e.g. Hertell & Tallavaara 2011: 13; Takala 2004: 109). One heat-treated flint flake was found, but its origin cannot be determined. The Hetuoja collection does not contain a single datable flint find, but finds like retouched blades and double scrapers are typical Mesolithic features, and it must be noted that no finds typical for Neolithic cultures were found (see e.g. Takala 2004: 133–145 with references for flint tool types and their chronology).

All the flint finds derive from different cores. The flakes indicate knapping at the site. E. Hertell and M. Tallavaara have argued that this kind of flint assemblage indicates the gradual accumulation of flint at a site, and that the sites with this kind of assemblages were occupied during several periods (Hertell & Tallavaara 2011: 30–31). At Hetuoja, the cultural layer covered an area ca. 22 m wide on top of a terrace, which implies that the site may have been occupied several times and that the above-mentioned deduction of flint as-

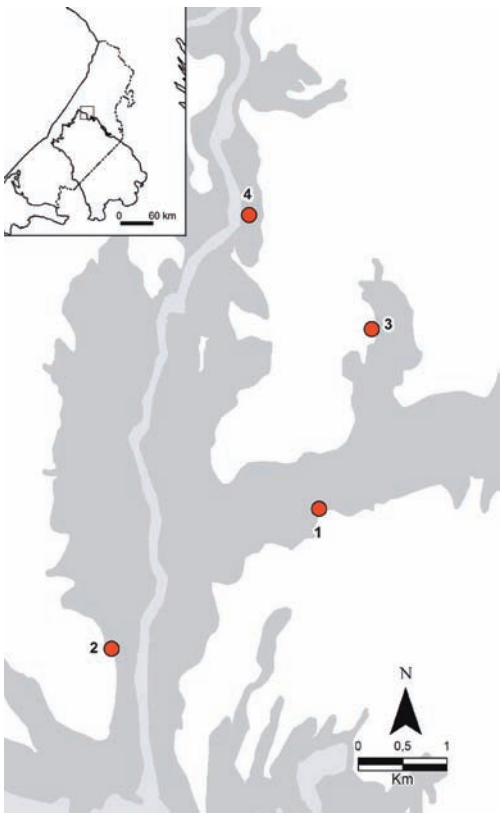

Figure 4. The present-day and Ancylus maximum (30 m a.s.l.) shorelines in the Jänisjoki River valley, and the sites studied within this project. 1 – Hetuoja 1 (30 m a.s.l.); 2 – Hiidenvuori 1, 2 (15–20 m a.s.l.); 3 – Keto (30 m a.s.l.); 4 – Lehvosenmäki (25 m a.s.l.). Drawing: A. Malinen and E. Sorvali, Museum of Lahti.

semblage accumulation could be correct. Still, only one datable construction has been found so far, and the lack of burned bone material does not allow further discussion of the occupation periods of the site.

Flint and metatuffite are foreign materials in the research area. Hertell and Tallavaara have also studied the mobility and exchange of flint finds in southern Finland and neighbouring areas during the Mesolithic. According to their studies, Early Mesolithic flint finds were not distributed in southern Finland through population mobility, but mainly by exchange (Hertell & Tallavaara 2011: 36). So far, in the northern parts of Lake Ladoga, only a couple of Mesolithic sites and stray finds are known. The reasons for this may be due to research history or the area may really be very scarce in finds. In order to be able to say anything about population mobility or exchange in the research area, more finds are needed –proper conclusions cannot be drawn yet.

In addition to the ^{14}C datings and finds, it is also useful to study the shore displacement dating of the site. At first, it must be noted that the same isobase that lies in the Heinjoki area on the Karelian Isthmus also runs in the 45° direction east of the Impilahti village, 12 km south-east of the Hetuoja site. During the Ancylus maximum, the shoreline was at 27 m a.s.l. at this Heinjoki-Impilahti isobase. When the Ancylus maximum shoreline for the Hetuoja site is measured from this isobase, the results are as follows: the southern Finnish gradient (42 cm/km x 12 km) gives an elevation of 32 m a.s.l. and the Karelian Isthmus gradient (22.4 cm/km x 12 km) gives an elevation of 29.7 m a.s.l. (Fig. 4).

However, there are several reasons why the shore displacement dating of the Hetuoja site must be considered with care. The elevation of the site is based on the contour lines of a basic survey map, according to which the site lies just above the Ancylus maximum level. The slope in front of the site is very steep, which means that the changes in water level after the Ancylus maximum have not changed the position of the shoreline dramatically from a horizontal perspective. The site could actually have been used for a long period of time.

3.2.2 Impilahti, Koirinoja 1A

Four sites are located on the bank of the present-day Koirinoja River, at elevations of 25–27 m a.s.l. (Fig. 5). All the sites are located on small terraces on top of a steep bank around the Ristimäki hill. According to the shore displacement chronology, they belong to the maximum stage of the Ancylus transgression, ca. 8100 calBC, or to the regressive stage, ca. 8000–7800 calBC.

Near the Ristimäki hill there is a large area full of sand dunes. From the eastern and western

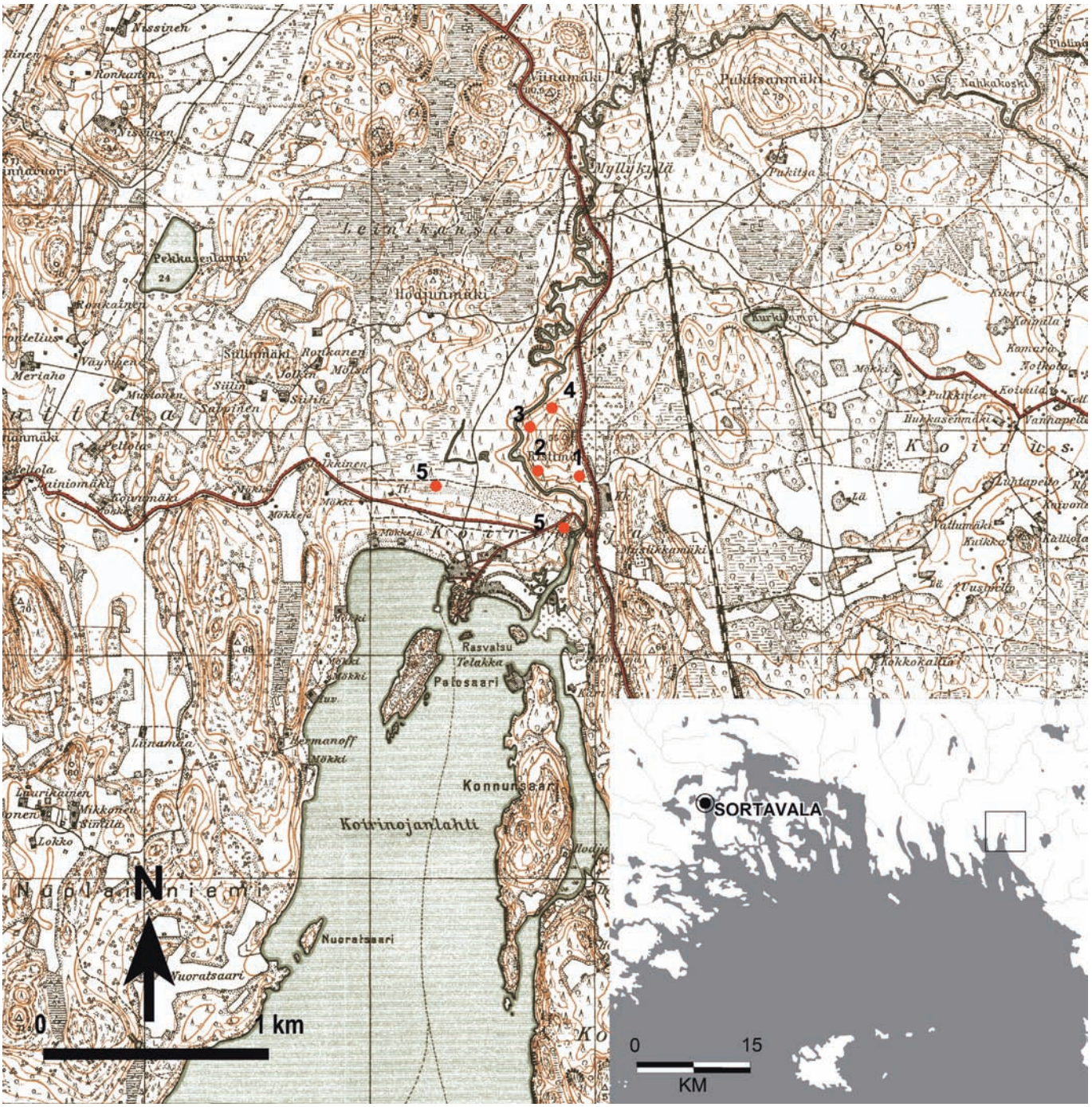

Figure 5. Sites in Koirinoja. 1 – Koirinoja 1 A; 2 – Koirinoja 2; 3 – Koirinoja 3; 4 – Koirinoja 4; 5 – Koirinoja 1 discovered by J. Ailio. Map: National Land Survey of Finland, modified by E. Sorvali, Museum of Lahti.

Figure 6. Anssi Malinen (left) and Mark Shakhnovich (right) test pitting between the trenches from 1939–1940 at the Koirinoja 1A site. Behind the trenches, the steep edge of the terrace can also be seen. Photo: H. Takala, Museum of Lahti.

ends of the nearly 800-m-long dune, pieces of quartz and ceramics were collected as surface finds. The location clearly resembles the description of the site that J. Ailio discovered in 1917.

The site of Koirinoja 1A is located on the north-eastern bank of the Koirinoja River, at an elevation of 27 m a.s.l. on the southern side of the Ristimäki hill. The slope towards the river is very steep, but the terrace itself is a flat area (25 x 12 m), which was badly destroyed during the war in 1939–1940. The area that was intact was nevertheless large enough for small-scale test pitting (Fig. 6).

From a one-square-metre test pit, 28 finds were collected: five pieces of burned bone, one uncertain piece of Typical Comb Ware, three pieces of asbestos-tempered ware, five pieces of bipolar quartz flakes, and 14 undetermined quartz flakes. The site itself is on sandy soil and a clear cultural layer was visible under the topsoil.

The pieces of burned bone were so small that they could not be dated. According to the shore displacement chronology, the site is dated to the regressive stage of Lake Ancylus, ca. 8000 calBC, but the finds seem to belong to a much later phase. Early Asbestos Ware is dated to ca. 4500–3800 calBC, when the water level in the Koirinoja River was at 20 metres. Typical Comb Ware can be dated to 4000–3600 calBC. If the fragmented pieces of pottery date to the Pöljä Ware period (see Koirinoja 2), the site would belong to the transgressive phase of Lake Ladoga, when the water level rose to ca. 22 metres at the site – which is still some 5 metres lower than the occupation terrace.

The Koirinoja 1A site may possibly be a multiperiod site, but based on the research so far, it can securely be dated only to the Neolithic.

3.2.3 Impilahti, Koirinoja 2

The Koirinoja 2 site is located 150 m to the west of Koirinoja 1A. Site 2 is also located on a flat terrace (25 m a.s.l.), which is 35–60 x 13 m in size and lies between the riverbank and a bedrock cliff. Also here only a one-square-metre test pit was dug.

The finds consisted mainly of burned bone, ceramics, and quartz. Also one small flint flake and a broken tip of an adze (40 x 25 x 13 mm) made of metatuffite – possibly part of a so-called Eastern Karelian adze – were found. Metatuffite originates from the mouth of the Shuja River, west of Lake Onega, from where the material spread to a large territory over the Baltic States, Finland, and Karelia (Kostylëva et al. 2014; Tarasov & Kriiska 2014; Tarasov et al. 2010).

Altogether 12 small pieces of pottery were found. The pieces included comb ornaments and asbestos temper. They can be classified as asbestos ware of the Orovnavolok (Pöljä) type, which is dated to ca. 3000–2500 calBC (Zhul'nikov 1999). All the quartz finds (63 pieces) were small flakes: 11 flakes were struck from bipolar cores and 7 from platform cores, but for the rest of the flakes, the striking technique could not be determined.

According to the osteological analysis (see Table 2), the identified burned bones were of seal (1 piece) and mammals (135 pieces). A piece of mammal bone was dated with the result 3870±33 BP (2460–2290 calBC; Hela-2831).

The dating of the burned bone and typology of ceramics are in conjunction. This indicates that during the time of the occupation (ca. 2500–2300 calBC), the water level was some 3–4 metres lower than the occupation terrace.

3.2.4 Impilahti, Koirinoja 3

Koirinoja 3 lies 200 m to the north of the Koirinoja 2 site, on a long but narrow terrace (58 x 4–11 m) on the western side of the hill. The site is on very sandy soil, on a west-facing terrace that gradually slopes towards the south at a level of 25–27 metres. The excavated area was 3 x 4 m in size and situated just at the edge of the terrace.

Underneath the turf and shallow podsol, ca. 15–25 cm of dark yellow sand formed the cultural layer. In the south-eastern part of the excavation area, a change of colour and texture in the cultural soil was observed: a dark red sandy loam formed a pit feature, which extended deeper than the bottom of the cultural layer elsewhere in the excavated area. This construction was interpreted as the possible remains of a house pit. The feature continued outside the excavated area, and only a part sized 1.65 x 0.75 m was located in the corner of the excavation – in other words, the pit construction is larger than seen in the excavation. Because the remains were only partially excavated, and there was no pit-like depression visible on the topsoil (which is normally the case with pit dwellings), the interpretation is still only tentative. The dark red formation could also be natural, even though nothing certain can be said without more extensive excavations at the site. In addition, a clear hearth (85 cm deep and 55 cm in diameter) made of small pebbles was discovered (Fig. 7).

Species	Koirinoja 2	Koirinoja 3
Alces alces	0	1
Castor fiber	0	2
Pusa hispida	0	1
Phocidae	0	5
Cf. Phocidae	1	0
Megamammalia	1	0
Mesomammalia	0	3
Mammalia	134	63
Anatidae	0	1
Esox lucius	0	15
Cyprinidae cf. *Leuciscus* sp.	0	1
Teleostei	0	8
Indeterminata	10	116
Total	146	216

Table 2. Results of the osteological analysis of materials from the Koirinoja 2 and Koirinoja 3 sites (Archives of the Museum of Lahti, analysed by Kristiina Mannermaa 23 November 2011).

Figure 7. General view of the Koirinoja 3 site from the north. A pit for a hearth can be seen in the south-western corner. Photo: H. Takala, Museum of Lahti.

The finds at the site consisted of ceramics (21 pieces), burned bone (216 pieces), quartz (312), quartzite (2), and other stones (21 pieces). The ceramics were small broken pieces of vessels representing an older stage of Early Comb Ware (ca. 5100–4300 calBC) with gravel temper and horizontal imprints. The quartz was of good quality, white, grey, and sometimes even transparent.

Technological analysis was carried out on the quartz finds. Of the pieces larger than 15 mm, 52.3% were from bipolar cores and 12.2% from platform cores. The average size of flakes from bipolar cores is 30 mm, from platform cores 32 mm, and from undetermined cores 28 mm. Cores included four bipolar, four undetermined, and two half-used 'test' cores.

It must be noted here that not a single quartz tool was found – only cores, chips, and flakes. The same applies to other materials. Finds of slate and other stones consisted only of flakes and pieces of a broken cradle-runner-shaped axe made of metatuffite or black diabase.

The pieces of burned bone provide more information. The full analysis is presented in Table 2, but in summary it can be said that the material included terrestrial (*Alces alces, Castor fiber*) and marine (*Pusa hispida*) mammals together with remains of fish (*Esox lucius*, Cyprinidae, Teleostei) and birds (Anatidae). It can also be seen that small terrestrial mammals are completely absent in the material from both sites (Koirinoja 2 and 3), which appears to correspond to the 'traditional' range of species identified in burned bone assemblages from Mesolithic sites (see e.g. Takala 2004: 64).

Nevertheless, the datings place the bones in a younger period. The oldest datings derive from an unidentified mammal, 6262±40 BP (5300–5215 calBC; Hela-2827), and from a beaver bone, 6209±43 BP (5225–5065 calBC; Hela-2829). Both bone fragments were found

in the third excavation layer near the bottom of the excavation. The third dating was made from a fragment of ringed seal, 4884±37 BP (3700–3640 calBC; Hela-2828), found at the same level as the other dated bones.

The dating of Early Comb Ware coincides well with the oldest datings, and they all belong to a phase when the water level in Koirinoja was at ca. 20 metres, that is, 5–7 metres lower than the site itself. Traditionally, the beginning of the Neolithic is dated to ca. 5000 calBC. Thus, the datings are placed just at the turn from the Mesolithic to the Neolithic and can actually even predate the beginning of the Neolithic in the research area (see also German 2012: 572).

The younger dating provides clear evidence of the multiperiod nature of the site. At that time, the transgressive water level had reached 22–23 metres. As there was no visible discontinuity or any natural layer separating different parts of the cultural layer, the site could have been in use continually from the Mesolithic–Neolithic turn to the latter part of the Neolithic. According to the refuse fauna and the known hunting seasons, we can argue that that especially the Koirinoja 3 site was used all year round (see Matiskainen 1989: 48–53).

3.2.5 Impilahti, Koirinoja 4

In total, 12 m^2 were excavated at the site of Koirinoja 4, which lies ca. 150 m to the northeast of the Koirinoja 3 site. Koirinoja 4 is situated on the northern side of the Ristimäki hill, on a sandy terrace at 26–27 m a.s.l. The size of the whole terrace is 20 x 10 m and it is limited by the steep riverbank to the north and west and by bedrock to the south. The edge of the terrace was destroyed by trench digging during the war of 1939–1940, and the excavation area had to be opened further away from the edge of the terrace, towards the mainland. Small wartime artefacts were collected from the topsoil, but otherwise the excavation area was undisturbed.

The only finds consisted of quartz, altogether 80 pieces. The tools included three scrapers and two flakes with use-wear. One scraper was made on a broken flake, others on bipolar flakes. Two bipolar cores were found, but the rest were flakes. The flaking techniques could not be analysed reliably because the amount of big flakes (length over 15 mm) was not large enough. However, in general it seems that the bipolar technique dominates the finds.

Koirinoja 4 completely lacks datable finds and ^{14}C datings. At the moment, the site cannot be dated in more detail. According to the datings of other sites around the Ristimäki hill at roughly the same elevations, Koirinoja 4 can be dated to the Neolithic.

3.2.6 Impilahti, Sumeriajoki 3

Altogether 20 m^2 were excavated at the Sumeriajoki 3 site, which is located at an elevation of 30 m a.s.l. on a large terrace on top of the bank of the Sumeriajoki River. The terrace itself is 20 x 15 m in size and limited on the eastern side by a steep bedrock cliff. In front of the terrace, to the west, the slope towards the present-day river is very steep. The terrace itself consists of sandy soil (Fig. 8).

The excavation area was only 35 cm in depth. Underneath the topsoil there was a thin, coloured layer of 3–7 cm, which was interpreted as a cultural layer. No hearths or other manmade constructions were found.

The total number of finds is 359. There were two small burned flint flakes, a sinker of the so-called Pyheensilta type (62 x 12 x 7 mm), and a small grooved stone of greyish slate (32 x 15 x 10 mm), the rest of the finds being quartz. There were no burned bones or any charcoal from a clear construction, so the site lacks ^{14}C datings.

The majority of quartz finds were flakes, 340 pieces in total. Flakes larger than 15 mm amounted to 181 pieces: 32% of these were from platform cores, 11.6% from bipolar cores, and 56.4% from unidentified cores.

Altogether 12 quartz cores were found. Two of them are bipolar and three prismatic, the rest being broken pieces or combined platform cores. One prismatic core contains veinstone, which seems to originate from the bedrock. The tools included three quartz scrapers: one is made on a flake from a platform core

Figure 8. The Sumeriajoki 3 site from the east. The steep edge of the terrace can be seen in the background. Photo: H. Takala, Museum of Lahti.

and two are made on undetermined flakes. The fourth tool is a retouched flake.

According to shore displacement chronology, the Ancylus maximum shoreline is at 28–29 m a.s.l. at the find location, which coincides well with the shore formation. The only datable find from the site, though, is from the Pyheensilta period and dates roughly to ca. 3000–2500 calBC. At that time, the transgressive stage of Lake Ladoga reached the 22-metre level at the site.

The dating of the Sumeriajoki 3 site must be left open. Based on the Pyheensilta type sinker, the site was occupied during the Neolithic, although not a single potsherd was found at the site. The site could also have a multiperiod nature, because the elevation of the site and shore displacement chronology hint strongly at a Mesolithic dating.

4 Conclusions

The sites discovered during the project concentrate on the mouths of ancient bays and the shores of narrow inlets. The sites of Hämäläisenmäki, Lehvosenmäki, Keto, and Hetuoja are contemporary with the transgression maximum of Lake Ancylus based on their elevations and finds. The Hetuoja site, with a radiocarbon dating to 7815–7605 calBC, is so far the second oldest site in Ladoga Karelia after the Kirkkolahti 1 site – and among the 20 oldest sites in all of the Karelian Isthmus and southern Finland (see Takala 2012: 167, 177–183; Tallavaara et al. 2014: 173–174).

Based on its flint assemblage, the Hetuoja site could be interpreted as not a single-period site but one that was visited repeatedly. As the site is over 600 years younger than the oldest known Mesolithic sites in the area, it cannot be

used for the study of the pioneering postglacial settlement of the area. Nevertheless, the flint and metatuffite finds indicate direct or indirect contacts with the east, where these raw materials originate.

The rest of the excavated sites (Koirinoja 1A–4 and Sumeriajoki 3) are located at elevations that correspond to Mesolithic shores, but the finds and ^{14}C datings place the sites in much younger periods. The earliest datings from Koirinoja 3 are contemporary with the datings from Hepojärvi on the western shore of Lake Ladoga (Gerasimov & Kul'kova 2003: 191; Vereshchagina 2003: 149) and several other sites on the Karelian Isthmus (Takala & Gerasimov 2014: 10; Tallavaara et al. 2014), but no such datings are known from the area between Lakes Ladoga and Onega.

Nevertheless, Early Comb Ware is also known from the Värtsilä 4 site to the north of Lake Ladoga and from the Meijeri 3 site further to the west (Kochkurkina 2007; Shakhnovich 2007: 11). There are no indications of reliable remains of pit-houses dated to the Early Neolithic from the Republic of Karelia (Zhul'nikov 2003: 46). If the remains excavated at Koirinoja 3 actually are from a pit-house, they are the first such construction known to date.

The analysed quartz finds show that the bipolar technique dominated the studied sites, including Hetuoja 1 (Shakhnovich et al. 2014: 45–46). In Karelia, especially around Onega Bay, the bifacial production of quartz appears during the Early Neolithic, but increases at Late Neolithic sites (Tarasov 2006).

From earlier research it is also known that in Finland and Sweden, the bipolar technique was more common during the Mesolithic than during the Neolithic and that in the Mesolithic, bipolar striking was more common than platform striking (Lindgren 1996: 34–35; 2003: 180; Schulz 1996). At the same time, it must be noted that quartz cores can always be reused with another technique (Callahan 1987: 62; Rankama 2002: 85), and that Neolithic sites where the bipolar technique dominated are also known (see e.g. Hertell & Manninen 2005).

Quartz dominated the lithic finds at all the sites studied within this project. This is exceptional compared to other Neolithic sites from central and southern Karelia, where slate, lidite, and even imported flint are more numerous. On the contrary, the amount of quartz resembles the situation at Mesolithic sites in Karelia (Pankrushev 1978; Savvateyev 1977; Zhul'nikov 1999: 56).

Although the proportion of different raw materials cannot be used for dating alone, the above-mentioned points about quartz finds may, after all, indicate the Mesolithic use of the excavated sites. However, the amount of finds and the extent of the excavated areas are very small, and conclusions should not be too far-fetched.

More and more non-shorebound Stone Age sites have been published. Some of these are located on top of moraine hills and possibly linked to hunting (Taavitsainen 1982: 35), whereas others are situated closer to the shore but are not in immediate contact with water (Jussila & Kriiska 2006: 45–46). Results from the Karelian Isthmus show that it was, actually, common to occupy locations where the shore formation was steep and where small changes in the water level did not affect the sites themselves (Mökkönen 2009: 135; Mökkönen et al. 2006: 116). The sites studied in this project were also situated on steep shores, so the multiperiod nature of the sites published in this paper can be left open as a task for future research.

5 Summary

To summarise the project, it can firstly be said that the Hetuoja site and the pre-war stray finds provide indisputable proof that there was human activity in the area between Lakes Ladoga and Onega and especially in the coastal zone of Lake Ladoga (then Lake Ancylus) during the Mesolithic, ca. 7700 calBC and possibly even earlier. How, from where, and when the Mesolithic population came into the area remain questions for future research.

Secondly, the datings and finds from the Sumeriajoki 3 and Koirinoja 1A–3 sites pro-

vide information about Neolithic occupation. Thirdly, if the interpretations related to house pits are proven correct with further excavations, they will be the first such finds in the research area. Fourthly, the differences in shore displacement and typological datings of the sites mean that their multiperiod nature still remains open.

The results presented in this article were obtained with meagre resources. This shows that it is meaningful to continue research related to the special problems of the Mesolithic or any other period of the Stone Age in the region between Lakes Ladoga and Onega.

Acknowledgements

The authors wish to thank Professor Matti Saarnisto for his comments on the research and help during the fieldwork. Mikhail Zhilin receives our thanks for helping to start the project and Mr Michael Greed for checking the language of this article. The project was funded by the Museum of Lahti, the Finnish Cultural Foundation, and the Karelian Cultural Foundation.

References

Unpublished sources

German 1997 = Герман, К. Э. 1997. Отчёт об археологических исследованиях в Республике Карелия в 1997 г. Research report, Karelian Scientific Centre, Petrozavodsk.

Karjalainen, T. 2005. Jänisjärven ympäristön inventointi: Muinaisilla poluilla hanke. Research report, Museum of North-Karelia, Joensuu.

Pankrushev 1982 = Панкрушев, Г. А. 1982. Отчёт о полевых археологических работах Онежско-Ладожского отряда Карельской археологической экспедиции в 1982 году. Research report, Karelian Scientific Centre, Petrozavodsk.

Voionmaa, J. 1937. Muinaisjäännöksiä Salmin pitäjän Tuleman, Miinalan ja Karkun kylissä. Research report, National Board of Antiquities, Helsinki.

Published sources and literature

Bronk Ramsey, C. 2009. Bayesian Analysis of Radiocarbon Dates. *Radiocarbon* 51 (1): 337–360.

Callahan, E. 1987. *An Evaluation of the Lithic Technology in Middle Sweden during the Mesolithic and Neolithic.* Aun 8.

Carpelan, C. 1979. Om asbestkeramikens historia i Fennoskandien. *Finskt Museum* 85 (1978): 5–25.

Dolukhanov, P. M. 1979. The Quaternary History of the Baltic Leningrad and Soviet Carelia. In V. Gudelis & L.-K. Königsson (eds.) *The Quaternary History of the Baltic*: 115–125. Symposia Universitatis Upsaliensis annum quingentesimum celebrantis 1.

Donner, J. 1970. Deformed Late Weichselian and Flandrian Shorelines in South-eastern Fennoscandia. *Commentationes Physico-Mathematicae* 40: 191–198.

Donner, J. 1980. The Deteremination and Dating of Synchronous Late Quaternary Shorelines in Fennoscandia. In N.-A. Mörner (ed.) *Earth Rheology, Isostasy and Eustasy*: 285–293. New York: J. Wiley & Sons.

Forsberg, O. 2006. Jänisjärven reitin varhaisin asutus: Inventointituloksia Värtsilästä ja Laatokan pohjoispuolelta. *Muinaistutkija* 2006 (1): 2–16.

Gerasimov & Kul'kova 2003 = Герасимов, Д. В. & Кулькова, М. А. 2003. Хронологическая атрибуция археологических комплексов многослойных памятников Силино и Большое Заветное 4 на Карельском перешейке по геохимическим данным. In В. И. Тимофеев & Г. И. Синицына (eds.) *Неолит–энеолит юга и неолит севера Восточной Европы*: 181–192. Санкт-Петербург: ИИМК РАН.

German 2012 = Герман, К. Э. 2012. Культура сперрингс на территории Карелии. In С. В. Ошибкина (ed.) *Первобытные древности Евразии*: *К 60-летию Алексея Николаевича Сорокина*: 571–590. Москва: ИА РАН.

Hertell, E. & Manninen, M. A. 2005. Rävåsens kvartsmaterial. In H. Edgren (ed.) *Rävåsen*: 84–100. Finskt Museum 109 (2002).

Hertell, E. & Tallavaara, M. 2011. High Mobility or Gift Exchange: Early Mesolithic Exotic Chipped Lithics in Southern Finland. In T. Rankama (ed.) *Mesolithic Interfaces*: *Variability in Lithic Technologies in Eastern Fennoscandia*: 11–41. Monographs of the Archaeological Society of Finland 1.

Huurre, M. 2003. Viipurin läänin kivikausi. In M. Saarnisto (ed.) *Karjalan synty*: *Viipurin läänin historia* I: 151–244. Joensuu: Karjalan Kirjapaino Oy.

Hyyppä, E. 1937. Post-glacial Changes of Shore-line in South Finland. *Bulletin de la Commission Gèologique de Finlande* 120: 1–26.

Hyyppä, E. 1943. Beiträge zur Kenntnis der Ladoga- und Ancylus-transgression. *Bulletin de la Commission Gèologique de Finlande* 128: 139–176.

Jussila, T. & Kriiska, A. 2006. Pyyntikulttuurin asuinpaikkojen rantasidonnaisuus: Uusia näkökulmia Suomen ja Viron kivi- ja varhaismetallikautisten asuinpaikkojen sijoittumiseen. In. P. Pesonen & T. Mökkönen (eds.) *Arkeologipäivät 2005*: *Arkeologia ja kulttuuri*: *Uutta kivikauden tutkimuksessa*: 36–49. Helsinki: Suomen arkeologinen seura.

Kochkurkina 2007 = Кочкуркина, С. И. (ed.) 2007. *Археологические памятники Карелии*: *Каталог*. Петрозаводск: ИЯЛИ Карельский НЦ РАН.

Kostylëva et al. 2014= Костылёва, Е. Л., Тарасов, А. Ю. & Уткин, А. В. 2014. Импортные орудия русско-карельского типа из раскопок Сахтышских стоянок: Стратиграфия, планиграфия, хронология. *Вестник Ивановского государственного университета, Вып.* 3 (7): 34–40.

Lindgren, C. 1996. Kvarts som källmaterial: Exempel från den mesoliltiska boplatsen Hagtotp. *Tor* 28: 29–52.

Lindgren C. 2003. My Way or Your Way: On the Social Dimensions of Technology as Seen in the Lithic Strategies in Eastern Middle Sweden during the Mesolilthic. In L. Larsson, K. Knutsson, D. Loeffler & A. Åkerlund (eds.) *Mesolithic on the Move*: *Papers Presented at the Sixth International Conference on the Mesolithic in Europe*: 177–183. Oxford: Oxbow

Books.
Matiskainen, H. 1989. The Paleoenvironment of Askola, Southern Finland: Mesolithic Subsistence 10 000–6000 b.p. *Iskos* 8: 1–97.
Mökkönen, T. 2009. Neolithic Housepits in the Vuoksi River Valley, Karelian Isthmus, Russia – Chronological Changes in Size and Locations. *Fennoscandia Archaeologica* XXVI: 133–161.
Mökkönen, T., Lavento, M. & Halinen, P. 2006. Neolithic Sites in Various Environments of the Karelian Isthmus: Kaukola–Räisälä-project's Survey 2004. In A. N. Kirpichnikov, E. N. Nosov & A. I. Saksa (eds.) *Slavs, Finns and Ougriens*: *The Zones of Contacts and Cooperation*: *The Papers of Russian–Finnish Symposium on the Problems of Archaeology and History, Pushkinskije Gory 2004, October 7–10*: 112–129. Saint-Petersburg: IHMC RAS.
Pankrushev 1978 = Панкрушев, Г. А. 1978. *Мезолит и неолит Карелии*: *Ч. 2, Неолит.* Ленинград: Наука.
Pesonen, P., Hertell, E., Simponen, L., Mannermaa, K., Manninen, M. A., Rostedt, T., Taipale, N. & Tallavaara, M. 2014. Postglacial Pioneer Settlement in the Lake Sarvinki Area, Eastern Finland. In F. Riede & M. Tallavaara (eds.) *Lateglacial and Postglacial Pioneers in Northern Europe*: 176–192. BAR International Series 2599.
Rankama, T. 2002. Analyses of the Quartz Assemblages of Houses 34 and 35 at Kouvonkangas in Tervola. In H. Ranta (ed.) *Huts and Houses*: *Stone Age and Early Metal Age Buildings in Finland*: 79–108. Helsinki: National Board of Antiquities.
Rankama, T. & Kankaanpää J. 2008. Eastern Arrivals in Post-glacial Lapland: the Sujala Site 10 000 calBP. *Antiquity* 82: 884–899.
Reimer, P. J., Baillie M. G. L., Bard E., Bayliss, A., Beck J. W., Blackwell, P. G., Bronk Ramsey, C., Buck, C.E., Burr, G. S., Edwards, R .L., Friedrich, M., Grootes, P. M., Guilderson, T. P., Hajdas, I., Heaton T. J., Hogg A. G., Hughen, K. A., Kaiser, K .F., Kromer, B., McCormac, F. G., Manning S. W., Reimer, R. W., Richards D. A., Southon, J. R., Talamo, S., Turney, C. S. M., van der Plicht J. & Weyhenmeyer, C. E. 2009. IntCal09 and Marine09 Radiocarbon Age Calibration Curves, 0–50,000 Years calBP. *Radiocarbon* 51 (4): 1111–1150.
Saarnisto, M. 1971. The History of Finnish Lakes and Lake Ladoga. *Commentationes Physico-Mathematicae* 41: 371–388.
Saarnisto, M. 2003. Karjalan geologia: Karjalan luonnonmaiseman synty. In M. Saarnisto (ed.) *Karjalan synty*: *Viipurin läänin historia* I: 21–80. Joensuu: Karjalan Kirjapaino Oy.
Saarnisto, M. 2008. Emergence History of the Karelian Isthmus. In M. Lavento & K. Nordqvist (eds.) *Karelian Isthmus*: *Stone Age Studies in 1998–2003*: 128–139. Iskos 16.
Saarnisto, M. 2011. Challenging the Early Holocene Isolation Dating of the Saimaa and Ladoga Ringed Seals. In J. Haarala, M. Helamaa & J. Harjula (eds.) *Times, Things & Places*: *36 Essays for Jussi-Pekka Taavitsainen*: 28–41. Turku: Festschrift committee.
Saarnisto, M. & Grönlund, T. 1996. Shoreline Displacement of Lake Ladoga: New Data from Kilpolansaari. *Hydrobiologia* 322: 205–215.
Savvateyev 1977 = Савватеев, Ю. А. 1977. *Залавруга*: *Археологические памятники низовья реки Выг*: *Ч. 2, Стоянки.* Ленинград: Наука.
Schulz, H.-P. 1996. Pioneerit pohjoisessa: Suomen varhaismesoliittinen asutus arkeologisen aineiston valossa. *Suomen Museo* 103 (1996): 5–45.
Shakhnovich 2007 = Шахнович, М. М. 2007. Мезолитическое поселение Киркколахти I в Северном Приладожье (результаты работ 2005–2006 гг.). *Своеобразие и особенности адаптации культур лесной зоны Евразии в финальном плейстоцене – раннем голоцене*: 163–181. Москва: ИА РАН.
Shakhnovich et al. 2014 = Шахнович, М. М., Такала, Х., Малинен, А. & Тарасов А. Ю. 2014. Стоянка Хетуоя I: Новый мезолитический памятник в Северном Приладожье. In В. Н. Карманов (ed.) *От Балтики до Урала*: *изыскания по археологии каменного века*: 37–55. Сыктывкар: ИЯЛИ Коми НЦ УрО РАН.
Shakhnovich et al. 2015 = Шахнович, М. М., Тарасов, А. Ю & Такала Х. 2015. Новые памятники каменного века в Северном Приладожье. *Проблемы первобытности и раннего Средневековья лесной зоны Восточной Европы, Вып.* IV: 165–176.
Subetto 2007 = Субетто, Д. А. 2007. История формирования Ладожского озера и его соединения с Балтийским морем. *Общество. Среда. Развитие (Terra Humana)* 1 (2): 111–120.
Taavitsainen, J.-P. 1982. Hollolan Kapatuosian linnamäki. *Fennoscandia Antiqua* I: 27–35.
Takala, H. 2004. *The Ristola Site in Lahti and the Earliest Postglacial Settlement of South Finland.* Lahti: Museum of Lahti.
Takala, H. 2012. Kannaksen varhaisin jääkauden jälkeinen asutus. In H. Takala (ed.) *Äyräpään kihlakunnan esihistoria* II: 143–194. Lahti: Lahden kaupunginmuseo.
Takala, H. 2014. Recent Archaeological Research in the Northern Parts of the Lake Ladoga Region in Karelia, Russia. In F. Riede & M. Tallavaara (eds.) *Lateglacial and Postglacial Pioneers in Northern Europe*: 193–206. BAR International Series 2599.
Takala, H. & Gerasimov, D. V. 2014. Kivikautinen asuinpaikka Kirvun Hauhialassa Karjalan kannaksella: Asutusta mesolitikumin ja neolitikumin rajapinnassa. *Muinaistutkija* 2014 (3): 2–15.
Tallavaara, M., Manninen, M. A., Pesonen, P. & Hertell, E. 2014. Radiocarbon Dates and Postglacial Colonisation Dynamics in Eastern Fennoscandia. In F. Riede & M. Tallavaara (eds.) *Lateglacial and Postglacial Pioneers in Northern Europe*: 161–175. BAR International Series 2599.
Tarasov 2006 = Тарасов, А. Ю. 2006. Нуклеусы и бифасы: Некоторые особенности первичной обработки окремнённых пород и кварца на поселениях Карелии (неолит – ранний железный век). *Тверской археологический сборник, Вып.* 6: 74–86.
Tarasov & Kriiska 2014 = Тарасов А. Ю. & Крийска, А. 2014. Рубящие орудия русско-карельского типа с территории Латвии: К вопросу об обмене в финальном каменном веке. In Г. А. Хлопачев & С. А. Василев (eds.) *Каменный век от Атлантики до Пацифики*: 307–317. Замятнинский сборник, Вып. 3.
Tarasov et al. 2010 = Тарасов, А. Ю., Крийска, А. & Кирс, Ю. 2010. Свидетельства обмена между населением Карелии и Эстонии в финальном каменном веке: По результатам археологического и петрографического изучения рубящих орудий русско-карельского типа с территории Эстонии. *Труды КарНЦ РАН* 2010 (4): 56–65.
Uino, P. 2003. Kunnittainen katsaus luovutetun Karjalan muinaisjäännöksiin, arkeologisiin tutkimuksiin ja löytöihin. In M. Saarnisto (ed.) *Karjalan synty*: *Viipurin läänin historia* I: 505–511. Joensuu: Karjalan Kirjapaino. Oy.
Vereshchagina 2003 = Верещагина, И. В. 2003. Поселение Хепо-ярви в южной части Карельского перешейка. In В. И. Тимофеев & Г. И. Синицына

(eds.) *Неолит–энеолит юга и неолит севера Восточной Европы*: 140–151. Санкт-Петербург: ИИМК РАН.

Zhul'nikov 1999 = Жульников, А. М. 1999. *Энеолит Карелии.* Петрозаводск: ИЯЛИ Карельский НЦ РАН.

Zhul'nikov 2003 = Жульников, А. М. 2003. *Древние жилища Карелии.* Петрозаводск: ИЯЛИ Карельский НЦ РАН.

Notes

1 For updated lists of datings concerning Mesolithic sites in Finnish northern and southern Karelia and the Lake Onega region, see the articles published in the British Archaeological Reports, International series in 2014 (Pesonen et al. 2014; Takala 2014; Tallavaara et al. 2014).

2 The radiocarbon datings presented in this article were made at the dating laboratory of the University of Helsinki and calibrated using the IntCal09 curve and Oxcal 4.1 programme (Bronk Ramsey 2009; Reimer et al. 2009). The calibrated dates are given with a probability of 68% and a confidence interval of 1 sigma.

Suomen Muinaismuistoyhdistys ry – Finska Fornminnesföreningen rf
The Finnish Antiquarian Society

New Sites, New Methods

Proceedings of the Finnish-Russian Archaeological Symposium

Helsinki, 19–21 November, 2014

Editors:
Pirjo Uino & Kerkko Nordqvist

ISKOS 21

Helsinki 2016