Petri Halinen & Teemu Mökkönen

BETWEEN LAKE AND SEA – STONE AGE SETTLEMENT BY ANCIENT LAKE LADOGA ON THE KARELIAN ISTHMUS

Abstract

This paper discusses changes in the settlement pattern of the hunter-fisher-gatherers once inhabiting the shores of Ancient Lake Ladoga. So far, the study area is archaeologically the most extensively studied area on the Karelian Isthmus, Russia. Recent surveys and small-scale excavations have diversified the picture of hunter-gatherer settlement in the Kaukola–Räisälä area, nowadays located in the lower River Vuoksi Valley. This article presents new data and discusses the changes in site location with respect to environmental zones and variation in the shelteredness of the sites. Special attention is paid to the differences between housepit sites and other dwelling sites without such permanent dwelling structures. In addition, the excavated sites provide a selection of various settlement types located in different environmental zones. The occupation phase and the settlement type of the excavated sites are determined with the help of osteological and archaeological material. Research indicates that the most distinctive change in settlement pattern took place during the Middle Neolithic, at the time when Typical Comb Ware was in use (ca. 4000–3400 cal BC).

Key words: Stone Age, Mesolithic, Neolithic, housepit, settlement pattern, subsistence, Karelian Isthmus

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INTRODUCTION

How did the subsistence strategies and mobility or sedentariness of societies change during the Stone Age and Early Metal Period on the Karelian Isthmus? These questions are answered by analyzing the structures and osteological material of sites, along with their environmental location. This article summarises some results of the Kaukola-Räisälä Project conducted in Finnish-Russian-Estonian co-operation from 2004 to 2006.[1] The aim of this article is to present and analyze the material gathered in the project. Due to the lack of Early Metal Period material found in surveys and excavations since 1999, this study concentrates on the Stone Age. The rich archaeological material found before World War II functions as background data and is not actively discussed here.[2]

The research area was selected in order to continue a long-term archaeological project already started in the late 1990s (Lavento 2008a; 2008b), one purpose of which was to resolve how people have lived on the shores of Ancient Lake Ladoga during the Stone Age and the Early Metal Period. After an excursion made to the known sites (Siiriäinen et al. 2008), several intensive surveys (Lavento et al. 2001; Mökkönen et al. 2006) and excavations were carried out from 1999 to 2005. In terms of the number of dwelling sites, the study area was the most intensively studied area on the Karelian Isthmus already before the latest project.

The study material consists of dwelling sites with a varying number of housepits and sites with no housepits at all. In this study, the topographic settings of the sites are analyzed in order to observe the differences in the site's rate of shelteredness.

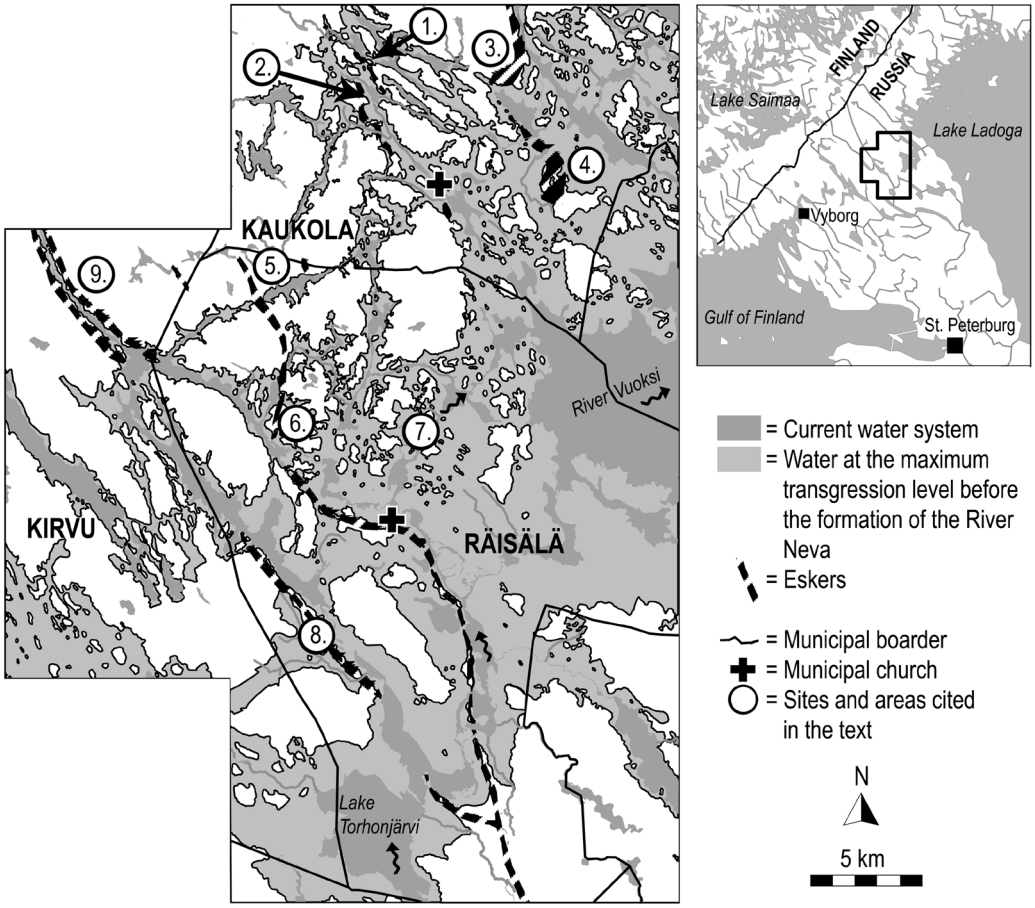

Fig. 1. The location of the Kaukola-Räisälä Project's research area and former Finnish municipalities. Areas cited in the text: 1) Piiskunsalmi area, 2) Riukjärvi area, 3) Kaarlahti area, 4) Rupunkangas area, 5) Lake Juoksemajärvi, 6) 'Räisälä inner archipelago', 7) 'Räisälä outer archipelago', 8) Papinkangas area, and 9) River Kuunjoki. The curved arrows show the current flow of the River Vuoksi. Maps: T. Mökkönen.

The analysis of the excavated and surveyed material indicates that there are changes in settlement patterns and subsistence strategies throughout the millennia. This article, together with another article in this volume (Mökkönen in this volume), argues for the most distinctive change in settlement pattern taking place during the Middle Neolithic, when a large number of housepits was constructed in the inner archipelago.

Research history

Archaeological material collected from the Kaukola–Räisälä Project's research area (Fig. 1) has played an essential role in Early Stone Age research in Finland. During the first two decades of the 20th century, extensive research focusing on the Stone Age was carried out in the project's research area (Ailio 1909; Pälsi 1915; 1918; Lavento et al. 2001; 2006; Huurre 2003: 154–7; Uino 2003; Mökkönen et al. 2006; Lavento 2008a; 2008b; Nordqvist & Lavento 2008; Nordqvist et al. 2008a; 2008b).

The significance and scale of the material collected during this early research is testified to by the fact that in 1947, the archaeological material from 'ceded Karelia' made up some 40% of the total amount of Stone Age material in Finland (Uino 2003: 137). Half of this material was from Kaukola, mostly from the Riukjärvi–Piiskunsalmi area. In the light of research history, it can be said

that the Finnish Stone Age was initially discovered during the research done in the Kaukola and Räisälä municipalities in the early 20th century.

The period of the Soviet era starting from 1947 and continuing to 1990s Russia was a quiet phase in Stone Age research (Uino 1997: Appendix 1; 2003:141–2; Lavento et al. 2001:6–8; Mökkönen & Nordqvist 2006; Lavento 2008a; Nordqvist & Lavento 2008; Nordqvist et al. 2008a; 2008b). A second period of intensive research on the Kaukola-Räisälä area started in the late 1990s when archaeologists of the University of Helsinki carried out the first survey in the area (Lavento et al. 2001). The work was done in collaboration with Russian archaeologists based in St. Petersburg.

In the three surveys carried out in 1999, 2004, and 2005, the number of sites dating from before the Common Era was multiplied by six (Tables 1-3). In the latest project, namely the Kaukola–Räisälä Project, the surveys and excavations were focused on three former Finnish municipalities: Kaukola, Räisälä, and Kirvu3 (Fig. 1). Some results of the project have been published (Lavento et al. 2006, Mökkönen et al. 2006, Mökkönen et al. 2007), but the two articles in this volume (second article Mökkönen in this volume) publish the data and answer the main questions of the project. Archaeological material collected in earlier projects by the University of Helsinki is included in this study (see Lavento et al. 2001; Seitsonen, O. 2005; Halinen et al. 2008; Nordqvist & Lavento 2008).

Table 1. The accumulation of sites in surveys.

Year	Sites
1999>	24
1999	36
2004	65
2005	20
Total	145

The sites found in the early 20th century were mostly located on arable land and were first noticed by local farmers (Nordqvist 2005: 52–6, Appendix VII). Nowadays the old fields are mostly out of active farming use and have been changed to unploughed hayfields or reforested. Therefore, the recently found sites, with only a few exceptions, are located in forests, where the Stone Age structures are still visible on the ground. In the survey of 1999, the first housepits – the bases of semi-subterranean houses, also called dwelling depressions – known on the Karelian Isthmus were found (Lavento et al. 2001: 19–20). At the moment, 78 housepits are spread over 23 dwelling sites.

Environmental zones before the formation of the River Neva (ca. 1350 cal BC)

In the research area, the water level of Ancient Lake Ladoga has been rather stable from its isolation from the Baltic Sea Basin (ca. 7800–7000 cal BC) to the formation of the River Neva (ca. 1350 cal BC). There are two reasons for this. First, the research area lies approximately at the same land uplift isobase with the first outlet channel of Lake Ladoga located in Vetokallio in the Heinijoki municipality – a situation that has prevented long-term fluctuations of the water level. Second, in most of the research area, the relatively steep topography has also prevented environmental changes caused by land uplift (Fig. 2) (e.g., Saarnisto 2003b: 57, 64; 2008).

The formation of the River Vuoksi (ca. 4000 cal BC), a new outlet from Lake Saimaa to Lake

Table 2. Sites of different character.

	Kaukola	Kirvu	Räisälä	Pyhäjärvi	Vuoksenranta	Total
Sites with dwelling depressions	11	2	18	-	-	31
Sites without dwelling depressions	36	15	34	2	2	89
Quartz find locations	9	0	11	0	2	22
Other[1)]	2	0	1	-	-	3
Total	58	17	64	2	4[2)]	145

[1)] hunting pits and a 'Lapp cairn; [2)] includes two sites found by Russian archaeologists

Table 3. The dating of the sites.

Dating	N	(N)
Stone Age	123	-
Neolithic	64	1
Mesolithic	17	1
Early Metal Period	22	11
Multiperiod	18	-

(N)= number of potential sites

Ladoga, started transgression in the research area, too (Saarnisto 1970: 61–5; Jussila 1999). The transgressive phase of Ancient Lake Ladoga ended with the formation of the current outlet, namely the River Neva (ca. 1350 cal BC). The transgression was most effective in the southern part of the current research area, where a lower land uplift rate and a rather flat topography gave more weight to the effects of the rising shoreline.

However, the overall changes are not very extensive in the northern and middle parts of the research area where most of the sites are located (Fig. 2). The difference in water levels preceding the faster transgression caused by the River Vuoksi since ca. 4000 cal BC and the maximum transgression level before the River Neva is less than two meters (Saarnisto & Siiriäinen 1970). This is supported by the stratigraphical observations made on the soil profile at the dwelling site of Rupunkangas 3 in the Kaukola municipality, dated synchronous with the isolation of the Lake Ladoga basin ca. 7940–7610 cal BC (1 sigma).

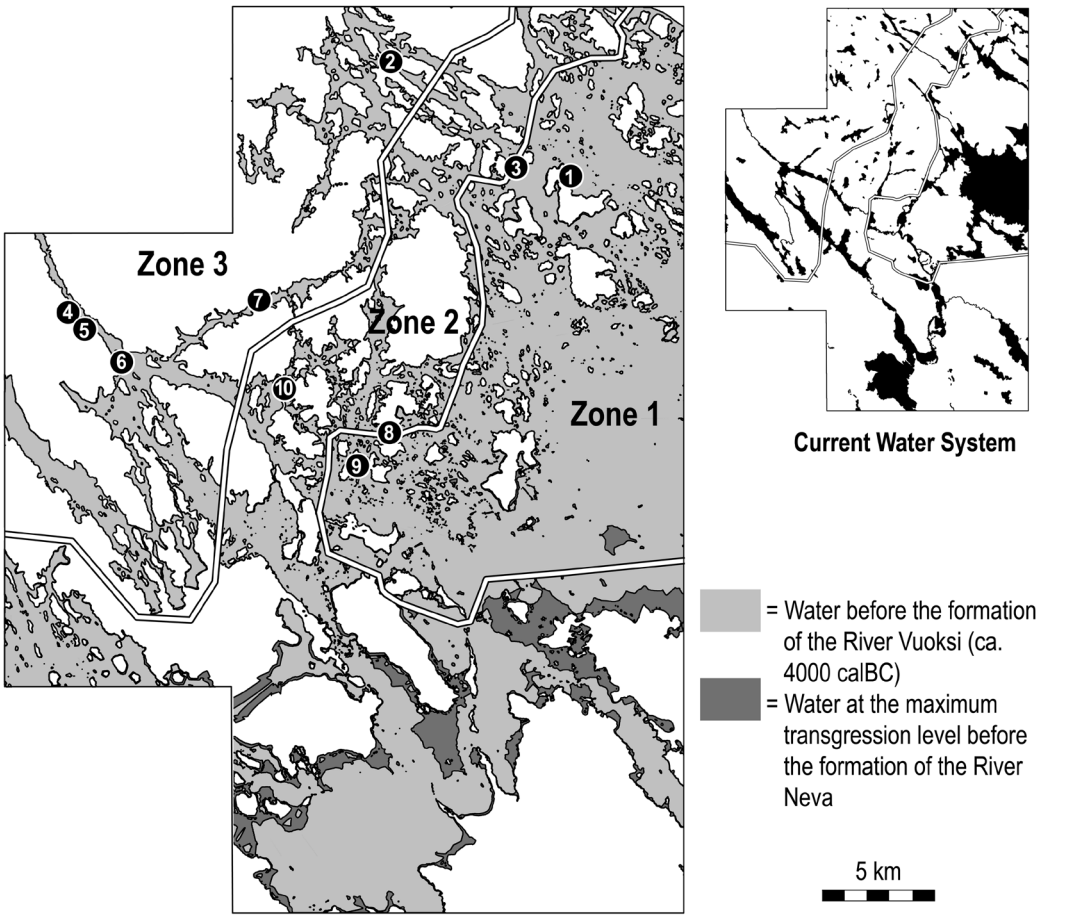

Fig. 2. A reconstruction of the water level before the formation of the River Neva and the division of the environmental zones during Ancient Lake Ladoga: Zone 1 – Outer archipelago and open water area, Zone 2 – Inner archipelago and the mouths of bays, and Zone 3 – Shores of narrow fjord-like bays and inland.
The excavated sites mentioned in the text (see Appendix 1): 1) Kaukola Rupunkangas 1 and Rupunkangas 3, 2) Kaukola Kakarlahti 2, 3) Kaukola Autio 1, 4) Kirvu Juhola 2, 5) Kirvu Kivimäki 2, 6) Kirvu Harjula, 7) Räisälä Juoksemajärvi Westend, 8) Räisälä Kuusela, 9) Räisälä Hiekka 1, and 10) Räisälä Peltola C.
Maps: T. Mökkönen.

There the maximum transgression of Ancient Lake Ladoga (dated ca. 1350 cal BC) did not rise above terraces formed during the isolation (Mökkönen et al. 2007: 5–7).

The vegetation and annual temperature has changed notably during the Stone Age. The first settlers came to the area during the Late Preboreal period (10000–9000 BP/9500–8200 cal BC) (see, e.g., Huurre 2003: 170–4; Carpelan 2008), when the climate was cool and the vegetation was dominated by mixed shrub and birch (*Betula*). During the Boreal period (9000–8000 BP/8200–7000 cal BC), into which the oldest sites in the research area can be dated, the arboreal vegetation was increasing with the dominance of pine (*Pinus*). During the Atlantic period (8000–5000 BP/7000–3750 cal BC), the mild climate brought along deciduous trees, such as elm (*Ulmus*), oak (*Quernus*), linden (*Tilia*), and hazel (*Corylus*). At the end of the Atlantic period, spruce (*Picea*) arrived in the area in ca. 5500 BP/4350 cal BC. During the last climatic period of the Stone Age, the Sub-Boreal period (5000–2500 BP/3750–600 cal BC), deciduous trees declined and spruce became more abundant at first, but later declined again. During this period the climate was cooling off (Davydova et al. 1996; Simola 2003).

Concerning the alternation between land and water, the environment in the research area was very similar to that of the northeastern shores of the Gulf of Finland. In both areas, eskers and higher bedrock exposures running in the northwest-southeast direction are typical features. The shores of Ancient Lake Ladoga were split by long narrow bays reaching into the inland, as well as long capes dividing the water areas. The archipelago was mostly composed of relatively large islands. In the Räisälä area, there was also a large number of very small islands and islets. As a whole, the narrowness of the archipelago characterized the area.

In this study, the research area is divided into three environmental zones. They follow the typical division of the ecological and geographical zones in the archipelago of the Gulf of Finland (e.g., Hanhijärvi & Yliskylä-Peuralahti 2006: 9–10). The conventional division of coastal areas into the outer, intermediate, and inner archipelago has been used in a slightly modified way in this study. The division is based on the relations between land and water areas.

The following environmental zones are used in the study (see Fig. 2):

Zone 1) Outer archipelago and open water area are combined to form one environmental zone. The outer archipelago is an area in which the number of islands is relatively low and the size of islands usually smaller than average. The smallest islands in this zone are usually quite stony and rocky, and the vegetation type is barren. The amount of water areas is notably higher than the amount of land areas.

Zone 2) Inner archipelago and the mouths of bays are combined into the same zone. In this zone, the amount of water and land areas are roughly equal. There are rather large islands and the land areas in this zone mostly face open water areas.

Zone 3) Shores of narrow fjord-like bays and inland. In this zone, the land areas dominate, the number of islands is low, and the water areas are limited in size.

SITES AND ENVIRONMENTAL ZONES

Most of the sites in this study have been found in the surveys of 1999 and 2004–2005. The total number of sites in this study, including those found some one hundred years ago, is 145. Out of these, altogether 134 dwelling sites are used for studying the rate of protection against winds with the help of the topographic shelter index. These sites include 23 housepit sites. The excluded sites are solitary find locations and sites not classified as dwelling sites.

Spatial distribution of the sites

The dwelling sites are quite evenly spread over environmental zones 2 and 3. However, the largest dwelling site areas in terms of the extent of the sites, as well as the abundance of finds, are concentrated in two regions: in the 'Räisälä inner archipelago' (Zone 2) and the Riukjärvi–Piiskunsalmi area (Zone 3). Despite the fact that these site clusters are not located in the same environmental zone, they share a number of common elements: eskers (i.e., sand and moraine ridges), steep topography, and the meeting point of several waterways from the outer archipelago leading further inland (Mökkönen et al. 2006: 116). Both areas are characterized by relatively well-sheltered sites

along narrow fjord-like waterways and by being located approximately within the same distance from the outer archipelago.

Most of the housepits are located in the 'Räisälä inner archipelago' (Figs. 1 & 3, Table 4). However, the currently observed clustering of the housepits is affected by later agricultural activity. It is notable that the 'classic sites' excavated roughly a hundred years ago in the Riukjärvi–Piiskunsalmi area have been located on fields and meadows, and therefore the semi-subterranean structures were and are not visible on the ground. However, some field reports of the early excavations hint at the possible existence of housepits (Mökkönen et al. 2006: 117, see also Seitsonen, O. 2006), although they were not interpreted as such at the time. Considering this, as well as the abundance of finds on the sites of the Riukjärvi–Piiskunsalmi area, there is good reason to assume that there were housepits also in this area during the Stone Age (see Mökkönen et al. 2006).

Generally speaking, most of the sites with housepits are located in environmental zones 2 and 3. Due to later agricultural activities, the number of sites with housepits located in Zone 3 could be higher than the number presented in Table 4. All the housepits located in Zone 1 are located in the Rupunkangas area, which used to be a large island in the outer archipelago of Ancient Lake Ladoga (see Mökkönen et al. 2007).

The sites located further towards the inland or the outer archipelago from the densest site clusters are more or less minor in character (Mökkönen et al. 2006: 116). However, smaller sites of more restricted extent are located within the richest dwelling site areas, too. This is a general view,

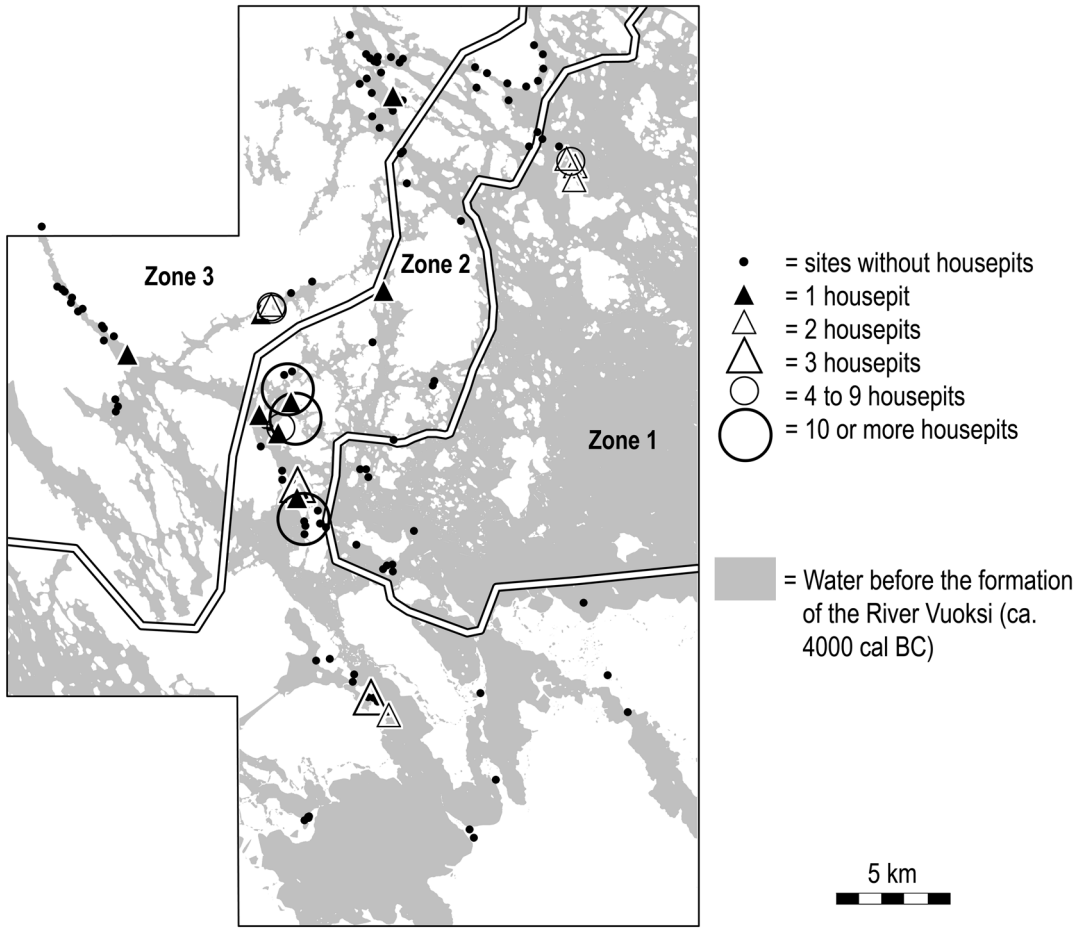

Fig. 3. The distribution of the archaeological sites within the environmental zones. Map: T. Mökkönen.

Table 4. The number of sites with and without housepits.by environmental zones The number of sites with housepits of slightly uncertain character is in parentheses. The 'without housepits' category includes eleven sites not associated with dwelling sites (e.g., hunting pits, a 'Lapp cairn' and locations with isolated finds).

	Zone 1		Zone 2		Zone 3		Total	
	N	%	N	%	N	%	N	%
housepit sites	5+1	20 (22)	12+2	47 (52)	6+4	26 (33)	23+7	21
without housepits	12	11	59	57	33	32	115	79
Total	18	13	73	50	54	37	145	100

but there are some exceptions as well, namely the housepit sites by Lake Juoksemajärvi, the Kirvu Harjula site in Zone 3, and the sites in the Rupunkangas area in Zone 1.

Chronological variations on site distribution

As noted earlier, the sites in the research area cannot be divided exactly into chronological schema with the help of shore displacement data. A somewhat better way to handle the chronology goes hand in hand with ceramics found at the sites. However, there is no detailed chronology of ceramics found on the Karelian Isthmus. Supposedly, the chronology is essentially equivalent to the chronologies of the nearby areas. This is probably true for the earlier part of the Neolithic, but the later part of the Neolithic is more problematic (see more Mökkönen 2008; in this volume).

The identification of Early Mesolithic sites in the research area is difficult. The ages of all excavated Early Mesolithic sites have been discovered with the help of radiocarbon dates. In contrast, the sites with flint microblades have Late Mesolithic radiocarbon dates. In Finnish archaeology, flint microblades are considered to be connected, with only a few exceptions, to the pioneering settlement, that is, the first settlers colonizing the area after the last glaciation in ca. 8800–8400 cal BC (e.g., Takala 2004; Jussila et al. 2007: 157). Therefore, it seems that flint microblades and blades have stayed in use longer on the Karelian Isthmus. The radiocarbon dates and the material from the Räisälä Juoksemajärvi Westend site (Mesolithic dwelling phase ca. 7000–6400 cal BC), the Räisälä Hiekka 1 site (ca. 5900–5600 cal BC), and the Late Mesolithic–Early Neolithic part of the Hepojärvi site located on the southern Karelian Isthmus (ca. 5600–5300 cal BC, Vereshchagina 2003) all indicate the use of flint microblades through the Mesolithic to the Early Neolithic Stone Age. In the light of these sites, the presence of flint microblades does not automatically refer to Early Mesolithic habitation.

Based on the analyzed ceramics, there is some chronological variation in the way the sites are spread over the environmental zones (Fig. 4). Older ceramic styles, namely Early Neolithic Wares (Early Comb Ware aka Sperrings, Early Asbestos Ware) and Pitted Ware, are the only ceramics that are not found in the outer archipelago (Zone 1). All the younger ceramic styles are quite evenly spread into each environmental zone. The distribution of other artefacts gives a similar impression: the Middle Neolithic and younger materials are evenly spread over the different environmental zones (Nordqvist 2005: 98–100). Minor differences most likely originate from the poor representativeness of the material.

Topographic shelter index

The site location, at macro as well as micro level, holds information regarding the site's suitability for certain kinds of human activity. In this study, the immediate environment of the sites is analyzed by using the topographic shelter index.[4] It describes the site's topographic location and the rate of protection against wind. The index values analyzed together with the environmental zones and the structures found at the sites provide a basis for understanding the changes in the way the landscape has been settled during the Stone Age.

The topographic shelter index is composed of three variables (Fig. 5), each with a scale from 1 to 3, in which 3 stands for the best shelter and 1 for the worst shelter. The analyzed variables were the following: (1) Background. Was the site located on flat ground or does it have a sheltered background?

(2) Exposure to the open sea. Was the site situated by open sea or by sheltered narrow waters? (3) Topographic location of the site as a protected or vulnerable locus. Was the site situated on a windy cape or at the end of a sheltered bay?

The index value is calculated by counting the mean and the median of the three variables. The degree of shelteredness increases along with increasing index value. The most sheltered sites, which have a shelter index value of 3, are sites with a sheltered background (e.g., a high hill) that are exposed to narrow water areas and surrounded by large land areas. The index values are not absolute values, they just describe the prevailing atmosphere of the sites.

The differences in index values are not big, but they are noticeable (Table 5). On average, sites with housepits are in more sheltered locations than other sites (see also Nordqvist & Lavento 2008). According to the topographic shelter index, the well-sheltered sites are located in environmental zones 2 and 3. In the Räisälä region, the clusters of the most sheltered sites coincide with the densest cluster of housepits. In the northern part of the research area, in Kaukola, the well-sheltered sites are also situated in environmental zone 2 (Fig. 6).

It is not surprising that the most poorly sheltered sites with housepits are located in the outer archipelago (Zone 1). Instead, the housepit sites in Zones 2 and 3 seem to be located in especially well-sheltered places. The most poorly sheltered sites are spread into every environmental zone. Most of them are located in Zone 1, but especially in the Riukjärvi–Piiskunsalmi area, a great number of the sites in

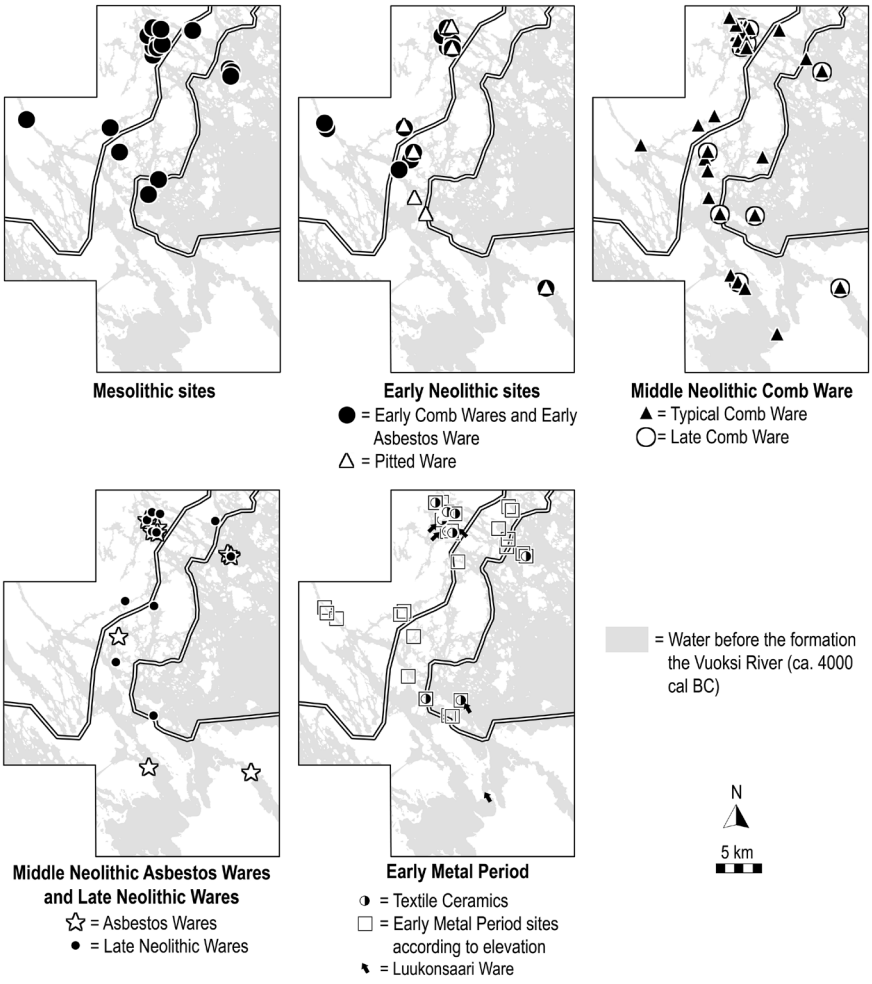

Fig. 4. The geographical distribution of Mesolithic, Neolithic, and Early Metal Period sites.

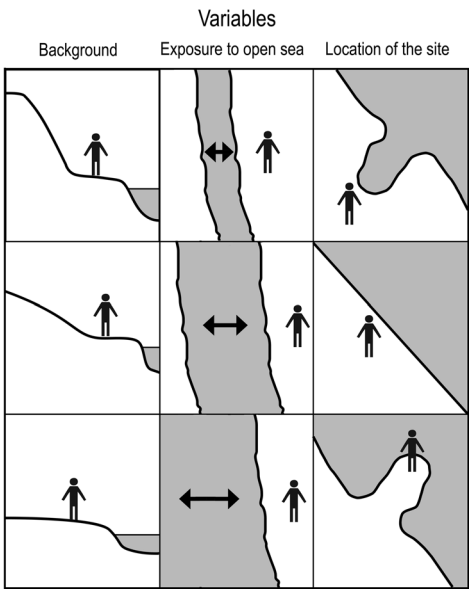

Fig. 5. Topographic shelter index variables and rating. A rating (on the left margin) of 3 indicates the best sheltered locations against winds and a rating of 1 the worst.

Zone 3 are poorly sheltered. There the size of the water areas is relatively restricted, but the sites are often in other respects unsheltered.

The comparison between sites with and without housepits is slightly misleading. Some sites nowadays located on fields could be housepit sites, too, although they cannot be classified as such at the moment. In addition, there are 111 sites without housepits, including 16 sites with a higher index value than the mean value of all housepits, which is 2.32. These sixteen sites are divided among the environmental zones as follows: three sites in Zone 1, ten sites in Zone 2, and three sites in Zone 3.

The distribution of sites in each analyzed variable of the topographic shelter index shows interesting differences between the different types of sites (Fig. 7). In the diagram showing the rate of protection provided by the background of the sites, the high percentage value of poorly sheltered sites with housepits is explained by the sites located in the Rupunkangas area in the outer archipelago. Similarly, in the diagram presenting the exposure to the open sea, the proportion of highly sheltered sites with housepits could be even higher if the housepits of the Rupunkangas area were excluded. The diagram shows clear tendencies, especially in the variables concerning the background and location of the site. The housepit sites often tend to be located in a topographically more sheltered place than other sites. Concerning the background, however, the housepits tend to be located in places without background cover more often than other dwelling sites. Therefore, the generalization that the housepits are on average better sheltered than the other sites is not the whole story. The sites with and without housepits emphasize different environmental features that collectively make up the overall rate of shelteredness.

DISCUSSION

Representativeness of the material

Most of the recently found sites are Neolithic. This view is probably distorted, because Neolithic material is usually both more abundant and more easily recognizable than the material dating to the Mesolithic or to the Early Metal Period. Several extensively excavated sites in the area have turned out to be multi-period sites, that is, the sites have been occupied for long periods. For example, most sites in the Riukjärvi–Piiskunsalmi area have a settlement history reaching from the Mesolithic Stone Age to the Early Metal Period and later.

The formation of multi-period sites is affected by both environmental history and people's habits in choosing dwelling sites. Even though the variation

Table 5. Topographic shelter index values of the sites.

	N	min	max	mean	median
All sites	134	1.3	3.0	2.05	1.82
Without housepits	111	1.3	3.0	2.02	1.82
With housepits	23	1.3	3.0	2.32	2.14
With housepits in Zone 1	5	1.3	2.3	1.73	1.33
With housepits in Zone 2	12	1.7	3.0	2.23	2.30
With housepits in Zone 3	6	1.7	3.0	2.65	2.30

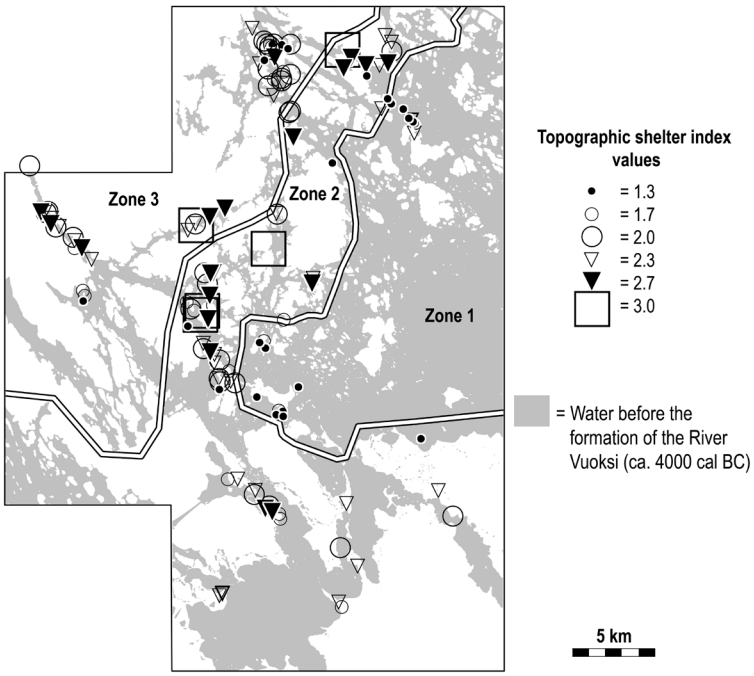

Fig. 6. Topographic shelter index values and the environmental zones. Map: T. Mökkönen.

in water level caused by land uplift before the River Neva has been within two meters, the dwellers' habit of favouring sites with steeper topography has caused the formation of multi-period dwelling sites (Mökkönen et al. 2006: 116). On the face of it, the abundance of such sites indicates quite a stable way of life through the millennia.

Another matter skewing the perspective on archaeological sites is related to stray finds made by locals some one hundred years ago. In total, they consist of 4423 numbers in the collections of the Finnish National Museum (Nordqvist 2005: 36, Appendix V). According to Nordqvist, most of the finds are from the areas surrounding the classic large sites around Lake Riukjärvi and the Piiskunsalmi strait, but there are also some areas rich in surface finds that were not inspected by archaeologists at the time. Some of those areas were inspected in the surveys of 2004 and 2005. In a few areas with surface finds, the dwelling sites could still be located, while some other probable dwelling site areas were totally destroyed by heavy-machinery agriculture (Nordqvist 2005: 112–113, 123.)

The temporal representativeness of the excavated material in use is not very extensive. Especially the old material is mostly from the multi-period sites and the old-fashioned excavation techniques do not allow a temporal processing of the material. As for recent excavations (see Table 6 and Appendix 1), the number and size of

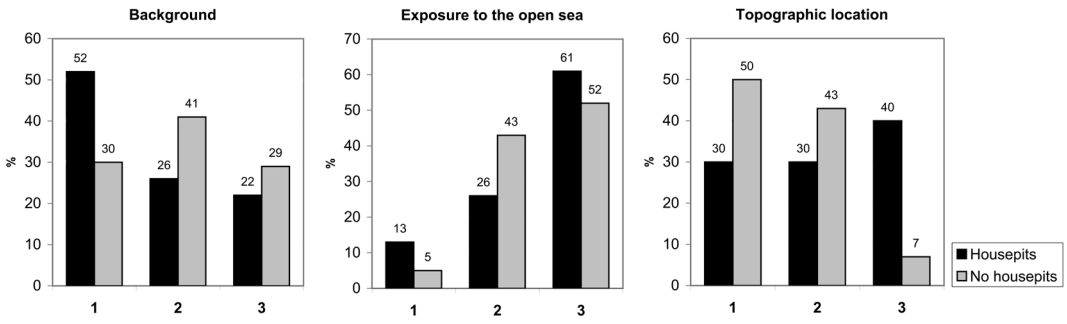

Fig. 7. The distribution of sites according to the variables analyzed in the topographic shelter index. 1 – poorly sheltered, 2 – moderately sheltered, and 3 – well-sheltered.

excavations, as well as the temporal coverage of the excavated sites, are insufficient for drawing wide-ranging conclusions about subsistence and settlement patterns. They merely provide snapshots of a few site types of different ages located in different environmental zones.

Changes in settlement pattern

The change in settlement pattern appears most often as a change in site locations and dwelling structures (Rafferty 1985; Marshall 2006). Despite the fact that the material from the Kaukola-Räisälä region is not ideal for studying the change

Table 6. A summary of the excavated sites (see also Appendix 1). The chronological division of the Mesolithic Stone Age is not based on any real changes in material culture. It is merely applied for practical reasons.

			Mesolithic			Neolithic							
Parish – site	A	Finds *N*	Early (8200–)	Middle (7000–)	Late (6000–)	Early (5200–)	Middle (4000–)	Late (2300–)	1800–	Early Metal Age	HPs	Cer.	Interpretation	Season
Zone 1														
Kaukola – Autio 1	2	*c* 102 *l* 93 *b* 2	-	-	-	-	x	-		-	-	CW2	Camp site, regular use	Summer (?)
Kaukola – Rupunkangas 1	6	*c* 131 *l* 223 *b* 380	x	x	x	-	x	x		x	1	CW3 TXT	Camp site, regular use	Autumn–winter–early spring (?)
Kaukola – Rupunkangas 3	–	*l* 1363 *b* 865	x	-	-	-	-	-		-	2	-	Camp site (?), regular use	Year-round (?)
Kaukola – Rupunkangas 4	6	*l* 63	-	-	-	-	-	-		-	-	-	Camp site	?
Zone 2														
Räisälä – Hiekka 1	4	*l* 641 *b* 1071	-	-	x	-	-	-		-	-	-	Camp site, regular use	Spring–summer
Räisälä – Kuusela	4	*l* 33 *b* 18	-	x	-	-	-	-		-	-	-	Camp site, seasonal and occasional use	Summer (?)
Räisälä – Peltola C	2	*c* 2111 *l* 112 *b* 1371	-	-	-	-	x	-		-	5	CW2	Base camp, regular use	Year-round
Zone 3														
Kaukola – Kakarlahti 2	2	*c* 241 *l* 478 *b* 541	-	-	(x)	-	x	x		-	-	CW2 ASB CoW (?) TXT (?)	Camp site, regularly used	Year-round (?)
Kirvu – Harjula	1	*c* 17 *l* 29 *b* 1732	-	-	-	-	x	-		-	-	CW3	Camp site, seasonal and regular use	Late summer (?)
Kirvu – Juhola 2	4	*l* 186 *b* 3643	x	-	-	-	-	-		-	-	-	Camp site, seasonal and regular use	Spring–summer
Kirvu – Kivimäki 2	5	*c* 898 *l* 34 *b* 297	-	-	-	x	-	-		-	-	-	Camp site, occasional use	?
Räisälä – Juoksemäjärvi Westend	51*	*c* 59 *l* 8270 *b* >30,000[1)]	-	x	-	x	x	(x)[2)]		-	6	CW1 CW2 (?) VOL (?)	Base camp	Year-round

Excavated area (A) in m^2; Finds: *c*= ceramics, *l*= lithics, *b*= bone; Housepits (Hps); Ceramics (Cer.): CW1= Early Comb Ware, CW2= Typical Comb Ware, VOL= Volosovo pottery, CW3= Late Comb Ware, ASB= asbestos tempered ware, TXT= Textile pottery, CoW= Corded ware

[1)] only the main excavation area included, [2)] Late Neolithic occupation indicated by radiocarbon dates and some artefacts.

in settlement patterns and subsistence strategies, some conclusions can be drawn. The question of changes in subsistence strategies and settlement patterns cannot be answered only through individual sites. Hence, the results of another article dealing with all the housepit sites of the Kaukola-Räisälä region (Mökkönen in this volume) are also employed here.

Since the water system has been very close to stable during the Ancient Lake Ladoga phase, some sites have stayed more or less constantly occupied for millennia. This implies that the ancient dwellers have been satisfied with those particular places. However, it must be pointed out that it is not very well known what kind of habitation has taken place on a certain site at different times. However, the sites richest in finds (both in number and in diversity) can be associated with base camps that were occupied for longer periods. At least the results of the Räisälä Juoksemajärvi Westend site and the 'classic' sites around Lake Riukjärvi and the Piiskunsalmi strait support this idea.

Different ceramic styles, as well as Mesolithic and Early Metal Period sites, are quite evenly distributed over the environmental zones. The different distribution of Early Neolithic and other ceramic styles is especially interesting. The distribution of the older ceramics (i.e., Early Comb Ware and Early Asbestos Ware) is oriented towards more terrestrial environments than that of younger ceramic styles, which are evenly distributed throughout the archipelago. The spread of Middle Neolithic ceramics to the archipelago is synchronous with the housepits' 'colonization' of the inner archipelago (see Mökkönen in this volume). However, these two events are not the whole truth. At the same time, the ceramics were distributed also to the other small seasonal sites in the archipelago. This is reason enough to suppose that a change in the way the ceramics were used really took place at the beginning of the Middle Neolithic period (after ca. 4000 cal BC), that is, at the time the presence of ceramics does not indicate only base camps.

As for settlement patterns, that is, the nature and distribution of individual dwelling sites and the relationships between them (Rafferty 1985), the inner archipelago (Zone 2) is an interesting area. Most of the housepits and a great number of well-sheltered sites are located within this zone. Unfortunately, there are only two recently excavated sites[5] – one Neolithic base camp, namely Räisälä Peltola C, and one Mesolithic seasonally used camp site, namely Räisälä Kuusela (see Table 6). Evidently, the housepit sites located in this zone are most probably base camps used at least during winters, but in the light of the Räisälä Peltola C site, a longer occupation season is highly probable. The study on all housepits also points to a longer occupation period (see Mökkönen in this volume).

The character of the sites in the outer archipelago and the open water area (Zone 1) indicates mostly seasonally used camp sites. Although the sites in the Rupunkangas area have a number of housepits, at least the partly excavated site of Kaukola Rupunkangas 1 has been interpreted as a seasonally used camp site (Mökkönen et al. 2007). The only site in the outer archipelago that could have served as a base camp in terms of its well-sheltered location is the Kaukola Rupunkangas 3 site. However, the accumulation of finds at the site could also be the result of regular short-term occupation during the Mesolithic.

Seasonal camp sites are found in every environmental zone. The sites considered as base camps are all found in the inner archipelago and further inland (Zones 2 and 3). The only excavated site interpreted as a Mesolithic base camp is the Räisälä Juoksemajärvi Westend site located in Zone 3. In contrast, the only excavated Neolithic base camp, namely the Räisälä Peltola C site, is located in the inner archipelago (Zone 2). The analysis of all the housepit sites (see Mökkönen in this volume) shows a change in the way the base camps have been placed in the landscape taking place during the time when Typical Comb Ware was in use. The older base camps used at least during the winter season are located in environmental zone 3, while those associated with Typical Comb Ware and younger ceramic styles are located in the inner archipelago and have supposedly had a longer occupation period than winter only (see more Mökkönen, in this volume).

On the basis of the Early Metal period sites found during the Kaukola–Räisälä project, not much can be said about settlement patterns. Of the sites excavated during the phase of early archaeological research approximately one hundred years ago, those containing ceramics can be assumed to represent base camps[6], but a more precise categorization is impossible.

Subsistence

Subsistence strategy is often defined by two opposite strategies: the immediate return strategy (or forager strategy) and the delayed return strategy (or collector strategy) (Binford 1980; Woodburn 1980; Kelly 1992; Shennan 1999). In a simplified model the immediate return strategy is based on collecting and consuming food instantly, while the delayed return strategy focuses on storing and consuming food at base camps. In the northern areas it is necessary to prepare for winter with the help of storages (Binford 1990; Halinen 2005: 21–2 with references therein), and thus we are dealing at least with a partly delayed return strategy. Most typically this is done by storing fish, and probably meat as well. On the Karelian Isthmus, storage constructions dating to the Mesolithic are not known at the moment. The only notable Mesolithic investments indicating stable resource exploitation are the Mesolithic housepits at the sites of Rupunkangas 1 and 3 in the Kaukola municipality.

Concerning subsistence, the material gathered on the early excavations carried out some one hundred years ago does not provide an opportunity to understand the temporal variation of bone assemblages (Seitsonen, S. 2008). Similarly, due to the limited size and number of the recent excavations, temporal changes in subsistence cannot be studied on the basis of the current osteological material.

However, the recent results enable us to interpret quite well the type of settlement and the most probable occupation season for some of the excavated sites (see Table 6 and Appendix 1). The diversity of finds in different kinds of sites is illustrated by two Mesolithic examples: a small Mesolithic site (Kirvu Juhola 2) with a large amount of fish bones of a few species and finds solely of quartz is interpreted as a spring-summer camp site. As an opposite example, the Räisälä Juoksemajärvi Westend site has a great diversity of Mesolithic finds and a variety of species in its bone assemblage. This site is interpreted as a base camp that was probably occupied year round.

Despite the lack of evidence, the cold climatic setting and the presence of permanent winter sites speak for the probable use of the delayed return strategy already during the Mesolithic. Later, during the Neolithic, when the climate was about two degrees warmer than today, the occurrence of housepits with an occupation period that was probably longer than one season indicates a certain degree of sedentism, and hence also the presence of a delayed return strategy.

Villages versus clusters of non-contemporaneous housepits

The largest change in the data is seen during the Neolithic, when housepits appear on a large scale. It is also probable that the population increased at the time. Most of the housepits are located in areas with easy access to both the inland and the outer archipelago.

At the moment, there is little evidence for the contemporaneousness of the housepits located on an individual site. Approximately one third of all housepit sites have more than four housepits, while the other two thirds have one to three housepits per site. All these sites are clustered in the same areas irrespective of the number of housepits. At large sites, such as Räisälä Mäenala or Räisälä Peltola (see Appendix 1, Fig. 9.), the housepits are clustered side by side in a row-like manner following the ancient shore formations (see Mökkönen in this volume, Fig. 4). This does not necessarily indicate contemporaneousness, since in a relatively stable environment sites have remained in use throughout the Stone Age and the housepits could have been rebuilt several times during millennia, as, for example, the Kaukola Rupunkangas 1 site (see Mökkönen et al. 2007).

As a whole, the occurrence of sites with many housepits and those with only a few housepits or a single housepit supports the idea of only a few simultaneously used houses rather than large villages. Nonetheless, larger villages could have existed, at least in cases where housepits in a continuous row are located at equal distances from each other. Basically, there is probably a lot of variation in the number of housepits per site.

Comparison to models for settlement

Two models for settlement patterns have been presented on the basis of Finnish coastal hunter-gatherer material (Siiriäinen 1981; 1987; Matiskainen 1989). In both models, the largest sites with the longest occupation period have been located at river mouths and in the inner archipelago, that is, in an area where marine and inland resources intersect. The sites in the inland and in the archipelago were seasonally occupied. In

Matiskainen's model the base camp located at the river mouth was occupied year round.

In comparing our data to the models presented by Siiriäinen and Matiskainen, both differences and similarities can be seen. Our Mesolithic and Early Neolithic data with base camps located in the inland zone and clearly oriented towards terrestrial resources is obviously contrary to the models. Instead, the Middle and Late Neolithic data points to sites inhabited for longer periods than only winters and located in the middle of all resource areas in the inner archipelago, thus having a clear affinity with the models presented above. However, as an exception, the Räisälä Juoksemajärvi Westend site located in Zone 3 has been a base camp from the Mesolithic to the Middle Neolithic Stone Age.

The change in the environmental location of base camps from the inland to the archipelago is something we can see in the Räisälä area, where the distance from the inland to the outer archipelago was long enough to make these changes visible. In the Kaukola area, the distance from the bottom of a bay to the outer islets was so short that changes cannot be observed.

CONCLUSIONS

The archaeological data from the Kaukola–Räisälä region supports the idea of a sort of continuity in the way the landscape has been settled through the Stone Age. This is demonstrated especially by the multi-period dwelling sites. Although certain sites have been occupied through millennia, it does not mean that the settlement has been unchanging. On the contrary, the duration of occupation, as well as the habitation period and the type of settlement at certain sites, could have changed several times in the course of the Stone Age. However, this statement cannot be supported solely by the analysis of the currently excavated dwelling sites.

There are temporal changes in the way the landscape has been settled. One such change is the 'colonization' of the archipelago seen in the geographic distribution of Typical Comb Ware and the later ceramics in contrast to the more terrestrially oriented distribution of Early Comb Ware. Likewise, the same phenomenon is seen in the distribution of housepits in the Middle Neolithic (see also Mökkönen in this volume). Therefore, it seems that a great number of sites remained in use throughout the Stone Age, but at the same time the way those sites have been used changed. In other words, there is temporal variation in the way sites with certain characteristics and a certain resource base were used. For example, a perfect base camp for the winter season could have remained in use later as a hunting camp, while the contemporaneous base camp with longer than winter-only habitation was located elsewhere. The Räisälä Juoksemajärvi Westend site is a good example of this. At this site, the archaeological material indicating a base camp dates from the Mesolithic to the Middle Neolithic period, and the later – Late Middle Neolithic/Late Neolithic – occupation is testified to by radiocarbon dates and a few finds (Halinen et al. 2008).

Generally speaking, permanent dwelling structures like housepits indicate the stability of the settlement pattern and, supposedly in the majority of the cases, a more sedentary way of life, at least when compared to the situation without other such permanent dwelling structures. The location of the housepits in well-sheltered places might give reason to conclude that the housepits were built in places suitable for winter or even year-round habitation. Other housepit sites in less sheltered locations have been seasonally occupied (Mökkönen et al. 2007) or base camps occupied for several seasons or year round (Mökkönen in this volume).

During the Late Mesolithic, sedentary winter sites were used, as, for example, the Räisälä Juoksemajärvi Westend site. In the spring, these winter sites were probably abandoned and at least a part of the people dispersed to seasonal hunting and fishing sites. However, the faunal material shows that the winter site was probably occasionally in use during warmer seasons, too. The Early Neolithic settlement pattern has likely been similar to the one seen already during the Late Mesolithic. The appearance of housepits in the inner archipelago during the Middle Neolithic signifies a growing rate of sedentariness. These sites are ideal for year-round occupation (for more information, see Mökkönen in this volume). At this time, at the latest, we are dealing with a delayed return strategy and a settlement system with one base camp occupied year round. On the other hand, the cold climatic setting and the presence of permanent winter sites speak for the probable use of the delayed return strategy already during the Mesolithic.

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The calibration of radiocarbon dates in the article has been carried out using the OxCal 4.0 calibration program. The calibration curve used is IntCal04, Northern Hemisphere (Reimer et al. 2004).

The English versions of the survey and excavation reports are not cited here. They are available at the Department of Archaeology, University of Helsinki, Finland.

NOTES

[1] The official name of the project is *Subsistence strategies and changes of communities between 9000-1 BC: an archaeological intensive-investigation in the western part of Lake Ladoga, Karelian Isthmus.* The much shorter name used here is given after the two former Finnish municipalities in which the main part of the research area is located, e.g., the Kaukola and Räisälä municipalities.

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[2] The early archaeological material is unfavorable for studying other subjects than the material culture itself. The early sites were located mostly on fields, and were often first noticed by local residents and then excavated by archaeologists using varying methods. This material is heavily mixed, and therefore it is not very suitable for studying subsistence, for example. Furthermore, the bulk of the material is enormous. It is obvious that no one has ever processed the whole Stone Age material gathered before World War II. This is especially true in the case of ceramics. For more information on the early stray finds, see Nordqvist (2005), and on the early archaeological research of the study area, see Huurre (2003) and Uino (2003) with references therein. See also the next section.

[3] The current Russian names of these former Finnish municipalities are Sevast'janovo (Fi. Kaukola), Mel'nikovo (Fi. Räisälä), and Svobodnoye (Fi. Kirvu).

[4] This is a simple analysis made for the purpose of this study. There is another method used for studying the site locations in the landscape, to which the topographic shelter index used here is obviously related. The variables created by Vikkula (1994) are later used and slightly modified in studies in the Ancient Lake Saimaa area in Finland (Pesonen 1996; Mökkönen 2000) and on the Karelian Isthmus (Nordqvist & Lavento 2008), as well as in southern Ladoga Karelia (Seitsonen & Gerasimov 2008). Although the variables used in the studies are rather similar, the topographic shelter index rates the site's vulnerability to the winds, in contrast to other studies that do not directly consider the shelteredness of the sites, but merely divide the sites into classes according to their topographic settings.

Results similar to those gained with the help of the topographic shelter index could certainly be obtained simply based on visual observation. However, the differences are easier to verify with the help of numbers than just by writing down the assumptions made after the visual analysis.

[5] The sites excavated in the late 19th and early 20th centuries are not discussed here – although they are located in Zone 2 – because of the obscure nature of the early data. These sites are Pitkäjärvi, Papinkangas, Tiurinlinna, and Teperinaho – all located in the former Räisälä municipality – and the Äijö site in the former Pyhäjärvi municipality.

[6] The Early Metal Period sites excavated during the early phase of research are, in addition to those located in site clusters in the Piiskunsalmi-Riukjärvi area in Kaukola, Räisälä Hovi Kalmistonmäki and Räisälä Tiuri Linnasaari ('Tiurinlinna') (e.g., Lavento 2003). The recently found sites with ceramics dating to the Early Metal Period are Räisälä Kökkölä (Lavento et al. 2001), Kaukola Kakarlahti 2, and Kaukola Rupunkangas 1 (Mökkönen et al. 2007). At Kaukola Rupunkangas 1, the textile ceramics probably belong to the last habitation phase of the partly excavated housepit.

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APPENDIX 1

SITES EXCAVATED IN THE KAUKOLA-RÄISÄLÄ PROJECT

In July 2005, small-scale excavations were conducted by the Kaukola-Räisälä Project at ten dwelling sites, all found in surveys in 2004 and 2005. In addition, the finds from a site destroyed by machine logging, namely Kaukola Rupunkangas 3, were collected with the help of a total station. The sites were selected in order to represent different periods, different environments, and different structures within the sites. Due to the low number of recently excavated sites, the Räisälä Juoksemajärvi Westend site – a multi-period dwelling site with housepits – excavated in 2002 (Halinen et al. 2008) is briefly included here. The largest excavation area was only 6 m² and the smallest only 1 m². The mean size of the excavation areas is ca. 4 m².

This appendix summarizes the main results of the excavations. The Mesolithic and the Neolithic sites are discussed separately, and in both chronological sections the sites are presented starting from the inland zone (Zone 3) and ending with the sites in the outer archipelago (Zone 1). The Early Metal Period is not discussed due to the low number of finds. The only finds dating to the Early Metal Period are a few sherds of textile ceramics from the Kaukola Rupunkangas 1 site (see Mökkönen et al. 2007) and the Kaukola Kakarlahti 2 site.

The results are summarized in Table 6. The calibrated radiocarbon dates are expressed with probabilities of 1 sigma (68.2 %). The uncalibrated dates and the probabilities of 2 sigma are provided in Appendix 2.

Mesolithic sites

The Kaukola-Räisälä area contains dwelling sites from every Mesolithic phase excluding the pioneering phase, which is considered here to be older than ca. 9000 BP/8200 cal BC. According to radiocarbon dates, the oldest pioneer settlement in the area of the Karelian Isthmus, Karelia, and southern Finland dates approximately to 9500–9200 BP (ca. 8800–8400 cal BC, e.g., Takala 2004; Pesonen 2005; Jussila & Kriiska 2006; Jussila et al. 2007; Mökkönen et al. 2007; Carpelan 2008). In the research area there are three sites dated to the early phase, namely Kirvu Juhola 2, Kaukola Rupunkangas 1, and Kaukola Rupunkangas 3 (Table 6). All three early sites, dating to the interval ca. 9000–8700 BP, have been in use when Lake Ladoga was still interconnected with the Baltic Sea Basin, that is, the sites have been located by the Ancylus Lake.

Three other sites date to the younger phases of the Mesolithic. In addition, one of the oldest sites, Rupunkangas 1, has been in use throughout the Mesolithic. Altogether 6 out of the 12 recently excavated sites have yielded Mesolithic finds and dates (Table 6, Appendix 2). The division of the Mesolithic into three nearly equally long periods called the Early, Middle, and Late Mesolithic applied in this article (see Table 6) is done for practical reasons: it is not a commonly used periodization. Next, the results of the excavations and the dates are shortly summed up.

Kirvu Juhola 2

The Kirvu Juhola 2 site is a small site with no dwelling constructions. It is dated to 8970±75 BP (Hela-1164, 8280-7990 cal BC), that is, to the beginning of the Early Mesolithic (see Table 6). The site is located by the River Kuunjoki in environmental zone 3. Based on the radiocarbon date, during the settlement period the site has been situated along a narrow fjord-like bay over 10 kilometres long on the shore of the Ancylus Lake.

In the bone assemblage, fish are well represented in the identified bones (n= 1481). The species indicate net fishing in the spring or summer – perch, pike-perch, and tench are fished during the summer and pike is easiest to fish in the spring. Seven pieces of ringed seal bone point to the practice of hunting on ice during late winter and early spring (Storå 2000: 71; 2001: 31; 2002a: 15; 2002b: 26–7). The lithics (n = 186) are solely of quartz, excluding a single flint flake. The assemblage includes a few artefacts: one scraper, one burin, fifteen blades and blade fragments, and five cores (including a platform core, a hammer-on-anvil core, and two bipolar cores). The nature of the site indicates a camp site that has been occupied regularly on a seasonal basis – most probably during the early spring and perhaps several times during the summer.

Räisälä Juoksemajärvi Westend

At present, the Räisälä Juoksemajärvi Westend site is situated at the head of Lake Juoksemajärvi, but during the Mesolithic, the site was located at the head of a bay of Ancient Lake Ladoga. The oldest radiocarbon date dates the site to ca. 6980–6430 cal BC (Appendix

2). The site is located in the inland zone (Zone 3) in a highly sheltered place. The location by a narrow bay and at the base of a high hill is ideal for wind-proof habitation. The find material is diverse: a large number of artefacts made of different types of quartz, flint, and other stones, as well as versatile bone material. A more detailed presentation and analysis of the site and find material is presented elsewhere (Seitsonen 2005; Halinen et al. 2008).

In total, 707 fragments of bones belonging to the Mesolithic layers were identified. The most suitable hunting season for the mammal species represented in the bone assemblage (seal, dog, red fox, elk, pine marten, bear, beaver, ruminants) would have been the winter season (Halinen et al. 2008). Seals dominated the mammals (44%). Mesolithic bird bones, such as migratory ducks, hawks, and eagles, point to the snowless season. Hawks and eagles or parts of them are not necessarily utilised for food, but apparently for ritual purposes or for ornaments (e.g., Mannermaa 2008a; 2008b). However, 78 % of the bone assemblage consists of fish, of which the identified species were eel, pike, pike-perch, whitefish, salmonid fish, cyprinid fish, and perch.

The Middle Mesolithic Juoksemajärvi Westend site is interpreted as a year-round base camp with possibly a lightly constructed hut. The longest uninterrupted continuous settlement period on the site has probably been the winter, while during the summer the settlement has been more dispersed. Probably a part of the community has stayed at the site for the summer as well. In addition to fishing, larger game (seal, beaver, and elk) was hunted during the winter. Fish has been a main food resource. The dog bones found point to the possibility of using dogs as reserve food. (Halinen et al. 2008.)

Räisälä Kuusela

The Räisälä Kuusela site was situated on the southern slope of a small island in the inner archipelago (Zone 2). It is dated to 7945±60 BP (Hela-1175, 7030–6700 cal BC). At the site there are only small areas with even terrain favourable for long-term occupation. The number of finds is low: 33 quartz flakes, 1 flint flake, and 8 fragments of burned bone. The identified bones belonged to beaver, perch, and cyprinid fish. There are no signs of dwellings.

The character of the site is that of an occasionally used seasonal camp site. The low diversity of artefacts and animal species indicates that the site was used for limited purposes. The season of habitation is difficult to define accurately. The perch is usually fished during the summer. The most favourable hunting period for beaver is early winter, but it has been hunted also during the summer. The location of the site may indicate summer rather than winter use.

The Kaukola Rupunkangas sites

Two of the oldest sites, Rupunkangas 1 and Rupunkangas 3 in the Kaukola parish, have been located on an island in the outer archipelago (Zone 1). There are housepits on both sites. The oldest dates of the sites are practically equal, dating to 8700–8800 BP/8200–7600 cal BC (see Appendix 2), that is, synchronous with the isolation period of Lake Ladoga. Therefore, it is highly probable that the oldest occupation phases of the sites have taken place by the Ancylus Lake.

Three other radiocarbon dates from the layers of the housepit on the Rupunkangas 1 site date to ca. 7200–6300 cal BC. In an article on the sites located in the Rupunkangas area (Mökkönen et al. 2007), the Rupunkangas 1 site, with a housepit that has been rebuilt several times, is interpreted as a regularly used seasonal camp site, from which the resources of the outer archipelago have been utilized during the cold season, namely from autumn through winter to early spring.

The Rupunkangas 3 site has two housepits side by side, the first one rectangular (10 x 6.5 meters in size and 0.6 meters in depth) and the second one round (4.5 meters in diameter and 0.6 meters in depth). No finds were discovered in drillings made inside the housepits during the survey. Instead, a great number of lithics were found in an open area between the housepits and the ancient shore bank. The nature of the occupation on the site is not clear. The great number of finds shows intensive occupation on the site, and the location of the site by a narrow bay is well-sheltered. The site could have been used regularly on a seasonal basis, but on the other hand, it could also have served as a base camp. In the osteological material, some species, such as seals, salmonid fish, and whitefish, most probably indicate occupation during cold seasons. (Mökkönen et al. 2007.)

Räisälä Hiekka 1

Räisälä Hiekka 1 is the only site in the research area dating to the Late Mesolithic. The Hiekka 1 site was situated on the northwestern cape of a small island in the outer archipelago (Zone 1). The site was exposed to eastern and western winds. It is dated to 6840±60 BP (Hela-1163, 5780–5660 cal BC) and 6950±60 BP (Hela-1256, 5890–5750 cal BC). The find material consists of 641 lithics and 1071 fragments of burned

bone. The lithics consist of quartz artefacts (scrapers, burins, and one retouched flake), quartzite flakes, and flint microblades (Fig. 8). There are no visible marks of dwellings.

In bone finds, the identified species are elk, beaver, ducks, pike, perch, and cyprinid fish. Elk is usually hunted during the autumn and winter, but in the archipelago, however, elk is hunted in the spring. The beaver, ducks, and fish are species well suitable for hunting in the outer archipelago. Elk, ducks, and pike point to the spring season, but the other species point generally to the summer. Based on the site's location and the material found there, it is interpreted as a regularly used camp site for warm-season habitation.

Kaukola Kakarlahti 2

In addition to above-mentioned sites, some finds possibly indicating Mesolithic settlement are found at the Kaukola Kakarlahti 2 site. This site is located in the Riukjärvi-Piiskunsalmi area on the outer sphere of the dense site cluster (Zone 3). The site is located on a small former island at the intersection of two water routes. One transverse point made of quartz, as well as blades and blade fragments (made of flint, quartz and quartzite), were found at the site. While the other material on the site dates to the Middle and Late Neolithic, it seems probable that the finds indicate Middle or Late Mesolithic activity at the site. The function of the site is difficult to specify, since it is located just next to a large dwelling site area composed of several sites with Mesolithic artefacts.

Neolithic sites

In the Kaukola-Räisälä region, there are dwelling sites from each phase of the Neolithic. Among the excavated sites, there are two sites dating to the Early Neolithic, namely Räisälä Juoksemajärvi Westend and Kirvu Kivimäki 2, both of which have Early Comb Ware (aka Sperrings). In both cases, the Early Neolithic dating is based on the find context of the ceramics, while the 14-C dates define older or younger dwelling phases, but not the Early Comb Ware settlement (for 14-C dates see Appendix 2).

Altogether six Middle Neolithic (ca. 4000–2300 cal BC) sites were investigated in the Kaukola-Räisälä Project (see Table 6). The material connected to the Middle Neolithic found at the Kaukola Rupunkangas 1 site (Mökkönen et al. 2007) consists of only a few sherds of pottery, and therefore it is not discussed here.

Among the excavated sites are only three with some finds connected to Late Neolithic (ca. 2300–1800 cal BC) settlement (see Table 6). Therefore, the Late Neolithic is not discussed separately here, since the material of these sites does not allow drawing any precise conclusions on the nature of the sites during the Late Neolithic.

Räisälä Juoksemajärvi Westend

The Räisälä Juoksemajärvi Westend site is located in environmental zone 3. A site with a total of 8 housepits is situated at the head of a long lake, but during the Neolithic it was situated by a sheltered bay of Ancient Lake Ladoga. The ceramics found in an entirely excavated housepit were determined as Early Comb Ware. The radiocarbon dates from charcoal did not fit well with the ceramics, because they gave younger dates (see Appendix 2). These dates can be connected to later activities, as well as some of the ceramics found at the site, which bear some similarity to Late Neolithic Volosovo ceramics. Another partly excavated housepit at the site also revealed ceramics that could not be classified unambiguously; they could be either Early Comb Ware or Typical Comb Ware. In addition to housepits, storage pits have been found at the site (Halinen et al. 2008).

The assemblage found at the site is diverse in artefacts and raw materials. In total 4116 fragments of bones were identified. Most of the material consists of fish (ca. 90 %) and a minority comes from mammals (ca. 9 %) and birds (less than 1 %). The identified

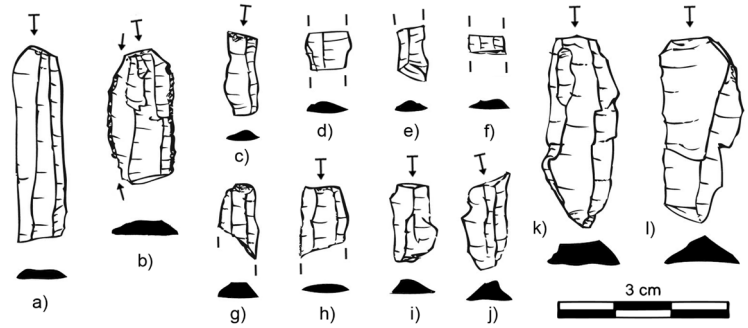

Fig. 8. Blades, microblades and their fragments from Räisälä Hiekka 1, b) burin on a retouched blade; a-f) flint, g-k) quartz, l) quartzite. Drawing: O.Seitsonen.

mammal species are seal (19 % of all mammals, most probably ringed seal), dog (24 %), beaver, red fox, elk, wild forest reindeer (probably), hare, and squirrel. The identified bird species are capercaillie and great crested grebe/red-necked grebe, as well as white-tailed eagle/golden eagle. Among the identified fish there are species with various spawning seasons. Fish such as eel and tench are almost impossible to catch during the winter. As an opposite example, four-horned sculpin is a winter fish that stays in shallow waters only during the winter. The other identified fish species were pike, whitefish, cyprinid fish, pike-perch, and perch (Halinen et al. 2008).

The mammal bones – such as elk, squirrel, and hare – clearly point to hunting during late autumn or winter. Ducks and hawks/eagles are usually migratory birds, and the presence of their bones indicates the snowless season. These bones are used for ritual purposes or as pendants as well (Mannermaa 2008a; 2008b). The fish species indicate both winter and summer. The low quantity of ceramics, as well as the solid construction of the whole excavated dwelling, indicate the winter season. The osteological material, as well as the diversity of artefacts and raw materials, allows interpreting the site as a sedentary base camp used year-round (Halinen et al. 2008). However, the longest uninterrupted settlement period has most likely taken place during the winter.

Kirvu Kivimäki 2

The Early Neolithic Kirvu Kivimäki 2 site is located on a flat area along a long and narrow bay opening towards the northwest in the inland zone (Zone 3). There are no signs of dwelling constructions. The amount of find material is rather small: blades, blade fragments, and flakes mainly of quartz, as well as nearly a thousand fragments of Early Comb Ware. The identified animal species are beaver, pike, and cyprinid fish. The amount and quality of the material do not allow determining the season of occupation. The nature of the site, that is, a scant cultural layer and a lack of larger structures, indicates that the site is an occasionally used camp site. A radiocarbon date from charcoal gave a substantially younger date than expected, dating to the beginning of the Iron Age (2380±35 BP/510–400 cal BC, Hela-1158).

Kirvu Harjula

The Middle Neolithic Kirvu Harjula site was situated at the mouth of a narrow bay (Zone 3). Nowadays the site is located by the River Kuunjoki on a relatively steep southern slope. At a slightly higher elevation there is a housepit with an entrance. The site is partly destroyed by sand extraction. The site is dated to 3995±40 BP (Hela-1176, 2570–2470 cal BC). The number of finds is low: 29 lithics, 1732 bone fragments, and 17 ceramic sherds of a single vessel. The ceramics have been identified as Late Comb Ware, which is, based on the dating of Late Comb Ware in Finland, perhaps several hundred years older than the C-14 date.

The lithic finds from the Kirvu Harjula site do not contain any tools. Most of the lithics are made of quartz, while other rocks – namely quartzite, flint, and other local rocks – are present as single finds. The assemblage of bone fragments includes mostly fish (pike, perch, perch/pike-perch, salmonid fish/trout, bream, cyprinid fish) and only three fragments of mammals (dog and seal). Most of the fish belong to species easiest to catch during the summer, but they may have been fished also during the winter. The seal found, most probably ringed seal, is usually hunted during the winter, but can also be hunted during the summer (Storå 2000; 2002a). The most probable occupation season has been the summer, perhaps late summer. The site is interpreted as a seasonal site that has been used regularly. The temporal relation between the excavated materials and the nearby housepit is unknown.

Kaukola Kakarlahti 2

Another excavated Middle Neolithic site located in the former environmental zone 3 is Kaukola Kakarlahti 2. The site is located on the outer sphere of the dense site clusters in the Riukjärvi-Piiskunsalmi area. During occupation, the site was located on a small island (ca. 40 x 80 meters in size) at the intersection of two water routes. Currently the site is located on a small terrace shelf bordered by exposed bedrock. The oldest finds at the site most probably date to the Mesolithic period, but the majority of the finds date to the Middle and Late Neolithic periods.

The ceramics found at the site are highly fragmented. The only clearly identifiable style is Typical Comb Ware. One polished sherd might be identifiable as Corded Ware and a few sherds most probably represent Textile Ceramics. Among the unidentifiable sherds, there are, however, a number of elements usually connected to other Middle and Late Neolithic ceramics, such as organic and asbestos temper. Among the asbestos-tempered sherds, both black and grey asbestos, used in the form of long as well as short fibres, are present. There are a few sherds in which the inner surfaces are either scratched or treated with some sort of spatula. The sherds with fibrous and plant impressions are usually undecorated

and made of fine and dense clay paste. As for lithic artefacts, there is rich variation in raw materials used as well as artefact types. The finds also include pieces of ground stone artefacts, for example, fragments of an 'East Karelian type of gouge', a suspended whetstone, and a retouched ground tool fragment of slate.

The bones found at the Kaukola Kakarlahti 2 site are identified as beaver, seals, and fishes (pike, perch, pike perch, tench, and cyprinid fish). The number of mammal bones is high, one third of the all determined fragments. The site is located 'a stone's throw' from the larger dwelling sites. This and the great variation and amount of material found at the site connects it with the nearby find-rich dwelling sites in the Riukjärvi-Piiskunsalmi area. Although the function of the site is difficult to define, it can be labelled as a regularly used camp site.

Räisälä Peltola C

There is only one excavated Middle Neolithic site located in the inner archipelago (Zone 2). Räisälä Peltola C is a dwelling site with five housepits at the head of a former cape facing northwest. The excavation was made between two housepits. Nearby on the same cape, there are two other clusters of housepits located on terrace shelves separated by small hillocks (Fig. 9).

The Räisälä Peltola C site is rich in finds. The find material contains 112 lithic artefacts (64 % quartz, 22 % flint, and 13 % rock crystal), 2111 sherds of ceramics from 16 vessels, and 1371 fragments of burned bone. All the ceramics are identified as Typical Comb Ware (Fig. 10). The material includes both small cups and large containers.

The bone material is mainly of fish, with a few fragments of beaver and birds (possibly hawks or eagles) as an exception. The identified fishes are eel, pike, perch, whitefish, pikeperch(?), salmonid fish (possibly trout), and cyprinid fish. Of these, the whitefish as well as the unidentified salmonid fish are easiest to catch during the spawning season in the autumn and in cold waters, that is, during the autumn, winter, and spring. The beaver is usually hunted during the early winter, but on island sites, beavers have been hunted also during the summer. The birds of prey are usually migrating birds and they are hunted during the summer, but they may have been used for ritual purposes or as pendants as well (Mannermaa 2008a; 2008b). Eel is fished during its migration in the autumn, but it is active also during the summer. Pike is easiest to fish early in the spring and in the midsummer, but it might have been stored for winter, too.

The season of habitation is an interesting question. The housepits are most likely winter dwellings, while the osteological material points to the summer season, too. Besides, the topography of the site – a windy cape – points to the summer rather than the winter. Therefore, the site has been most probably settled not only during the winter, but also during the warmer seasons (see also Mökkönen *in this volume*).

Kaukola Autio 1

The Middle Neolithic Kaukola Autio 1 site is the smallest site in the area. It has been located on an extremely small island, only 15 x 30 meters in size. At the time of occupation, the site was located on the border zone between the inner and outer archipelagos (Zones 1 and 2). The site has heavily coloured red cultural layers, but only a few finds. Among the finds are sherds of a single Typical Comb Ware pot, cores (bipolar, irregular, and platform), three scrapers of flint and quartz, and flakes. The lithic artefacts are made mostly of quartz (86 %) and rock crystal (12 %). Only two fragments of unidentified bones were found. The site is interpreted as a regularly used camp site, most probably used during fishing trips in the summer season.

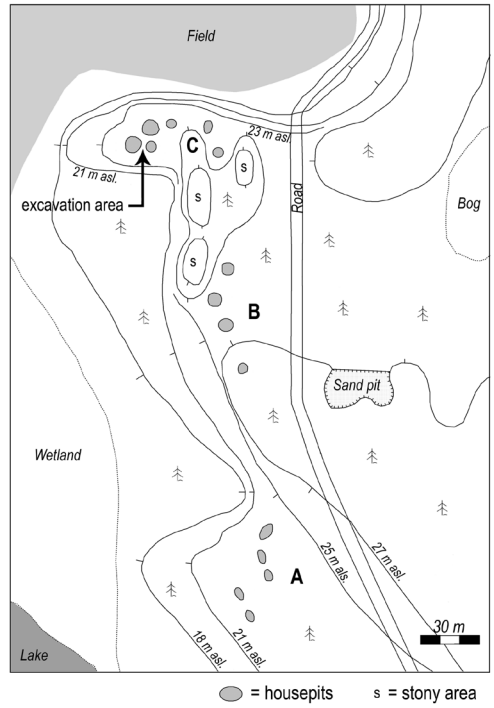

Fig. 9. The Räisälä Peltola site with three separate clusters of housepits (A-C). Digitazing: J. Väkiparta & T. Mökkönen.

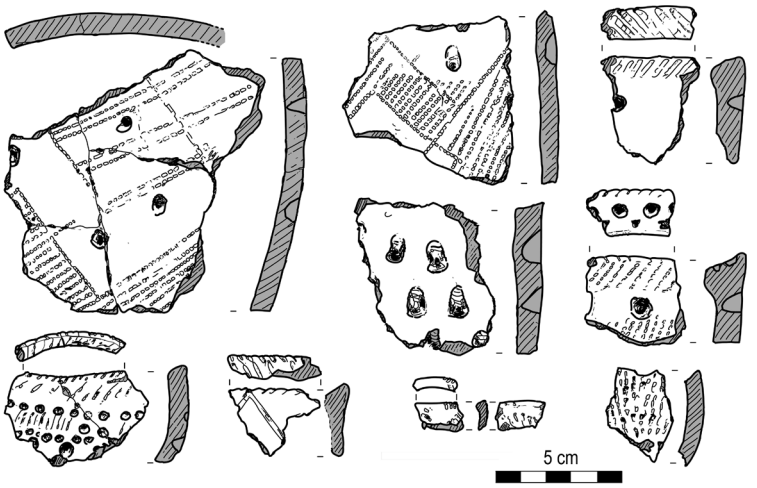

Fig. 10. Typical Comb Ware from the Räisälä Peltola C site. The find material is in the collections of the Kunstkamera – Peter the Great Museum of Anthropology and Ethnography, Russian Academy of Sciences, St. Petersburg. Pencil drawing: K. Nordqvist, Computer graphics: T. Mökkönen.

Municipality	Site	Lab. no.	BP	2 σ(calBC)[1)]	1 σ(calBC)[1)]	Material	Context	Reference
Kaukola	Rupunkangas 1	Hela-1182	8770±85	8200–7600	8160–7650	charcoal	inside a housepit	Mökkönen et al. 2007
	Rupunkangas 1	Hela-1197	8130±65	7350–6640	7280–7050	charcoal	inside a housepit	Mökkönen et al. 2007
	Rupunkangas 1	Hela-1196	7550±75	6570–6240	6470–6270	charcoal	inside a housepit	Mökkönen et al. 2007
	Rupunkangas 1	Hela-1195	6595±55	5620–5480	5610–5490	charcoal	inside a housepit	Mökkönen et al. 2007
	Rupunkangas 3	Hela-1165	8740±80	8190–7590	7940–7610	burned bone	surface find	Mökkönen et al. 2007
	Riukjärvi	Hela-359	4780±70	3700–3370	3650–3390	birch bark pitch on Late Comb Ware	-	Pesonen:2004; Saarnisto 2003a: 512
	Lavanmäki (Piiskunsalmi)	Hela-468	4130±60	2880–2500	2870–2620	charred crust on Corded Ware	-	Huurre 2003:234; Saarnisto 2003a: 512
	Juho Paavilaisen rantapelto (Kankaanmäki)	Hela-467	3085±70	1500–1130	1430–1270	charred crust on Textile ceramics	-	Lavento 2001:102
Kirvu	Juhola 2	Hela-1164	8970±75	8300–7840	8280–7990	burned bone	cultural layer	-
	Harjula	Hela-1176	3995±40	2620–2350	2570–2470	burned bone	cultural layer	-
	Kivimäki 2	Hela-1158	2380±35	730–390	510–400	charcoal	cultural layer	-
Räisälä	Kuusela	Hela-1175	7945±60	7050–6660	7030–6700	burned bone	cultural layer	-
	Hiekka 1	Hela-1163	6840±60	5870–5630	5780–5660	burned bone	cultural layer	-
	Hiekka 1	Hela-1256	6950±60	5990–5720	5890–5750	burned bone	cultural layer	-
	Peltola C	Hela-1159	4905±45	3790–3640	3710–3640	burned bone	cultural layer	-
	Juoksemajärvi Westend	Le-6642[2)]	3450±100	2020–1520	1890–1640	charcoal	outside a housepit	Halinen et al. 2008
	Juoksemajärvi Westend	Le-6557[2)]	3700±20	2190–2030	2130–2040	charcoal	outside a housepit	Halinen et al. 2008
	Juoksemajärvi Westend	Le-6601[2)]	3740±100	2460–1910	2290–1980	charcoal	outside a housepit	Gerasimov & Kul'kova 2003; Halinen et al. 2008
	Juoksemajärvi Westend	Le-6641[2)]	4550±180	3710–2780	3520–3020	charcoal	outside a housepit	Halinen et al. 2008
	Juoksemajärvi Westend	Le-6566[2)]	7750±180	7070–6240	6980–6430	charcoal	outside a housepit	Halinen et al. 2008
	Juoksemajärvi Westend	Le-6512[2)]	4150±50	2890–2580	2870–2640	charcoal	outside a housepit	Halinen et al. 2008
	Juoksemajärvi Westend	Le-6643[2)]	2620±70	930–540	900–600	charcoal	inside a housepit	Halinen et al. 2008
	Juoksemajärvi Westend	Le-6602[2)]	3660±30	2140–1950	2130–1980	charcoal	inside a housepit	Gerasimov & Kul'kova 2003; Halinen et al. 2008
	Juoksemajärvi Westend	Le-6600[2)]	3370±30	1750–1540	1730–1620	charcoal	inside a housepit	Gerasimov & Kul'kova 2003; Halinen et al. 2008
	Kalmistonmäki	Hela-8	2360±70	760–230	730–370	charred crust on Textile ceramics	–	Saarnisto 2003a: 512

[1)] Calibrated with OxCal 4.0 using the curve IntCal04, Northern Hemisphere (Reimer et al 2004); [2)] Conventional dates.