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HIETAMÄKI IN JÄMSÄ – A MULTI-PERIOD DWELLING SITE IN CENTRAL FINLAND

Abstract

Shore displacement in the northern parts of Lake Päijänne, dated into the period under discussion with exceptional precision with varved sediments, defines the possible periodization of the Hietamäki site in Jämsä, Central Finland. The oldest dates for the site are from the beginning of the period, when Northern Lake Päijänne was a bay of the Ancylus Lake stage of the Baltic.

Dated to ca. 7250 cal BC in the Early Mesolithic, the Hietamäki site represents a rare type of settlement that was inundated by transgression in the Lake Päijänne area. It had mostly been destroyed upon being found. For the time being, Hietamäki is the only representative of its type in Central Finland; nor is the type common elsewhere in the country, although transgression and regression of several metres caused by land upheaval are an integral part of the postglacial history of lakes.

As in the case of most Mesolithic sites in Finland, the finds from Hietamäki consist of a one-sided assemblage: quartz artefacts and flakes, a few lithic flakes and pieces of burnt bone. The sieved bone material is an important addition to the few unmixed Early Mesolithic assemblages of bone finds. It is also the most informative component of the finds, suggesting that the site was not a long-term base camp, being instead occupied in the early summer season when fishing was at its most productive.

There are also signs of two later stages of occupation at the site. One consists of only a hearth, which is dated to the Comb Ware period, and the other stage is from the Early Metal Period. The finds of the latter stage have been interpreted as a cooking pit. Neither of the later stages of settlement includes other finds, which may be due to the considerable damage undergone by the site. Investigated pits similar to the Early Mesolithic feature at Hietamäki are briefly discussed, noting the small number of contemporary finds and the possibilities of an intensified investigation of such pits to provide new material for the study of this period with its limited archaeological material.

Keywords: shore displacement, Lake Päijänne, Mesolithic, comb ceramic, early metal period, inundated sites, fire places, pits, osteology, refuse fauna

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Fig. 1. Excavation in progress at the Stone Age site of Hietamäki in Jämsä in August 2000. Photo J.-P. Taavitsainen 2000.

LOCATION AND HISTORY OF INVESTIGATION

In October 1999, Paavo Ihlberg, an amateur archaeologist from Jämsänkoski and Timo Sepänmaa, a professional archaeologist with the Museum of Central Finland, investigated the edges of a gravel pit visible from a local road at Jämsä. The gravel pit is at the south end of Pataniemi cape south of Juokslahti Bay on the west shore of Lake Päijänne, east of national highway no. 9 and south of the Säyrylä-Patajoki-Vaheri local road. The site is approximately 10 km ENE of the centre of Jämsä. The gravel pit belongs to Hietamäki farm. Roughly 60 metres south of the farm is the shallow Patajoki River discharging from Lake Patalahti into the Siikaselkä stretch of Lake Päijänne (Finnish Basic Survey map PK 2233 10 Patajoki, N = 6866 640, E = 3414 017). Patalahti is actually a bay of Lake Päijänne that was isolated from the lake in the 1830s as the result of clearing the Kalkkinen rapids.

The valley the river is oriented east-west and in places it is flanked by the considerably high hills typical of the west shore of Lake Päijänne. The narrowest part of the river valley, and presumably the isolation threshold of Lake Patalahti, appears to be in the east end of the valley towards Lake Päijänne, west of the bridge crossing the river. According to the basic survey map the elevation benchmark at the east end of the valley near the bridge is 84.5 metres above sea level, i.e. over six metres above the present level of Lake Päijänne (78.3 metres). There is arable land on the gentler slopes of the valley, in the hollows and along the banks of the river. The upper slopes and the tops of the hills are rocky forest land of partly moraine soil. The hills around the valley mostly rise to heights of 100–120 metres; to the southeast in the extensive Mustikkavuori-Haukkavuori area elevations rise to 180–200 metres. According to the basic survey map, there are considerable areas of rocky ground to the north of the valley at 100–120 metres above sea level, and to the south at 140–160 metres. Immediately to the north of the dwelling site above the gravel pit there is a leached area of stony ground of this kind at approximately 100 metres above sea level.

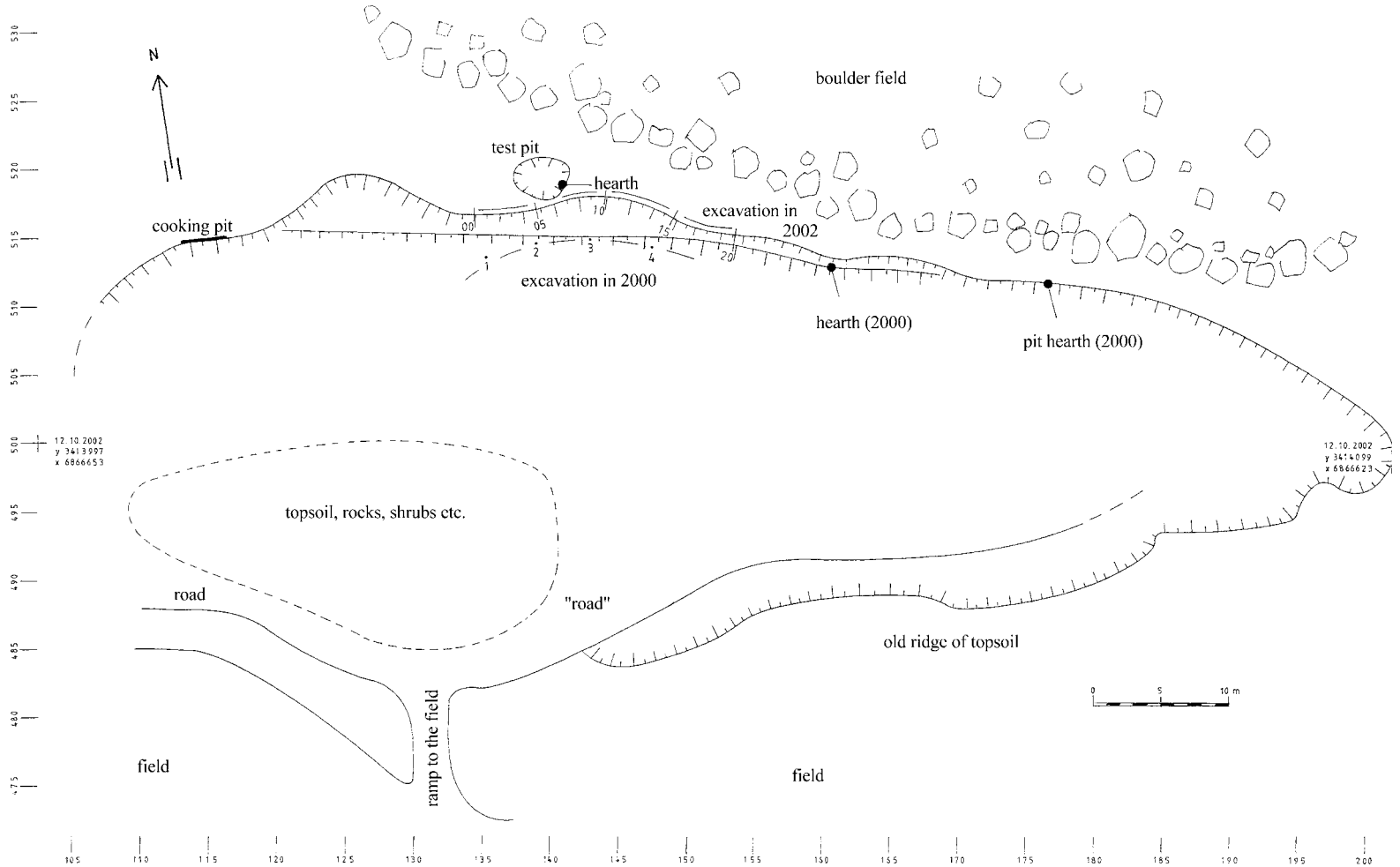

Fig. 2. Site plan of the 2000 and 2001 excavation at the Stone Age site of Hietamäki in Jämsä (T. Sepänmaa 2000 & M. Miettinen 2002).

Ihlberg and Sepänmaa observed signs of a Stone Age dwelling site on the sides of the gravel pit. Situated beneath a transgression layer, these indications were rare in Finnish conditions. This also suggests a considerably early date. Sepänmaa informed Professor Janne Vilkuna of the University of Jyväskylä of the find and the latter contacted Professor Matti Saarnisto of the Geological Survey of Finland. Together with Professor J.-P. Taavitsainen of the University of Turku and Docent Aleksanteri Saksa of the Institute of Material Culture Research of St Petersburg, Saarnisto inspected the site on 16 October 1999. Observed in this connection was a dark streak noted by Ihlberg and Sepänmaa, cultural layer with fragments of burnt bone, quartz flakes and fire-worn stones. By this stage, most of the cultural layer had been destroyed. In connection of the inspection, Saarnisto took two dating samples of charcoal (Taavitsainen 1999).

HISTORY OF FIELD WORK

Excavations in 2000. The National Board of Antiquities gave the Museum of Central Finland (Timo Sepänmaa) permission to carry out excavations at the site during the field work season of 2000. The fieldwork, of a rescue nature, was carried out between the 8th and 10th of August 2000 as a joint project involving the Museum of Central Finland, the University of Turku, the Geological Survey of Finland and volunteer archaeologists.

Situated in the almost vertical wall of the gravel pit and a couple of metres beneath the level of the pit, he site was technically difficult to excavate. Accordingly, conventional excavation methods, i.e. proceeding from top to bottom, could not be applied. Owing to the risk of the collapse of the wall, the occupation layer, roughly 12 metres long and 20 cm thick, could be dug to the depth of only a few dozen centimetres within the wall of the pit (Fig. 1). The investigated area remained small, limited to only a few square metres. The excavated soil was sieved. Most of the site had been destroyed in gravel excavation, and the fieldwork showed that only few dozen square metres of the site survived (Fig. 2). The elevation of the find layer was established at 90.1 metres by levelling.

A test pit was dug with an excavation machine with the assistance of land owner Heikki Rantanen in the level area between the bluff and the edge of the gravel pit. The pit revealed a stone-laid hearth but not finds of artefacts or cultural layer (Fig. 6). Furthermore, there was a depression at the west end of the pit, partly destroyed by gravel excavation and visible on the surface. In the profile section, it could be seen as pit containing mixed soot and charcoal (Fig. 7). No artefacts or cultural layer were found in the vicinity of this feature. According to Sepänmaa's field observations, there were two possible undated hearths at the end of the excavation area facing Lake Päijänne.

Excavations conducted in 2002. Remnants of the site still survived two years later, when Mirja Miettinen inspected the location in the early summer of 2002. Gravel had been excavated from the bottom of the pit and from both sides of the dwelling site layer. The upright wall in the middle part of the pit had collapsed after the excavation conducted in 2000 as the result of natural erosion. The situation is illustrated by the site plan of the excavations (Fig. 2).

There was still a distinct, although broken, streak of sooty soil containing burnt bone and quartzes in the wall of the pit. The sand that had fallen down from the wall of the pit contained burnt and fire-worn stones. Owing to the acute risk of destruction to the site, Miettinen and a number of local volunteers conducted a second rescue excavation on the 10th and 11th of October 2002. When the work was begun, it was observed that the wall of the pit had collapsed further since the early summer and after the particularly dry late summer.

The wall of the pit could not be cleaned or straightened, because it was unclear how much of the cultural layer still remained. Metal pins were placed in the wall of the pit above the soot streak at one-metre intervals and the streak was trowelled. The finds were recovered in one-metre long horizontal units, or "grids". Part of the excavated soil was sieved.

At the time of writing, only minor remnants of the Hietamäki site survive. Paavo Ihlberg who was the other finder of the site has monitored the situation and retrieved finds of quartz flakes and objects.

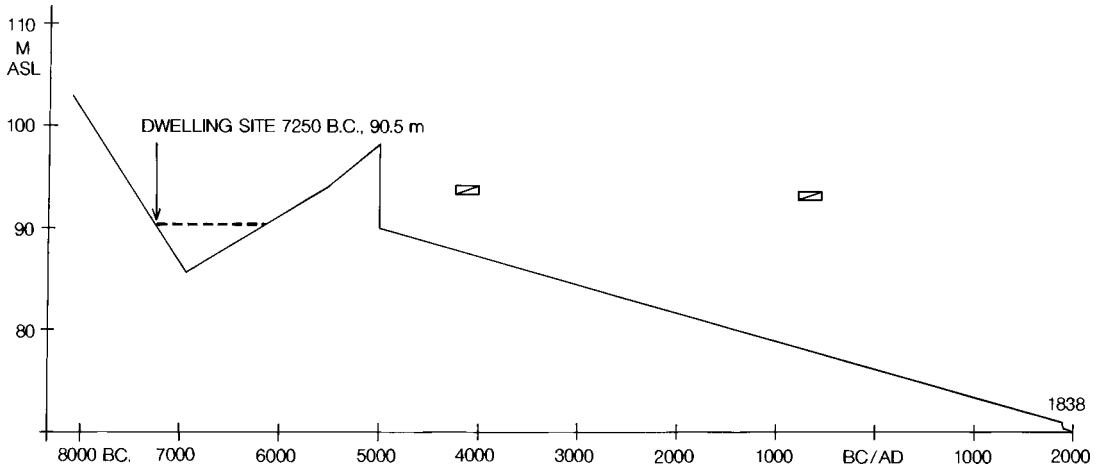

Fig. 3. Shoreline displacement curve of the Hietamäki site showing the emergence of the site from the Ancylus Lake waters of the Baltic basin before 7100 BC and it's submergence as a result of the transgression of Lake Päijänne 6200 BC. The broken line indicates the time period when the dwelling site was emergent. The elevations and ages of two cooking pits are also indicated. The shoreline diagram is constructed according to Saarnisto (1971a; for chronology see text).

PROBLEMS OF RESEARCH

Despite the fact that only a fraction of the site had survived and the finds from the rescue excavations were both meagre and one-sided, the site and its finds provides new and complementary materials for the study of the Early Mesolithic of Finland. As noted above, an interesting feature of the site was its location beneath the transgressive layer of Lake Päijänne, which suggested a very early age.

The earliest settlement of Finland has recently been the subject of a great deal of attention (see e.g. Matiskainen 1996; Schulz 1996; Nunez 1997; Carpelan 1999; Jussila 2000; Jussila & Matiskainen 2003; Takala & Sirviö 2003). The fields of linguistics and genetics have also figured prominently in related discussion (see e.g. Wiik 2002 and Carpelan 2001 and cited literature). A good example of current discussion, research and new results in this area is Hannu Takala recent doctoral dissertation presented at the University of Turku (Takala 2004). The starting point of this article, the Hietamäki site, complements in interesting ways the directly dated Early Mesolithic sites of Finland. The stratigraphy of Hietamäki reflects the history of Lake Päijänne and also establishes chronological boundaries for it. In this respect, the site is a rarity.

Hietamäki also adds to the overall picture of Finland's earliest settlement and fauna. The refuse fauna also permits a closer review of the nature of the site. It is particularly interesting locally, because Mesolithic stray finds had not previously been retrieved in the greater Jämsä area. This aspect and the difficulty of finding sites of this period may be partly explained by the history of shore displacement (see also Matiskainen 1987).

THE FINDS

As is common at sites of the period, the finds from both excavations are quite one-sided (the 2000 finds KM/AO 33373: 1–96, and the 2002 finds KM/AO 33373: 97–143). Most of the items are quartzes that have been tentatively classified when catalogued (T. Sepänmaa). According to the main catalogue of the Department of Archaeology of the National Board of Antiquities, there is a total of 463 quartz flakes from the site; 58 quartzes were classed as undefined artefacts. According to the main catalogue, there is also a possible point and three possible microliths. The finds also include a distinct scraper (33373: 72). The identification is tentative and highly uncertain, and the quartz finds still require further analysis.

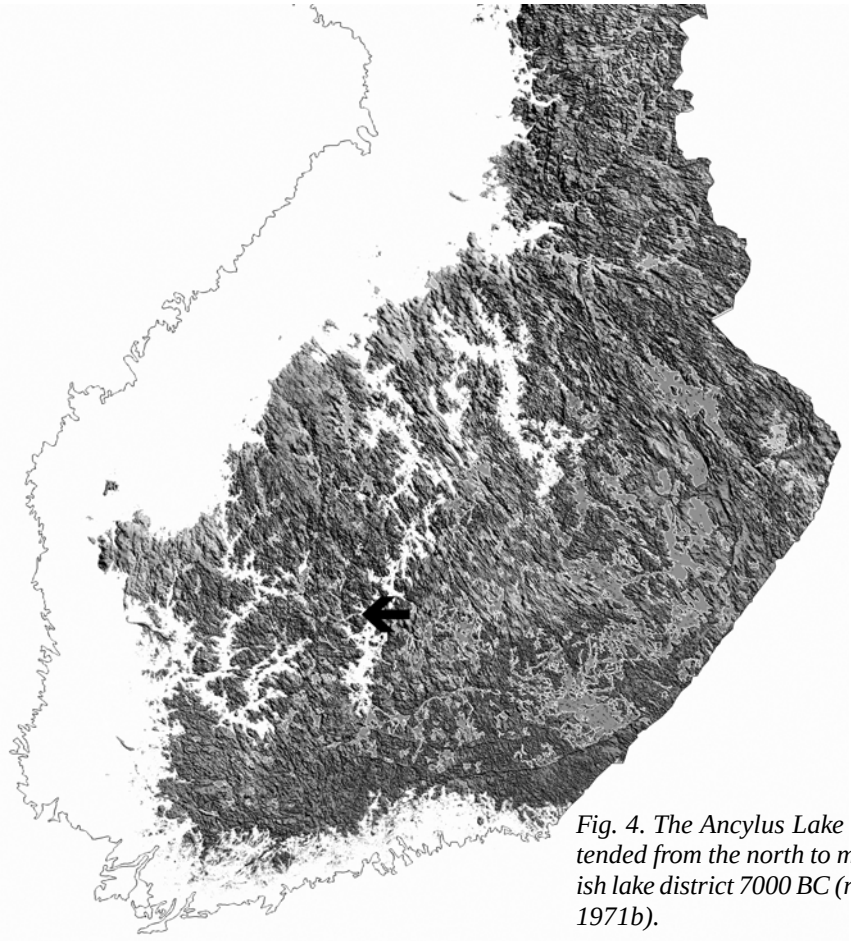

Fig. 4. The Ancylus Lake of the Baltic basin extended from the north to major parts of the Finnish lake district 7000 BC (redrawn from Saarnisto 1971b).

There are eight lithic scrapers that were shaped or possibly used. A large grinding stone was found at the bottom of the gravel pit, but it cannot be associated with any of the stages of settlement at the site.[1]

In addition to quartz, burnt bone is the most notable category of finds from the site. A total of 4,781 pieces of burnt bone were recovered, weighing, however, only 705.5 grams. The osteological material is discussed in a separate section below (J. Storå). The excavated soil was sieved to provide a representative bone material including even the smallest pieces of bone, which are often under-represented owing to reasons of excavation technique.

The Hietamäki material consists of typical Mesolithic dwelling-site finds. It does not include "exotic" raw materials or artefact forms found at some of Finland's earliest sites (cf. Takala 2004).

The quartz artefacts and flakes collected by Paavo Ihlberg after the 2002 excavation are not included in the above statistics.

THE HISTORY OF SHORE DISPLACEMENT IN THE LAKE PÄIJÄNNE REGION AND THE AGE OF THE SITE BENEATH THE TRANSGRESSION LAYER

The whole visible deposit of the Hietamäki site both above and beneath the cultural layer consists of shore terrace material, well sorted stratified gravel and sand. At the east end of the pit deeply sloping foreset beds are to be seen, being typical layers of the distal part of a shore terrace. The elevation of Ancient Lake Päijänne in the area is 98 metres above sea level, and the

levelled elevation of the cultural layer is approximately 90.1 metres, whereby the cultural layer is clearly older than the transgression maximum of Ancient Lake Päijänne: 6100 radiocarbon years or 5000 cal BC (Figs. 3, 4, 5; Saarnisto 1971a).

The postglacial/Holocene shore displacement of the Lake Päijänne region is well-known, and in particular the rate of shore displacement at the end of the Ancylus Lake stage of the Baltic, when North Päijänne was isolated from the Baltic (Saarnisto 1971b) is known exceptionally well in the area as a result of studies of annually laminated sediments in three small lakes. The lakes were isolated from the Ancylus Lake and it has been possible to date the isolation precisely with calculations of varves (Ojala *et al*. 2004). Hietamäki thus provides an opportunity for discussion on the precision of dating shoreline sites by geological means in exceptionally favourable conditions.

Two tilted shorelines have been constructed for the Päijänne region on the basis of stratigraphic material (Saarnisto 1971a); the higher and older shoreline slightly predates (by ca. 100 years) the Ancylus transgression maximum. It has been defined with the *Betula/Pinus* pollen zone boundary and dated with the above-mentioned annual laminated settlements to 8100 BC. The elevation of the shoreline at Hietamäki is 103 metres above sea level.

The later shoreline, with an elevation of 88 metres at Hietamäki, is defined according to the introduction of *Alnus* and dated with varved sediments to 7100 BC (Saarnisto 1971a; Ojala *et al*. 2004). It represents the stage of the Ancylus regression when the Ancylus Lake still extended from Pihtipudas in the north to the basin of Lake Päijänne. The slope at Hietamäki between the elevations of 103 and 88 metres above sea level, including the elevation of the site at 90.1 metres, thus emerged from the Ancylus Lake between 8100 and 7100 BC.

Water levels continued to sink until low thresholds isolated Päijänne into a separate lake above the Ancylus Lake. The critical thresholds were the discharge threshold of Äänekoski at Lake Keitele and the Kärnäkoski rapids between lakes Kolima and Keitele. The Kärnäkoski rapids regulated the level of lakes Päijänne and Keitele soon after isolation. The Ancylus regression in the period 8200–7400 BC had a rate of 2.6 cm per year

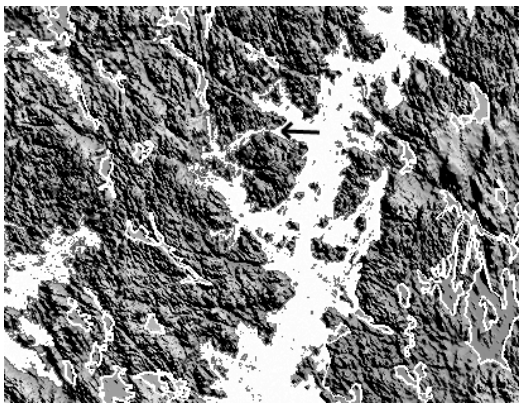

Fig. 5. A detail of the extension of the Ancylus Lake 7000 BC. The Hietamäki site was located on the mouth of a narrow strait of the Ancylus Lake which occupied the Lake Päijänne basin. The length of the arrow corresponds ca. 7 kilometres.

according to the above-mentioned varved sediments (Ojala *et al*. 2004), and this figure can be used in estimating the rate of shore displacement even a few centuries later. Lake Päijänne was isolated when the water level sank 2–3 metres beneath the above-mentioned shoreline of 7100 BC (Saarnisto 1971a), and the isolation took place around 7000 BC. At Hietamäki, the elevation of the isolation shoreline is 85–86 metres above sea level. It was from this level that the transgression of Lake Päijänne began, caused by the fact that the discharge threshold at Kärnäkoski and later at Pihtipudas was in an area of greater land uplift than Lake Päijänne. At Hietamäki, Lake Päijänne flooded at a rate whereby the level of the site, at 90.1 metres above sea level, was again reached around 6200 BC. The transgression gained pace around 5500 BP, when the Pihtipudas threshold furthest to the north and in the area of greatest land uplift became the discharge threshold of the whole lake as Kärnäkoski was inundated. The transgression culminated ca. 5000 BC, when the esker of Heinola was broken through and the waters of Lake Päijänne began to flow south into the Kymijoki River towards the area of lesser land uplift. The water level rapidly sank, by up to 8 metres, and by as much as 12 metres over the course of the millennia in the Hietamäki area (Saarnisto 1971a).

It can be deduced from shore displacement that

Table 1. The radiocarbon dates of Jämsä Hietamäki (Stuiver & Reimer 1993; Stuiver et al. *1998).*

Sample	Radiocarbon age BP	Cal BC (1 Sigma)	Probability distribution
Su-3248	**8250 ± 70**	7450–7427	0.094
		7424–7408	0.070
		7401–7392	0.034
		7375–7371	0.017
		7353–7280	0.314
		7273–7179	0.431
		7152–7141	0.041
Su-3249	**8220 ± 110**	7449–7433	0.052
		7422–7409	0.042
		7399–7393	0.018
		7350–7112	0.819
		7102–7081	0.069
Su-3359	**5270 ± 50**	4220–4196	0.188
		4161–4121	0.264
		4109–4092	0.104
		4078–4060	0.104
		4053–4036	0.117
		4023–3992	0.222
Su-3358	**2450 ± 50**	758–684	0.333
		661–643	0.080
		587–583	0.016
		544–478	0.300
		472–411	0.271

the 90.1 metre level of the Hietamäki site first emerged in 7300–7200 BC and was dry land for approximately a thousand years until 6200 BC. After the Päijänne transgression around 5000 cal BC, the level of the site again emerged quickly to become dry land, but the cultural layer was covered by a thick layer of sand. Shore displacement gives the cultural layer at Hietamäki chronological parameters of approximately 1000 years, but nothing more precise, even though it was possible to reconstruct shore displacement with exceptional accuracy. When defining ancient shore elevations it is also necessary to avoid apparent precision, as for example the average annual variation of water level in Lake Päijänne is 70–80 cm.

The cultural layer at Hietamäki survived because of its favourable location. During the transgression stage it was in danger of being leached, but instead it was covered by a protective layer of sand. The south slope at Hietamäki was the shore of a narrow strait, where sand could have accumulated parallel to the shore from the slop facing the lake. The cultural layer has distinct boundaries and the sand layer of a couple of metres that covers it is undisturbed, in other words no roots grow through the sand into the cultural layer. Nor does it contain iron-manganese precipitates that may indicate the flow of ground water and the transport of organic impurities. To date the cultural layer, two radiocarbon samples of charcoal were taken from the bottom of the cultural layer at a distance of roughly 5 metres from each other. The largest of the small pieces of charcoal in the layer were selected, mostly pieces less than one centimetre across. The other sample was taken from beneath a sooty (hearth?) stone. The dating results are almost identical: 8250±70 BP (7140–7450 cal BC) (Su-3248) and 8220±110 (7080–7350 cal BP) (Su-3249), i.e. ca. 7250 cal BC (Table 1; calibration according to Stuiver & Reimer 1993; Stuiver *et al*. 1998).

Fig. 6. Comb Ware period hearth. Timo Sepänmaa (left), Matti Saarnisto, Paavo Ihlberg and Tuovi Kankainen (1944–2004). Photo J.-P. Taavitsainen 2000.

The radiocarbon dates are excellently suited to the chronological parameters defined by shore displacement, falling into oldest end of the scale. The site was occupied immediately after the slope emerged from the Ancylus Lake ca. 7300–7200 BC. The clean and undisturbed nature of the sand beneath the cultural layer was noted on-site, i.e. no kind of soil horizon was visible. This alone suggested that the site was occupied immediately after it became dry land. The investigated layer represented the upper edge of the site. The lower part of the shore terrace had been excavated over a width of at least 20 metres and shore action had also moved the material of the original terrace. The extent of the cultural layer at lower elevations thus remains unknown. Its possible lower boundary was 2–3 metres lower at the isolation level of Lake Päijänne, which was reached at 7000 BC. The difference in elevation is so great that the hunting site, bound to the shore, most probably followed the quickly receding shoreline. When the regression turned to transgression, the inhabitants moved to a higher elevation and the level of the cultural layer was again at the shoreline in 6200 BC. The radiocarbon dates, however, do not support the assumption of the later use of the site, but perhaps the differences in the refuse fauna between the various parts of the site indicate different age. The small area excavated must also be kept in mind. Direct dates of bone finds should be necessary. The dating of Hietamäki was the oldest radiocarbon age for a

Fig. 7. Early Metal Period "cooking pit". Photo J.-P. Taavitsainen 2000.

Stone Age site in South Finland, and the site was in general one of Finland's few directly dated Early Mesolithic site. The evolution of the AMS method suited to the dating of burnt bone is nonetheless changing the situation for Early Mesolithic sites, as shown by dates obtained by Hannu Takala (2004) for bone from an Early Mesolithic context.

ON THE DWELLING-SITE TYPE

To our knowledge there are no other dwelling sites situated under transgression layers in Central Finland. They are also atypical elsewhere in Finland, at least partly because it is not easy to identify them in fieldwork.

In the area of ancient Lake Saimaa, there are the Mesolithic hearths of Mutala and Sihtala in Joensuu that were covered by a transgression layer (Pälsi 1937; Sauramo 1937; Saarnisto 1970; Matiskainen 1987: 28–29). Another similar site is possibly Kärenlampi in Rutola, Lappee (Meinander 1948: 40). In this connection we can also mention the submerged Mesolithic sites of the Lake Saimaa area (Koivikko 2000). The Telkkälä site at Muolaa is known for the Lake Ladoga region (Takala & Sirviö 2003) along with other sites inundated when the channel of the River Vuoksi formed c. 3750 BC (Saarnisto & Siiriäinen 1970).

For the time being, Mesolithic sites are rare in the greater Jämsä area. A dwelling estimated to be Early Mesolithic has been identified at Pitkäjärvenpohja in Jämsänkoski (ca. 8000 cal BC; Jussila 2000: 21). In the vicinity of the Lahti and Tampere highways there is an unexcavated site in a field surveyed by Kaarlo Katiskoski in archaeological inventory work. In view of its elevation, Katiskoski regards the location as (Late?) Mesolithic dwelling site that was inundated by the transgression of Ancient Lake Päijänne and largely destroyed by it.

LATER STAGES OF SETTLEMENT

In addition to the older stratum of occupation at Hietamäki, there are also two later stages of settlement. They are in the upper layers, clearly higher and younger than the Ancylus Lake stage and closer to the surface. They are associated with

a stone-laid hearth and a pit containing ashes, charcoal and fire-worn stones.

A stone-laid pit hearth (Figs. 6 & 2) came to light in the side of a test pit dug in the narrow area overlaying the gravel pit between the wall of the pit and the adjacent bluff. The top layer of stones in the hearth was approximately 45 cm below the present surface and the bottom of the hearth was roughly 100 cm below the surface. Radiocarbon dating of charcoal from the hearth gave the result 5270±50 BP (Su-3359) or cal BC 4220–3990 (Table 1; Stuiver & Reimer 1993; Stuiver *et al*. 1998). No artefacts were discovered in the test pit or the hearth. The calibrated date places the pit hearth in the Comb Ware period. Since the lower limit of the dwelling site that was possibly at the location could not be established, the elevation of the site remains unresolved. In view of its elevation of 92 metres, the hearth was some five metres above the shoreline of its period. There were no Comb Ware period finds from the gravel pit, nor are there any observations of an upper cultural layer in the profile of the pit. Owing to the size of the gravel pit, however, the possibility of a later site cannot be excluded.

Another hearth or similar feature, and also an indication of the latest stage of settlement at Hietamäki could be seen in the wall of the west end of the gravel pit. In this connection, a depression had survived on the surface, part of which had been destroyed by gravel excavation. The profile of the pit feature was clearly visible in the wall of the gravel pit (Figs. 7 & 2). It contained soot and charcoal of a greasy consistency. The charcoal was radiocarbon-dated to 2480±50 (Su-3358), cal BC 760–410 (Table 1; Stuiver & Reimer 1993; Stuiver *et al*. 1998). The feature is from the very end of the Bronze Age or the beginning of the Iron Age. There were no finds the vicinity of this pit either, nor were any other pits or depressions found in its surroundings. The situation is the same as with the Comb Ware period hearth. The same concerns the existence of a dwelling site. Although there is no information on a possible dwelling site or its lower limit, the pit feature was approximately 11 metres above the shoreline of its period. The hearth is thus further away from the shoreline than at Stone Age sites, as is the case in many other Early Metal Period dwelling sites and find locations in the lacustrine regions of the Finnish inland

Table A. Identified species at Hietamäki.

Mammals	**NISP**	**Weight (g)**
Elk, *Alces alces*	11	14,35
Large ungulate	17	31,72
Ungulate	1	0,59
Beaver, *Castor fiber*	18	13,44
Fox, *Vulpes vulpes*	4	0,53
Indet. Canid	3	0,9
Fish		
Perch, *Perca fluviatilis*	25	0,76
Indet. percid	11	0,3
Pike, *Esox lucius*	9	0,58
Roach, *Rutilus rutilus*	1	0,03
Indet. carp	10	0,5
Indeteterminate	4671	641,8
Total	4781	705,5

(Taavitsainen *et al*. 1998).

Pits and depressions of various kinds are the largest group of structures and features that the archaeologists come across in the terrain. Pits are eternal; they have been made and they have formed at all times and in all places. Therefore, it is very difficult to define their age or function by visual inspection; in many cases even excavation will not provide answers to related problems of chronology or function.

The nature of the pit feature at Hietamäki aroused a great deal of comment already at the time of the excavations. It was not a hunting pit, a feature that is common in Central Finland. But neither is it a unique type of prehistoric structure. As it is impossible to gather a complete comparative material, suffice it here to present information gleaned from published studies regarding similar pits and/or depressions, their criterion being that they are neither traditional hearths nor hunting pits.

The Hietamäki pit feature is not unique in Central Finland. At the Stone Age Village theme park (an actual prehistoric site) at Summassaari in Saarijärvi, archaeologists have investigated a findless pit similar in structure to the Hietamäki pit. It is dated to the 5th century BC (Muurimäki 1999). There are finds from the Early Metal Period in the near vicinity of the pit, including the Saarenpää dwelling site with Luukonsaari Ware. Similar features, i.e. pits that are neither traditional hearths of Stone Age type nor hunting pits, are known particularly from the coastal region of

Table B. Identified species/taxa in the excavation trenches at Hietamäki, NISP.

	Excavation 2000				Excavation 2002				
Taxon/species	**Trench 1**	**Trench 2**	**Trench 3**	**Stray finds**	**FNR 2**	**FNR 3**	**FNR 16**	**FNR 17**	**Total**
Elk		1	2		7		1		11
Large ungulate					15	1	1		17
Ungulate								1	1
Beaver	2	1	14	1					18
Fox			4						4
Canidae			2	1					3
Indet. Mammal						2			2
Mammals, total	2	2	22	2	22	3	2	1	56
Perch			24	1					25
Percidae			11						11
Pike	2		5	2					9
Roach	1								1
Cyprinidae			7		3				10
Indet. fish	17		146	20		1			184
Fish, total	20		193	23	3	1			240
Indeterminate	627	49	1201	181	958	663	387	419	4485
Total, NISP	649	51	1416	206	983	667	389	420	4781
Total, Weight (g)	92,64	9,64	139,36	43,36	90,66	193,51	76,19	60,14	705,5

Ostrobothnia and in the Ostrobothnian and South Lapland lake region (Sarkkinen 2003a: 17 & 2003b: 10; Sarkkinen & Mäkivuoti 2000: 145). Interestingly, where dates are available for the pits, they are from the Early Metal Period. Numerous pit hearths have been investigated in Southern Ostrobothnia, e.g. at Laihia. Five have been dated to the period 930–250 cal BC, all of them associated with Early Metal Period dwelling sites (Miettinen 1998: 113, 176; Miettinen 1994).

Commenting on the pit remains in Northern Ostrobothnia, Sarkkinen (2003b: 10) notes that "the post Stone Age period that has long been unknown is now being gradually discovered with the aid on these pit remains." According to Sarkkinen, remains of dwelling sites, above all quartz finds. This is an interesting type of prehistoric remains, requiring more systematic attention also in the inland regions of Finland. Here, too, it appears to fall into a period from which few re-

Table C. Identified specimens of elk (Alces alces) and a large ungulate at Hietamäki, NISP. Bones identified as being from a large ungulate most probably originate from elk.

	Elk				Large ungulate		
Element	**Trench 2**	**Trench 3**	**FNR 2**	**FNR 3**	**FNR 2**	**FNR 3**	**FNR 16**
Mandibula/Maxilla			6				
Vert thoracalis							1
Vertebrae						1	
Costae						1	
Scapula		1					
Radius						1	
Ulna					1		
Carpi 4			1				
Talus	1						
*Ph*1				1			
Metapodialia		1					
Ossa longa						12	
Total	1	2	7	1	1	15	1

Element	Trench 1	Trench 2	Trench 3	Stray find
Cranium		1	1	1
Dentes			3	
Scapula			3	
McV			1	
Coxae	1			
Femur			1	
Tibia	1			
Talus			1	
Mt			1	
Metapodialia			2	
Ph2 posterior			1	
Total	2	1	14	1

Table D. Identified specimens of beaver (Castor fiber) at Hietamäki, NISP.

mains are known except for Early Metal Period dwelling sites that can be identified on the basis of ceramic finds. Some of the depressions could even be from the later stage of the Early Metal Period, from which not even any dwelling sites have been found because ceramics presumably went out of use at the time. In many cases, there are no other finds in the near vicinity. Perhaps the inland pit features will turn out to be indications of actual dwelling sites once their surroundings are investigated in closer detail.

Shallow pits have also been investigated in the region of Satakunta, for example at Vermuntila in Rauma. The main difference is that no depression can be seen on the surface, but instead a small mound. Large amounts of ceramics have also been found in the pits in Satakunta, and they also appear to have more stones than the Hietamäki pit feature. There is also charred wood on the bottom. In addition the pits are clearly within a dwelling site. The Vermuntila pits and their immediate surroundings reveal finds of Morby Ware, according to which Unto Salo dated them to the Pre-Roman Iron Age (Salo 1983; on the age of Morby Ware, see Asplund [2004]). They, too, are thus from the Early Metal Period.

The Mesolithic and Corded Ware site of Jönsas at Myyrmäki in Vantaa in the province of Uusimaa also included an Early Metal Period stage of settlement represented by pit hearths. These features may perhaps also be included in the above-mentioned group. In the article on dates obtained for the Jönsas site, the term hearth is used for fire places dated to the Stone Age. Sinimarja Ojonen, who published the dates, calls the pit features dated to the Early Metal Period pit hearths. Charred pieces of wood and timber structures were found on the bottom of the pits. Although there were several Early Metal Period hearths at the site, there are very few finds from the period, only Epineolithic ceramics and Morby Ware (Ojonen 1983; see also Purhonen & Ruonavaara 1994).

It was suggested on-site that the pit feature at Hietamäki was a cooking pit, which is also the explanation given for the pits at Vermuntila (Salo 1983). The pit discovered in Northern Ostrobothnia has been associated with the drying of fish or game (Sarkkinen 2003: 17). The pits and depressions listed here are no doubt a group of heterogeneous function.

The term cooking pit, which is often used, is not a good choice. Cooking in a pit was a simple way of preparing food. Each pit was probably a case apart. There could many or only few stones depending on the function of the pit. The function also dictated the heat applied and the degree to which the firewood was charred or turned to soot; the pit could also be opened in different ways; used once or repeatedly etc. Even with precise excavation, it can be difficult to investigate all the above details and to establish a history of cooking in pits. It would be more important to

Table E. Identified specimens of fox (Vulpes vulpes) and canidae at Hietamäki, NISP.

Element	Trench 3	Stray find
*Vert. Caudalis**	2	1
McV	1	
Talus	2**	
*Ph*1	1	

* Canidae, fox/dog

** Both fragments from the same bone

Table F. Identified specimens of fish at Hietamäki, NISP.

Family/Species	Trench 1	Trench 3	Stray find	FNR2	FNR3	Total
Perch, *Perca fluviatilis*		24	1			25
Indet. Percid		11				11
Pike, *Esox lucius*	2	5	2			9
Roach, *Rutilus rutilus*	1					1
Indet. Carp, Cyprinidae		7			3	10
Indet. Fish	17	146	20	1		184
Total	20	193	23	1	3	240

distinguish cooking pits (ovens dug into the ground, pits for preparing food etc.) from hunting pits, charcoal pits, linen-soaking pits, storage pits etc. In future there is reason to collect other than dating samples in order to establish the various functions of the pits. It could be possible to distinguish groups among the cooking pits that represent the various cooking traditions of different cultural areas and environments.

This category of prehistoric remains is also highly problematic in Swedish archaeology. Identifiable structures, hearths etc. of the Early Iron Age often appear at Stone Age site, in which connection they can only be distinguished by radiocarbon dating (see e.g. Segerberg 1999).

Also related to this problematic is the number of pits at a single site, their contemporaneity, difference in age and relationship with the shoreline and the site itself. The elevation of the pit feature at Hietamäki shows that it is not bound to the shoreline in the manner of Stone Age dwelling sites. This appears to be the situation also for similar finds in the inland regions of Finland. Owing to the destruction of the site, nothing can be said about the original number of pits at Hietamäki. The same concerns the relationship of the pit with the possible Early Metal Period dwelling site. Elsewhere such pits of this kind are sometimes found in connection with dwelling sites and sometimes in places with not other signs of human occupation. This also suggests a specific function the investigation of which requires a detailed analysis of the whole material and the surroundings of all the known pits. Therefore, it is necessary to establish the need to led to these pits. It was probably not any exceptional major undertaking of the community, but rather an ordinary, repeated everyday chore.

OSTEOLOGICAL ANALYSIS

Material and methods. A total of 705.5 g of burnt bones were recovered during the excavations at Hietamäki. The faunal remains from Hietamäki consist of highly fragmented burnt bones. Most fragments show a high degree of burning and are of a white colour. The mean weight of the bone fragments is 0.15 g. Quantification was performed according to NISP (*Number of Identified Specimens*) and weight. The level of identification is low; only 2 % of the fragments and 9 % of the weight have been identified (Table A). Bones from three mammals and three fish species were identified. The original osteological reports are kept at the National Board of Antiquities, Helsinki (Storå 2001; 2002). A catalogue of the identifications is given in the appendix.

Results. Most of the bones from the 2000 excavations were recovered in three trenches (1–3) excavated in the section of the gravel pit. A small amount of stray finds was also collected. The bones from the 2002 excavation originate from four find contexts labelled 2, 3, 16 and 17. There are some differences in species composition in the investigated areas of the site (Table B). Bones of beaver and fox were recovered in the areas excavated in 2000 but not in 2002. Bones from elk dominate in the assemblage recovered in the 2002 season. The assemblage recovered in 2000 also contains a higher amount and a more varied material of fish. The differences are of some interest for the interpretation of the site.

Three mammal species, elk (*Alces alces*), beaver (*Castor fiber*) and fox (*Vulpes vulpes*) were identified at Hietamäki (Tables A and B). Some bones have been identified as being of a large

ungulate, ungulate or indeterminate mammal. Most identified bones, however, originate from fish. Bones of perch (*Perca fluviatilis*), pike (*Esox lucius*) and roach (*Rutilus rutilus*) were identified together with bones of indeterminate carp, an indeterminate percid and indeterminate fish. Most of the indeterminate specimens consist of small fragments of long bones, most likely from small or medium-sized mammals.

Elk, large ungulate and ungulate: Eleven bones have been identified as to elk in four find contexts, tables B and C. The fragments originate from the skull (upper or lower jaw), the wrist (C4) and fingers or toes (Ph 1). The six fragments from the upper or lower jaw most probably originate from the same bone. These anatomical regions are comparatively poor in meat and can be considered to be of low utility. It needs, however, to be considered that the bones identified as of a large ungulate (N=17) most probably also originate from elk. It seems improbable that the specimens would originate from another cervid, e.g. red deer (*Cervus elaphus*) (Forstén 1973; Ukkonen 1993). During this time period the environment favoured elk (Forstén 1973; Ukkonen 1993). The specimens identified as being from a large ungulate originate from the vertebral column and lower parts of the forelimbs. The largest group consists of fragments of indeterminate long bones. These regions are richer in meat and, thus, most anatomical regions of elk seem to be represented at Hietamäki.

One long bone fragment from a large ungulate in FNR 3 is of special interest. The specimen shows a distinct impact scar as a result of deliberate bone fracturing. Apparently the long bone had been cracked open with some kind of tool in order to extract the marrow from the bone cavity. It can be noted that burning is not the only cause for a high level of fragmentation at Hietamäki.

Beaver: A total of 18 bones a beaver have been identified in three find contexts, Tables B and D. Most bones were identified in trench 3, which shows a rather varied anatomical representation. Most major anatomical regions are represented except for vertebrae and ribs. However, these elements are sensitive to destruction by fire. Some indeterminate specimens probably originate from beaver.

Fox and indeterminate canid: Four bones from fox have been identified in trench 3, Table E. Two specimens from the *talus* probably originate from the same bone. It may be suspected that the three caudal vertebrae from an indeterminate canid in fact originate from fox ? probably all from the same animal. The identified bones all originate from the peripheral anatomical parts.

Indeterminate mammal: Two bone fragments come from an indeterminate mammal, both in FNR 2. One fragment is from the upper or lower jaw. The other is a rib fragment that probably comes from a small sized mammal, i.e. not from elk. Although, the rib fragment cannot be identified as to species, it shows that other mammals than elk are also present in the assemblage from the 2002 excavations.

Fish: A total of 240 bones from fish were identified, Table F. The bones were recovered in four find contexts. Among the identified specimens bones from perch dominate followed by pike and roach. There assemblage from Hietamäki most probably contains more species of carps and percids than those identified in the present study. Most bones originate from rather small-sized fish. Considering the location of the site, the representation of species corresponds well with what could be expected. Most probably the fish were caught in nearby waters.

Hietamäki in the light of the site refuse fauna. The mammal species identified at Hietamäki have previously been identified at several Finnish Mesolithic sites. Beaver, elk and fox are often well represented in the refuse faunas of the sites (Edgren 1982; Forstén 1973; Hiekkanen 1989; Jernvall in Matiskainen 1989; Schulz 1996; Siiriäinen 1981; 1982; Ukkonen 1993; 1996). Also, the fish species at Hietamäki have been previously identified in contemporary refuse faunas.

Despite the rather small amount of faunal remains at Hietamäki, the osteological analysis revealed a rather varied utilization of animal resources at the site. Forest game (and beaver) as well as fish were exploited at Hietamäki and there can be no doubt that the burnt bones originate from animals that were utilized by the Mesolithic occupants of the site. Caution is, however, called for in the interpretation of the subsistence economy of the site. The taphonomic history of the faunal assemblage from Hietamäki is complicated and preservation has to be considered far from ideal. All the bones in the assemblage were deposited after the animal carcasses have been

procured and the refuse burned. Although the amount of fish bones is relative high it is noteworthy that most of the identified mammal bones originate from the hardest parts of the bones.

Considering the location of the site, on the shore of the Ancylus Lake, the lack of seal bones in the assemblage may be considered slightly surprising. Seal bones have been identified at many other contemporary sites (e.g. Matiskainen 1989: Table 19). The absence of seal bones at Hietamäki could be explained by the location of the site in an inner-archipelago setting at some distance from the open sea. However, the absence of seal bones may perhaps also be explained by the season of occupation. The fish bones in the assemblage from Hietamäki can be taken as an indication that the site was occupied in the early part of the summer season of the year when fishing was most productive (e.g. Matiskainen 1989: fig. 22). This season would be suitable also for beaver exploitation but less suitable for seal hunting. However, the seasonal indicators at Hietamäki are weak and not conclusive.

It seems probable that the faunal remains deposited at Hietamäki represent a comparatively short-termed occupation. In fact, if the assemblage is treated as a whole, it is possible that only one individual represents each mammal species in the refuse fauna. Also, all the fish identified could have been caught on only one occasion. It is of some interest that the faunal remains deposited in different areas of the site not represent identical activities. The faunal assemblage from the 2002 excavations at Hietamäki differs in some aspects from that collected in 2000. The species composition of mammals in the 2002 assemblage is more limited with elk being the only mammal species identified. Also there is at least one other (smaller) mammal species present. Regardless of this, bones from elk (+ a large ungulate) were deposited mainly in the area excavated in 2002 while those of beaver in other areas ? mainly in trench 3. The most varied material at Hietamäki comes from trench 3 where the faunal assemblage is dominated by beaver, followed by smaller numbers of elk, and fox but a comparatively high number of fish bones. Probably this is an indication that the activities in this area of the site were more varied compared to other areas. Thus, the site cannot be characterized as a single-purpose site. The procurement of prey animals at Hietamäki has involved the utilization of meat as well as bone marrow. Apparently, long bones (of elk?) containing marrow were cracked open prior to burning, which indicates a rather extensive ?utilization pattern of animals at Hietamäki. Such activities would normally not have occurred at e.g. kill-sites.

The observed differences in species representation between the different areas indicate a spatial organization of activities at Hietamäki, which has been preserved after the site was abandoned. Possibly the transgression has contributed to the fairly good resolution of the spatial organization. It seems that Hietamäki functioned as some kind of base to which animal resources ? of meat, marrow, and fur were transported and then procured, utilized and finally burned. However, Hietamäki was probably not a long-term base camp. It can be argued that the observed spatial organization of activities would have been more difficult to observe at a long-term site. The parties involved in the excavation, however, wish to underline the fact that the studied sample was a very small part of the original site and investigated area was selected in view of land use at the site and not with archaeological research interests in mind. There is therefore particular need for caution with regard to conclusions on the spatial organization of the site.

DISCUSSION

The Finnish Mesolithic material is easily described as monotonous. It consists primarily of quartz artefacts and flakes, struck lithic artefacts and flakes and burnt bone. Even the variation of lithic artefacts is not very great. More detailed study of this material may alter the situation and provide a more varied picture of the material (cf. Takala 2004). Organic material from the period is poorly known (cf. Schulz 1996). The systematic dating of bog finds that have accumulated over the years in the collections of various museums may no doubt increase the number of known Mesolithic artefacts. Also thorough surveys of the environments of organic finds may reveal hitherto unknown sites and possibly even new discoveries of sites under bog layers (cf. Matiskainen 2002: 69–71; Matiskainen & Zhilin 2003; see also Taavitsainen 2001). In recent decades, however, the amount of flint items belonging to the

earliest stage of settlement has begun to grow as the result of systematic excavation and field inventory work. This has introduced new aspects to discussion on the origin of the earliest settlement of Finland. Unlike quartz, the flint material permits comparisons of objects and artefacts beyond the borders of Finland to establish the course of colonization (see e.g. Takala 2004; Schulz 1996: 5).

The nature of the material has largely dictated the fact that the archaeology of the Finnish Mesolithic has been predominantly characterized by the approaches of the natural sciences. Research has concentrated on questions of chronology, particularly on refining the basic chronology of the period, the reconstruction of the natural environment and means of livelihood and on evaluating the above-mentioned directions of approach of settlement, mechanisms of colonization and the rate of the spread of settlement (see e.g. Matiskainen 1989; Schulz 1996; Jussila 2000; Nunez 1997; Carpelan 1999).

Owing to the limited material and the lack of total excavations of sites, discussion of issues related to means of livelihood and human activities has largely relied on collections of refuse fauna analysed and interpreted by osteologists and interpretations by archaeologists of the results presented by osteologists (see e.g. Ukkonen 1993 & 1996; Siiriäinen 1981 & 1982; Hiekkanen 1987; Schulz 1996; Taavitsainen 1980). This has further been hindered by the mixed nature of many osteological materials (Schulz 1996: 24). The differences observed in the composition of the faunal remains in different parts of the Hietamäki site highlight some problems related to the characterization of the subsistence economy of Stone Age settlement sites. In the site refuse faunas of the interior regions of Finland, there is a general decrease of beaver bones while those of elk increase towards the latter part of the Mesolithic (see e.g. Schulz 1996). Obviously this trend can be associated with environmental changes (Schulz 1996) and also with a general shift in hunting patterns. However, it needs to be considered that the interpretation of faunal assemblages from Stone Age sites as a whole may mask important intra-site differences in depositional patterns and, thus, subsistence-related activities. At Hietamäki it is noteworthy that the bones of elk and beaver were recovered in more or less different parts of the site.

The sieved osteological material from Hietamäki is a significant addition to Finland's few unmixed Early Mesolithic collections of bone material. Also in connection with this site it is the most informative body of material. It indicates use of the site in the early part of the summer when fishing was at its most productive. The osteological material also suggests the spatial organization of activities, which is uncommon at Mesolithic sites. A possible explanation is inundation by the transgression of Ancient Lake Päijänne and the halting of processes whereby the assemblages would have been mixed. The phenomenon could also be explained by the possibility that this was no long-term base came, which would definitely have hindered possibilities to make observations regarding the spatial organization of the site. On the other hand the unfortunate but source-critically important fact must be borne in mind that except for minor remnants, the site had been destroyed in the excavation of gravel.

Dated to ca. 7250 BC, Hietamäki represents a hitherto unknown dwelling-site type in the Lake Päijänne region that was flooded by the transgression of Ancient Lake Päijänne. For the time being it is the only example of its type in the region, and the type is so far from common in other parts of the country. But in fact it is a common rarity of which further examples will no doubt begin to come to light. We are gradually learning where to look for them.

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NOTES

1. The find KM/AO 33373:91 is catalogued as small pieces of burnt clay or possibly pottery. The items, however, are probably natural concentrations of clay.

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