ISKOS 8

STUDIES ON THE CHRONOLOGY, MATERIAL CULTURE AND SUBSISTENCE ECONOMY OF THE FINNISH MESOLITHIC, 10 000—6000 b.p.

by
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Studies on the Chronology, material Culture and Subsistence Economy of the Finnish Mesolithic, 10 000—6000 b.p.

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Abstract

The thesis consists of articles in which the author discusses the chronology, material culture and subsistence economy of the Finnish Mesolithic. The chronology is outlined according to the radiocarbon-dated shore displacement chronology of the Baltic. The so-called stratigraphic method permits datings of dwelling sites on the shores of the Ancylus Lake and the Litorina Sea. Transgressions of the large lakes of the interior, due to land uplift and changes in discharge channels, have mainly destroyed dwelling sites on the lake shores and it is only in the regressive areas in the northern parts of the lakes that preserved sites are found. The chronology of settlement indicates that two stages corresponding to the facies of the Baltic can be shown, viz. the Ancylus and Litorina Mesolithic stages. This division also corresponds to changes in artefact assemblages.

Studies of material culture concentrate on two typical artefacts of the Litorina Mesolithic — the oblique-bladed quartz point and the South Finnish even-bladed adze. The quartz points are linked to the European Tardenoisien phenomenon, the influence of which can be dated to around 7700 b.p. Analyses of South Finnish adzes take into account their function and their processes of circulation was well as reasons for discard mainly due to damage to the artefact.

The Askola region, providing a compact catchment area, was the scene of subsistence studies. Settlement there was continuous from 9100 to 6000 b.p. The paleoenvironment was defined from the beginning of the Post-Glacial with the aid of geological methods. In the Ancylus period considerable changes occurred with the rapid emergence of dry land due to regression. In the Litorina stage, conditions stabilized and became stagnant for approximately 2500 years as the result of a balance between isostatic and eustatic factors.

Conclusions regarding the hunting system are based on archaeo-osteological analyses of refuse fauna. Game fauna was consistent with environmental conditions, with an initial predominance of seal-hunting followed by the unspecialized hunting of a wide range of mammals. The Mesolithic hunting system of Askola can be compared to the collector system outlined by Binford.

Finally, the thesis discusses the origin of the Askola population, which is most probably due to migration from the East Baltic region. At present, there is insufficient data on the transition from the Palaeolithic to the Mesolithic in NW Russia, but migration into Karelia and Eastern Finland may have occurred via Russia.

Contents

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I. Matiskainen, Heikki (1989). The Chronology of the Finnish Mesolithic. (In Clive Bonsall, ed., *The Mesolithic in Europe, III Int. Mesol. Symp. Edinburgh 1985),* 379—390.

II. Matiskainen, Heikki (1987). Die mesolithische Steinzeit und die Chronologie im Binnenseegebiet Finnlands. *Fennoscandia archaeologica IV,* 19—34.

III. Matiskainen, Heikki (1986). Beiträge zur Kenntnisse der mesolithischen Schrägschneidepfeile und Mikrolithen aus Quarz. *Studia praehistorica Fennica C F Meinander septuagenario dedicata. Iskos 6,* 77—98.

IV. Matiskainen, Heikki (1988). Geradmeissel vom südfinnischen Typ, spätmesolithische Gegenstandsgruppe. *Suomen museo 1987,* 5—34.

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STUDIES ON THE CHRONOLOGY, MATERIAL CULTURE AND SUBSISTENCE ECONOMY OF THE FINNISH MESOLITHIC, 10 000—6000 b.p.

A. GENERAL

The Mesolithic period was originally devised to fill the gap between the main epochs of the Stone Age, the old and new Stone ages. The term was first used by Westrapp in 1872, but it was Burkitt (1925) who presented the Mesolithic in the present sense of the term. The concepts of paleolithic and neolithic were first defined by Sir John Lubbock in 1865. These periods of the Stone Age were distinguished by chronology, technology and economy and these criteria can still be applied in Stone Age studies concerning phenomena between the hunter-gatherer and nomadic-agriculture periods. (Clark 1980; Price 1984).

Definitions of the Mesolithic have proven to be problematic.A critical review of definitions by various scholars is presented by Zvelebil (1986). Although the Mesolithic has mainly been regarded as an economic concept, the situation in Finland corresponds mainly to Mellars' (1981) view, according to which the Mesolithic is strictly bound to chronology. The beginning of the Mesolithic defined at ca. 10 300 b.p. can be connected to the year zero of clay varve chronology. Clay chronology, which varies to some degree according to geological interpretations, can be recommended for the study of Finnish conditions. In Finland it reflects the end of the Baltic Ice Lake stage, the beginning of the Preboreal period and the formation of sub-aquatic areas for Mesolithic settlement.

In Finnish archaeology the terms ''preceramic'' or ''Suomusjärvi culture'' were long used instead of Mesolithic. It was apparently only as late as 1950 that Aarne Äyräpää used the term in an article on Finland's oldest lithic artefacts. Despite the use of the term in the titles of his monographs, Luho (1956, 1967) avoided it in his actual texts. As a terminological concept the Mesolithic came into wider use in the 1970's and '80s in connection with Finnish studies on chronology and economy (Siiriäinen 1978, 1981a, 1981b; Nùñez 1978a,1978b).

The reason for this late use of the concept in Finland can be found in the fact that there was no need to define any boundary with a preceding Paleolithic period as the Finnish Stone Age begins with the Mesolithic. Material and economic change leading from the Paleolithic to the Mesolithic occurred outside the present area of Finland in the East Baltic regions, Belorussia and NW Russia, which indicates the possible direction of origin of the earliest settlement of Finland. The upper boundary of the Mesolithic is defined at the beginning of the ceramic period while economy continued almost unchanged without any actual neolithic developments. The preceramic/ceramic distinction is chronological while the ''Suomusjärvi culture''/Comb Ware culture dichotomy is related to material culture.

B. INTRODUCTION

This thesis consists of the following articles:

I. Matiskainen, Heikki (1989). The Chronology of the Finnish Mesolithic. (In Clive Bonsall, ed., *The Mesolithic in Europe. III Int. Mesol. Symp. Edinburgh 1985),* 379—390.

II. Matiskainen, Heikki (1987). Die mesolithische Steinzeit und die Chronologie im Binnenseegebiet Finnlands. *Fennoscandia archaeologica IV,* 19—34.

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C. CONCLUSIONS

1. Chronology

The first two articles (I,II) discuss the chronology of the Finnish Mesolithic. The means of dating applied is shore displacement chronology developed in quaternary geological studies. With respect to the Baltic on the one hand, and the inland lakes on the other, the methods differ insofar as in the former case (I) shore displacement curves based on the so-called stratigraphic method from a limited area are used. Their dating is based on radiocarbon-dated facies boundaries of diatom stratigraphy and the isolation elevations of bodies of water. In the latter case chronology is based on the shore displacement of the large inland lakes with the use of a distance diagram. Detailed descriptions of the shore displacement methods applied are presented in connection with articles I, II and V.

The archaeological chronology was devised by placing sites, documented as Mesolithic, on regional shore displacement curves on the basis of their elevation and on the other hand in connection with distance diagrams dated by pollen zones. This permitted the dating of the Mesolithic artefact types as defined by Äyräpää (1950). A general description of the artefact types is given in article I.

A comprehensive artefact chronology could be outlined in connection with coastal sites. In the area of the large inland lakes Post-Glacial transgressions preceding changes in discharge channels had destroyed the sites. However, in the northern parts of the lake basins, which were in completely regressive areas, Early Mesolithic sites have been preserved with datings to the Boreal and the beginning of the Atlantic period, ca. 9400—8000 b.p. Some of these may have been in connection with the regressive phase of the Ancylus Lake. Artefact chronology is in agreement with results from coastal sites. (II).

The Mesolithic artefact types are dated as follows (I,III,IV):

— leaf-shaped slate points	8800—8000 b.p.
— mace-heads with coniform holes	8500—8000 b.p.
— curved-backed gouges	8500—7500 b.p.
— oblique-bladed quartz points	7700—6000 b.p.
— South-Finnish adzes	7700—6000 b.p.

The so-called primitive adzes/axes were in use throughout the Mesolithic from ca. 9300 to 6000 b.p.

The artefact chronology shows a clear division into three early and two late artefact types. As these two groups find chronological parallels in the Ancylus Lake and Litorina Sea stages of the Baltic, the author has introduced this division of facies as applying to the material culture of the Mesolithic with the corresponding terms Ancylus and Litorina Mesolithic (I). The precise datings for the groups are 9300—8000 b.p. and 8000—6000 b.p. respectively. Thus, the chronology of the Finnish Mesolithic is based on a dated diatom stratigraphy.

The chronological term ''Suomusjärvi culture'' has been used of the Mesolithic of Finland, with a three-part division into the Laperla, Sikunsuo and Kisko phases. As there are no chronological or material grounds for verifying this division, the author suggests that it should no longer be used in studies of Mesolithic chronology and accordingly the whole concept of the ''Suomusjärvi culture'' should no longer be used (IV). On the other hand, the noncommital term preceramic, as opposed to the subsequent Comb Ware period, is acceptable.

2. Material

Studies II and IV discuss two artefact groups of the Litorina Mesolithic, the oblique-bladed quartz points and the South-Finnish adzes. In the area of the Gulf of Finland the eustatic conditions of the Litorina Sea, which remained in balance with land uplift, do not permit more precise conclusions regarding artefact chronology within the phase concerned. The aim of these studies was to elucidate in more detail the artefactual nature of the Litorina Mesolithic.

The oblique-bladed quartz points can be linked chronologically to the so-called Tardenoisien phenomenon as applied to quartz. In their manufacture flaking technique was replaced by chips removed from a quartz core and shaped into points. Article III also briefly discusses microliths and tanged points. In addition it may be noted that in a later study Schulz (1988) has found elements of micro-flaking technique (i.a. microburins) in Ancylus Mesolithic quartz materials. The Tardenoisien phenomenon reached Finland at a surprisingly early stage. In Ostrobothnia the oblique-bladed points display shore displacement datings beginning as early as ca. 7700 b.p., thus corresponding to the dating of transverse-bladed arrowheads in Southern Scandinavia. (III).

In connection with the South Finnish adzes, the author attempted a more detailed investigation of the possible existence of the above-mentioned Kisko phase. The starting-point of the study was Foley's (1981) flowchart of the use of an artefact leading to its discard. The material was approached from the point of view of reasons for discarding with a documentation of use-wear. The lithic materials were defined by Ilkka Laitakari.(IV).

The distribution of the South Finnish adzes is limited to the province of Uusimaa (Sw.Nyland) and the most numerous finds are from the commune of Kisko. The other Mesolithic artefact types display a much wider distribution (Matiskainen 1983). Due to the eustatic balance of the Litorina Sea in the period concerned, the South Finnish adzes are difficult to date in the area of the Gulf of Finland. Their manufacture and use appear to span the whole of the Litorina Mesolithic and it is one of the leading artefact types of the period. In a previous connection (Matiskainen 1983), the author suggested an even shorter period of use, dating to the end of the Litorina Mesolithic.

3. Subsistence

The main study relating to the above theme is article V where the development of the paleoenvironment and Mesolithic adaptation are approached from the perspective of a limited geographic area, the commune of Askola. The Mesolithic dwelling site material of Askola and previous excavations in the region provide adequate material for these purposes (Luho 1956, 1967).

In the first section of the study a quaternary-geological reconstruction of the paleoenvironment in the period from 10 000 to 6000 b.p. is presented. The emergence of dry land and the related stages of the Baltic are investigated on the basis of diatom flora and pollen analysis is applied to the history of forests and vegetation in Askola.

Shore displacement chronology permits the dating of all sites and find locations in Askola with known elevations. The chronology of sites with Mesolithic artefact types is compared with the chronological scheme presented in article I, applying to the Baltic region in general. The results are in agreement. The chronology of the sites in the Porvoonjoki river valley in Askola indicates continuous settlement from 9100 to 6000 b.p.

The basis of evaluations of Mesolithic subsistence is provided by osteological analyses of bone fragments recovered in excavations. The analyses were carried out by Jukka Jernvall. The mammal fauna of the earliest sites is dominated by seal. By the end of the Boreal period faunal remains reflect a predominance of seal, elk and beaver. Thermal indicators of the Post-Glacial period are species hitherto unidentifed in the Finnish material — wild boar and forest deer. The Askola fauna is highly similar with respect to species and chronology with Mesolithic refuse fauna from other contexts in Finland.

The inlying archipelago conditions in Askola during the regressive stage of the Ancylus Lake were favourable for sealing, but the increasing area of dry land forced unspecialized hunting to rely on all available game resources. The rapid regression was followed by a ca. 2000-year period of stagnatic conditions due to the joint effects of Litorina eustasy and land uplift. At this stage the estuary of the Porvoonjoki river and its environs develop into a division of four ecological zones for hunting and fishing (outlying archipelago/ inlying archipelago/ river estuary/ upper reaches of the river), characteristic of the optimal environments selected by hunter-gatherer communities. Hunting strategies were dictated by seasonal variations in the behaviour of game. The yield of the environment is estimated to have been sufficient for the subsistence of the community without reaching its potential limits. The pattern of acquiring nutrition remained unchanged and unaffected by crises throughout the Litorina Mesolithic.

In the author's opinion, Binford's environmental-deterministic model (1980) can be applied to the system that operated in the paleoenvironment of Askola. The so-called collector system (energy costs < energy yields) provided the most favourable means of utilizing the peak periods of the game.

Finally, the author discusses the nature of early settlement in Finland following the deglaciation stage. The origin of the early Post-Glacial settlement of Askola may be sought in the East Baltic region, possibly extending back to the Ahrensburgian elements of the late Glacial period. In chronological terms, settlement becomes permanent on the Karelian Isthmus, in SE Finland and the eastern parts of the Gulf of Finland around 9500—9000 b.p. The Ristola site in Lahti is a contact location with finds of flint of Baltic origin, possibly reflecting the existence of a colony originating from the southern shore of the Gulf of Finland. With the beginning of the Ancylus regression the settlers moved along with the formation of an inlying archipelago to the Askola region before 9000 b.p.

Settlement from the East Baltic region does not preclude the possibility of other origins of migratory settlers, from either the Karelian Isthmus or Eastern Karelia. Present finds show that settlement proceeded in conjunction with the spread of Boreal climatic conditions and reached the coastal areas of the Gulf of Bothnia only after 8500 b.p.

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The Chronology of the Finnish Mesolithic

Heikki Matiskainen

Abstract

The study presents a chronology by artifact type of the Finnish Mesolithic with the aid of shore displacement chronology as based on the history of the Baltic. The method is the so-called stratigraphic method as used in present-day Quaternary geology, whereby the elevations of radiocarbon-dated isolation thresholds of lakes and bogs are used to date Mesolithic sites by comparing information on their elevations with shorelines formed at various stages.

METHOD

The main grounds for the dating of the Stone Age of Finland have been provided by shore displacement chronology based on Holocene land upheaval and the history of the Baltic. Apart from Finland the method has also been used elsewhere in the land upheaval areas of Fennoscandia – in Norway, Sweden and Soviet Karelia. This means of dating can be regarded as an original Finnish method, whereby archaeological dates have been made possible by an active Quaternary geological study of Postglacial shore displacements (Siiriäinen 1969, 1973; Matiskainen 1978; Nunez 1978*a*, 1978*b*; Hyvärinen and Eronen 1979).

The methods used in the study of shore displacement can be summarized as follows: (i) field observations and levelling of ancient Baltic shorelines, providing relative and distance diagrams and gradient datings of them; (ii) stratigraphic methods, viz. microfossil-determined isolation horizons of the various phases of the Baltic in lake and bog sediments; and (iii) dating of isolation thresholds from the isolation horizons with the aid of pollen zones or radiocarbon dates.

During the past decade research has concentrated less on the synchronization of ancient shorelines, traditionally a central feature of Quaternary geological studies of shoreline displacement in Finland. Relative and distance diagrams based on shoreline observations have been the object of less interest, because of the uncertainties of interpretation of shoreline data. The presently used method can be described as stratigraphic. Limnic layer series from bogs and lakes isolated from the Baltic through land upheaval are selected for study. From these, the isolation horizon is determined through observed changes in diatom flora. In the process of isolation marine or large lacustrine species of diatoms are replaced by smaller lacustrine forms, and in the same connection changes in layer formation can be observed through loss-on-ignition. In this sense, pollen analysis has taken the role of a routine method solely for providing a basis for chronology when attempting to date the contact horizons by radiocarbon.

The stratigraphic method is at its most useful in limited and uniform areas of land upheaval, where isostatic tilting does not skew the dating of the shoreline displacement curve. A type area of this kind can be defined from isobases of present land uplift as in this study; alternatively, elevation isobases of the Litorina Sea can be used.

The archaeological shoreline displacement chronology is based on two main conditions. The first requirement is that a prehistoric site must be located at or near the shoreline of its time. The second requirement is a Quaternary dating of that shoreline. In defining the lower limit of the site a fixed point of elevation is chosen for the shoreline displacement curve, the precision of which, in turn, depends on the Quaternary geological methods used. Both indices contain numerous sources of error. The location of a hunter-gatherer dwelling site on the shore of the ancient Baltic is hard to demonstrate without precise excavation with soil phosphate analyses. In the main, dwelling sites of the Finnish Stone Age were linked to the shoreline, but there are also numerous examples to the contrary. Factors affecting the precision of the shoreline displacement curve based on the stratigraphic method include sources of error in radiocarbon determinations, contamination skewing dating of limnic sediments, and misinterpretations of diatom ecology. It is also difficult to demonstrate minor fluctuations in the water level.

ARCHAEOLOGICAL DATA

The chronological model is based on some 200 Mesolithic dwelling sites in southern and central

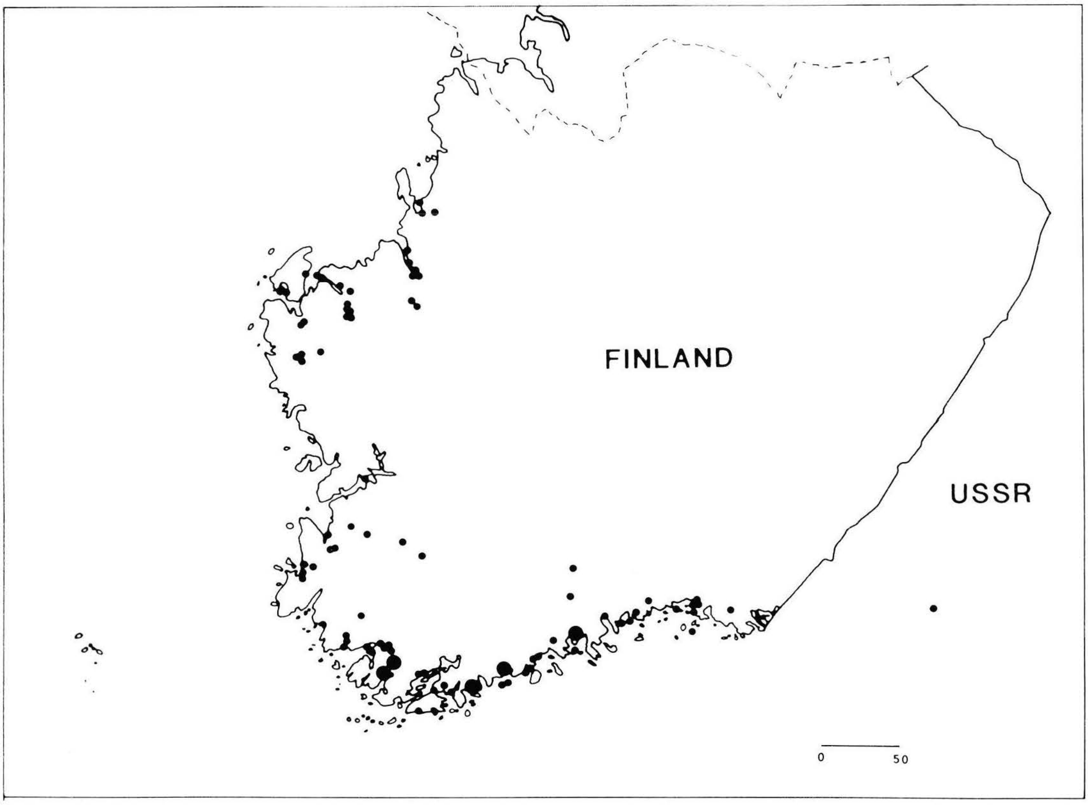

Figure 1 Distribution of Mesolithic sites dated in the study – shown in relation to the shoreline at the highest phase of the Litorina Sea, *c.* 7500 BP.

Finland, of which 60 have been excavated. It is assumed that these sites were 'shoreline' sites, i.e. located at or near the ancient shore of the Baltic (*Fig. 1*). The chronology is constructed so that the finds from these sites include one or more type artifacts suitable for dating. The artifact types are stone artifacts dated to the Mesolithic by Äyräpää (1950): the primitive axe, the coniform-holed globular stone mace-head, the leaf-shaped slate point, the curved-backed grooved adze, the South-Finnish even-bladed adze, and the oblique-bladed quartz points. The relative chronological ordering of the artifacts was partly known. The leaf-shaped slate point has been regarded as an early form, whereas the South-Finnish even-bladed adze and the oblique-bladed quartz point have been dated to the final stages of the Finnish Mesolithic (Äyräpää 1950; Luho 1967; Siiriäinen 1981).

To form the Mesolithic chronology, the study presents eight shoreline displacement curves based on the stratigraphic method from different zones of land uplift from the Karelian isthmus to southern Ostrobothnia. The curves have been prepared according to the dates of isolation horizons of bodies of water separated from the Baltic. A key shoreline displacement curve is that from the Askola area, which is described in more detail in order to illustrate the method (see Appendix).

EARLY HOLOCENE SHORELINE DISPLACEMENT IN ASKOLA

The most important find area in the Finnish Mesolithic is located in Askola, south Finland (Luho 1956).

Isolations and facies changes from six bodies of water have been studied at Askola. The material is based on research by Matti Eronen and this author (Eronen, Haila and Matiskainen 1982). The main aim has been to define the culmination of the Ancylus transgression and to date it, as well as determining the rate of the Ancylus regression and defining the development of the Litorina Sea on stratigraphic grounds.

Developments relating to the Ancylus Lake can be clearly observed in two of the bodies of water studied, Huiskaissuo and Kopinkallio bogs. In both of these the layer sequence was similar. At the base was clay overlain by a deposit of detritus mud. The organic layer is covered by a layer of gyttja indicating that the body was affected by a transgression. After this the sea regressed and bogs gradually developed.

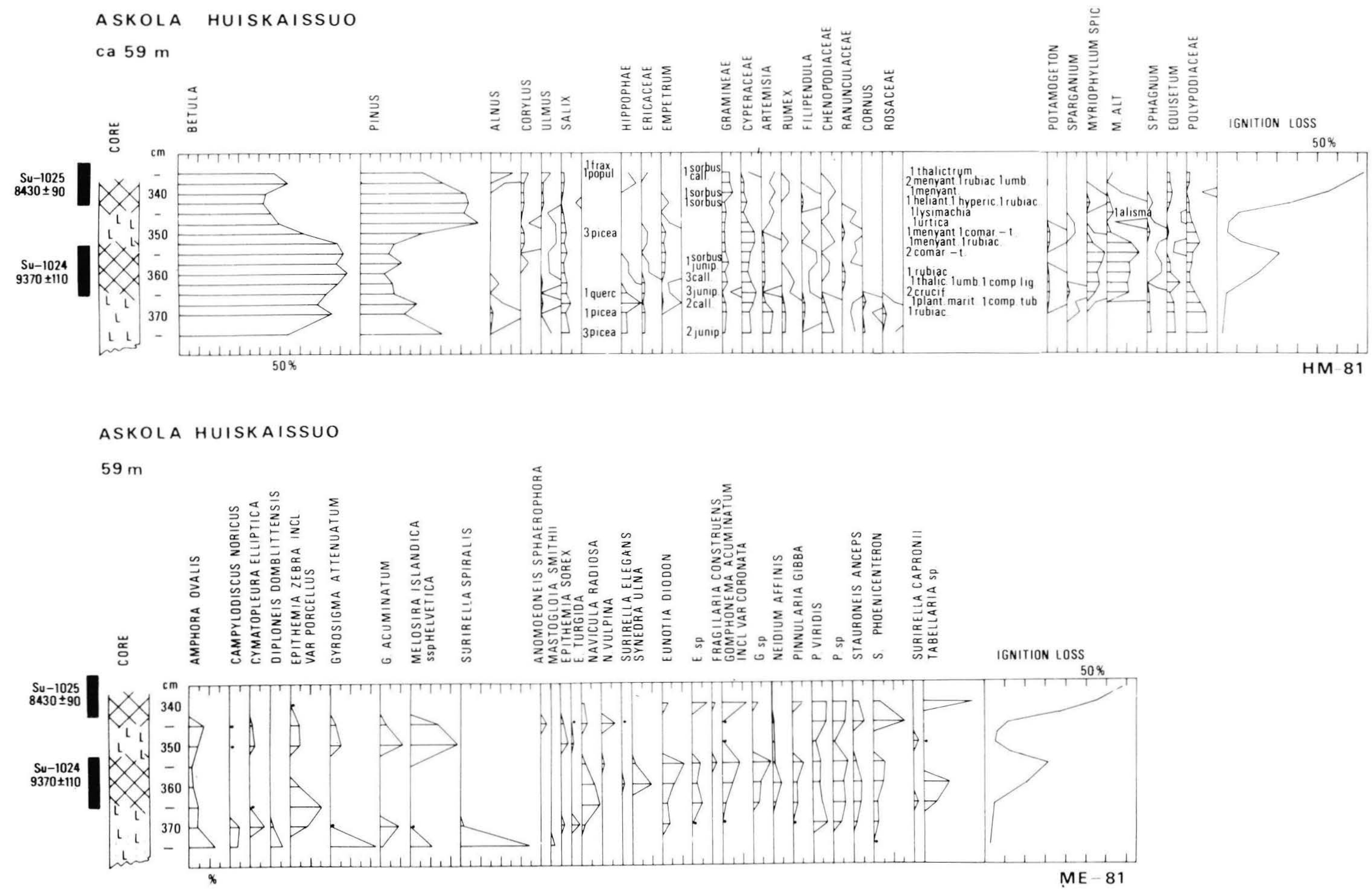

Figure 2 · Diatom and pollen diagrams from Askola Huiskaissuo bog.

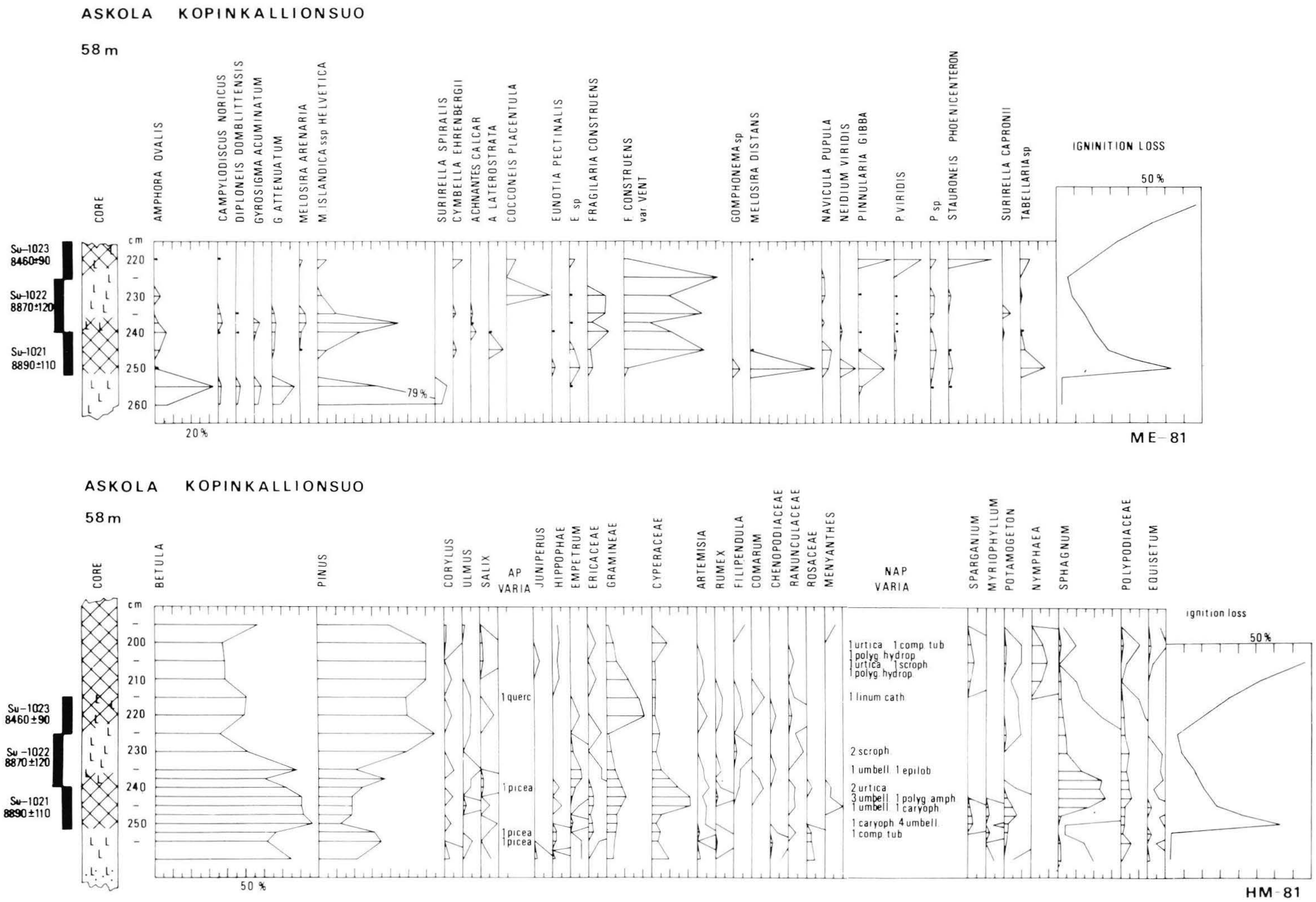

Figure 3 Diatom and pollen diagrams from Askola Kopinkallio bog.

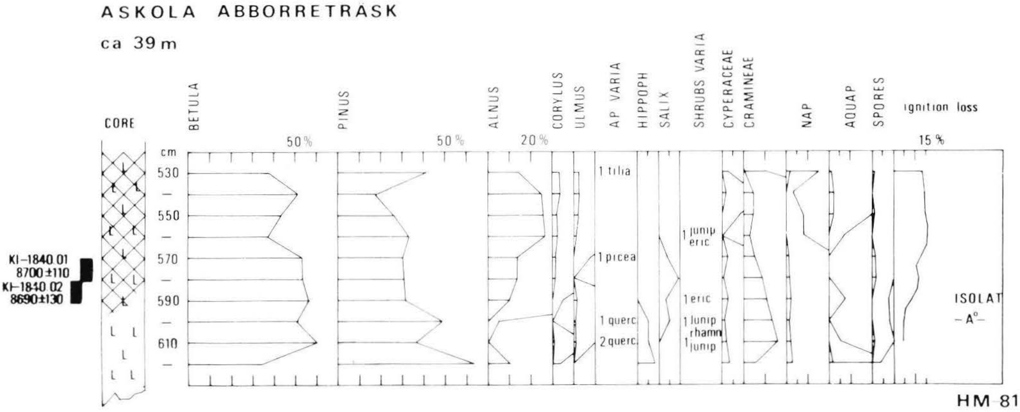

Figure 4 Pollen diagram from Askola Aborreträsk basin.

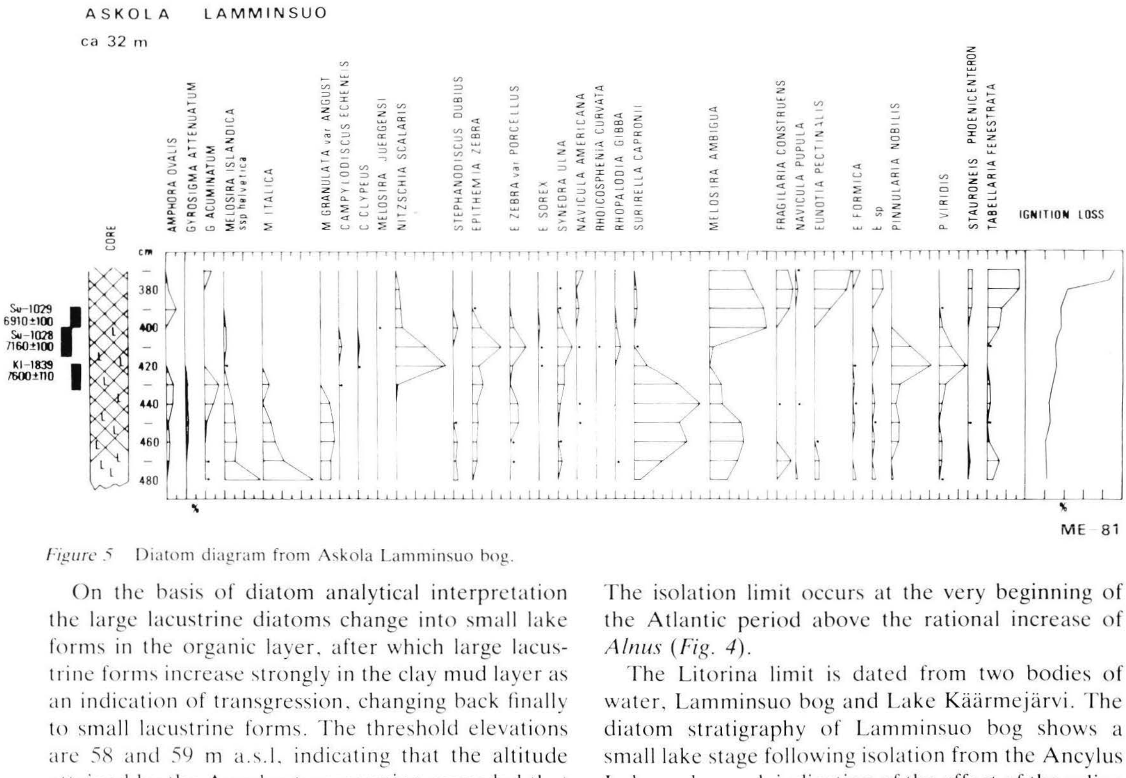

Figure 5 Diatom diagram from Askola Lamminsuo bog.

On the basis of diatom analytical interpretation the large lacustrine diatoms change into small lake forms in the organic layer, after which large lacustrine forms increase strongly in the clay mud layer as an indication of transgression, changing back finally to small lacustrine forms. The threshold elevations are 58 and 59 m a.s.l, indicating that the altitude attained by the Ancylus transgression exceeded that of both bodies of water. These events are radiocarbon dated (*Figs. 2 & 3*).

According to pollen analysis the first isolation occurred in the birch-dominated Pre-Boreal period. Contact with the Baltic was renewed at the boundary of the Pre-Boreal and Boreal periods, and the final isolation occurred in the early part of the Boreal period.

In order to determine the rate of regression, the isolation of a pond called Aborreträsk was studied. This pond is located at an elevation of 39 m a.s.l. and is in a zone between the Ancylus and Litorina levels. The isolation limit occurs at the very beginning of the Atlantic period above the rational increase of *Alnus* (*Fig. 4*).

The Litorina limit is dated from two bodies of water, Lamminsuo bog and Lake Käärmejärvi. The diatom stratigraphy of Lamminsuo bog shows a small lake stage following isolation from the Ancylus Lake and a weak indication of the effect of the saline Litorina Sea on the body of water. The marine indications are however so weak that the Litorina Sea could not have risen much above 32 m a.s.l., the threshhold elevation of the bog. A layer sequence from Lake Käärmejärvi from below the Litorina limit indicates isolation and hence regression of the Litorina Sea later than the rational rise of *Tilia*, at which stage there had been a regression in the development of the Litorina Sea (*Figs. 5 & 6*).

The sixth body studied was Stormossen bog in Porvoo, located at an elevation of *c.* 27.5 m a.s.l. The isolation of this bog is problematic, as halophilic

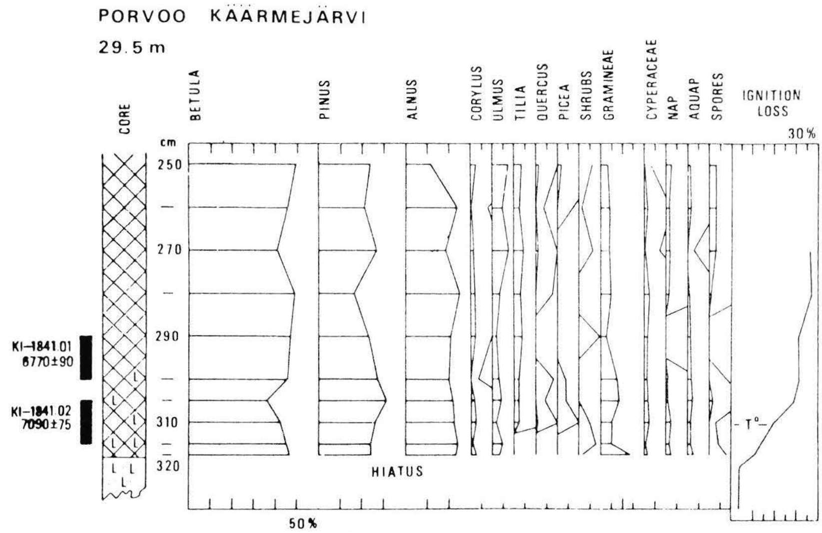

Figure 6 Pollen diagram from Porvoo Käärmejärvi basin.

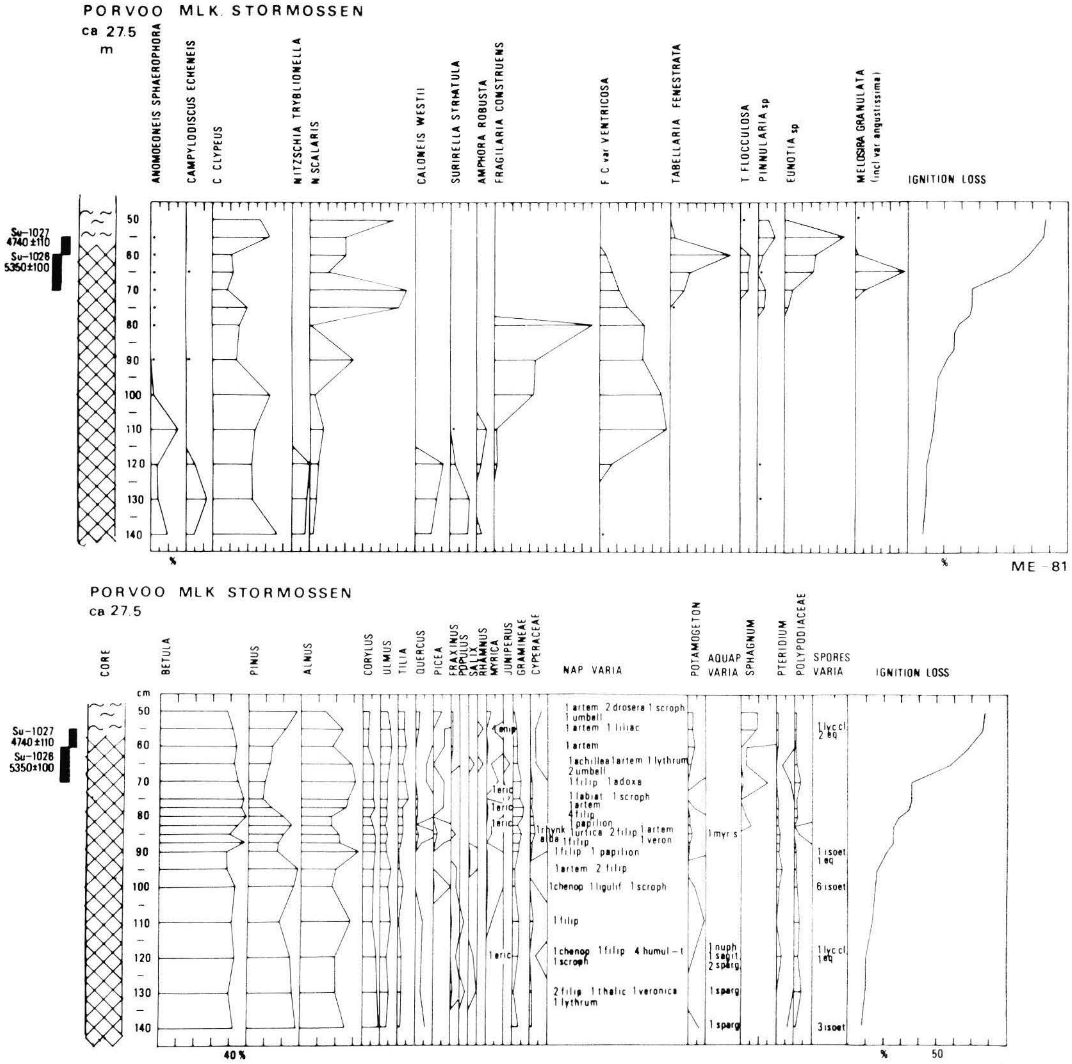

Figure 7 Diatom and pollen diagrams from Porvoo Stormossen bog.

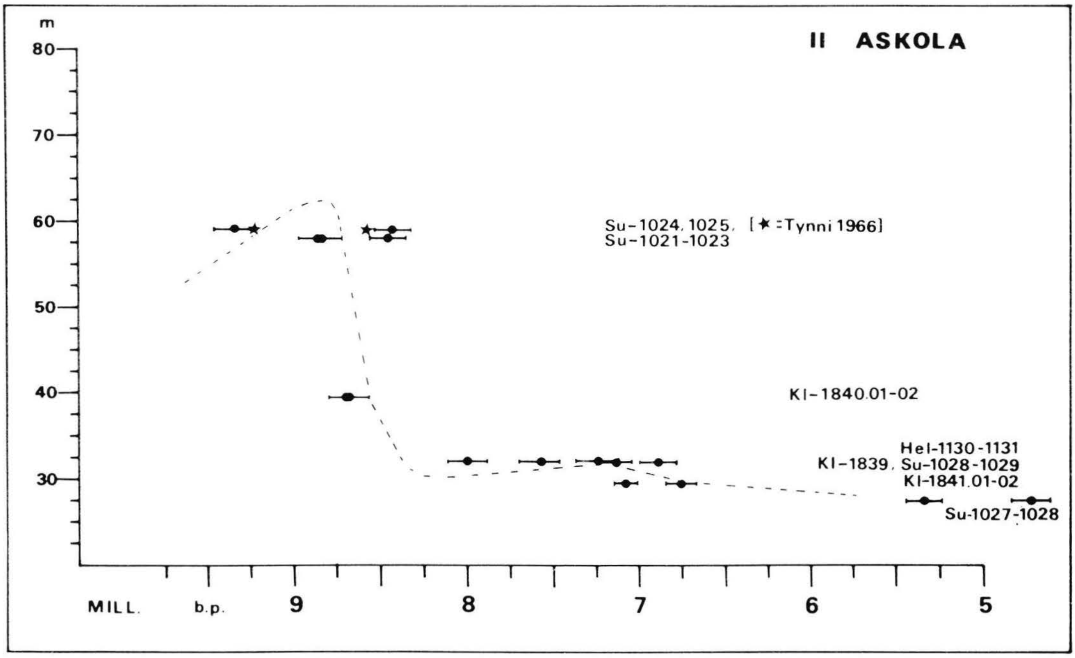

Figure 8 Shoreline displacement curve for the Askola area in the vicinity of the present 3 mm/yr uplift isobase.

diatom species seem to occur even after isolation (*Fig. 7*).

These datings provide the basis for the shoreline displacement curve of the Postglacial period in the Askola area. The shoreline displacement is characterized by an Ancylus transgression at *c.* 61 m a.s.l. *c.* 8800 BP and a rapid regression *c.* 8600 BP. Following these developments a eustatic rise partly exceeding land uplift can be observed in the transgression phase of the Litorina Sea at an elevation of 31–32 m *c.* 8000–7000 BP, followed by a gradual fall of the water level. In the Askola area the rapid developments of the Ancylus phase were followed by a period in which the shorelines remained fairly stable for *c.* 2000 years. In other words, eustatic rising of the water level has been nearly as great as the Askola land uplift (*Fig. 8*).

EARLY HOLOCENE SHORELINE DISPLACEMENT OF THE BALTIC IN FINLAND

To the east of Askola, in the Karelian isthmus area where land uplift is weaker, the Litorina transgression can be clearly observed. It can also be observed that the transgression has destroyed at least some of the Mesolithic sites in the area (*Fig. 9*, Curve I).

To the west of Askola, in the Helsinki area, the Litorina transgression cannot be observed and the curve is regressive from the Ancylus transgression onwards. The shoreline remained at the same elevation for 2500 years, from *c.* 8500 to *c.* 6000 BP (*Fig. 9*, Curve III).

Further to the west the following shoreline displacement curve has been produced for the Kisko area with the westernmost observations of the Ancylus transgression. The 'old' dates may have been caused by the small amount of available organic material and contamination by redeposited carbon (*Fig. 9*, Curve IV). In the area of Salo, southwest Finland, the Ancylus regression is distinct and the Litorina phase can be seen as a slowing of shoreline displacement (*Fig. 9*, Curve V). There are two isolation observations from the Turku area (*Fig. 9*, Curve VI).

Two curves have been prepared from the area of rapid uplift, from Laitila and Lauhanvuori. The variability in elevation is great and is thus best suited to providing an archaeological shoreline displacement curve. The rapid land uplift in the Lauhanvuori area indicates extremely rapid negative changes in shoreline displacement during the Ancylus phase. The eustatic Litorina phase does not seem to have had much effect on the rate of shoreline displacement (*Fig. 9*, Curves VII & VIII).

In summary the presented curves form the following picture of developments in the Baltic during the Mesolithic:

1) The Yoldia regression is followed by the regressive development of the beginning ôf the Ancylus period which became transgressive *c.* 9000 BP. The almost catastrophic Ancylus regression occurred *c.* 8800–8500 BP.

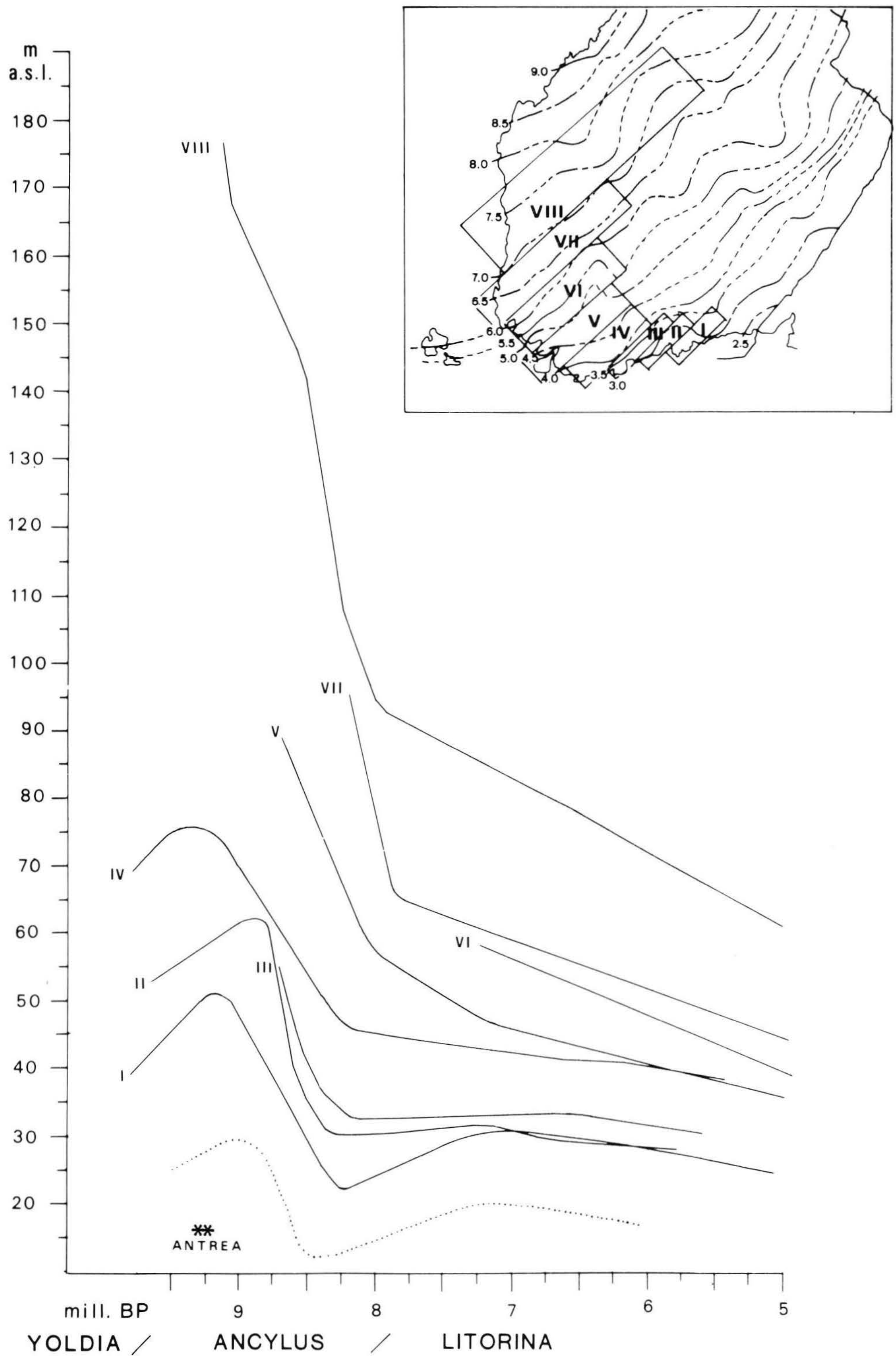

Figure 9 Postglacial shoreline displacement in south and central Finland based on radiocarbon evidence. The curves relate to different uplift zones: I – 2.5 to 3 mm/yr; II – 3 mm/yr; III – 3.5 mm/yr; IV – 4 mm/yr; V – 4.5 mm/yr; VI – 5.5 mm/yr; VII – 6.5 mm/yr; VIII – 7.5 mm/yr (zones according to present rates of uplift: Kiviniemi 1981). The dotted line curve is based on shore observations from the Karelian isthmus with the dates projected from curve I. The Antrea net find is located on the curve.

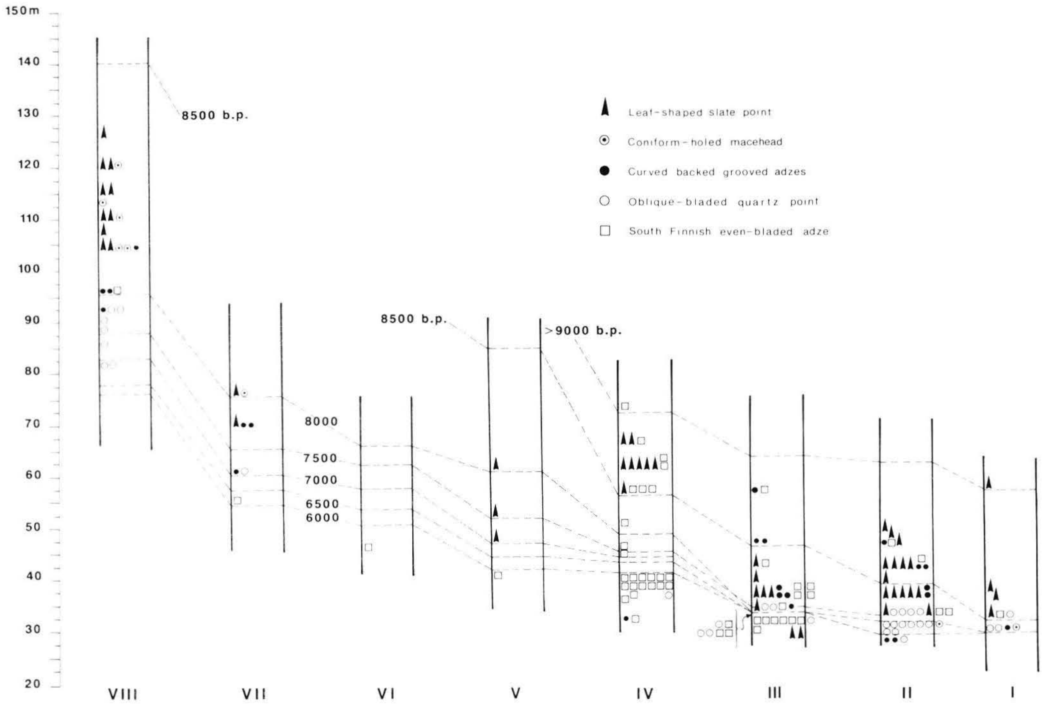

Figure 10 Sites from zones in *Fig. 9* combined on shoreline displacement curves I–VIII. Chronological limits have been established by comparing elevations of limits between 9000 and 6000 BP at 500 year intervals (^{14}C error limits of ±150 years on a ±0.5 m elevation zone). Sites marked with symbols indicate type artifacts found in the assemblages.

2) The first saline *Mastogloia* indication can be distinguished in layer sequences at *c.* 8000 BP.

3) The Litorina transgression occurs to the east of the 3 mm/yr land uplift isobase and is at its maximum *c.* 7600–7500 BP.

CHRONOLOGY OF THE MESOLITHIC

The Mesolithic chronology was developed by placing the sites located on the shore of the ancient Baltic on the shoreline displacement curves in accordance with their location in a particular uplift zone. The dating of a site is based on the presence of a Mesolithic type artifact and the use of quartz as a raw material. Sites with only quartz artifacts and flakes, except where they include oblique-bladed points, have not been included in the dating even though they could be dated to the Mesolithic on the basis of their elevation. The Mesolithic quartz material does not provide possibilities for typological dating, with the exception of the oblique points.

The Mesolithic artifact forms of Finland are dated as follows (*Fig. 10*):

Leaf-shaped slate points. The leaf-shaped slate points (*Fig. 11*) form the earliest artifact group of the Mesolithic, although some specimens seem to date to the later stages of the period. The main chronological emphasis is on the Ancylus period (cf. Luho 1967; Siiriäinen 1981).

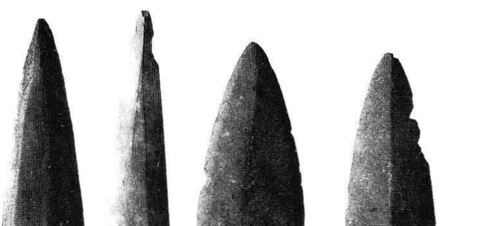

Figure 11 Leaf-shaped slate points (NM 1811 – Utajärvi; NM 3678.8 – Haapajärvi; NM 8927.1 – Punkalaidun; NM 4119.3 – Kuortane). Scale=1:2

Coniform-holed globular mace-heads. This singularly Finnish artifact form (*Fig. 12*), the distribution of which is centred on southern Ostrobothnia and central Finland, is also dated to the early Mesolithic, i.e. the Ancylus period. The chronological model confirms Luho's (1967) relative dating of this artifact group to the early Mesolithic.

Figure 12 Coniform-holed globular mace-heads (NM2386.75 – Alajärvi; NM 10620.5 – Liljendal). Scale=1:2

Curved-backed grooved adzes. The distribution of this artifact (*Fig. 13*) is centred mainly on south Finland, although specimens have been found throughout the country. Many of these artifacts are of so-called Onega green slate, the sources of which are on the western shores of Lake Onega, north of Petrozavodsk. The dating obtained for these is very broad, from the final stages of the Ancylus regression to the end of the Mesolithic, although the chronological emphasis is on the late Ancylus period and early Litorina period.

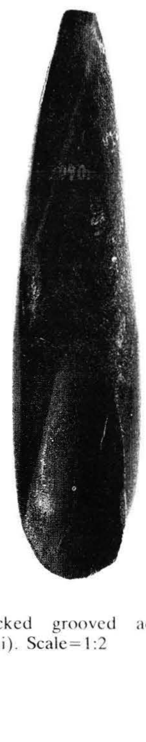

Figure 13 Curved-backed grooved adze (NM 2040.47 – Kylmäkoski). Scale=1:2

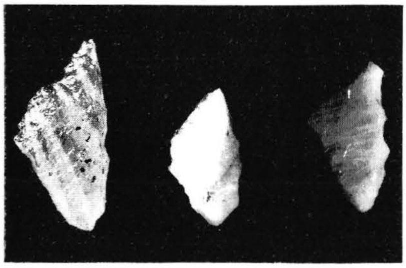

Figure 14 Oblique-bladed quartz points (NM 11771:3, 7 & 8 – Alajärvi). Scale=1:1

Oblique-bladed quartz points. Oblique-bladed quartz points (*Fig. 14*) have traditionally been dated to the late Mesolithic. The earliest specimens have been found in early Litorina contexts and the artifact form remains in use to the end of the Mesolithic (Luho 1967; Siiriäinen 1981).

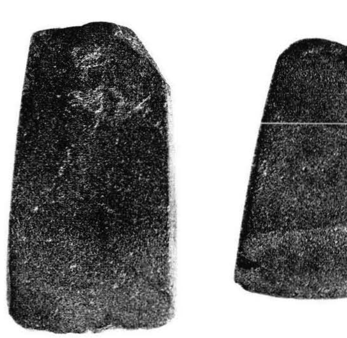

Figure 15 South-Finnish even-bladed adzes (NM 3875.1 – Kisko; NM 7347 – Lohja). Scale=1:2

South-Finnish even-bladed adzes. As indicated by its name this artifact group (*Fig. 15*) has a southern Finnish distribution. Mostly the adzes are of diabase, which is found associated with intrusive minerals in west Uusimaa. Traditionally the group has been dated to the end of the Mesolithic. Some South-Finnish even-bladed adzes have been found on Mesolithic sites in the Suomusjärvi region associated with slate points and at elevations corresponding to the Ancylus level. This could be taken to indicate that the chronological distribution is a broad one, but it is, however, more likely that they are from sites which were not in direct contact with the shoreline of the period. The majority of sites with these artifacts are dated to the end of the Mesolithic.

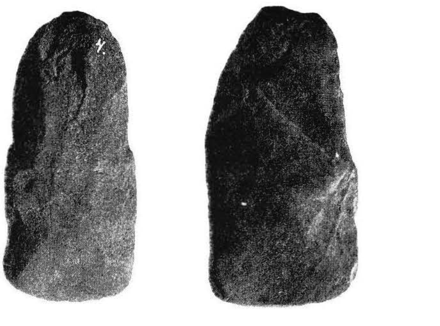

Figure 16 Primitive axes (NM 3712.4, NM 4576.1 – Suomusjärvi). Scale = 1:2

Primitive axes. The so-called primitive axes (*Fig. 16*) were in use throughout the Mesolithic. The earliest find is that associated with the well-dated Antrea net (9300–9200 BP) and axes have also been found on later sites. The primitive axe characterizes the Finnish Mesolithic; its more exact dating requires a more detailed typological classification, wherein the subdivisions may also have chronologicalal significance.

In the presented chronology the most critical problem is presented by the question of whether all of the sites were located on the shore of the ancient Baltic. Some of the sites chosen for *Fig. 1* are clustered near river outlets flowing from ancient inland lakes to the sea, as for example the sites at Askola. In these cases it may be presumed that settlement by river estuaries was at higher elevations than the sea.

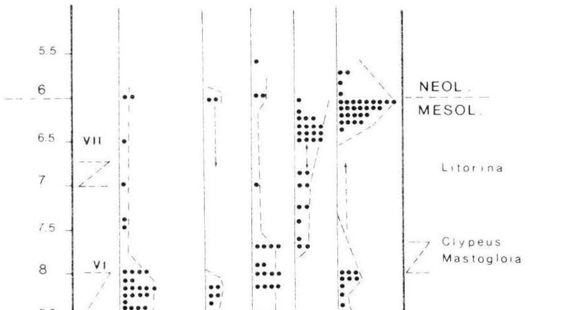

Figure 17 Chronological distribution of Mesolithic artifact forms in relation to the major phases in the development of the Baltic (see *Fig. 10* for key).

Fig. 17 presents artifact finds from sites in accordance with the radiocarbon-dated shoreline displacement chronology. Certain anomalies have been shifted in the direction of the main chronological groups. These came about mainly as a result of interpreting the stable shoreline displacement zones of the east Uusimaa region. *Fig. 17* shows the degree of precision available in sketching the chronology. The main chronological phases of the artifact forms are as follows: leaf-shaped slate points, *c.* 8800–8000 BP; coniform-holed globular mace-heads, *c.* 8500–8000 BP; curved-backed grooved adzes, *c.* 8500–7500 BP; oblique-bladed quartz points, *c.* 7700–6000 BP; South-Finnish even-bladed adzes, *c.* 6500–6000 BP.

The Finnish Mesolithic can thus be divided into two chronological phases, corresponding to the two major phases in the development of the Baltic. Also the artifact typology supports the biostratigraphic division. The chronological divisions are as follows:

Ancylus Mesolithic, 9300–8000 BP – characterized by leaf-shaped slate points and coniform-holed globular mace-heads.

Litorina Mesolithic, 8000–6000 BP – characterized by oblique-bladed quartz points and South-Finnish even-bladed adzes.

In addition to the Baltic, it is also possible to date the Mesolithic sites in the lake region of the Finnish interior. However, the above stratigraphic method cannot be applied and dating must be based on relative and distance diagrams of shoreline formations. The early Holocene development of the large lakes of the Finnish interior was one of transgression, which meant that sites were destroyed. It was only in the northern part of this area that rapid land uplift saved sites from destruction.

Note:

This paper is a summary of the author's unpublished Lic. phil. thesis (Matiskainen 1983).

APPENDIX: *Radiocarbon dates (years BP) relating to shoreline displacement curves I–VIII*

Curve I

Sippola Hangassuo, 47 m a.s.l. (Eronen 1976): (Hel-663) 9519±200; (Hel-662) 9530±200; (Hel-661) 9280±190; (Hel-660) 8870±170; (Hel-664) 8780±160; (Hel-665) 8360±190.
Porvoo Bastuberg, 28 m a.s.l. (Eronen 1974): (Hel-394) 8480±190; (Hel-393) 7960±180; (Hel-392) 7250±240; (Hel-391) 6230±220; (Hel-390) 5970±200.

Curve II

Askola Kopinkallionsuo, 58 m a.s.l. (Eronen and Haila 1982): (Su-1021) 8890±110; (Su-1022) 8870±120; (Su-1023) 8460±90.
Askola Huiskaissuo, 59 m a.s.l. (Eronen and Haila 1982): (Su-1024) 9370±110; (Su-1025) 8430±90.
Askola Aborreträsk, 39 m a.s.l. (Eronen and Haila 1982): (Ki-1840.01) 8690±130; (Ki-1840.02) 8700±110.
Askola Lamminjärvensuo, 32 m a.s.l. (Eronen and Haila 1982): (Ki-1839) 7600±110; (Su-1028) 7160±100; (Su-1029) 6910±100.
Porvoo Käärmejärvi, 29.5 m a.s.l. (Eronen and Haila 1982): (Ki-1841.01) 6770±90; (Ki-1841.02) 7090±75.

Porvoo Stormossen, 27.5 m a.s.l. (Eronen and Haila 1982): (Su-1026) 5300±100; (Su-1027) 4740±110.

Sipoo Bakunkärrträsk, 33 m a.s.l. (Hyvärinen 1979): (Hel-1131) 7250±120; (Hel-1130) 8010±120.

Curve III

Vantaa Marsupolku, 44 m a.s.l. (Eronen and Haila 1982): (Hel-1240) 8570±190; (Hel-1239) 8490±120.

Espoo Odinlampi, 34.9 m a.s.l. (Hyvärinen 1980): (Hel-1266) 8010±120; (Hel-1267) 7370±100; (Hel-1268) 6390±110.

Vantaa Lammaslampi, 31.8 m a.s.l. (Alhonen *et al.* 1978): (Hel-996) 7740±170; (Hel-997) 7470±160; (Hel-998) 7310±160; (Hel-999) 6550±170; (Hel-1000) 6160±160.

Kauniainen Gallträsk, 31 m a.s.l. (Alhonen 1972; Eronen 1974): (Hel-351) 7410±250; (Hel-350) 6180±230.

Curve IV

Karjalohja Lehmälampi, 71.2 m a.s.l. (Glückert and Ristaniemi 1980): (Su-885) 9710±150; (Su-886) 9060±160.

Kisko Leilänlampi, 42 m a.s.l. (Eronen 1974): (Hel-287) 6620±170; (Hel-395) 7780±230.

Tenhola Träskmossen, 41 m a.s.l. (Eronen 1974): (Hel-669) 6260±200.

Curve V

Halikko Hiitteenmäensuo, 88.9 m a.s.l. (Glückert 1976): (Hel-767) 8620±190.

Paimio Meltolansuo, 67 m a.s.l. (Glückert 1976): (Hel-730) 8110±170.

Salo Santamäensuo, 57.5 m a.s.l.: (Hel-1455) 7960±130.

Dragsfjaärd, Sandbrinksmossen, 47 m a.s.l. (Glückert 1976): (Hel-726) 7150±170.

Kemiö Slätmossen, 38 m a.s.l. (Glückert 1976): (Hel-658) 5490±180.

Curve VI

Vahto, Neittesuo, 58 m a.s.l. (Glückert 1976): (Hel-727) 7100±140.

Turku Isosuo, 40 m a.s.l. (Glückert 1976): (Hel-564) 4950±140.

Curve VII

Yläne, Iso-Vuohensuo, 58 m a.s.l. (Glückert 1976): (Hel-652) 8050±250.

Yläne Muurassuo, 67 m a.s.l. (Glückert 1976): (Hel-729) 7450±230.

Eura Vähäjärvi, 61.5 m a.s.l. (Eronen 1974): (Hel-385) 8070±250; (Hel-384) 7360±170; (Hel-383) 6960±170.

Laitila, Sammalsuo, 47 m a.s.l. (Glückert 1976): (Hel-647) 5030±200.

Eura Pyhäjärvi, 47 m a.s.l. (Eronen, Heikkinen and Tikkanen 1982): (Hel-1391) 7420±120; (Hel-1392) 5630±120; (Hel-1393) 5580±120.

Curve VIII

Kauhajoki Juurakkojärvi, 167 m a.s.l. (Salomaa 1982): (Hel-1293) 8920±180; (Hel-1294) 9070±190.

Kauhajoki Kauhajärvi, 143.9 m a.s.l. (Salomaa 1982): (Hel-1291) 7960±170; (Hel-1294) 9070±190.

Isojoki Haukilampi, 107 m a.s.l. (Salomaa 1982): (Hel-1171) 8230±160.

Isojoki Kodesjärvi, 94.1 m a.s.l. (Salomaa 1982): (Hel-1175) 8010±160.

Siikainen Haapajärvi, 80.6 m a.s.l. (Salomaa 1982: (Hel-1366) 6410±150; (Hel-1367) 6760±150.

Kuortane Porraslampi, 90 m a.s.l. (Eronen 1974): (Hel-450) 7750±260.

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Heikki Matiskainen

DIE MESOLITHISCHE STEINZEIT UND DIE CHRONOLOGIE IM BINNENSEEN-GEBIET FINNLANDS

Abstract

The Mesolithic settlement of the inland lake regions of Finland is sparse due to the transgressive history of development of the Postglacial period. In this paper the dwelling sites unaffected by the transgression are presented and the available possibilities for their dating are discussed. Most of the preserved sites can be assumed to date from approximately 9000 to 8000 b.p., i.e. prior to the isolation of the bodies of water from the Ancylus Lake. The chronology is comparable to the corresponding shoreline displacement chronology. Dwelling sites have been preserved only in land upheaval regions where the later development of the inland lakes did not extend to the regressive Ancylus shoreline. The lack of finds in the regions of lakes Näsijärvi and Pielinen is with all probability only an apparent one and there is a distinct possibility of finding Late Mesolithic sites in connection with them.

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Hintergrund

Die Chronologie der mesolithischen Steinzeit Finnlands stützt sich bis auf weiteres auf die Uferverschiebungschronologie der Ostsee, da ^{14}C-Datierungen von mesolithischen Siedlungsplätzen spärlich zur Verfügung stehen. Die bei als mesolithisch eingeschätztem Grabungs- und Untersuchungsmaterial vorgenommenen Datierungen stimmen oft auf unerwartete Weise mit den archäologischen Anschauungen überein (Jungner 1979, Jungner & Sonninen 1983). Die Uferverschiebung der Ostsee andererseits ist schon seit den 20er Jahren ausgenutzt worden, obwohl das Vertrauen zu den mit quartärgeologischen Methoden erhaltenen Uferverschiebungsdatierungen die vorgeschichtliche Chronologie gefesselt hat. Die von Wilhelm Ramsay (1920) in Gebrauch genommene Methode hat sich fast unverändert bis in unsere Tage erhalten (Europaeus 1922; Äyräpää 1950; Hyyppä 1935; Luho 1956; 1967; Sauramo 1958; Tynni 1966, Siiriäinen 1969, 1972, 1981; Nunez 1978a, 1978b; Matiskainen 1983).

Man ist daran gewöhnt, die transgressive Entwicklung der Binnenseen Finnlands zu Beginn der Postglazialperiode als Grund dafür anzusehen, dass im Seen-Finnland keine mesolithischen Siedlungsplätze gefunden werden konnten. Hinsichtlich der vier grössten Binnenseen, Näsijärvi, Päijänne, Saimaa und Pielinen sind solche für die Südseite der Becken auch nicht bekannt. An den Nordteilen der Becken sind jedoch eine Reihe mesolithischer Siedlungsplätze angetroffen worden, womit also eine Rückschau betreffs der Entwicklung der Seen in Hinsicht auf die mesolithische Besiedlung am Platze ist.

Hauptzüge der Untersuchungsmetode der frühpostglazialperiode der Binnenseen

Die Landhebungen und die dadurch verursachte Uferverschiebung haben die frühpostglaziale Entwicklung gesteuert. Die Metachronität der Landhebung hat die Neigung der Binnenseebecken hervorgerufen und die Verlegung des nördlichen Abflusses nach Süden ist bei allen vier genannten Becken vor sich gegangen. Vor der Veränderung des Abflusses waren die Südteile der Becken unter Wirkung der Transgression gewesen und an den Nordteilen hat die

Höhe der Uferflächen entsprechend die Lokalisierung und die Höhe der Abflüsse reguliert. Die Neigungsschwelle hat sich grad um Grad nach Norden verschoben, bis die Ausbrüche an den Südteilen der Becken geschahen (Saarnisto 1971 a).

Bei der Untersuchung der Entwicklung der Binnenseen wurde das Hauptaugenmerk auf einige strategische Details gerichtet. Diese sind die Isolation der Seen von der Ostsee zu eigenständigen Becken und die Datierung der Vorgänge, das Alter des nördlichen Abflusses und mögliche spätere Lokalisierungen des höchsten Transgressionsufers sowie die durch die Landhebung verursachte Verschiebung der Abflüsse an ihre heutigen Standorte.

Die Uferverschiebungsuntersuchungen der Binnenseen basieren auf der Bestimmung der Höhe der morphologischen Uferbildungen bzw. Uferwälle sowie der Bestimmung der Höhe der Steinzonen unter Benutzung der Höhenunterschiede entsprechend den Erdhebungsisobasen unter Beachtung der Höhenunterschiede. Im allgemeinen ist die oberste Grenze der Transgression der grossen Binnenseen morphologisch klar, nur betreffs des obersten Ufers des Päijänne sind beachtliche Unterschiede in den Auffassungen der Forscher aufgetreten (Aario 1965; Saarnisto 1971 b).

Bei der Darstellung der Uferflächen wurden Distanzdiagramme und Relationsdiagramme zu Hilfe genommen. Im Distanzdiagramm werden die Uferbeobachtungen von der Mitte des Seebeckens auf ein ausgewähltes auf die Isobasen der Erdhebung gerichtetes Projektionsniveau projiziert. Im Relationsdiagramm wird die als Leitebene gewählte Uferebene in Bezug auf die übrigen Uferbeobachtungen relativiert. Die meisten Untersuchungen der Seenbecken basieren auf der Verwendung des Distanzdiagramms (Saarnisto 1971 a).

Die Datierung der Veränderungen geschah anfangs relativ mit Hilfe der Pollenzonengrenzen. Zwei klare Zonengrenzen IV/V (Betula/Pinus) und V/VI (Pinus/Betula, Alnus, Corylus, Ulmus) des Beginns der Postglazialperiode waren besonders für die Datierung der Abtrennung der Seen von der Ostsee geeignet. Nach der Ingebrauchnahme der ^{14}C-Datierung hoffte man, grössere Klarheit über die Datierung der genannten Ereignisverläufe zu erhalten. Die gewässergeschichtlichen Veränderungen konnten recht grob eingegrenzt werden, genaue Transgressions-Regressionsgrenzen sind zeitlich nicht vollständig klar. Bei der Datierung kann auch die Zeitgradientmethode, deren Zuverlässigkeit weitgehend von der ^{14}C-Datierung der sich neigenden Ebenen, z.B. der Pollenzone oder der obersten Uferebene abhängig ist, benutzt werden (Saarnisto 1971 a; Siiriäinen 1973; Ristaniemi 1987).

Erst kürzlich ist bei der Untersuchung der Binnenseen begonnen worden, die Bestimmung der diatomfloristischen Isolationshorizonte nach den gleichen Prinzipien, nach denen die Methode bei den Untersuchungen der Ostsee schon Jahrzehntelang angewendet worden ist, vorzunehmen (Ristaniemi 1982, 1987). Die Grenzhorizonte konnten durch die Diatomanalyse genauer als früher geklärt werden und die ^{14}C-Datierungen konnten präziser in die Stratigraphie plaziert werden. Erfolgreich war auch die Determination der Transgression mit Hilfe des Glühverlustes, mit der die Zunahme eines mineralogischen Stoffes, Ton oder Feinsand, im Detritus festgestellt wird. Der Beginn von Ton- oder Feinsanddetritus in der Stratigraphie informiert über das Eindringen der Transgression über die Schwellenhohe des Beckens und Entsprechend über das Ende von Regressionen und der Isolation vom Becken. Im Päijänne-See und im Saimaa-See konnte so eine genannte Schichtserie meistens mit dem Wechsel der Abflussrichtung vom Norden zum Süden verknüpft werden (Saarnisto 1970, 1971b).

Mesolithische Siedlungsplätze

Man weiss von der Existenz von fast 300 mesolithischen Siedlungsplätzen in Mittel- und Südfinnland (Matiskainen 1983). Diese Anzahl basiert sowohl auf mit Hilfe von Ausgrabungen untersuchten als auch auf durch die Oberflächenkartierung erfassten Funden. Die Siedlungsplätze wurden auf der Basis dessen definiert, ob in Verbindung mit anthropogenen Quarzabschlägen Typgegenstände der mesolithischen "Suomusjärvi-Kultur" oder eine Anzahl mesolithischer Steingegenstände gefunden wurden. Es muss auch möglich sein, den Siedlungsplatz topographisch zu bestimmen und eine authentische Höhengrenze anzugeben. Die Siedlungsplätze dieser Untersuchung basieren auf den topographischen Katalogen des Denkmalpflegeschutzes des Regionalplanungsverbandes für das Seengebiet.

Die Leittypen der mesolithischen Steinobjekte wurden den Forschungstraditionen gemäss auf der Basis der von Äyräpää (1950) ausgearbeiteten Formenklassifizierung bestimmt. Von den zentralen Gegenstandstypen sind uns die folgenden sechs bekannt:

- primitiver Meissel oder Axt (ca. 9000–6000 b.p.)
- blattförmige Schieferspitze (ca. 8800–8000 b.p.)
- Kugelkeule mit trichterförmigem Loch (ca. 8500–8000 b.p.)
- krummrückiger Hohlmeissel (ca. 8500–7500 b.p.)
- schrägschneidige Quarzspitze (ca. 7750–6000 b.p.)
- Geradmeissel vom südfinnischen Typ (ca. 6500–6000 b.p.)

Die Datierung der Gegenstände basiert auf mit Hilfe der Uferverschiebung datierten Siedlungsplätzen, an denen Typengegenstände gefunden wurden (Tabelle 1; Matiskainen 1983, 1985).

Beim Vergleich mit dem Auftreten von Siedlungsplätzen im Seengebiet Finnlands sind die Kugelkeulen mit trichterförmigem Loch, die blattförmigen Schieferspitzen und die krummrückigen Hohlmeissel für Nord-Savo und Mittelfinnland üblich, ebenso primitive Äxte. Auch einige schrägschneidige Quarspitzen sind in dem Binnenseegebieten Mittelfinnlands angetroffen worden. Dagegen sind die südfinnischen Geradmeissel nur auf Südfinnland begrenzt (Karte 1; Äyräpää 1950; Matiskainen 1983).

Das Typenmaterial umfasst nicht alle auf die mesolithische Steinzeit datierte Gegenstandsformen, wie Ilomantsiäxte und Zapfenkeulen u.a. Spezialgegenstände, da es sich von der Dichte des Auftretens her um als Kuriositätenexemplare einzuordnende Funde handelt (Äyräpää 1950; Carpelan 1976).

Näsijärvi

Die Untersuchung der Entwicklung des Näsijärvi basiert auf den ufermorphologischen Messungen von Tolvanen (1924) (Saarnisto 1971 a). Der Abfluss des Sees Näsijärvi befand sich am Sapsalampi von Alavus, wo die Schwellenhöhe etwa 115 m beträgt. Nach der Uferverschiebungskurve von Salomaa (1982) hat sich der Näsijärvi-See um etwa 8500 b.p. vom Ancylus-See abgetrennt. Als Folge der Landhebung begann am Südteil des Beckens sofort nach der Abtrennung die Transgression. Das Aufbrechen des Bettes des Tammerkoski rief wahrscheinlich im Becken eine schnelle Regression hervor. Das oberste Ufer des Näsijärvi unterscheidet sich mit einer Höhe von 97 m in Pyynikinharju/Tampere und auf der Grundlage des unter dem Flutsand gemessenen Bodens in Lielahti hat die Hebung des Wasserspiegels 5.5 m betragen (Donner 1976).

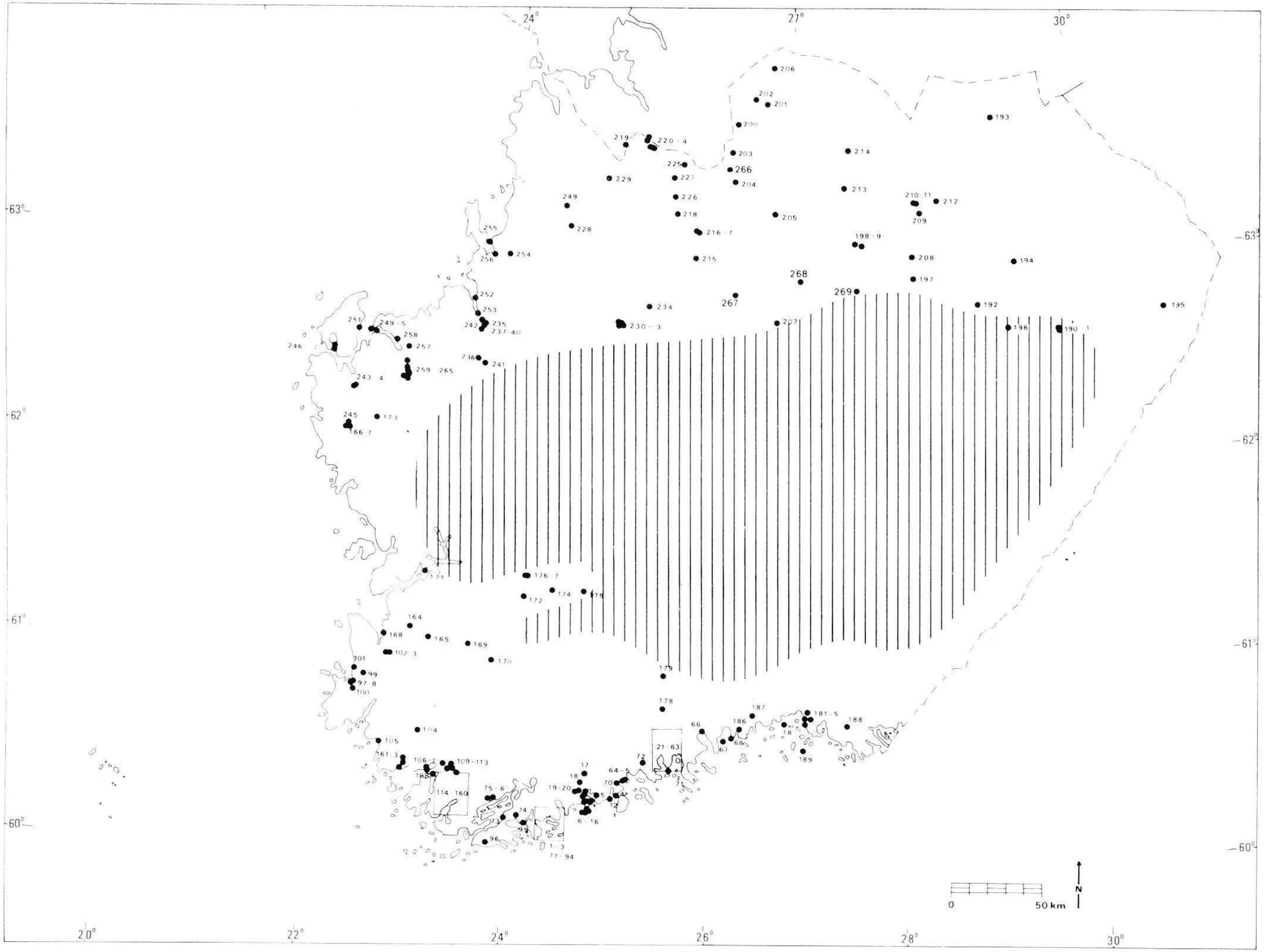
Die Datierung des Aufbrechens des Bettes ist schon in den Untersuchungen von Tolvanen schlecht geklärt worden. Mit Hilfe der Neigung der Uferfläche ist sein Alter mit etwa 6300 b.p. bestimmt worden, was gleichzeitig also auch das Alter des Tammerkoski wäre (Donner 1976). Nach Saarnisto (1971 a) entspricht der Gradient 20 cm/km des oberen Ufers der Datierung von über 6500 b.p.

Von den Regressionsvorgängen hat man später zwei ^{14}C-Datierungen erhalten (Tabelle 2). Alhonen (1981) beobachtete in der unterhalb des Tammerkoski befindlichen Schichtenserie des Sees Iidesjärvi ein schmales Flutsediment, dessen Alter mit 5390 ±140 b.p. gemessen wurden. Im untersuchten Mantereenrahka-Moor am Südteil des Pyhäjärvi wurde eine Flut anzeigender Detritushorizont gefunden, der auf 6890 ± 80 b.p. datiert wurde (Grönlund 1982; Perttunen & al. 1984). Zuoberst in der Schichtserie von Mantereenrahka tritt ausserdem noch ein zweites schmales Flutsediment auf, das der von Iidesjärvi datierten Transgression zu entsprechen scheint (Alhonen 1982). Bis auf weiteres ist ungeklärt, wie diese als jünger datierte Transgressionserscheinung mit der Entwicklungsgeschichte des Näsijärvi und der Entstehung des Tammerkoski zu verbinden ist.

So scheint das Alter des Bettes des Tammerkoski und die Transgressions-/Regressionsgrenze etwas nach 7000 b.p. zu liegen. Die Uferverschiebungschronologie des Näsijärvi ist jedoch bis auf weiteres nicht von so grosser Bedeutung, da keine mesolithischen Siedlungsplätze aus dem Bereich des Beckens bekannt sind (vgl. Saarnisto 1971 a). Der Grund für diese Erscheinung scheint in der bescheidenen Forschungsaktivität in diesem Gebiet zu liegen. Entsprechend den Naturverhältnissen wäre die ungestörte Erhaltung von Siedlungsplätzen für die frühe Phase des Mesolithikums im oberen Teil des Gewässers und für die spätmesolithische Periode auch im Südteil des Beckens möglich. Die in Alavuus in der Nähe des Abflusses befindlichen Siedlungsplätze (Nr. 235–242, Karte 1) sind Meeresufer-Siedlungsplätze und stehen nicht in Verbindung mit dem nördlichen Abfluss des Sees.

Päijänne

Die archäologische Uferverschiebungschronologie des Sees Päijänne hat bis auf weiteres genauere Anhaltspunkte für die relative Datierung der Grenze zwischen der vorkeramischen und der



Karte 1. Verbreitung der mesolithischen Siedlungsplätze in der Zeit von 9000–6000 b.p. Das Ufer der Ostsee folgt den Litorinamaximi, ca. 7500 b.p. Das transgressive Binnenseegebiet ist dunkler gekennzeichnet. Numerierung der Siedlungsplätze siehe Tabelle 1; Matiskainen 1983.

Steinzeit geboten (Saarnisto 1971 b; Siiriäinen 1980; Matiskainen 1979). Am Nordteil des Päijänne-Sees wurden zahlreiche mesolithische Siedlungsplätze gefunden, deren Altersstufe auf der Grundlage der Uferverschiebung des Päijänne-Sees geschätzt werden kann.

Nach Saarnisto (1971 b) hat sich der See Päijänne vom Ancylus-See in der Nähe der Pollenzonengrenze V/VI abgetrennt. Nach dem Vergleich der Schwellenhöhe des Abflusses von Hinkua bei Kotajärvi, 122 m, mit dem Uferverschiebungsdiagramm von Salomaa (1982) wäre die Isolierung während einer schnellen Regression, eingetreten 8500 b.p. Im Südteil des Bekkens begann die Transgression schon vor der Entstehung der Schwelle von Kotajärvi zuerst wegen der Schwelle von Äänekoski und dann wegen der von Kolima und setzte sich so lange fort, bis das Bett des Jäniskoski nach Heinolanharju aufbrach. Die oberste Uferfläche unterscheidet sich klar als morphologisches Niveau, als dessen Neigungsgradient 17 cm/km bestimmt worden ist. (Tolvanen 1922; Aarnio 1965; Siiriäinen 1970; Matiskainen 1979).

Nach Ristaniemi (1987) ist die Isolation derart zweiteilig, dass sich die erste Schwelle in Kärnäkoski, Viitasaari befunden hat, wo die Isolation vom Ancylus-See etwa 8900 b.p. geschehen wäre und die zweite Schwelle in Hinkua, wo das Alter der Isolation 8300 b.p. wäre. Die Transgression des Alt-Päijänne hätte zu Beginn Kärnäkoski in zwei Hauptbecken geteilt, in Alt-Kolima und Keitele-Päijänne bis 7500 b.p. Danach hätte sich das Becken als einheitlicher, das oberste Ufer einnehmende Alt-Päijänne entwickelt.

In Verbindung mit dem Becken des Päijänne wurde eine ganze Reihe von Teichen datiert, die zur Einwirkungen der Transgression geworden waren (Saarnisto 1971 b; Ristaniemi 1982, 1987). ^{14}C-Datierungen gibt es ausserdem von den Pollenzonen (Tabelle 2). Zwischen den verschiedenen Datierungen gibt es eine Reihe von Widersprüchen und auf deren Basis spiegelt sich der Zeitpunkt des Aufbrechens des Bettes von Heinolaharju auf etwa 6000 b.p. Die traditionelle "Meso-Neo"-Grenze, 6100 b.p., basiert auf dem von Saarnisto (1971 b) mitgeteilten Alter (Siiriäinen 1970). Ristaniemi hat das Alter um hundert Jahre auf die Zeit um 6000 b.p. verlegt (Abbildung 3).

In bezug auf die Altersbestimmung der mesolithischen Siedlungsplätze des Oberteiles des Päijänne-Beckens sind auch die Pollenzonengrenzen von IV/V und V/VI wichtige Horizonte. Die neuesten Datierungen von Ristaniemi unterscheiden sich bedeutend von den vorangehenden. Saarnistos (1971 b) Ansicht war, dass Alter der Grenzen (IV/V) 9000 b.p. und (V/VI) 8000 b.p. waren. Ristaniemi datiert die IV/V-Zonengrenze auf 9400 b.p., was Alter her dem auf der Grundlage der Transgressionsphase unterschiedenen obersten morphologischen Ancylusufer entspricht. Der Gradient des Ufers ist 46 cm/km, also etwas steiler geneigt als die IV/V-Grenze, 42 cm/km ein Distanzdiagramm verwendenden Saarnisto. Falls die bei dem Ancylusgrenze und die IV/V-Zonengrenzen synchron sein sollten, unterscheiden sich auch die Auffassungen von Ristaniemi und Aario (1965) über die Höhe der Grenze im Gebiet von Hinkua beträchtlich. Nach Aarnio ist die Höhe der Zonengrenze etwa 160–165 m ü.M., wogegen nach Ristaniemi die Höhe von Ancylus etwa 180 m ü.M. ist (siehe auch Saarnisto 1971 b, Fig. 2). Als Alter der V/VI-Zonengrenze gibt Ristaniemi (1987) 8700-8500 b.p. an, was als ein sehr frühes Alter angesehen werden kann.

Auf der Abbildung 1 ist das Uferverschiebungsdiagramm der Entwicklung des Päijänne-Sees zu Beginn der Postglazialperiode im Oberteil des Gewässers dargestellt. Als Diagramm wurde ein Distanzdiagramm gewählt, wobei als Grundlinie die von Saarnisto (1970, app. VIII) vorgestellte in Richtung auf die Erdhebungsisobasen angefertigte Linie für das Saimaa-Gebiet verwendet wurde (siehe auch Matiskainen 1979). In bezug auf den Längenkreis beträgt die Richtung der Grundlinie etwa 315 Grad, wobei die Gradienten etwas höher sein können. Ristaniemi (1987) hat als Richtung 320 Grad verwendet, was dem traditionellen Neigungswinkel des PM-Ufers 17 cm/km entspricht. Der Ausgangspunkt des Diagrammes befindet sich an der Mündung des Abflusses von Hinkua und der Abschlusspunkt kurz hinter der Grenzzone vom obersten Transgressionsufer des Päijänne (PM) und Uferflächen entsprechend die Chronozonen IV/V, V/VI zeitlichen Uferphasen der Ostsee, etwa in der Nähe von Suonteenselkä.

Die mesolithischen Siedlungsplätze des Gebietes können auf zwei uferverschiebungschronologische Bezugspunkte datiert werden; auf die Pollenzone V, deren Alter etwa 9000–8000 b.p. beträgt und auf das Maximalufer des Päijänne (PM), dessen Alter etwa 6000 b.p. ist. Die entsprechenden Altersangaben von Ristaniemi (1987) für die Pollengrenzen sind 9400–8600±1000 b.p. Die Siedlungsplätze befinden sich mit Ausnahme von Nr. 207 oberhalb der Schwelle von Äänekoski, womit das oberste

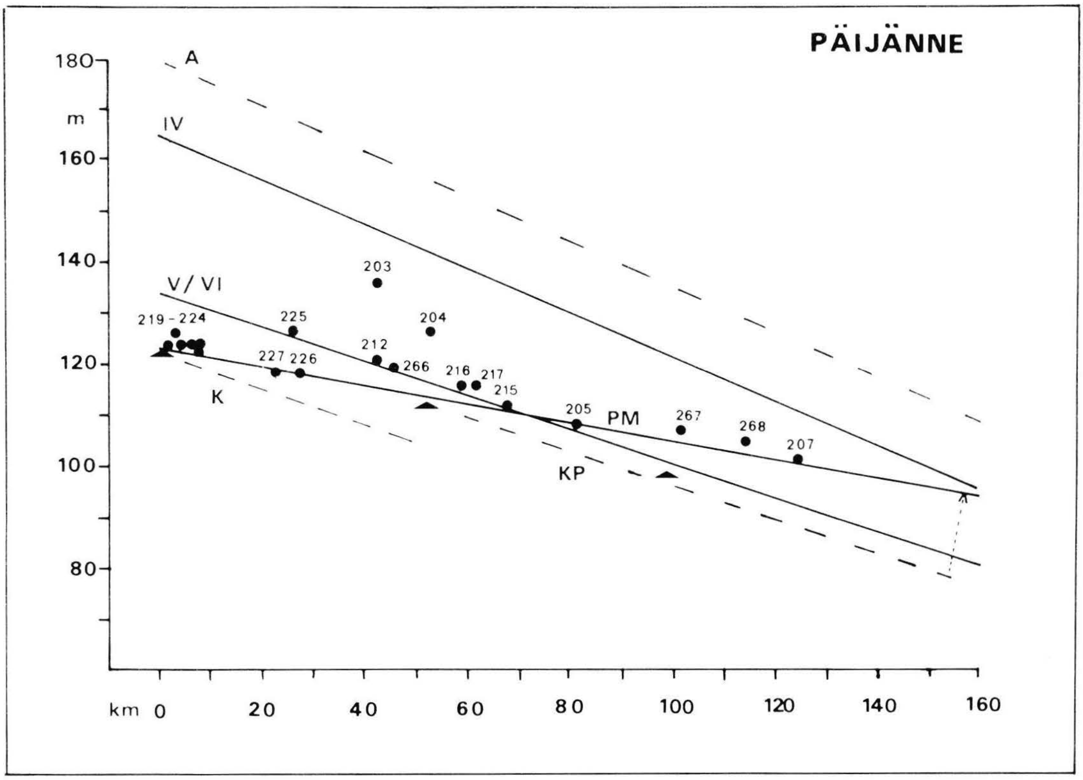


Abb. 1. Die mesolithischen Siedlungsplätze des Päijänne-Sees zum Distanzdiagramm relativiert. Siehe Numerierung Tabelle 1. oberste Grenze des Ancylussees (Ristaniemi 1987), IV, Betula-Zone, V, Pinus-Zone, VI, Betula-Alnus-Corylus-Ulmus-Zone, PM, Päijännemaxim (Saarnisto 1971 b). K, Alt-Kolima, KP, Keitele-Päijänne (Ristaniemi 1987). Berechnungsschwellen sind die Schwellen von Hinkua, Kolima und Äänekoski.

Ufer des Päijänne von anderem Alter und im Südteil jünger zu sein scheint. Die Siedlungsplätze Nr. 225, 203, 212, 204, 216, 217, 266, 267, 268 oberhalb des PM-Ufers sind wahrscheinlich aus der Borealperiode stammende, zum Ancylusmesolithikum gehörende Siedlungsplätze. Die in der Nähe des PM-Ufers befindlichen Siedlungsplätze sind wahrscheinlich mit dem Maximalufer des Päijänne-Sees verbunden und so zur Zeit des Litorinamesolithikums gehörend, jedoch könnte auch ein Teil von ihnen auf die Pollenzone VI datiert sein, also auf das regressive Ancylusufer (Matiskainen 1983).

In bezug auf die Meeresufer-Siedlungsplätze hat man für die mesolithischen Gegenstände eine andeutungsweise Datierung erhalten die man mit den an den Siedlungsplätzen des oberen Teiles des Päijänne-Sees gefunden Objekten vergleichen kann (Abbildung 2).

Das jüngste geschätzte Alter der Trichterlochkeulen und der blattförmigen Schieferspitzen, 8000 b.p. steht im Einklang mit der Uferverschiebung des Päijänne-Sees, da die Siedlungsplätze sich in der Nähe der Pollenzone V/VI befinden, dessen Altersstufe von Ristaniemi (1987) als etwa 8700–8500 b.p. mitgeteilt worden ist und im Genick des Bettes von Hinkua, dessen Isolationsdatierung etwas jünger ist als die vorangehende, etwa 8500–8300 b.p. (Matiskainen 1983; Salomaa 1982). Andererseits ist ihre Datierung im Abgang von Hinkua von der Ancylusregression bis zum Ende der mesolithischen Zeit möglich. Auch mit Hilfe der Transgressionskulmination des Päijänne-Sees kann die Grenze von vorkeramischer und keramischer Zeit nicht geklärt werden, denn die mesolithischen Gegenstandsdatierungen sind in den Oberteilen sehr früh, auf die Endphase datierte Gegenstände fehlen ganz. Viele der Siedlungsplätze wirken sehr langlebig, wie z.B. Nr. 227, Pihtipuhdas Rönny, dessen Nutzung sich vom Mesolithikum bis in die kammkeramische Zeit fortgesetzt hat (Ailio 1909).

Die von Ristaniemi (1987) mitgeteilten frühen

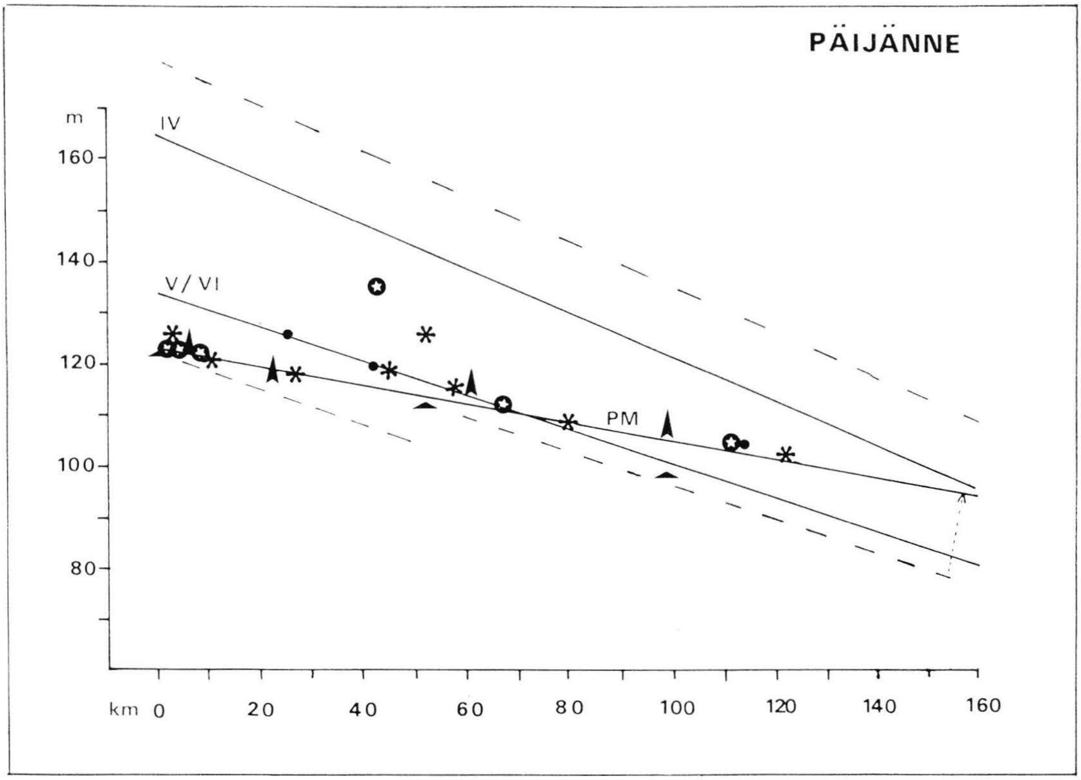


Abb. 2. Das Auftreten der Typgegenstände an den mesolithischen Siedlungsplätzen des Päijänne-Sees, vgl. Abbildung 1✱, primitive Axt, ✪ Trichterlochkeule, ▲ blattförmige Schieferspitze, • krummrückiger Hohlmeissel.

Datierungen stehen etwas im Widerspruch mit der vorgestellten mesolithische Chronologie, sind jedoch nicht vollständig voneinander abweichend. Die auf 9400 b.p. datierte IV/V-Zonengrenze entspräche dem obersten Ancylusufer. Die darauffolgende Regression wäre sehr schnell vor sich gegangen, da die Keitele-Päijänne-Phase 8900 b.p. entstanden wäre, schon vor der V/VI-Zone, deren Alter 8700–8500 b.p. wäre. Somit läge das Alter der mit der regressiven Ancylusphase zusammenhängenden Siedlungsplätze bei 9000 b.p. Nach der Meeresuferchronologie ist das Alter des entsprechenden Bestandes, Trichterlochkeulen und blattförmige Schieferspitzen, des Bottnischen Meerbusens 8500–8000 b.p., was auf der von Salomaa (1982) genau datierten Uferverschiebungschronologie von Lauhavuori basiert (Matiskainen 1983). Nach archäologischen Auffassungen wirken die von Ristaniemi vorgestellten Altersangaben bis auf weiteres zu hoch.

Wenn man die Grenze zwischen vorkeramischer und keramischer Periode auf der Grundlage des Päijänne-Sees datieren will, ist das Alter der Transgressions/Regressionskulmination bis auf weiteres sehr breit (Abbildung 3). Gleichermassen ist das Alter der obersten Grenze des Transgressionsufers mit grösster Wahrscheinlichkeit metachronisch, so dass im Oberteil die frühkeramischen Siedlungsplätze nach Rönny sich auf dem Niveau des obersten Ufers und weiter unterhalb unter dem obersten Ufer befinden. Die mesolithischen Siedlungsplätze fehlen auch für den Südteil des Beckens, die man für oberhalb der Maximalgrenze befindlich annehmen könnte, falls das Uferniveau überall vom gleichen Alter wäre (Siiriäinen 1970; Saarnisto 1971 b; Matiskainen 1979; Ristaniemi 1982, 1987).

Saimaa

Die Uferverschiebung des Saimaa-Gebietes ist in dessen Frühphasen mit der Entwicklung des Päijänne-Sees zu vergleichen. Das Becken hat

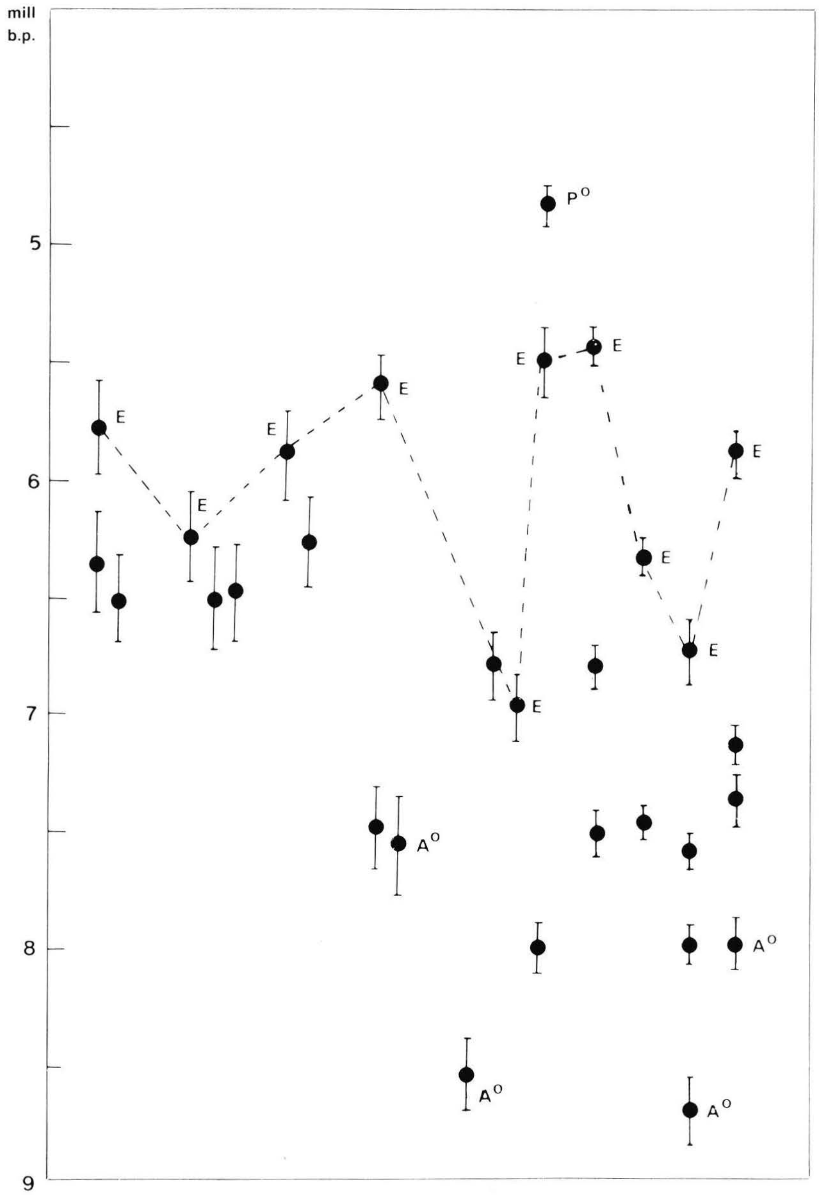


Abb. 3. Streuung der von der Transgressions-/Regressionsgrenze datierten C14-Alter für den Päijänne-See, (siehe Tabelle 2). E, Datierung oberhalb des Transgressionssedimentes, A°, Beginn der BACU-Zone, P°, Beginn der PP-Zone.

sich schon während der regressiven Yoldiaphase von seinem Südteil isoliert, wobei es an den sich zurückziehenden Eisrand gestützte Schmelzwasserseen bildete. Die Isolation der Gewässer des Oberteiles ist zur gleichen Zeit wie die des Päijänne-Sees vor sich gegangen, also etwa 8500 b.p., wonach der Abfluss sich am Selkäyslampi von Pielavesi befand, und das Wasser floss über den Päijänne-See durch das Bett von Hinkua in den späten Ancylussee/Mastogloiameer. Wie beim Päijänne-See ist das oberste Ufer des Saimaa-Sees morphologisch bestimmt und als klar metachronisch konstatiert worden. Zwischen dem Bett von Pielavesi und Matkuslampi/Ristiina ist das Alter der Grenze etwa 5500 b.p. und zwischen Matkuslampi und Vuoksi etwa 5000 b.p. (Hellaakoski 1922; Meinander 1948; Saarnisto 1970).

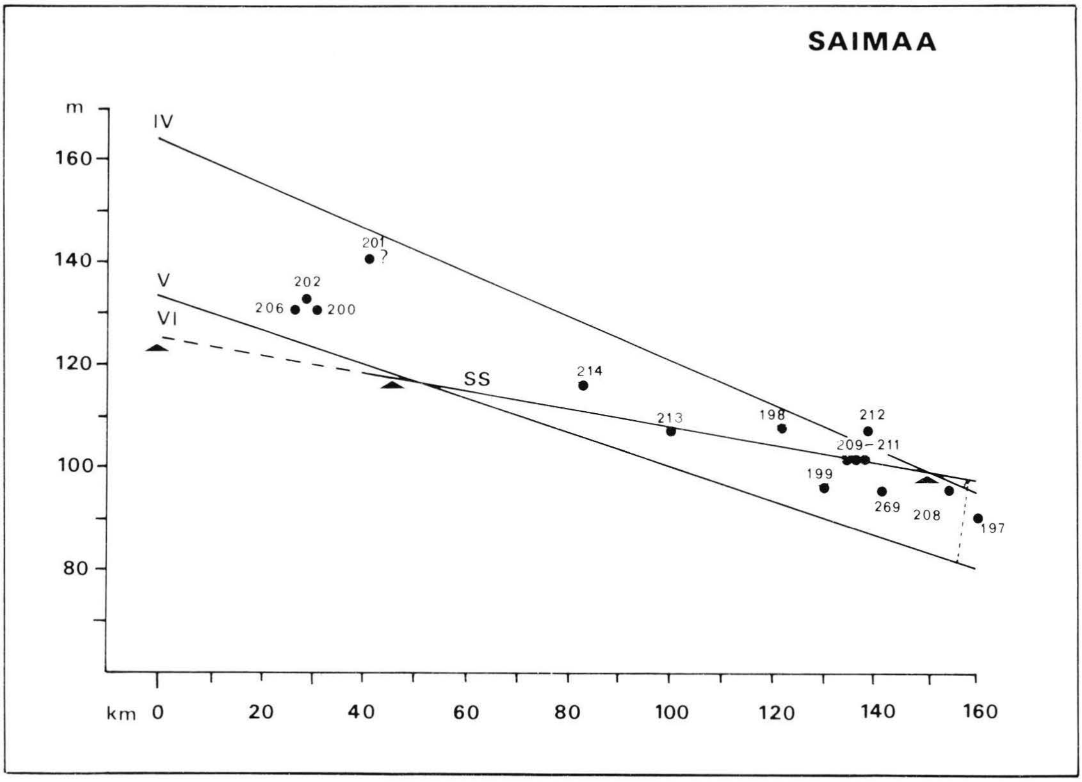


Abb. 4. Die mesolithischen Siedlungsplätze des Saimaa-Sees zum Distanzdiagramm relativiert. Siehe Numerierung Tabelle 1. Zonengrenzen wie auf Abbildung 1. Berechnungsschwellen sind Hinkua, Pielavesi und Suonenjoki.

Aus der Verbreitungskarte (Karte 1) der mesolithischen Siedlungsplätze ist erkennbar, dass sie sich am Nordteil des Beckens befinden, wobei die südlichsten in Kuopio und Siilijärvi liegen. Auf der Abbildung 4 sind ein Uferverschiebungsdiagramm und die mesolithischen Siedlungsplätze in Nord-Savo dargestellt. Es ist als Distanzdiagramm von der gleichen von Saarnisto (1970) vorgestellten Grundebene wie die Diagramme der Abbildungen 1 und 2 vom Päijänne-See angefertigt worden.

Die Datierung der Siedlungspätze entsprechend der Abbildung 5 scheint problematischer als beim Päijänne-See. Eine Reihe von Siedlungsplätzen, Nr. 197, 199, 208 und 269, befinden sich unterhalb der transgressiven Uferebene des Gross-Saimaa-Sees, der auf die Zeit von 5000 b.p. datiert ist. Bei der genaueren Untersuchung der Siedlungsplätze wird deutlich, dass diese mesolithischen Siedlungsplätze wirklich unter der Flut des Gross-Saimaa-Sees geblieben sind. Nr. 197, (Kuopio Leppäranta) befindet sich auf 90 m Höhe, wobei die entsprechenden typischen kammkeramischen Siedlungsplätze sich am nach dem Aufbrechen von Vuoksi auf der Höbe von 95 m im gleichen Gebiet befinden (Pohjakallio 1978). Nr. 269, (Kuopio Jynkkä), beinhaltet neben einer primitiven Axt auch eine Reihe von Quarzen. Die von Vanhatalo (1986) an diesem Punkt durchgeführte Grabung hat keine Anzeichen eines erhaltenen Siedlungsplatzes zum Vorschein gebracht. Nr. 199 (Siilinjärvi, Vilhola) scheint ein entsprechender Siedlungsplatz zu sein wie auch Nr. 208 (Juankoski Västiniemi), von denen vier mesolithische Objekte als Einzelfunde bekannt sind, aber keine anderen Anzeichen eines Siedlungsplatzes (siehe Pohjakallio 1977).

Es scheint so, als ob die durch die Transgression durcheinandergebrachten Siedlungsplätze mit dem Ancylussee in Verbindung stehen und aus der Pollenzone V oder von der transgressiven Gross-Saimaa, Pollenzone VI, stammen. Auf Grund der vorgestellten Anschauung ist es nur am nordwestlichen Landhebungsgürtel des Abflusses des Suonenjoki möglich Siedlungsplätze von Primärstellung zu finden. Im Gewässergebiet unterhalb des Abflusses wie auch in des-

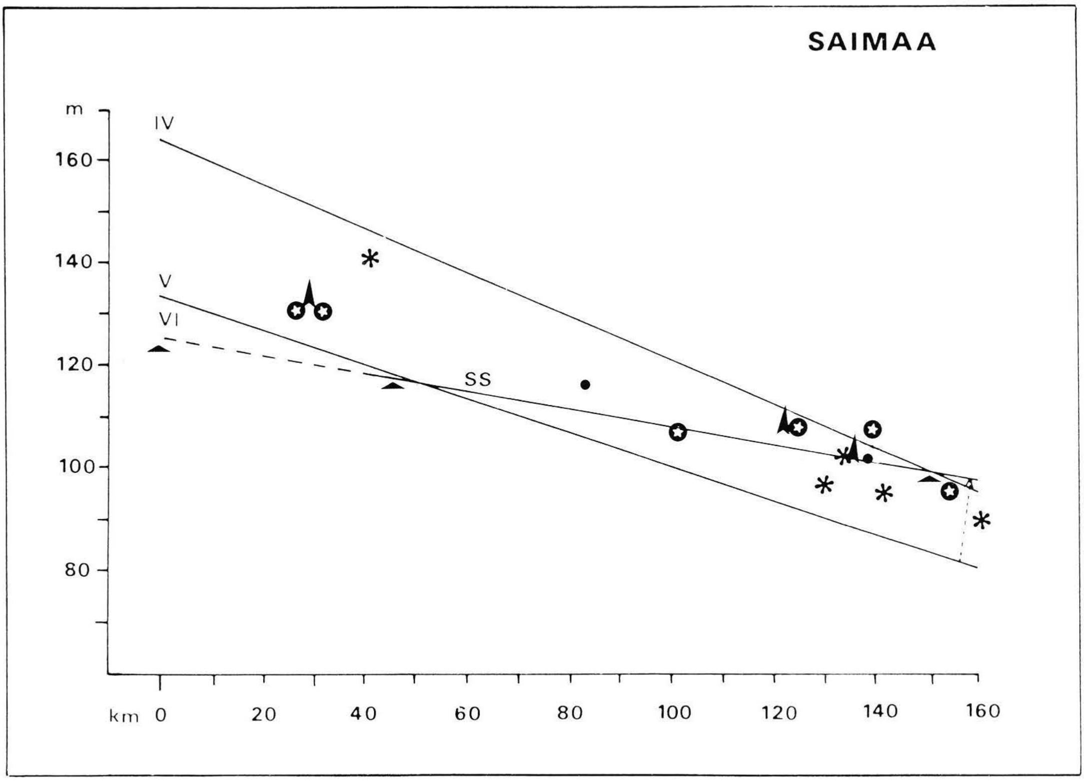


Abb. 5. Auftreten der Typengegenstände an den mesolithischen Siedlungsplätzen des Saimaa-Sees, vgl. Abbildung 4. Symbole wie auf der Abbildung 2.

sen Nähe sind die Siedlungsplätze unterhalb des obersten Ufers zerstört.

Mesolithische Siedlungsplätze in ungestörter Position datieren sich auf das regressive Ancylusufer, die Pollenzone V, und es ist bemerkenswert, dass die darunter gefundenen Leitartefakte sich harmonisch auf den Beginn der mesolithischen Steinzeit, etwa 9000–8000 b.p., datieren (Edgren 1977; Matiskainen 1979). Spätmesolithische Siedlungsplätze fehlen für das Saimaa-Becken wie auch beim Päijänne-See, was von der schwachen Forschungsaktivität herrühren und daher illusorisch sein könnte. Schrägschneidige Quarzspitzen sind an keinem der Urufer der beiden Beckenkomplexe angetroffen worden. Dieser Mangel rührt nicht von der gebietsweisen Verbreitung her, denn Huurre hat schrägschneidige Quarzspitzen in Kaalainsalmi, Outokumpu gefunden (Nr. 192).

Im Gebiet von Joensuu sind zwei Siedlungsplätze befunden worden, die unter den Transgressionsschichten des Saimaa-Sees geblieben sind (Nr. 190–191; Pälsi & Sauramo 1937; Väkeväinen 1979). Die Funde setzen sich ausschliesslich aus Quarzgegenständen und -abschlägen zusammen, doch wegen der Entwicklung der Umgebung kann man beide als mesolithisch datieren. Auf den Siedlungsplätzen hat sich eine etwa 1–2 m dicke Sandschichtung angesammelt. Neben der Transgression des Saimaa-Sees hat auch das Aufbrechen von Pielinen um etwa 8500 b.p. höchstwahrscheinlich die Bodenhorizonte in der Nähe des Aufbruchsabflusses mit Flutsand bedeckt (Hyvärinen 1966).

Von der Feuerstelle des Siedlungsplatzes von Mutala, Joensuu (Nr. 190) steht eine direkte ^{14}C-Datierung 7160 ±250 zur Verfügung. Von der unter der Transgression stehenden organischen Schicht sind auf Veranlassung der Geologen mehrere Datierungen mit der Radiokarbonmethode angefertigt worden, die das Ausarbeitung der auf Abbildung 6 dargestellten transgressiven Uferverschiebungskurve ermöglicht haben (Tabelle 2). Die Datierungen staffeln sich gleichmässig im Verhältnis zur Höhe, durch Abnutzung hervorgerufene Fehler scheinen nicht aufzutreten. Die obersten Datierungen des Diagramms, die den Abschluss der Transgression

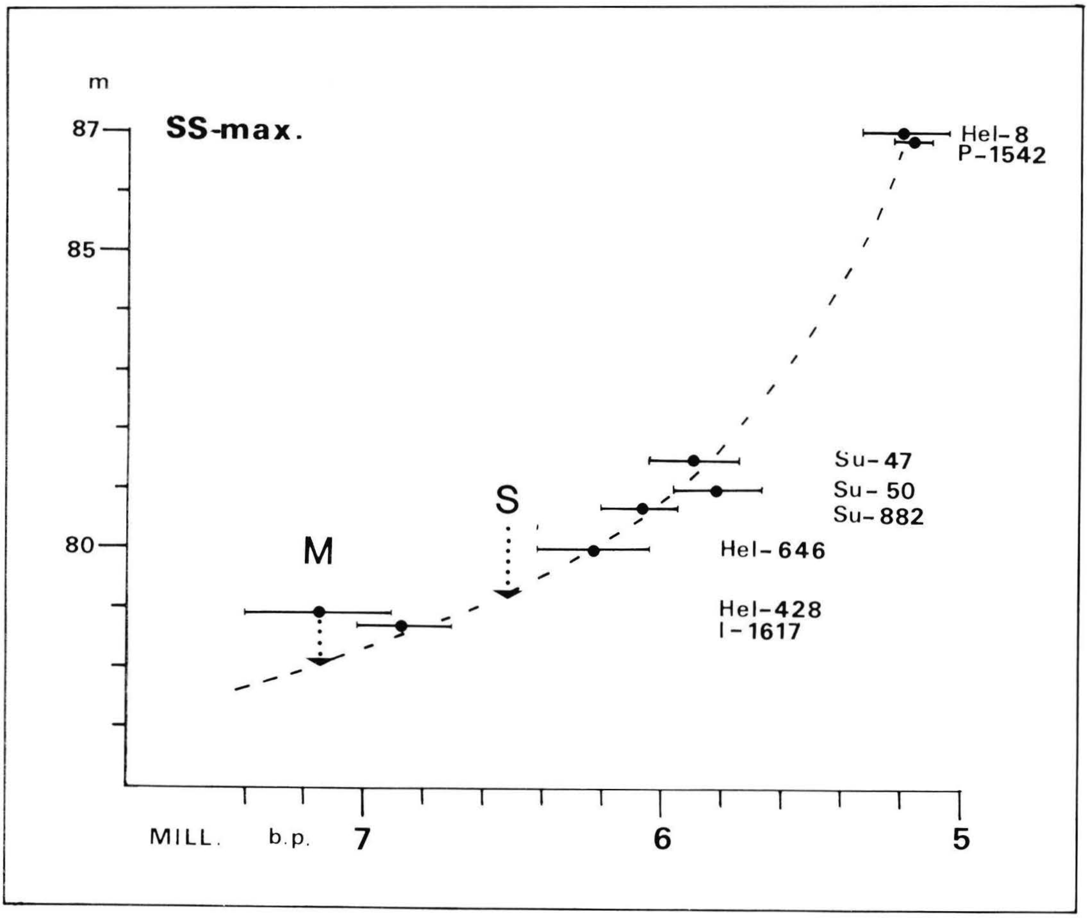


Abb. 6. Transgressive Uferverschiebungskurve für das Gebiet Joensuu, siehe Tabelle 2. M, Siedlungsplatz Mutala, (Nr. 190), S. Siedlungsplatz Siihtala, (Nr. 191).

mitteilen, stammen von Linnansuo, Imatra. Das höchste Ufer ist als vom Alter des Aufbrechens von Vuoksi bestimmt worden, aber es ist auch möglich, dass das Maximum in dem Gebiet älter ist, wobei die Regression schon zur Zeit des Abflusses vom Kärelampi beginnt (Pälsi & Sauramo 1937; Saarnisto 1970).

Im Jahre 1979 grub Lea Väkeväinen den Siedlungsplatz Siihtala, Joensuu (Nr. 191) aus, der sich als mit Mutala gleichartiger, unter der Transgression stehender Siedlungsplatz erwies. Seine Datierung kann mit den Datierungen Su-50 und Su-882 verbunden werden. Davon ist Su-50 ein organischer Bodenhorizont auf etwa 81 m Höhe und Su-882 wiederum ist aufgrund des in Verbindung mit der Grabung aus den Bodenhorizonten entnommenen Rumpfes von Betula auf etwa 80,7 m Höhe datiert worden. Auf der Grundlage der Datierungen kann geschlossen werden, dass der Wasserspiegel sich 6000 b.p. über den Fundhorizon erhoben hat. Durch die Einordnung der Fundhöhe der am Siedlungsplatz befundenen Quarzabschläge in das Diagramm und unter Schätzung der Untergrenze des Siedlungsplatzes entsprechend den von Väkeväinen gemachten Beobachtungen auf 79 m über dem Meeresspiegel, erhält man für die mesolithische Siedlung von Siihtala ein Alter von 6500 b.p. Die Datierung der Feuerstellenkohle des Siedlungsplatzes von Mutala zeigt, das sich der Uferstrich damals einen Meter unterhalb von Siihtala befunden zu haben scheint. Somit ist der Altersunterschied zwischen den Siedlungsplätzen von Siihtala und Mutala etwa 500 Jahre.

Die die Entwicklung des Joensuuer Gebietes am vollkommensten beschreibende Schichtserie wurde in Kontiosuo gefunden (Vesajoki & al.

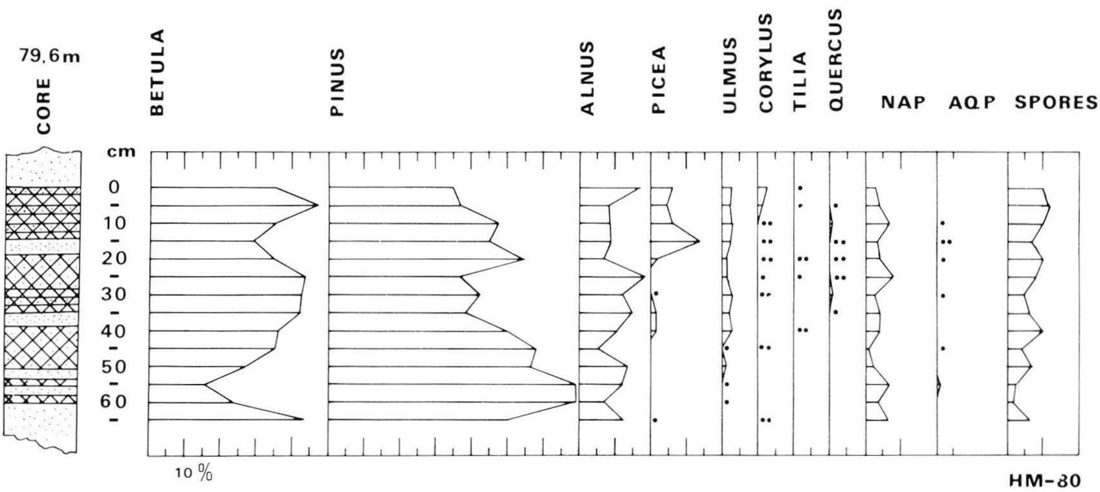


Abb. 7. Pollendiagramm von der den Siedlungsplatz Siihtala bedeckenden organischen Schicht.

1985). Aus der Serie wurden die Isolation des Saimaa-Sees vom Yoldia, das Aufbrechen von Pielinen und eine den vorhergehenden Datierungen entsprechende organische Schichtung vor der Flut des Saimaa-Sees datiert. Die Untergrenze der unter der Transgression befindlichen Torfschichtung ist 6520 ±120 b.p. Mit früheren Datierungen verglichen scheint dies ein wenig alt, aber offensichtlich datiert sie sich eher auf das Zuwachsen des Kontiosuo-Moores als auf den Beginn der Transgression. Bedauerlicherweise ist aus der Schichtenserie nicht das Alter der Transgression des Saimaa-Sees datiert worden, was limnologisch in diesem Falle möglich gewesen wäre.

Am Siedlungsplatz von Siihtala wurde auch ein etwa 60 cm hoher Sedimentpfeiler sichergestellt, der auf der pollenanalythischen Abbildung 7 dargestellt ist. Allgemein genommen entspricht die Schichtserie dem Oberteil der Pinus-Zone und der Anfangsphase der Pinus-Betula-Zone von Hyvärinen (1966) und vertritt so biostratigraphisch die mittlere Phase der mesolithischen Periode. In der Schichtfolge häuft sich Picea in bezug auf die organische Schicht, was der in der ungestörten Schichtabfolge von Kontiosuo festgestellten Stellung der Fichte entspricht. Die Verbreitung von Picea kann man aus dem Diagrammen von Sauramo (1937) ablesen, dagegen kann aus dem in niedrigerer Höhe von Alhonen (1967) untersuchten Diagramm das Auftreten von Picea noch nicht beobachtet werden.

Pielinen

Aus der Umgebung des Beckens von Pielinen ist ein mesolithisch datierter Siedlungsplatz bekannt, Nr. 193. Nach der von Hyvärinen (1966) untersuchten Entwicklungsgeschichte von Pielinen isolierte sich der See etwa um die Zeit von 8900 b.p. (vom Ancylus-See?). Anfangs befand sich der Abfluss im Norden, bei Kalliojärvi, Valtimo. Der nördliche Abfluss hielt etwa 500 Jahre und etwa 8400 b.p. brach der Abfluss von Uimaharju im Südost-Teil des Pielinen-Sees auf und es entstand der Fluss Pielisjoki. Im Kontiosuo ist der Aufbruch des Pielisjoki um 8610 ±120 datiert worden. Nr. 193 (Nurmes, Saramo, Niittyrinne) befindet sich in der Nähe der Zonengrenze IV/V, die Hyvärinen auf 8500 b.p. datiert hat. Die Zeitgrenze umreisst höchstwahrscheinlich das Mindesalter der Zone, die neuesten Datierungen weissen auf die Zeit von etwa 9000 b.p. hin. An dem Siedlungsplatz ist eine Trichterlochkeule gefunden worden, deren frühmesolithisches Alter in guter Übereinstimmung mit dem Alter der Zone steht.

Schlussfolgerungen

Es ist möglich, an den Nordwest- und Nordteilen des Päijänne- und des Saimaa-See unstörte mesolithische Siedlungsplätze zu finden. Diese gehören zur Besiedlung des Befinnes der Postglazialperiode, etwa 9000–8000 b.p., und entsprechen dem auf der Grundlage der Facies der Ostsee unterschiedenen Ancylusmesolithikum (Matiskainen 1985). Die Datierung kann man von den Chronozonen IV/V und V/VI ableiten. Typgegenstände sind neben primitiven Äxten Kugelkeulen mit trichterförmigem Loch und blattförmige Schieferspitzen. Es ist jedoch zu beachten, dass die gebietsmässige Verbreitung der Trichterloch-Kugelkeule in unserem Land gerade in den Nordteilen von Päijänne und Saimaa besonders bezüglich aus Topfstein hergestellter Exemplare dicht ist. Chronologisch ist es schwer, die Siedlungsplätze, die zum obersten Transgressionsufer des Binnensees gehören und die auf seiner Höhe befindlichen Siedlungsplätze der Zeit des Ancylusufers voneinander zu unterscheiden.

Diese Zusammenfassung basiert in ihren Hauptzügen auf den von Saarnisto (1971 b) dargestellten Auffassungen, bei denen das Alter der Pollenzonen von ausserhalb des Gebietes hergeleitet wurden. Das Alter der territorialen Pollengrenzen macht die Datierung nach Ristaniemi (1987) um etwa 500 Jahre älter. Die archäologische Uferverschiebungschronologie steht immer mit den Ergebnissen, die bei den quartärgeologischen Untersuchungen erzielt wurden, in Verbindung und in der Zukunft könnten frühe Alter die neue Wertung der vorgestellten mesolithischen Chronologie wenigstens betreffs ihrer Frühphasen erfordern. Die archäologischen Vorgänge nach der Deglaziationsphase bis hin zur Ancylusregression sind vollkommen unklar. Die geologischen Vorgänge, die schnelle Erdhebung und die transgressive Entwicklungsgeschichte der Ostsee und der Seenbecken hat die bescheidenen Spuren der Pionierbesiedlung zerstört. Von der Migration der (IV)-Zone der Tundraphase sind keine Beweise erhältlich, erst in der Pinus (V)-Phase werden die frühesten Zeichen der Besiedlung angetroffen, als wichtigster Ansatzpunkt der Netzfund von Antrea etwa 9400–9200 b.p. (Junger & Sonninen 1983).

Das Auftrittsgebiet der Siedlungsplätze beschränkt sich auf einen Gürtel, wo die sich stark neigende Uferphasen der Frühpostglazialperiode nicht im Becken von der späteren Transgression bedeckt wurden. Praktisch sind im Durchschnitt 100 m Höhe vom jetzigen Meeresspiegel sowohl beim Päijänne- als auch beim Saimaa-See die Grenze, unter der mesolithische Siedlungsplätze von der Transgression bedeckt geblieben sind. In der Nähe des Grenzpunktes sind mit Glück Zeichen von Siedlungsplätzen erhalten geblieben.

Das Auftreten mesolithischer Siedlungen im südlichen Binnenseegebiet ist während der Frühpostglazialperiode aufgrund der Transgressionen sehr schlecht feststellbar. Es handelt sich nicht um Besiedlungsleerräume, da verschiedene mesolithische Einzelfunde auch für die Südteile der Becken Zeichen von Besiedlung anzeigen, die jedoch der Transgression unterlagen (Äyräpää 1950, Abb, 29–31). Das Alter des obersten Ufers (PM,SS) ist höchstwahrscheinlich metachronisch, herrührend aus dem unterschiedlichen Alter der Erdhebung. Die Transgression ist im langsameren Erdhebungsgebiet effektiver fortgeschritten als in den oberen Teilen der Becken.

Im Lichte der Entwicklungsgeschichte der Becken ist es bei der Zunahme der Anzahl der ^{14}C-datierten Schichtserien und der Präzisierung des Alters der Entwicklungsphasen möglich, das Erscheinen und die Datierung der mesolithischen Besiedlung besser zu klären. Die Forschungsaktivitäten betreffs der mesolithischen Steinzeit sollen dorthin gerichtet werden, wo die frühpostglaziale Besiedlung ungestört erhalten geblieben ist. Vor allem das Becken von Näsijärvi und Pielinen sind schon in der mesolithischen Periode regressiv gewesen, wobei darunter solche Siedlungsplätze zu finden sind, die in den südlichen Teilen von Päijänne und Saimaa unmöglich zu finden sind.

Das vermeintliche Fehlen von Siedlungsplätzen erschwert die Untersuchung der steinzeitlichen Territorien des Binnenseegebiets. Informationen über die Archipel-Meeresufer-Siedlungsplätze, die Flussmündungssiedlungsplätze sind zu erlangen, betreffs der Süsswasserbecken jedoch sind die Informationen auf sporadische Siedlungsplätze begrenzt, die sich oberhalb der Gross-Seen, an den Ufern der kleinen Seen befinden. Wenn die Besiedlungsintensität mit der vom Beginn der Regression bekannten kammkeramischen Besiedlung vergleichbar wäre, kann man die Verluste abschätzen, die die transgressive Entwicklungsgeschichte für die Archäologen unerreichbar zerstört hat.

Unter diesem Verlust leiden vor allem die soziale, ökologische und demographische Erforschung der mesolithische Steinzeit. Die sozialen Territorien gehen aus den Fundleerräumen nicht hervor und verfälschen das Bild von der ausschliesslichen Entwicklung der Besiedlung am Meeresufer und den Flussmündungen. Die ökologische Forschung leidet unter dem Fehlen der Restfauna, so dass ein eventuelles Spezialisieren auf eine bestimmte Faunaart nicht beklärt werden kann, ganz zu schweigen von Fanggrunden oder den Kontrasten von Salz- und Süsswasser. Die Konzentration der Meeresuferpopulationen auf den Robbenfang könnte weiterreichende Schlussfolgerngen über die mesolithische ökologie verfälschen, wobei die Ausbeutung des Binnensees im Schatten bliebe. In bezug auf die demographische Forschung ist die Situation genauso düster, denn der Fundleerraum lässt keinerlei

Wahrnehmungen von bevölkerungshistorischen Erscheinungen zu (vgl. Siiriäinen 1981; 1987).

* * *

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Tabelle 1. Die mit den Beinnenseebecken zusammenhängenden Siedlungsplätze. Karte 1. (Matiskainen 1983; Kataloge der vorgeschichtlichen Denkmalspflegeschutzobjekte der Regionalplanungsverbände Nord-Kareliens, Nord-Savos und Mittelfinnlands.)

PIELINEN:

Nro	193	Nurmes Saramo Niittyrinne

SAIMAA:

Nro	190	Joensuu Mutala
,,	191	Joensuu Siihtala
,,	197	Kuopio Riistavesi Leppäranta
,,	198	Siilinjärvi Kasurila Kaletonlampi
,,	199	Siilinjärvi Vilhola (?) [1]
,,	200	Kiuruvesi Lehmilahti
,,	201	Kiuruvesi Mäntysuo (?)
,,	202	Kiuruvesi Lassila
,,	206	Vieremä Koivumäki
,,	207	Rautalampi Jokivarsipelto
,,	208	Joensuu Västinniemi
,,	209	Nilsiä Kuisti
,,	210	Nilsiä Kumpuharju
,,	211	Nilsiä Marjoniemi
,,	212	Rautavaara Alaluosta Meltunsaari
,,	213	Lapinlahti Riita-Aho
,,	214	Iisalmi Hernejärvi Siltala
,,	269	Kuopio, Jynkkä, Jynkänlahti

PÄIJÄNNE:

Nro	203	Kiuruvesi Haahkarinsuu
,,	204	Pielavesi Jokiharju
,,	205	Pielavesi Tupakkaniemi
,,	215	Viitasaari Lamminpää A und B
,,	216	Viitasaari Ruuppo
,,	217	Viitasaari Siirtola
,,	218	Viitasaari Ottola
,,	219	Pihtipudas Metsälä
,,	220	Pihtipudas Koivukangas
,,	221	Pihtipudas Rimpiaho
,,	222	Pihtipudas Teini
,,	223	Pihtipudas Auhtola
,,	224	Pihtipudas Vuohtojärvi
,,	225	Pihtipudas Keto
,,	226	Pihtipudas Lähdeaho
,,	227	Pihtipudas Rönny
,,	266	Pielavesi Koivujärvi Koivumäki
,,	267	Vesanto Närhilä Lääminginmäki
,,	268	Karttula Viitataipale Aittoranta

[1] Die am Siedlungsplatz Siilinjärvi, Vilhola gefundene Steinaxt ist mit einem Fragezeichen katalogisiert worden. Die zeitliche Stellung des Ortes ist nicht vollständig sicher. Information von J. Aroalho.

Tabelle 2. Im Text erwähnte ^{14}C-Datierungen (b.p. uncalibriert.)

NÄSIJÄRVI:

Iidesjärvi, Tampere, (Alhonen 1981, 1982)

Hel-1377	5390±140,	Transgressionsschicht

Mantereenrahka, Lempäälä, (Grönlund 1982; Perttunen & al. 1984)

Su-846A	6670± 80,	Torf oberhalb der Transgression,
Su-846B	6650± 80,	die gleiche Probe von der Humusfraktion gemessen,
Su-795A	6890± 80,	Transgressionsmoor,
Su-795B	7000± 80,	die gleiche Probe von der Humusfraktion gemessen
Su-796A	7580±100,	Eq-Torf unterhalb der Transgression,
Su-796B	7500±100,	die gleiche Probe von der Humusfraktion gemessen,

PÄIJÄNNE

Särkijärvi, Sysmä, (Saarnisto 1971 b)

Hel-109	5780±190,	Ende der Transgression,
Hel-110	6360±210,	aus der Nähe des Endes der Transgression,
Hel-111	6510±200,	Anfang der Transgression,

Salmelanlampi, Sysmä, (Saarnisto 1971 b)

Hel-107	6230±180,	Ende der Transgression,
Hel-108	6500±210,	aus der Nähe des Endes der Transgression,
Hel-112	6440±200,	Anfang der Transgression,

Lahnalampi, Asikkala, (Saarnisto 1971 b)
Hel-106 5890±190, Anfang der Transgression,
Hel-113 6350±180, Anfang der Transgression,

Karisjärvi, Korpilahti, (Ristaniemi 1982)
Su-914 5590±130, Ende der Transgression,
Su-913 7470±170, Anfang der Transgression
Su-1005 7510±180, Zonengrenze V/VI

Kilpijärvi, Korpilahti, (Ristaniemi 1982)
Su-1000 6960±140, Ende der Transgression
Su-999 6760±130, Anfang der Transgression
Su-998 8510±140, Zonengrenze V/VI

Vaskonlampi, Jyväskylä, (Ristaniemi 1982)
Su-869 5480±140 Ende der Transgression
Su-870 7970±100, Anfang der Transgression
Su-872 8710±160, Zonengrenze V/VI

Sirkkalampi, Laukaa, (Ristaniemi 1987)
Su-1402 7510±100, Zone VI
Su-1401 6800±100, unterhalb der Transgression
Su-1400 5430± 70, oberhalb der Transgression

Oitinlampi, Laukaa, (Ristaniemi 1987)
Si-1540 7480± 80, unterhalb der Transgression
Su-1539 6340± 80, oberhalb der Transgression

Kaakonlampi, Sumiainen, (Ristaniemi 1987)
Su-1403 8700±140, Alt-Kolima,
Su-1404 7980± 70, VI-Zone,
Su-1405 7590± 80, Anfang der Transgression,
Su-1406 6740±140, oberhalb der Transgression,

Karvalampi, Pihtipudas, (Ristaniemi 1987)
Su-1407 7980±110, V/VI-Zonengrenze,
Su-1408 7300±120, VI Zone,
Su-1409 7140± 80, unterhalb der Transgression,
Su-1410 5900±100, oberhalb der Transgression,

SAIMAA

Gebiet von Joensuu, Datierung von der organischen Schicht unterhalb des Flutsandes.
Su-47 5950±150, (Mansikkaniemi 1975)
Su-50 5810±150, (Mansikkaniemi 1975)
Su-882 6080±130, (Matiskainen 1983)
Hel-646 6220±200, (Mansikkaniemi 1975)
I-1617 6880±150, (Alhonen 1967)
Hel-428 7160±250, (Siiriäinen 1973)

Kontiosuo, Joensuu, (Vesajoki & al. 1985)
Hel-1498 9030±180, direkte Isolation H IV (?)
Hel-1499 9090±130, oberhalb des vorangehenden,
Hel-1500 8610±120, Alter der Flut von Pielisjoki,
Hel-1501 6520±120, Zuwachsen von Kontiosuo vor der Transgression der Saimaa.

Linnasuo, Imatra, (Saarnisto 1970)
Hel-8 5200±140, organische Schicht unterhalb der Flut von Vuoksi,
P-1542 5183± 56, organische Schicht unterhalb der Flut von Vuoksi

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Heikki Matiskainen

Beiträge zur Kenntnisse der mesolithischen Schrägschneidepfeile und Mikrolithen aus Quarz

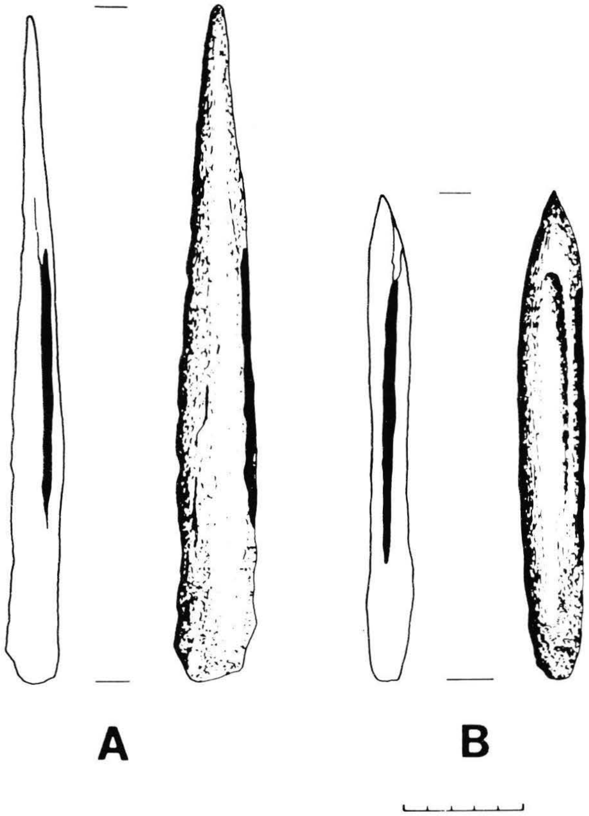
Einleitung

Die mesolithische Steinzeit Finnlands unterscheidet sich von den entsprechenden europäischen Kulturen darin, dass man keine für bestimmte Zeitabschnitte charakteristischen Mikrogegenstände, Mikrolithen bestimmen konnte. Der Grund dafür ist auch gut bekannt: aus auf dem Quarzmineral beschränkten Abschlagsmaterial kann man retuschierte Kleingegenstände nicht genauso klar wie aus dem Feuerstein bestimmen. Die genaue Definition der Mikrolithen als aus Mikroklingen mit der »Mikrosticheltechnik» hergestellte verschiedenförmige Kleinobjekte kann man nicht auf die Quarze anwenden. Die Kenntnisse über die Nützung von Quarz bei der Herstellung von Mikrolithen sind sehr spärlich (Luho 1948, 1956, 1967, Äyräpää 1950, Welinder 1977, Siiriäinen 1977, 1984).

Im mesolithischen Fundmaterial Finnlands trifft man aber trotzdem ab und zu Spuren von Mikrolithen an. Die klarsten von diesen Beobachtungen sind die auf die Grenze Präboreal- und Borealzeit, etwa 9000 B.P. datierten Funde von Antrea Korpilahti gehörenden Erkenntnisse über Mikrolithen sowie die Gruppe der schräg- oder querschneidigen Quarzpfeilspitzen. Der in Zusammenhang mit dem Netzfund von Antrea im Jahr 1913 gefundene Knochengegenstand (NM 6688: 1) ist der einzige Gegenstand aus Finnland, an dem die in der Mikrolithkultur genutzte Schäftungsart hervorgeht. Der Gegenstand ist aus der Innenseute des Schienbeins vom Elch (*Alces Alces*) hergestellt, die eine Seite ist mit einer Rille versehen, in der beim Auffinden des Gegenstandes 3–4 scharfe Quarzsplitter mit Hilfe einer schwarzen organischen Substanz befestigt waren, die sich aber später nach Abtrocknen des Gegenstandes von der Schneide lösten und verlorengingen. Der Fund von Antrea beinhaltete auch eine zweite entsprechende Spitze, die aber verlorengegangen war, bevor der ganze Fund ins Nationalmuseum gerettet wurde. Die Knochenspitze interprätierte Pälsi als Knochenmesser, Äyräpää später als Speerspitze (Pälsi 1920, Äyräpää 1950, Luho 1967, Clark 1975). (Abb. 1A)

Pälsi (1920) kombinierte das Antrea-Messer als »Waffen dieser Art aus Schiefer entsprechend» beim Vergleich des Gegenstandes mit den von Ailio beschriebenen blattförmigen Speerspitzen (Ailio 1909). Nach Äyräpää (1950) ahmt die Knochenspitze Schieferspeerspitzen nach, so seien die Schieferspitzen nun von der Funktion entweder Messer oder Speerspitzen. Neben ihnen sind nach beiden Erklärungen im finnischen Mesolithicum aus Knochen hergestellte, mit Quarz versehene Spitzen aufgetreten.

Für die Morphologie der Mikrolithen bietet der Fund von Antrea keine Zusatzinformationen, da man von den verlorengegangenen Quarzen der Knochenspitze weder



1. Mit einer Rille ausgestattete Knochenspitzen. Antrea (A), Nishni Veretje I (B).

die Form kennt, noch ob sie überhaupt mit Retuschetechnik hergestellt worden sind. Zum Fund von Antrea gehören auch einzelne Quarzabschläge die als solche, ohne weitere Bearbeitung nicht in die in den Knochengegenstand gravierte Rille passen.

Zusätzliches Licht für die Antrea-Spitze scheint die Untersuchung der auf den Beginn der Borealzeit, ca. 8700–8400 B.P. datierten Moor-Siedlungsplätze im Gebiet des Latsasees, in der Onega Region in der Sowjetunion zu bringen. Am Wohnplatz Nishni Veretje I wurden einige Spitzen oder »Dolche» gefunden, die mit Feuersteinmikrolithen versehen sind (Osibkina 1983). Diese entsprechen auch zeitlich den quarzschneidigen Spitzen von Antrea (Abb. 1).

Die mit Mikrolithen oder mit den Bruchstücken von Feuersteinklingen geschärfte Knochenspitze ist während des Mesolithicums weit bekannt. Die Objektform triff man von Süd-Skandinavien bis zum südlichen und östlichen Baltikum, von Weiss- und Mittelrussland bis zum Ural an. Nach dem Fund von Antrea waren Spitzen mit Quarzeinsätzen auch im finnischen Mesolithicum bekannt. Die Schwierigkeit besteht nur darin, nach dem unhaltbaren zersetzten Knochenmaterial die Quarzeinsätze aus dem sonst breiten Material an Quarzgegenständen und Abschlagsmaterial zu erkennen, das die finnischen Steinzeitfunde charakterisiert. Als »Mikrolith» – Einsätze von Knochenspitzen wurden Quarzabschläge benutzt, diese können aber wahrscheinlich unretuschierte, zufällig entstandene Abschläge gewesen sein, die unter dem anderen am Siedlungsplatz in reichlichem Umfang ausgegrabenen Quarzmaterial verschwinden. Die kleinen Quarzabschläge sind leicht zu passenden »Pseudomikrolithen» ohne besondere, sichtbare Retuschen zu formen.

Unter den Funden von Latsasee treten auch klare grosse aus Feuersteinklingen hergestellte Entsprechungen auf, die in die frühmesolithischen Steinzeit datierten blattförmigen Schieferspitzen, die Pälsi mit der Knochenspitze von Antrea verglich (Osibkina 1983). Die finnischen Schieferspeerspitzen scheinen die mit der Epi-Swidry -Technik hergestellten grossen Feuersteinspitzen und Messer nachzuahmen. Die mit Feuerstein- oder Quarzeinsätzen ausgestatteten Knochenspitzen bilden eine eigene parallele mesolithische Gegenstandsgruppe.

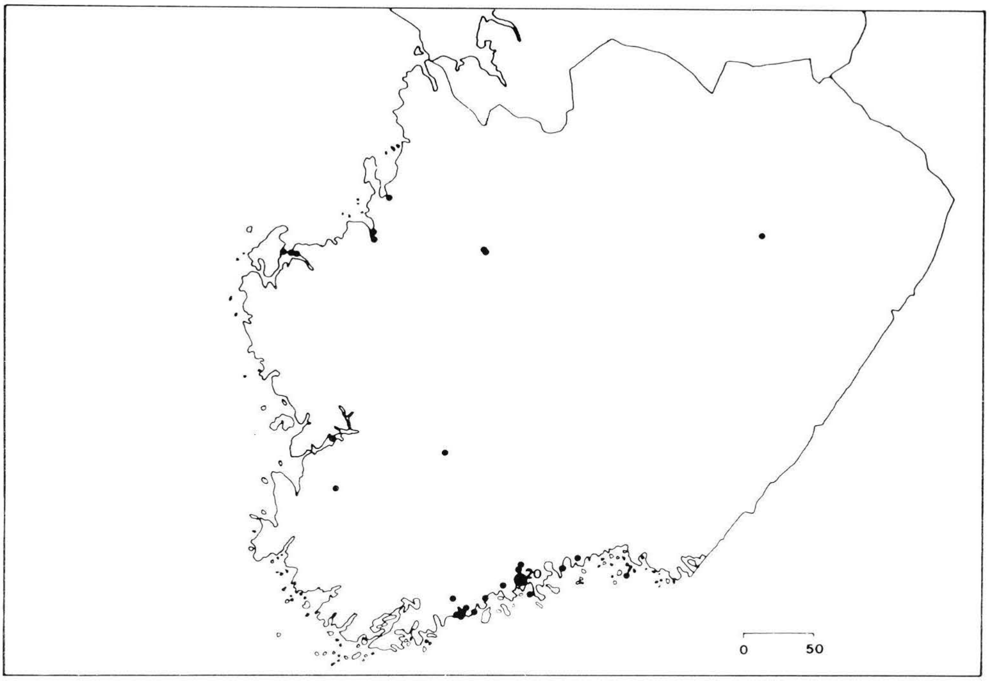
Die im Quarzmaterial Finnlands auftretende, traditionell auf die Endphase der mesolithischen Steinzeit datierte Gruppe von schrägschneidigen Pfeilspitzen aus Quarz vertreten als Mikrogegenstände am klaresten die Mikrolithentradition. Ob man diese »Schrägpfeile» als Mikrolithen einordnen kann, ist noch nicht genauer untersucht worden: aus Mikroklingen sind sie nicht hergestellt worden, wie Feuersteinmikrolithen, auch nicht aus orthodoxen Klingen wie die frühneolithischen Querpfeilspizen in Südskandinavien und Mitteleuropa. Die Auffassungen von den Steinzeitforschern unterschieden sich sogar darin, ob die Querpfeile zu den Mikrolithen gehören und ob der Unterschied zwischen der Herstellungstechnik auf der Grundlage von Mikroklingen oder gewöhnlichen Klingen so gross ist, dass sie einander in verschiedenen Gruppen sich ausschliessen? Von der Funktion her haben sie beide den gleichen Inhalt, obschon die Dreieckmikrolithen zur Verbesserung der Schnitteigenschaften der Seitenteile und bei Querpfeilen zur Effektivierung des Durchschlagsvermögens benutzt werden (Mathiassen 1938, Clark 1934, 1975, Luho 1948, Becker 1952, Brinch Petersen 1966, Welinder 1971).

Die Forschungsgeschichte der schrägschneidigen Pfeilspitzen aus Quarz in Finnland

In den 20er Jahren wurde an dem frühkammkeramischen Siedlungsplatz von Sperrings ein aus Feuerstein hergestellter südskandinavischer (?) Querpfeil gefunden, der für seine Art der einzige Fund in unserem Land geblieben ist. Die Pfeilspitze ist aus einer Feuersteinklinge hergestellt, die retuschierten Seiten biegen sich stark nach innen, die Spitze ist im Feuer hell gebrannt worden. Ihre südskandinavische Herkunft ist nie in Frage gestellt worden (Äyräpää 1927, 1955).

Die Gruppen von schrägschneidigen Spitzen wurde in Finnland seit den 40er Jahren gefunden. Schon von dem im Jahre 1936 untersuchten Siedlungsplatz von Pielisensuu (Joensuu) Mutala verifizierte Pälsi eine »glattschneidige Pfeilspitze, die Seiten schräg geschlagen», also nicht retuschiert (Pälsi & Sauramo 1937). Luho veröffentlichte 1944 die am oberen (I) mesolithischen Siedlungsplatz von Porvoo Henttala von Äyräpää unterschiedenen Spitzen, die aber, auch unretuschiert, nicht die Kriterien der schrägschneidigen Quarzspitzen erfüllen (Luho 1948). Die erste retuschierte Quarz-Pfeilspitze, (NM 11617: 83 Bild Nr. 117) wurde 1946 an dem unteren (II) frühkammkeramischen Siedlungsplatz von Porvoo Henttala gefunden (Luho 1948).

Die Existenz dieser Artefaktgruppe erhielt im nächsten Jahr 1947 seine wirkliche Bestätigung: Bei der Ausgrabung des Siedlungsplatzes von Kurejoki Rasi in Alajärvi bestimmte Luho 38 Pfeilspitzen, darunter allerdings auch unsichere (Luho 1948). Es scheint so, dass das Unterscheiden und Bestimmen von Schrägpfeilschneiden sehr



2. Mesolithische Siedlungsplätze in Süd- und Mittelfinnland, von welchen schrägschneidige Quarzspitzen bekannt sind. Die Uferlinie aus der Zeit des Litorinamaximums, etwa 7700–7500 B.P. gezeichnet.

schwer für die mit der Typologie der Quarzgegenstände unvertrauten Archäologen bei dem für finnische steinzeitliche Siedlungsplätze charakteristisch umfangreichen Quarzmaterial ist. Auch später ist das Erkennen der schrägschneidigen Quarzspitzen fast gänzlich die Aufgabe von Luho geblieben (Luho 1967). Huurre hat auch einige aussondern können (Huurre 1983).

Der Fund der schrägschneidigen Pfeilspitzen von Kurejoki Rasi Alajärvi regte Luho zur Untersuchung der Evolution der Spitzen und des Ursprungs breiter als die Tardenoisien-Strömung an. Luho hat eine Zusammenstellung der Untersuchungen von Menghin (1931) und Schwantes (1933) von vor dem 2. Weltkrieg angefertigt, wobei auch die die Mikrolithen betreffenden Untersuchungen von Brøndsted (1957), Mathiassen (1938) und Becker (1939) zitiert werden (Luho 1948).

Die schrägschneidigen Quarzspitzen

In dieser Untersuchung sind c.a. 150 schrägschneidige Quarzspitzen, die an steinzeitlichen Siedlungsplätzen in Süd- und Mittelfinnland gefunden wurden, die zum Teil schon von Luho veröffentlichten Spitzen von Alajärvi inbegriffen, behandelt worden. 75 Spitzen sind aus Askola, aus Alajärvi 25 und an anderen Siedlungsplätzen wurden 43 von ihnem, bei einer Gesamtmenge von 143, angetroffen. Ausserdem wurden einige von der schrägschneidigen Herstellungstechnik abweichende mögliche Kerbspitzen und retuschierte für die Einsätze geeignete Mikrolithen vorgestellt (Abb. 11, 12). Das Bestimmen von schrägschneidigen Quarzspitzen ist nicht ganz einfach. In der typologischen Einteilung von Luho gibt es für gleichartige Artefakte mehrere verschiedene Bezeichnungen. Die Bezeichnung *querschneidige* Spitze ist ein Sammelbegriff, zu dem *schrägschneidige*, dreiecksförmige Querpfeile und *geradschneidige* trapezförmige Querpfeile gehören. Bei den schrägschneidigen treten zwei Untergruppen auf, die stark und schwach schrägschneidigen. Bei den Funden von Alajärvi kommt auch ein möglicherweiser Rombenpfeil vor. Die von Luho vorgenommene Einteilung scheint in ihrer ganzen Visualität berechtigt zu sein, ist aber unmöglich masslich zu verifizieren. (Abb. 3, 4, 5, 6).

Das angewandte Material ist entsprechend dem Länge-Breite – Index so gemessen worden, dass das Material der Gebiete Askola und Alajärvi als Kuriosität von dem übrigen Material Finnlands getrennt worden ist. (Abb. 7).

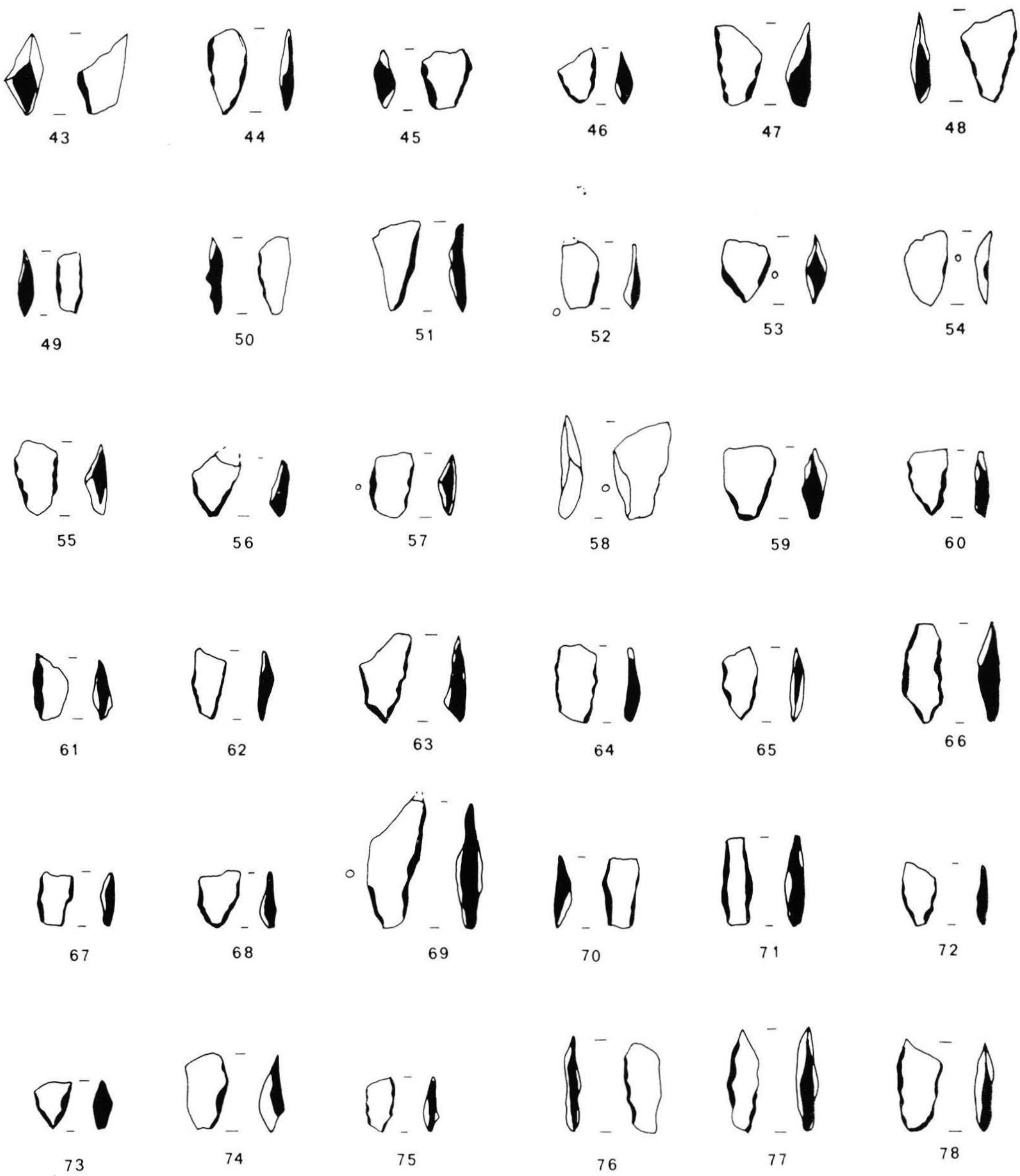
Die Indexverteilung der Spitzen ist sehr homogen, die Spitzen aus Askola und dem übrigen Finnland sind gleichartig, aber die Alajärvi-Gruppe unterscheidet sich etwas von den vorhergehenden, die durchschnittliche Grösse der Spitzen ist etwas grösser. (Abb. 8). Ob der Grössenunterschied in der Praxis Bedeutung hat, kann an Hand der Statistiken nicht geklärt werden. Den Grössenunterschied beeinflusst das zur Verfügung stehende Rohmaterial und die Tradition, welche Gründe auf die in der Statistik schlecht zu unterscheidende Grössenanomalie der Spitzen von Alajärvi gewirkt haben können.

Quarz ist als Silikatoxid (Si02) eines der gewöhnlichsten Mineralien der Welt. Führendste sind Feuerstein, Chert, Jaspis, Obsidian, Agat, usw. aber ihr Fehlen im Gebiet von Fennoscandia, im präkambrischen Felsboden begründen, dass die gefundenen Quarze die wichtigsten Abschlagrohstoff-Quellen in der mesolithischen Steinzeit bilden (Luho 1956, Broadbent 1979). Zum Quarz gehören Verunreinigungen, wie Eisen und Aluminium. Wegen der Deformierung der Kristallstruktur, wie Spalteigenschaften und Zerfallstörungen, sind einige Quarzarten als Rohstoffe sehr gesucht. Es ist kaum eine Frage der Ästhetik, dass die meisten schrägschneidigen Spitzen aus glasklarem Quarzmaterial oder sogar aus Rauch- oder Rosenquarz hergestellt sind. Für die Retuschierung von Kleinartefakten ist am besten möglichst »reiner» (ohne Verunreinigungen) Quarz geeignet. Die strukturelle Uneinheitlichkeit, z.B. die vielzähligen unregelmässig laufenden Bruchflächen, hat es trotzdem nicht verhindert, dass es einige deutliche Spitzen aufweist.

Wie eine schrägschneidige Quarzspitze angefertigt wird und welche Verbindung diese Technik zu den südskandinavischen Parallelformen hat, nennt Luho (1948) über die Herstellungsweise nur die Schneide, die »man durch die Nutzung der langen, scharfen Seiten der Klinge entstehen liess». Auf der Grundlage des untersuchten Materials kann man klären, wie die Spitzen gemacht sind. Da das Schlagen der regelmässigen Klingen aus einem Quarzkern selten gelingt, bildet die Klingentechnik keinen Ausgangspunkt für das Formen von schräg- und geradschneidigen Spitzen wie in Südskandinavien, sondern die Abschläge.

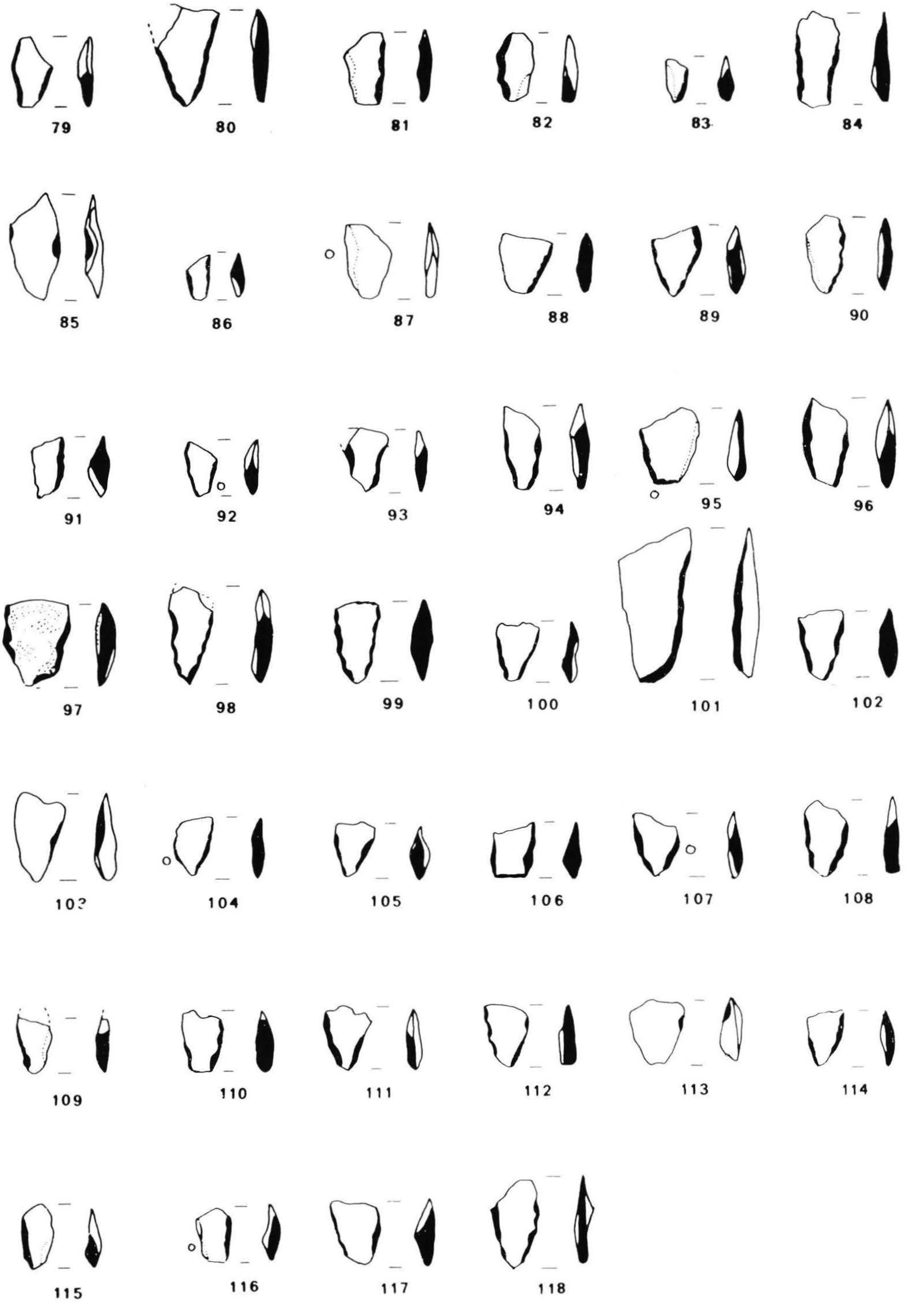
Von einem Quarzkern abgetrennte Abschläge bilden zwei scharfe Seiten (Abb. 9 a). Der Dorsalteil des Abschlages bildet meistens auch die Dorsalseite der Pfeilschneide, die gleichmässiger gebogene Seite, die Ventralseite bildet eher die Unterseite, mit der sich die zur Dorsalseite abgeschrägte schräge Schneide verbindet. Die Seite des Schlagpunktes wird meistens als kürzere Seite der Spitze ausgewählt, da der scharfe Rand des Abschlags sich vom Schlagpunkt schräg anwachsend entwickelt und so eine schräge Schneide bildet. Der Abschlag wird schief der Schlagrichtung entgegengesetzt abgetrennt, wodurch die längere Seite der Spitze entsteht (Abb. 9 b). Wenn der Abschlag ausreichend dick ist, wird die Spitze durch Retuschieren der Seiten und das Formen eines schmalen, an den Schaft anzupassen-

3. Schrägschneidige Quarzspitzen aus dem Gebiet von Askola, (siehe Tabelle 1). 1 : 2.

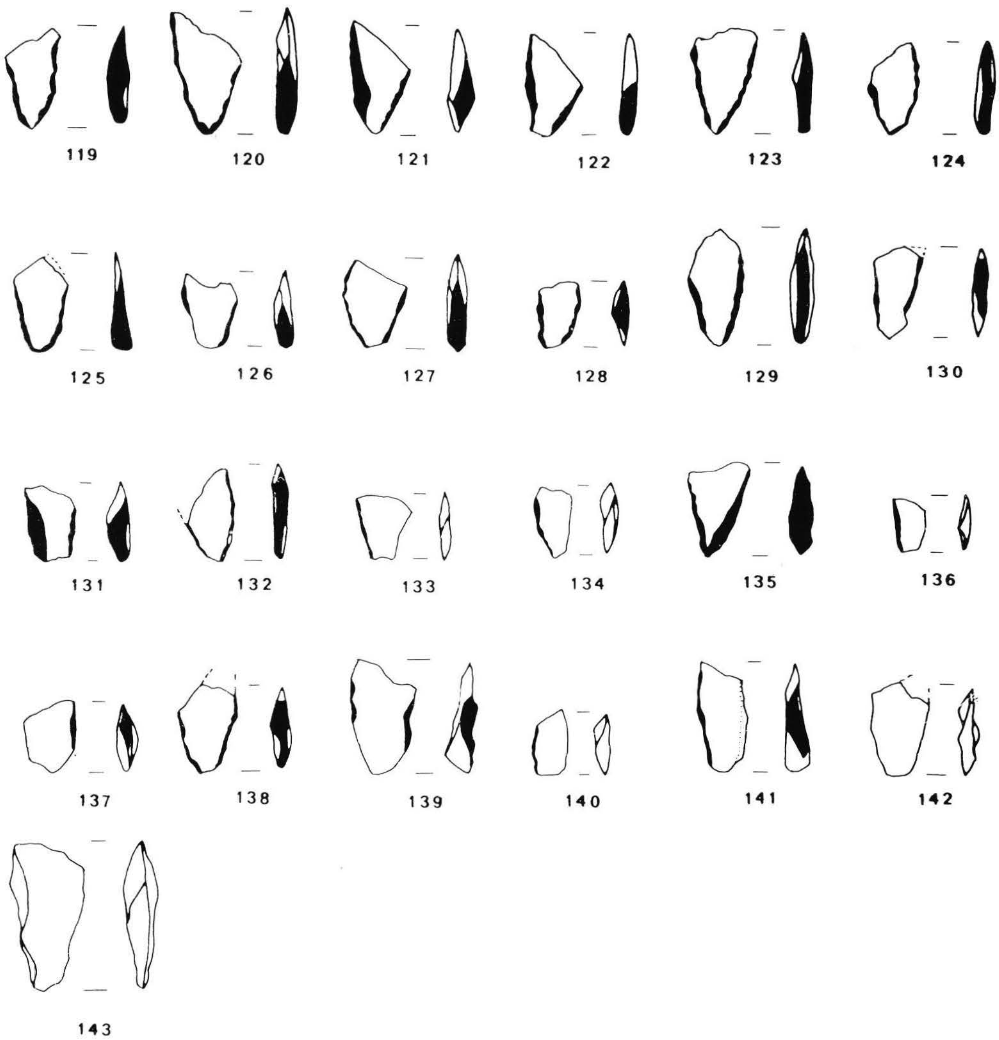


4. Schrägschneidige Quarzspitzen aus dem Gebiet von Askola, (siehe Tabelle 1). 1 : 2.

den Endes vervollkomnet (Abb. 9 c). Wenn aber der Abschlag störend dick ist, wird der an dem Schlagbuckel bleibende »Bulbus» gleichmässig in Richtung der Fläche wegretuschiert. Bei Bedarf kann die Spitze überall entlang der Flächen verdünn werden (Abb. 9 d). Oft wird die längere Seite der Spitze schon durch einen Seitenabschlag fertig geformt, nur die kürzere Seite, das Proximal-Ende wird retuschiert. Die Schneide kann auch durch eine passend gewählte Retusche verbessert werden. Es scheint so, dass das Retuschieren meistens nur auf das Notwendigste begrenzt ist, wenn die Seiten als solche passend sind, mit einigen



5. Schrägschneidige Quarzspitzen aus Süd- und Mittelfinnland. (siehe Tabelle 1). 1 : 2.

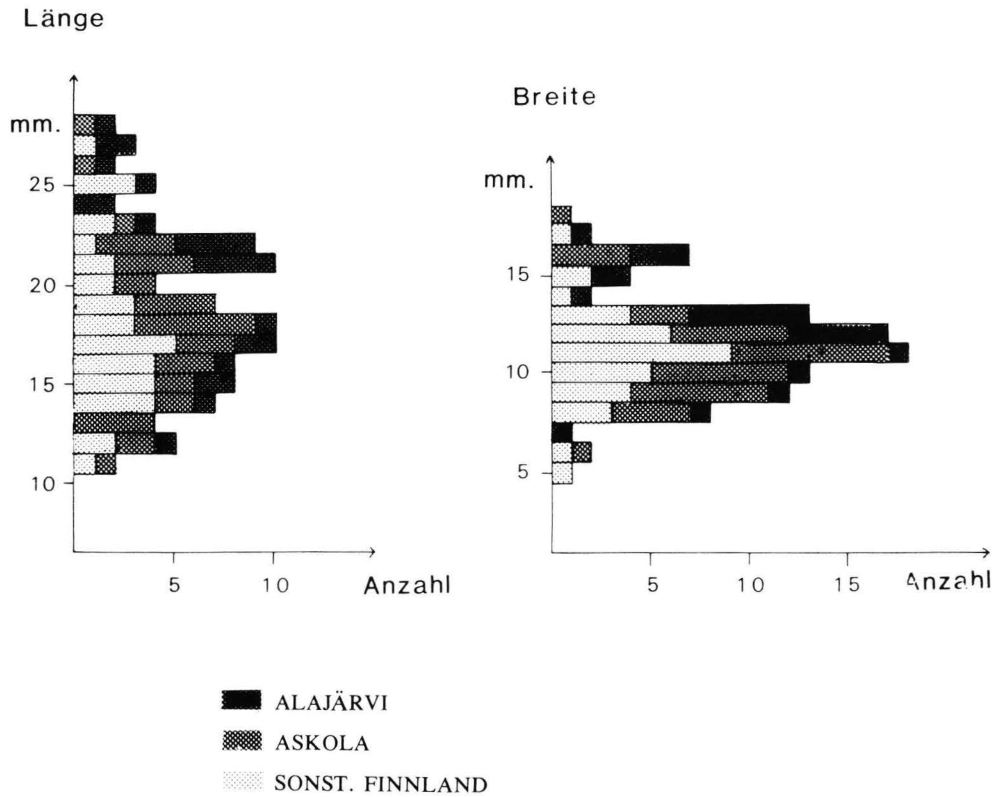


6. Schrägschneidige Quarzspitzen vom Siedlungsplatz Alajärvi Rasi. 1 : 2.

illusorischen Endbearbeitungen wird die Spitze für den Gebrauch akzeptiert. (Abb. 10).

Bei der Herstellung einer schrägschneidigen Quarzspitze dominiert grundsätzlich die oben beschriebene Technik, obwohl dies unzählige Abweichungen einschliesst. Manchmal ist es gelungen, eine klassische Klinge zu lösen, wobei die Methode sehr klar zu erkennen ist, manchmal wiederum ist der Gegenstand zufällig aus einem passenden Abschlag oder Abschlagabfall unter Anpassung an die scharfe Schneide geformt. Ein Bulbus kann sich manchmal am Ende der Spitze befinden, wenn der Abschlag leicht von dieser Seite als Spitze zu formen ist.

Es ist zu berücksichtigen, dass die Auswahl von etwa 150 Spitzen, mit den Mikrolithen, Trapezen und Querpfeilen aus Südskandinavien verglichen, ein vergleichsweise beschränktes Material ist. Es wird möglich gewesen sein, so eine

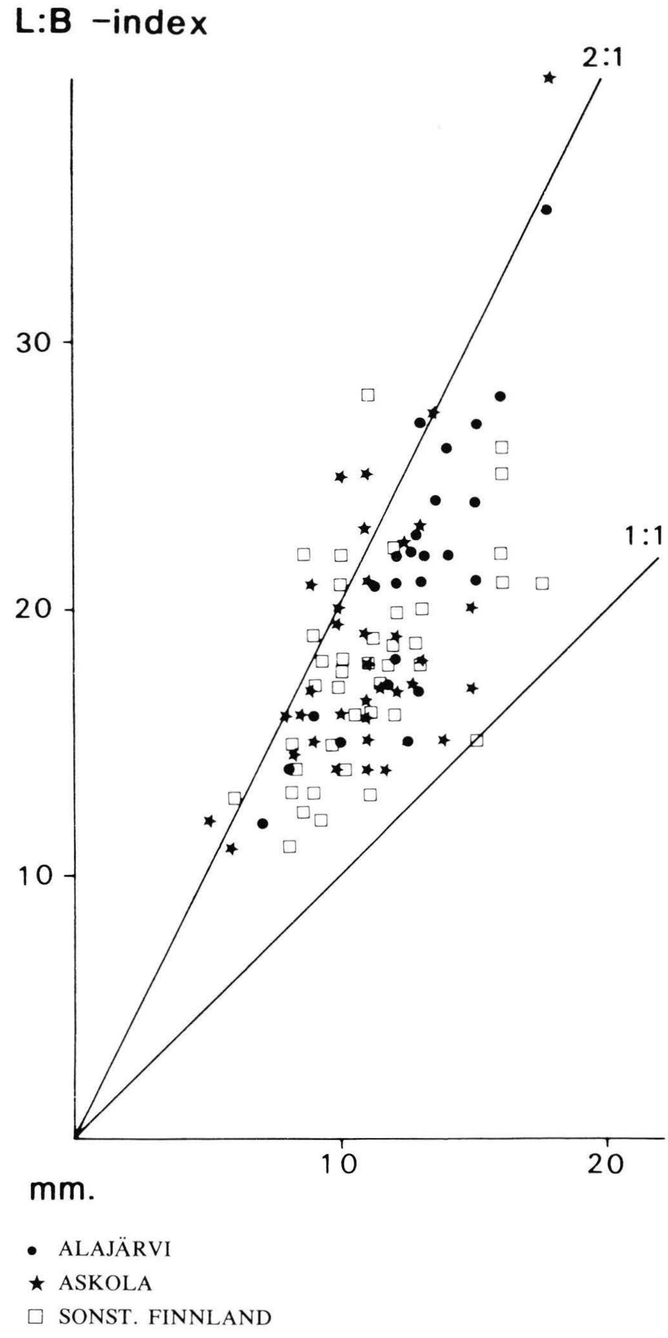


7. Die Längen- und Breitenverteilung von schrägschneidigen Quarzspitzen.

Menge schrägschneidiger Quarzpfeile in der Steinzeit an einem Tag herzustellen. Ausserdem besteht das am Siedlungsort zurückgelassene Material zum grössten Teil aus den Gegenständen, die nach der Herstellung wahrscheinlich nicht für den Gebrauch qualifiziert waren. Der Steinbearbeiter hat eine bestimmte Anzahl der Spitzen angefertigt, mit ihnen seine benötigten Fanggeräte geschärft (Pfeile?), die Überzähligen und die fehlerhaft angefertigten sind mit dem anderen Quarz-Abschlagmaterial am Siedlungsort geblieben (Abb. 9 e).

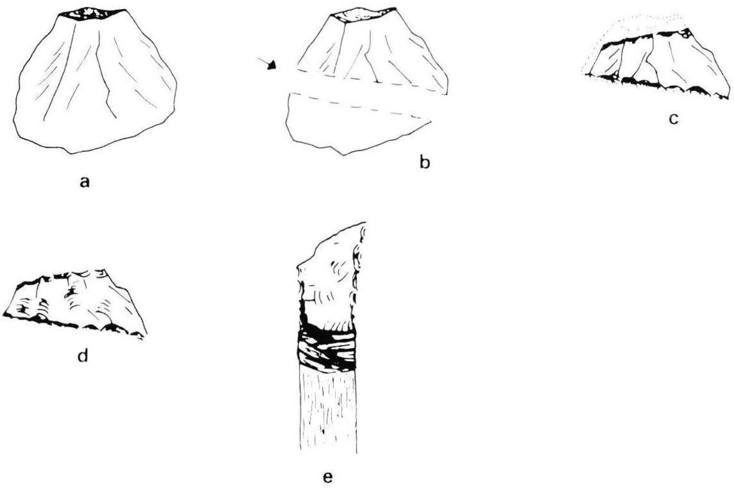
Quarz als hartes Mineral zerbricht leicht, ein Pfeil hat wahrscheinlich nur einen einmaligen Gebrauch ausgehalten. Einziger Zweck der Schneide war vermutlich, das Eindringen des Pfeiles in das zähe dicke Fell eines Grosssäugers zu erleichtern, ballistische oder den Durchschlag verbessernde Eigenschaften hat das leichte Quarz an der Spitze des Pfeiles nicht gehabt.

Dei der Aufgliederung der schrägschneidigen Spitzen ist nach Kriterien zu sehen, nach denen die Seiten des Gegenstandes retuschiert sein müssen (siehe Luho 1967, s. 50, 64). Andererseits wurden fertige unretuschierte Objekte zum Schärfen benutzt. Das kann man mit den von Luho (1948) als Quarzspitzen angenommenen Abschlägen aus Alavus Ojalankangas, begründen, auf deren Oberfläche organische Substanzen auftreten. Entsprechende Stoffe sind am Siedlungsplatz von Lahti Renkomäki Ristola gefundene schrägschneidige Pfeilspitzen nachahmende, unretuschierte Quarze. Es könnte sich um Reste des zur Befestigung gebrauchten Harzes handeln



8. Die Korrelation von Länge und Breite der schrägschneidigen Quarzspitzen.

(NM 18051: 647). Im Zusammenhang mit dieser Untersuchung sind zwei von Luho (1948, 1957) als schrägschneidige eingeordnete unretuschierte Spitzen (Nr 58, 142, 143) vorgestellt worden.

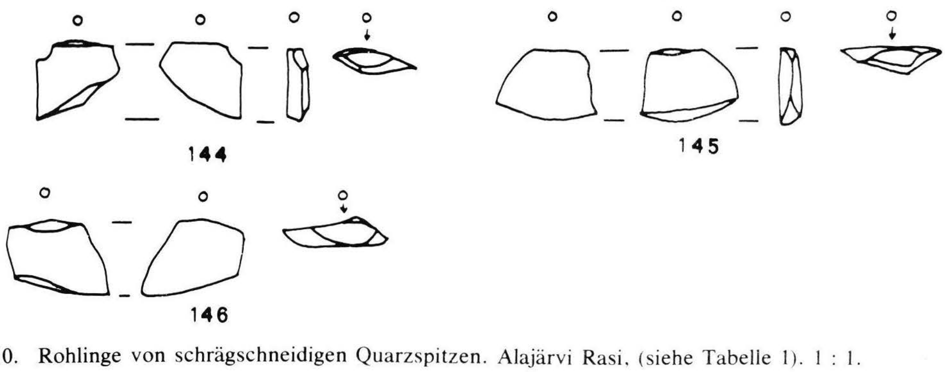


9. Herstellungsart von schrägschneidigen Quarzspitzen.

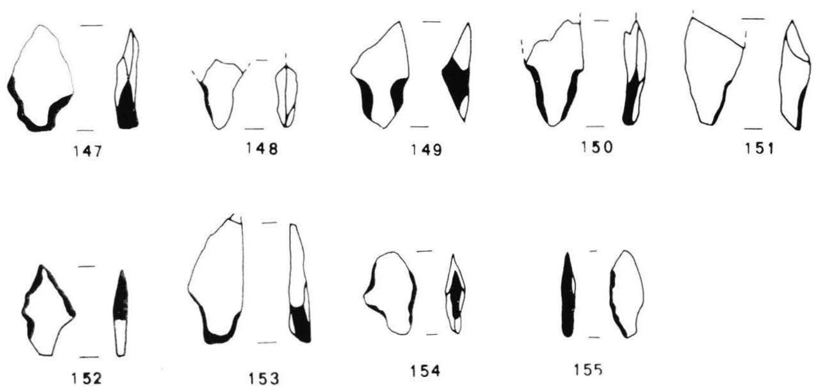
Die Kerbspitzen

In seiner Askola behandelnden Untersuchung hat Luho aus dem Quarzmaterial als Kerbspitzen gedeutete Objekte ausgesondert (Luho 1956, tf. XXII 1–9, tf. LII 1–5, 1967 s. 61). Siiriäinen hält diese Artefakte für Objekte, die der Phantasie Luhos entsprungen sind, zu denen zufällig ein als gekerbt zu deutender Schaft entstanden ist (Siiriäinen 1981). Ein Teil der Spitzen sind als schrägschneidige Spitzen einzuordnen, (Fig. Nr 38–41, vol Luho 1956 tf LII 1–5). (Abb. 11).

Als Kerbspitzen sind einige Quarzspitzen oder ihre angenommenen Schaftreste beschrieben worden (Abb. 11, Nr. 147–155). Kriterium ist der, im Unterschied zu der bei der Herstellung von schrägschneidigen Spitzen verwendeten Technik, kerbartig geformte Schaftteil. Der Ursprung der Objekte scheint sich nicht von den frühmesolithischen skandinavischen Kerbspitzen herzuleiten, auch nicht von den Swidry-Spitzen auf Grundlage der wenigen beschriebenen unsicheren Stücke. Grundlegende klare Beweise für die breite Benutzung von Kerbspitzen in Finnland im Mesolithicum fehlen ganz. Aus Feuerstein hergestellte sog. Epi-Swidry -Spitzen



10. Rohlinge von schrägschneidigen Quarzspitzen. Alajärvi Rasi, (siehe Tabelle 1). 1 : 1.

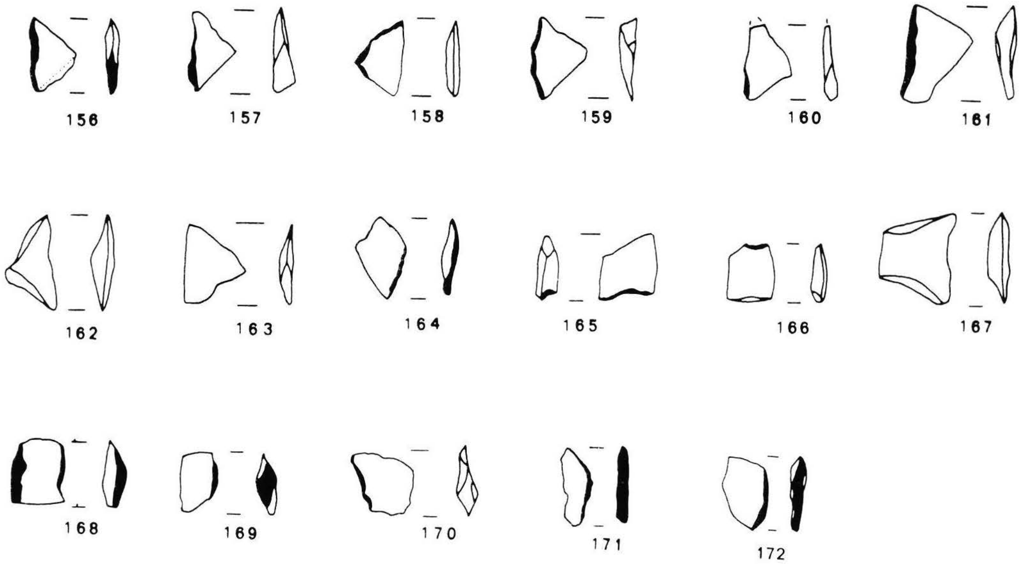


11. Mögliche Kerbspitzen und ihre Fragmente, (siehe Tabelle). 1 : 2.

sind aus Sowjet-Karelien bekannt, u.a. umfangreich von dem bekannten Oleni Ostrov-Gräberfeld (Gurina 1956). Demgegenüber ist aus Finnland keine einzige sichere Spitze und auch nicht die zu Quarzspitzen angepasste »Swidry-Retusche» bekannt. An der Ventralseite des Kerbteiles eines möglichen Spitzenfragments (Nr. 151 Abb. 11) tritt eine sehr undeutliche Überretuschierung auf, die zu den Nachahmungen der Swidry-Technik gehören könnte. Der einzige durch die Grabungsuntersuchung zu begründende Hinweis auf die Swidry-Technik ist unter dem Feuersteinmaterial, das am Siedlungsort von Lahti Renkomäki Ristola gefunden wurde, angetroffen worden. Neben mesolithischem Material wurde an dem Ort neolithische Schnurkeramik gefunden. Edgren, der die Funde kürzlich vorstellte, hat die retuschierten Feuersteinklingen-Bruchstücke als mesolithisch gedeutet, wobei er sie mit den Funden des in Estland befindlichen Siedlungsplatzes Pulli, datiert von der Grenze zwischen Präboreal- und Borealzeit, verglich (Edgren 1984). In der Sammlung des Museums von Kuopio ist eine vollkommen aus braunem Feuerstein hergestellte gekerbte Swidry-Spitze mit unbekannten Funddaten verzeichnet (KuM 2371), aber wegen ihrer Einmaligkeit scheint sie als mögliches »Reisesouvenir» aus dem Ausland nach Finnland gebracht worden zu sein. Der Fund ist um die Jahrhundertwende in das Museum geraten.

Dreieckmikrolithe und Trapeze

Die aus Quarz hergestellten dreieckigen, mit einer Schneide versehenen Objekte sind nicht in klassischem Sinne mit der Mikrosticheltechnik hergestellte, mit den südskandinavischen Feuersteinentsprechungen gleichzusetzende Dreiecksmikrolithe. Die beschriebenen Dreiecksmikrolithen stammen alle vom Siedlungsplatz Alajärvi, Kurejoki Rasi (Abb. 12). Einen Teil davon hat Luho (1948) als Schrägpfeile oder Bruchstücke bestimmt. Fünf davon sind durch Retuschieren, mit dem Ziel, einen dreiecksförmigen Mikrolithen, zu erhalten, der mit einer scharfen Schneide angefertigt ist, geformt. Die Objekte unterscheiden sich klar von den schrägschneidigen Spitzen. Eine passende Befestigungsart ist das Anschärfen der Seite der Knochenspitze oder sonst die Benutzung zusammen mit einer Schrägspitze am Pfeilschaft auf die Art des »Lohult» -Pfeiles (Malmer 1969).



12. Dreieckmikrolithe und Trapeze, (siehe Tabelle 1). 1 : 2.

Die Trapeze, von denen in der Untersuchung sieben vorgestellt werden, sind eines ausgenommen retuschierte Quarzklingenstücke. Die dem Quarzrohmaterial angepasste Klingentechnik, mit der die Trapeze angefertigt worden sind, ist eine der selten auftretenden Gemeinsamkeiten, bei denen man Quarz- und Feuersteintechnik einander gleichsetzen kann. Die Einordnung der aus Quarz gefertigten Trapeze durch Messen kann man nicht genauso leicht wie bei Feuersteintrapezen vornehmen. Der Länge/Breite -Index nähert sich 1: 1. Von den schrägschneidigen Spitzen unterscheiden sie sich klar, von der Funktion her scheinen sie mit den Dreieckmikrolithen identisch zu sein. Mit ihrer Hilfe wurde die schneidende Seite der Spitze geschärft (vo. Gurina 1956, Osibkina 1983).

Die Verbreitung der schrägschneidigen Pfeilspitzen aus Quarz

Die Verbreitung von schrägschneidigen Spitzen umfasst ganz Süd- und Mittelfinnland (Abb. 2). Das Auftreten der Spitzen steht im Verhältnis zu den untersuchten Siedlungsplätzen, unter Inventurfunden werden sie selten angetroffen. Der Grund ist auch klar, nur unter umfangreichem Quarzabschlagmaterial findet man dann und wann Spitzen, als Oberflächenfunde kommen sie selten vor. Aus diesen Gründen befindet sich der Schwerpunkt der Verbreitung auf Grund der Forschungsaktivitäten von Luho in Askola und in Ost-Uusimaa. Genauso sind in Helsinki und in West-Uusimaa auf Grund der Bodennutzung zahlreiche Siedlungsplätze untersucht worden. Die dritte Gruppe befindet sich in Süd-Pohjanmaa, wo Luho auch eine Grabungen durchführte. Die Leere des inneren Finnland liegt an der Siedlungsplätze zerstörenden transgressiven Entwicklung in Seefinnland in der Frühholozänzeit (Saarnisto 1971).

Die östlichste Spitze trifft man in Outokumpu an, die westlich davon gemachten zwei Spitzen sind aus Saarijärvi. Die Spitze aus dem Varsinais-Suomi ist aus

Punkalaidun. Der auf der Verbreitungskarte befindliche Randstreifen ist das obere Ufer des Litorina-Meeres (etwa 7700–7500 B.P.) Die Siedlungsorte des Inlandes ausgenommen, scheinen diese in Verbindung mit dieser Meerphase zu stehen. Die Schrägpfeile treten neben Süd- und Mittelfinnland auch nördlicher auf. Sie wurden u.a. in Suomussalmi Kestilä und Kemijärvi Neitilä gefunden (Huurre 1983, Kehusmaa 1972). Luho erwähnt als unsichere Funde die Spitzen von Säräisniemi, Ranua und Rovaniemi Niska (Luho 1948).

Die Datierung der schrägschneidigen Quarzspitzen

Schrägschneidige Quarzspitzen wurden fast ausschliesslich an den untersuchten Siedlungsplätzen gefunden. Trotzdem steht von diesen Siedlungsplätzen die 14C-Datierung nicht direkt zur Verfügung. Die mit Skandinavien vergleichbare typologische Datierung, auf deren Grundlage sich die schrägschneidigen zu geradschneidigen verändern, kann man in Bezug auf die Quarzspitzen nicht anwenden.

Paradox für die Datierung der Objekte ist gewesen, dass die frühesten Funde, wie die obengenannte Sperringser Importspitze wie auch die erste klar dokumentierte Quarzspitze vom Siedlungsort Porvoo Henttala II, von frühkammkeramischen Siedlungsplätzen stammen, datiert auf etwa 6000–5500 B.P. Die Datierung der Sperrings-Spitze entspricht vollständig der Datierung von südskandinavischen Pfeilspitzen. Auch im Zusammenhang mit dem Fund von Punkalaidun (Nr 101) ist Keramik gefunden worden, die wie frühe Kammkeramik wirkt, die Bestimmung ist aber doch nicht ganz sicher.

Die zur Verfügung stehenden Datierungsmethoden sind die auf der Landhebung und den postglazialen Phasen der Ostsee basierenden Uferverschiebungen und das Auftreten von schrägschneidigen Quarzspitzen an kammkeramischen Siedlungsplätzen, wobei zur Datierung die Keramiktypologie genutzt werden kann (Matiskainen 1983, Luho 1957). Die Erklärung der weitläufigen Methodologie der Uferverschiebungsforschung ist in diesem Zusammenhang nicht begründet. Kursorisch kann man feststellen, dass die Uferverschiebungschronologie die besten Voraussetzungen in Süd-Ostrobotnia hat, wo aufgrund der starken Landhebung die Eustasie in der Ostsee nicht zu erkennen ist. Am Finnischen Meerbusen, im Gebiet von Askola kann die Datierung wegen der geringeren Landhebung nicht genauso präzise durchgeführt werden. Die Datierungen sind auch in dem Falle unsicher, wenn die Siedlungsplätze sich nicht am Ufer des postglazialen Balticum befunden haben. Die kritischste Weise, die Uferverschiebungsdatierung zu benutzen, ist *terminus post quem* – zu datieren, also die Situation, in der Quarzspitzen umfassende Siedlungsplätze frühestens vorhanden gewesen sein könnten.

In Ostrobotnien umfassen die Siedlungsplätze von Alajärvi, Kuortane und Kurikka Querschneidpfeilspitzen, die sich auf einem Höhengürtel von 92–80 m über dem heutigen Meeresspiegel befinden. Auf dieser Grundlage ist der *terminus ante quem* 7700 B.P. *und post quem* 6700 B.P. (Matiskainen 1983, Salomaa & Matiskainen 1983).

Im Gebiet von Askola und Helsinki ist der Meeresspiegel etwa 2000 Jahre, etwa 8000–6000 B.P. auf dem gleichen Niveau von 30–33 ü.d.M. geblieben (Matiskainen 1983, Hyvärinen 1980). Die genannte Henttala Spitze datiert sich auf 6000 Jahre in die jüngere, frühkammkeramische Periode. Dennoch gibt das rege Auftreten der Spitzen in der späteren Phase des Mesolithicums, genauer horizontal dem frühkammkeramischen Fundniveau der Ostsee, Grund zur Annahme, dass der zeitliche

Schwerpunkt der Objektgruppe etwa im 5. Jahrtausend B.P., etwa 6500 B.P. zu bemerken ist. Die Spitzen treten auch oft gemeinsam mit den südfinnischen Geradmeisseln auf. Diese Gegenstandsgruppe entsteht auch in der Endphase der mesolithischen Steinzeit, der sog. »Kisko» -Phase. Die relative Datierung ist schon seit den 40er Jahren verwirklicht worden (Luho 1948, Äyräpää 1950, Luho 1967, Siiriäinen 1981).

Luho stellte ein Reihe keramischer Siedlungspläze vor, an denen nach ihm schrägschneidige Quarzspitzen angetroffen wurden. Nach Luho sah es so aus, dass die querschneidigen Spitzen vorkeramische wären, aber seltener als geradschneidige noch in der kammkeramischen Periode auftreten. Bei dieser Schlussfolgerung leitete er die schon bekannte skandinavische Entwicklungslinie ein, die Formung von schrägen zu geradschneidigen in der neolithischen Steinzeit. Später behandelte Luho (1957) das Verhältnis von querschneidigen Spitzen und der Frühkammkeramik an den Siedlungsplätzen von Ost-Uusimaa. Der interessanteste Siedlungsplatz ist Askola Siltapellonhaka, der zwei in drei Meter Höhe befindliche Fundgürtel behandelt. Der untere ist »rein» vorkeramisch aber am oberen Fundgürtel ist im Zusammenhang mit vorkeramischem Material auch spärlich frühe Kammkeramik gefunden worden, Äyräpääs Stilphase I: 1, »älteste Stufe». Querschneidige Spitzen sind am unteren Gürtel vier und am oberen 14 gefunden worden (Nr 25–28, 59–72). Es ist trotzdem wahrscheinlich, dass die Keramik sekundär ist und eine spätere Siedlungsphase des früheren vorkeramischen Siedlungsplatzes. Auf Grund des Siedlungplatzes von Askola Siltapellonhaka erhält man keine vollständige Sicherheit, ob die querschneidige Spitze auch zur frühkeramischen Zeit im Gebrauch gewesen ist.

Auch vom Siedlungsplatz von Lapinjärvi Gammelby sind querschneidige Spitzen bekannt (Luho 1957). Mit Sicherheit kann trotzdem nicht aufgezeigt werden, ob sich am Siedlungsplatz auch eine spätkeramische Siedlungsphase verbirgt, worauf ein an diesem Wohnplatz gefundener südfinnischer Quermeissel hinweisen würde. Man kann ausserdem noch das Auftreten der südfinnischen Quermeissel am Siedlungsplatz Liljendal Kvarnbacken nennen (Rauhala 1977). Querschneidige Spitzen kennt man aus dem Material von Kvarnbacken nicht. Die stabile Position des Meeresspiegels in der Anfangsphase der Litorinazeit in Ost-Uusimaa wirkt auf das Umreissen einer klaren Uferverschiebungs-kronologischen Grenze zwischen der frühkeramischen und keramischen Grenze (Nunez 1978).

Zusammenfassung

Schrägschneidige aus Quarz geformte Spitzen beschränken sich kaum auf das Gebiet von Finnland, obwohl in den umgebenden Gebieten aus Quarz hergestellte nicht festgestellt wurden. Wahrscheinlich treten sie wenigstens unter den spätmesolithischen Funden im Gebiet von Onega auf, da das Material sonst sehr an das entsprechende finnische Fundmaterial erinnert. Bei Verbreitung einer Volga-Oka beeinflussten Feuersteinkultur in Südost–Onega trifft man Trapeze wenn auch keine klaren Schrägpfeile an (Koltsov 1973, Gurina 1977, Pankrusev 1978). Einige einzelne Trapezfunde beschreibt Gurina (1977 Abb. 1) am Südufer von Kola. Aus dem Gebiet von Ruija sind auch Schrägspitzen bekannt (Odner 1966). Im nördlichsten Teil, im Zusammenhang mit der Swidry-beeinflussten Kultur, wurde am Feuerstein und Quarz beinhaltenden Siedlungsplatz Pesmog I an den Flüssen Pechora und Wytschegda eine querschneidige Pfeilspitze gefunden (Burov 1979 S. 139). Die Swidry- oder Episwidry -Technik scheint im Gebiet von Weiss- und Nordwestrussland während der ganzen frühmesolithischen Periode vorherrschend gewesen zu sein.

Beim Verfolgen der Entwicklung im Ostbaltikum, in Litauen, im Kerngebiet der Epi-Swidry -Technik am Neman-Fluss erschienen neben dieser Technik Trapeze und Querpfeile, die sich auf die Maximalphase der Litorina-Transgression datieren (Rimantiene 1973). Die südskandinavischen Trapeze kommen etwa 7700 B.P. in der Kongemose-Phase, etwa 7000 B.P. erscheinen querschneidige Pfeilspitzen (Brinch Petersen 1973, Gullberg 1972). Die Mikrosticheltechnik scheint beim Erscheinen der transversen Spitzen in der Ageröd V -Phase etwa 7000 B.P. das Gebiet von Südschweden zu umfassen (Larsson 1973, 1978).

Es scheint wahrscheinlich, dass keine bestimmte aus Feuerstein hergestellte Spitzenform auf das Entstehen der finnischen, schrägschneidigen Spitzen aus Quarz eingewirkt hat. Vielmehr scheint es sich um eine Innovation zu handeln, wobei die am Pfeil passierende Entwicklung eine Spitze empfähle, die keine in Längsrichtung behandelte oder verfeinerte Klinge oder Mikroklinge ist, wie die Swidry- und Kerbspitzen, sondern die scharfe Schneide der Klinge erhält eine grössere Bedeutung. So ist es mit Hilfe der Quarztechnik möglich gewesen, auch die Entwicklung zu verfolgen, da man grobe, grosse Abschläge, wie Feuersteinklingen zu schrägen Spitzen bearbeiten konnte. Die Mikroklingentechnik konnte man nie systematisch an das Quarz anpassen.

Es ist natürlich daran zu erinnern, dass sich in Finnland nach Luho kein einziger Archäologe genauso umfassend mit der Untersuchung der mesolithischen Siedlungsplätze befasst hat. Zu Luhos Zeit machte man sich oft der ungenauen Ausgrabungsdokumentation schuldig, wobei Quarze kleiner Grösse nicht aufbewahrt wurden. Das hat sich naturlich auf das Entstehen neuer Erkenntnisse über eine eventuelle an Quarz angepasste Mikroklingentechnik ausgewirkt.

Auf Grundlage der vorgelegten Untersuchung kann man über die Schrägspitzen und Mikrolithen des finnischen Mesolithicums folgende Schlussfolgerungen ziehen:

- Die Mikrolithtechnik ist auf Grundlage der Funde von Antrea seit dem Frühmesolithicum benutzt worden, die Form der Mikrolithen ist nicht dokumentiert.
- Die schrägschneidigen Quarzspitzen sind die aus dem mesolithischen Quarzmaterial am klarsten zu unterscheidende Mikrolithengruppe. In Material treten vereinzelt retuschierte dreiecksförmige und Trapeze nachahmende Mikrolithen auf.
- Die Stellung der Kerbspitzen aus Quarz im mesolithischen Fundmaterial ist bis auf weiteres fraglich.
- Das Erscheinen der schrägschneidigen Quarzpfeilspitzen entspricht zeitlich dem Erscheinen der Trapeze und querschneidigen Pfeilspitzen in Südskandinavien, etwa 7 500—7000 B.P.
- Die schrägschneidigen Spitzen verschwanden in der frühen kammkeramischen Periode aus dem Gebrauch.

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Tabelle 1. **In der Untersuchung vorgestellte schrägschneidige Quarzspitzen**

1.	NM 12789: 37	ASKOLA KORTTIA LEPISTÖ
2.	NM 12273: 6	ASKOLA VAKKOLA LATONIITTY JUNGFERN
3.	NM 13142: 4	ASKOLA VAKKOLA SILTA-ARO
4.	NM 12603: 90	ASKOLA PAPPILA PERUNAMAA-SAUNAPELTO
5.	NM 12761: 3a	ASKOLA PAPPILA PERUNAMAA-SAUNAPELTO
6.	NM 12761: 3b	ASKOLA PAPPILA PERUNAMAA-SAUNAPELTO
7.	NM 13068: 2	ASKOLA PAPPILA PERUNAMAA-SAUNAPELTO
8.	NM 13608: 102	ASKOLA PAPPILA PERUNAMAA-SAUNAPELTO
9.	NM 13608: 242	ASKOLA PAPPILA PERUNAMAA-SAUNAPELTO
10.	NM 13068: 146	ASKOLA PAPPILA PERUNAMAA-SAUNAPELTO (Strahlschiefer)
11.	NM 12276: 5	ASKOLA NALKKILA ETULINNA-KOTOPELTO
12.	NM 18599: 3	ASKOLA NALKKILA ROKKI RANTAPELTO
13.	NM 12159: 80	ASKOLA PUHARONKIMAA JÄRVENSUO
14.	NM 12159: 81	ASKOLA PUHARONKIMAA JÄRVENSUO
15.	NM 12159: 92	ASKOLA PUHARONKIMAA JÄRVENSUO
16.	NM 12788: 19	ASKOLA PUHARONKIMAA JÄRVENSUO
17.	NM 12940: 20a	ASKOLA PUHARONKIMAA JÄRVENSUO
18.	NM 12940: 20b	ASKOLA PUHARONKIMAA JÄRVENSUO
19.	NM 12431: 3	ASKOLA VAKKOLA LATONIITTY
20.	NM 12431: 1	ASKOLA VAKKOLA LATONIITTY
21.	NM 12605: 22	ASKOLA VAKKOLA JUSLAN SUURSUO
22.	NM 12605: 32	ASKOLA VAKKOLA JUSLAN SUURSUO
23.	NM 12605: 42	ASKOLA VAKKOLA JUSLAN SUURSUO
24.	NM 12605: 55	ASKOLA VAKKOLA JUSLAN SUURSUO
25.	NM 12601: 25	ASKOLA PAPPILA SILTAPELLONHAKA II
26.	NM 12601: 43	ASKOLA PAPPILA SILTAPELLONHAKA II
27.	NM 12601: 52	ASKOLA PAPPILA SILTAPELLONHAKA II
28.	NM 12601: 62	ASKOLA PAPPILA SILTAPELLONHAKA II
29.	NM 12260: 88	ASKOLA NALKKILA ROKIN VALKAMAA
30.	NM 12260: 175	ASKOLA NALKKILA ROKIN VALKAMAA
31.	NM 12260: 194	ASKOLA NALKKILA ROKIN VALKAMAA
32.	NM 12260: 195	ASKOLA NALKKILA ROKIN VALKAMAA
33.	NM 12260: 234	ASKOLA NALKKILA ROKIN VALKAMAA

34.	NM 12260: 237	ASKOLA NALKKILA ROKIN VALKAMAA
35.	NM 12372: 16	ASKOLA NALKKILA ETULINNA RUOKSMAA B
36.	NM 12372: 17	ASKOLA NALKKILA ETULINNA RUOKSMAA B
37.	NM 18568: 1	ASKOLA MONNI PÖÖKÄRI KOTOPELTO
38.	NM 12661: 350	ASKOLA NALKKILA KOPINKALLIO
39.	NM 12929: 136	ASKOLA NALKKILA ETULINNA RUOKSMAA A
40.	NM 12929: 187	ASKOLA NALKKILA ETULINNA RUOKSMAA A
41.	NM 12929: 293	ASKOLA NALKKILA ETULINNA RUOKSMAA A
42.	NM 12506: 11	ASKOLA NIETOO MATTILA TALLIKÄÄRÖ
43.	NM 12934: 171	ASKOLA NIETOO MATTILA TALLIKÄÄRÖ
44.	NM 12934: 173	ASKOLA NIETOO MATTILA TALLIKÄÄRÖ
45.	NM 12937: 25	ASKOLA NIETOO MATTILA TALLIKÄÄRÖ
46.	NM 12947: 5	ASKOLA PAPPILA PERUNAMAA
47.	NM 13067: 278	ASKOLA NALKKILA TAKALAN RUOKSMAA
48.	NM 13067: 302	ASKOLA NALKKILA TAKALAN RUOKSMAA
49.	NM 13067: 326	ASKOLA NALKKILA TAKALAN RUOKSMAA
50.	NM 13067: 358	ASKOLA NALKKILA TAKALAN RUOKSMAA
51.	NM 13067: 368	ASKOLA NALKKILA TAKALAN RUOKSMAA
52.	NM 13067: 387	ASKOLA NALKKILA TAKALAN RUOKSMAA
53.	NM 13067: 446	ASKOLA NALKKILA TAKALAN RUOKSMAA
54.	NM 13067: 656	ASKOLA NALKKILA TAKALAN RUOKSMAA
55.	NM 13138: 6	ASKOLA VAKKOLA TYYSKÄ
56.	NM 12260: 32	ASKOLA NALKKILA VALKAMAA VON ROKKI
57.	NM 12346: 17	ASKOLA NALKKILA VALKAMAA VON ROKKI
58.	NM 12364: 12	ASKOLA VAKKOLA SILTAPELTO, (unret.)
59.	NM 12600: 6	ASKOLA VAKKOLA SILTAPELLONHAKA I
60.	NM 12600: 25	ASKOLA VAKKOLA SILTAPELLONHAKA I
61.	NM 12600: 65	ASKOLA VAKKOLA SILTAPELLONHAKA I
62.	NM 12600: 79	ASKOLA VAKKOLA SILTAPELLONHAKA I
63.	NM 12600: 81	ASKOLA VAKKOLA SILTAPELLONHAKA I
64.	NM 12600: 94	ASKOLA VAKKOLA SILTAPELLONHAKA I
65.	NM 12600: 95	ASKOLA VAKKOLA SILTAPELLONHAKA I
66.	NM 12600: 126	ASKOLA VAKKOLA SILTAPELLONHAKA I
67.	NM 12600: 135	ASKOLA VAKKOLA SILTAPELLONHAKA I
68.	NM 12600: 187	ASKOLA VAKKOLA SILTAPELLONHAKA I
69.	NM 12933: 842	ASKOLA VAKKOLA SILTAPELLONHAKA I
70.	NM 12933: 1090	ASKOLA VAKKOLA SILTAPELLONHAKA I
71.	NM 12933: 288	ASKOLA VAKKOLA SILTAPELLONHAKA I
72.	NM 12933: 419	ASKOLA VAKKOLA SILTAPELLONHAKA I
73.	NM 12603: 6	ASKOLA VAKKOLA PERUNAMAA
74.	NM 12603: 54	ASKOLA VAKKOLA PERUNAMAA
75.	NM 12613: 6	ASKOLA PAPPILA
76.	NM 9759: 58	LAPINJÄRVI GAMMELBY
77.	NM 9759: 71	LAPINJÄRVI GAMMELBY
78.	NM 9759: 86	LAPINJÄRVI GAMMELBY
79.	NM 16416: 4	KAUHAJOKI KAINASTO KOIVUMÄKI
80.	NM 16416: 10	KAUHAJOKI KAINASTO KOIVUMÄKI
81.	NM 16163: 23	KUORTANE MÄYRY HAAVISTONHARJU
82.	NM 16163: 50	KUORTANE MÄYRY HAAVISTONHARJU
83.	NM 16163: 53	KUORTANE MÄYRY HAAVISTONHARJU
84.	NM 16163: 122	KUORTANE MÄYRY HAAVISTONHARJU
85.	NM 16856: 3	KUORTANE YLIJOKI LAHDENKANGAS
86.	NM 16856: 13	KUORTANE YLIJOKI LAHDENKANGAS
87.	NM 16856: 19	KUORTANE YLIJOKI LAHDENKANGAS
88.	NM 16856: 24	KUORTANE YLIJOKI LAHDENKANGAS
89.	NM 16856: 38	KUORTANE YLIJOKI LAHDENKANGAS
90.	NM 16564: 97	KURIKKA PITKÄMÖ PALOMÄKI
91.	NM 16564: 133	KURIKKA PITKÄMÖ PALOMÄKI
92.	NM 16680: 13	KURIKKA PITKÄMÖ PALOMÄKI
93.	NM 16680: 30	KURIKKA PITKÄMÖ PALOMÄKI
94.	NM 17486: 100	KURIKKA TOPEE

95.	NM 17077: 34	KURIKKA MÄKI-VENNA
96.	NM 9106: 7	LAPINJÄRVI BACKMANSBACKEN
97.	NM 9851: 27	LAPINJÄRVI ANTASBACKEN (Grünschiefer)
98.	NM 16822: 638	LUOPIOINEN HIETANIEMI
99.	NM 16822: 870	LUOPIOINEN HIETANIEMI
100.	NM 19787: 10	NURMIJÄRVI ALITALO
101.	NM 13669: 394	PUNKALAIDUN HANKURI RAUTEE
102.	NM 18092: 3	SAARIJÄRVI KALMUNKANGAS
103.	NM 12234: 3	SAARIJÄRVI SUMMASSAARI
104.	NM 12234: 337a	SAARIJÄRVI SUMMASSAARI
105.	NM 12234: 337b	SAARIJÄRVI SUMMASSAARI
106.	NM 20873: 110	SIUNTIO SUITIA
107.	NM 20873: 207	SIUNTIO SUITIA
108.	NM 20873: 205	SIUNTIO SUITIA
109.	NM 20873: 267	SIUNTIO SUITIA
110.	NM 18959: 75	VANTAA KAIVOKSELA GRÖNDAL 2
111.	NM 20164: 212	VANTAA KOIVUKYLÄ 5
112.	NM 20164: 224	VANTAA KOIVUKYLÄ 5
113.	NM 20164: 233	VANTAA KOIVUKYLÄ 5
114.	NM 19423: 14	VANTAA URHEILUPUISTO
115.	NM 19423: 23	VANTAA URHEILUPUISTO
116.	NM 19423: 19	VANTAA URHEILUPUISTO
117.	NM 11617: 83	PORVOO HENTTALA II
118.	NM 19430: 25	VANTAA ERIKAS
119.	NM 11771: 7	ALAJÄRVI KUREJOKI RASI
120.	NM 11771: 3	ALAJÄRVI KUREJOKI RASI
121.	NM 11771: 2	ALAJÄRVI KUREJOKI RASI
122.	NM 11771: 4	ALAJÄRVI KUREJOKI RASI
123.	NM 11771: 8	ALAJÄRVI KUREJOKI RASI
124.	NM 11771: 18	ALAJÄRVI KUREJOKI RASI
125.	NM 11771: 16	ALAJÄRVI KUREJOKI RASI
126.	NM 11771: 9	ALAJÄRVI KUREJOKI RASI
127.	NM 11771: 11	ALAJÄRVI KUREJOKI RASI
128.	NM 11771: 10	ALAJÄRVI KUREJOKI RASI
129.	NM 11771: 17	ALAJÄRVI KUREJOKI RASI
130.	NM 11895: 2	ALAJÄRVI KUREJOKI RASI
131.	NM 11895: 66	ALAJÄRVI KUREJOKI RASI
132.	NM 11895: 91	ALAJÄRVI KUREJOKI RASI
133.	NM 11895: 51	ALAJÄRVI KUREJOKI RASI
134.	NM 11895: 116	ALAJÄRVI KUREJOKI RASI
135.	NM 11895: 85	ALAJÄRVI KUREJOKI RASI
136.	NM 11895: 119	ALAJÄRVI KUREJOKI RASI
137.	NM 11771: 20	ALAJÄRVI KUREJOKI RASI
138.	NM 11771: 25	ALAJÄRVI KUREJOKI RASI
139.	NM 11771: 6	ALAJÄRVI KUREJOKI RASI
140.	NM 11771: 32	ALAJÄRVI KUREJOKI RASI
141.	NM 11771: 15	ALAJÄRVI KUREJOKI RASI
142.	NM 11771: 26	ALAJÄRVI KUREJOKI RASI (unretuschiert)
143.	NM 11771: 1	ALAJÄRVI KUREJOKI RASI (unretuschiert)

ROHLINGE VON SCHRÄGSCHNEIDIGEN QUARZSPITZEN

144.	NM 11771: 28	ALAJÄRVI KUREJOKI RASI
145.	NM 11771: 13	ALAJÄRVI KUREJOKI RASI
146.	NM 11771: 30	ALAJÄRVI KUREJOKI RASI

KERBSPITZEN AUS QUARZ

147.	NM 20164: 100	VANTAA KOIVUKYLÄ 5
148.	NM 12940: 21	ASKOLA PUHARONKIMAA JÄRVENSUO
149.	NM 17131: 69	LUOPIOINEN HIETANIEMI

150.	NM 12601: 68	ASKOLA PAPPILA SILTAPELLONHAKA
151.	NM 10057: 4	TUUSULA RUOTSINKYLÄ (Streufund)
152.	NM 17131: 888	LUOPIOINEN HIETANIEMI (Schneide retuschiert)
153.	NM 11895: 26	ALAJÄRVI KUREJOKI RASI
154.	NM 11771: 43	ALAJÄRVI KUREJOKI RASI
155.	NM 12934: 172	ASKOLA NIETOO MATTILA TALLIKÄÄRÖ

DREIECKMIKROLITHE UND TRAPEZE

156.	NM 11895: 108	ALAJÄRVI KUREJOKI RASI
157.	NM 11895: 3	ALAJÄRVI KUREJOKI RASI
158.	NM 11771: 24	ALAJÄRVI KUREJOKI RASI
159.	NM 11771: 5 ?	ALAJÄRVI KUREJOKI RASI
160.	NM 11895: 42	ALAJÄRVI KUREJOKI RASI
161.	NM 11771: 22	ALAJÄRVI KUREJOKI RASI
162.	NM 11895: 128	ALAJÄRVI KUREJOKI RASI (unretuschiert)
163.	NM 11771: 31	ALAJÄRVI KUREJOKI RASI (unretuschiert)
164.	NM 11771: 29	ALAJÄRVI KUREJOKI RASI
165.	NM 11771: 5 ?	ALAJÄRVI KUREJOKI RASI
166.	NM 11771: 23	ALAJÄRVI KUREJOKI RASI
167.	NM 11771: 21	ALAJÄRVI KUREJOKI RASI (unretuschiert)
168.	NM 16880: 46	KURIKKA PITKÄMÖ PALOMÄKI
169.	NM 12159: 87	ASKOLA PUHARONKIMAA JÄRVENSUO
170.	NM 12606: 71	ASKOLA NALKKILA ROKIN VALKAMAA
171.	NM 12601: 32	ASKOLA PAPPILA SILTAPELLONHAKA (Segmente)
172.	NM 12933: 1096	ASKOLA VAKKOLA SILTAPELLONHAKA II

NICHT VORGESTELLTE BEKANNTE SPITZEN

NM 17541	KYMI SAKSALA SAUKKO, (Kotka Museum)
NM 20019	OUTOKUMPU SYSMÄ KAALAINSALMI, (Outokumpu Museum)
NM 18836, 19275	VANTAA JÖNSAS

DIE VON M. HUURRE (1983) GENANNTEN SCHRÄGSCHNEIDIGEN PFEILE AUS DEN GEBIETEN VON OSTROBOTNIA UND LAPPLAND

NM 19030: 32	HAAPAJÄRVI TERVAMÄKI
NM 14536: 55	NIVALA JÄRVENPÄÄ
NM 17062: 57	KESTILÄ PÄIVÄRINNE
NM 14831: 158a	SUOMUSSALMI KELLOLAISEN TULI
NM 16145: 1750	KEMIJÄRVI NEITILÄ 4
NM 16553: 794	KEMIJÄRVI NEITILÄ 4
NM 16553: 1637	KEMIJÄRVI NEITILÄ 4
NM 15846: 78	KEMIJÄRVI LAUTASALMI (Feuerstein ?)

Heikki Matiskainen:

Geradmeissel vom südfinnischen Typ, spätmesolithische Gegenstandsgruppe

Einleitung

Äyräpää (1950), der danach strebte bei der »Suomusjärvi-Kultur» drei Abschnitte zu unterscheiden, benannte die Spätphase des Mesolithikums mit »Kisko-Stufe», deren wichtigsten Leitgegenstand neben den Quarzspitzen der Geradmeissel vom südfinnischen Typ vertrat. Der sich von seiner Verbreitung her hauptsächlich auf das Gebiet von Uusimaa begrenzende Geradmeissel vom südfinnischen Typ wird in der archäologischen Alltagssprache so auch »Kiskoer Axt» genannt. Diese zwei die spätmesolithische Steinzeit charakterisierenden Gegenstandsformen, die Geradmeissel vom südfinnischen Typ und die schrägschneidigen Quarzspitzen sind uferverschiebungschronologisch als zum Litorinamesolithikum, etwa 7700—6000 b.p., gehörend datiert worden (Matiskainen 1985).

Geradmeissel vom südfinnischen Typ sind im Verlaufe von hundert Jahren schätzungsweise 300 Stück als Streufunde im Nationalmuseum, sowie in den Provinz- und Gemeindemuseen gesammelt worden. Bei Ausgrabungen von Siedlungsplätzen sind sie dagegen selten gefunden worden. In West-Uusimaa waren auch die Rettungsgrabungen nicht auf Wohnplätze der spätmesolithischen Steinzeit gerichtet. In der Gemeinde Kisko, in der die Funddichte der Gegenstände traditionell für grösser gehalten worden ist, sind überhaupt keine Grabungen durchgeführt worden. Im Gebiet der Hauptstadt am Siedlungsplatz von Jönsas, Vantaa sind einige Meissel gefunden worden (Purhonen 1984). Auch vom spätmesolithischen Siedlungsplatz Suitia, Siuntio gibt es das Fragment eines Geradmeissels vom südfinnischen Typ (Heikkurinen 1982). Die mit den Meisseln verbunde Information basiert somit nur auf Streufunden und Siedlungsplatzinventarisierungen. Auch von den Streufunden ist ein grosser Teil schon beim Eintreffen zu Beginn dieses Jahrhunderts im Nationalmuseum deponiert worden. Bei späteren Inventarisierungen hat man neue Informationen über ihre mögliche Verbindung mit Siedlungsplätzen erhalten.

Die typologische Bestimmung des Geradmeissels vom südfinnischen Typ ist leicht. Von seiner äusseren Form her ist es eine geradkantige Scheibe, an der eine recht schroffe Querscheide abgeschliffen worden war. Sie waren in Primärkonstitution meistens gänzlich geschliffen und die Seitenecken fasettisiert. Von der primitiven Kernaxt sowie von den sogenannten ostbottnischen Gegenstandsformen kann er klar unterschieden werden (Luho 1948). Der Rohstoff ist meistens feinkörniger Diabas.

Dies sind auch schon kurz gefasst die Informationen, die traditionell über den Geradmeissel vom südfinnischen Typ bekannt sind. In dieser Untersuchung wird danach gestrebt den Charakter des Gegenstandes zu betrachten und seine Funktion zu untersuchen, ist der Gegenstand seinem Namen entsprechend ein Meissel oder ein sogenanntes geschäftetes Beil und wie unterscheidet es sich von den anderen Steinäxten. Bei der Untersuchungsstrategie wird das von Foley (1981) geschaffene Modell über die Herstellung, die Benutzung und Aussonderung des Artefaktes befolgt. Auf welche Art ist der Geradmeissel vom südfinnischen Typ vom Rohmaterial zum Gebrauchsgegenstand »gekreist», wie wurde er benutzt und welche Gründe führten zu seiner Aussonderung. Mit Hilfe der Verbreitung wird eine Antwort auf die Erscheinung von »Kisko» angestrebt und unter Beachtung seines Charakters auch chronologische Indisien angestrebt. Da als bekannter Ausgangspunkt auch ein fast einseitiger Rohstoff, Diabas, angesehen wird, soll in dieser Untersuchung auch die Gesteinsartzusammensetzung des Geradmeissels vom südfinnischen Typ und die mögliche Beweglichkeit und Bedeutung als steinzeitliches Tauschmittel geklärt werden.

Geschichte der Untersuchung des Geradmeissels vom südfinnischen Typ

Den südfinnischen Geradmeissel definierte Ailio (1909) mit dem Begriff »Platter Geradmeissel». Ailio war einer der wenigen Steinzeitforscher, die den Unterschied zwischen Axt, Beil und Meissel erwogen.[1] Nach ihm gehören zu den Geradmeisseln Gegenstände, die hauptsächlich als Meissel benutzt wurden, d.h. mit diesen wurden unter Zuhilfenahme einer Keule »Löcher und Höhlungen» zustande gebracht. Aufgrund ihrer Grösse und des Abfallens der Schneide waren sie für die Benutzung als Beil nicht geeignet. Zwischen dem Querbeil und dem Meissel sieht Ailio keinen grossen Unterschied wobei er feststellt, dass man den Geradmeissel beschäftet auch als zum Schlagen gedachten Gegenstand verwenden kann. So erscheinen vor allem die südkarelischen Geradmeissel als geschäftete Beile, wobei der Gegenstand ohne Schaft auch für den Gebrauch als Meissel geeignet ist. Ailios Einteilung bleibt jedoch theoretisch. In der Praxis war er nicht in der Lage, den Unterschied zwischen Beil und Meissel oder deren Funktion zu klären. Der als Geologe Kenntnisse über die Steinarten besitzende Ailio erkannte jedoch, dass die Funde aus Uusimaa, vor allem die Meissel, sehr oft aus feinkörniger Diabas angefertigt waren, der sich von dem schon damals unterschiedenen Olivindiabas unterschied.

Auf beachtliche Art haben auch Äyräpää (1922; 1926; 1950) und Luho (1967) die Gegenstandsform untersucht. Die klarste typologische Definition des südfinnischen Geradmeissels fertigte Äyräpää bei der Analyse des steinzeitlichen Materials von Espoo und Kirkkonummi an. Die Bezeichnung des Gegenstandes mit »tvärmejseln eller yxan av sydfinsk typ» ist auch bezeichnend für die Vorsicht, mit der Äyräpää der Funktion des Gegenstands gegenübersteht. Die Typendefinition als solche ist immer noch hervorragend verwendbar (Europaeus 1922):

> »Dessa redskap äro korta och breda, vanligen mycket platta, jämförelsevis väl slipade tvär- och rakeggade verktyg; frontalplanet, som varierar mellan triangel och en rektangel, är oftast trapetzoidiskt; bredsidorna äro planslipade, ryggsidan någon gång mjukt välvd, eggytan för det mesta tämligen brant och uppåt begränsad av en vanligen sded linje. Vid ryggsidans båda kanter, mera sällan endast vid den ena, finnas smala facetter, någon gång finnas sådana vid framsidans kanter. Ibland ligga facetterna å själva smalsidorna,

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[1] Unter dem Begriff »Axt» wird in dieser Untersuchung entweder eine rechtschneidige Axt oder eine Lochaxt verstanden. »Beil» ist eine über Kreuz geschäftete hackenartige Schneide-Waffe und »Meissel» ein ungeschäftetes auf seinen Nacken zu schlagendes Werkzeug.

och i dessa fall blir tvärsnittet nästan sex- eller åttkantigt; i de flesta fall är det likväl rektangulärt eller trapetzoidiskt. Största delen av dessa verktyg äro platta mejslar; blott ett tiotal kraftigare tväryxor förekomma bland våra exemplar. Bergarten är oftast finkorning diabas. Dessa redskap ha först tillhuggits och därpå utformats medels slipning» (s. 96)

Die gebietsweise Verbreitung der Geradmeissel vom südfinnischen Typ vermochte Äyräpää schon 1922 sehr klar begrenzt zu bestimmen. Dies umfasste nur Uusimaa und einen Teil von Varsinais-Suomi, ungefähr den von Kymijoki bis nach Turku reichenden Küstenstreifen. Besonders häufig wurde der Gegenstand in den Gemeinden von Kisko, Lohja und Kirkkonummi angetroffen. Die Datierung des Meissels war zu dieser Zeit vor Entwicklung der Uferverschiebungsdatierung schwierig. Es stellte sich heraus, dass der Gegenstand oft an einem Siedlungsplatz gefunden wurde, der Schnurkeramik enthielt. Äyräpää siedelte den Gegenstand chronologisch als der Kammkeramik vorausgehend an, nahm jedoch an, dass der Gegenstand auch während der Zeit der Kultur der Schnurkeramik noch in Benutzung gewesen sein könnte, waren doch auch die Hammeräxte aus Diabas hergestellt.*
Mit der Uferverschiebungschronologie präzisierten sich die Auffassungen und schon in den 20er Jahren konnte der Geradmeissel vom südfinnischen Typ oder »Kiskoer Axt» am Ende der sogenannten »Suomusjärvi-Kultur», in der der Keramik vorangehenden Phase, verankert werden (Äyräpää 1926). Die sich auf umfassendes Streufundmaterial stützende Untersuchung »Die ältesten steinzeitlichen Funde aus Finnland» plazierte den Gegenstand an seinem jetzigen archäologischen Kontext (Äyräpää 1950). Äyräpää schuf dort für die »Suomusjärvi-Kultur» eine chronologische, relative Dreiteilung in die Phasen von Laperla, Sikunsuo und Kisko. Die Teilung basiert jedoch nicht auf ausgegrabenem Material sondern auf der Inventarisierung der Funde von Suomusjärvi, vervollständigt durch die von Äyräpää zu Beginn des Jahrhunderts in Espoo und Kirkkonummi durchgeführten Untersuchungen. Die Kisko-Phase begrenzte Äyräpää auf das Gebiet von Kisko, Siuntio, Kirkkonummi und Espoo. Auch die sogenannten ostbottnischen Gegenstandsformen mit dem Import des Strahlsteinschiefers treten schon an Siedlungsplätzen der Kiskoer Phase auf. Äyräpääs Meinung ist »die Wohnplätze sind schon vollneolithisch, obwohl die Keramik noch fehlt» (s. 17).

Luhos umfassende die »Suomusjärvi-Kultur» behandelnde Monographie, die auch ein ausgezeichnetes Quellenwerk für die Geschichte der mesolithischen Forschung ist, streift die Geradmeissel vom südfinnischen Typ etwas. An den veröffentlichten 26 Grabungsplätzen hat Luho bei den Ausgrabungen nicht einen einzigen Gegenstand dieses Typs gefunden. Somit konnte er in seinen Untersuchungen Äyräpääs »Kiskoer Stufen» und auch die vorausgehende »Sikunsuoer Phase» nicht verifizieren. Nach Luhos Meinung muss die Kiskoer Stufe auch als südwestfinnische Sondererscheinung betrachtet werden, die eine mögliche vorkeramische Phase der »Jäkärlä-Gruppe» ist. Die Erscheinung unterscheidet sich von der Chronologie her von Suomusjärvi und bleibt eine örtliche Erscheinung, »Die besagte (Jäkärlä) keramische Gruppe beschränkt sich ja auf Südwestfinnland, wie auch die Kisko-Stufe, wie aufgrund von Streufunden zu schliessen ist. Es hat also den Anschein, als liessen sich in der Suomusjärvi-Kultur

* Als bedeutende ökonomische Beobachtung, die sich jedoch später als unzutreffend erwiesen hat, ist auch Äyräpääs Vorschlag zu verbuchen, dass diese Stellen schnurkeramische Fang- oder Fischereiplätze gewesen sein könnten.

ausser chronologischen Stufen auch örtliche oder regional beschränkte Nachlassgruppen unterscheiden» (Luho 1967: 116).

Untersuchungsmaterial und Gegenstandsauswahl

Wie gesagt sind Geradmeissel vom südfinnischen Typ nur an einigen Siedlungsplätzen bei eigentlichen Feldgrabungen gefunden worden. In der Hauptsache sind die Funde Streufunde, wobei sich einige von ihnen in Verbindung mit der Inventarisierung als zu den Siedlungsplätzen gehörig erwiesen. Diese Untersuchung basiert nicht auf einer totalen Gegenstandsmenge, sondern hierfür ist eine Auswahl der Geradmeissel südfinnischen Typs ausgewählt worden, die von zu Denkmälern unter Schutz ernannten Siedlungsplätzen stammen. Im Verzeichnis der Denkmäler der Regionalplanungsverbände das vom Nationalamt für Antiquitäten angefertigt wurde, sind die mesolithischen Siedlungsplätze unterschieden, von denen ein Typgegenstand der jeweiligen Zeitperiode bekannt ist: sog. primitiver Meissel oder Axt, die blattförmige Schieferspitze, die Kugelkeule mit trichterförmigem Loch, der krummrückige Hohlmeissel, die schrägschneidige Quarzspitze oder der Geradmeissel vom südfinnischen Typ (Matiskainen 1983). Die Punkte an denen Geradmeissel vom südfinnischen Typ gefunden worden sind, sind bis zur Inventarisierungsnummer 20.000 des Nationalmuseums für tauglich befunden worden. Die Auswahl umfasst also nicht alle Geradmeissel südfinnischen Typs, die sich in Sammlungen von Museen befinden, sondern beinhaltet 70 dokumentierte Objekte (Abbildungen 1—6). Das Untersuchungsgebiet ist auf Süd- und Mittelfinnland begrenzt.

Als Kriterium für einen Siedlungsplatz ist verlangt worden, dass der Geradmeissel vom südfinnischen Typ in Verbindung mit antrophogenen Quarzabschlägen gefunden worden ist, oder dass an dieser Stelle mehrere mesolithische Steingegenstände gefunden worden sind. Der Siedlungsplatz muss auch topographisch bestimmbar sein und er muss bezüglich der Uferverschiebungschronologie eine verlässliche Höhengrenze haben. Bei den Inventarisierungspunkten muss man sich so mit der Höhe bezüglich des Meeresspiegels der Grundkarten zufriedengeben. So sind die Streufunde ausgesondert, obwohl sie auch ohne Ausnahme von als Siedlungsplätze auszulegenden vorgeschichlichen Stätten ohne genauere Informationen zu stammen scheinen. Andererseits würden ganze Streufunde von guter Konstitution bessere Möglichkeiten für die typologische Klassifizierung bieten als unvollständiges Siedlungsplatzmaterial. Es gibt insgesamt 43 Siedlungsplätze (Tabelle 1). Insgesamt sind in den Verzeichnissen über zu schützende mesolithische Denkmäler ca. 270 unterschieden worden, wobei Nord-Ostbottnien und Lappland ausgenommen sind (Matiskainen 1983).

Äyräpää (1922) vermerkte, dass der Geradmeissel vom südfinnischen Typ unter den Funden von Espoo und Kirkkonummi ein sehr verbreiteter Gegenstand ist. Er teilte mit, dass in diesem Gebiet insgesamt 53 Gegenstände gefunden wurden, von denen 4/5 von den Siedlungsplätzen aus der Umgebung von Lojärvi stammten. Die Anomalie von Lojärvi wird in dieser Untersuchung nicht sichtbar, denn er konnte nicht alle Fundstätten als feste archäologische Bodendenkmäler bei der späteren Oberflächenkartierung kennzeichnen. Aus Kirkkonummi und Espoo sind 10 Gegenstände dokumentiert, der eigentliche Schwerpunkt der Verteilung befindet sich jedoch in der von Huurre 1963 genau inventarisierten Gemeinde Kisko, aus der über ein Drittel (27/70) der für diese Untersuchung ausgewählten Gegenstände stammen.

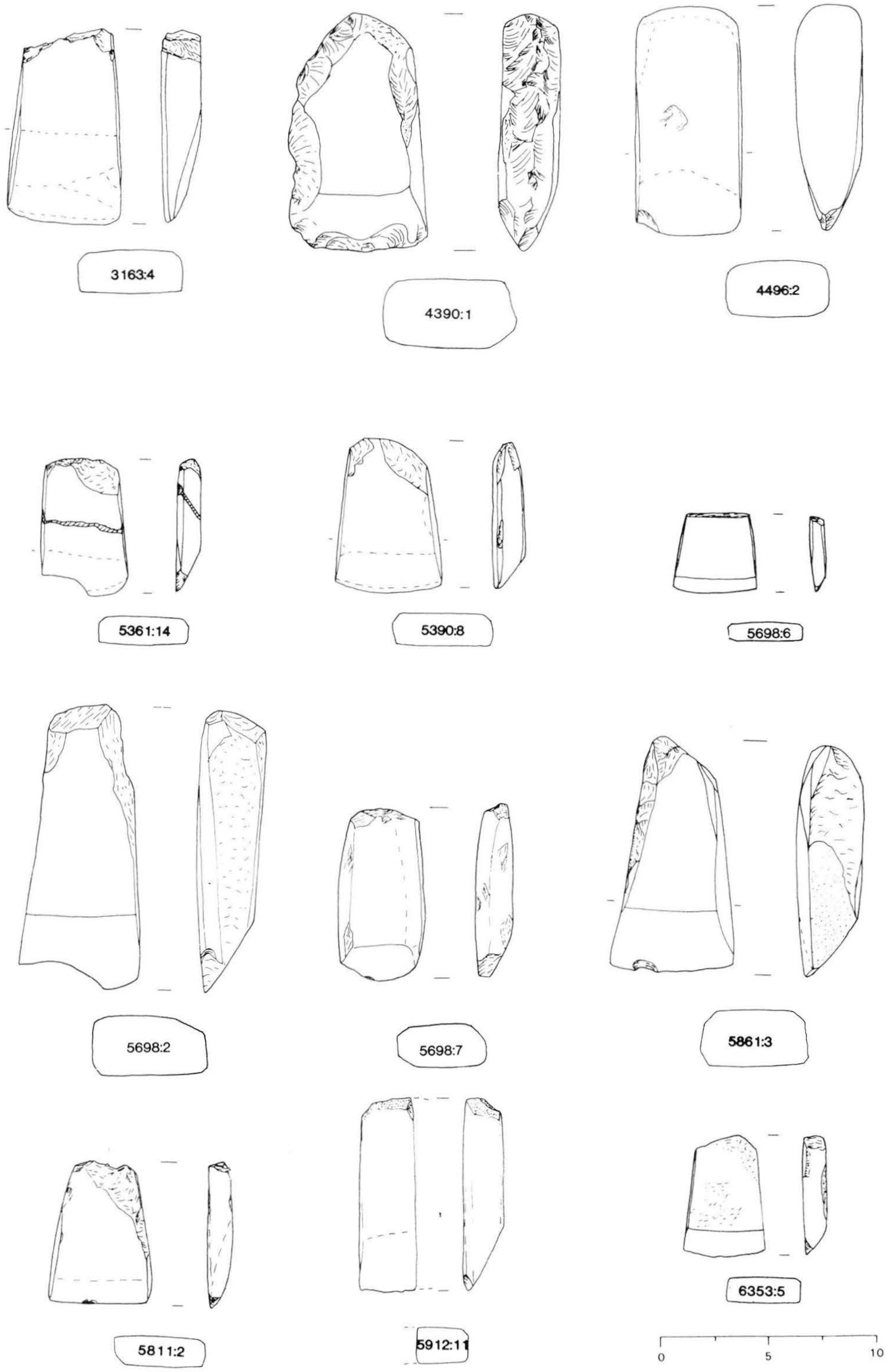

3163:4
4390:1
4496:2
5361:14
5390:8
5698:6
5698:2
5698:7
5861:3
5811:2
5912:11
6353:5
0
5
10

Abb. 1

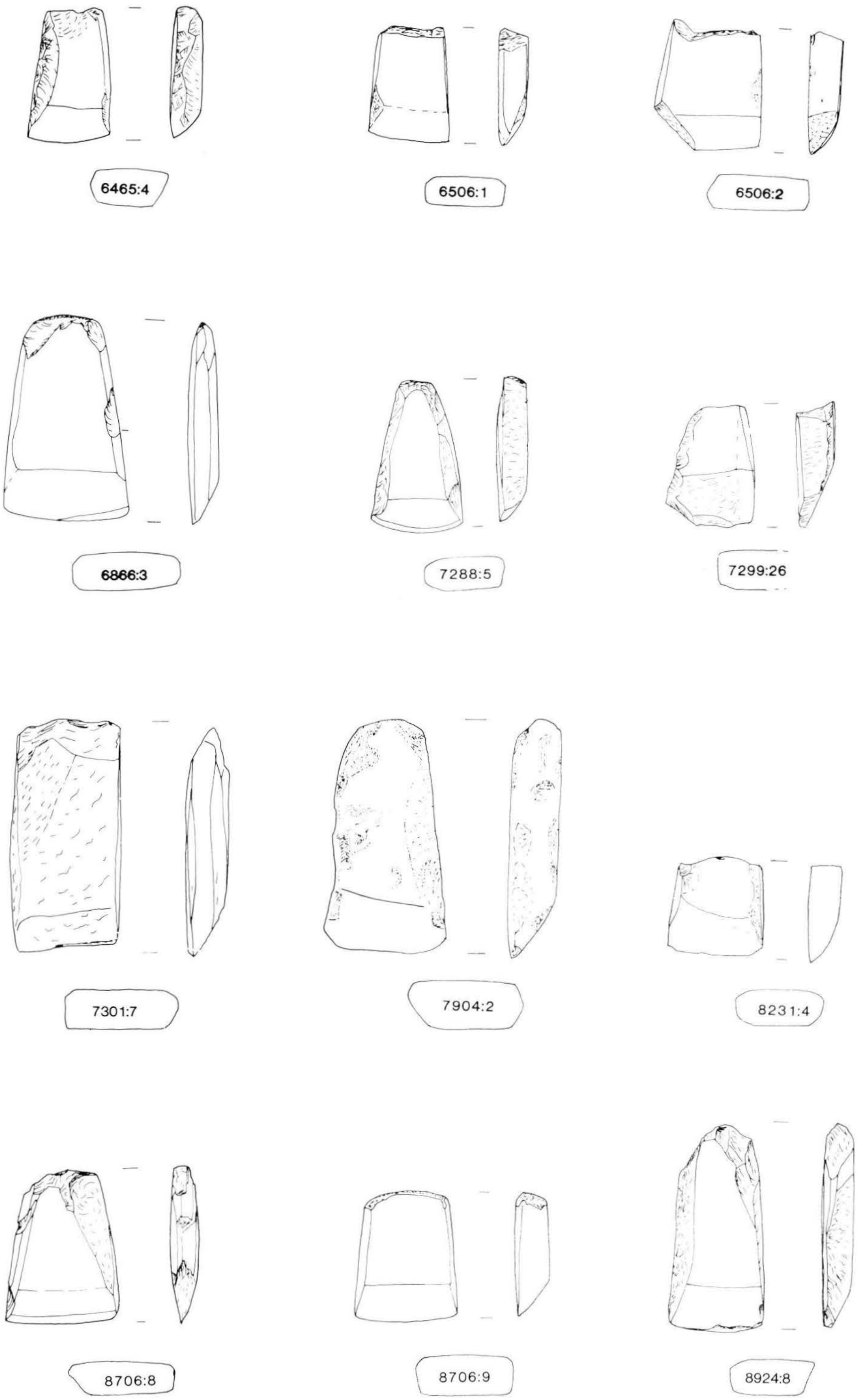

6465:4
6506:1
6506:2
6866:3
7288:5
7299:26
7301:7
7904:2
8231:4
8706:8
8706:9
8924:8

Abb. 2

0 5 10


8924:9
8924:10
9362:4
9107:11
9154:2
9413:2
9420:8
9767:7
9759:139
9943:4
Abb. 3


10563:4
10608:1
10636:1
10653:1
10626:3
10954:3
10954:4
11984
11187:8
12003:1
12121:2
12159:93
0
5
10

Abb. 4

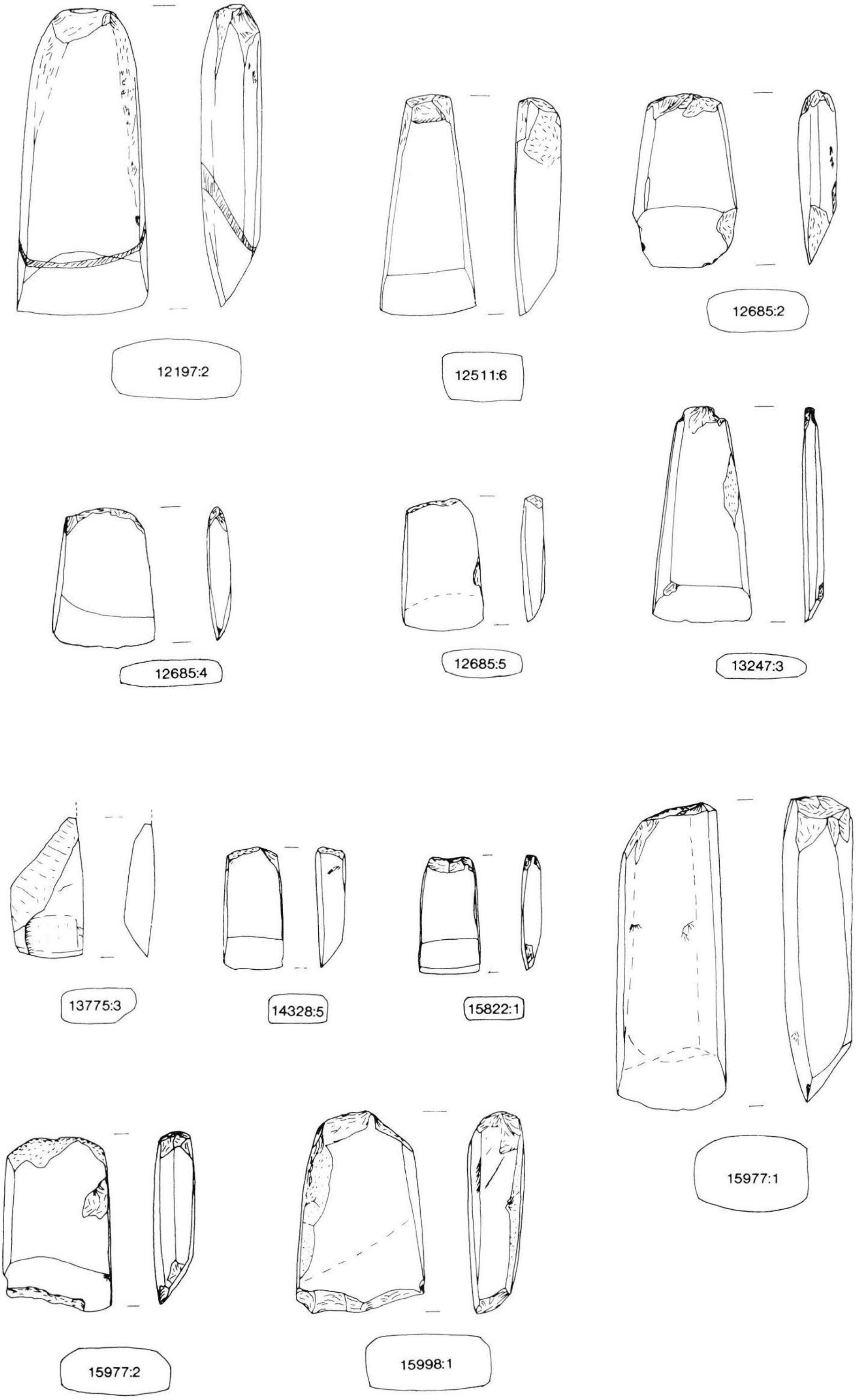

12197:2
12511:6
12685:2
12685:4
12685:5
13247:3
13775:3
14328:5
15822:1
15977:1
15977:2
15998:1

Abb. 5

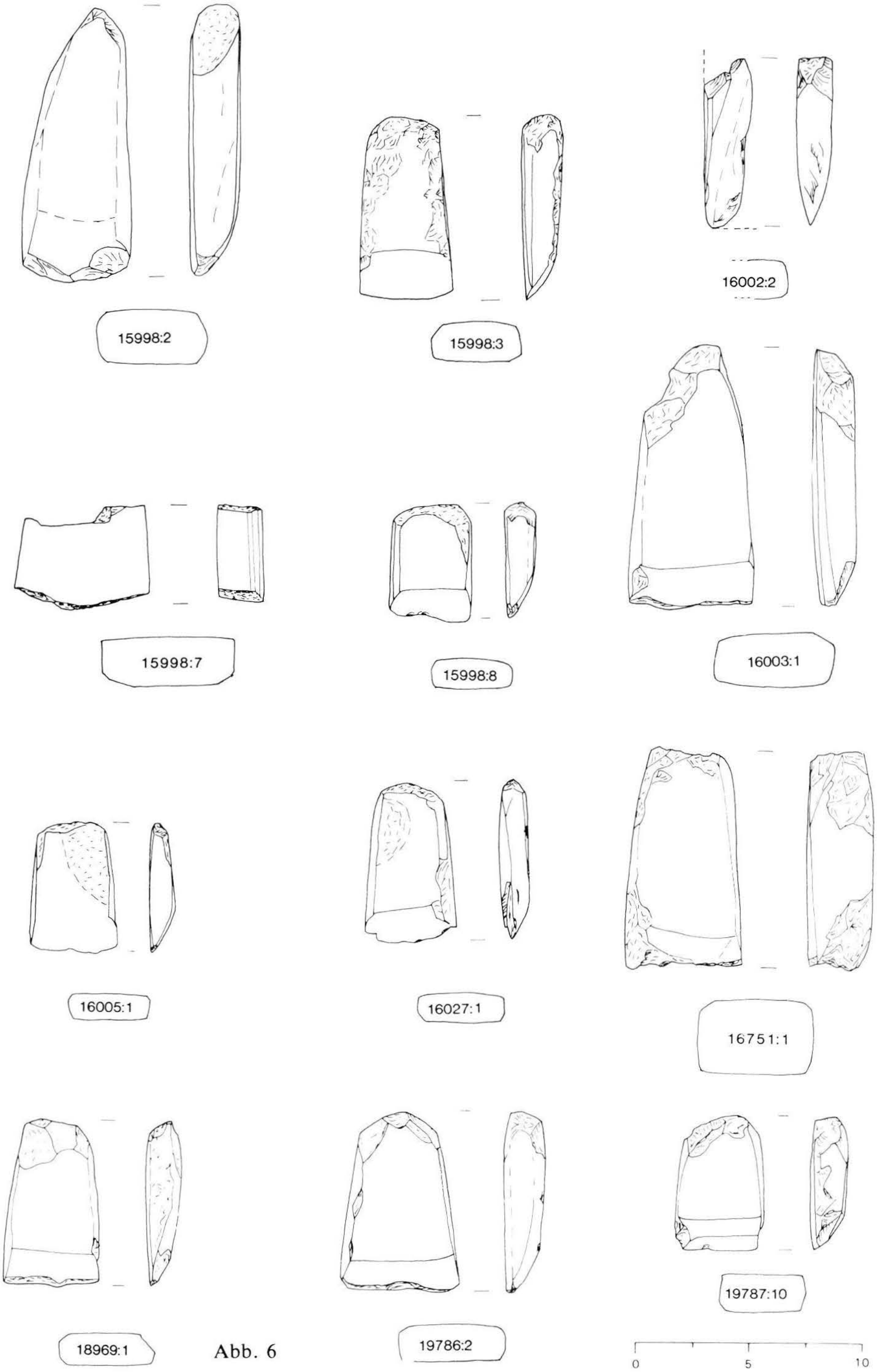
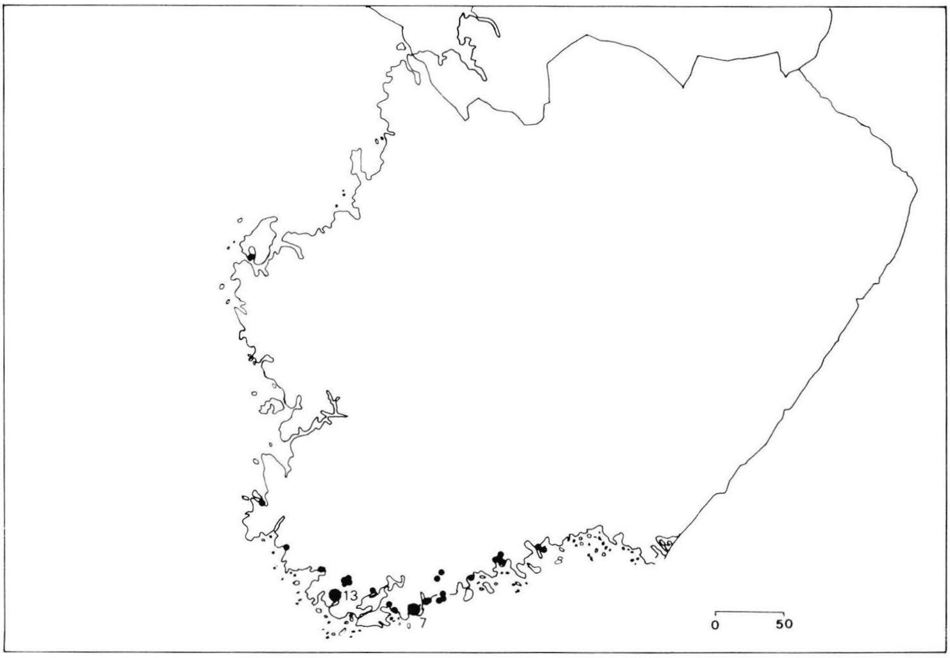


Abb. 6

Abbildungen 1—6. In der Untersuchung vorgestellte Geradmeissel vom südfinnischen Typ. (Vgl. die Tabelle 1).

Aus der Verbreitung der Geradmeissel vom südfinnischen Typ wird sichtbar, dass sich die Siedlungsplatzfunde auf das schon von Äyräpää 1922 mitgeteilte Gebiet, den Küstenstreifen zwischen Kymijoki und Turku (Karte 1) beschränkt. Am Westufer werden sie in Tarvasjoki angetroffen, der nördlichste Siedlungsplatz-Fundort ist in Kauhajoki. Von den mesolithischen Siedlungsplätzen des inneren Finnland sind sie überhaupt nicht bekannt, obschon die mesolithischen Siedlungsplätze des Seengebietes aus gewässergeschichtlichen Gründen zerstört sind (Matiskainen 1987).



Karte 1. Die Verbreitung der mesolithischen Siedlungsplätze mit den Funden der Geradmeissel vom südfinnischen Typ. Das Ufer der Ostsee folgt den Litorinamaximi, ca. 7500 b.p.

Huurre (1983) teilt den Fund von 15 Geradmeisseln des südfinnischen Typs in Nord-Ostbottnien mit, »diese sind auch nicht alle gänzlich typisch» (S. 84). Nach Huurre befindet sich die Nordgrenze des Gegenstandes im Gebiet der Gewässer von Oulujärvi, wo man sie aus Sotkamo Vaala und Utajärvi kennt.

Ziel dieser Untersuchung war es, die Geradmeissel vom südfinnischen Typ aufgrund der Unterschiede in den Abmessungen zu klassifizieren. Als Attribute wurden die Steinart, das Gewicht, die Länge, die Breite, die Stärke, der Schneidenwinkel, der Nackenindex (Breite/Stärke) und der Index 1/3 der Länge ab Nacken definiert. Die Beschädigungen der Schneide und des Nackens wurden klassifiziert, der %-Anteil des Schliffs an der Dorsal- und Ventralseite sowie an den Seitenkanten, die Abschrägung des Schliffwinkels der dorsalseitigen Schneide gemessen und es wurden Beschädigungen sowohl an der Schneide als auch am Nacken beachtet. Insgesamt wurden 14 verschiedene Indexe gemessen.

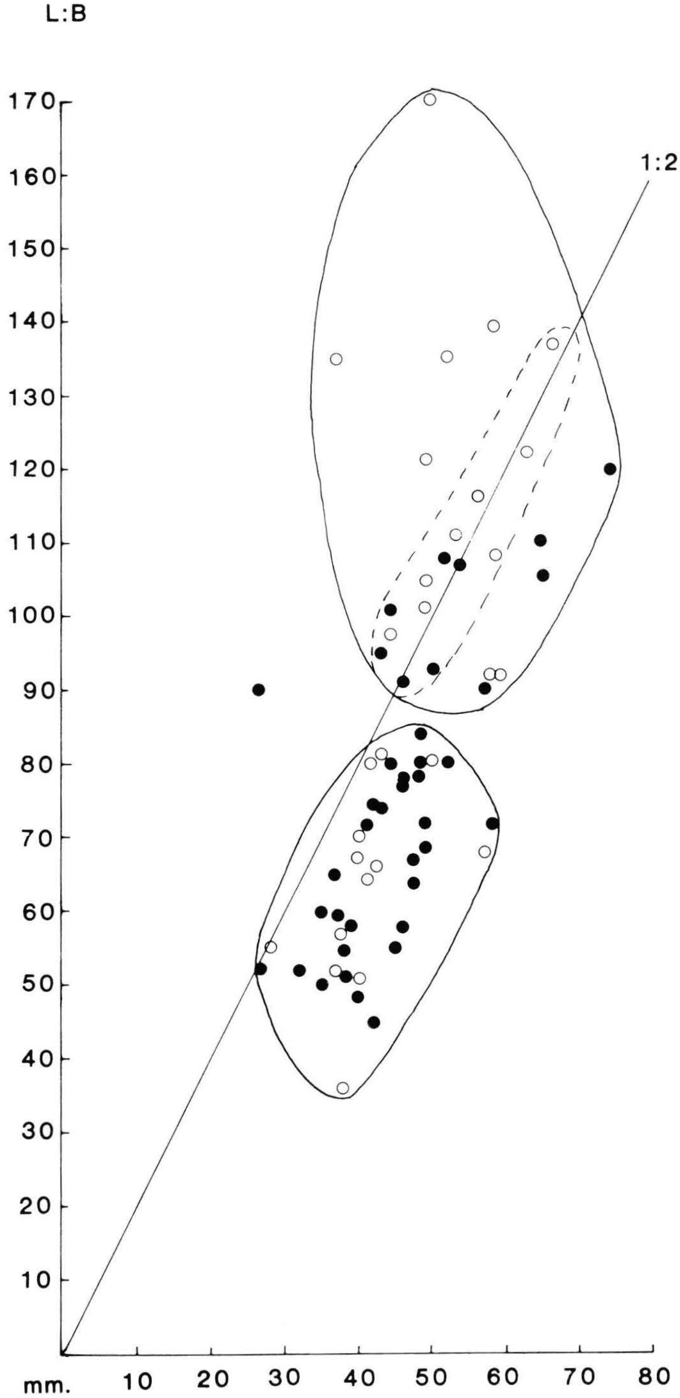


Abbildung 7. Die Länge/Breite-Indexe der Geradmeissel vom südfinnischen Typ. (Kreis — Kisko Gemeinde, Punkt — sonstiges Finnland).

Die Arbeit erwies sich im bestimmten Umfang als umsonst. Vollkommene Informationen konnten nicht an allen Gegenständen genau gemessen werden, die Korrelation zwischen den Indexen wie auch die Korrelation zwischen den Attributen hat keine bemerkenswerten Unterschiede zum Vorschein gebracht. Es schien klar, dass man mit Hilfe der Typologie in der Untersuchung bei so einer heterogenen Gegenstandsgruppe zu nichts als zu einigen statistischen Kuriositäten käme.

Die brauchbarste Information offenbarte sich bei dem einfachen Länge/Breite-Index. Die Variationen waren gross, die Länge der Gegenstände variierte zwischen 35—170 mm und die Breite zwischen 27—74 mm. Besonders die im Gebiet von Kisko gefundenen Meissel akzentuierten ihre Voluminösität und zum Teil als in ihrer Fundverfassung besser. Die voluminösen und längeren Stücke konzentrierten sich in der Nähe der Strecke der 1 : 2 Abbildung, jedoch sind die von einer Länge unter 80 mm im Verhältnis breiter als die grösseren Gegenstände. Auf der Abbildung 7 sind zwei Kluster zu unterscheiden, bei denen in Verbindung mit den grösseren eine längliche Verdichtung bei einem Länge/Breite-Verhältnis von 1 : 2 festzustellen ist.

Es scheint offensichtlich, dass die Unterschiede die folgende Dreierteilung wiederspiegeln:

1) fertige Gegenstände und wenig benutzte
2) im Länge/Breite-Verhältnis verschlissene und
3) verbrauchte und ausgesonderte (discarded)

Daraus kann geschlussfolgert werden, dass ein Grossteil der an Siedlungsplätzen gefundenen Geradmeissel in Primärkonstitution grösser gewesen ist. Falls sie nicht bis zur Unbrauchbarkeit beschädigt worden sind, hat sich ihre Grösse im Verlaufe des Gebrauchs und des Schleifens der Aussonderungsgrenze genähert und der Gegenstand ist ausgesondert oder nicht mehr geschliffen worden, wenn er die vom Benutzer gesetzten Anforderungen unterschritt.

Eine andere Erklärung für die zwei sich gebildeten Kluster ist, dass der Unterschied den von Ailio angenommenen Unterschied zwischen Beil und Meissel wiederspiegelte. Die voluminöseren Gegenstände wären Beile und die kleineren auf die Art von Meisseln verwendete.

Herstellung, Verwendung, Abstossen

Die auf der Typologie basierende Information hat über die Geradmeissel vom südfinnischen Typ nichts zum Vorschein gebracht, was früher unbekannt gewesen wäre. Das Verhältnis des Gegenstandes zur spätmesolithischen Zeitperiode und dem damit verbundenen Material muss auch aus einem anderen Blickwinkel untersucht werden. Es handelt sich um eine breite und grenzenlose Dimension des menschlichen Gebrauchsmechanismus, bei dem das Objekt die damalige materielle Gesamtheit vervollständigt. Ausgangspunkt ist, dass die dokumentierten Gegenstände den Abschluss der funktionellen Ereigniskette verkörpern, wobei der Gegenstand ausgestossen wurde, nachdem er für seinen Besitzer unbrauchbar wurde.

Robert Foley (1981) hat ein hervorragendes geschlossenes Modell über die Zusammengehörigkeit des menschlichen Verhaltensmechanismus und des archäologischen Prozesses vorgestellt. Die archäologische Information schliesst in sich die »spatial

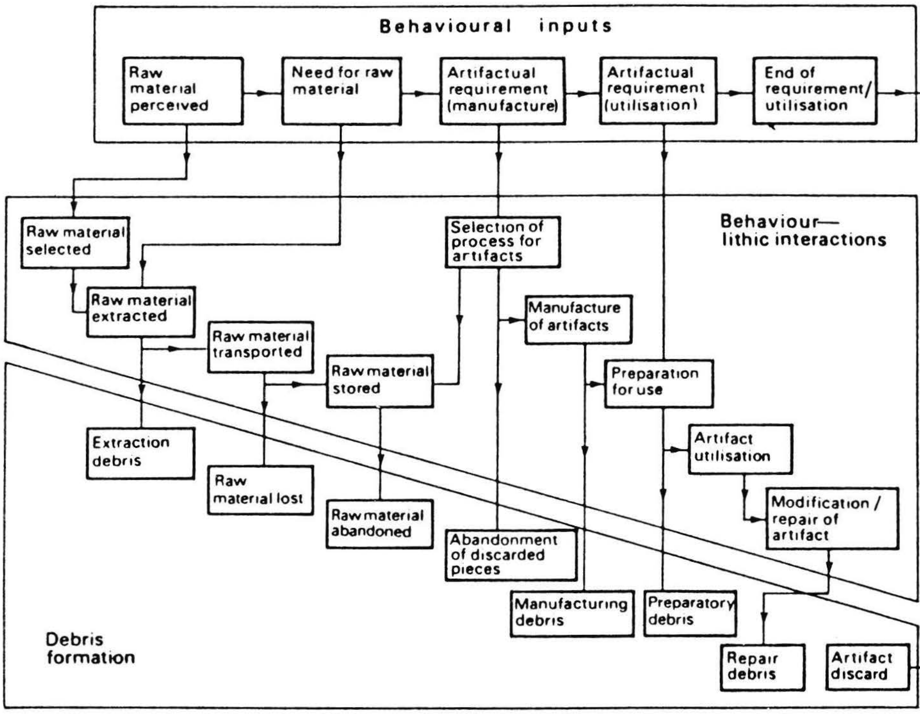


Abbildung 8. Das Schema von Foley (1981) über die Wechselwirkung des Verhaltensmechanismus und des Gesteinsmaterials relativiert zum Kreislauf der Artefakte im archäologischen Material.

and behavioural information» ein, die den Zustand der Konservierung des Gegenstandes kontrolliert. Seine Ursache-Verbindung-Anschauung des unsichtbaren Materials hat er entsprechend der auf der Abbildung 8 dargestellten »flowchart» vorgestellt.

Unter Anwendung des von Foley geschaffenen Modells auf den Geradmeissel vom südfinnischen Typ kann der Kreislauf gründlicher untersucht werden. Die Ereigniskette wird durch drei Hauptelemente reguliert:

1) der Verhaltensmechanismus mit den vom Menschen an den Gegenstand gestellten Herstellungs- und Gebrauchsanforderung,
2) Wechselwirkung zwischen Anforderungen und Steinmaterial, womit die Herstellung des Gegenstandes und der Benutzungsprozess verbunden sind, sowie
3) die Information, die bei der Aussonderung des Gegenstandes auftritt, also in dem Abfall, den das ausgegrabene Material repräsentiert.

Am offensichtlichsten repräsentieren die Geradmeissel vom südfinnischen Typ in ihrem Fundzustand die zwei letzten Phasen des auf Abbildung 8 dargestellten Musters, den ausgesonderten Gegenstand oder den reparierten und wiederverwendeten Rest. Die Aussonderung ist in Foleys Schema wiederum auf die Phase »end of requirement/utilisation» zurückzuführen. Die Klärung der anderen Phasen der Ereignisabfolge erfordert ein genaueres Suchen der Ursachen, wobei entsprechend Foleys Schema vorgegangen wird.

Tabelle 2. *Gebrauchsschäden und Aussonderungszustände der Geradmeissel vom südfinnischen Typ.*

	Schneiderbruch	Nackenbruch	Flächenbruch	Reparatur	Keine Reparatur	Absichtlich beschädigt	Unbeschädigt	Gross-Unbesch.	Abgenutzt	Materialfehler	Nacken geschlagen und gepickt	Anzahl der Schleif-fazetten in der Schneide	Sonstiges
3136:4		×			×						×	3	
4390:1			×	×							×	1	
4469:2							×	×			×	2	
5361:14	×	×			×	?			×		×	2	
5390:8		×			×				×		×	2	
5698:2		×		×		×					×	1	
5698:6		?			×				×		×	1	
5698:7	×				×						×	—	Ambosstein benutzt
5811:2		×	×		×						×	1	Steile Schneide
5861:3		×	×	×							×	1	
5912:11	×		×	×							×	1	Gespaltteil
6353:5			×	?			×		×		×	1	Steile Schneide
6465:4		×	×	×							×	2	Steile Schneide
6506:1	×	×			×				×		×	1	
6506:2	×	×	×		×	?					×	2	Steile Schneide
6866:3		×					×		?		×	2	
7288:5			×	?							×	2	
7299:26	×	×	×	?		?					—	2	
7301:7		×	×	×						×	—	—	
7904:2			×							×	×	1	
8321:4		×			×				?		—	2	
8706:8		×	×		×						×	2	
8706:9							×		×		×	2	
8924:8		×	×	×	×	?					×	1	
8924:9	×	×			×				?		×	1	
8924:10	×	×			×				×		×	1	
9107:11	×		×		×				?		×	1	Steile Schneide
9154:2	×	×			×		×		×		×	2	Steile Schneide
9362:4	×									×	×	—	
9413:2	×			×								—	Ambosstein benutzt
9420:8	×	×	×			×			?		×	—	
9759:139		×			×		×		?		×	2	
9767:7	×	×	×		×	?					×	—	
9943:4							×		×		×	1	Steile Schneide
10563:4		×	×	×			?				—	1	
10608:1							×	×		?	×	2	
10636:1		×			×						×	2	Hohlschliff
10653:1							×		×		×	1	
10626:3		×			×				×		×	1	
10954:3	×	×		×							×	2	
10954:4	×	×			×	?					—	—	
11187:8			×	×						?	×	1	
11984							×		×		×	1	
12003:1		×	×		×				×		×	1	
12121:2									×		×	2	Hohlschliff
12159:93		×			×								Ambosstein benutzt?

Tabelle 2. *Fortsetzung (Gebrauchsschäden . . .)*

	Schneiderbruch	Nackenbruch	Flächenbruch	Reparatur	Keine Reparatur	Absichtlich beschädigt	Unbeschädigt	Gross-Unbesch.	Abgenutzt	Materialfehler	Nacken geschlagen und gepickt	Anzahl der Schleif-fazetten in der Schneide	Sonstiges
12197:2							×	×		×	×	1	
12511:6			×	×			×				×	1	
12685:2	×	×			×					?	×	1	
12685:4							×		×		×	1	
12685:5							×		×		×	2	
13247:3							×		×		×	2	
13775:3	×	×		×							—	1	Hohlschliff
14328:5							×		×		×	2	
15822:1							×		×		×	2	
15977:1							×	×			×	1	
15977:2	×					?			×		×	1	
15998:1	×	×		×		×					×	1	
15998:2		×	×	×		×					×	1	
15998:3		×			×						×	1	
15988:7	×	×											
15988:8	×				×				×		×	1	
16002:2				×	×						×		Schmalmeissel
16003:1	×	×	×	×		×					×	—	
16027:1	×				×					×	×		
16751:1	×	×	×		×		?				×		
18969:1		×	×		×	?					×	1	
19786:2	×	×			×				×		×	2	Steile Schneide
19787:10		×					×		×		×	2	Steile Schneide

Auf der Tabelle 2 ist der Aussonderungsmechanismus genauer beschrieben und die Gründe vermerkt worden, die das Ende der Verwendung des Gegenstandes hervorgerufen haben. Die Abnutzungsschäden, mögliche Reparaturen von Schäden der Meissel, der Zustand des Gegenstandes bei der Aussonderung oder andere Gründe wie z.B. die fehlerhafte Wahl des Rohstoffes usw. sind analysiert worden.

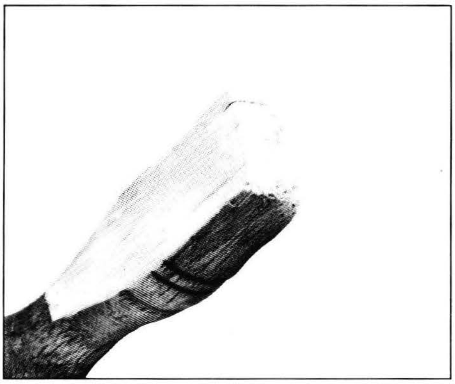
Bei der Betrachtung des Fundzustandes ist zu erkennen, das vier Gegenstände (KM 4496:2; 10608:1; 12197:2; 15977:1) bei beachtlicher Grösse, wenig gebraucht und in ganzem Zustand ausgesondert worden sind. Einen sichtlichen Grund für die Aussonderung der Gegenstände gibt es nicht. Auf die Benutzung hinweisende Schlagspuren sind jedoch am Nacken des Meissels anzutreffen, ganze Aussonderungen sind somit auf das interne Verhaltensmodell der Sippe zurückzuführen, da die Gründe nicht von technischer Art sein können.

In der Tabelle 2 ist bei 29 Gegenständen als Aussonderungszustand gut vermerkt, wobei davon vier fragwürdig sind. Diese vier Meissel würden unbeschädigt aber viel benutzt wirken. Auf Grund des Fundzustandes könnte man sie wegen der Fehlerlosigkeit und der geringen Beschädigungen für brauchbar halten. Diese Meissel sind ohne Aussnahme von kleiner Grösse, oder der L/B-Index ist etwa 1.5 oder kleiner. Sie repräsentieren die im Kluster der Abbildung 7 vorgeschlagene aufgebrauchte Gruppe. Bei einem Teil treten Abnutzungsschäden bestimmten Grades auf, dessen Reparatur leicht gewesen wäre. Wegen der geringen Nutzungsgrösse hat man dies nicht mehr in Angriff genommen. In einigen Fällen ist der Winkel der Schneide so steil abgeschliffen, dass die Bearbeitungseigenschaften entscheidend vermindert worden sind. Der gewünschte Schneidenwinkel konnte wegen der Kürze des Gegenstandes am Meissel nicht mehr geschliffen werden. In der Tabelle 2 ist auch die Anzahl der an der Schneide geschliffenen Fasetten vermerkt. Wahrscheinlich ist an der Spitze der Schneide keine steilere Fasette geschliffen worden, sondern ein solcher zwei-oder dreifasettiger Schneidenabfall ist im Zusammenhang mit dem erneuten Schärfen entstanden.

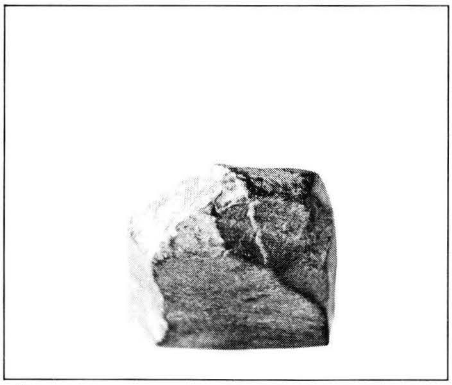
Den grössten Teil der zur Aussonderung führenden Gründe haben Nutzungsschäden hervorgerufen. An der Schneide wie auch am Nacken und den Seiten sind Spalten entstanden, durch die der Gegenstand nicht mehr verwendbar war oder eine Reparatur sich nicht mehr gelohnt hat (z.B. vgl. Abbildungen 1—6, 3163:4; 5811:2; 6506:1 und 2; 8924:9; 10954:3). In 15 Fällen sind die Schäden entweder durch das Glattsteppen der rauhen Spalte oder das erneute Schleifen der Spaltenfläche repariert worden (z.B. 5861:3; 5912:11; 8924:8; 12511:6; 15988:1). Interessant ist, dass man annehmen kann, dass die Beschädigungen zum Teil absichtlich verursacht worden sind. Auf die Schneide war ein Schlag gerichtet, dessen Beschädigung man nicht als im Arbeitsprozess entstanden annehmen kann. So ein Gegenstand ist bezüglich seines Nackens wahrscheinlich schon in der Arbeitsphase beschädigt und bis zur Unbrauchbarkeit zerstört worden und danach ist der Gegenstand endgültig »getötet» worden (z.B. 5698:2; 9420:8; 15998:1 und 2; 16003:1). Es ist zu beachten, dass die spätere Bodennutzung und das Pflügen Sekundärschäden verursacht haben kann, aber aufgrund der frischen Umbruchfläche sind solche Spuren klar von den vorgeschichtlichen zu unterscheiden.

Die gewöhnlichste Arbeitbeschädigung wurde durch das Zerspringen oder Splittern des Nackens verursacht. An der Schneide sind ebenfalls fast immer Sprünge anzutreffen. An den Kanten und Flachseiten befindliche Sprünge sind zumeist Folgen von auf den Nacken gerichteten sehr kräftigen Schlägen. Ohne Aussnahme ist der Nacken jedes analysierten Gegenstandes beschlagen oder punktiert worden, und man kann schlussfolgern, dass die Geradmeissel von südfinnischen Typ ihrem Namen gemäss wirklich Meissel sind und nicht als Beile geschäftet waren.

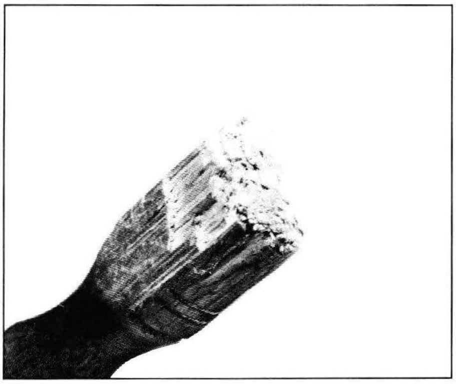
Die Nutzungsspuren des Nackens sind entweder Punktierspuren oder durch stärkere Schläge hervorgerufene Brüche oder Sprünge. Mit dem Gegenstand wurde genauso wie auch mit einem modernen Geradmeissel gearbeitet, durch das Schlagen auf den Nacken. Die Fruktion des breiten Steingegenstandes ist bei der Arbeit sehr gross. Schlagwerkzeug ist mit grösster Wahrscheinlichkeit entweder irgend ein weicheres Steinmaterial als das des Geradmeissels oder eine Horn- oder Knochenkeule gewesen. Höchstwahrscheinlich musste der Gegenstand während der Benutzung ständig neu angeschliffen werden und alle kleinen Nutzungschäden und Brüche sind möglichst früh, entweder durch Punktieren oder Schleifen zu reparieren versucht worden, um grössere Schäden zu verhindern.



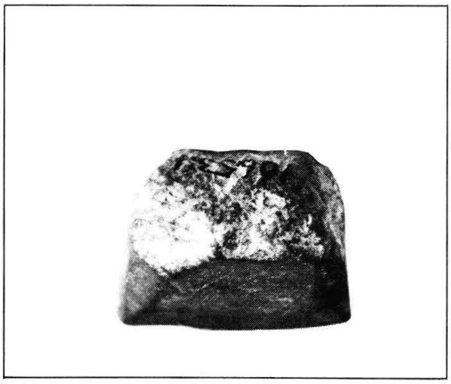
1



2



3



4

Foto 1. Im Gebrauch am Nacken gesplitterter moderner Meissel.

Foto 2. Im Gebrauch am Nacken gesplitterter Geradmeissel vom südfinnischen Typ.

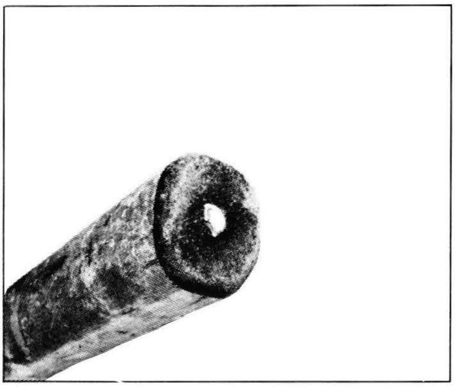
Foto 3. Punktierspuren am Nacken der modernen Meissel.

Foto 4. Punktierspuren am Nacken der Geradmeissel vom südfinnischen Typ.

Foto 5. Moderner am Nacken gepolsterter Tischlermeissel.

Foto 6. Abgenutzter moderner Stahlmeissel.

Foto 7. Abgenutzter Geradmeissel vom südfinnischen Typ.



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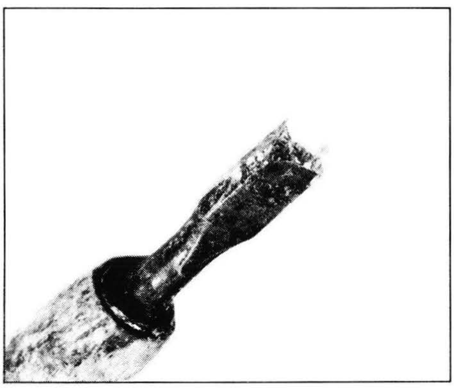

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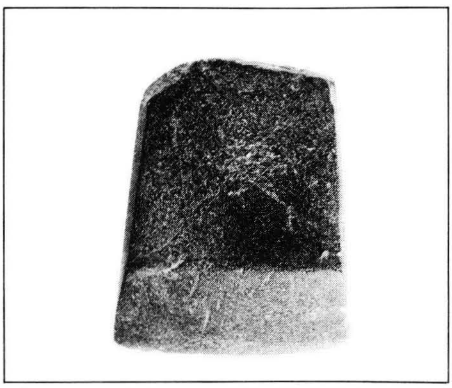

7

Bei der Untersuchung der Nackenschäden und ihrer Entstehung kann man ahnen, dass das Entstehen der Schäden genauso passiert ist wie es heute beim Schlagen auf die vom Tischler verwendeten eisernen Meissel mit Holzenden geschieht. Falls der Schlag zu kräftig oder der Gegenstand mit dem geschlagen wird, aus zu hartem Material ist, springt das Holzende genauso wie die altertümlichen Diabasmeissel, (Fotos 1, 2). Auch die Punktierspuren, die den am Holzende auftretenden Schlagspuren entsprechen, entstehen beim Schlagen auf den Nacken, (Fotos 3, 4). Es ist möglich, den Nacken dadurch zu schützen, dass man dort z.B. einen Lederschutz befestigt, welcher die auf den Nacken gerichtete Belastung abschwächt, was allerdings wiederum die Gebrauchseigenschaften des Gegenstandes vermindert, (Foto 5). Auf den Fotos 6, 7 werden beide, wegen völligem Verschleiss aus der Nutzung entfernte Meissel gezeigt.

Aus der Auswahlgruppe sind in vier Fällen die unreparablen Reste der Meissel sekundär für andere Zwecke verwendet worden. So ist aus einem länglichen Kantensplitter ein Schmalmeissel (16002:2) geformt worden. Drei Reste sind ihrerseits als Schlagsteine wahrscheinlich entweder zum Punktieren der Steinartgegenstände oder bei der Bearbeitung von Quarz verwendet worden (5698:7; 9413:2; 12159:93).

Was war der Benutzungszweck des Geradmeissels vom südfinnischen Typ? Leider geben noch nicht einmal die Moor- oder Feuchtbodenfunde die Möglichkeit die Frage technisch zu beantworten. Der dem Verhaltensmuster nach maritime Charakter der Siedlungsplätze gibt Grund zur Annahme, dass die Bearbeitung und das Spalten des für die Fortbewegungsmittel und Unterkünfte benötigen Holzmaterials mit Geradmeisseln erfolgt wäre. Für den Beutefang oder die Behandlung der Beute und die Bodenbearbeitung ist ihre Verwendung kaum wahrscheinlich.

Äyräpää (1922) widmet sich kurz der Herstellungsart der Geradmeissel vom südfinnischen Typ. In seinem Untersuchungsmaterial von den Fundorten Kvarnåker, Kirkkonummi und Lökpers werden drei Gegenstände angetroffen, die man als Entwürfe der Meissel ansehen kann. Die Entwürfe sind durch Schlagen zu Rohlingen geformt worden und dann durch Schleifen fertig geformt worden.

Der Schleifgrad des unbeschädigten Gegenstandes ist hundertprozentig, wobei der Nackenteil ausgenommen ist. Der Verwendungszweck des Meissels erfordert ständiges Anschleifen, da Porösität und Unebenheit der Oberflächen die Gebrauchseigenschaften des Gegenstandes vermindern. Die genannten grossformatigen, ganzen Meissel, die die Schlussphase des Herstellungsprozesses zu vertreten scheinen, sind vollständig geschliffen. Durch das Fasettieren der Kanten wurde wahrscheinlich danach gestrebt, die durch die Schnittkanten verursachte Friktion zu vermindern und das Eindringen des Werkzeugs in das Holzmaterial zu erleichtern. Wie Äyräpää (siehe oben) in seiner Gegenstandsbeschreibung vermerkt, wird die Fasettierung — anders als bei den heutigen Stahlmeisseln — meistens an den Seitenkanten der Ventralflächen angetroffen. In einigen Fällen sind auch die Seitenkanten der Dorsalseite fasettiert, wobei sich ein 8 -kantiger Querschnitt des Gegenstandes ergibt.

In Verbindung mit drei vorgestellten Meisseln ist das Schleifen der Schneide zu einer ovalen Krümmung zu erkennen, (10636:1; 12121:2; 13755:3). Eigentliche krummschneidige Hohlmeissel sind sie jedoch nicht, sondern zählen zu den Geradmeisseln.

Wegen der Geringfügigkeit der Siedlungsplatzfunde ist die Schleiftechnik der Geradmeissel vom südfinnischen Typ nicht bekannt. Am Siedlungsplatz »Kivikauden nummi» von Kisko ist eine aus Sandstein geformte Schleifplatte gefunden worden, an der eine durch kreisförmige Schleifbewegungen hervorgerufene Abnutzung von einem

Durchmesser von 50 cm ist. Dies würde zeigen, dass das Schleifen mit kreisförmigen Bewegungen erfolgte. Das Schleifen auf einer Sandsteinplatte durch Drehen ruft jedoch das Abrunden der an der Fläche entstehenden Krümmung hervor. Es ist begründet, zum Erziehlen ebener Flächen an eine Vor-Zurück — Schleifbewegung zu glauben. Sandstein ist zum Schleifen auch am Siedlungsplatz Koivisto, Sammatti benutzt worden.

Das Auftreten von geschliffenen Steingegenständen in der mesolithischen Steinzeit Finnlands ist ein Zug, der in Mitteleuropa so früh nicht angetroffen wird. Entsprechend der traditionellen neolithischen »Revolutionstheorie» beginnt die Zeit der geschliffenen Steingegenstände, wie des Schuhleistenkeils in Verbindung mit dem Ackerbau. Aus Steinarten hergestellte Steingegenstände sind aus der Jäger- und Sammlerkultur ausgeschlossen. Im Prekambriagebiet Fennoskandias ist der Ausgangspunkt ein anderer als in den Feuerstein-dominanten Gebieten. Wenn die Herstellungstechnik der primitiven Beile von Suomusjärvi auf dem Aufspalten entsprechend der Grundaxt basiert, ist der einzige Weg ein brauchbares Werkzeug zu erhalten gewesen, es durch Schleifen zu schärfen. Es ist daran zu erinnern, dass die frühmesolithischen Zapfenhauen, die Tierkopfwallen wie auch die Ilomantsi-Beile Beispiele des frühen Schleifens sind (Äyräpää 1950, Carpelan 1976). Die Schleiftechnik ist am unverfälschtesten bei den Schiefergegenständen und den Speerspitzen schon 9000—8500 b.p., so dass man nicht von einer technischen Innovation und deren Bewegung von irgendwoher ins Gebiet Finnlands sprechen kann. Die Funktion der Geradmeissel vom südfinnischen Typ verlangt einen perfekten Schliff. Zeitlich entsprechen die Geradmeissel allerdings dem Frühneolitikum Mitteleuropas, aber stehen in keiner Verbindung oder Kulturauswirkung damit.

Steinarten, ihre Erhältlichkeit und die Wahl des Rohmaterials für die Meissel

Die wichtigsten Steinartuntersuchungen über die Steingegenstände der Steinzeit Finnlands haben Ailio (1909) und A. Laitakari (1928) veröffentlicht. Auch Eino Mäkinen hat ein beachtliches Verzeichnis über die Steinarten der ostkarelischen Steingegenstände angefertigt (Äyräpää 1944, Heikkurinen 1980). Die Bestimmungen sind von Berufsgeologen mit Augenmass anfertigt, aber für die archäologische Genauigkeit völlig ausreichend. Das Verfahren ist mit den Auswahlkriterien des vorgeschichtlichen Waffenherstellens vergleichbar, da auch sie mit dem Erkennen der Steinarten mit dem Augenmass vertraut waren.

Die Steinbestimmungen dieser Untersuchung hat Geologe Ilkka Laitakari angefertigt, (der als Geologe der zweiten Generation wie auch sein Vater mit den Diabasen vertraut ist, I. Laitakari 1969). Die Steinarten der Meissel bestimmte er oberflächenfeucht mit einer 6 X vergrössernden Lupe, so dass das Verfahren das gleiche wie bei den oben erwähnten Untersuchungen ist.

Die für die Meissel benutzten Steinarten sind in der Tabelle 3 dargestellt. Von den Diabasen ist entsprechend der Korngrösse von der Durchschnittgrösse abweichende Feinkörnigkeit $\longleftrightarrow$ Grobkörnigkeit und Porphyrität unterschieden worden. Neben der Diabase sind andere verwendete Steinarten stärker metamorphierte Metadiabase, Glimmerschiefer, sowie intermediare und basische Vulkanite. Als einzelne Gesteinarten treten Strahsteinschiefer, Uralitporphyrit, Mandelstein und Gabbro auf. Das

Bestimmen von vier Meisseln der Gegenstandgruppe war mit Augenmass nicht möglich, sondern hätte als Hilfsmittel eine Dünnschliffanalyse verlangt.

Den Diabas kann man an der typischen ophitischen Struktur erkennen, die bei Diabasen von gröberer Struktur mit den Augen leicht erkennbar ist. Der Olivindiabas Satakuntas ist unter den Diabasen ein eigener zu bestimmender Diabas. Diese Gesteinsart tritt unter Ausnahme eines einzelnen bezweifelten Meissels (13247:3) nicht auf. Der Olivindiabas ist die üblichste bei den Streitäxten Südwestfinnlands verwendete Gesteinsart (A. Laitakari 1928).

Diabas tritt im Grundfelsen als Begleiter bestimmter Hauptgesteinsarten nicht auf, sondern entsteht als Spaltenfüllung, wobei es bedeutend jünger ist, etwa 200—300 Mill. Jahre. Diabas kann auch metamorphiert sein, sog. Metadiabas der von ihrem Alter her svekofennisch, also etwa 1900 Mill. Jahre ist. Die Stärke des Diabasenganges reguliert auch seine Korngrösse, breite Gänge sind ohne Ausnahme grobkörnige Diabasen. In schmalen Gängen ist die Korngrösse im Mittelteil des Ganges gröber, an den Randteilen ist die Feinkörnigkeit feiner, die Korngrösse deckt oft die Stärke des Ganges auf. Diabas konnte auch aus Felsen geschlagen werden. Die Gesteinsart splittert wegen ihrer zwei senkrechten Spaltgeraden leicht scheibenförmig, so dass sie leicht zu Meisseln geschliffen werden kann. Das Anfertigen von Rohlingen war wegen der regelmässigen Splitterung leicht. Die Hauptminerale des Diabases sind Plagioklas, Olivin und Augit, deren Härtegrad auf der Scala von Moh etwa 6 ist. Das Mineral des Sandsteines, Quarz, von seinem Härtegrad 7, hat die Diabasen effektiv auf die vom Schleifer gewünschte Art abgenutzt, wie man besonders an dem aus Olivindiabas von Satakunta hergestellten Streitäxten festestellen kann.

Trotz des allgemeinen Auftretens der Gesteinart im Grundfelsen des Küstengebietes von Uusimaa scheint es nicht so, als ob die Geradmeissel vom südfinnischen Typ irgendein gemeinsames Ausgangsgebiet hätten. Die variierende Struktur und Korngrösse weisst eher auf die Verwendung von von der Glazialzeit bewegten Steinen und Blöcken für die Meissel hin. Die Diabasengänge sind in den ausgespülten Küstenfelsen klar. Da das Gebiet Archipelag gewesen ist und wegen der schnellen Landhebung sich die Flora nicht in so einem Umfang in den Küstenfelsen verwurzeln konnte wie beim Vergleich mit der Situation der jetzigen Schärenlandschaft. Der von der Flora freie Gürtel war breiter und hat die Lokalisierung der Gänge wie auch das Sammeln der erratischen Blöcke erleichtert. Die auf geophysikalischen Magnetstörungen

Tabelle 4. *Die örtliche Verbreitung der bei der Geradmeissel vom südfinnischen Typ verwendeten Gesteinsarten.*

Steinart	Tot. %	WK 8.7	KI-SU 45.7	WU 22.5	MU 11.5	OU 11.5
Diabas	48	4	20	14	5	5
Schiefer	6	—	6	—	1	—
Vulkanit	8	2	1	1	1	3
Sonstiges	3	—	2	1	—	—
Unbestimmbar	5	—	3	—	1	—
	70	6	32	16	8	8
% — Diab/Sonst.	65/35	50/50	60/40	80/20	60/40	60/40

basierenen Niederflugkarten zeigen, dass in West-Uusimaa besonders in der Gegend des Lohjanjärvi mehrere in Nordwest-Südost -Richtung verlaufende Diabasengänge angetroffen werden (persönlicher Kommentar von Laitakari).

In der Tabelle 4 wird eine Zusammenfassung der für die Geradmeissel vom südfinnischen Typ verwendeten Gesteinsarten von der gebietlichen Ausbreitung gegeben wobei geographisch die Westküste, das Gebiet Kisko-Suomusjärvi, West-Uusimaa, Mittel-Uusimaa und Ost-Uusimaa unterschieden sind. Die Aufteilung ist angedeutet, aber verdeutlicht, dass die für die Meissel verwendeten Mineralien auch gebietlich uneinheitlich sind. Eine Diabase verschiedenen Grobheitgrades ist mit Abstand das beliebteste Waffenmaterial, aber doch nicht die beherrschende Gesteinsart bei den Meisseln, wie es Äyräpääs (1922, 1950) Auffassung war. 65 % der Gesamtanzahl sind Diabasen in West-Uusimaa scheint der Anteil am grössten zu sein, etwa 80 %.

Es ist offentsichtlich, dass die Herstellung der Geradmeissel vom südfinnischen Typ keinen organisierten Austausch oder Verbreitung beinhaltet. Die Antihomogenität der Diabasen weisst darauf hin, dass kein spezieller Steinbruch existiert, aus dem das Waffenmaterial geholt worden wäre. Die Meissel sind entsprechend der individuellen Bedürfnisse hergestellt worden und auch die ursprüngliche Grösse kann von dem zur Verfügung stehenden Rohmaterialstein oder dem Bedürfnis des Herstellers abhängen.

Datierung der Geradmeissel vom südfinnischen Typ

Neben der schrägschneidigen Quarzspitze ist der Geradmeissel vom südfinnischen Typ ein Typgegenstand, nach dem versucht wurde die Spätperiode der mesolithischen Steinzeit als eine chronologische Gesamtheit zu datieren (Matiskainen 1986). Der Begriff des sog. »Suomusjärvi-Kultur» basiert darauf, dass man darin drei sich zeitlich voneinander unterscheidende Perioden umreissen kann. Äyräpää (1950) schloss in Bezug auf die Stufen von Laperla, Sikunsuo und Kisko auf die »Dreiteilung», wobei die geforderten Kriterien erfüllt waren.

Luho (1967) hat auf der Grundlage der 26 mesolithischen Siedlungsplätze seiner Untersuchungen keine Zeichen der Stufe von Sikunsuo und auch nicht von Kisko festgestellt. Luho hat jedoch die Existenz dieser Stufen nicht direkt in Frage gestellt. Kleine mit der Stufe von Sikunsuo zusammenhängende primitive Beile wie auch die Geradmeissel vom südfinnischen Typ sind in so einem Umfang gebietlich begrenzt, dass man auf ihrer Grundlage keine ganz Finnland umfassende Einteilung vornehmen kann. Luho setzte seinen Unterperiodengedanken jedoch trotzdem fort, indem er die Verteilung der »Suomusjärvi-Kultur» teils entsprechend der Uferverschiebungschronologie schuf. Die Teilung hat sich schon von ihrer frühsten Phase her als hinkend erwiesen (Siiriäinen 1981).

Die Uferverschiebungschronologie ist bis auf weiteres die einzige Alternative für die Datierung der Geradmeissels des südfinnischen Typs, denn von Siedlungsgrabungen steht nur die Richtung gegebene ^{14}C -Datierung von Jönsas, Vantaa zur Verfügung. Hier gibt es drei verschiedene Siedlungsphasen, spätmesolithische, schnurkeramische und die früheisenzeitliche. An dem mesolithischen (etwa 32 m ü.d.M.) Siedlungsplatz hat man etwa zehn Ockergräber angetroffen und mehrere Geradmeissel vom südfinnischen Typ gefunden, einer mit grösster Wahrscheinlichkeit als Grabbeigabe. Aus der Kohle der Feuerstelle wurde die Datierung 7420 ± 170 (Hel 1077) erhalten (Ojonen 1983; Purhonen 1984 und persönliche Information).

Wenn man von der Annahme ausgeht, dass die mesolithischen Siedlungsplätze mit der Küste der Ostsee verbundene Fangplätze sind, ist ihre Datierung mit Hilfe der quartärgeologischen Uferverschiebungschronologie möglich. Die im Moment in Benutzung befindliche sog. stratigraphische Datierungsmethode ermöglicht das Schaffen einer selbständigen Uferverschiebungschronologie für auch ein sehr begrenztes Erdhebungsgebiet (Salomaa & Matiskainen 1983, 1985; Matiskainen 1983, 1985; Siiriäinen 1987). Es ist möglich die Siedlungsplätze, die Typgegenstände beinhalten, entsprechend der Chronologie zu verbinden, somit erhält man für die Gegenstandsgruppe das Alter aus der auf der ^{14}C -Datierung basierenden Uferverschiebung.

Entsprechend der Chronostratigraphie der Ostsee ist es möglich zwei getrennte Phasen das Ancylusmesolithikum, (etwa 9500—7700 b.p.) und das Litorinamesolithikum (etwa 7700—6000 b.p.) zu unterscheiden. Die Siedlungspläze datieren sich so auf Grund ihrer topographischen Höhe in der Diatomenökologie auf entsprechende Hauptphasen (Matiskainen 1983). Die Metachronität der Erdhebung verursacht im Gebiet des finnischen Meerbusens Probleme, wo die mit der Zeit nach der Ancylusregression verbundenen eustatischen Transgressionen der Litorinasee, Siedlungsplätze zerstört haben könnten. Vom Gebiet Helsinkis nach Westen ist die Uferverschiebungsentwicklung für die Zeit der gesammten Postglazialperiode regressiv und beim Übergang auf West-Finnland sind die chronologischen Höhenunterschiede in der schnellen Erdhebung schon beachtlich grösser. Die besten Voraussetzungen für das Schaffen einer Chronologie gibt es in Ostbottnien.

Das Auftreten der Geradmeissel südfinnischen Types an den Meeresufer-Siedlungsplätzen der Postglazialperiode scheint zeitlich umfangreich. Der Uferverschiebungschronologie entsprechend handelte es sich auch nicht um eine reine späte Gegenstandsgruppe der mesolithischen Steinzeit Finnlands. Der Siedlungsplatz von Peura, Kauhajoki, datierte sich schon in der Nähe von ca. 8000 b.p., auch die in Suomusjärvi befindlichen Objekte gehören klar zum Ancylusmesolithikum, etwa 8500 b.p.. Die Siedlungsplätze von Kauhala Råbacka und Kylmälä Karlsberg, Kirkkonummi, sind von nach 8000 b.p. Das Alter des Siedlungsplatzes von Rintelä, Nurmijärvi ist über 8500 b.p. Das Alter von Järvensuo, Askola ist auch ancylusmesolithisch, über 8000 b.p. (Matiskainen 1983).

Der Grossteil der Siedlungsplätze datiert sich jedoch auf das Litorinamesolithikum, denn ihre Verbindung mit dieser Phase der Ostseegeschichte ist unbestritten. Die Siedlungsplätze von Kisko befinden sich alle in etwa 40—42 m ü.d.M. Das entspricht ungefähr der Höhe der Faciesgrenze des süssen (Ancylus) und salzigen (Litorina) Wassers (Eronen 1974; Glückert 1976). Es ist dabei zu bemerken, dass der Wasserspiegel im Finnischen Meerbusen in Kisko, im Gebiet von Helsinki und in Askola wegen der Eustasie eine lange Zeit, etwa 2000 Jahre, in der gleichen Höhenzone geblieben ist.

Auch an dem frühkammkeramischen Platz von Gammelby, Lapinjärvi, werden als zu Geradmeissel vom südfinnischen Typ zu zählende Steingegenstände angetroffen (9579:139, 9943:4). Genauso treten am Siedlungplatz Kvarnbacken, Liljendal, sehr nahe mit dieser Gruppe in Verbindung stehende Meissel auf (Rauhala 1977). Die Schwierigkeit besteht jedoch darin, dass sich in Ost-Uusimaa die spätmesolithischen und frühkammkeramischen Siedlungsplätze wegen der langsamen Erdhebung in der gleichen Höhenzone befinden können. Es scheint, dass während der frühkammkeramischen Zeit diese Gegenstandsform nicht mehr im Gebrauch ist und das zu der Zeit aus Strahlsteinschiefer hergestellte Gegenstände die Geradmeissel vom südfinnischen

Typ verdrängt hätten. Die in Ostbottnien schon zu Beginn des Mesolithikums in Benutzung befindlichen Kloritschiefermineralien, wie Strahlsteinschiefer verbreiten sich als Waffenmaterial auch auf die Siedlungsplätze Südfinnlands und beliebt werden die sich als fertige Gegenstände verbreiteten sog. bottnische Gegenstandsformen (Huurre 1983). In jedem Falle kommen in den Gebieten von Uusimaa und des Varsinais-Suomi bald aus Diabase hergestellte sog. westfinnische Beile (Jäkärlä-Äxte) in Benutzung.

Eine Schwierigkeit ist auch die schwere Bestimmbarkeit des südfinnischen Meisseltyps. Wie Huurre (1983) gezeigt hat, begrenzt sich die Verbreitung des Meissels nicht nur auf Südfinnland, sondern in den Funden von Nord-Ostbottnien treten von ihrer Typenbestimmung her gleiche Gegenstände auf. Huurre stellt fest, dass ein Teil der Funde in Kalajokilaakso aus einer Höhe stammt, wo der Ort in der mesolithischen Steinzeit noch vom Wasser bedeckt gewesen wäre. Genauso erwies die Höhe des Siedlungsplatzes Peura, Tarvasjoki, dass sich die Funde als jünger als 6000 b.p. datierten.

Es wirkt sehr wahrscheinlich, dass der Meissel vom südfinnischen Typ Ergebnis einer langen Evolution ist. Ähnliche werden vor der eigentlichen Kulminationen der »Kiskoer Stufe» angetroffen, wie auch genauso geschliffene Meissel nach der mesolithischen Steinzeit auftreten.

Schlussbetrachtung

Ailio (1909) teilte die Steinzeit Finnlands gestützt auf die Typologie von Montelius ein und datierte sie unter verschiedenen Steingegenstandsformen so, dass der Nacken von Beilen und Meisseln die wichtigsten Einteilungskriterien bildeten. Äyräpää (1920) nahm die bis in die heutigen Tage fortgesetzte Formenklassifikation in Benutzung. In dieser Untersuchung wird danach gestrebt die traditionelle typologische Anschauung betreffs der Geradmeissel vom südfinnischen Typ in Richtung auf eine funktionalistische Auffassung zu erweitern. Als Klassifizierungskriterium ist die Typendefinition von Äyräpää (1922) verwendet worden, aber die Analyse ist auf die Deutung der Benutzung der Meissel und dadurch hervorgerufenen Beschädigungen ausgedehnt worden. Mit Hilfe sich auf die Ethnoarchäologie stützender Anschauungen ist eine Erklärung für den Geschehensablauf auch von den heute von Tischlern benutzten Meisseln gesucht worden.

Die Meissel vom südfinnischen Typ sind ihrem Namen entsprechend Meissel, mit anderen Worten, mit ihnen ist, wie auch heute noch, durch das Schlagen auf den Nacken gearbeitet worden. Dies geht aus den Gebrauchschäden hervor, vor allem wegen der auf den Nacken gerichteten Schläge. Die Arbeit ist im Marginalbereich unter der Gefahr der ständigen Beschädigung des Gegenstandes passiert oder entsprechend musste man bei der Arbeitseffektivität etwas ablassen.

Das Material der Siedlungsplätze zeigt, dass in Verbindung mit den Meisseln des südfinnischen Typs auch andere Steinmeissel und Steinbeile verwendet wurden. In 11 Fällen ist an den Siedlungsplätzen ein oder mehrere sog. primitive Beile gefunden worden, selten auch ein krummrückiger Hohlmeissel und eine blattförmige Schieferspitze. Das Anfertigen von Korrelationen ist unsicher, da die Zusammengehörigkeit der Gegenstandsgruppen in bezug auf die Oberflächenfunde jemals sicher sein könnte (Matiskainen 1983).

Nach der »flowchart» von Foley, Abb. 8, kann der Kreislauf des Geradmeissels südfinnischen Typs folgendermassen zusammengefasst werden. Das erkannte Rohmaterial, bei dem nach Diabase oder ihr sehr gleichenden Gesteinsarten gestrebt wird, ist von mit den losen Materialen der Glazialschichten im Verbindung stehenden Steinen oder Blöcken gesammelt worden, wobei das Nutzen von im Grundfelsen auftretender Gänge möglich war. Der Rohstoff ist kaum gehandelt worden und die Herstellung der Gegenstände ist auf Grund der Heterogenität der Gesteinsarten individuell am Siedlungsplatz geschehen. Der Benuzungszweck bleibt zu vermuten, mit grösster Wahrscheinlichkeit zu verschiedener Holzbearbeitung. Ein auf die Art des Meissels benutztes Werkzeug wird beschädigt oder verbraucht am Siedlungsplatz ausgesondert.

Gebietlich befindet sich der Schwerpunkt der Verbreitung des Geradmeissels vom südfinnischen Typ im schon bekannten Küstengebiet zwischen Kisko-Espoo, wobei die in ihrer äusseren Form den Geradmeisseln vom südfinnischen Typ gleichzusetzenden Funde aus anderen Teilen Finnlands zu beachten sind. Typologisch kann der Gegenstand nicht vollständig nur auf die Funde der Küstengebiete Uusimaas eingegrenzt werden. Die Dichte des Auftretens weisst jedoch auf einen gebietlichen Benutzerkreis, von dem das Varsinais-Suomi und Ost-Uusimaa schon ausgeschlossen sind, obgleich in den wenigen Siedlungsplatzfunden dieser Gebiete auch Geradmeissel des südfinnischen Types auftreten.

Die zeitliche Streuung ist breit. Das Alter der auf Grundlage der Uferverschiebungschronologie frühesten Siedlungsplätze ist schon vom Ende des Ancylusmesolithicums, etwa 8000 b.p. Die Balance des Litorinameeres und der Erdhebung haben hervorgerufen, dass sich im Gebiet zwischen Kisko und Askola die Küste etwa 2000 Jahre lang fast in der gleichen Höhe, (etwa 42—32) befunden hat. Mit Hilfe der Uferverschiebungschronologie umfasst die Datierung der Meissel das ganze Litorinamesolithikum, etwa 7700—6000 b.p. Als Festpunkt kann das ^{14}C -Alter von Jönsas, Vantaa, etwa 7500 b.p. angesehen werden. Das spätere Auftreten des Meissels vom südfinnischen Typ scheint in der frühkammkeramischen Periode zu veralten, wenn auch die typologischen Kriterien des Meissels erfüllende Gegenstände später auftreten.

Der Geradmeissel vom südfinnischen Typ ist neben der schrägschneidigen Quarzspitze ein Gegenstandstyp, der mit dem Litorinameer in Verbindung stehende Siedlungsplätze charakterisiert und so die spätmesolithische Steinzeit repräzentiert, jedoch nur gebietsweise. Die Verifizierung der »Kiskoer Kultur» oder der sog. »Kiskoer Phase der Suomusjärvi-Kultur» als das Mesolithicum ganz Finnlands umfassend ist übertrieben und irreführend. Die zeitliche Nutzungszeit des Gegenstandes ist zu breit und die Verbreitung zu beschränkt, um die spätmesolithische Zeitperiode ganz Finnlands zu charakterisieren. Das von Luho (1967) veröffentlichte Grabungsmaterial erweist für die Geradmeissel südfinnischen Typs keine Sonderstellung, dem entsprechend man von der »Kiskoer Erscheinung» anders als von einem Spezialzug von Uusimaa sprechen könnte.

* * *

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Tabelle 1. *Verzeichnis der in der Untersuchung verwendeten Geradmeissel vom südfinnischen Typ und Siedlungsplätze.*

Nr	Siedlungsplatz
KM 11984	Askola, Ellilä, Ilmari
KM 12003:1	Askola, Haitin Myllypelto
KM 12121:2	Askola, Puharonkimaa, Ryykinpelto
KM 12159:93	Askola, Puharonkimaa, Järvensuo
KM 10954:3	Espoo, Ryte
KM 10954:4	Espoo, Ryte
KM 8231:4	Espoo, Svartbäck
KM 12685:2	Kauhajoki, Peura
KM 12685:4	Kauhajoki, Peura
KM 12685:5	Kauhajoki, Peura
KM 5361:14	Kisko, Kankare
KM 9362:4	Kisko, Kankare
KM 10626:3	Kisko, Kaukuri, Vuorela
KM 16005:1	Kisko, Kaukuri, Vuorela
KM 12197:2	Kisko, Kivikauden nummi
KM 15988:1	Kisko, Kivikauden nummi
KM 15988:2	Kisko, Kivikauden nummi
KM 15988:3	Kisko, Kivikauden nummi
KM 15988:7	Kisko, Kivikauden nummi
KM 15988:8	Kisko, Kivikauden nummi
KM 6866:3	Kisko, Nummela-Alho
KM 15977:1	Kisko, Tieksmäki, Arkkila
KM 15997:2	Kisko, Tieksmäki, Arkkila
KM 10653:1	Kisko, Nummenpää—Mäntylä
KM 13247:3	Kisko, Puosta, Kansakoulu
KM 14328:5	Kisko, Puosta, Kansakoulu
KM 9154:2	Kisko, Kaukuri, Saari
KM 7031:7	Kisko, Sillanpää, Seppä
KM 16002:2	Kisko, Kaukuri, Saari
KM 16003:1	Kisko, Sillanpää, Myllypakka
KM 3163:4	Kisko, Tieksmäki, Leppämäki
KM 5698:2	Kisko, Tieksmäki, Leppämäki
KM 5698:6	Kisko, Tieksmäki, Leppämäki
KM 5698:7	Kisko, Tieksmäki, Leppämäki
KM 10636:1	Kisko, Tieksmäki, Leppämäki
KM 5861:3	Kisko, Kaukuri, Kaukossuo
KM 16027:1	Kisko, Toija
KM 10608:1	Kisko, Ylispakka
KM 4390:1	Kirkkonummi, Evitskog, Alis
KM 9767:7	Kirkkonummi, Lappböle, Herla
KM 4496:2	Kirkkonummi, Kylmälä, Karsberg
KM 5811:2	Kirkkonummi, Nybacka
KM 6353:5	Kirkkonummi, Myllhalåker
KM 9107:11	Kirkkonummi, Kauhala, Råbacka
KM 6506:1	Kirkkonummi, Västerkulla, Koskenrinne
KM 6506:2	Kirkkonummi, Västerkulla, Koskenrinne

KM 6465:4	Kirkkonummi, Västerkulla, Koskenrinne
KM 9420:8	Lapinjärvi, Backmansbacken
KM 9579:139	Lapinjärvi, Gammelby
KM 9943:4	Lapinjärvi, Gammelby
KM 8706:8	Lohja, Grönberga
KM 8706:9	Lohja, Grönberga
KM 18969:1	Nurmijärvi, Alitalo
KM 19787:10	Nurmijärvi, Alitalo
KM 19786:2	Nurmijärvi, Rintelä
KM 8924:8	Sammatti, Koivisto
KM 8924:9	Sammatti, Koivisto
KM 8924:10	Sammatti, Koivisto
KM 9413:2	Sammatti, Koivisto
KM 5912:11	Sipoo, Martinkylä
KM 7288:5	Suomusjärvi, Hankalanpelto
KM 16751:1	Suomusjärvi, Hermolanvaha
KM 11187:8	Suomusjärvi, Mustionsuo
KM 10563:4	Suomusjärvi, Tyry
KM 12511:6	Tarvasjoki, Karhula
KM 13775:3	Tarvasjoki, Karhula
KM 7904:2	Vantaa, Solbacka
KM 15822:1	Vantaa, Viinikka
KM 5390:8	Yläne, Ali-Jokela

Tabelle 3. *Verzeichnis der Gesteinsarten der Geradmeissel vom südfinnischen Typ. (Bestimmung von Ilkka Laitakari).*

Nr	Steinart
KM 3163:4	Strahlsteinschiefer
KM 4390:1	Mandelstein
KM 4496:2	Diabas, feinkörnig
KM 5361:14	Diabas, feinkörnig
KM 5390:8	Metadiabas
KM 5698:2	Gabbro
KM 5698:6	Diabas, feinkörnig
KM 5698:7	Intermediarisches Vulkanit
KM 5861:3	Diabas, feinkörnig
KM 5811:2	Diabas, feinkörning
KM 5912:11	Diabas, feinkörning
KM 6353:5	Diabas, feinkörnig
KM 6465:5	Diabas
KM 6506:1	Diabas, grobkörnig
KM 6502:2	Diabas, feinkörnig
KM 6866:3	Uralitporphyrit
KM 7288:5	Diabas, porphyrisch
KM 7299:26	Diabas
KM 7301:7	Glimmerschiefer
KM 7904:2	?
KM 8231:4	Diabas
KM 8706:8	Diabas
KM 8706:9	Diabas
KM 8924:8	Intermediarisches Vulkanit
KM 8924:9	Diabas

KM 8924:10	Diabas
KM 9107:11	Diabas
KM 9154:2	Diabas
KM 9362:4	?
KM 9413:2	Diabas
KM 9420:8	Intermediarisches Vulkanit
KM 9759:139	Basisches Vulkanit
KM 9767:7	?
KM 9943:4	Diabas
KM 10563:4	Diabas, feinkörnig
KM 10608:1	Glimmerschiefer
KM 10626:3	Diabas, feinkörnig
KM 10636:1	Glimmerschiefer, (Fyllit)
KM 10653:1	?
KM 10954:3	Diabas
KM 10954:4	Metadiabas
KM 11984	Basisches Vulkanit
KM 11187:8	Glimmerschiefer
KM 12003:1	Diabas
KM 12121:2	Diabas
KM 12159:93	Diabas, pophyrisch
KM 12197:2	Diabas
KM 12511:6	Diabas
KM 12685:2	Basisches Vulkanit
KM 12685:4	Diabas, grobkörnig
KM 12685:5	Intermediarisches Vulkanit
KM 13247:3	Diabas
KM 13775:3	Diabas, feinkörnig
KM 14328:5	Diabas
KM 15822:1	Basisches Vulkanit
KM 15977:1	Diabas
KM 15977:2	Diabas
KM 15998:1	Diabas
KM 15998:2	Diabas
KM 15998:3	Diabas
KM 15998:7	Diabas
KM 15998:8	Diabas
KM 16002:2	Diabas, feinkörnig
KM 16003:1	Metadiabas
KM 16005:1	Diabas
KM 16027:1	Glimmerschiefer
KM 16751:1	?
KM 18969:1	Diabas
KM 19786:2	Diabas, porphyrisch
KM 19787:10	Diabas

(? = Ohne Dünnschliffanalyse unbestimmbar)

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Heikki Matiskainen

The paleoenvironment of Askola, southern Finland. Mesolithic settlement and subsistence 10 000—6 000 b.p.

1. INTRODUCTION

1.1. Background of the study

Throughout its history, Stone Age research in Finland has relied on quaternary geology as an aid in elucidating details of cultural history. This is to a great extent a result of the Finnish tradition of research as well as the fact that many Finnish archaeologists have trained in this field. The Stone Age find material of Finland is limited in scope and forms in many respects a skewed selection of past material culture. Research is further limited by the poor preservation of organic materials and quartz material that is difficult to analyze. New perspectives for the investigation and study of cultural processes have been provided by the many archaeological applications of quaternary geology, the ''environmental science'' of prehistory, and especially archaeological shore displacement chronology.

The starting-point of this study is a combination of these two disciplines — a personal aim in the author's involvement in archaeology ever since his undergraduate days. Quaternary geology in the 1970s was especially concerned with the history of the Baltic and re-evaluations of shore displacement facilitated by the adoption of radiocarbon dating and the dating laboratories established in Finland at the time. The renewed research concerning shore displacement in the early Post-Glacial provided opportunities for developing a new shore-displacement chronology for the Mesolithic, which hitherto had been based on obsolete data on the history of the Baltic (Äyräpää 1950a). Only a rough relative chronology of artefact types had been available and it now appeared possible to accommodate the relative chronology of the Mesolithic with shore-displacement and its absolute radiocarbon dates. The Mesolithic material of Finland had not been studied to any great degree and its overall extent still permitted detailed study. The Mesolithic that are the subjects of intensive research in quaternary geology.

The aim of the author was at first to investigate the extent and nature of Mesolithic find material from Southern and Central Finland with an overall review of known dwelling-sites and to set out the main features of a relative chronology in turn based on the radiocarbon-dated shore-displacement chronology of the Baltic. A result of this was a comprehensive distribution map of Mesolithic sites. In addition to the chronology based on the history of the Baltic the study was also concerned with Mesolithic sites on the shores of inland lakes and rivers. The author arrived at a division of the Finnish Mesolithic into two stages corresponding to the facies of the Baltic — the Ancylus and Litorina Mesolithic respectively. This division is also supported by the datings of the artefact types (Matiskainen 1983, 1987, 1989).

The study revealed that Late Mesolithic shore-displacement chronology was more difficult to investigate in the area of the Gulf of Finland where the eustatic movement of the Litorina Sea and the slow rate of land uplift obscured the formation of chronologically distinct settlement horizons in the period from 8000 to 6000 b.p. The Late Mesolithic artefact types (oblique-bladed quartz points and the so-called South Finnish even-bladed adzes) may provide further information on this period. In a series of separate studies the author concentrated on the nature, function and chronology of these artefact types in order to outline the characteristic features of the Litorina Mesolithic from the more distinct Ancylus Mesolithic. (Matiskainen 1988, 1989).

Because of the imprecise nature of the chronology for the Gulf of Finland region in the Ancylus and Early-Litorina stages, the author set about to develop a comprehensive archaeological shore-displacement chronology for the Askola region, to which it was possible to link the numerous archaeological sites of the area. The stratigraphic method that was employed was favoured by rapid shore displacement and dictated the choice of Askola as the case study area. In connection with bodies of water providing datings two Ancylus transgression sites were found and their dating facilitated a connection between early settlement and shore-displacement chronology. Matti Eronen together with the author carried out studies of a number of bodies of water, through which the shore-displacement curve could be dated for the interval 9500—5000 b.p.

This study is concerned mainly with the question of the nature of changes in the development of natural conditions in the Porvoonjoki river valley in Askola and changes in settlement in the early Post-Glacial prior to the beginning of the ceramic period of the Stone Age around 6000 b.p. Stratigraphical studies provided the basis for defining the nature of the paleoenvironment of Askola in the Post-Glacial. With respect to the sites and finds the emphasis of artefact analysis has not been on typology, but mainly on chronological details. By combining stratigraphical and archaeological data it has been possible to set out a relative chronology for sites in the Porvoonjoki river valley.

The question of subsistence economy has been approached with the aid of local archaeo-osteological refuse fauna compared with Mesolithic refuse faunas studied from other areas of Finland. Game fauna has been studied in a broader perspective through an assessment of the resources and opportunities provided by the local paleoenvironment. The structure of settlement has been interpreted on the basis of hunting systems. The long-term effects of environmental change on the overall configuration of settlement are also discussed.

The early settlement of Askola can be connected with the Post-Glacial settlement of other parts of Finland. With respect to this background the Late Palaeolithic development of settlement in NW Europe in the deglaciation stage was also studied with a synthesis of the formations of the Early Mesolithic of Finland.

1.2. The present geography of the Askola region

The area studied comprises the commune of Askola in the eastern part of the province of Uusimaa in Southern Finland. Askola is approximately 55 km NE of Helsinki and 15 km north of the town of Porvoo (Fig. 1). The total area of Askola is 218 km^2 of which approximately half belongs to the catchment area of the Porvoonjoki River. The mean yearly temperature is 14°C with a precipitation of ca. 600 mm/yr. The thermic warmth period is ca. 170 days with permanent snow cover for ca. 120 days yearly (Nironen 1987).

The topography of the area, mainly dictated by the relief of the local bedrock, had formed already before the last Weichsel glaciation. The Pre-Cambrian bedrock of Askola consists mainly of supracrustal rock such as amphibolites, veined gneiss, uralite porphyrite and feldspar schist as well as basic plutonic rocks such as granodiorite, granite, diorite-gabro and peridodite. To the east of Askola the bedrock changes predominantly into granodiorite and granite. Roughly 15 km east of the centre of Askola is the boundary of the Rapakivi granite zone running N-S. The Rapakivi granite zone extends east as far as the Karelian Isthmus (Laitakari & Simonen 1963).

The elevation of the terrain varies from ca. 15 to 95 metres above present sea level. The highest elevations are the crests of outcrops of bedrock and the lowest elevations are from the clayey plain of the Porvoonjoki river valley in the southern part of the

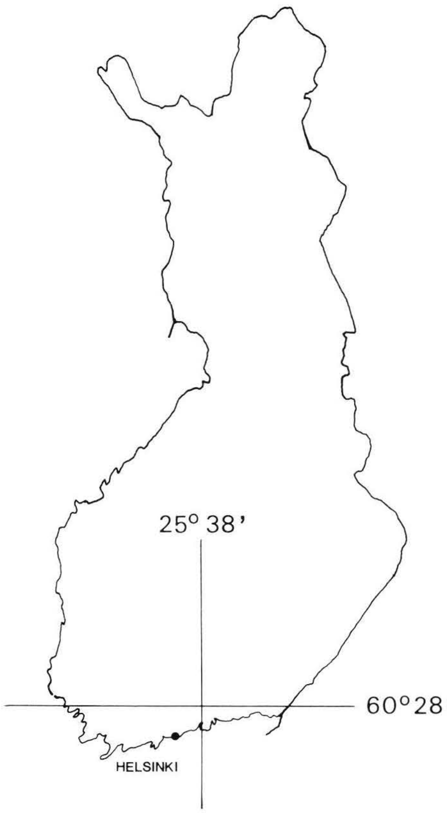


Fig. 1. Geographical location of Askola.

area. The highest outcrops of bedrock have been eroded by the effects of ancient shores and they are surrounded mainly by till. There are small occurrences of glacial stream deposits in the Porvoonjoki river valley and at Hännilänmäki at Vahijärvi. To the north of Askola at Pukkila there is a more extensive glaciofluvial ridge running NE-SE. The system of ridges passing through Askola is not uniform. It is formed by delta-like formations, kames, and the kame terraces of outcrops of bedrock.

The shore displacement of the Baltic has formed shore deposits that are more developed in the ridge area than in the areas of till. Sedimentation has occurred in the low-lying areas between points of higher elevation. The shore deposits and sedimentation came about during the final stages of the Baltic Ice Lake after the retreat of the glacier as well as in the Yoldia, Ancylus and Litorina stages at the lower elevations (30—15 metres) (Tynni & al. 1976).

The present forest cover is dominated by *Picea* and *Pinus*. There are few bogs in a natural state of preservation in Askola, as all of the low-lying bogs and marshes that could be cleared have been reclaimed into fields. The best and most fertile areas of soils are under cultivation at present and present forest vegetation differs considerably from earlier conditions. Some small areas of groves have remained with abundant stands of mixed forest. It is possible that the origin of the more demanding mixed forests can be traced back to the climatic optimum of the Post-Glacial (Tynni 1966).

2. THE PALEOENVIRONMENT OF ASKOLA IN THE EARLY POST-GLACIAL PERIOD

2.1. Basis for outlining the paleoenvironment

Compared with overall conditions in Finland the Stone Age finds of Askola are numerous. Reasons for this may be sought in a past environment that was favourable to human activity. A reconstruction of the paleoenvironment permits an outline of the catchment area providing subsistence for the Stone Age communities and their hunting-fishing economy. The environment can be reconstructed by investigating events of natural history in the area from the Early Post-Glacial to the thermal optimum of the Holocene (ca. 11000—5000 b.p.). Chronologically, this period spans the Mesolithic, which is central to the Askola region.

Starting-points for the formation of paleoenvironments in Finland are provided by four basic factors of quaternary geology:

1) The chronology of the retreat of the continental ice-shelf
2) Land uplift
3) Post-glacial changes in the Baltic
4) Development of vegetation and forests

The relationship of the glacial isostasy of the Early Holocene and the eustatic movements of the Baltic presents a complex set of problems. Shore displacement studies carried out over the decades could be reliably correlated only as late as the 1970s and '80s through the increased use of the more precise radiocarbon datings instead of the former relative chronologies. It must be noted, however, that numerous problems and inadequacies still remain. Previously studied materials from various parts of the Baltic provide a solid basis for more precise studies employing radiocarbon datings (e.g. Alhonen et al. 1978; Eronen 1974, 1976; Hyvärinen 1980; Glückert 1976, 1979; Nùñez 1978a, 1978b; Glückert & Ristaniemi 1980; Matiskainen 1989; Salomaa & Matiskainen 1983, 1985; Haila 1987).

The main studies of relative chronology relating to Askola and the eastern Uusimaa region have been published by Hyyppä (1935), Virkkala (1951), Sauramo (1958) and Tynni (1960, 1966). Shoreline displacement of the area has been connected with radiocarbon datings in studies by Eronen (1974, 1976), Matiskainen (1989) and Haila (1987) (see also Eronen & Haila 1982). Risto Tynni's precise study of Early Post-Glacial shoreline displacement in Askola (1966) was the last major work based on relative shore-displacement chronology. Tynni had the opportunity of carrying out only three radiocarbon datings of his material. Later studies have renewed the complex system of dating, but despite this, stratigraphic occurrences in series of deposits are still valid material for comparison in combining observations with present radiocarbon-based chronology.

Tynni's study was based on 41 series of layers of Post-Glacial sediments, mainly present-day bogs. In addition to stratigraphical description he also carried out analyses of pollen flora and in a large number of cases also diatoms. The diagrams are carefully prepared and the history of flora can be clearly interpreted. The present author, together with Matti Eronen, has carried out analyses of six series of layers, in addition to which Virkkala's analyses of five series of deposits are also available. On the basis of an Ancylus transgression discovered at Huiskaissuo bog in Askola Haila (1987) has studied the development of the transgression throughout the bog basin with a lengthwise profile of the bog consisting of six pillars.

We have thus at our disposal a relatively extensive and reliable body of material for

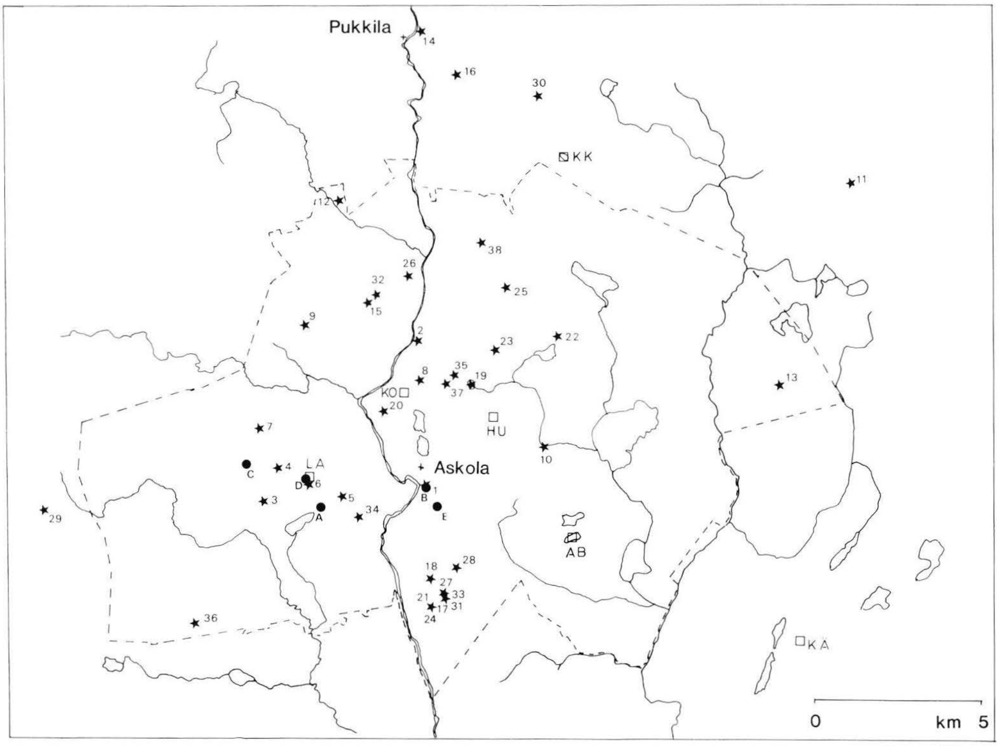


Fig. 2. The Commune of Askola with studied pollen and diatom stratigraphical sites. (★ = Tynni 1966, = ●Virkkala 1951, □ = Matiskainen 1983).

investigating paleoenvironmental conditions. In most of the layer series, the emphasis of study has been on the early stages of the Post-Glacial and especially the Ancylus Lake stage. The latter part of the Litorina stage following the transgression (ca. 7000—6000 b.p.) has been the subject of lesser interest (Fig. 2).

In studying the paleoenvironment of the Early Holocene the main aspects concern the chronologically fixed occurrence of dry land as conditioned by land upheaval and the various phases of the Baltic. The environment that had formed under these conditions with its bedrock, soils, bodies of water, climate and vegetation as well as the development of the forests formed the ecosystem of the local fauna and together dictated the conditions of subsistence for the hunter-gatherer communities dependent on the yield of the environment. The changing natural conditions in the millenium immediately following the melting of the glacier are the most difficult to verify as Early Post-Glacial events, land upheaval, changes in sea-level and vegetational changes were rapid and abrupt in comparison with later periods.

2.2. Methods of reconstructing the paleolandscape

2.2.1. Pollen analysis

Pollen analysis has mainly been used in the study of post-glacial forest history, but the various forest-historical phases can also be used in relative dating. The radiocarbon-dated zone boundaries permit the use of chronozones. The third important aspect of pollen analysis is revealing the traces of early farming and other effects of man upon the environment with the use of cultural-indicator pollen (Fægri & Iversen 1975; M.Tolonen 1978; Huttunen 1980; Hyvärinen 1986). Phenomena caused by Mesolithic man that can be identified in pollen series are very limited. Only the occurrence of possible forest-fires identifiable through particles of charcoal may in some cases be related to the activities of past hunter-gatherers (Welinder 1983, 1989; K.Tolonen 1983).

Fig. 3 presents a schematic stratigraphy of the Askola area with information provided by pollen analysis. The stratigraphical pillar presented also takes into account sediments of the Baltic from the beginning of the Early Post-Glacial as well as the subsequent development of pollen types in the body of water studied (bog). The lowermost sediments are of the Post-Glacial ice sea and ice lake and consist of layers of sand and varved layers of sand, silt and clay. These sediments formed before and after the Baltic Ice Lake broke its barriers, especially around the time of the so-called g level. The Yoldia clays can be seen as symmictic varved clays. The development of the Ancylus phase is indicated by post-Yoldia regression sediments with a higher organic content, clay, gyttja or detritus. The Ancylus transgression brings about gyttja which changes to detritus mud after isolation in the regression stage. In the specific system of the bog, especially in connection with its growing over due to batymetric factors, it is possible to distinguish the *Equisetum* > *Carex* peat stages before the present *Sphagnum*-growing state. The type stratigraphy can be found at an elevation of 57—60 metres a.s.l., where the Ancylus transgression can also be observed (Tynni 1966; Matiskainen 1989). The pillar cannot be connected with the Litorina sea and its possible transgression as this stage occurs at an elevation of ca. 28—32 metres asl.

In accordance with Sauramo (1958) the pollen composition zones present are II,III, IV, V, VI and VII, which in chronozones correspond to the Alleröd (II), Youngest Dryas (III), Preboreal (IV), Boreal (V) and Atlantic (VI,VII) periods. The regional pollen composition zones corresponding to the above composition zones are NAP (non-arboreal pollen), II, B (*Betula*), IV, P (*Pinus*), V, BACU (*Betula-Alnus-Corylus-Ulmus*), VI-VIII. In some cases in the Askola layer series zone VII can be delineated to the beginning of the uniform curve for the occurrence of *Tilia*. The regional zones of pollen composition are based on radiocarbon-dated events. Chronozones dated from outside the area have also been used in this connection (Tolonen & Ruuhijärvi 1976; Donner & al. 1978).

In paleoecological perspective the history of the forests in the Post-Glacial displays the same law-like tendencies as during the former glacial and interstadial phases. The cryocratic glacial pollens cannot be distinguished at Askola apart from possible long-range wind transport and re-sedimentation in zones II and III. There may have been primary sedimentation during the Alleröd interstadial, although this has not been verified in Finland. In the protocratic stage corresponding to zones IV and V the pollen is already very progressive. Zones VI-VIII correspond to the mesocratic thermal optimum, the warmest phase of the Post-Glacial (Hyvärinen 1986; Khotinsky 1986.)

2.2.2 Diatom analysis

Diatom flora permits a study of the history of the Baltic and the emergence of dry land with respect to the Askola region and the specific details of when it was isolated from the sea due to the eustatic movement of the Baltic and the isostatic factors affecting the earth's crust. The main problem is to what extent the Late Glacial and Early Post-Glacial sediments contained redeposited diatoms. For example Sauramo (1958) using diatom flora indicating salinity distinguished from the Preboreal Yoldia Sea the brack-

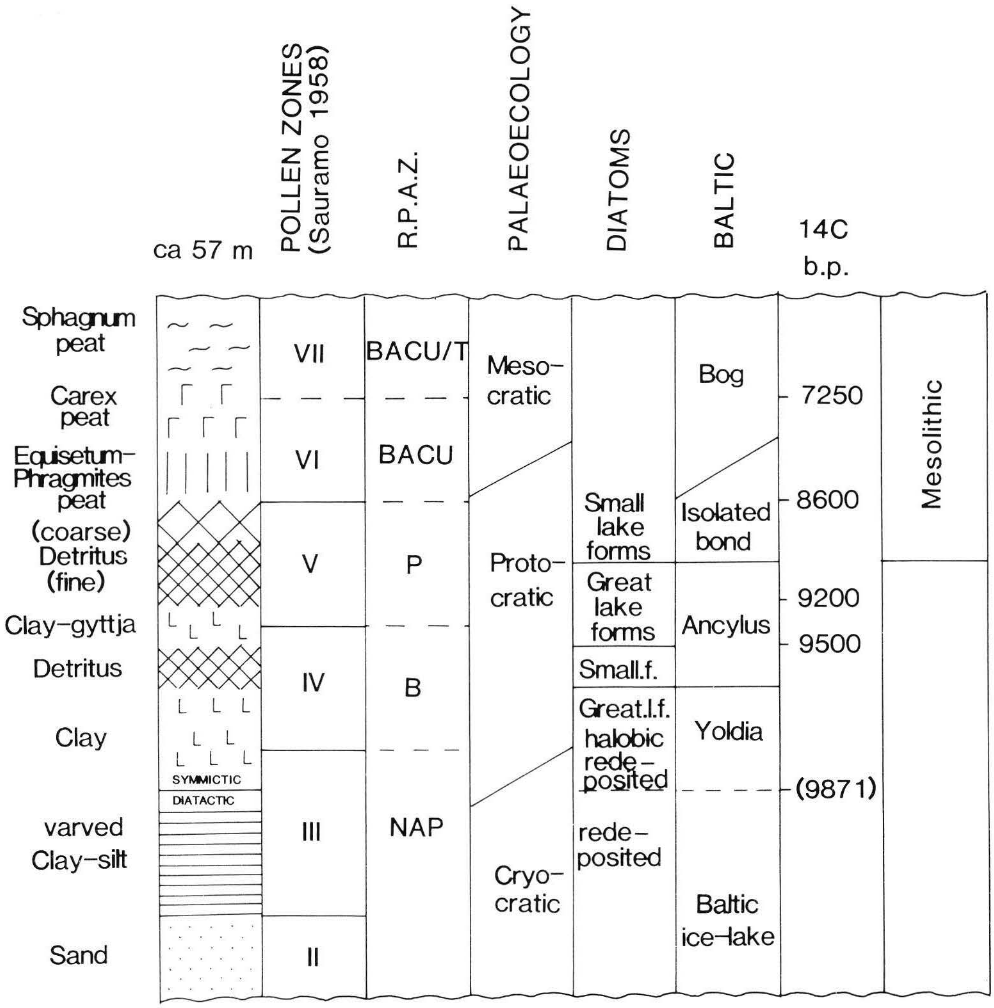


Fig. 3. Example of stratigraphy with data concerning the Early Post-Glacial period ca. 11 000—5000 b.p.

ish Echineis Sea phase preceding the Ancylus phase. Eronen (1974) presents serious doubts concerning even the saline diatom ecology of the Yoldia Sea maintaining that the fresh melting waters prevented the development of halobic diatom species. According to Eronen the salinity of the Yoldia Sea has been over-emphasized by interpreting as primary redeposited halobic species of the Eem interglacial. In any case, Tynni (1966) observed symmictic clay in the stratigraphy, which indicates a saline sedimentation environment, as well as diatoms indicating salt water. In the latter stage of the Yoldia Sea fresh-water diatoms begin to dominate and it can be assumed that at least in the period of the Yoldia maximum the Baltic was saline in the region of Askola (nos. 33,34,35, Fig. 2). It has not been possible to distinguish the Echineis phase in any of the layer series from Askola.

The diatom species of the the Ancylus phase represent a typical ''Arenaria'' flora. Bodies of water isolated from the Yoldia regression display a small lake flora, which in waters affected by the Ancylus transgression, change over into large lake flora up to the culmination of the transgression and the isolation of the bodies of water concerned. There are no observation that distinguish the so-called Mastogloia phase following the Ancylus transgression. The so-called ''Clypeus'' flora of the Litorina sediments is on the other hand distinct as are also minor indications of the Litorina transgression (Alhonen 1986).

Shore-displacement studies are based on the changes of the above diatom facies following the isolation of the small bodies of water from the Baltic. At this stage the diatom ecology changes into detritus mud. The boundary horizons can dated with radiocarbon methods, which has been the case in subsequent studies at Askola (Matiskainen 1989; Haila 1987). At the time of Tynni's studies it was attempted to correlate the boundary points of the isolation process with pollen zones in accordance with relative chronology (see Chapter 4.4.).

2.2.3. Climate, fauna and chronology

Climate is central to our study of the paleoenvironment and in this connection the basic starting-points are provided by cycles governing vegetation that can be distinguished in the interglacials. In accordance with revertence the thermocratic species are replaced by mediocratic species in the thermal optimum. The Blytt-Sernander theory of climatic change with its continental Boreal and Sub-Boreal periods and the marine Atlantic and Sub-Atlantic periods is not precise enough to describe climate in the Mesolithic catchment of Askola. However, detailed taxonomic interpretations of pollen stratigraphy permit more detailed investigations of climate. The climatic graph is projected from Khotinsky's (1986) graph for relative climatic development in the Post-Glacial (see p. 22).

Post-Glacial change and development in fauna must remain less detailed. Certain conclusions may be drawn by comparing the present ecology with a reconstruction of the paleoenvironment. Limited indications of Stone Age refuse fauna from the area of Askola are the only concrete means of approaching the means and aims of the hunter-gatherer community with respect to the utilization of faunal resources. Archaeological excavations have revealed small amounts of burnt bone suitable for species determination (see Chapter 5).

The aim of chronology is to date shore displacement and the Stone Age sites. The only suitable dating method at Askola is to develop a uniform shore displacement chronology. Stone Age chronology can be approached by comparing the relationship of sites with sea-level using the so-called stratigraphic method based on horizons dated with radiocarbon (see Chapter 4).

2.2.4. Long-term change in the paleoenvironment

The means provided by quaternary geology and palynology for studying the Mesolithic paleoenvironment of Askola were presented above. Welinder (1984) has presented a general model of the ecosystem, divided into inter-linked sub-systems. His diagram gives a comprehensive view of the information by which it is possible to recover and reconstruct a prehistoric catchment in its entirety and to which the above methods can be applied in order to outline long-term phenomena (Fig. 4). The terrestrial sub-system produces simple compounds and living biomass from sunlight through photosynthesis. The independent physical and environmental sub-system governs the biological sub-system creating the resources and opportunities for organic nature to function in. The interaction of the human sub-system and the physical-biological environment can be seen in the use of soils and in the utilization of plants and animals.

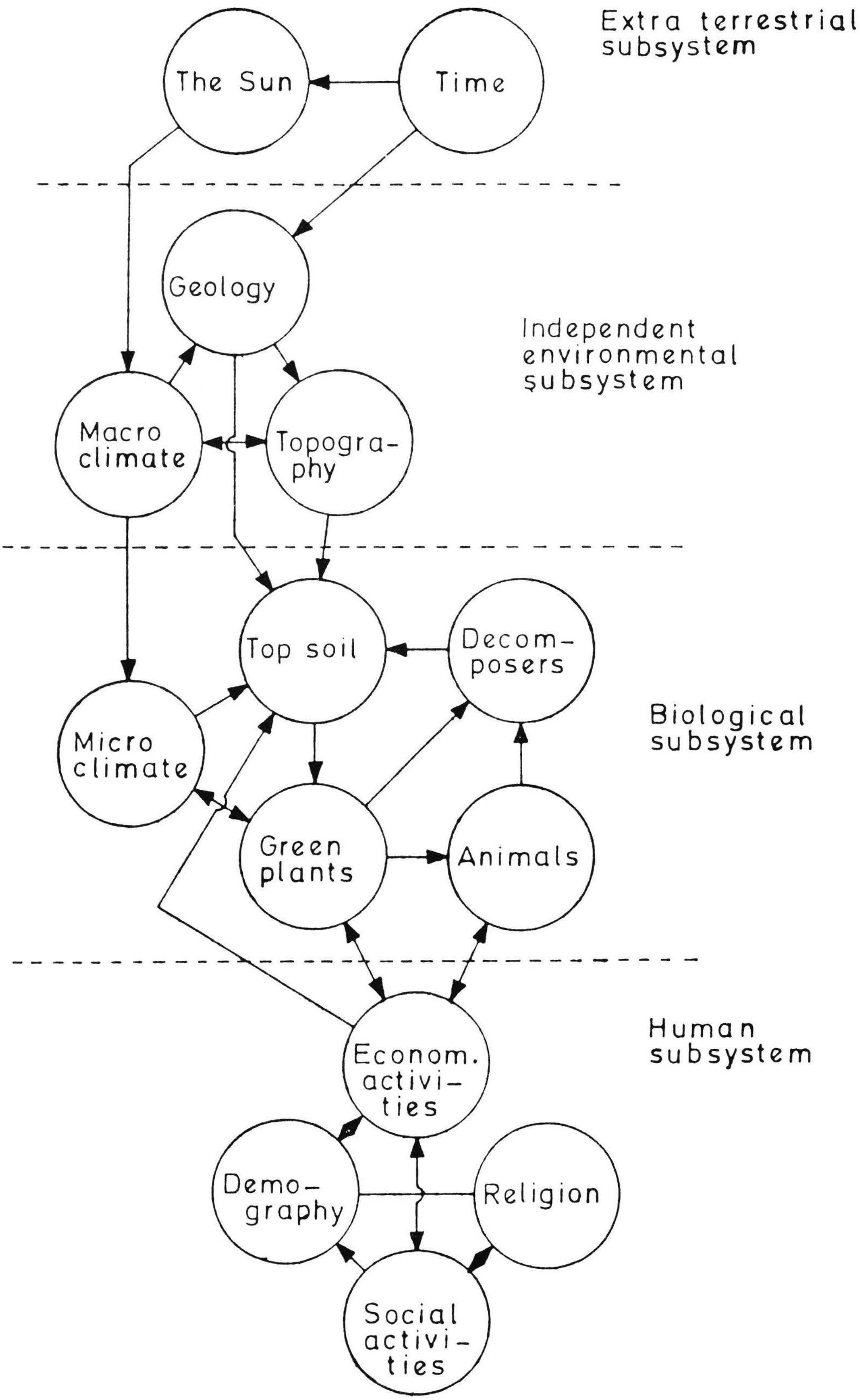


Fig. 4. Generalized model of the ecosystem with subsystems, reprinted from Welinder (1984).

Welinder (1984) has presented the following explanations regarding possible changes in the environment (in connection with Askola certain additions and specific details are added in parentheses):

1. Changes in the independent physical environment (e.g. eustatic change, changes in climate, development of vegetation),

2. Changes in population (e.g. migration, overpopulation/catastrophes)

3. Changes in the human sub-system (e.g. diffusions, innovations, subsistence economy, religion) and

4. Changes in the interaction and relationship of the human and biological sub-systems (e.g. changes in fish and game stocks, new hunting methods, new species).

2.3. The formation of dry land and Early Post-Glacial shore displacement in Askola

2.3.1. The Baltic Ice Lake and the Yoldia stage

In Tynni's opinion the earliest Late Glacial stages correspond to the Alleröd period according to clay chronology, at which stage the shoreline was at an elevation of 60—70 metres above present sea level. This is difficult to verify in the pollens as there is a considerable amount of redeposited pollen flora at the edge of the glacier mixed with regional pollens (Tynni 1960, 1966; Hyvärinen 1986).

The presence of the Alleröd stage in the area is indicated by coarse-layered bottom sediments showing that there had been dry land in the area already before the varved clays of the Baltic Ice Lake. In the 12th millenium, according to varve chronology, the continental ice sheet had reached the northern shore of the present Gulf of Finland and from there had melted as indicated by the de Geer moraines to the north of the first Salpausselkä ridge (Donner 1976). However, according to Kvasov (1979) the glacier was still in the present area of Estonia as late as ca. 11,900 b.p. (cf. Raukas 1986).

In the Late Dryas period of the Baltic Ice Lake there was no dry land at all in the region of Askola. The rapid changes in the level of the Baltic are difficult to study. According to Tynni (1966) the g level was at an elevation of approximately 95 metres, from where it rose to higher elevations of 130—140 metres judging from the Salpausselkä deltas. In stage III of the Baltic Ice Lake rapid regression revealed the bedrock islet landscape typical of Askola at elevations above 60—70 metres. The varve dating of this event is ca.10,200 b.p. (Donner 1978).

The Yoldia Sea stage with its warmer climate permits the first reliable observations of local vegetation. The transgressive culmination of the Yoldia stage was defined by Tynni at ca. 73 metres a.s.l. and its regressive development continued to 52 metres. Later studies have not been able to verify this Yoldia transgression. According to Tynni, pollen zone III can be connected with the beginning of the Yoldia stage, dated to ca. 10 200—9700/9600 b.p. (Donner 1982; Björck & Digerfeldt 1986; Ristaniemi & Glückert 1987). The pollens indicate a dominance of grasses, small shrubs and bushes in the vegetation cover (see p. 20). The ''Ephedra'' syndrome can also be observed in the Early Post-Glacial pollen flora of Askola (Tynni 1959; Glückert 1979).

Pollen zone IV dominates the regressive stage of the Yoldia Sea. According to varved clay chronology the diatactic varved clays of the Baltic Ice Lake change into symmictic clay indicating a saline sedimentation environment in the varve year 9871 b.p. (Donner 1969). In the diatom flora of Askola salt water indicators are mainly *Nitzschia navicularis* and *Diploneis smithii* and to a lesser extent *Campylodiscus echeneis*. Brackish water is indicated by *Fragilaria virescens var. subsalina*. These sediments do not yet contain the indicator diatoms of a lacustrine fresh-water environment. At Askola at least the initial stages of the Yoldia phase were clearly saline and the melting waters no longer affected the flora as was the case near the retreating ice-sheet. As mentioned above, the Echineis phase with its change into fresh-water conditions cannot be distinguished in Askola.

In Askola Late Glacial and Early Post-Glacial shore displacement was rapid varied to a great extent. From 10,000 to 9600 b.p. the area received its pioneer vegetation and the landscape changed to correspond to an archipelago environment. At this stage there are no signs yet of human influence or presence, although conditions by the Yoldia stage at the latest were even favourable for off-shore subsistence strategies. Because of the effects and dynamics of transgressions and regressions, traces of Stone Age human activity are difficult to find. Settlement of the period should have been at elevations of 73—64 metres a.s.l. in order for the sites to have been preserved in their primary state as according to indications of shore displacement. The only site that could possibly be connected with the Yoldia phase is the quartz quarry of Kopinkallio in Askola, located at an elevation of ca. 70 metres (see Chapter 4), but its connection with shoreline datings is questionable (Siiriäinen 1969, 1981b).

2.3.2. The Ancylus Lake

One of the most interesting problems of the shore displacement history of Askola that has been the subject of intensive study in recent years is the Ancylus transgression and its dating (Tynni 1966; Donner & Eronen 1981; Matiskainen 1989; Haila 1987). Land uplift following the Yoldia regression isolated the Baltic from the North Sea and the Atlantic and the melting waters of the retreating glacier soon changed it into a large fresh-water lake. Fast land upheaval and the melting waters brought about a rapid metachronic transgression in the basin of the Baltic.

The Ancylus Lake and above all its relationship with the Atlantic is still a subject that is not well known. There does not even appear to be any agreement among experts concerning its discharge channel and opinions are also divided concerning its age (Björk 1986; Svensson 1985; Påsse 1985). Recent studies suggest that the marine Yoldia phase may have been shorter in duration than hitherto assumed, possibly only 200 years (10,000—9800 b.p.). The short duration of the marine phase may explain, why the effects of the salt water of the Yoldia Sea on diatoms are so weak and why fresh-water diatom flora begins to dominate already in the final stage of the Yoldia phase. Accordingly, the beginning of the Ancylus Lake stage was earlier in date (Haila 1987).

At Askola the diatom flora of the Ancylus Lake are represented by a highly typical so-called ''Arenaria'' flora. The most common species are *Melosira islandica ssp. helvetica, Melosira arenaria, Amphora ovalis, Diploneis domblittensis, Gyrosigma attenuatum* and *Campylodiscus noricus var. hibernica* (Tynni 1966; Matiskainen 1989; Haila 1987). At present there are five studies of series of sediments from Askola sites where the Ancylus transgression following the Yoldia regression inundated bodies of water that had already been isolated at an earlier stage. These are Haapasuo (Tynni 1966), Nietoo (Tynni 1966), Kopinkallionsuo (Matiskainen 1989), Kokkusa (Matiskainen 1983) and Huiskaissuo (Matiskainen 1989; Haila 1987). Water levels rose from 52 metres to 61—62 metres a.s.l. in the area.

Haila (1987) has presented a detailed study of an Ancylus transgression series recovered by the author in 1980 from Huiskaissuo bog. Six stratigraphical pillars containing information on the transgression provided 15 radiocarbon datings offering a precise dating for the Ancylus transgression.

The Huiskaissuo bog appears to have been isolated from the sea for the first time during the Yoldia regression (9700—9600 b.p.). The transgression reached the body of water with its threshold at 58 metres slightly before 9500 b.p. and the culmination can be dated to around 9200 b.p. The final isolation of the bog is dated to 9100 b.p. Material from the western Uusimaa region has provided corresponding dates (Ristaniemi & Glückert 1987).

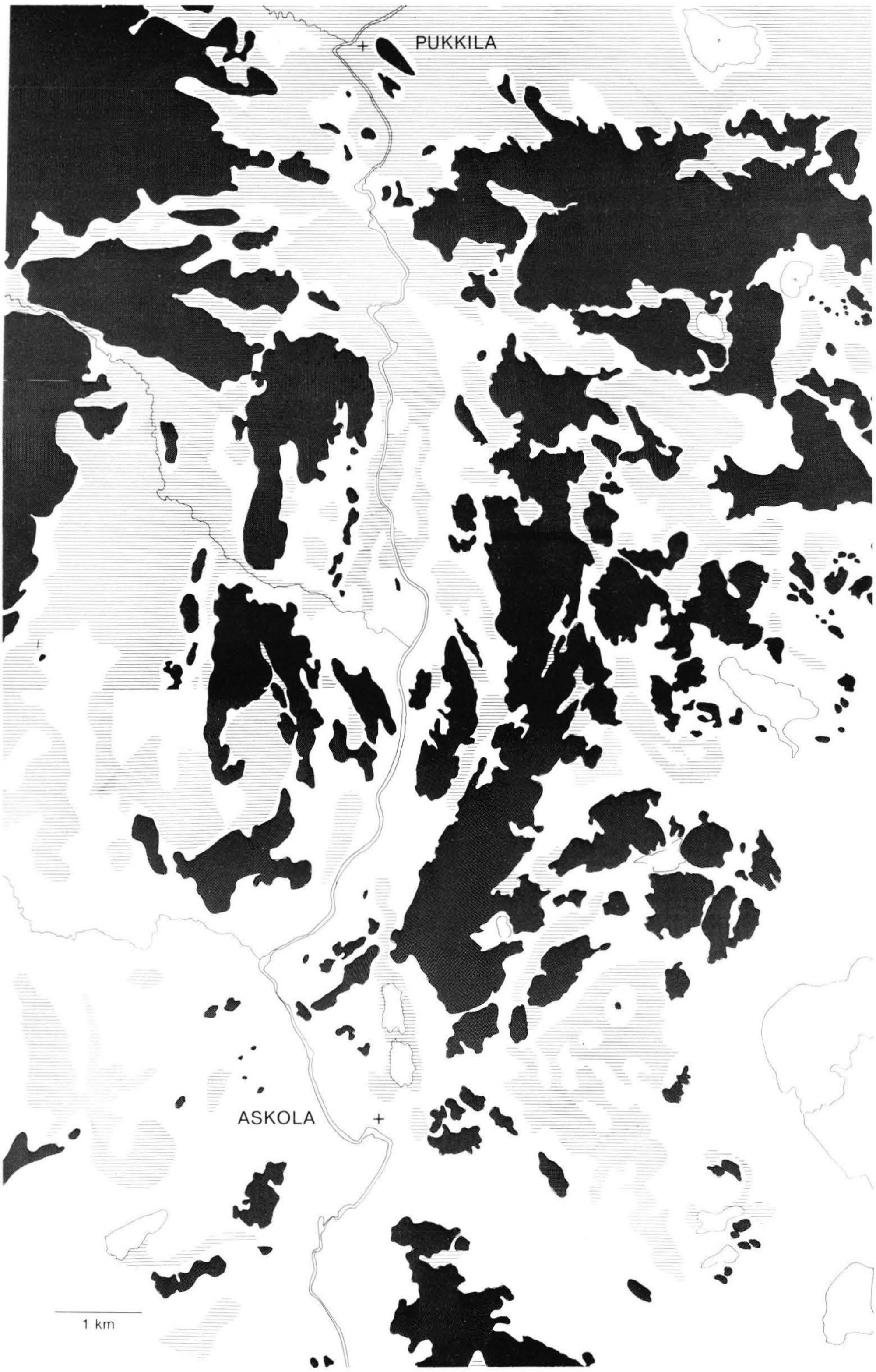
The previous dating for the final isolation of Huiskaissuo bog was considerably younger, ca. 8500 b.p., but the sample in question clearly appears to have been taken from a point too high in the stratigraphic pillar, thus explaining the younger date. At Kopinkallionsuo bog the dating from above the isolation point was also ca. 8500 b.p. (Matiskainen 1989). The datings reported by Haila (1987) are possibly better suited to the beginning of the Ancylus transgression.

In Askola pollen zone boundary IV/V (*Betula/Pinus*) appears to have a date that is earlier than the previously accepted boundary of 9000 b.p. At Huiskaissuo bog the boundary (P.A.Z.) is already in the first part of the transgression gyttja, which indicates a dating to ca. 9200 b.p. — earlier than the culmination. The dating of the zone boundary is in agreement with zone boundaries dated from from western Uusimaa (Ristaniemi & Glückert 1987).

Following the culmination there was a rapid and almost catastrophic regression with the opening of the discharge channel in the the straits north of Denmark. Sauramo (1958) and Tynni (1966) have described the event as partly an abrupt fall in the shore displacement diagrams. Radiocarbon datings also appear to support the interpreted catastrophic nature of the event. At Lake Aborreträsk in Askola where the threshold is at an elevation of 39 metres the regression is dated to ca. 8700 b.p. and it must also be noted that the spread of *Alnus* and accordingly pollen zone boundary V/VI (*Pinus/Betula-Alnus-Corylus Ulmus* P.A.Z.) corresponds roughly to the date of isolation. The metachronic nature of the boundary is clearly evident at Askola, as the rational increase of *Alnus* in the pollen diagrams falls into a broad range of dates in the various series of sediments. At Huiskaissuo bog its age is ca. 8400 b.p. and at Haapasuo bog the available dates range between ca. 8600 b.p. and 7600 b.p. It can be assumed that the considerable degree of local variation in the dating of the beginning of *Alnus* posed problems of interpretation for Tynni (1966) with the result that there are bends and kinks in the shore displacement curves as well as a long Ancylus transgression phase. It appears that water levels fell over 20 metres within a few hundred years. Haila (1987) has estimated a regression rate of ca. 7 metres/100 years, but it could also have been faster.

In any case, the Ancylus transgression brought about marked changes in the environment. Eronen (1974) has dated the isolation of the Bastuberg bog situated in the rural commune of Porvoo on a lower land uplift isobase to ca. 8500 b.p. The bog is at an elevation of 28.5 metres a.s.l. Projecting this data onto the Askola area we may conclude that during the stage of rapid regression beginning around 9200 b.p. and continuing only approximately 700 years the level of the Baltic fell over 30 metres. The archipelago environment of the culmination of the Ancylus Lake changed into a river estuary the mouth of which was to the south of Askola below the present Henttalankoski rapids in the rural commune of Porvoo. The Porvoonjoki river valley began to form around 8500 b.p. in the present area of Pukkila-Askola. Characteristic features of the changes

Fig. 5. Paleoenvironment of Askola in the Ancylus Lake stage ca. 9500—8000 b.p. The shaded area indicates extent of dry land at the time of the Ancylus culmination, ca. 9200 b.p. (60 metres above present sea level). Hatched area presents the occurrence of relict lakes and marshy areas which have subsequently paludified and grown over.


PUKKILA
ASKOLA
1 km

were the isolation of deeper areas into separate bodies of water, growing-over and paludification. The deeper bodies of water, controlled by their own thresholds, continued their own Post-Glacial course of development. The shallower locations were grown over but favourable conditions have preserved a few relict lakes and ponds up to the present day.

The paleogeographic map of Fig. 5 demonstrates the history of the Baltic in the Askola region from 9500 to 8000 b.p. The darker area is dry land at the time of the Ancylus culmination ca. 9200 b.p. (elevation 60 metres a.s.l.) at which stage the area consisted of an outer/middle/inner archipelago complex with preboreal birch vegetation. The map also takes into account tilting in the area caused by land uplift. The hatched area indicates the occurrence of isolated relict lakes and other bodies of water following the regression. These have paludified and grown over and at present most of them have been cleared for field cultivation. Certain present-day relict lakes as well as the Porvoonjoki river have been marked in the map for reasons of orientation.

2.3.3. The Mastogloia phase and the Litorina Sea

In the transition from the Ancylus Lake to the Litorina Sea the littoral facies of the Baltic displays a brackish water stage known as the Mastogloia phase in accordance with the Mastogloia diatom species generally occurring in shallow environments. In the case of Askola it is interesting to observe how shore displacement developed in this transition stage.

The rapid rate of regression of the Ancylus Lake has been assumed to have been the result of the shift of the channel of discharge from Central Sweden to the straits north of Denmark with its resultant fast discharge of waters. The mechanisms in question are not known in detail and various theories have been presented concerning the event (e.g. Påsse 1985). Salt water entered the Baltic, possibly in small amounts at first as assumed by Sauramo (1953) and later to a greater extent as eustatic movement enlarged the discharge channel. The first metachronic distributions of salt water are observed in Southern Sweden around 8500 b.p. (Berglund 1964). On the Finnish coast the earliest datings for this event are around 8000 b.p., but in the deeper sediments the change of salinity occurred only as late as ca. 7500 b.p. (Ignatius & al. 1981; Hyvärinen 1984).

At Askola the Mastogloia phase cannot be distinguished at all on the basis of the eponymic species. However, comparisons of two bodies of water, Lamminjärvensuo bog in Askola and Lake Bakunkärrträsk in Askola, give certain indications of the development of the shoreline in the period concerned. Both are located on approximately the same 3.2 mm/yr land uplift isobase and are thus comparable with each other.

The Late Ancylus diatom stratigraphy of Lake Bakunkärrträsk (elevation 32.2 metres a.s.l.) shows that it had almost become isolated into an independent body of water, but had soon come under the influence of brackish water. The event is dated to 8000 b.p. The effects of brackish water cease around 7500 b.p. (there is a dating to ca. 7250 b.p. from a point higher up in the stratigraphy). The beginning of the spread of *Tilia* (T°) is dated to around the same time (Hyvärinen 1979). The elevation of Lamminjärvensuo bog is ca. 31.5—32 metres a.s.l. Here the large lake diatom species change into species typical of small bodies of water, but the stratigraphy does not indicate any distinct isolation from the Baltic. This is followed by a weak brackish water stage. The bog was studied by Tynni (1966) and was re-investigated in 1980 in order to date the

Fig. 6. Paleoenvironment of Askola following the Litorina culmination. Shaded area indicates sea-level around 6500 b.p. (30 metres above present sea level).


+ ASKOLA
1 km

brackish water stage (Matiskainen 1983). The event in question is younger than at Lake Bakunkärrträsk. A dating of ca. 7600 b.p. was obtained from below the brackish water stage, 7200 b.p. for the actual brackish water stage and ca. 6900 b.p. from above the point of isolation. Accordingly isolation into a small body of water had occurred around 7000 b.p. The beginning of *Tilia* at Lamminjärvensuo bog corresponds to the occurrence of brackish water, ca.7200 b.p. (Matiskainen 1989; Tynni 1966).

The brackish water of the Mastogloia phase cannot be indicated in the above bodies of water and the event in question must be interpreted as the ''salinification'' of the rapidly regressed Ancylus basin along with the eustatic changes in the level of the ocean, which were almost in balance with land uplift in the Askola region. Because the isolation from the Ancylus Lake cannot be distinguished in either case, it appears that the Ancylus Lake continued its existence in relatively fresh-water conditions and in a state of near balance for over 500 years after the regression. It is only after this stage that salinity can be observed in the diatom species. There are no clear indications of a Litorina transgression extending to 32 metres a.s.l.. The transgression can be observed at 28.5 metres a.s.l. in the Bastuberg bog in the rural commune of Porvoo. Here the beginning of the transgression dates to ca. 7250 b.p. and its end to ca. 6250 b.p. (Eronen 1974). The dates of the Lamminjärvensuo bog are, however, in good agreement with those from the Bastuberg bog at least with respect to the beginning of the transgression. The location of Bastuberg bog on a lower zone of land uplift gives a clearer indication of the effects of the transgression.

The effects of the Litorina transgression can be seen in the Askola region in at least two bodies of water located at lower elevations. Metsä-Henna bog (ca. 31 metres a.s.l.) and Lake Käärmejärvi (29.5 metres a.s.l.) in the rural commune of Porvoo display clear indications of leached sediments as well as a hiatus in the stratigraphy. At Lake Käärmejärvi isolation occurred around 6800 b.p. (Matiskainen 1983).

The paleogeographic map in Fig. 6 shows the position of the Baltic around 6000 b.c. (30 metres a.s.l.) in the Litorina period. The features of the map include the Porvoonjoki River and a long bay extending to the present-day site of Suursuo bog, to the east of the centre of Askola. A strait at the site of the Henttalankoski rapids may have been an important connection between the saline Litorina Sea with the Porvoonjoki River and the water may have been brackish between Henttala and the Hiirikoski rapids.

Luho's (1967) excavation results show that the occupation layers of certain Mesolithic sites were leached as a result of the transgression. This question is further discussed in Chapter 4.6.

2.3.4. Summary of shore displacement in the Askola area

Shore displacement chronology for the Late Glacial and Early Post glacial is linked to varved clay chronology, whereas the latter stages of the Yoldia sea and the datings of the Ancylus Lake and the Litorina Sea are based on radiocarbon. The shore displacement curve is given in Fig. 7. The early stages of shore displacement are of importance for the history of the environment, but with respect to prehistoric settlement the curve is of importance in the period following the Ancylus culmination. The area of probability of shore displacement in the diagram can be outlined as a zone within the limits of error of the 14C datings. The dates of the Ancylus culmination and regression have been defined on the basis of recent studies by Haila (1987). The broken line shows the curve previously presented by the author (Matiskainen 1983).

The later stages of the Litorina Sea and its possible eustatic changes such as Litorina

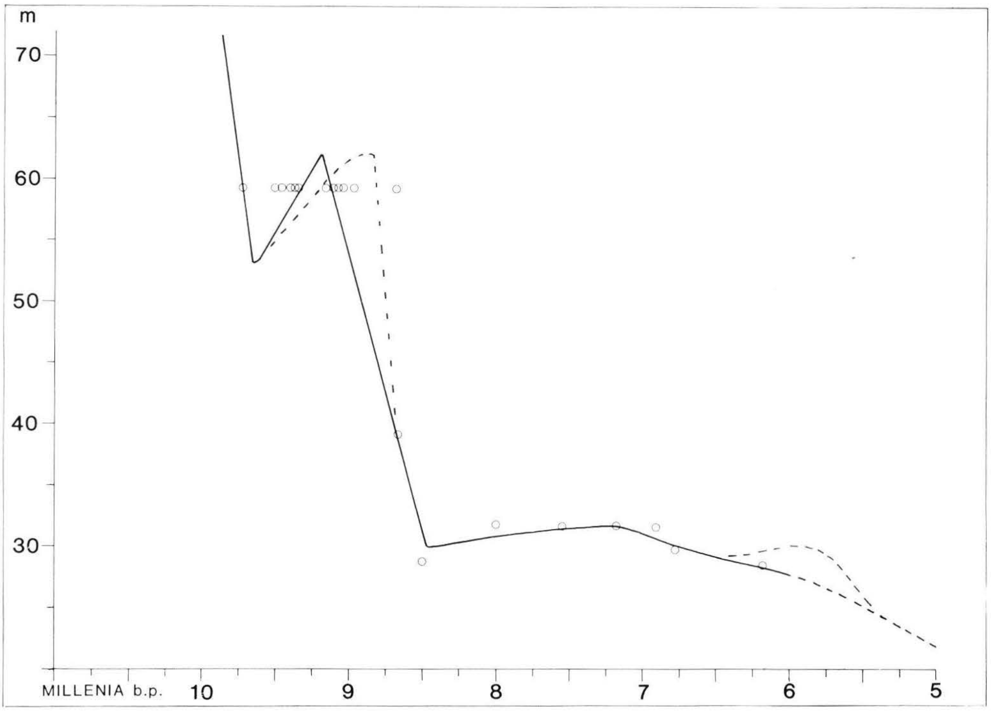


Fig. 7. Shore displacement curve for Askola, ca. 10 000—5000 b.p.

II remain unverified. Archaeological sites provide certain observations for solving these problems and are discussed below.

Nùñez (1978a) has studied shore displacement in Askola from the point of view of exceptional land uplift. The present 3.2 mm/yr land uplift isobase extends to the north in eastern Uusimaa and possibly caused differences in the elevations of prehistoric sites with respect to other regions in the coastal zone (Äyräpää 1929). A different rate of land uplift may be the result of the changing of the bedrock from plutonic rocks to the Rapakivi zone to the east of the Porvoonjoki river. According land uplift would be lesser than expected in the Rapakivi zone. The present stratigraphic shore displacement curve is not affected by abnormal land uplift as it is based on 14C datings from a limited area.

2.4. Development of vegetation and forests in Askola in the early stage of the Post-Glacial

Most of Tynni's (1966) series of sediments contain only the sediment stratigraphy of the Early Post-Glacial, which is in accordance with his specific aims of investigating the Yoldia, Ancylus and Early Litorina phases. This also applies to later studies (Matiskainen 1989; Haila 1987). In the material there are, however, 17 series extending into pollen zone VIII and stratigraphic data covers to whole of the prehistoric period studied, ca. 9300—6000 b.p.

The primary pollens of zone III represent the Dryas period of the supra-aquatic area. However, in Askola the material is dominated by pollen redeposited in connection with the melting of the ice. This NAP-dominated flora can be reconstructed at sites 12,13,17,21,33 and 36 (Fig. 2). The most common species are *Compositae, Artemisia* and *Chenopodiaceae* which are of more durable exine and most probably produced pollen that withstood the effects of the environment. The typical flora also includes *Thalictrum, Ranunculaceae* and *Rosaceae*. Percentually the proportion of the resistant *Compositae* and *Artemisia* pollens may be as much as over 70 %. The *Poaceae* and *Cyperaceae* species are also common and at a later stage small shrubs also begin to increase.

It is only in the Preboreal that more reliable data on vegetation in the area can be obtained from bodies of water at higher elevation where sedimentation conditions were undisturbed. Grasses and small shrubs are dominated by the marked *Betula* maximum. Birch-dominated vegetation, initially of *Betula nana* type changed into *Betula alba* -type forest cover at the end of the period. The pollens of these sub-species have not been separated in the Finnish material, but we may assume that the course of development corresponded to similar conditions in Southern Scandinavia and northern Central Europe (Usinger 1975).

Small shrubs such as the *Hippophae, Salix, Empetrum* and *Ericales* species occur to a considerable degree in the pollen spectrums. Grasses are also common, such as *Poaceae, Cyperaceae, Rosaceae* and *Artemisia*. The local NAP zone, which found its growth environment in dry land after the Yoldia regression and before the *Betula* zone (P.A.Z.), is difficult to identify distinctly in re-sedimented flora of zone III.

With the increase of dry land the conditions for the growth of pine improved and its pollen increase to large number by the end of the Preboreal. Accordingly, with the change from an outer archipelago to an inner archipelago environment the proportion of small shrubs and especially *Hippophae* decreases. The species displays a metachronic southward shift along with the emergence of the outlying archipelago as a result of land uplift. Water-based vegetation begins to form in limnic bodies of water, especially the *Myriophyllum* sub-species; *Nymphaea* and the *Potamogeton* species thrive in conditions suitable to their biotope.

The boundary of pollen zone IV corresponds to the Yoldia regression as well as the period of the Ancylus transgression with a resultant decrease of dry land. The *Betula* species decrease sharply and pine becomes the dominant forest species. There are also limited occurrences of *Corylus* and *Ulmus* that begin to invade the area. Grasses also decrease clearly and NAP pollen decreases to a proportion of 10—20 %. The dry land of the inner archipelago consisted for a long time of only leached till and outcrops of bedrock, which did not permit the growth of vegetation.

During the Ancylus transgression in the beginning of the Boreal period the proportion of dry land increased rapidly as well as finer sediments in the soils. The sharp rise in pine pollen is a result of a change in the climate, but also the increased area of dry land may have led to its larger proportion in the pollen spectrums. The varied nature of the pollen material was increased by vegetation growing in connection with waterlogged areas, bogs and ponds. The Boreal material does not contain any clear indicators of a warmer climate. In the latter part of the period there is an occurrence of *Ceratophyllum* which required temperatures higher than at present. According to radiocarbon datings, the chronostratigraphic duration of the Boreal period at Askola extends from ca. 9200 to 8600 b.p.

During the Ancylus transgression the change from the Boreal to the Atlantic period occurs at pollen zone boundary V/VI with a shifting date of ca. 8700 to 8400 b.p. The change to Atlantic conditions is generally indicated by the rational introduction of *Alnus* in the pollen spectrums, but this event has not been dated at Askola with complete reliability. At Lake Aborreträsk the ca. 8700 b.p. dating of the beginning of isolation dates the beginning of *Alnus* and also indicates the extent of dry land in the beginning of the Atlantic period at elevations of over 40 metres. At site 26 Tynni (1966) dated the event to ca. 7200 with radiocarbon, but this dating is clearly too young. In addition to the standard view of the age of the boundary at ca. 8000 b.p. recent studies indicate earlier datings from elsewhere in Finland (Ristaniemi 1987; Salomaa 1982).

The main change in vegetation is the introduction of *Alnus*. At the same time the previously limited occurrences of *Corylus* and *Ulmus* also increase in proportion and *Quercus* becomes more common in the diagrams. The proportion of grasses decreases and the sedimentation environments of the samples are dominated by NAP species, mainly *Poaceae* and *Cyperaceae*. On the other hand, the number of pollen taxons computed in the diagrams is small, ca. 200, and the pollen of different species of trees appear to exclude the different variants of grasses. The emergence of dry land continued at a fast rate in the beginning of the Atlantic period, but around 8400 b.p. conditions stabilized with the end of the rapid regression. The warmer and more humid climate of the Atlantic period may have increased paludification and the formation of water-logged areas.

Stratigraphic studies of the Askola area have revealed in places the existence of pollen zone boundary VI/VII which reflects the rational introduction of *Tilia*. The beginning of the Post-Glacial climatic climax can be connected with this event. The occurrence of *Tilia* appears to have been of a highly local nature, apparently the result of small numbers of pollen counted. Other available series contain only single pollens and in places the frequency is over 5 % of the total of AP pollen. The occurrence of other deciduous trees corresponds to proportions observed in zone VI.

The age of pollen VII is approximately the same throughout the area as the dating of the introduction of salt water, ca. 7400 b.p. According to datings compiled by Hyvärinen (1984) the beginning of *Tilia* is dated to ca. 7500—7250 b.p. in the Uusimaa region.

Two of the series of sediments from Askola also contain pollen of *Trapa natans* (nos. 7 & 30, Fig. 2, Photo 1). At site 7 the occurrence begins at the same time as *Tilia* and at site 30 *Trapa* appears in the middle of zone VII ending in zone VIII around the empirical beginning of *Picea*. There are no radiocarbon dates available from Askola concerning *Trapa*. In the Mäntsälä region *Trapa* has been observed to appear as early as the Preboreal (Mölder & al. 1957). The occurrence of *Trapa* at Pennala in Orimattila is approximately of the same age as the beginning of *Tilia* and ends around 5300 b.p. (Vuorela & Aalto 1982). Alhonen (1964) has dated a layer containing subfossil remains to ca. 6600 b.p.

Photo 1. Leveäsuo bog, subsequently dried and reclaimed, was a body of water originally isolated in the Ancylus regression. The lake with an area of ca. 2 km^2 belonged to the catchment area. The environs include sites 26 and 67. *Trapa natans* L., with a pollen dating of ca. 7200 b.p. had thrived in the lake.

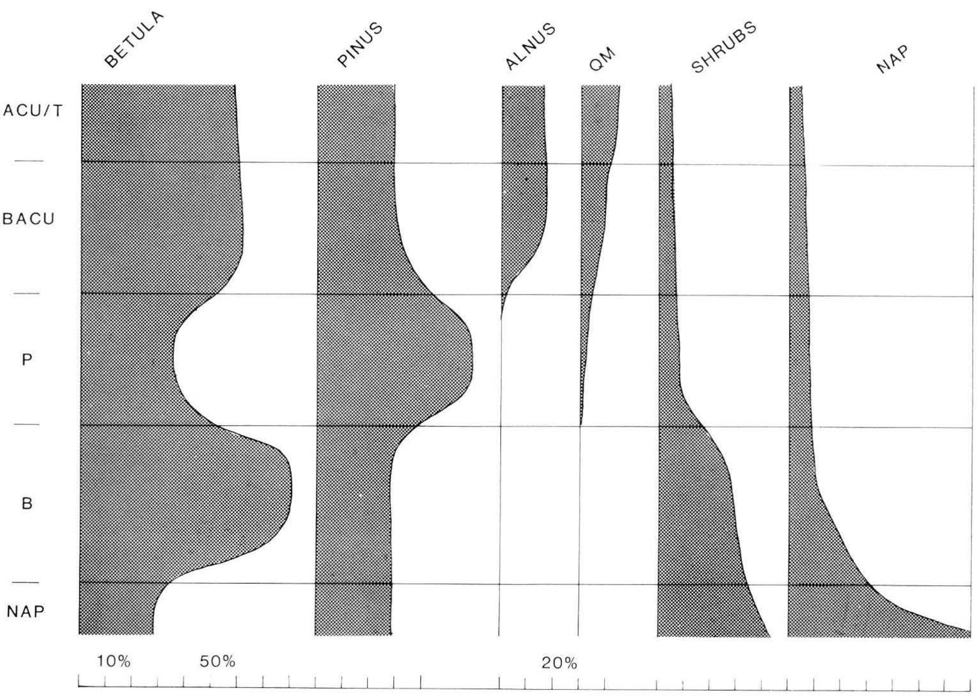


Fig. 8. General pollen diagram for the Askola region, ca. 10 000—6000 b.p.

Fig. 8 presents a summary in vertical diagrams of the mean percentual proportions of pollens in the Early Post-Glacial. The percentages for AP pollen are averages of sediment series studied in the area. There have been no studies of pollen concentrations in Askola and accordingly there is no data on absolute amounts of pollen. For this reason especially the proportions of the NAP zone may differ considerably from the actual production of pollen.

The *Betula-Pinus* ratio in the *Betula* zone is ca. 70:30 and 30:60 in the *Pinus* zone. The *Betula-Alnus-Corylus-Ulmus* zone is divided among several AP species. The average proportions are *Betula* 50 %, *Pinus* 30%, *Alnus* 15 % and QM < 10%. The introduction of *Tilia* does not bring about any significant changes in the upper part of the zone. The local summary diagram for Askola does not differ to any great extent from the overall diagram for Southern Finland presented by Donner (1971). Fig. 9 shows the same result as a pie-graph.

2.5. Development of climate in the Post-Glacial

The most evident climatic changes of the deglaciation phase of the Weichsel glaciation are a rise in temperature and increased humidity. This study refers to Khotinsky's (1986) chronology of climatic change beginning at ca. 12,000 b.p. This chronology covers the western and north-western parts of the Soviet Union. The climatic curve is based on a large number of studied pollen diagrams with statistical recordings of thermal indicators. The occurrence of thermophilic insects as well as oxygen isotope changes have also been used (Fig. 10).

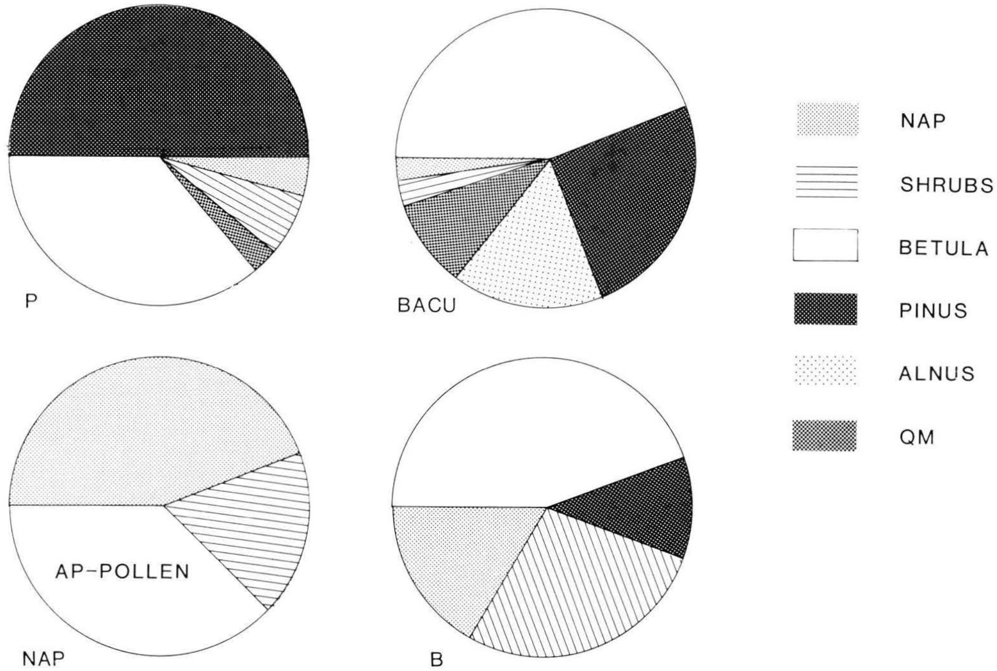


Fig. 9. Pie-graphs showing proportions of pollen in the Askola diagrams in regional pollen assemblage zones.

The trends following the Dryas III stadial are very clear. Temperatures and humidity increase in stages in the Preboreal and Boreal periods, but also the dramatic changes of the beginning of the Atlantic period have had definite effects on changes in the climate and the formation of mesocratic vegetation. It must be noted that in Khotinsky's curve the increase of humidity does not correlate completely with temperature. The Subboreal also includes a dramatic cooling stage which becomes warmer in the middle of the zone. The climate is cooling at a regular rate and it appears that conditions correspond to the Boreal period in both temperature and humidity.

3. PREHISTORIC SITES AND FINDS IN ASKOLA

3.1. Prehistoric finds

The archaeological research of the Askola region is based to a great extent on the work of the late Dr. Ville Luho. From 1946 to 1955 Luho carried out excavations of numerous sites in the Porvoonjoki River valley with the aid of Reverend Lauri Hakalehto of the parish and Soini Järvelä, a local farmer. They succeeded in discovering a large number of Mesolithic sites in the region. Luho's scientific activities concentrated on the study of Mesolithic quartz material, the special features of which he combined with available data on shore displacement. In 1956 Luho presented his doctoral dissertation which was based on his concept of the so-called "Askola culture" (Luho 1956). Over a decade

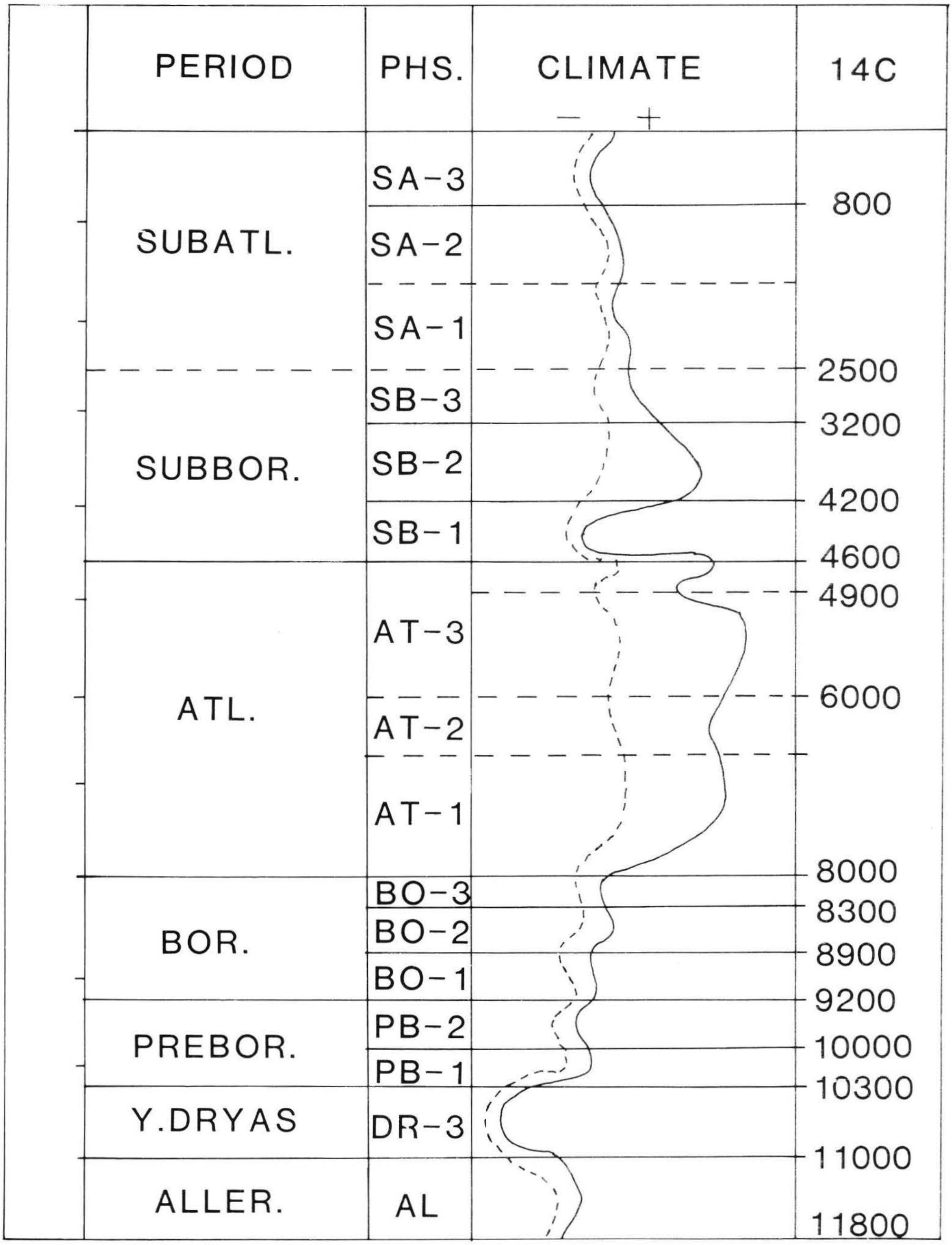


Fig. 10. Diagram of climatic change in NE Europe in the Post-Glacial, according to Khotinsky (1986).

later (1967) Luho published his studies concerning the sites of the so-called ''Suomusjärvi culture'' in Askola. Luho also wrote several newspaper articles concerning the prehistory of Askola. (Laaksonen 1978; Meinander 1982).

Lauri Pohjakallio's archaeological survey of Askola in 1971 succeeded in mapping most of the prehistoric find locations of the area, but unfortunately many sites and finds from the late 19th century and the early years of the 20th century could no longer be identified. Inadequate inspections of sites and later divisions of land made it impossible to verify earlier information concerning the finds at the time of Pohjakallio's survey. Nor was it possible to identify the find locations of a large number of stone artefacts and dwelling-site finds that had been sent to the local historical museum at Askola with insufficient data. Luho's work encouraged many local amateurs to look for new sites as well as collecting finds from previously known locations. The actual locations could not always be recalled at the time of the survey. The survey also showed that the insufficient detail of Luho's excavation reports were a definite obstacle for subsequent studies. Due to the lack of excavation maps the excavated areas could no longer be identified in the terrain and it was often impossible to know exactly where Luho had excavated. A total of 172 prehistoric find locations have recorded at Askola of which 163 date from the Stone Age. Of the latter 71 were documented by Pohjakallio as dwelling sites. A density of finds of this magnitude in an area of ca. 200 km^2 is a considerable one in Finnish conditions.

The prehistoric finds are listed and numbered in topographic order mainly in accordance with Pohjakallio's (1971) numbering of sites and finds (1—172). It has been attempted to place on the map each find location, stray find, dwelling site or other prehistoric site known from the area, but nevertheless there is a considerable number of finds that cannot be given any definite original location. In most of the latter cases the general area of the find is known, but precise information has not been available or survey conditions were such that it was not possible to search for surface finds. (Fig. 11).

Table 1 lists the Askola sites and find locations by name and their appended catalogue and accession data. The finds from the 172 sites and locations total over 500 catalogue entries. Most of the catalogued finds are quartzes obtained as ''yearly pickings'' from previously known sites in the period of active research from 1948 to 1955. The Askola finds are kept in the National Museum of Finland as well as in the local historical museum of Askola (Fi. Askolan kotiseutumuseo — AKM), but in the latter case their origin can only be guessed at. The artefacts have not been catalogued or consistently numbered. A few stone artefacts from Askola are also in the Porvoo Museum (PoM).

A detailed presentation of the extensive material from Askola is not necessary in this connection. It has been presented and described in Luho's Mesolithic studies (1956, 1967) and the stone artefact types are described adequately in Äyräpää (1950a). The material has been grouped into 29 categories, in addition to which the elevation above sea level of the find location is also given (A—Ö; Table 2). The table provides qualitative data, as the sites and locations differ considerably with respect to the numbers of artefacts and their variation. The table gives a selection of the artefact groups that have been recurrently and consistently observed and recorded in the Stone Age material of Askola.

The first group lists excavated sites (1), surveyed and identified sites (2) and stray finds or unidentified sites (3). The group of primitive adzes (B) consists of the so-called ''Suomusjärvi axes'' characterized by a a transverse blade, splitting technique and polishing of the blade part. Adzes of four-sided section (C) include specimens ground and polished throughout, so-called Southern Finnish even-bladed adzes, East Karelian even-bladed adzes and other adzes with blades and corresponding to the above form that are not primitive adzes. Group D includes fragments of ground and polished stone artefacts that have come about in use or through re-shaping. Curved-backed gouges (E) are as described by Ailio (1909) and the group of other gouges (F) consists of specimens that do not fit Ailio's description of the type (cf. Edgren 1966). The fragments of gouges

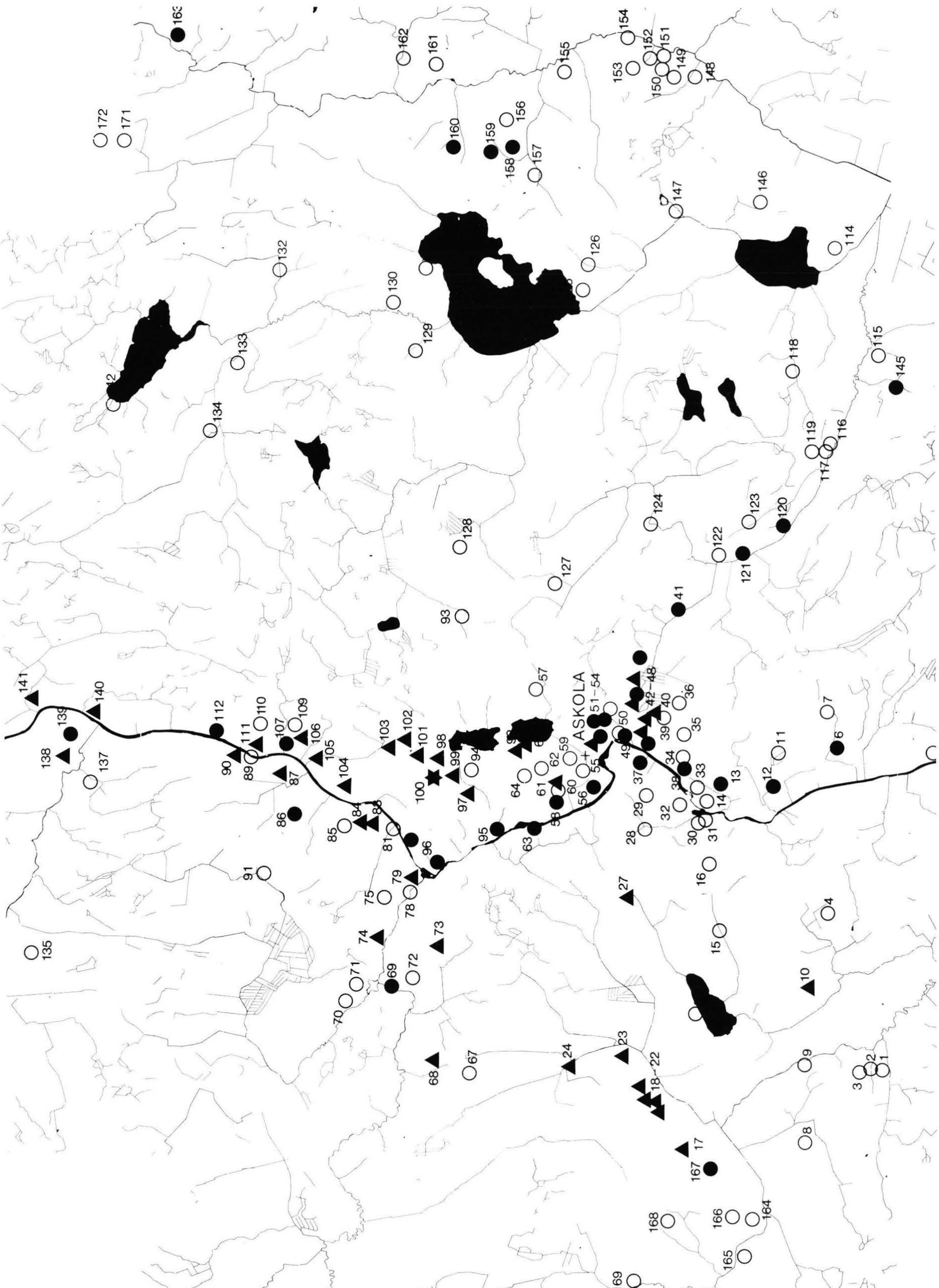


Fig. 11. Distribution of archaeological sites and finds in Askola. (▲ Ancylus Mesolithic site, • Litorina Mesolithic site, ○ undated or unidentified find or site)

(E) are listed separately from the fragments of other stone artefacts (D). Listed as separate groups are double-bladed adzes (H), uncompleted adzes (I) and adzes that have weathered or have become worn through use J). Slate points (K) include leaf-shaped specimens and the chronologically younger slate points (Äyräpää 1950b). Fragments (L) and uncompleted specimens (M) are also listed. Finds of points from Askola include flint points (N) and quartz points with oblique blades (O) (Matiskainen 1986). Perforated weapons and stones (P) and uncompleted similar artefacts (Q) form their own groups and include rhomboid mace-heads, battle-axes, mace-heads with knobs, mace-heads with coniform holes and perforated stone weapons and stone weights that do not correspond to type descriptions. Flint artefacts (R) and flakes (S) include prehistoric flints as well as surface finds of flints used in guns or for striking fire. The most numerous group of finds consists of quartz artefacts (T) and flakes (U) either obtained as surface finds or from excavated contexts. Striking debitage of rocks is also listed (V). Parallel-bladed axes (W) and potsherds (X) are from the Late Stone Age. Grinding stones (Y) and their fragments (Z) are common in both surface and excavation finds. Striking stones (Å) are also listed as well as excavated fragments of burnt bone (Ä) and charcoal (Ö).

The elevations of the finds locations and sites are given in Table 2 for shore displacement chronological purposes. The most reliable levelings of lower limits are from Luho's (1956, 1967) excavations amounting to 17 in all. The elevations of surveyed sites are also included. There are of course no entries for the elevation of unidentified finds. In some cases it has been possible to fix the elevation of stray finds.

Table 3 presents the occurrence of the qualitative groups of material in the 172 sites excavated and surveyed in Askola. The most common group consists of quartz flakes (107 sites). It was not possible to define the precise location of all quartz sites, not could they be defined as dwelling sites. In 67 of the sites quartz artefacts in addition to flakes have also been identified, mainly easily identifiable quartz scrapers.

Fragments and debitage from the making of adzes and especially the primitive adzes (40) are common in the find material. Flint debitage is either of Stone Age date or from later use in striking fire. Grinding stones and their fragments as well as striking stones are commonly found. Burnt bone and charcoal was recovered mainly from sites excavated by Luho.

Finds of ceramics are chronologically separate from this study. However, the Early Comb Ware sites (6,48) are interesting from the point of view of shore displacement chronology (see chapter 4.5). Bronze Age ceramics found in connection with the excavation of the Ruoksmaa Mesolithic site in the village of Takala have been presented by Meinander (1954) and Typical Comb Ware from the Honkaniemi site has been published by Äyräpää (1930). There are sporadic finds of ceramics from sites 7, 15, 21, 23, 26, 86, 88, 105, 106, 114, 126, 146, 147 and 168. The sherds in question are mainly small and undecorated and may be classed as Corded Ware, Epineolithic Ware and Iron Age ceramics. A flint scythe (NM 12621:3) and a sherd of Corded Ware (NM 12159:97) have been found at the Järvensuo site (86). The base part of a battle-axe was recovered from the Syrjäpelto site in Hassa, Askola (23) together with an undecorated potsherd (NM 18580). Pollen analysis has not been applied to the study of the history of cultivation in the Askola River valley, but it can be assumed that palynological results may provide new and interesting information.

Based upon visual inspection the most common mineral used in the stone artefacts appears to have been diabase (cf. Matiskainen 1988). Imported minerals, especially Onega green slate, also occur. Curved-backed gouges (sites 18,27, 21, 37, 68, 158) of this material most probably found their way into the Askola region in the Mesolithic as readymade objects. Three East-Karelian even-bladed adzes dating to later periods of the Stone Age have also been found (Sites 9, 85, 91; Heikkurinen 1980). A fragmentary handle of a dagger of North Scandinavian red slate has been found at site 141 (NM 18268:4).

4. THE MESOLITHIC CHRONOLOGY OF THE ASKOLA REGION

4.1. The basis of shore displacement chronology

The methods of shore displacement chronology applied by Brögger (1905) were introduced in Finland by Ailio (1909). At that stage the aim of research was to define the elevation of the "Litorina or Tapes sinking", to which the elevations above present sea level of the Stone Age dwelling sites were percentually related. Ramsay's (1920) studies comparing the elevations of Stone Age sites in western Uusimaa with the highest limit of the Litorina Sea finally led to the formation of a relative chronology of the cultural phases of the Finnish Stone Age (Matiskainen 1978).

Through the co-operation of Ramsay and Äyräpää the main outlines of the Stone Age chronology of Finland were established by the mid-1920s (Ramsay 1924,1926; Äyräpää 1925). Further information was provided by Äyräpää's chronology of the stylistic phases of Finnish Comb Ware (1930). Since then shore displacement studies have mainly concentrated on "problems of detail and additional information" (Siiriäinen 1969).

The different shore displacement chronologies applied in Finland can be divided into three groups according to the method of dating: relative chronology, time-gradient chronology and stratigraphic chronology.

Relative chronology is based on a relation diagram relying on morphological observations of ancient shorelines. The relative chronology of cultural phases and sites can be established fairly well, but the method does not provide absolute datings. Early studies of shore displacement chronology were based on relative chronology, culminating in Äyräpää's above-mentioned (1930) study of the style phases of Comb Ware.

The second method is Siiräinen's application of distance diagrams on time-gradient curves (Siiriäinen 1969, 1970, 1971, 1972, 1973, 1978). The time-gradient concept was introduced already by Ramsay (1926), but the points of the gradient were based on the relative datings of observations. The false comparison of archaeological and geological datings and circular reasoning applied in these connections are mainly based on the various interpretations of Ramsay's gradient curve.

The distance diagram applied by Siiriäinen is more useful than the relative diagram in the study of the tilting gradients required by the gradient curve. The points of the time-gradient curve could be based on radiocarbon-dated tilting gradients. The method is well suited to the dating of Comb Ware sites on former shorelines of the Baltic, but cannot be applied to the relative chronology of the Mesolithic.

4.2. Previous shore displacement curves for Askola

Shore displacement in the Askola region has been one of the main subjects studied in connection with Mesolithic chronology. While the Laperla region of Suomusjärvi provided chronological information for Äyräpää (1950a) and Sauramo (1958) in the dating of the ''Suomusjärvi culture'' the Askola region with Luho's excavations of sites has become all the more important for the dating of the Mesolithic.

Luho's (1956) dating of the ''Askola culture'' was based on elevations of the various phases of the Baltic as defined by Sauramo (1953, 1955) on quaternary geological grounds. Luho plotted his data on the elevations of sites on his own shore displacement curve that provided the chronological boundaries for this cultural phase.

Luho's main conclusion was that the sites with no other finds than quartz (nos. 49, 65, 92, 100, 101, 107) constituted the earliest stage of settlement. These sites were at elevations from 39.5 to 50 metres a.s.l. With reference to the principles of shore displacement chronology an inconsistent detail of Luho's studies was to exclude a number of his excavated sites from the curve, despite the fact that they were at elevations corresponding to the ''Askola culture'' (e.g.nos. 103, 47, 44, 21). The reason for this was apparently the fact that the latter were not ''pure'' quartz sites as required of the ''Askola culture''.

Tynni's above-mentioned studies concerning Askola produced a shore displacement curve that differed considerably from Sauramo's views. With reference to Tynni's curve, Siiriäinen (1969) demonstrated that Luho's chronology was untenable and that the sites of the so-called ''Askola culture'' were by no means on Yoldia shorelines but belonged to the regressive phase of the Ancylus Lake which was not well known at the time.

Nùñez (1978a) revised the chronology based on Tynni by using a projected stratigraphic method related to dated elevations in the region. Nùñez applied series of sediments from locations dated by Eronen (1974, 1976), i.e. the Hangassuo bog in Sippola and and the Bastuberg bog in the rural commune of Porvoo. As mentioned above, the chronology of the present study, with the exception of the Early Ancylus stage, is based on a shore displacement curve previously published by the author (Matiskainen 1983).

4.3. Stratigraphical shore displacement chronology

The development of the stratigraphic method into a chronological system suitable for the study of Post-Glacial shorelines is a result of the adoption of radiocarbon methods. Previously, limnic isolation horizons were dated through comparisons with pollen zones. The dating of boundary horizons directly with radiocarbon methods has clarified many problems of interpretation. As a result, pollen analysis has even become unnecessary in dating. Only diatom analysis is of importance as it provides data on changes in facies and horizons for radiocarbon dating.

The first radiocarbon datings of isolation horizons came about as late as the early 1970s. Until then, the datings of pollen zones had mainly been obtained from stratigraphic samples and were connected with the history of the Baltic. Studies by Eronen (1974, 1976) were the first applications of the method. These were soon followed by Glückert (1976, 1979), Alhonen & al. (1978), Hyvärinen (1979, 1980) and Saarnisto (1981). The most comprehensive shore displacement curves have been obtained from Lauhanvuori, Southern Ostrobothnia, the Helsinki region and Askola (Salomaa 1982, Salomaa & Matiskainen 1983, 1985; Hyvärinen 1980; Matiskainen 1983, 1989).

The dating of Stone Age sites with the stratigraphic method is presented in schematic form in Fig. 12. The isolation of a body of water (I,II) is brought about by the lowering of the water level and regression caused by glacial isostasy or eustatic factors. The change in diatom ecology from Ancylus or Litorina species to small lake flora occurs when the shore level of the sea is at the threshold elevation. The isolation boundary is defined and dated by preferably two radiocarbon samples from the end of the marine stage and

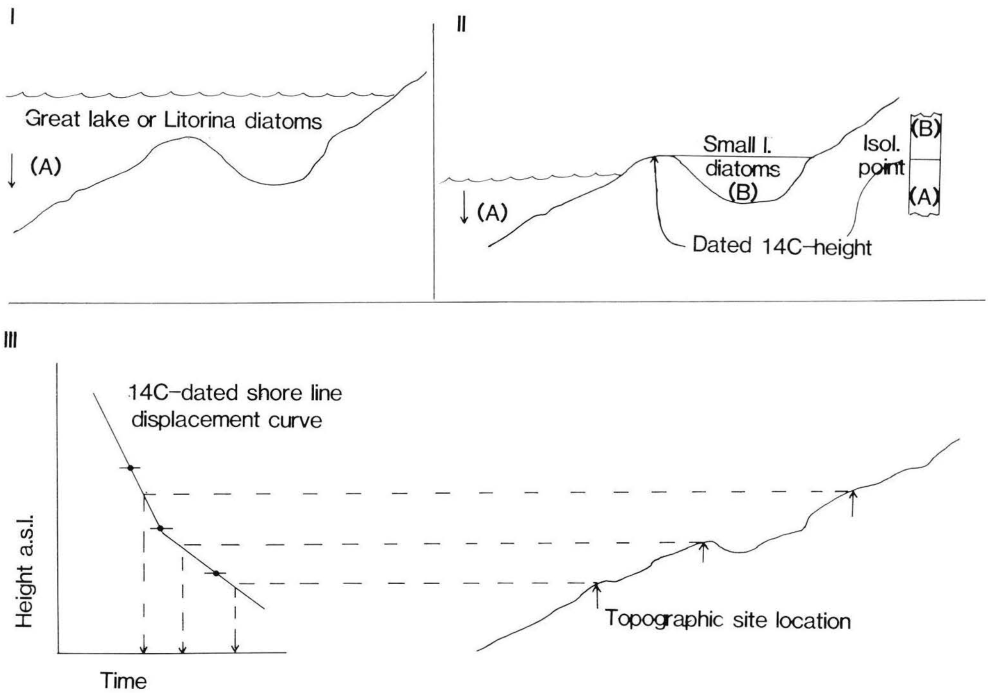


Fig. 12. Diagram demonstrating the use of the stratigraphic method in outlining archaeological shore displacement chronology.

the beginning of the small lake stage respectively. The datings are then connected with the shore displacement curve (III) and the curve can be drawn with the aid of several dated thresholds at different elevations. In accordance with their topographic elevation the sites are in turn connected with the shore displacement curve, the datings of which can be read from the axis signifying time.

The previous curves for Askola presented by Tynni and Luho were basically constructed with the stratigraphic method where isolation horizons were connected with the assumed ages of pollen zones. The chronological variety of pollen zones complicated the curves and led to difficulties in interpretation. These problems were further increased by morphological observations of ancient shorelines which at present are dated hardly at all by radiocarbon.

The present shore displacement curves are streamlined due to the margins of error of 14C datings. Accordingly, shore displacement must be seen as a broader zone falling within the above margins. In accordance with radiocarbon datings the shore displacement curve or zone follows a chronology differing from normal calendar years and with its own problems of calibration. The method does not present minor fluctuations of water level. The mechanisms of isolation may vary considerably in different bodies of water and accordingly there may be several stratigraphic sources of error in connection with points of elevation. The material that is dated also presents a number of problems, e.g. small amounts of organic material, resedimentation and the presence of old calcium.

The stratigraphic method can be applied in only limited areas of land uplift and projecting its results always lead to factors of uncertainty caused by the irregularities of land uplift. (cf. Nùñez 1978a).

An advantage of the stratigraphic method is the fact that at present it is the only available means of shore displacement dating that can be applied to the Mesolithic and is reliable especially in areas of rapid land uplift (Finland-Proper, Satakunta and Ostrobothnia). In the area of the Gulf of Finland the transgression of the Litorina Sea decreases the potential for dating in the later stages of the Mesolithic. Furthermore, there is no risk of archaeological and geological circular reasoning, as the datings are in accordance with absolute radiocarbon years.

4.4. On the reliability of elevation data in Askola

The chronological reliability of the occupation sites and find location depends on the precision of their leveling. At the time of Luho's studies the available Russian topographic maps were based on turn-of-the-century military surveys where distances and elevations were given in *sashens*. Measurements in metres were in turn adapted from these. In previous studies of chronology Luho's levelings of a total of 17 sites in Askola sites were accepted as reliable (Nùñez 1978a; Siiriäinen 1969, 1981b). It is however, difficult to assess or control Luho's elevations as we do not known the precision of the actual method of leveling applied. The available maps and documents of the Askola excavations do not show if the elevations were taken from official topographic benchmarks in the terrain or whether they were estimated from maps.

The elevations of the find locations for shore displacement chronology are given in Table 2. This also includes the elevations of surveyed and identified sites. The elevations are taken from the basic survey map and are reliable to within 2.5 metres. Unidentified finds are naturally without elevation data. In some cases the known elevations of stray finds can also be used. The presented elevations differ to some degree from those in Pohjakallio's survey, as the basic survey maps for the Askola region were redrawn in the early 1980s. The locations and co-ordinates given by Pohjakallio have remained correct, but corrections of elevation contours may cause discrepancies.

The actual lower limits of the sites may not necessarily be the same as the elevations presented in this connection. Lower limits of sites cannot be reliable defined without excavation or the use of pedochemical methods. The locations of finds of artefacts are defined from the basic survey map and the topographic elevation in these cases is derived from the lower elevation isobase. A number of locations contain finds from different elevations with possibly considerable chronological variability (e.g. nos. 48, 54, 96c and 106).

The original location of the sites with respect to the water line must remain unsolved. Shore displacement chronology is based on the assumption that dwelling sites were on the shoreline of the period in question thus providing a dating of the situation after which settlement had become feasible (*terminus post quem*). Part of the Askola sites were definitely located on river banks and their elevations may have considerably higher than the contemporary shoreline. The gradient of the Ancylus Lake is ca. 43 cm/km and accordingly a distance of even 5 km projected in the direction of the isobases of land uplift causes a discrepancy of over 2 metres. Tidal change in water levels and the effects of storms may have caused sites to be located at elevations higher than assumed.

4.5. The Askola sites compared with the shore displacement curve

In reality the shore displacement curve for Askola forms a zone with chronological variability where the limits of error of the 14C dates are at least ± 50 years. The stratigraph-

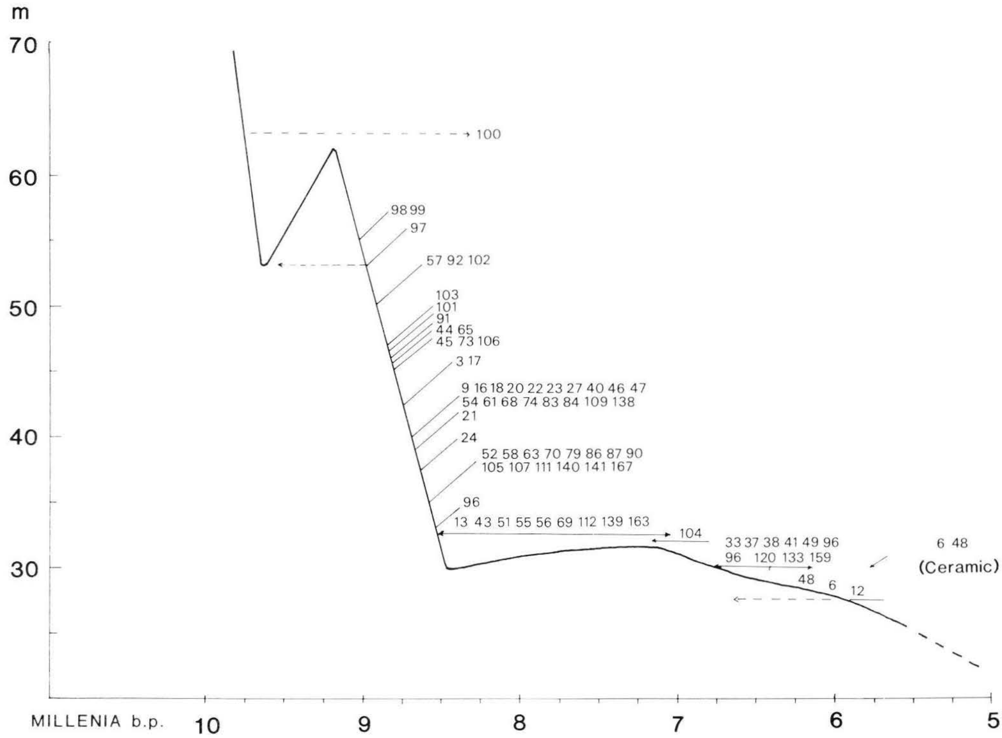


Fig. 13. Datings of the Askola sites on the basis of the shore displacement curve.

ic method does not permit a higher degree of precision in dating. The sites and find locations are marked on the shore displacement curve in Fig. 13. With the exception of the Kopinkallio quartz quarry all of the sites are in connection with the regressive Ancylus shoreline and the Litorina Sea. Excavations of the Koivuniemi sites (93) revealed signs of a past transgression and Luho observed that quartz artefacts and flakes were found beneath a layer of leached sand and deposited shore stones. It is possible that this site was flooded by the Ancylus transgression, but a similar situation may also have come about even during the regressive stage as the result of short-term oscillation of water level. If the Koivuniemi site is contemporary with the transgression the corresponding date would be as old as 9700 b.p., otherwise the probable date is ca. 9000 b.p.

The sites of highest elevation are at 55 metres a.s.l. and can be dated to slightly before 9000 b.p. (cf. Nùñez 1978a). There are three sites at 50 metres (nos. 57, 92 and 102) that can be dated to ca. 8900 b.p. Along with the Koivuniemi site the latter represent the oldest Boreal period settlement of Askola.

A total of eight sites are located at ca. 45 metres a.s.l.(ca. 8800 b.p.) and as many as 22 sites are found at a 40 metre elevation indicating the transition from the Boreal to the Atlantic, ca. 8700 b.p. (Photo 2).

The 35 metre level is still connected chronologically to the Ancylus Lake and this stage (ca. 8600—8500 b.p.) is represented by 14 sites and locations.

The regressive Ancylus Lake stage, which at Askola appears to cease at approximately 30 metres a.s.l. and before the eustatic transgression of the Litorina Sea, cannot be adequately accounted for in terms of local settlement. It can be assumed that the transgression destroyed a number of sites from ca. 8400 to 8200 b.p.

Photo 2. The residential base area of Siltala (nos. 18, 19, 21, 22, 23) dating to the Ancylus regression. The original shoreline was in the immediate vicinity of the finds zone at an elevation of ca. 40 metres above present sea level. The only identified fragment of bone from the are a indicates sealing.

Photo 3. The Porvoonjoki river valley at present. View to the north from the rapids near site 38. The Late Mesolithic finds of the area form a continuous zone along the shoreline of the period (30 metres a.s.l.) on both banks as far as the present-day village of Askola.

Sites and finds from 32.5 metres a.s.l. fall into a broad period from ca. 8200 to 6800 b.p., at which time the shoreline of the Baltic remained at the same elevation in Askola. Temporary fluctuations may have caused disturbances in this period. Ten sites are known from the 30 metre elevation zone and can be dated either to the above-mentioned latter stage of the Ancylus Lake or from ca. 6800—6500 b.p. (Photo 3).

The youngest Mesolithic finds have been recorded at elevations from 27.5 to 28 metres a.s.l and are from ca. 6500—6000 b.p., i.e. the end of the Mesolithic period. A problem in this connection is the possibility of the Litorina II transgression (see p. 38).

The numbers of sites recorded in the shore displacement curve may be caused by random factors. Certain elevations may have been prospected and surveyed more thoroughly with an unduly large sample of sites as a result. The period of transition from the Boreal to the Atlantic (40 metres a.s.l.) is especially prominent in the numbers of sites.

The finds of lowest elevation in Askola are from 20 to 25 metres a.s.l. corresponding chronologically to the Late Comb Ware period. For some reason these sites have not been connected with the Porvoonjoki River but the Ilolanjoki River flowing in the eastern part of the region. It appears that the Porvoonjoki River with its mouth and estuary to the south of the present Henttalankoski rapids was abandoned and the Ilolanjoki River became considerably more important for the settlers of the Comb Ware period. Significant sites in the latter region are Böle and Vävarsbacka in the rural commune of Porvoo and Honkaniemi in Askola (Äyräpää 1929; Edgren 1969; Ruonavaara 1985).

4.6. Chronological seriation of artefacts and sites

The radiocarbon dated shore displacement of the area discussed above places the sites into different chronological horizons in connection with the Ancylus Lake and the Litorina Sea. In the following the relative ages of the artefacts from the sites will be discussed.

The leading artefact types of the so-called ''Suomusjärvi culture'' provide the basis for the relative chronology of the Mesolithic. These consist of the following : primitive axes or adzes, leaf-shaped slate points, globular mace-heads with coniform holes, quartz points with oblique blades and the Southern Finnish even-bladed adzes (Äyräpää 1950a).The previously published chronological seriation by the author of the above artefact types from Mesolithic sites of the whole of the coastal region of Finland showed that the earliest artefact group consists of primitive axes/adzes and leaf-shaped slate points (8800—8000 b.p.), curved-backed gouges (8500—7500 b.p.) as well as globular mace-heads with coniform holes (8500—8300 b.p.). The Southern Finnish even-bladed adzes and quartz points with oblique blades are dated to the Litorina Mesolithic, ca. 7700—6800 b.p. (Matiskainen 1983, 1986, 1988, 1989).

The seriation of the Askola finds is presented in Fig. 14 based on the occurrence at various elevations of the find categories presented in Table 2. The diagram shows only the leading Mesolithic artefact types as according to Äyräpää (1950a).

The primitive axes/adzes are found at elevations from 27.5 to 47.5 metres a.s.l. The lowest single find is from 22.5 metres. The curved-backed gouges appear somewhat later, at 43 metres a.s.l. A couple of leaf-shaped slate points have been found at elevations of 47 and 45 metres and they are commonly found at elevations ranging as low as 35 metres. There are also single finds of slate points at lower elevations. The highest elevation at which oblique-bladed quartz points have been found is 40 metres, while the majority of the specimens of this type are from 35—40 metres a.s.l. The only globular mace-head in the material was found at 32.5 metres a.s.l. An incomplete specimen of a cross-shaped mace-head was found at 35 metres in the yard of the local vicarage (50). The elevation horizon for the Southern Finnish even-bladed adzes is 35—32.5 metres.

The artefact chronology for Askola, based on the elevations of finds, is in general agreement with the previously presented chronology for the whole of Finland. There are, however, certain discrepancies in the Askola material (Matiskainen 1989). The chronological position of the primitive axes/adzes is clear. The type has been found in connection with the Antrea net, 14C-dated to ca. 9300 b.p. as well as in the Mesolithic find material from the Ristola site in Lahti. At Askola the *terminus post quem* for the earliest primitive axe/adze find is ca. 8850 b.p. It must be taken into account that fragments of ground and polished stone artefacts have also been found on sites at higher elevations and it can be assumed that the artefact type was in use since the earliest settlement of the region. The period of use of the axes/adzes continues until the end of the Mesolithic, i.e. the period of settlement in the Porvoonjoki River valley in Askola.

The curved-backed gouges appear in the material at an elevation of 43 metres, dated to ca. 8750 b.p. The most numerous finds of this artefact type are in the 40 metre horizon, the age of which according to results from Lake Aborreträsk is 8700 b.p. There are three separate finds of the artefact from later connections. The curved-backed gouge can also be regarded as an early artefact type, assuming that an unfinished specimen of a gouge of Onega green slate found in connection with the Antrea find represents the type in question. Six of the gouges found at Askola are of green slate (see p. 27).

The dating of the leaf-shaped slate points is the same as that of the primitive axes/adzes, 8800 b.p. The points remained in use at sites located extending to the elevation zone of 32.5 metres corresponding to 8500 b.p. There are also individual finds from

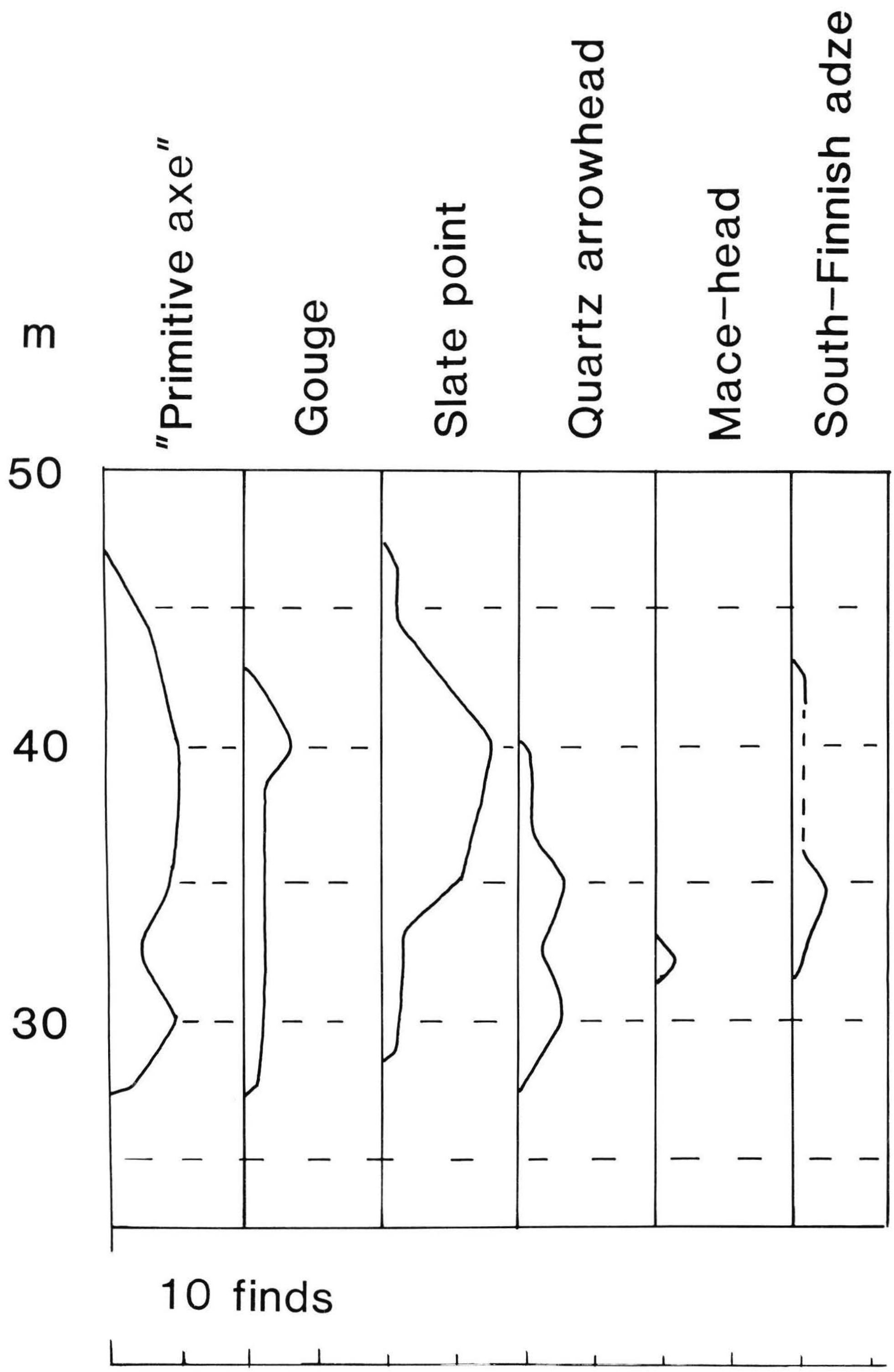


Fig. 14. Chronological seriation of Mesolithic artefact types in the Askola material.

as low as 28 metres a.s.l. If the dating of the points to 8800—8000 b.p. is correct the finds of lowest elevation are from the end of the Ancylus regression (ca. 30 metres).

In an earlier connection Siiriäinen (1981b) has presented a comparison of the leaf-shaped slate points and the the oblique-bladed quartz points from Askola in terms of shore displacement chronology. The present results confirm Siiriäinen's observations, although both artefact types occur together in the 35 metre elevation zone. Siiriäinen's reference in this connection solely to sites excavated by Luho emphasizes the difference. The dating of the quartz points in Askola mainly corresponds to results from other parts of Finland and especially Southern Ostrobothnia (7700—6000 b.p.).

The only artefact from Askola that can be interpreted as a globular mace-head with a coniform hole was found at an elevation of 32.5 metres and indicates a dating that is too young in comparison with corresponding results from sites in Southern Ostrobothnia (Matiskainen 1989).

The dating of the Southern Finnish even-bladed adzes is in agreement with results from Western Uusimaa. The 35—32.5 metre elevation zone falls into the Early Litorina period in Askola, but it must be noted that here the artefact type is no longer found in Late Litorina connections as is the case in Western Uusimaa (Matiskainen 1988).

Discrepancies and contradictions in relation to chronological results from other areas of Finland are not unduly great. The outlining of the shore displacement curve demonstrated the problems and sources of error that may skew the chronological seriation obtained. The most reliable area for constructing shore displacement chronology is Southern Ostrobothnia with a continually regressive shoreline and a fast rate of land uplift. In Eastern Uusimaa the dating of Late Mesolithic material is especially difficult due to the long-term stability of the Baltic. The precision of estimating elevations is also a source of chronological error.

In the Porvoonjoki River valley running N-S the Mesolithic sites occupy an area extending 10—12 km. The southernmost site is Henttala in the rural commune of Porvoo and the northernmost site is that of Yli-Hyrylä in Naarkoski in the commune of Pukkila. The locations and relationship of occupied sites with the Porvoonjoki River can be investigated with the aid of a N-S section of the area. This demonstrates the elevations and distances of sites and their relative chronology. Fig. 15 shows the sites in the catchment of the Porvoonjoki River.

The gradient of the Porvoonjoki River between Henttalankoski and Vakkolankoski rapids is not steep. The Vakkolankoski rapids form the main fall in the river, almost 9 metres. The significance of this feature of the landscape for subsistence in the Late Mesolithic is a problem to be discussed below. With small variations the gradient continues at a gentle slope from the Vakkolankoski rapids to the Naarkoski rapids in Pukkila and the only steeper part is at the Hiirkoski rapids in Nalkkila. The present flow structure of the river has come about at a late stage and with the exception of the Vakkolankoski rapids it has not had the same effect on the Stone Age environment (Nironen 1987).

The regional and chronological clusterings of the sites are presented in Fig.16. The earliest stage of settlement was in vicinity of Kopinkallio and the pioneer stage may be divided into two phases (I, II). Intensity of occupation increased around the 45 metre zone (III) with a new concentration of sites and finds around Suurisuo bog in the centre of the parish (IV). At the time of the transition from the Boreal to the Atlantic periods settlement continued in the Kopinkallio area (V) and also at Suursuo (VI). At this time a new cluster formed at Siltala in Vahijärvi (VII). The settlement of the last stage of the Ancylus Lake located in the 35 metre zone may also contain later Litorina sites. The cluster of settlement at Kopinkallio extended to the north to the Porvoonjoki River

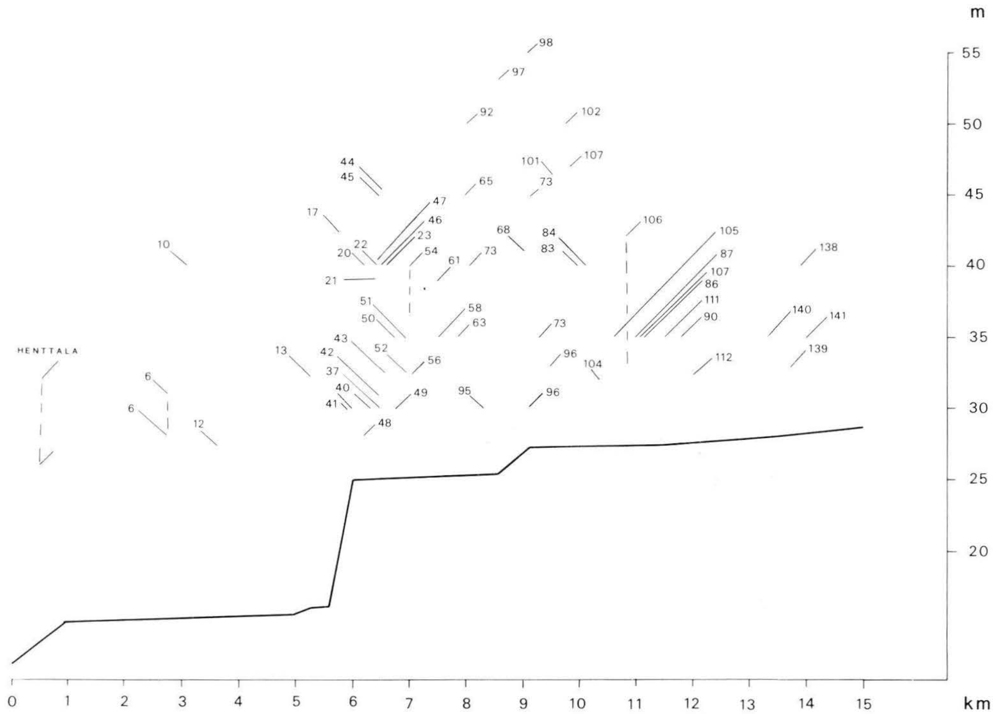


Fig. 15. Vertical locations of dwelling-sites and find locations in the Porvoonjoki river valley.

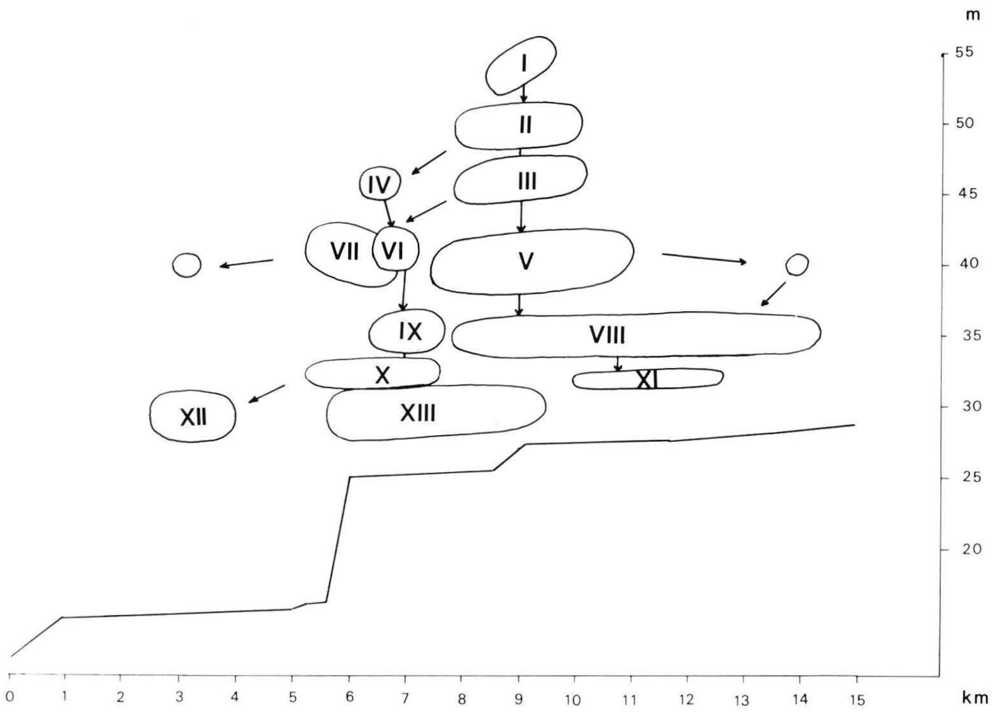


Fig. 16. Simultaneous horizons of settlement on the basis of Fig. 15.

which was in the process of formation at the time. The settlement in the present parish centre area also continued (XI).

The Litorina sites form two clusters at 32.5 metres a.s.l. The youngest phase of settlement formed in the area lying between Vakkolankoski and the present parish centre (XIII) as well as in Nietoo (XII) to the south of the rapids.

The chronological changes in the sites are seen in Figs. 17 a-f. The more rapid changes in the environment in the Ancylus stage led to a recurrent need to relocate and long-term occupation was not possible. It was only in the stagnatic Litorina period that settlement appeared to have become more permanent on the banks of the river flowing into the sea.

4.7. Litorina II ?

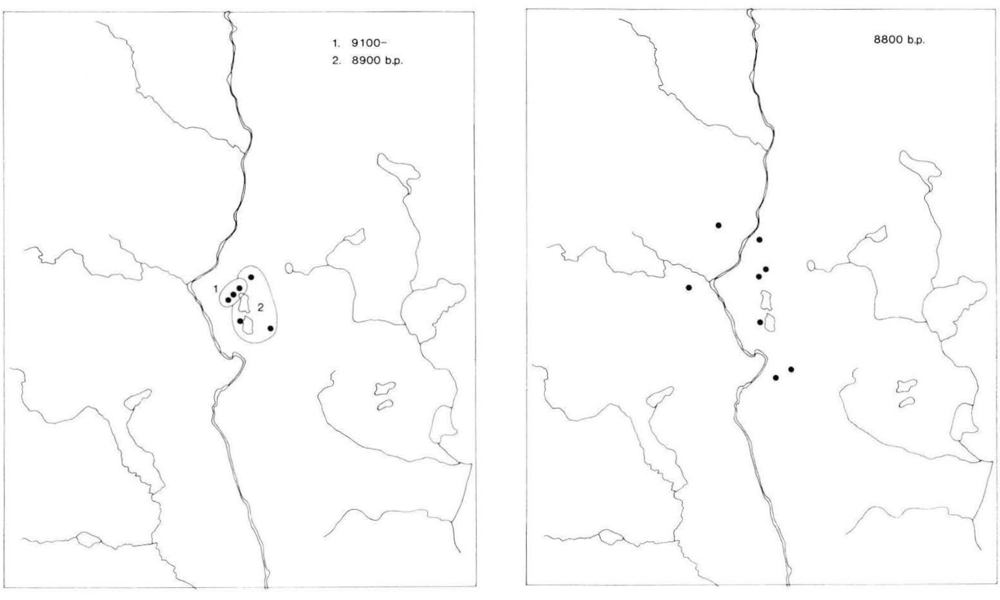
Earlier studies identified a total of four transgressions of the Litorina Sea (Litorina I-IV) and positive observations of these are available for the area of slow land uplift of Southern Sweden (Berglund 1964; Digerfeldt 1975). Changes in sediment stratigraphy and diatom facies as well as observations of ancient shorelines have sometimes been interpreted in Finland as indications of several transgressions (e.g. Hyyppä 1935).

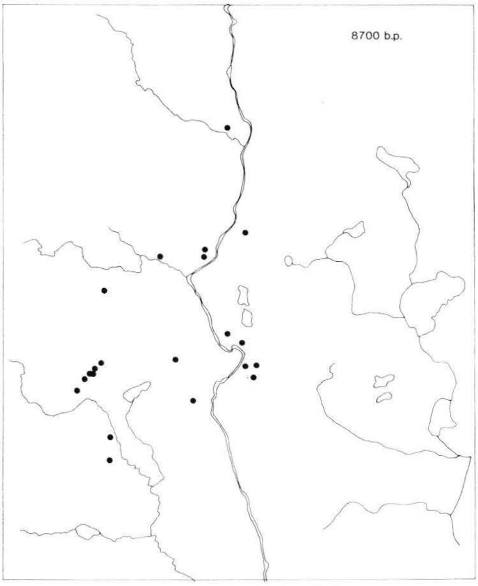
The stratigraphic shore displacement chronology based on radiocarbon dates is not well suited to insignificant isolated phenomena. The shore displacement curve forms a broad temporal zone where short-term fluctuations of water-level are without significance. Eronen (1974) streamlined and "straightened out" the transgressions from the previous curve for Litorina shore displacement. Glückert (1976) still mentions the separate phases of the Litorina Sea, although they cannot be verified stratigraphically.

There is however a certain discrepancy in the Askola material that awoke the interest of Luho (1958) and Tynni (1966). The sites of Siltapellonhaka (no. 48) at 28 metres

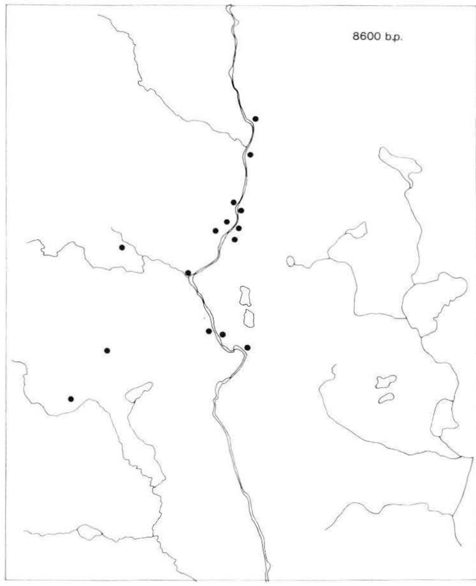
Fig. 17a-f. Distribution of simultaneous points of settlement in Askola with reference to the chronological horizons of settlement.

a b





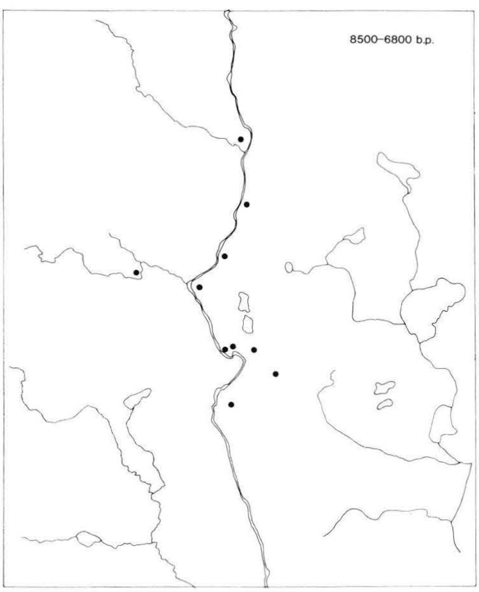
c



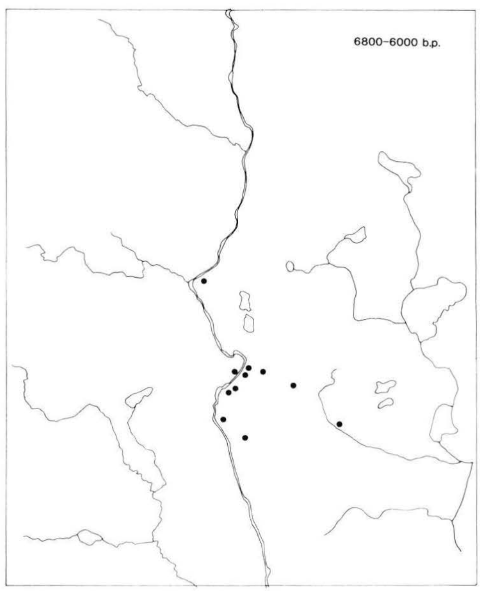
d

a.s.l. and Mattila, Nietoo (No. 6) at 29 metres are situated below Early Comb Ware sites at elevations from 30.5 to 31 metres a.s.l. Luho (1967) states that the Mesolithic sites excavated by him were affected by a transgression (''sehr stark ausgewaschen''). The Early Comb Ware site of Gammelby (elevation 29—30 metres) in Lapinjärvi in Eastern Uusimaa is quite probably accompanied by a Preceramic site located at a lower elevation in the immediate surroundings (Luho 1958).

e



f



The ceramics from the sites mentioned corresponds to Äyräpää's style I:1a, the oldest ceramic industry in Finland on the basis of stylistic criteria. The Early Comb Ware from Henttala is of style I:1c and this site is already at a lower elevation of 26—28 metres a.s.l (Luho 1946, 1958; Edgren 1969).

The irregularities of elevation of the Early Comb Ware sites were explained by Luho (1958) in terms of the Litorina II transgression. According to Tynni, L II can be dated in Askola to the VII/VIII zone boundary. In the stratigraphy of the Porrassuo bog there are indications of a transgression in the diatom flora situated above L I. According to the present chronology the climax of the transgression was around 6300 b.p. and the ensuing regression had lowered the shoreline from 31 metres a.s.l. to 26 metres by ca. 5700 b.p. (see Fig. 7).

It is difficult to demonstrate the LII stage or other possible later transgressions. This would require a thorough geological study of Askola, or preferably Vehkalahti to the east, where land uplift conditions for the study of transgressions are more favourable. The question of the L II transgression must remain open, but we must not disregard Luho's observations of flooded Mesolithic sites. The material of the sites studied by Luho can be classed into the Litorina Mesolithic, e.g. with reference to the oblique bladed quartz points. These sites cannot thus be from the lowest elevations of the Ancylus regression, subsequently affected by Litorina eustasy. It is possible, however, that a transgression may have occurred around 6000 b.p., but it would have hardly extended as high as 30 metres a.s.l. Accordingly, the Early Comb Ware sites were located on river banks and were not in direct contact with the former shoreline.

Soviet archaeologists of the Leningrad region have carried out studies of the Häyrynsuo bog in Viipuri (Vyborg) and the Suursuo bog in Säkkijärvi (Kondratyevo) under the direction of Dr. P.M.Dolukhanov. These sites have been studied previously by Hyyppä (1935). There are preliminary isolation datings of both sites and the diatom stratigraphy of the Häyrynsuo bog clearly indicates a second transgression of the Litorina Sea ending around 4600—4500 b.p. on the basis of radiocarbon dating. (P.M.Dolukhanov, personal communication). A certain discrepancy lies in the fact that Hyyppä gives the elevation of Häyrynsuo bog as 16—17 metres a.s.l., which is also the elevation given by Äyräpää (1925) for the occurrences of style I:1 Comb Ware at the Häyrynmäki site. This may suggest the possibility of L II also in the Askola area where land uplift is weak. On the other hand, Digerfeldt (1975) has presented datings of a transgression of considerable magnitude that correspond to the radiocarbon datings from Häyrynsuo bog and Tynni's (1966) assessed dating of L II to the VII/VIII zone boundary corresponds to a dating of ca. 5000 b.p.

4.8. Radiocarbon datings from sites in Askola

During the most intensive period of research in the 1940s and '50s, Luho did not file or record the documents of his excavation. The only available archive data consists of the catalogues of finds recorded in excavation units for the main catalogue of the National Museum of Finland. Along with quartzes and stone artefacts Luho also collected charcoal, often described as "charcoal from square ..." or "charcoal from a hearth in square ..." This was hardly haphazard, as Luho's 1956 dissertation refers to the radiocarbon datings of the Star Carr site.

In 1983 a number of radiocarbon datings of the charcoal finds were carried out. At that time the material had been in storage in the National Museum of Finland for about 30 years. The results, listed below, contain no Mesolithic datings:

The estimated shore displacement datings of the sites are given in brackets.

No. 44, Vanha-Klemetti	Hel-1714 5480 ± 120	(ca. 8800 b.p.)
No. 45, Urheilukenttä	Hel-1715 1620 ± 140	(ca. 8800 b.p.)
No. 98, Keturinmäki	Hel-1723 1330 ± 130	(ca. 9050 b.p.)
No. 103, Rahkaissuo (I)	Hel-1711 2710 ± 100	(ca. 8900 b.p.)
—»— (II)	Hel-1712 1930 ± 130	(ca. 8900 b.p.)
—»— (III)	Hel-1713 1830 ± 140	(ca. 8900 b.p.)
Yli-Hyrylä, Pukkila (I)	Hel-1736 5030 ± 110	(ca. 8800 b.p.)
—»— (II)	Hel-1732 470 ± 120	(ca. 8800 b.p.)
—»— (III)	Hel-1738 1250 ± 120	(ca. 8800 b.p.)

It appears that the only specimens of Stone Age charcoal are Hel-1714 and Hel-1736 and even these samples are younger than the Mesolithic with datings falling into the Typical Comb Ware period.

The remaining charcoal samples are most probably evidence of early and later farming in the region. Charcoal mixed in the soil in connection with burn-beating and clearing has subsequently come to light in connection with Mesolithic finds. On the other hand, the contamination of the samples in storage must also be taken into account as a possible source of error in dating.

Hel-1711 corresponds to the Bronze Age and Hel-1712,1713 and 1715 are from the period of intensive cultivation in the Early Iron Age (Donner 1984; Tolonen 1985; Zvelebil & Rowley-Conwy 1984). Hel-1723 and 1738 are from the Middle Iron Age. As mentioned above, excavations of Mesolithic sites have also revealed ceramics that can be dated to the early stages of farming and cultivation in the Askola region (see p. 27).

5. THE OSTEOLOGICAL REFUSE FAUNA OF THE ASKOLA REGION

5.1. On taphonomy and the study of refuse fauna from archaeological contexts

The occupation layers of Stone Age sites in Finland usually contain fragments of burnt bone, preserved either as larger pieces that can be collected or in extremely small fragments. Burnt bone is not necessarily found in connection with hearths and it appears that the fragments were spread and ground into the soil by humans or dog. Due to high temperatures the size of the fragments has reduced by up to 25 % and the organic calcium has changed into inorganic form. The acidic podzol soils of Finland rapidly break up unburnt organic material such as bone into minerals and this material can only be traced with pedochemical methods such as phosphate or calcium analysis. Preserved fragments of burnt bone may permit the identification of species, although only less than 10 % of fragments contain identifiable elements (Forstén 1972; Fortelius 1981).

The overall range of Stone Age game has been known since the early years of the 20th century when Herluf Winge, a Danish zoologist, carried out analyses of burnt bone from Pihtipudas in Savo and the Jettböle site in the Aland Islands for Julius Ailio's dissertation on the Finnish Stone Age (1909). It was only in the 1970s that osteological material with its numerous problems of identification became a subject of interest again. Forstén's (1972) studies with analyses of the majority of Luho's excavated bone finds had most bearing on the Mesolithic (see also Forstén & Blomqvist 1974; Forstén & Alhonen 1975). The refuse fauna of the Hietaniemi site in Luopioinen, analyzed by Blomqvist (Miettinen 1980), is partly of Mesolithic date. Mikael Fortelius carried out his first archaeo-osteological analyses in the late 1970s (Rauhala 1977; Kokkonen 1978) continuing his work in the early 1980s with analyses of a significant body of material in the collections of the National Museum of Finland (Fortelius 1981; analysis results in the archives of the Bureau of Prehistory). These results have been presented by Siiriäinen (1981a, 1982) in his studies concerning Stone Age economy (see also Taavitsainen 1980, Edgren 1983; Hiekkanen 1984).

With reference to the taphonomy of archaeological refuse fauna Stone Age studies in Finland have repeated as something of a cliché that only burnt bone material has been preserved as evidence of the diet of Stone Age man, although bone artefacts have also been preserved in inorganic connection (e.g. Taavitsainen 1980).

The preservation of bone in soils appears to be dictated by its location in the different horizons of the podzol. Excavations of the Comb Ware site of Naarajärvi in Pieksämäki (ca. 5000 b.p.) permitted the author to observe a number of features that explain the factors of preservation with more detail than hitherto discussed in studies (Matiskainen & Jussila 1983). Burnt bone is best preserved in the C horizon, located below the enrichment horizon in podzol. This is a result of pedochemical processes and the differing degrees of acidity of the soil horizons. Burnt bone contains large amounts of calcium phosphate, apatite, which tends to be enriched below the B horizon, whereas Fe and Al phosphates are bound as film to the surface of mineral grains. Phosphate analysis specifically searches for the latter phosphates. Fig. 18 presents the percentual degree of preservation of the bone material from Naarajärvi in the various soil horizons. The presence of burnt bone at the site is not solely the result of the chance occurrence that bone material in contact with fire is completely preserved. The podzolification of the soil subsequent to the end of occupation destroyed at first all of the organic bone material and in the course of time most of the burnt bone as far as the B 2 horizon. The vertical location of bone fragments or their secondary deposition due to human action, dogs or trees felled by wind are the main factors in bringing about the selection of material for archaeological analysis. The Naarajärvi site presents an analogy for the sites of the Askola region, but we must also take into account the earlier dates of the Askola sites and the consequently longer period for the destruction of bone in the soils. On the other hand, acidic podzol began to develop actively in Finland only with the onset of the Sub-Boreal period.

The following summary of processes related to the taphonomy of bone material in Finnish conditions can be presented (cf. Grønnow 1987).

- — butchering site and methods used; selection of bones transported to the dwelling site
- — utilization of bone; artefacts, diet, marrow etc.
- — bones consumed and used by dogs and other carnivores
- — the burning process of bone, i.e. intentional or unintentional burning (diet, hygiene, magic etc.)
- — physical deposition; vertical movement in the soil
- — chemical destruction.

Factors independent of taphonomy:

- — precision of excavation and collection
- — Stone Age game species
- — degree of identifiability; occurrence of characteristic features in the material.

Under favourable conditions with the preservation of bone it is possible to estimate minimum numbers of game killed (Grønnow 1987). Burnt bone itself indicates only the qualitative range of species utilized. According to Fortelius (1981) estimates of mini-

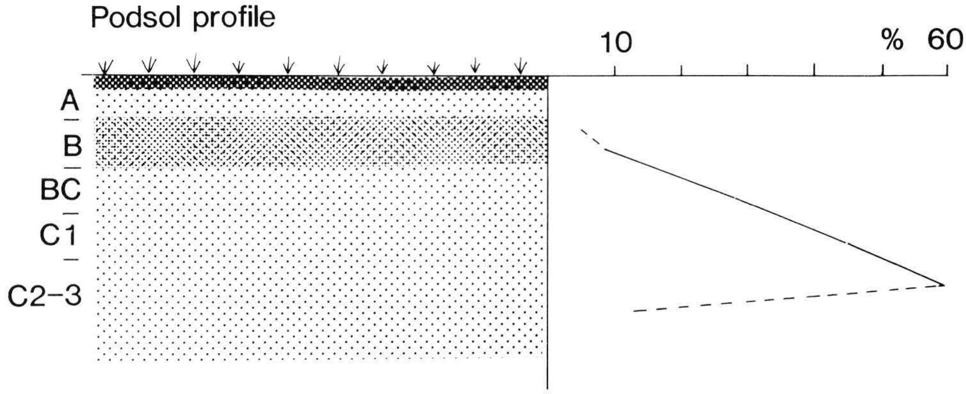


Fig. 18. Percentual degree of preservation of burnt bone in different soil horizons at the Naarajärvi site, Pieksämäki (Matiskainen & Jussila 1983).

mum numbers of individuals rely mainly on the principle that the more mixed the material, the larger the difference between the original number of individuals and the theoretical number as represented by the mixed ''burnt'' bone material of Finland. This suggests that counts of minimum numbers of individuals are unrealistically small in relation to the actual periods of settlement and occupation.

Recent studies by Binford (1978, 1981) have greatly increased the scope of archaeosteological methods. Binford carried out studies of the one-sided utilization of *Rangifer* by Alaskan eskimos from an ethnoarchaeological perspective with interpretations of anthropogenic remains of butchering activities. Binford's minimum number of individuals (MNI) and modified general utility index (MGUI) may also be applied in Finland, for example in connection with organically preserved *Rangifer* fauna from Medieval Lapp sites. However, these methods are not suited for the study of Mesolithic refuse fauna due to the limited selection of bone material.

5.2. The refuse fauna of Askola

The ''burnt'' bone material of Askola was collected mainly in connection with Ville Luho's excavations. Table 2 lists the sites where osteological material has been preserved and found (marked with the letter Ä). Fragments of bone have also been found in surveys of the area (sites 43, 46, 111, 147), but they are mainly of small size and are not of osteological interest. The excavated finds of bone from Askola are fewer in number in comparison with other excavations by Luho (1967) elsewhere in Finland. The reason for this may be the small areas uncovered as well as the lack of detail in excavation. Of the Askola material only the bone finds from the Rahkaissuo site could be used in Forstén's (1972) analysis. Here the amount of bone material recovered amounted to 182 g according to Luho. A total of 175 fragments were collected from the Toppinen site (47) and 122 fragments from the Siltapellonhaka site (48). A larger amount of osteological material was recovered from the Henttala site, included in Forstén's (1972) analyses of refuse fauna from Mesolithic sites.

For the purposes of the present study all of the osteological material from Askola was selected for study. The analyses were commissioned by the author and carried out by Mr. Jukka Jernvall, cand.phil. Material permitting identification of species was found from 13 sites, including Rahkaissuo (103) and Henttala in the rural commune of Porvoo, both previously studied by Forstén (1972). The analysis of material from the Siltapellonhaka site (48) now included also the Early Comb Ware occupation horizon. The results are given in unabbreviated for in Appendix I. The blank museum catalogue references indicate bone finds without identifiable fragments. The Askola material is limited and problematic even in Finnish conditions, but the results, albeit limited, shed some light on the hunting strategies of the Mesolithic in the area.

The results of the osteological analyses by site are presented in Fig. 19. The sites are listed in chronological order from the Ancylus to the Litorina Mesolithic. The youngest item in the list is the partly (?) Early Comb Ware bone material from the Siltapellonhaka site (48). The table lists the identified species and numbers of bone fragments. There are 19 classes of species, including 10 mammal species. In accordance with the classification *Carnivora sp.* and *Mammalia sp.* are listed separately and of the individual orders *Artiodactyla sp.* According to Jernvall, *Phocidae* consists solely of *Pusa hispida Schreb.* and in three cases it was possible to determine the actual species on the basis of skull bones. There are no identified bones of *Halichoerus crypus* Fabr. or of *Pagophilus groenlandicus* Erxl. Of the fishes the only species identified is *Esox lucius* (L.) and the identified families are *Salmonidae sp.* and *Cyprinidae sp.* The remaining fish material has been identified at the level of classes, *Teleostei sp.* There is a single observation of fowl (*Anatidae sp.*).

The Askola material also contains three species that have not been hitherto observed in refuse fauna from Stone Age contexts in Finland, *Sus scrofa* L., *Capreolus capreolus* (L.) and *Lutra lutra* (L.). *Sus scrofa* is mentioned by Ailio (1909), but this observation from Pihtipudas is marked with a question-mark indicating that it was not known whether the boar was wild or domesticated. With the exception of otter, wild boar and forest deer are indicators of the warmer climatic period and they have subsequently disappeared or have ben hunted to extinction in Finland . Other land mammals are the usual *Alces alces* (L.), *Castor fiber* (L.), *Lepus sp.* (timidus?) and *Ursus arctos* L. It is to be noted that there are no observations of *Rangifer tarandus* (L.) in the refuse fauna.

The information provided by the analysis contains a number of limitations. Fortelius (1981) has presented highly critical views of the possibilities of interpretation. According to him the primary results do not answer the question of "what animals were eaten by the inhabitants of the site" or even the question of "what bones were recovered" but only "what bones has the analyst been able to identify with the available methods". In any case there must be some congruence between the original diet and the results of analysis, i.e. at least the identified species were hunted and eaten. Conversely, the lack of a specific species does not prove that it was not hunted. Thus, it is not possible to outline the overall hunting strategy solely on the basis of the identified species listed in the table mentioned. The scope of information must be broadened to include the Post-Glacial biotope of the whole area and the opportunities it offered for man (see Chapter 6.2.).

The various parts of the skeleton of the game animals are of obvious significance for the final results of osteological analysis. A review of the identification of the bones of the three most numerous mammal species in the material, elk, seal and beaver clearly indicates the bones that have been identified in the largest number of cases (see Appendix 1). The most surprising result in this connection is that 22 out of 34 identified specimens of elk bones (76 %) in Askola are of the side hoofs (phalanx) or the metatarsus/metacarpal (see Forstén 1972). The easy identification of these bones with their special features cannot be the sole explanation for this and we must take into account the possibility that for some reason the elk hoofs separated from the ankles came into contact

	HOPEAPELTO (92)	RAHKAISSUO (103)	TOPPINEN (47)	AHLSTEDINPELTO (46)	S. KOTOPELTO (21)	T. RUOKSMAA (107)	HAITI-MYLLYPLETO (96a)	HENTTALA (Porv. mlk)	J. SUURSUO (42)	SAUNAPELTO-PERUNAMAA (49)	SILTAPELLONHAKA (48)	TALLIKÄRÖ (6)	SILTAPELLONHAKA Ka 11	total
Alces alces (L.)			2	1		16		1			22	1	5	48
Canis sp.											3	10		13
Castor fiber L.			3			27	1	11		2	6	2	7	59
Capreolus capreolus (L.)						1								1
Lepus sp.									1			2	1	4
Lutra lutra (L.)												1		1
Sciurus vulgaris L.											1			1
Sus scrofa L.											1			1
Ursus arctos L.										1				1
Pusa hispida (Schreb.)		1									1		1	3
Phocidae sp.	3	8	6		1	8		10		3	18	41	10	108
Carnivora sp.						1					1			2
Arctiodactyla sp.						1								1
Mammalia sp.		1	1			25		3		1	6	12	5	54
Esox lucius (L.)		1	1			8		2				2	4	18
Salmonidae sp.						2						2		4
Cyprinidae sp.						1					5			6
Teleostei sp.		1				9	1	1			4	5	12	33
Anatidae sp.													1	1
Σ	3	12	13	1	1	99	2	38	1	7	68	78	46	359

(Ancylus Mesol.) 9000—8500 b.p. — 8500—7500 b.p. — (Litorina Mesol.) 7500—6000 b.p.

Fig. 19. Archaeo-osteological refuse fauna of the various sites in Askola.

with fire more often than other bones. The preparation of this part of the carcass with its meagre nutritional value is hard to understand as it probably has little dietary value. The bones in question may be related to ritual practices in hunting magic. In connection with the refuse fauna of Liljendal, Rauhala (1977) quotes Olaus Magnus' (1555) account of hunting magic in the Arctic, which deserves to be mentioned in this connection:

''The inhabitants of the North, not wishing to appear before their gods empty-handed, bring them as sacrifices the bones of animals of the forest, large whales and fish they have caught. These bones are not burned by them in summer (so as not to appear to mock sunlight and warmth), but only with the onset of the harsh winter do they burn them assembled together in honour of their gods and believing that with this sacrifice they can show the respect required of them.''

In connection with seal the above-mentioned bones are not as prominent in the material as in the case of elk. Nevertheless bones from below the ankle amount to ca. 53 %

of the material. In the material from the Kvarnbacken site in Liljendal these amount to ca. 47 %. On the other hand, in the remains of beaver *phalanx* and *mt/mc* bones do occur in any proportion differing from other parts of the skeleton. Accordingly, beaver would thus appear to be under-represented in the material. In the case of Askola it appears that the relative proportion of *phalanx* and *mt/mc* bones correlates with the size of the mammal in question. As demonstrated by Fortelius (1981), only small solid fragments remain identifiable. The large number of identified bones of pike is due to its well-preserved and easily identified teeth (*dentale*).

Thus, at least in the case of Askola percentual estimates of the total amount of identified bones do not reflect the intensity or degree of specialization of hunting (cf. Siiriäinen 1981a, 1982). The results can only suggest the conclusion that of the mammals the most hunted species were seal, elk, beaver and hare and that the diet also included dogs. The fauna does not appear to differ to any great degree from the mammals hunted at presented.

The chronological distribution of the various species at the sites indicates that the oldest sites, Hopeapelto (no. 92—2 fragments) and Rahkaissuo (no. 103 — 12 fragments), may have been locations of a community specializing in the hunting of seal, at least on the basis of the fact that the material contained no bones of terrestrial mammals. In the beginning of the Atlantic period elk and beaver are introduced into the mammal fauna alongside seal. The sites of Toppinen (47), Ahlstedinpelto (46), Kotopelto (21) and Ruoksmaa, Taka-Piskula (107) are all dated to the beginning of the period (ca. 8700—8600 b.p.). It must be taken into account, however, that the material from the Ruoksmaa site contains Bronze Age ceramics in addition to Mesolithic artefacts and the fauna may also be of Bronze Age date (Meinander 1954). The sites of Haiti (93a) and Henttala in the rural commune of Porvoo are from the end of the Ancylus Mesolithic and the faunal species recovered are very similar to material from Early Atlantic period contexts. In the Litorina Mesolithic the elk-beaver-seal-fish economy continued and the Early Comb Ware occupation horizon of Siltapellonhaka does not appear to differ from the above. The ''new'' species of the refuse fauna are also dated to the Atlantic period. *Capreolus* found at Ruoksmaa may of course be of Bronze age date. *Sus scrofa* has been found at the Late Mesolithic site of Siltapellonhaka and *Lutra lutra* at the Tallikäärö site which is of the same period. These sites also provided the largest amounts of identified refuse fauna in Askola.

5.3. Comparisons of the osteological material of Askola with refuse fauna from other Mesolithic contexts in Finland

Archaeo-osteological analyses of Mesolithic refuse fauna prior to the present study have been carried out by Forstén (1972) and Fortelius (Siiriäinen 1982). A total of 10 sites were investigated and the results are presented in Fig. 20. The species are presented according to identified bone fragments and the sites are listed chronologically from the Ancylus to the Litorina Mesolithic. The dating of the sites is based on stratigraphic shore displacement chronology (Matiskainen 1983).

The refuse fauna of Askola is highly similar to corresponding Mesolithic contexts in Finland. The oldest sites considered are Pisinmäki in Kerava and Paltamo Kaarre, both dated to ca. 8500 b.p. (Siiriäinen 1978, Matiskainen 1983). The sites of Halme-Hietarinta in Honkajoki and both sites in Alavus date to ca. 8200 b.p. (Salomaa & Matiskainen 1985). The sites in question are from the beginning of the Atlantic period. Rasi in Alajärvi, Ylijoki in Kuortane and Topee in Kurikka are all from the beginning of the Litorina Mesolithic (ca. 7700—7200 b.p.). Large amounts of Corded Ware have

	KERAVA PISINMÄKI (8500 b.p.)	HONKAJOKI HALME-HIETARANTA (8200 b.p.)	ALAVUS RANTALANVAINIO (8200 b.p.)	ALAVUS VASIKKAHAKA (8200 b.p.)	ALAJÄRVI RASI (7700 b.p.)	KUORTANE YLIJOKI (7600 b.p.)	KURIKKA TOPEE (7200 b.p.)	SALO PUKKILA (7000 b.p.)	PALTAMO KAARRE (8500 b.p.?)	SAARIJÄRVI TARVAALA?	VIRRAT MAJAJÄRVI?	total
Alces alces (L.)				7		6	4	7	3	35	12	74
Canis familiaris	3	11	2		1					4		21
Vulpes vulpes (L.)	1									4		5
Castor fiber L.	5	20		2	3				5	41	2	88
Lepus sp.								7				7
Martes martes (L.)							1					1
Phocidae sp.	36	15	3		13	1	11	3				92
Ursus arctos L.										8		8
Rangifer tarandus (L.)										5		5
Esox lucius (L.)	2									13		15
Teleostei sp.	1	16			1		8		1	22		49
Aves sp.							3			5		8
Σ	48	62	5	9	18	7	27	17	9	137	14	353
	(Ancylus Mesol.) 8500—8200 b.p.				(Litorina Mesol.) 7700—7000 b.p.				(Inland Mesol.) ?			

Fig. 20. Mesolithic refuse fauna of Finland (Forstén 1972; Siiriäinen 1982).

been found at the Topee site and the fauna may thus be of two distinct periods. There are no finds of Mesolithic artefact types from the Pukkila site in Salo, but its elevation indicates a dating of ca. 7000 b.p. The site of Tarvaala in Saarijärvi cannot be dated on the basis of shore displacement, as it is connected with an inland lake. Finds of leaf-shaped slate points and oblique bladed quartz points suggest datings to both the Ancylus and Litorina Mesolithic periods (Luho 1967).

Comparisons of the chronological occurrence of game species between Askola and sites from other parts of the country show that along with fish, seal was the most hunted species. The Pisinmäki site in Kerava, dated to the transition from the Boreal to the Atlantic period, provided finds of seal and beaver with the exclusion of elk, which is also the case in the refuse fauna from Halme-Hietaranta and Rantalanvainio. At Vasikkahaka and Paltamo Kaarre the fauna is dominated by elk and beaver. As demonstrated by the Askola finds, the Litorina Mesolithic of Finland in general is dominated by an elk, seal, beaver-type fauna.

Explanations for this phenomenon must first make reference to the history of forests. The one-sided pine/birch flora of the Boreal period was a suitable biotope for elk and beaver, but specifically favourable conditions for beaver came about only with the increased range of deciduous trees in the beginning of the Atlantic period. Assuming that the climate of the Boreal period can be compared to the snow and frost situation of our present winters, the warmer Atlantic period signified a considerable improvement in the amount of winter nutrition for elk with a possible significant increase in elk stock. Also the rapid emergence of dry land in the Ancylus regression stage increased the territories of terrestrial mammals with corresponding changes in the environment of seal. At this stage the relict seal stocks of Lakes Saimaa and Ladoga were isolated with isolation occurring also in other larger inland lakes. The Tarvaala site is in the inland where seal hunting was not even possible. Siiriäinen (1982) has observed that also the Paltamo Kaarre site may be a river bank occupation of later date than the Ancylus Lake.

The site of Ristola in Lahti has been estimated as the oldest Mesolithic dwelling-site in Finland. Its elevation places it on the highest transgression shore of the Ancylus Lake with a corresponding dating of ca. 9200 b.p. (Edgren 1984). The refuse fauna of Ristola does not contain any bones of seal and consists of elk, beaver and fish. However, the Mesolithic occupation layer of Ristola has been strongly contaminated by later Corded Ware occupation and the osteological material strongly indicates typical inland fauna of the latter period. On the basis of the artefacts recovered in connection with the Antrea net find, elk was definitely part of the available mammal fauna as early as the end of the Boreal period and accordingly elk was hunted from the beginning of the Mesolithic onwards.

6. THE MESOLITHIC SUBSISTENCE ECONOMY AND SETTLEMENT SYSTEM OF ASKOLA

6.1. Stone Age subsistence economy in Finland

It was only until the early 1980s that the problems of Stone Age economy could be addressed in any comprehensive manner in Finnish archaeology. This was due mainly to analyses by Mikael Fortelius of osteological material from archaeolgical contexts. The central studies concerning Stone Age subsistence economy have been published by Siiriäinen (1981a, 1982). In these connections the overall cultural ecology of the Stone Age is discussed , but specific details referring to the Mesolithic can be compared with events in Askola. Zvelebil's (1981) studies concentrate on periods following the Mesolithic, but the method of catchment analysis applied by him also suggests approaches to the hunting strategies of the Porvoonjoki River valley.

In Siiriäinen's (1981a) discussion of hunting strategy the main problem is distinguishing specialized and unspecialized hunting on the basis of recovered refuse fauna. In the presented models conclusions regarding economy are linked to the Post-Glacial migration of settlement into Finland, the development of the natural environment and disruptions of equilibrium in hunting.

Fig. 21 presents a schematic diagram of the various emphases of hunting in the early Post-Glacial period according to Siiriäinen (A). Also included are specific details that appear to be probable in the light of the refuse fauna from Askola (B,C). The diagrams show the qualitative shifts of hunted species in the subsistence economy in relation to chronology. Briefly stated, Siiriäinen maintains that hunting was unspecialized in the Boreal period concentrating on large mammals, mainly elk. From the time of migration

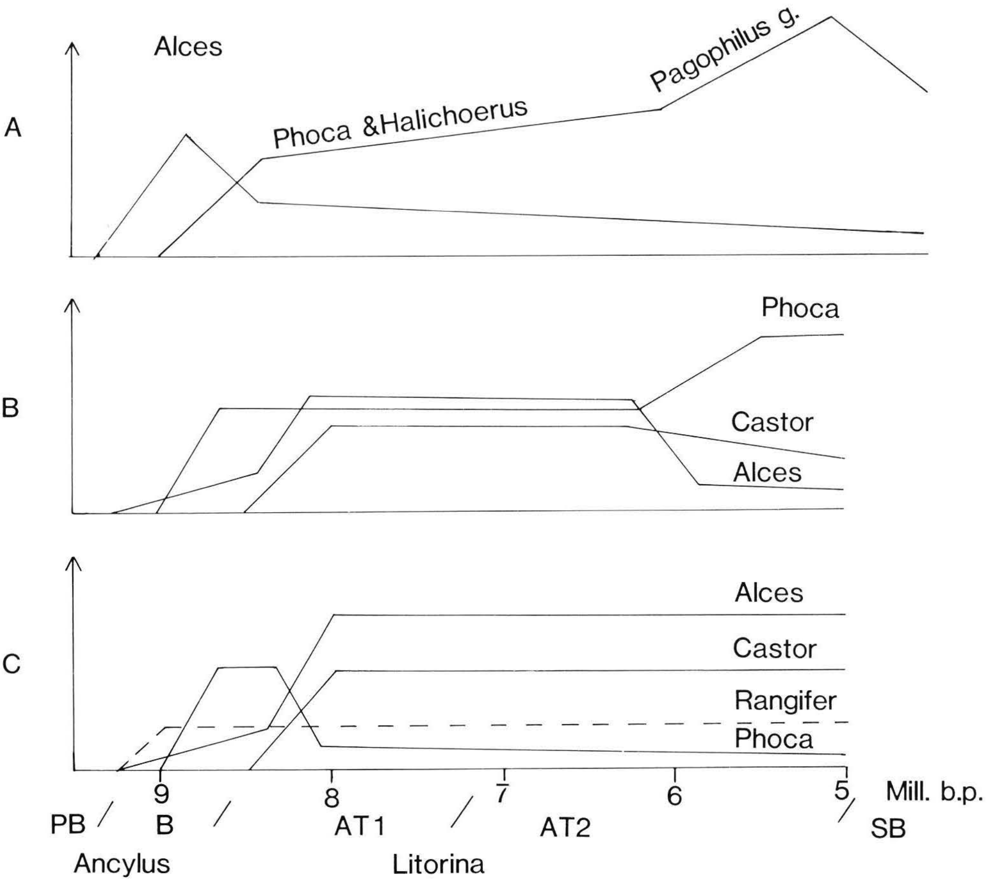


Fig. 21. Intensity of hunting of different species of game in the Mesolithic (see text).

onwards the population appears to have adapted to marine and inland lake hunting and fishing, in which connection seal was also a central item. Due to over-kill the elk and bear stocks diminished by the end of the Boreal period and hunting strategy changed with a greater reliance on seal. The increase of the seal stock and especially the spread of *Pagophilus groenlandicus* into the Baltic in the beginning of the Litorina period led to further specialization with respect to seal. This process culminated in the Comb Ware period and began to show signs of decreasing in the beginning of the Sub-boreal period around 5000 b.p.

Chronological comparisons of refuse fauna from Askola as well as other parts of Finland do not, however, lend unequivocal support for this view. It must of course be taken into account that the archipelagic hunting conditions of the area in the beginning of the Boreal period were hardly favourable for the hunting of terrestrial mammals and a more profitable source of biomass was provided sealing along with fishing. This is indicated by the emphasis of *Phocidae* in the faunal remains from the Hopeapelto and Rahkaissuo sites (Fig. 19). The Pisinmäki site in Kerava, dated to the end of the Boreal and the beginning of the Atlantic period also demonstrated a specialization in sealing (Fig. 21). In the region of Ostrobothnia the overall configuration of hunting in the Atlantic period does not differ much from that observed in Askola. During the Mesolithic the coastal and inland lake sites appear to differentiate in the use of their specific biotopes and this division is clearly indicated by the refuse fauna. The hunting strategy according to Siiriäinen is unspecialized. By way of analogy elk was also hunted in the Boreal period, but the chronologically earliest finds in the refuse fauna are from as late as the beginning of the Atlantic period.

A major stage in the differentiation of coastal and inland lake hunting is the isolation of the large inland lakes (Näsijärvi, Päijänne, Saimaa and Ladoga) from the Ancylus Lake in the beginning of the Atlantic period around 8500 b.p. (Matiskainen 1987). Inland lake conditions had developed in the upper reaches of these lakes already before their final isolation. It can be assumed that the uniform course of development changed at this time and with the exception of Lake Ladoga sealing ceased to be of major importance in the economy. Of the inland sites, the refuse fauna of Luopioinen in Hietaniemi contained seal bones. A leaf-shaped slate point suggests the Ancylus Mesolithic as the earliest stage of occupation at the site (Miettinen 1980). Seal has also been identified at the Kapakkamäki site in Sulkava on Lake Saimaa (dating ca. 5000 b.p.). On the other hand finds of seal are very common in the refuse fauna of the Lake Ladoga area (e.g. Otsoinen in Sortavala and in Kaukola; Heikki Teräväisen rantapelto, Pekko Iivosen rantapelto, Tiitunmäki and Ville Pessin Lavamäenpelto; Pälsi 1915; analyses by M. Fortelius). In the inland (C) unspecialized hunting relies on elk and beaver. To a lesser degree forest deer (*Rangifer tarandus fennicus* Lönnb.) and bear provide additions to the diet alongside intensive fishing.

In connection with the coastal sites (B) there appears to have been a hunting equilibrium between elk, seal and beaver from the beginning of the Atlantic period to the advent of Comb Ware. Hunting is unspecialized and there is no variation in the material indicating significant changes or specialization. It was only in connection with the ceramic innovation of the Comb Ware period that opportunities arose for specialization in seal hunting, the over-kill of seal and the storage of blubber for trade and exchange (Siiriäinen 1981a; Edgren 1983).

6.2. Resources and opportunities

An outline of the paleoenvironment provided indications of the nature of the biological catchment of the Porvoonjoki River valley in the early Post-glacial (see p. 10). The flora and fauna of the environment were the basis of subsistence for Mesolithic settlement and had to be adapted to also with respect to long-term change. The available resources permit an estimate of the specific opportunities for human activity in the area. Site-catchment analysis offers a method for the interpretation of these factors (Zvelebil 1981).

The starting-point of catchment analysis is von Thünen's early-19th century economic model where spatial organization considered the distance factor in depth by using a normative model of land-use. When a certain distance is reached the expenditure of energy exceeds the benefits of collecting energy (Zvelebil 1981).

This seemingly consistent model is nonetheless difficult to apply to archaeological material. The main questions are estimates of the size of the catchment, reconstruction of the paleoenvironment and assessments of the available game resources. The extent of the area utilized varies under different conditions from 5 to 25 km. Time can also be used to estimate the size of the area, for example by measuring the distance walked in 2 hours taking into account natural barriers and obstacles (Zvelebil 1981).

In the case of Askola the problems of the method are compounded to such a degree that, strictly adhered to, site catchment analysis cannot reveal the specific details of the utilization of the environment. The paleoenvironment differs from present conditions to such a degree that the total energy potential of the prehistoric biomass can no longer be estimated. The biotopes of the game species were completely different from present-day conditions and the beaver or fish stocks of grown-over and isolated lakes and ponds can no longer be evaluated as their original area is not known. Due to seasonal migration the numbers of seal that gathered in packs at the estuary of the Porvoonjoki River cannot be estimated with any precision. There may be better opportunities for applying catchment analysis in areas where recent natural conditions correspond to the prehistoric environment, e.g. in Kainuu and Lapland.

Interpretations of refuse fauna gave certain indications for outlining resources and possibilities and the structure of settlement. On the whole, Mesolithic settlement in Askola was stabile in nature. In long-term development there is only one significant boundary that may be of importance for prehistoric adaptation, viz. changes in climate, forests and marine conditions from ca. 8700 to 8500 b.p. The question arises of what effects these relatively dramatic changes had on human economy. In the history of Mesolithic settlement the Boreal and Ancylus Lake periods were of short duration (ca. 500—600 years) and the Atlantic and (Mastogloia)/Litorina periods continued without any significant changes for 2500 years until the end of the Mesolithic. Developments in the Atlantic period can be viewed as a uniform long-term catchment situation where certain criteria specific to catchment analysis can be applied (e.g. in defining the extent of utilized territory).

If we interpret the refuse fauna as reflecting unspecialized hunting as the most probable strategy employed production can thus be assumed to have consisted of all edible biomass available in the optimal hunting area (energy yield > energy costs). In cases where the catchment provides a varied and abundant biomass of game settlement becomes sedentary. If the number of individuals in the hunting population remains in equilibrium with available resources, the need for mobility is significantly reduced (Sahlins 1972; Siiriäinen 1981a). The stagnatic nature of settlement entails a situation where the yearly peak periods of the occurrence of fauna are the basis of the optimal hunting strategy. On the seasonal level there is species-specific hunting during peak periods.

The occurrence of favourable periods is the result of the behaviour of certain animal species that makes hunting easier than usual at certain times. Reasons for this are e.g. gathering for spawning or mating (fowl, fish), migration (water-fowl) and gathering in herds as a result of winter stress (elk, deer) or for the needs of acquiring nutrition (seal, beaver). Utilization of favourable periods may force the hunting population to become mobile, but under ideal conditions nutrition may be "at hand" without undue expenditure of energy for mobility. With increases in the types of resources available and the range of hunted species the costs of mobility are diminished (Winterhalder 1981).

Fig. 22 presents a calendar diagram of the peak or anomalous hunting periods of six resources or game species. Due to the warmer climate the Atlantic period the seasonal configurations of Atlantic period resources may differ considerably from present-day conditions. Recent conditions in the South Baltic area from around the 55th parallel may correspond better to the past situation on the shores of the Gulf of Finland. The Boreal period climate with its winters may have been similar to present conditions (cf. p. 22).

The optimal periods for fishing (A) are naturally linked to spawning in the following yearly order: *Esox* > *Perca* > *Cyprinideae* > *Lucioperca* > *Salmonidae* (Koli 1979, 1980a, 1980b). The nutritional value of fish is less than that of mammals and accordingly this resources may have had significance for the total subsistence of the population only in the spawning periods. On the other hand, it was easier to store fish than mammal food.

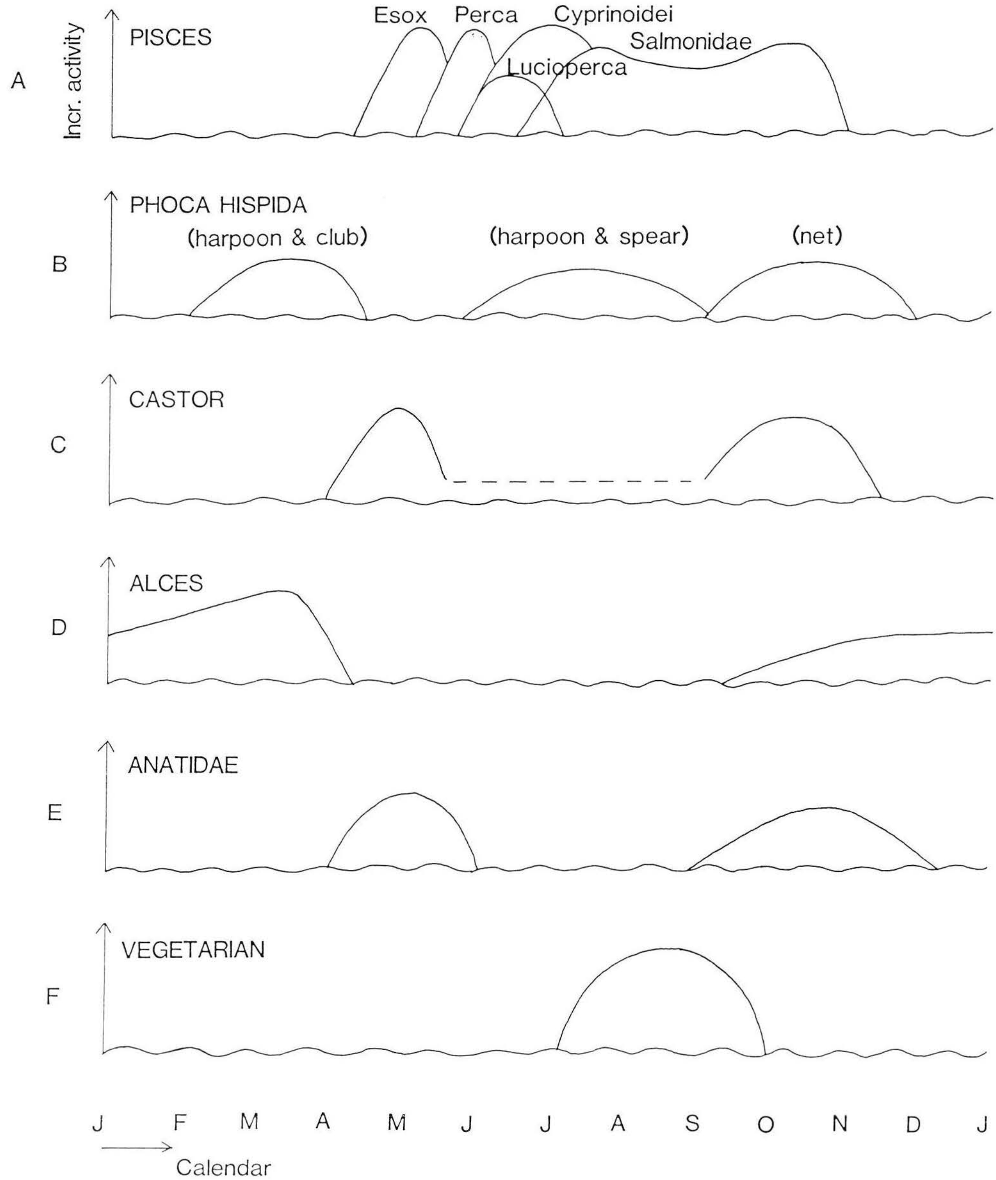


Fig. 22. Anomalous hunting seasons of certain species in Finland presented in calendar form.

The availability of seal (B) culminates in three yearly periods with corresponding hunting strategies, although the seasonal habits of *Pusa hispida* and *Halichoerus crypus* differ from each other (Hämäläinen 1930b). Hunting on the ice in late winter and spring when seals give birth is also an effective period. In the summer the seal come ashore and gather in packs to catch spawning salmon in the river estuaries. The third effective period is in the autumn when seal is caught with nets (Niemelä 1981).

The hunting of beaver (C) is regulated by the available biomass and the quality of the fur, which is best in the spring and in late autumn. Beaver is harder to catch in the winter.

Ethnographic sources indicate that the best season for hunting elk (D) is winter when the animals gather in herds. In the summer the herds are dispersed, but with the onset of the mating-season in the autumn elks move about and gather in herds again with increased ease of hunting (Nygrén 1979).

Birds (E) fall into two groups of economic significance, water-fowl and terrestrial fowl. The spring migrations of the former and the mating-season of the latter are profitable periods of hunting. A second culmination is in autumn with the newly -hatched young of the species and migration.

Although there are no macrofossil analyses of Mesolithic conditions, berries and nuts may also have been of importance (e.g. *Vaccinium vitis-idaea* L., *V. myrtillus* L., *V. oxycoccum* L., *Arctostaphylos uva-ursi* L., *Corylus avellana* L. and *Trapa natans* L.). These resources are available in the period from July to October.

In estimating the utilization of peak periods it appears that the resources provided by the various species are favourably dispersed throughout the year and the hunter-gatherer population did not encounter periods of crisis that would have significantly limited the conditions of subsistence. Due to changes in the environment there were long-term variations in the availability of different game. By the Atlantic period at the latest the catchment area had achieved optimal conditions and all resources were available without undue need for mobility.

6.3. On the Mesolithic demography of Askola

The distribution of the sites indicates that in the Atlantic period the catchment area of Askola was approximately 200 km^2 with a hunting and gathering radius of 7—8 km. In this area there appears to have been a state of equilibrium between energy acquired and the expenditure of energy, which provided for the subsistence of the hunter-gatherer population of the region. Hunter-gatherer catchment territories are usually within a maximum radius of 10 km from the base camp. With distances exceeding 10 km energy costs for acquiring nutrition rise sharply (Lee 1968, Vita-Finzi & Higgs 1970; Hassan 1981).

Estimates of population numbers are highly speculative in nature. According to Hassan (1981) ethnohistorical sources lace the size of a hunter-gatherer group at 15—50 individuals. An often recurring "magic number" is 25 persons.

Excavations of a Comb Ware-period dwelling found at the Naarajärvi site in Pieksämäki offer indications of population size. The NW room of the dwelling provided space for 35—40 persons assuming 4 sq.m as the minimum requirement of space for one person (Matiskainen & Jussila 1983). (In comparison, the half-platoon tent used by the Finnish Defence Forces provides slightly less than 2 sq.m of space per soldier). In the case of Askola we may suggest a group of 35 $\pm$ 5 persons forming the hunter-gatherer community subsisting on the catchment of the territory.

The size of the population can be assumed to have remained stabile throughout the Mesolithic. EpiPalaeolithic infant mortality (at ages of under ten years) has been estimated at ca. 50 % and the life-span of the individual at ca. 30—37 years (Hassan 1981). The maximum age of the deceased of the Oleni-Ostrov cemetery has been estimated at 37 years (O'Shea & Zvelebil 1984). If the natural interval of childbirth was ca. 28 months, the average number of children that an individual woman would give birth to was 6.4. Taking into account infant and adult mortality it can be assumed that of the children of one mother 2.1—2.5 survived childhood. With a lesser number of women population will accordingly decrease and conversely a majority of women will lead to an increase in population. If the proportions of the sexes remain the same, population will be highly stabile. To what degree Hassan's estimates can apply to the situation in Askola remains to be verified.

Assuming infant mortality of less than 50 % we arrive at a situation where the proportion of survivors increases as well as the size of the hunter-gatherer population. The carrying-capacity of the catchment begins to regulate the size of the population. Variations in the amount of resources are synchronized with increases and decreases in the size of the population. Crises bring about difficulties in maintaining subsistence, increase the amount of labour and lead to the use of suboptimal resources and even in some cases lead to new innovations (Hassan 1981).

The basic aim, however, is affluent subsistence with crises prevented beforehand. The population most probably controlled group size by birth-control through sexual behaviour (Siiriäinen 1981a). Ethnographic data speaks of population control in situations of crisis by killing children and the aged (e.g. Pälsi 1984; Hassan 1981).

Assuming a daily calorie requirement for adults of ca. 2200 kcal per person (the present FAO standard is 2354 kcal/p/d.), the corresponding yearly requirement is ca. 800,000 kcal. Use of energy cumulates naturally with age, but assuming a group size of 25 adults (see above) the total energy requirement is ca. 20,000,000 kcal/yr.

Zvelebil (1981) has presented estimates of numbers of game individuals and corresponding calorie yields permitting assessments of catch sizes required for maintaining hunter-gatherer populations. If a certain mammal resource was being specialized in, the corresponding consumption of the Askola community was either ca. 50 elks, 75 seals, 400 beavers or 20,000 kg of fish. With unspecialized hunting as the most probable alternative and the use of other mammals and fowl alongside the above species, energy yield is divided among several species of game animals. We can only guess at the nature of this division in the Mesolithic as it was dependent on yield and ease of hunting in peak periods.

The availability of game and fish in the catchment area was considerably higher than their utilization, which would suggest that there were no crises of subsistence. As mentioned above, a thorough estimate of the total biomass of all available species cannot be presented in the case of Askola and its paleoenvironment. The author's personal experiences indicate that the present exceptionally high density of elk varies between 0.5 and 5 individuals per square kilometre. Assuming a maximum of 1.0 individuals we arrive at an optimum density of 200 elks in the ca. 200 km^2. Despite fluctuations in stock and the effects of predators natural production was so great that it alone could have been a sufficient source of nutrition for the population of assumed size. The fact that elk was not the sole game hunted is most probably a result of its seasonality, which would have required a more mobile way of life. Accordingly, the difficulties engendered by crises would have been all the more evident.

The question of whether the Askola catchment could have supported several groups simultaneously must remain unanswered. The large number of sites that are possibly of the same age may indicate that in especially favourable periods the yield of the environment could have supported more than one population. For example, the clusters of settlement at the beginning of the Atlantic period as indicated by shore displacement chronology could signify the presence of more than one population (see Fig. 16).

The above hypothetical sketch of demographic conditions attempts to outline the locations available to settlement and its intensity with respect to available natural resources in the Mesolithic. The sedentary nature of settlement in this connection must be seen as the utilization of the environs of the Porvoonjoki River, which appears to have provided the population of assumed size with an affluent degree of subsistence. The following section discusses in further detail the use-model of the river valley in the process of isolation from the Ancylus Lake and in later stages of development from the perspective of the hunting system.

6.4. Structure of settlement and the hunting system

Siiriäinen (1981a, 1987) has presented a model of the location of dwelling-sites in ecological zones which may reflect seasonal mobility in the utilization of various game, i.e. yearly rotation among different forms of resources (Fig. 23). The four catchments outlined by Siiriäinen are:

1) outer archipelago
2) inlying coastal archipelago
3) sheltered bays and river estuaries,
4) inland lakes

A similar model of hunting strategy has also been outlined by Welinder (1983), (see also Cullberg 1981).

A characteristic feature of the model is a certain hierarchy of sites (Siiriäinen 1987). In cases 1) and 4) the sites are small and mainly encampments or task camps. Locations 2) and 3) are more extensive dwelling-sites. The model is logistic in nature and appears to support the assumption of resource utilization through unspecialized hunting.

Can the overall image of the Askola catchment be related to the above model? The

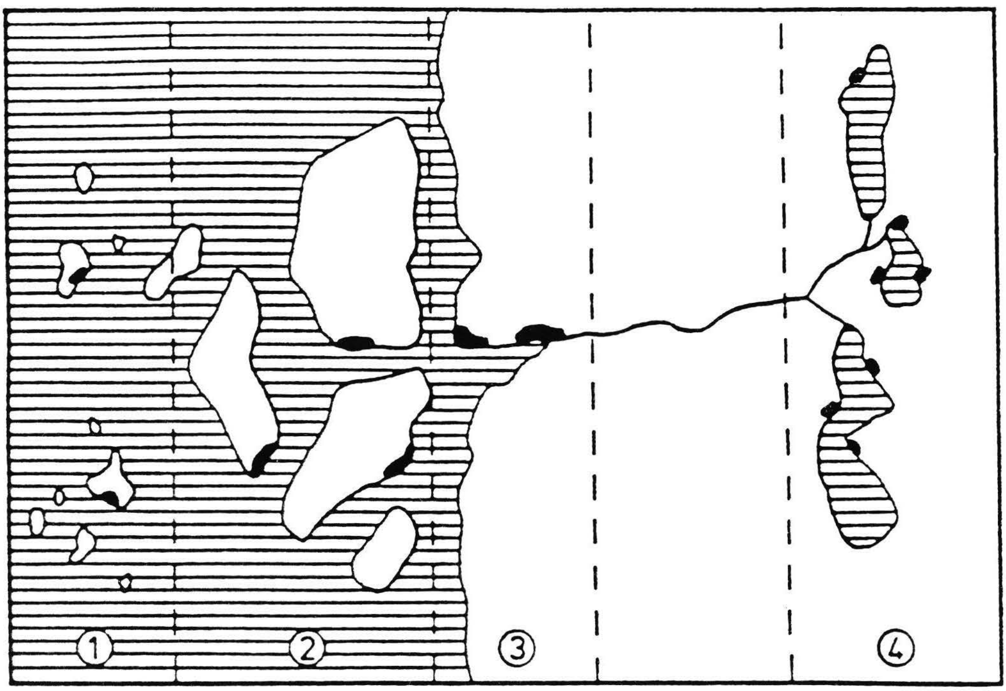


Fig. 23. Strategic locations of Stone Age dwelling sites on the Baltic according to Siiriäinen (1987).

history of the environment of the area displays all four stages. During the rapid changes that occurred in the Ancylus Lake stage the outer archipelago of the region changed into an inlying coastal archipelago and finally during the Litorina stagnation came to resemble ecozones 3) and 4) as a river estuary and inland lake environment. The economic zones can be seen as chronological horizons, but it was only as late as the Atlantic period with the emergence of the Porvoonjoki River that the latter landscape zones came about. The differences must also be taken into account in reviewing the evidence provided by refuse fauna.

In estimating the intensity of occupation the question of the extent of the archaeological surveys arises as well as the possibilities of applying the material studied to the zonal division. As mentioned previously, surveys were carried out most actively in the environs of the centre of the commune and field surveys were possibly not as intensive in outlying regions.The more extensive nature of sites in zones 3) and 4) as assumed in the model is suitably underlined by the more numerous finds of the immediate vicinity of the centre of the commune. These sites with their more numerous remains are more susceptible to being found than the short-term encampments on the outlying islets and the shores of the inland lakes. The growing-over and paludification of the smaller lakes may have also led to the smaller sites being covered over with turf and peat and only isolated stray finds may indicate their past existence.

After the Ancylus culmination the Askola region became a sheltered offshore archipelago environment where the proportion of dry land increased throughout the Boreal period. The outlying archipelago was further to the south and there are no archaeological finds indicating occupation in these parts. Also excluded from occupation are the inland-lake and riverine zones that had not yet formed at the time. Ecozone 2) was the predominant milieu at the time, which explains the emphasis of *Phocidae* along with fish in the refuse fauna. The Late Boreal period economy of Askola can even be regarded as specialized in sealing and spread along the coast in accordance with the requirements of ecozone 2). Although present-day conditions would suggest that an offshore archipelago would be especially suited to seasonal elk hunting, the refuse fauna does not give any indications of the hunting of large mammals. The small number of sites suggests that settlement was at first mobile and became sedentary in nature at the end of the Boreal and the beginning of the Atlantic period. This can be seen in the formation of clusters of sites (Fig. 17). The early Atlantic period landscape (ca. 8600 b.p.) corresponds to the Ancylus Lake situation outlined by Siiriäinen (1981a, Fig. 4), despite the fact that the sites in the illustration are of different age with respect to shore displacement chronology and as a whole are not related to this stage in the history of Baltic. In the early Atlantic period (ca. 8600—8000 b.p.) the natural environment corresponded to ecozone 3), i.e. a sheltered bay with better conditions for unspecialized hunting. The warmer climate and the increased range of flora in turn led to greater diversity in the mammal species (beaver, wild boar, forest deer etc.). The prevailing ecozones are 1) , 2) and 3) forming the catchment with its yearly peak periods. The hunting of beaver also required active utilization of small lakes in the area.

Siiriäinen's four-part division of ecozones was complete only when the Porvoonjoki River provided suitable conditions for the spawning of salmon. With the slowing of environmental change in the Litorina period the nature of the catchment with its species and the applied hunting strategies also changed and became stabile. Shore displacement chronology permits only the dating of sites in connection with the Litorina Sea and accordingly only zones 1), 2) and 3) can be reconstructed.

Fig. 24 shows the distribution of finds of oblique-bladed quartz points at the various sites and locations compared with the zonal division. The artefact type does not occur

Fig. 24. Distribution of certain oblique-bladed quartz points possibly corresponding to the ecological locations of sites as presented in Fig. 23.

at all in zones 1) and 2) and all finds are from zones 3) and 4). The sites in question are at the mouth of the river at the boundary of salt and brackish water (nos. 6, 41, 42, 48, 49, 56, 58 and 120) and further upstream at the boundary of brackish and fresh water (nos. 84, 86, 104, 106, 107 and 139). In addition, there is a single find (no. 167)

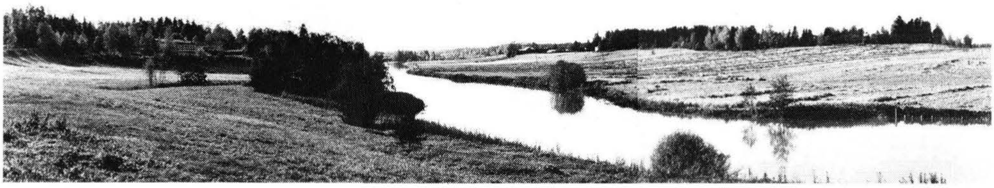


Photo 4. View from the Pappila-Saunapelto site (49) to the south towards the Vakkolankoski rapids. The Siltapellonhaka site (49) is in the background. On the right bank of the Porvoonjoki river is the extensive Niemenpelto site (37).

from the shore of an inland lake. This distribution may be explained by the fact that there were few sites in zones 1) and 2).

In comparing the yearly peak periods of game resources and the utilization of the catchment the following seasonal ecozone model is obtained. The site selected for purposes of comparison is Siltapellonhaka (no. 48; and partly also Perunamaa-Saunapelto, no. 49) which is assumed to have been a base camp (Photo 4). Assuming a hunting organization aiming at the utilization of all available resources the following hypothetical outline can be presented:

Winter:	— large mammals (elk, bear, forest deer wild boar)	> Zones 3,4
	— seal (long-range hunting)	> Zone 1
	— dog	
Spring:	— beaver, fishing, terrestrial fowl	> Zone 4
	— fishing (*Esox, Perca*)	> Zones 3,4
	— fishing, water fowl	> Zones 2,1
Summer:	— fishing 1. (*Cyprinidae*)	> Zone 4
	— fishing 2. (*Salmonidae*)	> Zone 3
	— seal (short-range hunting)	> Zone 3
	— vegetation for nutrition	> Zone 4
Autumn:	— beaver, elk and large mammals	> Zones 4,3,2
	— terrestrial and water fowl	> Zone 4
	— fishing 2. (*Salmonidae*)	> Zones 2,3
	— fishing 2.,seal, water fowl	> Zones 2,1

Fig. 25 presents a schematic view of how autumn hunting was may have utilized the resources of the Askola catchment. From the base camp hunting expeditions were made to the outlying archipelago (zone 1) in order to catch seal and sea birds. The zone is outside the normal foraging radius (A). Alongside fishing, hunting in zone 2) concentrated on seal and water fowl thriving on salmon (B). Hunting in zone 3) concentrated in turn on large mammals, terrestrial and water fowl and of the furry animals especially beaver in the small lakes and ponds isolated in the regression stage (C). Autumn was still a favourable season for salmon fishing with the possible use of weirs along the river (D).

Subsistence placed certain social requirements on the hunter-gatherer community. The question of organization can be approached by comparing the catchment strategy of

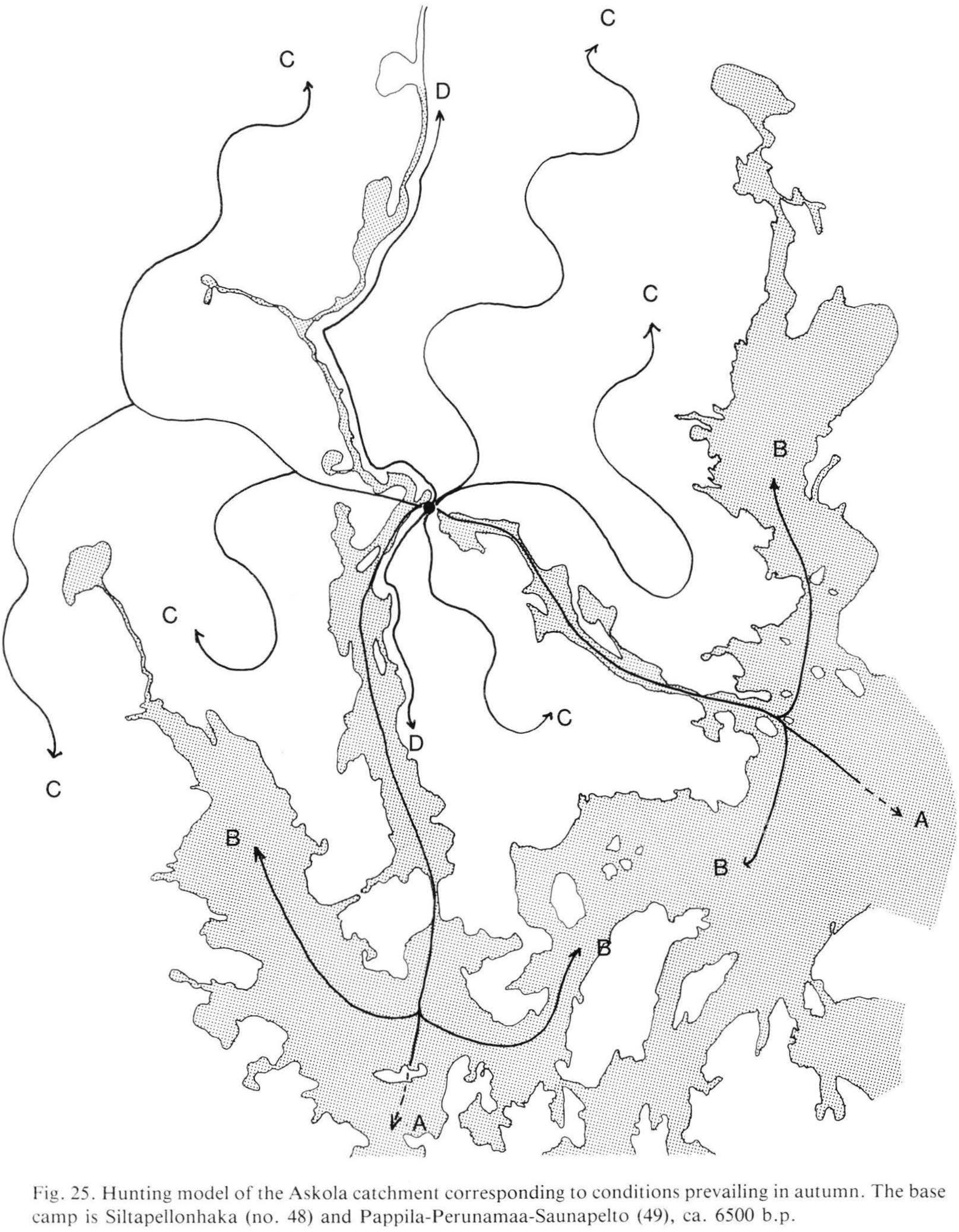


Fig. 25. Hunting model of the Askola catchment corresponding to conditions prevailing in autumn. The base camp is Siltapellonhaka (no. 48) and Pappila-Perunamaa-Saunapelto (49), ca. 6500 b.p.

Askola with Binford's (1980) model of the pattern of differing settlement systems in relation to subsistence strategy, utilization of the environment and the archaeological material. Starting-points for the comparison are provided by the assumptions that the archaeological material of Askola can serve to define the extent of the catchment, that hunting was unspecialized and that settlement was relatively sedentary.

Binford's model is based on his own ethnoarchaeological fieldwork with the Nunamiut as well as data provided by historical and ethnographic sources concerning the adaptation of hunter-gatherers with their environment. The main comparison with the material of this study is provided by Binford's division into foragers and collectors. Inter-group variability is the result of differences of the organizations concerned in their hunting activities (Fig. 26; Savelle 1987). In principle foragers do not store their catches , but gather their daily requirement of food. The settlement type employed is a residential base, to which the foragers return in the evenings from their hunting expeditions. The group is mobile and settlement shifts according to the yearly peak periods of game. In situations where resources are scarce and dispersed group size is small and the sites are accordingly dispersed over large areas. Early residential moves occur to a great deal. (Binford 1980; Hassan 1981).

The foraging system produces two types of spatial context for the discard or abandonment of artefact remains, residential bases and locations. These differ mainly with respect to hunting activities, use and the amount of remains deposited at sites. Locations are smaller ''low-bulk'' sites for acquiring resources and are of shorter. Discarded artefacts are rare at locations. (Binford 1980).

The collector system has a more developed organization than the forager system with also more intensive storage. Residential sites are of a more permanent nature and logistically organized ''task groups'' operate from the site establishing subsidiary camps where required by the hunting strategy. These are of various types and include field camps, stations and caches as the operative centres for hunting. Specialization leads to a division of sites according to production and consumption. The produce of the subsidiary camps is transported to the consumers of the main camp. The former camps may be located according to the requirements of the season or of the various game hunted (e.g. fishing camps, beaver camps, etc.) (Binford 1980).

The strategic differences of these two settlement systems can be summarized in the observation that foragers bring the consumers to the resources with frequent residential moves while collectors bring the game acquired to the consumers with generally fewer residential moves (Binford 1980).

Wiessner (1982) has criticized Binford's organization model mainly on the basis that it is based one-sidedly on the utilization of the resources of the environment and provides only a very limited framework for archaeologists to work with. Wiessner maintains that Binford's system does not stress adequately the concept that basic differences in hunter-gatherer organization are the products of adaptive strategies relating persons in social relations of production as well as being the product of inter- and intra-group interaction (exchange, style, internal site structure, etc.).

Despite the danger of a possibly limited environmental-deterministic approach the aim of this study is to investigate whether the Mesolithic hunting organization of Askola displays features that could be compared with the subsistence strategies of the above systems. It must first be underlined that in Askola hunting strategy did not remain the same from the time of the earliest settlement to the end of the Mesolithic. Changes in the natural environment as well as improved game resources in the time-span from the Ancylus period to the Litorina period brought about significant changes in the catchment. The forager system on the whole appears to be too simple and mobile to account for the situation observed in Askola with sedentary use of the resources of a small area. An organization model of the collector type would provide a more satisfactory explanation of the spatial form of settlement with seasonal occupations at various sources of resources in accordance with the utilization model discussed above. The residential bases are in zones 2) and 3) and the temporary hunting sites in zones 1) and 4). The

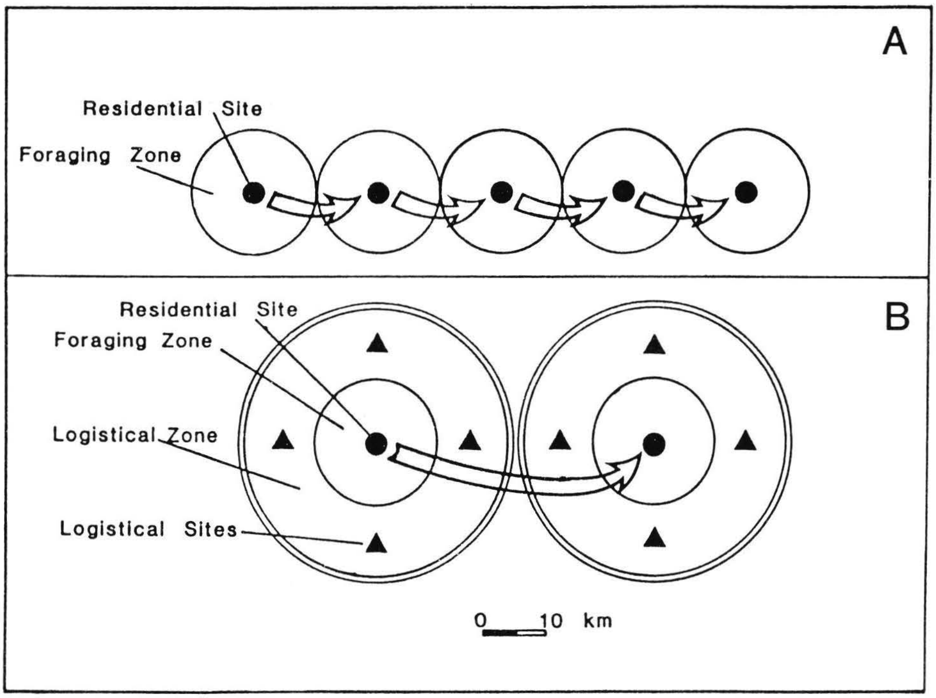


Fig. 26. Succession of settlement in Binford's (1980) collector and forager systems (from Savelle 1987).

Litorina period environment, resources and location of sites correspond to a situation characteristic of a collector system. On the other hand we must take into account that Binford's systems were studied and outlined in the tundra zone of Alaska and are based on a relatively one-sided utilization of deer.

The collector system employs a more complex organization with greater stress on individual input of production in the hunter community. This requires some degree of differentiation of activities in hunting and hierarchical divisions between the members of the population. The use of dogs suggests effective hunting and the prior planning of the choice of game. With an economy based on the hunting of game of different biotopes the members of the community may specialize in different game mainly on the basis of personal interest and achieve status with their hunting skills, e.g. as more skilled beaver hunters. Hunting skills and physical prowess were of use to the community as they decreased the energy costs of subsistence thus providing favourable relations of energy cost vs. yield. A hierarchical hunting organization stressing the input of the individual leads to the formation of a non-egalitarian community, which however does not necessarily become competitive or antithetic to its basic existence.

The term ''affluent society'' has often been used of the hunter-gatherer system. This use of the term suggests that the system did not employ a production economy that was difficult to manage or that it entailed an ongoing struggle with the environment (Sahlins 1972; Koyama & Thomas eds. 1981). The structure of the economy did not necessarily even strive at utilizing the full carrying capacity or all possible resources of the environment nor did it attempt to maintain maximum population. This may however be an overly idealized view of past conditions. Binford (1980) uses the term ''Garden of Eden'' of areas where environmental conditions are to such a degree optimal that there is no need for mobility. In the Litorina phase the Askola catchment may well have supported an "affluent" community in the period of optimal subsistence of the Post-Glacial hunter-gatherer culture.

A main body of material for the testing of the above views is provided by the Oleni Ostrov cemetery in Soviet Eastern Karelia. This well-known cemetery is located on an island in Lake Onega. It is dated to the end of the Mesolithic with approximately 170 excavated burials (Gurina 1956). Due to the high lime content of the soil organic material has been preserved exceptionally well, even to the degree that in many cases the sex and age of the deceased could be determined. The amount and nature of grave-goods provide indications of status, in turn reflecting the degree of respect afforded by the community to its deceased members. There are no Mesolithic grave finds from Askola, but red-ochre graves of Mesolithic date have been found elsewhere in Finland, albeit without preserved osteological material (Purhonen 1984). The tradition in question is the same as in Eastern Karelia.

Briefly stated, hunter-gatherer communities have been described as necessarily small, simple and egalitarian in nature. According to the Marxist view, also the Oleni Ostrov cemetery would have been an indication of an egalitarian past society. O'Shea's and Zvelebil's (1984) studies of the demography of the cemetery show, however, that there was a considerably higher degree of intra-community differentiation than previously assumed. The hierarchical status of the graves indicates a definite emphasis on the individual in the Mesolithic. Grave-goods are mainly ornaments and pendants made of the teeth of hunted animals (beaver, elk, bear) that were worn be the deceased. It has also been assumed that the ornaments and animal figures denote the clan to which the deceased belonged in his lifetime. Differences of sex are subtly expressed in the grave-goods, mainly in the sense that women's graves in most cases contained "household articles" while hunting equipment was placed in the men's graves. Ornaments of bear's teeth were mainly worn by adult males, while the women's ornaments were mainly made of elk and beaver teeth (O'Shea & Zvelebil 1984). Individual specialization with respect to hunted game is not however indicated.

The above-discussed collector system with its stress on individual production and status and its non-egalitarian nature is reflected by the finds of the Oleni Ostrov cemetery and a framework for a community structure that existed from at least the latter stages of the Mesolithic also in Askola. In the Onega region the system was based on inland conditions and was probably more mobile than in the case of Askola where the division into ecological zones was more productive and extensive.

The most distinct changes in the artefact types of the Finnish Mesolithic can be linked with two facies of the history of the Baltic, the Ancylus Lake and the Litorina Sea. Are the innnovations of material culture (oblique-bladed quartz points and the South Finnish adzes) the result of changes in hunting strategies and were the new inventions brought about by possible crises of subsistence? Some of the artefacts, such as the globular mace-heads with coniform holes and the South Finnish adzes display distributions that are more regional in nature and their interpretation in the case of Askola must remain incomplete. In Finnish conditions only stone artefacts permit further-going conclusions, but for example in Estonia bone artefacts of the same period suggest an abundance of material that may also have been the case along the northern coast of the Gulf of Finland. Adaptation to the rocks and minerals of the Precambrian bedrock in the manufacture of artefacts conditioned the advent of singular artefact forms. Accordingly, the manufacture and forms of the bone and antler artefacts can be assumed to have been dictated by the range of hunted mammals. The anatomy of the hunted animals developed the artefact forms that were best suited to their slaughter.

The lithic artefact finds from Askola can be classed as either passive or active hunting weapons. Axes and adzes are the most important passive ones as they were employed in connection with the hunting strategy for building traps, weirs and other constructions as well as for constructing means of transport and dwellings. The most numerous and apparently most significant implement was the so-called "primitive adze/axe" which remained the same throughout the Mesolithic. This hafted object was apparently a basic tool that did not require re-designing. The curved-backed gouge is also an artefact type of long duration, mainly used in the Ancylus Mesolithic. In the regional distribution of the South Finnish adzes the Askola finds are in the easternmost area. Frequencies of finds indicate that this artefact was not used to the same extent as in the western parts of the Uusimaa region. The fourth passive artefact is the globular mace-head with a coniform hole. In the area of the Gulf of Finland the function of this artefact was apparently understood in a manner different from Central Finland or Ostrobothnia where it appears in considerable numbers in the Ancylus period. On the whole, it appears that changes in environmental and hunting strategies are reflected to only a slight degree in the changes of stone artefact types in Askola.

With reference to artefacts for active hunting use, the clearest change is in the case of the leaf-shaped slate points that occur in numerous quantities in the Ancylus period, but fall out of use in the end of the period. In the early Litorina period the oblique-bladed quartz points increase in the finds. This artefact type was common throughout Southern and Central Finland until the end of the Mesolithic. The regional distribution of the quartz points covers the previous distribution of the leaf-shaped points, although shore displacement shifts the distribution to sites on the shore of the Litorina sea (Matiskainen 1986). In Askola the chronological separateness of the artefact groups is clearly evident (cf. p. 36, Siiriäinen 1981b).

The development of polished leaf-shaped slate points has traditionally been explained as a local application of the manufacturing technique of Swiderian points of flaking technique in the region of Precambrian bedrock (e.g. Äyräpää 1955). Siiriäinen (1981b) has suggested the hypothesis that the function of the artefact is linked to the hunting of large terrestrial mammals and that it goes out of use when over-kill diminishes the latter resources at the end of the Boreal period (cf. Fig. 21). Assuming this to be correct, the artefact would indicate the active hunting of elk in herds as well as the hunting of bear from winter lairs or by tracking. In the Early Ancylus period offshore archipelago of Askola this would appear to be a suitable strategy for hunting elk, but, as mentioned above, osteological analyses of refuse fauna do not support the assumption of large-scale hunting of terrestrial mammals. The slate-pointed spear could have been just as suitable for hunting seal, especially in the winter hunting of packs of seal where unbarbed spearheads were needed (Hämäläinen 1930). The spears fall out of use around the same time that the range of game increases (ca. 8000 b.p.) and it is possible that the mass hunting of seal, in turn linked to peak periods, is replaced by unspecialized overall hunting of mammal fauna. It is of course also possible that the slate points, the manufacture of which was to some degree difficult, were replaced by points of bone or antler.

The adoption of the oblique-bladed quartz points reflects an innovation that came about in Southern Scandinavia and Central Europe with the changing of microlith technology to the manufacture of trapezoids. The Early Mesolithic finds of the East Baltic region include arrowhead points of flint flaking technique and it can be assumed that the bow and arrow were in use in the areas to the north of the Gulf of Finland already before finds of points begin to indicate their use. The earliest points were possibly bone points of Sigir type or bone points fitted with quartz flakes. These are, however, not indicated by the Ancylus Mesolithic finds. It is possible that in the diversified utilization of the catchment in the Litorina period the bow and arrow became more important and the oblique-bladed points indicate changes in hunting strategy and the necessity of this technical innovation in Finnish conditions.

The stone artefacts provide limited indications of the nature of Mesolithic subsistence and its long-term changes. The material does not even provide a satisfactory degree of detail in this respect. The artefacts as such are of little value in the interpretation of hunting strategy and conclusions must therefore be drawn mainly on the basis of the paleoenvironment, the locations of sites and the nature of the hunted fauna.

7. POST-DEGLACIATION STAGE EARLY SETTLEMENT IN FINLAND WITH SPECIAL REFERENCE TO ASKOLA

7.1. Provenance studies

Until the 1970s part of the Mesolithic settlement of the Porvoonjoki River valley was regarded as indicating the earliest post-Ice Age settlement of Finland. As discussed above, Luho's (1956) studies defined a specific Early Mesolithic »Askola culture» of the Preboreal period that was distinct from the Mid and Late Mesolithic »Suomusjärvi culture». Critical views regarding the Askola culture have already been presented in a number of connections and especially Siiriäinen (1969, 1981b) has demonstrated that Luho's concept of the Askola culture was mistaken both chronologically and with respect to artefact typology. The evidence presented by Siiriäinen is to such a degree convincing that it need not be repeated in this connection. Suffice it to say that the results of the present study do not support the idea of a separate »Askola culture» as argued by Luho on the basis of the archaeological material.

The debate concerning the Askola culture has been useful for Mesolithic studies in Finland. Our concept of the Mesolithic is to a large extent based on the finds from Askola. This extensive material was collected mainly as a result of Luho's determination to prove the existence of a separate cultural phase and in this respect archaeology has clearly benefited from the problems of research that were originally put forth by Ville Luho.

The significance of the earliest settlement of Askola for the overall Stone Age chronology of Finland is still a valid subject of study. The earliest settlement following the Ice Age is a highly problematic subject with a great deal of unknown factors and lack of detail. The following discussion will attempt to compare the Askola region with other Early Mesolithic finds in Finland. An introductory section discusses the main features of the East European Late Palaeolithic of the deglaciation stage with emphasis on possible points of origin for the settlement of Askola.

Following Luho's (1956) studies the origin of Finland's early settlement has been discussed by Siiriäinen (1981b) and most recently Nùñez (1987). Nùnez has presented a generalized model based on available data concerning the Upper Palaeolithic of Eastern Europe, the deglaciation process and changes in the natural environment. In the following discussion theoretical views will be compared with certain concrete phenomena relating to the earliest settlement of the regions to the north of the Gulf of Finland and especially Askola.

7.2. The Late Palaeolithic of the melting zone of the Valdai glacier

The main Upper Palaeolithic concentration of finds is in the steppe region of Central Russia in the vicinity of the River Dniepr and its tributary the Desna. In this region a number of sites have been discovered that can be dated to the period 26,000—12,000 b.p. (Soffer 1985a,b). The material displays two periods of settlement, of which the latter, ranging from ca. 18,000 to 12,000 b.p., is of interest for the history of population and settlement of the northern regions. Main sites include Sungir (youngest dates from 16,000 to 14,000 b.p.) and Bysovaya from ca. 18,000 b.p. (Bader 1978; Kanivets 1976). In this connection the map presented by Nùñez (1987, Fig. 2) is incorrect insofar as the deglaciation stage of ca. 13,000 b.p. (Luga stadial?) and the Late Palaeolithic sites are not chronologically comparable.

The maximum stage of the Valdai (Weichsel) glacier dates to earlier than 16,000 b.p., but the glacier still reached its maximum extent during the Vepsovo (Pomerania) stadial (ca. 15,000—14,000 b.p.). The retreat of the glacier began after these events and includes two distinct stadial and interstadial cycles before the Salpausselkä-Dryas III stage and its final melting (Gerassimov & Velichko 1982).

The position of the glacier during the Raunis interstadial (ca. 13,500 b.p.) is not known. It is possible, however, that the glacier retreated rapidly into the central parts of present-day Estonia and to a position in line with Lakes Ladoga and Onega, with subsequent retreat to its well-known position during the colder Luga (Dryas I) stadial (Fig. 27).

During the following interstadial cycles and by the Alleröd interstadial at the latest the ice sheet had retreated across the Gulf of Finland to the north of the Salpausselkä zones, from where it extended south-east during the Dryas III stage to its SI and SII positions (Donner 1982; Kvasov 1979).

Deglaciation is by no means a static process and the related interstadial and stadial cycles must be taken into account in studying the spread of settlers into areas from where the ice had retreated. Cyclic variations brought about changes also in the long-term subsistence of hunter-gatherers. The permanent Palaeolithic form of settlement that has been assumed to have existed until the Valdai maximum stage was disrupted and from the beginning of the melting stage the hunter-gatherer communities had to adapt their hunting strategies to the new opportunities provided by territories of increasing size. The subsistence conditions of mammoth were hardly affected by the limited vegetation of the narrowing tundra zone, but more likely by the fact that the biotope concerned clearly deteriorated with increased humidity and snowfall (cf. Nùñez 1987). The ecological disturbances led to a sharp drop in the mammoth stock and organized hunting had to adopt new resources such as deer. The conditions for the existence of deer may even have improved as a result of the deglaciation cycles, while those of other cryophilous mammals deteriorated (Järvinen & Miettinen 1987).

Soffer (1985a) has suggested that mammoth hunting was not the sole means of hunting in Eastern Europe in the Late Palaeolithic and that carcasses preserved in permafrost were also used. A large number of frozen mammoth carcasses have been found at Berelech in Yakutia and the Kostienki site is possibly a similar location where frozen carcasses were utilized. ''Dry-frozen'' mammoth may, however, be poorly suited for nutrition (cf. Kurtén 1982). In situations of stress, however, it was possible that the decreasing mammoth stock was hunted more intensively and man had a definite effect on the metachronic extinction of the species. The latest radiocarbon dates of this stage from Russia are from ca. 13,000 b.p. (Berglund & al. 1976).

In the stage of glacial retreat the tundra zone narrowed and accordingly increased in size in the stadial phases. The periglacial steppe forest type ''borealized'' into a more

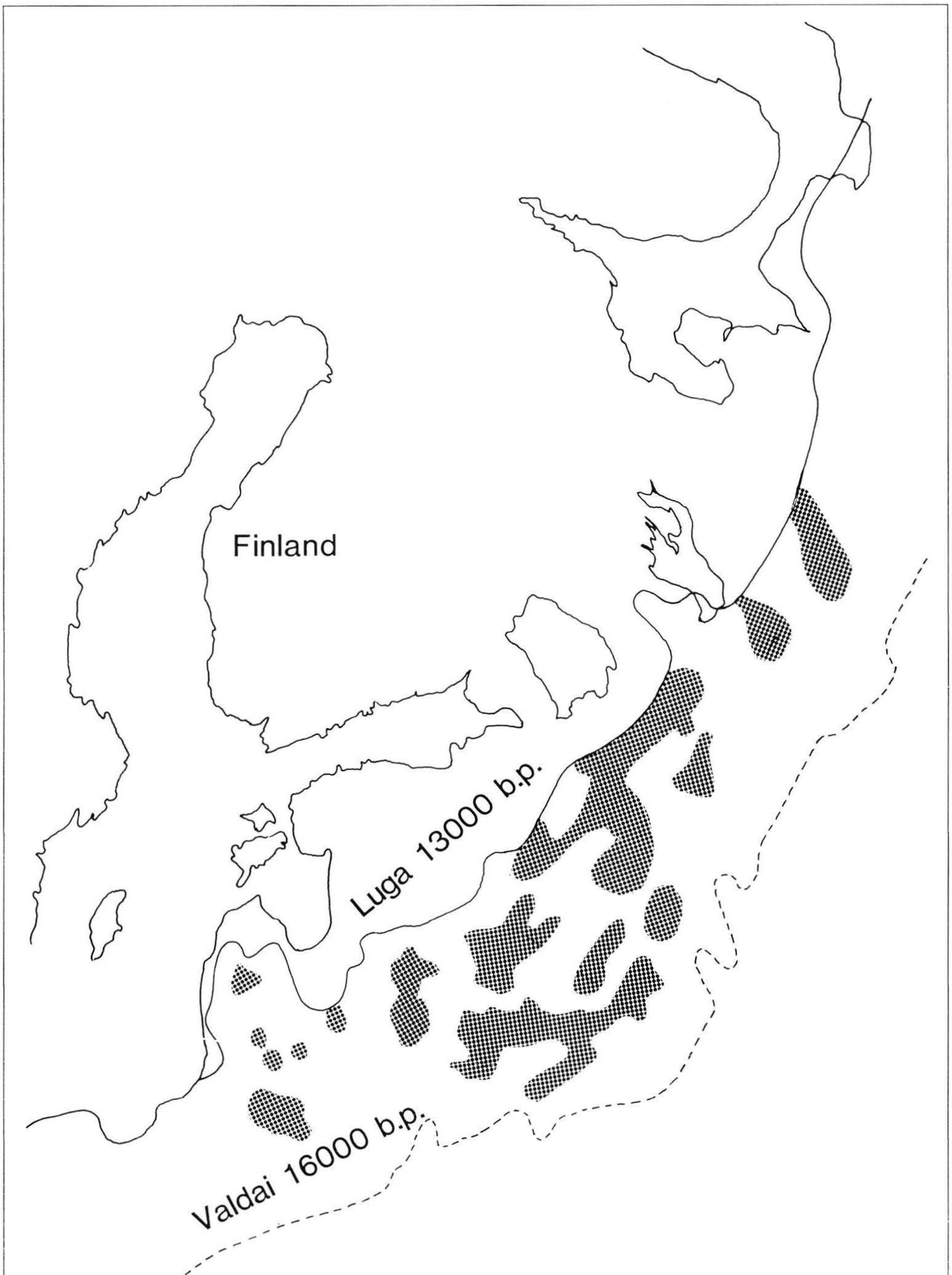


Fig. 27. Location of the glacier during the Luga stadial in the beginning of the Late Paleolithic ca. 13,000 b.p.

luxuriant mixed forest of pine-fir-larch-birch. Late Palaeolithic fossil finds of elk are few in number and the species has been identified only in the refuse fauna of the Borschevo site, radiocarbon-dated to 12,300 ± 100 b.p. (Dolukhanov 1978). Limited fossil finds indicate the existence of elk in the periglacial forest zone of the Oder and the Danube and Moldavia as well as in the Dniepr region. The northernmost finds of elk are from the area lying between the Kama and Petschora Rivers adjacent to the tundra zone. Conditions became favourable for elk and the species occupied new territory along with the spread of Boreal conditions. The biotope boundary of deer corresponds to the boundary of the periglacial tundra-forest zone (Gerassimov & Velichko 1982).

The melting stage also led to the expansion of lakes that had been hitherto dammed by the ice. Environmental change forced the hunter-gatherers to adapt to the ecology of ice lakes and isolated residual bodies of water. The population spread to the ice-free areas in following the retreat of the glacier (i.e. to the north and north-west). Nùñez (1987, Fig. 3) has presented a model of this process whereby the increased hunting territories of "neothermal" areas led to the splitting of hunter-gatherers into new populations. The model is the same as Binford's (1982) "complete-radius leapfrog" model of catchment population transhumance, although in the latter the mobile population attempts to locate better resources whereas in Nùñez's model part of the split population remains in the traditional catchment area. With respect to periglacial conditions, Bokelmann (1979) has presented an interesting model of the mobility of Late Palaeolithic hunting populations which follows the herd behaviour of deer throughout the seasons. Deer thrived in the environs of ice lakes in the tundra zone as well as in the periglacial tundra-forest zone. Accordingly, deglaciation shifted this biotope to the north with a corresponding movement of population. This is not far removed from Luho's (1956) suggestion of population movement following the herds of deer. Bokelmann specifically discusses the tunnel valley of Ahrensburg in Northern Germany where the finds concerned date back to the Bölling and Alleröd interstadials, but the model may also be applied to the subsistence strategies of the same period in the regions of the Baltic and the Upper Volga.

However, the deer hunting strategy did not extend as far as Finland (Siiriäinen 1981b), apparently because of the fact that the Baltic Ice lake formed a natural barrier for the subsistence of deer. With the warming of the climate Boreal conditions spread to the Baltic and the utilization of deer as a resource could continue in the present Dvina region of Karelia in the NE end of the Baltic Ice Lake. In the Dryas III period the species most probably divided into *Rangifer tarandus tarandus* (L.), living in fell conditions, and *Rangifer tarandus fennicus* Lönnb., adapted to the forest conditions of the Boreal.

In the Boreal region of the east Baltic area the hunting strategies changed considerably in comparison with Late Palaeolithic utilization of deer herds. The species hunted became more diverse and with the changing of the ice lakes into residual lakes a mixed fishing-hunting strategy was adopted. The population that had moved into the Baltic region also specialized in marine fauna and sealing along with the hunting of terrestrial mammals. It is possible, however, that suitable conditions for sealing came about only in the Yoldia stage when the Baltic came into contact with the North Sea and the Atlantic (Alhonen & Forstén 1976). In the Ladoga-Onega region the lake biotope was favourable for the hunting of elk and forest deer, whereas further to the north in the White Sea area large marine mammals such as whale, walrus and seal could be hunted.

The chronology of ecological change in relation to human subsistence activities in the deglaciation stage presents the following overall configuration:

I. Prior to the Valdai deglaciation around 26,000—15,000 b.p. mammoth (and possibly also mammoth carcasses) along with other cryophilous mammals provided the main body of biomass for human subsistence.

II. After the extinction of mammoth after 15,000 b.p. conditions became mobile in adaptation to the ecology of biomass in the vicinity of the ice lakes , mainly deer. In the expanding boreal areas inland lake complexes formed where elk became the most sought after terrestrial mammal (15,000—10,000 b.p.).

III. The Baltic Ice Lake was the natural barrier for deer hunting and the strategy could be continued only with respect to forest deer in Eastern Karelia. Boreal fauna became more diverse in the East Baltic region and an adaptation to sealing occurred by the Preboreal at the latest (10,000—8000 b.p.).

7.3. Main features of Mesolithic development in the East Baltic region

The above model concerning the chronological changes of hunting strategy is difficult to test with archaeological materials as there are few dated and excavated sites of the deglaciation period in the north-western regions of Russia. Migration of populations and the formation of culture become more distinct only in the period 10,000—9000 b.p. The situation can be compared to the early Post-Glacial remains of settlement in Finland, which, due to the rapid changes of the environment, are very hard to verify. The upper terrace of the former ice-dammed lake of Usviati has provided possible remains of Late Palaeolithic occupation. A scarce number of finds of possibly similar date have also been recorded in the Valdai and Upper Volga regions, the Suhora site near Vologda is also a possible Late Palaeolithic occupation (Dolukhanov & Miklyajev 1986; Dolukhanov — personal communication; Miklyajev & Dolukhanov 1986).

The map in Fig. 28 presents a number of datings and phenomena that are of interest in the formation of the earliest settlement of the East Baltic region. The easternmost distinct Ahrensburg elements are found the region of the River Neman. The northern distribution of the Ahrensburg points extends to Latvia (Salakspils) and Belorussia (Usviati), (Zagorska 1981; Dolukhanov & Miklyajev 1986, personal communication). Microliths of geometric shape are known also in Lithuania, thus linking this region to the flint technology of Central Europe of the Later Dryas period (Rimantiene 1973, 1977, 1981).

The Late Palaeolithic Swiderian culture of Eastern Europe had a greater effect than the Ahrensburgian on the development of the Preboreal Early Mesolithic in Lithuania from where Post-Swiderian elements were transferred to the Kunda Mesolithic. Kozlowsky, however, does not trace the origin of the Kunda Mesolithic from the Swiderian and suggests as a possible origin a hitherto unknown phenomenon that may have been destroyed from the archaeological record by a transgression of the Baltic. Swiderian elements occur together with ''éléments orientalo-siberiens'' and in the finds from Pulli these occur together with the material of a hitherto unknown culture (Kozlowsky 1975, personal communication; Kozlowsky & Kozlowsky 1981). The Episwiderian influences of Kunda are however quite obvious (Jaanits 1977, 1981; Jaanits & Jaanits 1978).

The presence of Ahrensburgian and Swiderian elements in the East Baltic region may reflect the above-mentioned shift from deer hunting to a utilization of the more varied fauna of the Boreal areas. In the Ahrensburg phase around 11,000 b.p. deer hunting extended from Latvia to the marginal area of the Baltic Ice Lake. Along with the shift to Boreal conditions Swiderian elements were distributed into the area. There is a group of sites between the Dvina and Lovatia Rivers with ''Lyngby'' and Swiderian elements. It has been assumed that the ''Lyngby'' component is older (Miklyajev & Dolukhanov 1986).

The following Early Mesolithic sites are known at present from the East Baltic region: Sveinieki and Olaine in Latvia (Zagorska 1981), Krumplevo in Belorussia (Gurina

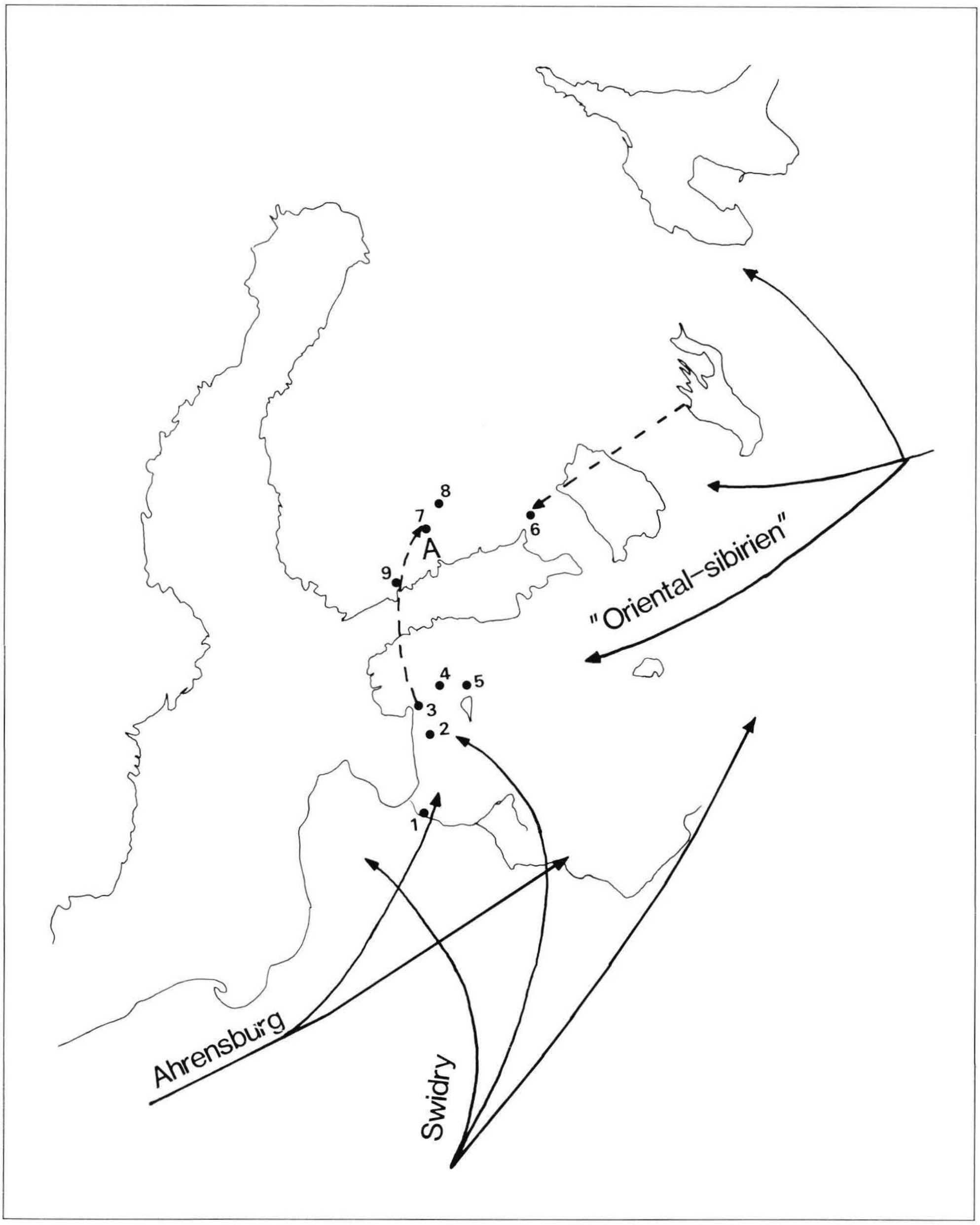


Fig. 28. Distribution and spread of various cultural influences in NW Russia and the East Baltic region ca. 13,000—9000 b.p. (1. Salakspils, 2. Sveinieki, 3. Pulli, 4. Lepakose, 5. Vöru, 6. Antrea, 7. Ristola, Lahti, 8. Viikinäinen, Heinola, 9. Kirkkonummi).

1960) and Lepakose, Vöru and Pulli in Estonia (Jaanits 1978, 1981). The Sokolov site near the Luga River in the Leningrad region may also belong to this phase of settlement (Timofeev 1987). Characteristic of the earliest sites of the northern East Baltic region is the use of flint that is of high quality, dark in colour and easily flaked. The origin of this material is not known so far but a possible source is the Cretaceous flint of the Neman region (cf. Kovnurko 1963).

The flint found at the Early Mesolithic sites is not solely of the above-mentioned high-quality material and the finds include nodular concretions found in local glacial deposits. For example, at the Pulli site one-third of the flint material was of local origin along with small amounts of quartz.

As mentioned above, a common feature of the Early Mesolithic of the East Baltic is the lack of geometric microliths in the material and it appears that the micro-burin technique did not extend to the east of present-day Lithuania. Microliths were replaced with fragments of microflakes, which have been described in large numbers in the Mesolithic find material from the Soviet Union (e.g. Gurina 1977).

Concrete evidence of the Late Palaeolithic refuse fauna of the East Baltic region and Belorussia is as scarce as evidence of occupation. The osteological material does not reflect the assumed shift from deer hunting to the utilization of boreal fauna and the above view must remain a theoretical suggestion. With the permanence of boreal vegetation the osteological material of organic deposits begins to indicate the diverse nature of hunting. Several features of the archaeological record also reflect this phenomenon such as various types of harpoons, bone points (Sigir) and a wide array of fishing equipment. The Early Mesolithic sites of the East Baltic also provide indications of hunted fauna and it can be seen that in the period from 9700 to 9000 b.p. hunting concentrated on large terrestrial mammals. At Pulli, Umbusi and Sveinieki elk was the main species of game alongside beaver. A qualitative analysis of the refuse fauna of these three sites is presented in Fig. 29.

The earliest sites have not provided evidence of the utilization of marine fauna, but the transgressive development of the Baltic since the beginning of the Ancylus Lake stage prevented the preservation of Mesolithic dwelling remains in the area. The above-mentioned sites are in inland locations and the emphasis on terrestrial mammals in the fauna can be compared to the Mesolithic inland hunting strategies of the Finnish Mesolithic.

7.4. Askola and the earliest settlement of Finland

At present there is no certain data on Stone Age finds or sites dating back to the Preboreal period in Finland. These were either nonexistent or the pronounced changes in the environment — the rapid Yoldia regression, the Ancylus transgression and the rapid rate of land uplift — have left this evidence outside the scope of archaeological investigation. In Eastern and South-Eastern Finland where conditions for Preboreal pioneer settlement in the supra-aquatic areas appear to have been the most favourable the early finds do not form a coherent picture. Of interest in this connection are Taavitsainen's (1982) observations of Stone Age sites situated at high elevations on the crests of ridges (e.g. in Hollola, Jämsänkoski and Saarijärvi). Shore displacement and paleoenvironmental conditions suggest the possibility that these locations could have been sites and bases utilized even as early as the Preboreal period. Their potential as direct evidence of Preboreal settlement is however insignificant.

The earliest dated Stone Age finds of Finland are from the period of the Ancylus culmination (ca. 9300—9200 b.p.) in the beginning of the Boreal period. On the basis of these observations Siiriäinen (1981 b) has presented the conclusion that the earliest migration into the present territory of Finland proceeded in conjunction with the shift of the pine forest zone. Accordingly at this stage, hunting groups specializing in elk and other terrestrial mammals followed their game into Finland with the expansion of the biotope concerned. A comparison of the metachronic shift of the pine zone (zone

	Pulli	Sveinieki	Umbusi
Alces alces (L.)	×	×	×
Castor fiber L.	×	×	×
Ursus arctos L.	×	×	×
Sus scrofa L.	×	×	×
Canis familiaris L.	×	×	
Vulpes vulpes L.		×	
Equus sp.		×	
Cygnus sp.	×		

Fig. 29. Qualitative archaeo-osteological analysis of material from the Pulli, Umbusi and Sveinieki sites in the East Baltic region.

boundary IV/V) in the deglaciation zone with the expansion of settlement suggests that this hypothesis is in many respects plausible.

Presently known finds that can be connected with Early Mesolithic settlement are the Ristola site in Lahti, the Korpilahti net find from Antrea and a sledge-runner found at Viikinäinen in Heinola (Luho 1967; Edgren 1984). These finds are dated as follows:

Ristola, Lahti ca. 9250 b.p.
(Shore displacement dating; Ancylus culmination)
Korpilahti, Antrea 9230 ± 210 b.p. (Hel-296)
9310 ± 140 b.p. (Hel-1303)
(Radiocarbon datings of the net floats)
Viikinäinen, Heinola ca. 9200 b.p.
(Dating of the IV/V zone boundary according to bog finds)

The age of the Ristola site is based on the dating of the Ancylus culmination in Southern Finland as according to Ristaniemi and Glückert (1987) and Haila (1987). The Heinola sledge-runner was found in a bog deposit at a depth with palynological indications of the IV/V zone boundary. The age of the find is taken from the dating of the zone boundary in Southern Finland (Ristaniemi & Glückert 1987). In earlier studies a bone ice-pick found in Kirkkonummi has been included among the Early Mesolithic finds of Finland. This artefact is, however, considerably younger (> 8500 b.p.). It was found in a deposit of Ancylus clay ca. 1.1 metres thick at an elevation of approximately 34 metres (Luho 1967). Analyses of diatoms in the clay on the surface of the pick show that the deposit in question did not form at any considerable depth and it appears to have sunk to a maximum depth of 10 metres from the surface of the ice. Accordingly, it had sunk to the bottom of the Ancylus Lake only as late as the beginning of the Atlantic period. (Comment by Professor Pentti Alhonen).

The map in Fig. 30 shows the metachronic age of the IV/V zone boundary and its movement from the Finnish Gulf to Southern and Central Finland. The boundary is fixed at ca. 9600 b.p. The boundary has also been defined in Estonia on the basis of stratigraphic pollen observations in connection with the Pulli site. The radiocarbon datings of the organic deposits from Pulli also date the IV/V zone boundary. The following boundary (9300 b.p.) is provided by the radiocarbon datings from the Antrea net find. The horizon of the find is situated at the zone boundary (Sauramo 1951). The chronological boundary of 9200 b.p. is in agreement with South Finnish datings presented

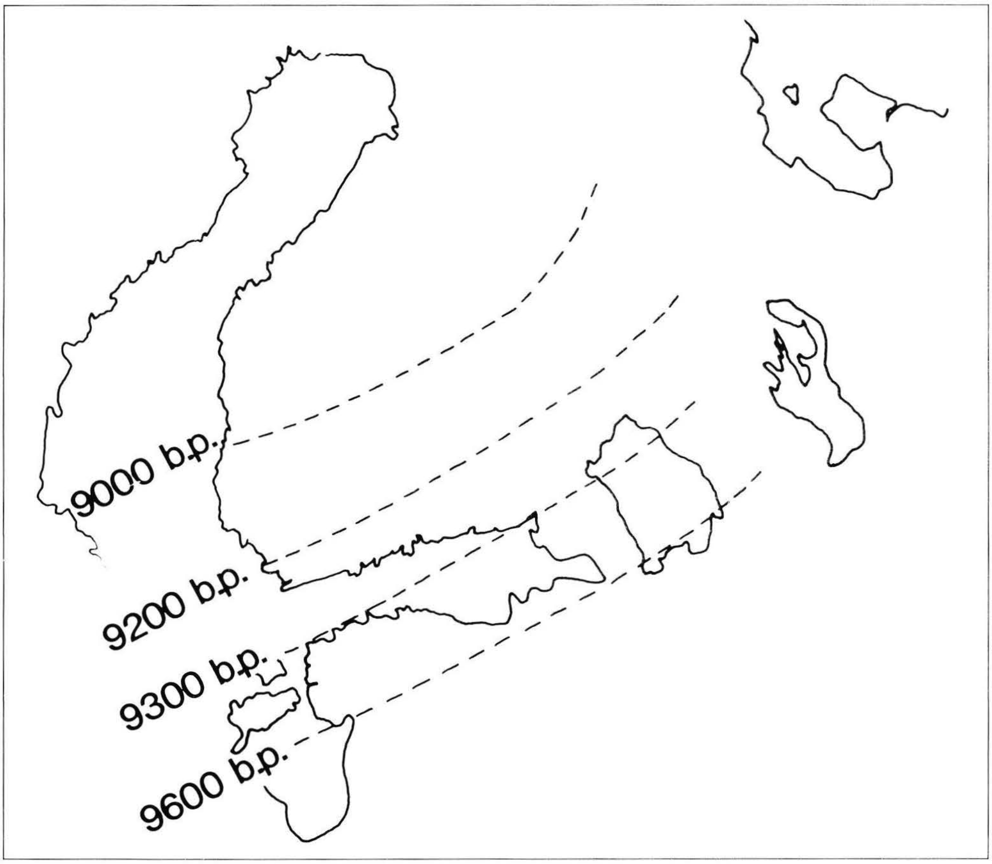


Fig. 30. Preboreal and Boreal period zone boundaries in Southern Finland and the East Baltic region based on datings.

by Ristaniemi and Glückert (1987) and the last defined boundary (9000 b.p.) is to the north of the Salpausselkä zone.

Fig. 31 presents the dating of the migration of population. Ahrensburg elements indicate that Late Palaeolithic settlement expanded into Lithuania and the southern parts of Latvia before 10,000 b.p. The Pulli material dates the early Estonian finds to before 9500 b.p.

On the basis of the finds from Antrea, Lahti and Heinola the pioneer settlement of Southern and South-Eastern Finland dates to the time of the Ancylus culmination and the area in question appears to have been occupied in the period 9500—9000 b.p. The chronology of sites in the northern part of the Finnish Lake District that were not affected by the inland lake transgressions indicates the advent of pioneer settlement around the mid-Boreal phase — ca. 9000—8500 b.p. (Matiskainen 1983,1987). Mesolithic sites older than this period have not been found so far in the coastal region of SW Finland. According to shore displacement chronology the earliest settlement of Ostrobothnia is younger than 8500 b.p. (Salomaa & Matiskainen 1985).

There appears to be distinct correlation between the metachrony of settlement and the onset of the Boreal period. It can be assumed that migration into the present territory of Finland was linked to the expansion of the pine forest zone in the Early Post glacial period. Thus, the first settlers of Finland were hunter-gatherer groups specializing

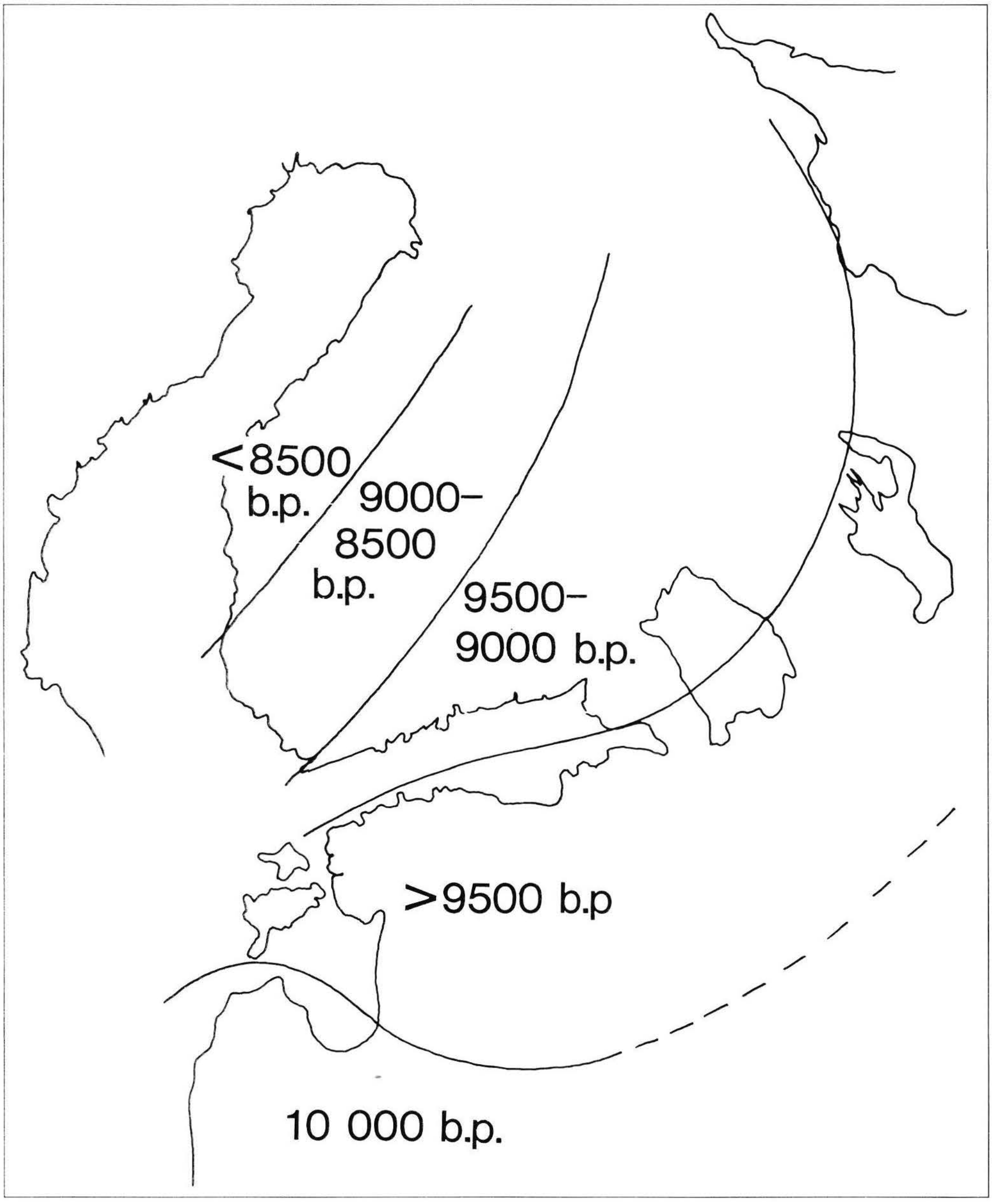


Fig. 31. Succession of Early Mesolithic settlement in the East Baltic region and the southern areas of Finland.

in the fauna of the Boreal zone. As mentioned by Edgren (1984), flint artefacts and flake fragments from Ristola — comparable to the Pulli finds — indicate a migration of settlers (cf. Fig. 28). Once the former ties and contacts of this population were severed quartz became the sole material used in retouched artefacts. Assuming that the refuse fauna of Ristola with its emphasis on elk and beaver can be linked with the Mesolithic settlers, the catchment of the pioneer hunter-gatherers would then appear to have concentrated on the terrestrial mammals of the Boreal environment. Accordingly, adaptation to the available resources of the local environment would have caused the population, thus established, to concentrate on effective sealing practices in the regressive stage of the Ancylus Lake. The above-mentioned early finds reflect mobility and transhumance and it was only the early catchment-type economic pattern of Askola that begins to reflect adaptation and permanent settlement in the areas to the north of the Gulf of Finland.

The early sites in Askola are older than 9000 b.p., which is in agreement with the process of settlement in Southern and South-Eastern Finland. The Ristola site in Lahti is 30 km north of Askola and it is logical to assume that in the Ancylus regression stage when the biotope of the former region became less favourable it was abandoned for the more advantageous environment of Askola region. The areas are separated by a chronological hiatus of only a couple of generations. In theoretical terms, the roots of the early settlement of Askola are to be found to the south of the Gulf of Finland in the ''Episwiderian'' culture or the so-called ''Kunda culture'', which was in the process of formation. An alternate explanation for the earliest settlement of Askola is that it was a result of the utilization of the offshore archipelago zone and the spread of settlement along the northern seaboard of the Gulf of Finland.

Boreal period centres of settlement along the northern shore of the Gulf of Finland that can be compared to Askola in both ecological and chronological terms formed in the regions of Anjalankoski, Elimäki and Laperla in Kirkkonummi. On the other hand, the earliest Mesolithic settlement of Vantaa and Sikunsuo in Kirkkonummi are from the early stages of the Atlantic period (Matiskainen 1983).

The earliest stages of settlement in the eponymic area of the so-called ''Suomusjärvi culture'' (i.e. Laperla in Suomusjärvi) appear to be of slightly younger date than the Askola sites. Fig. 32 presents a comparison of shore displacement curves from these respective areas. Suomusjärvi is located in an area of more rapid land uplift with the result that a long-term stagnatic catchment area of the same type could not form there. In the Ancylus regression stage the situation was similar in both areas with offshore archipelago conditions prevailing, but regressive conditions in the beginning of the Atlantic period led to the formation in Laperla of an ''Ancient Lake Aneriojärvi'' located at an elevation of ca. 50 metres and considerably larger than the present lake of the same name (Sauramo 1958). In the Litorina period the coastal catchment shifted to the Kisko region with its characteristic finds of South-Finnish adzes (Matiskainen 1988). The Suomusjärvi area remained an inland lake zone (cf. Fig. 23) where artefact finds indicate use of this territory from the Kisko region.

8. SUMMARY

The starting-point for the present study concerning the Askola region is an investigation of paleohistory and settlement in the period 10,000—6000 b.p. Reconstructions of prehistoric conditions are mainly based on the results of quaternary paleontology. Pollen analyses have provided data on the development of vegetation and forests and diatom analyses on the formation of dry land and Early Holocene changes in the history of the Baltic. The area is well suited for research purposes due to the fact that Early Post-Glacial developments can be defined within it. Constructing a geological shore displacement chronology for a limited area also serves the purposes of outlining a so-called stratigraphic shore displacement chronology for Mesolithic sites and finds. The chronology of sites permits an evaluation of chronological change in the artefactual record.

The Ancylus/Litorina Mesolithic periodization is called for also in terms of settle-

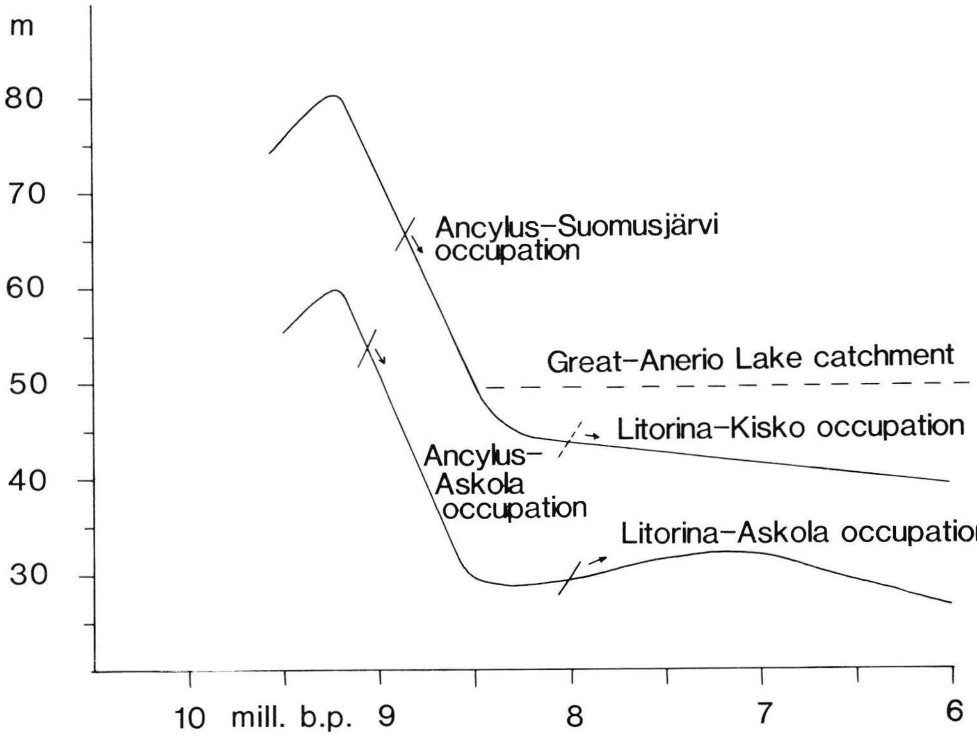


Fig. 32. Shore displacement curves comparing the Mesolithic territories of Suomusjärvi and Askola.

ment chronology in the case of Askola. The Ancylus period can be regarded as the pioneer stage when the rapid changes of the Boreal period both in the development of the forests as well as in the rapid increase of dry land due to shore displacement were reflected in the locations of sites and assumedly in their number. The beginning of the Atlantic period around 8500 b.p. is a distinct phase of settlement judging from the numbers of sites. At this stage shore displacement was retarded and the stagnatic Litorina phase began. This boundary also entails a clear change in the artefact material of the Mesolithic — the leaf-shaped slate points fall out of use and a new group of artefacts, the oblique-bladed quartz points appear in the material, possibly replacing the former. The stagnatic stage of the Litorina Sea led to an adaptation to the natural resources of the Porvoonjoki River valley, which was in the process of formation at the time. The stabilization of environmental conditions can also be seen in the locations of sites. The nature of shore displacement at Askola explains why dwelling site finds display a distinct concentration in the Mesolithic and the formation of a catchment with long-term use of resources at the ecologically favourable region around the mouth of the river.

Analyses of refuse fauna from Askola provide significant additions to data on Mesolithic economy both qualitatively and quantitatively. The material has revealed previously unknown species — *Capreolus capreolus* and *Sus scrofa,* which indicate a much more varied range of game in the Atlantic period. A new species in the prehistoric refuse fauna of Finland is also *Lutra lutra.* The dating of the refuse fauna indicates that sealing was a significant practice ever since the Early Mesolithic.

The possibilities of applying site catchment analysis in conclusions regarding the economy of the period remain limited mainly for the reason that the rapid and abrupt changes in the natural environment do not permit unequivocal reconstructions of the biotopes of the game species concerned. Accordingly, catchment analysis can only be used in a qualitative sense. The Mesolithic of the Askola region clearly indicates the utilization of a river estuary environment by hunter-gatherers that is characteristic of the Boreal zone. The theoretical division of four biozones finds grounds in the case of Askola. The sites, the hunted fauna and the occurrence of oblique-bladed quartz points indicate that the hunting strategies corresponded to the zonal division.

With reference to Binford's environmental-deterministic classification of site strategies, the so-called collector system would appear to provide the best explanation for human activity in the Askola catchment. Hunting in the various ecozones can be linked, at least on a theoretical level, with the seasonal habits of various game. By utilizing peak periods settlement became sedentary at the river mouth remaining so throughout the Mecolithic. The stagnatic conditions of the Litorina stage led to a situation where land uplift had little effect on environmental change. Possible food crises are unlikely in the case of Askola and the theoretical limits of productions were never reached.

Askola is at present the oldest known succession of settlement in Finland. Only the Ristola site at Renkomäki in Lahti is of earlier date in terms of shore displacement chronology. The flint artefacts found at Ristola are from areas to the south of the Gulf of Finland and indicate the direction of migration of the early population. The settlement of Askola can be traced back directly to Ristola where the Ancylus regression increased the area of dry land to such an extent that the population was forced to move south to the Askola region in order to carry on a subsistence strategy utilizing archipelagic conditions. In the coastal zone of the Gulf of Finland areas of settlement chronologically successive to Askola formed in the Anjalankoski-Elimäki region and at Laperla in Suomusjärvi. The archaeological record has not provided evidence of a a distinct ''Askola culture'' with a one-sided use of quartz artefacts. The Mesolithic artefacts were probably used already by the early settlers.

Mesolithic occupation in Askola appears to have continued uninterrupted from the end of the 10th millenium b.p. to the beginning of the 6th millenium. It is highly possible that past human activity in accordance with the previously presented models of hunting specializing in seal disrupted the sedentary structure of settlement in the Porvoonjoki river valley at Askola, which had adapted to the various ecological zones. The changes of the stagnatic Litorina stage into regressive conditions led to changes in hunting conditions and during the Typical Comb Ware period the Ilolanjoki river became a catchment area of greater importance than the Porvoonjoki river.

The archaeological record indicates an unbroken succession of settlement in the Askola region from 9100 to 4000 b.p. Paleoecological pollen analyses are required in evaluating the nature and continuity of subsequent settlement. These studies may also bring light on the origins of farming along the northern seaboard of the Gulf of Finland.

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Table 1. CATALOGUE NUMBERS AND EXCAVATIONS OF PREHISTORIC SITES IN ASKOLA

1. Monninkylä, Pykälistö, NM 11628,
2. Monninkylä, Mattila, AKM (adze),
3. Monninkylä, Uusipelto, NM 18263,
4. Monninkylä, Tyynelä, NM 12644,
5. (Monnikylä, Punahieta, cairn),
6. Nietoo, Tallikäärö, NM 12423:1—4, 12640:1—4, 12506:1—15, 12934:1—479, 18569, 18794, (Luho 1951, Luho 67, p. 62),
7. Nietoo, Kolokorpi, NM 13163, 18570, AKM,
8. Monninkylä, Hakkari, NM 2455, 13132,
9. Monninkylä, Lavi, NM 10123, 12657:1—3, AKM,
10. Monninkylä, Kuoppamäki, NM 6007:2, 11813:1—2, 12763:1—5, 18571, PoM 3797—3598,
11. Nietoo, Vähämäenniitty, NM 6435,
12. Nietoo, Pohjoisniitty, NM 12648:1—2, 13158,
13. Vakkola, Aropelto, NM 12639:1—13, 12735:1—13, 12972:1—6, 13156:1—6, 18573, AKM,
14. Vakkola, Aittapelto, NM 12654:1—5,
15. Monninkylä, Katissuo, NM 18572, 18706:1—6, 18761, 18768, AKM,
16. Monninkylä, Metsäpelto, NM 15270,
17. Monninkylä, Kotopelto, NM 12634, 18574,
18. Monninkylä, Konnu, NM 9213:1, 9584:1, 18575,
19. Vahijärvi, Siltala—Luoma, NM 6456, 11618:46, PoM 3700—3701,
20. Vahijärvi, Siltala—Riihipelto, NM 11618:47, 12645:1—16,
21. Vahijärvi, Siltala—Kotopelto, NM 9200:1—18, 9213:2—5, 9584:2—3, (4), 9703:2, 10646:3—9, 11428:1—13, 11618:1—45, 11619:1—47, 11723:1—27, 11724:1—8, 12160:1—9, 12645:1—16, 12939:1—17, 13155:1—30, 18576, 18577, 18578, AKM, (Cleve 1930, Luho 1946—47; Luho 67 p. 51),
22. Vahijärvi, Metsä—Henna—Kotopelto, NM 11725:1—3, 18579, AKM,
23. Vahijärvi, Hassa—Syrjäpelto, NM 11622:1—2, 12630:1—5, 12759:1—156, 13152:1—189, 14907:1—6, 18580, AKM,
24. Vahijärvi, Kotokorpi, NM 9588:1, (11623),
25. (Vahijärvi, Hassa, cupstone),
26. Vahijärvi, Koivistonpelto, NM 18581,
27. Vahijärvi, Peltomäki, NM 12631, 13134,
28. Vakkola, Taltinaro, NM 12031, 12267,
29. Vakkola, Uusi-Klemetti, NM 18938, AKM,
30. Vakkola, Kivimäki, NM 12161:1—2,
31. Vakkola, Salovaara, NM 12269,
32. Vakkola, Iso-Pitkänen, NM 13137,
33. Vakkola, Pihapelto, NM 12126, 12736:1—2,
34. Vakkola, Seppälä, NM 12655:1—3, 13136,
35. Syrjälä, NM 12658,
36. Metsä—Peltola, NM 12699:1—2, 12951, 12975:1—3,
37. Vakkola, Niemenpelto, NM 6416, 12268, 12278:1—7, 12609:1—4, 12649:1—3, 12653:1—3, 12962:1—10, 13139:1—2, 18584:1—6, 18688:1—6, 19351:1—7, (Virtamaa 1973),
38. Vakkola, Jokipelto, NM 12737, 12762, 13135:1—14, 13157:1—11,
39. Vakkola, Metsäpeltolan tie, NM 13143:1—3, 18583,
40. Vakkola, Suoranta, NM 12943, 12953, 18585,
41. Vakkola, Silta-aro, NM 12271, 12128, 13142:1—5, 18582, 18939,
42. Vakkola, Suursuo, NM 12605:1—79, 18586, (Luho 1950, Luho 67, p. 60),
43. Vakkola, Kurjala, NM 12960:1—14, 18587, 18588, AKM,
44. Vakkola, Vanha-Klemetti, NM 14954:1—12, 15325:1—170, (Luho 1960, Luho 67 p. 47),
45. Vakkola, Urheilukenttä, NM 13983:1—8, 14542:1—179, 18589, AKM (Luho 1957),
46. Vakkola, Ahlstedinpelto, NM 12647:1—4, 18590,
47. Vakkola, Toppinen, NM 10415, 12264:1—4, 12265, 12266:1—99, 12604:1—93, 12739:1—2 12981:1—4, 18591, AKM, (Luho 1949—50, Luho 67 p. 49),
48. Vakkola, Siltapellonhaka, NM 12122:3, 12280:1—2, 12283:1—3, 12613:1—7, 12637, 12601:1—82, 12738:1—9, 12760:1—20, 12933:1—1206, 12978:1—21, 13130:1—32, 18592, 18687, 18937:1—7, AKM, (Luho 1950, Luho 67 p. 61),

(continued)

Table 1. Continued.

49. Vakkola, Pappila—Saunapelto, NM 11986:1—7, 12019:1—3, 12052:1—8, 12122:5, 12282:1—13, 12594, 12603:1—98, 12740:1—2, 12761:1—4, 12974:1—17, 13068:1—282, 18593, 18594:1—3, 18935:1—4,
50. Vakkola, Pappila, NM 12122:4, 12279(?), 18595,
51. Vakkola, Grindinpelto, NM 12285:1—2, 12641, 12741:1—2, 12979:8—10, 18596,
52. Vakkola, Muuntajanmäki, NM 11985, 12281:1—4, 12496:1—7, 12979:1—5, 19332:1—62 (Sarkki 1973),
53. Vakkola, Jaakonpelto, NM 12957:1—2, 13133, 13984:1—2,
54. Vakkola, Reväsmäki, NM 12284:1—4, 12365:1—2, 12635, 12742:1—6, 12743:1—3, 12945:1—5, 12979:11—12, 13668:1—117, 14543:78—177, 18597, 18801:1—16(?), 18934:1—12, (Luho 1954, Luho 67, p. 53),
55. Nalkkila, Taka-linna, NM 12275:1—2,
56. Nalkkila, Etu-linna, NM 12123:1—2, 12276:1—7, 12611:1—6, 12955:1—5, 18598,
57. Nalkkila, Kairassuo, NM 12619:1—3,
58. Nalkkila, Rantapelto, NM 12002:1—3, 12612:1—5, 18599:1—3,
59. Nalkkila, Rokki—Riihipelto, NM 13148:1—2,
60. Nalkkila, Haiti, NM 2452:15,
61. Nalkkila, Haiti—Kotopelto, NM 12009:1—7,
62. Nalkkila, Kieroseipäänpelto, NM 13147, 18600,
63. Vahijärvi, Mäkelänpelto, NM 12620:1—21, 12961:1—17,
64. Nalkkila, Kivistömäki, NM 12952,
65. Nalkkila, Riihimäenpelto, NM 12794:1—3, 12928:1—368, (Luho 1951, Luho 56, p. 66),
66. Vahijärvi, Varjoranta, NM 12633,
67. Vahijärvi, Leveäsuonpelto, NM 11624,
68. Vahijärvi, Suontaka, NM 6175:6—8, 9584:4, 9588:2, 11428:14, 11620, 11625:1—2, 11626, 11723:28—30, 12160:10, 12700,
69. Puharonkimaa, Ryykinpelto, NM 12121:1—2, 18601:1—3,
70. Puharonkimaa, Isoniemi, NM 18602:1—2,
71. Puharonkimaa, Puhdenpelto, NM 12642,
72. Puharonkimaa, Aropelto, NM 18603,
73. Vahijärvi, Kurkelanmäki, NM 3226:1—2, 18604:1—2,
74. Puharonkimaa, Pitkähuhta, NM 18605, AKM,
75. Puharonkimaa, Alastupa, NM 12643, AKM,
76. (Puharonkimaa, Ylästupa, cup-marked stone),
77. (Puharonkimaa, Laukaankulma, cup-marked stone),
78. Puharonkimaa, Joki, NM 12784:1—3,
79. Puharonkimaa, Koskipelto, NM 12626:1—28, 18606,
80. (Puharonkimaa, Heikkilä, cup-marked stone),
81. Puharonkimaa, Paala—Paavola, NM 12791:1—2,
82. (Puharonkimaa, Paavola, cup-marked stone),
83. Puharonkimaa, Paavola—Riihipelto, NM 18608:1—2,
84. Puharonkimaa, Valkamaa, NM 12614, 12617:1—37, 12785:1—5, 12786, 12956:1—4, 12959:1—4, 14205, 18609:1—2,
85. Puharonkimaa, Tukkinen, NM 6863,
86. Puharonkimaa, Järvensuo, NM 12159:65—101, 12621:1—123, 12788:1—19, 12940:1—21, 18610, 18947:1—21,
87. Puharonkimaa, Yrjölä, NM 18611:1—2, AKM,
88. Puharonkimaa, Yrjölä—Onkimaa, NM 13144:1—3, 18611:3—6, 18948,
89. Puharonkimaa, Yrjölä—Ilmari, NM 12965:1—2, 18611:7, AKM,
90. Puharonkimaa, Ilmari—Piskulanpelto, NM 18620,
91. Puharonkimaa, Keskisuo, NM 13003,
92. Nalkkila, Hopeapelto, NM 13064:1—575, 18944:1—5, (Luho 1952, Luho 56 p. 78),
93. Nalkkila, Alho, NM 12055:1,
94. Nalkkila, Yli-Järvelä, NM 2452:21,
95. Nalkkila, Haiti—Hiirikoskenpelto, NM 13131:1—10, 18612:1—5, 18929:1—3,

96a. Nalkkila, Haiti—Myllypelto, NM 12003:1—6, 12055:7—9, 12159:45—64, 12368:1—16, 12623:1—86, 12636:1—18, 12935:1—107, 18613:1—2, (Luho 1951, Luho 67 p. 55),

(continued)

Table 1. Continued.

96b. Nalkkila, Ellilä—Myllypelto, NM 12004:1—2, 12783:1—5, 18940(?),
96c. Nalkkila, Etu-linna—Rantanen, NM 12005:1—6, 12159:37—44, 12610:1—4, 12616:1—57, 17604(?), 18941:1—60,
97. Nalkkila, Koivuniemi, NM 13066:1—40, 13670:1—18,
98. Nalkkila, Keturinmäki, NM 15744:1—125, 16161:1—153, (Luho 1962, Luho 67 p. 44),
99. Nalkkila, Niemi, NM 12969:1—2(?), 18614,
100. Nalkkila, Kopinkallio, NM 12261:1—25, 12262:1—115, 12661:1—7877, 13670:22, 18797, 18951, AKM,
101. Nalkkila, Filpotti, NM 13065:1—101, (Luho 1952, Luho 56 p. 86),
102. Nalkkila, Kalliopelto, NM 13154, 18615,
103. Nalkkila, Rahkaissuo, NM 13302:1—227, (Luho 1953, Luho 67 p. 42),
104. Nalkkila, Rokki—Valkamaa, NM 11987, 12006:1—16, 12007:1—6, 12041:1—4, 12055:5—6, 12159:1—11, 12260:1—246, 12260:1—92, 12606:1—92, 12624:1—139, 12739:1—13, 12790:1—40, 12973:1—56, 12967:1—2, 13140, 13146, 18616:1—7, 18931:1—7, AKM,
105. Nalkkila, Puurata, NM 11983:1—3, 12008, 12124, 12125, 12159:28—35, 68, 12948, 13141, 13670:21, 18617:1—6, 18945:1—5,
106. Nalkkila, Etu-Linna—Ruoksmaa, NM 12263:1—51, 12277, 12345:1—25, 12615:1—123, 12629:1—50, 12929:1—462, 12936:1—19, 12966:1—2, 13670:19—20, 18618:1—10, 18689, (Luho 1952, Luho 56 p. 86),
107. Nalkkila, Taka-Piskula—Ruoksmaa, NM 12010, 12261:1—25, 12931:1—269, 13067:1—871, 13303:1—328, 18618:11, 19189,
108. (Nalkkila, Ruoksmaa, Medieval cemetery),
109. Nalkkila, Kannisto, AKM,
110. Nalkkila, Lemonmylly, NM 12795:1—6,
111. Nalkkila, Ellilä, NM 11984, 12622:1—5, 12932:1—15, 18949:1—11(?),
112. Nalkkila, Järvelä—Jokiniitty, NM 12011:1—5, 12159:65—67, 12787:1—3, 12946, 18619:1—5,
113. (Nalkkila, Heissuo, cairn),
114. Huuvari, Koivisto, NM 12289,
115. Särkijärvi, Hannula, NM 18621,
116. Särkijärvi, Vakängi, NM 12270,
117. Särkijärvi, Kuusisto, NM 18318,
118. Särkijärvi, Vallila, NM 18622,
119. Särkijärvi, Rintala, NM 13149:1—4,
120. Vakkola, Jungfern, NM 12273:1—7, 12274:1—17, 18623,
121. Vakkola, Multala, NM 18624,
122. Vakkola, Latoniitty, NM 12052:1—8,
123. Vakkola, Salatti, NM 12272,
124. Vakkola, Kuusela, NM 12941,
125. Huuvari, Krävi, NM 10414:14, 16,
126. Huuvari, Norrookeri, NM 13160:1—9,
127. Huhtaniitty, AKM,
128. Tiilää, Vanha-Talo, AKM,
129. Tiilää, Koulutila, NM 13566,
130. Huuvari, Slotti, NM 12954:1—7,
131. Huuvari, Kassilanpelto, NM 12744:1—3,
132. Huuvari, Vainio, AKM,
133. Tiilää, Jokimaa, NM 11728,
134. Särkijärvi, Koivumäki, NM 12746:1—2,
135. Korttia, Mättähistö, NM 18629,
136. (Korttia, Torpinjoki, iron axe),
137. Korttia, Uusikartano, NM 12636:1—2,
138. Korttia, Vanhakartano, NM 18626,
139. Korttia, Lepistö, NM 12789:1—47, 12964:1—8, 18625,
140. Korttia, Mäntylä, NM 12159:102—105, 12627:1—11, 12782:1—7, 12937:1—33, 18627, 18706, 18793, 18946:1—18,
141. Korttia, Hoikkala, NM 12950:1—2, 18628, AKM,
142. Tiilää, Pyykkö, NM 12745,

(continued)

Table 1. Continued.

143. Nietoo, Ruokomaa, NM 12638:1—5, 13151, 18636,
144. Nietoo, Marttila, NM 12656, 12958, 13150, AKM,
145. Särkijärvi, Myllyniitty, NM 14104, 18637,
146. Huuvari, Koivisto, NM 9184:1—2, 9263, 9501:1—3, 9656, 9715, 10031:1—2, 13145: 1—4,
147. Huuvari, Lihtamäki, NM 10324:1—10, 10414:1—15, 18630,
148. Huuvari, Lehtelä, NM 14334, 18685:1—3,
149. Huuvari, Laakso, NM 10032,
150. Huuvari, Lehtelä—Laakso, NM 9183:1,
151. Huuvari, Riihipelto, NM 12651:1—7, 18631, AKM,
152. Huuvari, Lähteenaho, NM 12650:1—4, 12971,
153. Huuvari, Lähteenaho—Virta, AKM,
154. Huuvari, Honkaniemi, NM 8727, 8737, 8738:1—12, 8828:1—50, 8829:1—58, 8952:1—20, 8970, 9182:1—51, 9203:1—14, 10030:1—18, 10314:1—9, 10542:1—2, 12025:1—130, 12286:1—6, 12287, 13159:1—15, 15204:1—3, 18632, (Äyräpää 1929),
155. Huuvari, Anttila, NM 12288,
156. Huuvari, Kaunisto, NM 18268, 18633:1—2,
157. Huuvari, Hiiksi, AKM,
158. Huuvari, Männistö, NM 12938, 13161:1—54, 16563:1—92, 18634:1,
159. Huuvari, Männistö—Virta, NM 18634:2,
160. Huuvari, Impivaara, NM 12607:1—8,
161. Juornaankylä, Kotopelto, NM 16535, AKM,
162. Journaankylä, Vähätalo, AKM,
163. Juornaankylä, Koskipelto, NM 12963:1—5 (?), 18635,
164. Monninkylä, Greijula, NM 2452:9,
165. Monninkylä, Haukkastenkallio, (quarzes),
166. Monninkylä, Luhtala, NM 9703:1,
167. Monninkylä, Pöökäri, NM 12652:1—2, 18568,
168. Monnikylä, Vähä-Tynni, NM 14908:1—2,
169. Monnikylä, Sintonen, NM 10054:1—2,
170. Monninkylä, Ollinsalo, NM 12632,
171. Juornaankylä, Kuoppamäki, NM 10692,
172. Juornaankylä, Metsola, NM 12947:1—7,

Unidentified finds in Askola:

2085:1—5, 2452:13, 17, 18, 34—36, 45—47, 2704, 5537, 6007:1—2, 6175:4, 9917, 10243, 10646:1—2, 10660:1—2, 12608:1—25, 12618:1—5, 12628:1—26, 12643, 12967, 12968, 12969, 12970, 12972:1—9, 12976, 12977, 12980, 12982, 12983:1—5, 13138:1—9, 13689:9—10, 18638:1—48, 18754, 18763:1—4, 18930:1—5, 18932:1—3, 18933:1—2, 18936:1—6, 18942:1—7, 18943:1—3, 18952:1—7.

Table 2. ARTEFACTS AND ELEVATIONS OF SITES IN ASKOLA (c.f. Symbols in Table 3.)

No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	
1.	3																				×									—
2.	3		×																											42.5
3.	3																×													—
4.	3		×																											—
5.																														
6.	1			×											×					×	×	×		×	×		×	×	×	28.0
7.	3																							×	×					—
8.	3	×																			×									—
9.	3	×	×			×		×													×									—
10.	2	×	×		×			×			×					×			×		×									40
11.	3					×																								—
12.	2																				×	×			×					27.5
13.	2																			×	×									32.5
14.	3																		?		×									—
15.	3		×			×													×		×	×		×	×	×				—
16.	3							×																						40
17.	2				×																×		×							42.5
18.	3				×	×																			×					40
19.	3	×																							×					—
20.	2											×								×	×				×					40
21.	1	×	×	×	×				×	×	×	×	×			×			×	×	×	×	×	×		×		×	×	39.0
22.	2			×								×					×			×	×						×	×		40
23.	2	×	×	×	×					×		×							×	×	×	×		×	×	×				40
24.	3					×																								37.5
25.																														
26.	2																		×	×	×			×	×					—
27.	3																				×				×					40
28.	3	×		×																										—
29.	3		×																											—
30.	3		×		×																									—
31.	3								×																					—
32.	3	×																												—
33.	3	×																			×									30
34.	3																			×	×									—
35.	3		×																											—
36.	3	×								×											×									—
37.	1	×	×	×	×														×	×	×	×			×			×		30
38.	2																			×	×	×					×		×	30
39.	3			×															×	×	×				×					—
40.	2												×						×	×	×									40
41.	2			×					×						×					×	×				×					30
42.	1					×									×				×	×	×	×				×	×	×	×	31.0
43.	2									×										×	×	×			×			×		32.5
44.	1	×																		×	×	×				×		×	×	45.5
45.	1																			×	×	×					×	×		45
46.	2																			×	×						×	×		40
47.	1	×	×								×	×	×			×			×		×	×		×				×		40.0
48.	1	×							×			×			×					×	×	×			×	×		×		28.5
49.	2	×		×											×					×	×							×		30
50.	2															×				×	×									35
51.	2																		×	×	×									32.5
52.	1																			×	×							×		35
53.	3																				×									—
54.	1	×		×							×	×								×	×	×				×	×	×		40
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	

(continued)

Table 2. Continued.

No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	
55.	3																										×			32.5
56.	2			×					×						×					×	×	×			×	×				32.5
57.	3														×					×	×				×					50
58.	2																			×	×	×								35
59.	3																			×	×									—
60.	3															×														—
61.	2																			×	×				×					40
62.	3																		×		×									—
63.	2																	×		×	×	×					×			35
64.	3		×																											—
65.	1																			×	×									45.5
66.	3					×																								—
67.	3																								×					—
68.	2	×		×	×				×												×					×				40
69.	2	×	×													×			×		×									32.5
70.	3		×																		×									35
71.	3																				×									—
72.	3	×																												—
73.	2	×																			×									45
74.	2																			×	×									40
75.	3				×											×														—
76.																														
77.																														
78.	3																		?	×	×									—
79.	2											×								×	×					×				35
80.																														
81.	3																			×	×									—
82.																														
83.	2																				×									40
84.	2			×						×					×					×	×	×								40
85.	3		×																											—
86.	2		×	×											×			×	×	×	×	×		×	×		×			35
87.	2	×	×																		×	×				×				35
88.	3		×																	×	×	×	×	×	×					—
89.	3	×																												—
90.	2			×																×	×									35
91.	3		×																											46
92.	1																		×	×	×							×	×	50
93.	3																				×									—
94.	3				×																									—
95.	2								×										×	×	×									30
96a.	1	×	×	×					×		×	×	×				×			×	×	×			×	×	×	×		33
96b.	2	×		×															×	×	×	×			×					30
96c.	2			×								×							×	×	×				×		×			30
97.	2																			×	×	×					×		×	53.0
98.	1			×																×	×	×							×	55
99.	2		×																		×									55
100.	1																			×	×									63
101.	1																			×	×							×		46.5
102.	2			×					×											×	×									50
103.	1	×							×		×	×								×	×						×	×	×	47
104.	1	×	×	×			×		×		×	×	×		×				×	×	×	×			×	×	×	×	×	32
105.	2	×	×				×				×	×	×							×	×	×		×	×	×				35
106.	1	×		×						×		×			×					×	×	×		×	×	×	×	×	×	45
107.	1	×							×					×	×					×	×	×		×				×		35
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	

(continued)

Table 2. Continued.

No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	
108.																														
109.	3						×																							40
110.	3																				×	×				×				—
111.	2	×	×																	×	×	×			×			×		35
112.	2	×	×	×					×											×	×	×			×		×			32.5
113.																														
114.	3																		×					×	×					20
115.	3																						×							—
116.	3																				×									—
117.	3																								×					—
118.	3							×																						25
119.	3	×		×																	×									—
120.	2	×													×						×									30
121.	3	×																												27.5
122.	3																				×									27.5
123.	3																										×			—
124.	3			×																										—
125.	3																									×				—
126.	3																		×	×	×			×			×			—
127.	3		×																											—
128.	3						×																							—
129.	3		×																											—
130.	3																		×	×	×	×					×			25
131.	3																		×		×									—
132.	3		×																											—
133.	3																						×							30
134.	3																		×		×									—
135.	3																×													—
136.																														
137.	3		×													×														—
138.	2		×			×	×				×								×											40
139.	2		×		×										×			×		×	×	×								32.5
140.	2	×	×	×								×						×	×	×	×	×			×					35
141.	2											×								×	×				×	×				35
142.	3																				×									—
143.	2																			×	×									20
144.	3		×								×										×									—
145.	2															×					×									30
146.	3		×							×						×	×		×		×		×	×	×					—
147.	2	×		×			×							×				×	×	×	×	×		×				×		22.5
148.	3		×											×							×				×					—
149.	3		×																											22.5
150.	3																								×					—
151.	2																				×				×	×				20
152.	2		×	×																×	×	×			×		×			22.5
153.	3					×																								—
154.	1					×					×			×		×		×	×	×	×	×		×	×					20
155.	3																						×							—
156.	3															×									×					—
157.	3		×																											—
158.	2	×		×	×														×	×	×	×				×				27.5
159.	2																				×									30
160.	2	×																			×				×					25
161.	3	×																												27.5
162.	3															×														—
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	

(continued)

Table 2. Continued.

No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	
163.	2																				×						×			32.5
164.	3					×																								—
165.	3																				×									—
166.	3																						×							—
167.	2										×				×					×										35
168.	3																			×				×						—
169.	3	×																												—
170.	3				×																									—
171.	3															×														—
172.	3																			×	×									—
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Å	Ä	Ö	

Table 3. Occurrence of categories of finds at the Askola sites (cf. Table 2).

A	1) excavated site, 2) surveyed and identified site, 3) stray find or unidentified site, see Table 2.	
B	Primitive adze	40
C	Adze of four-sided section	39
D	Fragments of artefacts	30
E	Curved-backed gouge	13
F	Gouge	11
G	Fragments of gouges	6
H	Double-bladed adze	4
I	Unfinished adze	13
J	Weathered or worn adze	6
K	Slate point	12
L	Fragments of slate points	15
M	Unfinished slate point	6
N	Flint point	4
O	Oblique-bladed quartz point	14
P	Perforated weapon or stone	14
Q	Unfinished perforated weapon	5
R	Flint artefact	6
S	Flint flakes	32
T	Quartz artefact	67
U	Quartz flakes	107
V	Stone debitage	39
W	Parallel-bladed axe	7
X	Potsherds	18
Y	Grinding stone	41
Z	Fragment of grinding stone	19
Å	Striking stone	22
Ä	Burnt bone fragments	23
Ö	Charcoal	11

Appendix

Osteological analysis
Jukka Jernvall 1987

Definitions of seal are in most cases given on the level of family as the bones are highly fragmentary. The main species is *Pusa hispida* (i.e. *Phoca hispida* Schreber).

Definitions of elk in this material pose the risk of bones being mixed with those of aurochs (*Bos primigenius* Bojanus). In uncertain cases the entry is followed by a question-mark (?). It must also be pointed out that fragments of wisent bones (*Bison bonasus* L.) can resemble those of elk.

Sites marked with an asterisk (*) contain bones of large animals, most probably elk. Sites: 13067:301, 534; 13303:95; 12600:58, 70.

The identified fragments of canine bones (*Canis* sp. L.) appear to be those of domesticated dogs (*Canis familiaris* L.) on the basis of their size and form. It is not always possible to identify canines in the case of metacarpal, metatarsal and phalanx bones (lynx, wolverine?). The question-mark (?) is also added in uncertain cases.

The material also contains large numbers of small fragments of mammal spines (Mammalia sp.) which do not provide reliable identification (seal, beaver etc.).

The identification of fish is restricted by the fragmentary condition of the bones as well as the lack of comparative material (e.g. from different-sized individuals).

Osteological analysis 1987, Jukka Jernvall
ASKOLA

12281:1	—		
12599:43	*Castor fiber*	naviculare sin.	1
	»	nasale dex. fr.	1
	»	humerus sin. fr. dist.	1
	Alces alces	phalanx 2 fr. prox.	1
	Mammalia sp.	vertebra fr.	2
	Esox lucius ?	praemaxillare/vomer fr.	1
	Salmonidae sp. ?	vertebra fr.	1
	Teleostei sp.	vertebra fr.	1
12602:7, 24	—		
12603:8, 14	—		
23	Phocidae sp.	humerus dex. fr. prox.	1
	»	patella fr.	1
	Mammalia sp.	femur fr. dist. ?	1
35, 47, 49, 56	—		
68	*Castor fiber*	ectocuneiforme sin.	1
73	*Castor fiber*	ulna dex. fr. prox. artic.	1
79, 81, 85, 96	—		
12604:14	*Alces alces*	phal. 3 fr. prox.	1
25	Phocidae sp.	humerus dex. fr. dist.	1
	Mammalia sp.	vertebra fr.	1
31, 41, 85, 93	—		
12605:26	—		
58	*Lepus* sp.	femus sin. fr. dist.	1
63, 68	—		
12606:82, 91	—		
12640:4	—		
12647:4	*Alces alces*	phal. tarsi (II/V)/1	1
12929:466	—		
12932:4	—		

12933:89	*Alces alces*	phal. 2 fr. dist.	1
91, 93, 97	—		
99	Phocidae sp.	astragalus sin. fr.	1
	Castor fiber	radius dex. fr. dist.	1
	Alces alces	phal. 3 fr. prox.	2
	»	phal. 2 fr. dist.	5
	»	phal. 2 fr. prox.	4
	»	phal. 1 fr. dist.	3
	»	phal. 1 fr. prox.	4
	»	costa fr. prox.	2
102, 137, 175, 184	—		
206	Phocidae sp.	naviculare dex. fr.	1
245	—		
253	Phocidae sp.	phal. carpi 1	1
	»	» fr. prox.	1
	»	phal. carpi 2	1
	»	naviculare sin. fr.	1
	Castor fiber	mt.V sin. fr. prox.	1
	»	phal. 3 fr. prox.	1
	Mammalia sp.	phal. 3 fr. dist.	1
300	Phocidae sp.	capitulum mandibulae dex.	1
	Castor fiber	phal. tarsi 1 fr. prox.	1
	Sciurus vulgaris	calcaneum sin.	1
301	Teleostei sp.	vertebra fr.	1
387	Teleostei sp.	vertebra fr.	1
388	Phocidae sp.	phal. tarsi 2 fr. prox.	1
	Mammalia sp.	vertebra fr.	1
421	Phocidae sp.	mc. IV sin. fr. prox.	1
	»	condylus occipitalis dex.	1
	Alces alces ?	mc./mt. fr. dist.	1
	Canis sp.	astragalus sin. fr.	1
450	*Sus scrofa*	mc./mt. epiph. fr. dist.	1
12933:466	—		
487	*Pusa hispida*	squamosum sin. fr.	1
	Mammalia sp.	phal. fr. dist.	1
	»	vertebra fr.	1
495, 496, 555, 585, 600, 609	—		
642	Phocidae sp.	mt. I dex. fr. dist.	1
689, 690	—		
732	Mammalia sp.	vertebra fr.	1
777	Cyprinidae sp. ?	vertebra fr.	1
816, 831, 875, 910	—		
911	Cyprinidae sp. ?	vertebra fr.	2
912	Phocidae sp.	mc. II dex. fr. prox.	1
	»	phal. carpi 3 fr. dist.	1
	Castor fiber	phal. carpi 1	1
950	*Castor fiber*	femur sin. diaph. fr. dist.	1
	»	cuneiforme dex. fr.	1
1009	Cyprinidae sp. ?	vertebra fr.	2
1010	Phocidae sp.	femur sin. diaph. fr.	1
	Canis sp. ?	phalanx	1
1036	Phocidae sp.	bulla auditorius sin. fr.	1
1066	Phocidae sp.	entocuneiforme dex. fr.	1
	Carnivora sp.	phal. fr. prox.	1
	Mammalia sp.	vertebra cervicalis fr.	1
	Teleostei sp.	vertebra fr.	1
1103	Phocidae sp.	trapezium dex.	1
1146	—		
1195	Phocidae sp.	humerus dex. fr. dist.	1
	Canis/Vulpes sp.	calcaneum dex. fr.	1

	Teleostei sp.	dentale fr.	1
1206	—		
12934:174	Phocidae sp.	phal. tarsi fr. dist.	1
185, 195, 197, 199, 202, 206	—		
12934:238	Phocidae sp.	humerus dex. fr. dist.	1
	»	ulna dex. fr. prox.	1
	»	radius sin. diaph. fr.	1
	»	mt. II dex. fr. dist.	1
	»	mt. IV dex. fr. prox.	2
	»	mt. IV sin. fr. dist.	1
	»	mc. II sin. fr. prox.	1
	»	phal. tarsi fr. dist.	3
	»	» epiph. fr. prox.	1
	Alces alces	phal. carpi (II/V)/1 fr.	1
238	*Canis* sp. ?	vertebra cervicalis fr.	1
	»	mc/mt. fr. dist.	1
	Mammalia sp.	vertebra cervicalis fr.	1
	Teleostei sp.	vertebra fr.	1
272	Phocidae sp.	radius dex. fr.	1
	»	mc. III sin. fr. prox.	1
	»	mc. V sin. fr. prox.	1
	»	mt. III dex. fr. prox.	1
	»	phal. tarsi fr. prox.	1
	»	» dist.	1
	Castor fiber	capitulum mandibulae dex.	1
	Lutra lutra	calcaneum sin. fr.	1
	Mammalia sp.	phal. fr. dist.	1
280	*Canis* sp.	calcaneum sin. fr.	1
283	—		
289	Phocidae sp.	ulna sin. fr. prox.	1
	Mammalia sp.	phal. fr. dist.	1
303	Phocidae sp.	cuboideum dex.	1
	»	» fr.	1
	»	mc. I sin. fr. dist.	1
	»	mc. II dex. fr. prox.	1
	»	phal. tarsi I/1 sin. fr.	1
	Canis sp.	atlas fr.	1
	»	calcaneum sin. fr.	1
	» ?	phal. 2 sin.	1
	Mammalia sp.	vertebra fr.	2
12934:359	Phocidae sp.	ulna dex. fr. prox.	1
	»	radius dex. fr. prox.	1
	»	mt. I dex. fr. dist.	1
	»	phal. carpi	1
	»	phal. tarsi fr. dist.	1
	Canis sp. ?	mc./mt. fr. dist.	1
360	Salmonidae sp.	vertebra fr.	1
	Teleostei sp.	vertebra fr.	1
371	Phocidae sp.	mt. V dex. fr. prox.	1
	»	phal. tarsi 1 fr. dist.	1
	Lepus sp.	astragalus sin. fr.	1
	Mammalia sp.	phal. fr. dist.	2
374	—		
380	Phocidae sp.	scaphoideum dex.	1
	»	phal. 3 fr.	1
	Mammalia sp.	phal. fr. dist.	2
386	*Canis* sp.	ulna sin. fr. prox.	1
	Mammalia sp.	vertebra fr.	1
387	Teleostei sp.	vertebra fr.	2
389	—		

390	Salmonidae sp. ?	vertebra fr.	1
414	Phocidae sp.	humerus dex. fr.	1
	»	scaphoideum sin. fr.	1
	»	mt. III sin. fr. prox.	1
	Castor fiber	phal. tarsi 1 fr. prox.	1
427	*Lepus* sp.	scapula fr. prox.	1
432	—		
438	Mammalia sp.	phal. fr.	1
439	Teleostei sp.	vertebra fr.	1
447	—		
454	Phocidae sp.	squamosum sin. fr.	1
	»	phal. tarsi 1 fr. dist.	1
	Mammalia sp.	vertebra fr.	1
455	*Esox lucius*?	vertebra fr.	1
12934:468	Phocidae sp.	mt. II dex. fr. prox.	1
	Canis sp. ?	mc./mt. fr. dist.	2
	Esox lucius	dentale dex. fr.	1
473	Phocidae sp.	humerus sin. fr. dist.	1
	Canis sp. ?	phal. 1	1
479	—		
12935:26, 29, 37, 53, 59	—		
70	*Castor fiber*	maxillare dex. fr.	1
	Teleostei sp.	vertebra fr.	1
81	—		
12978:21	—		
12979:10	—		
13064:230	Phocidae sp.	tibia dex. fr. dist.	1
241	Phocidae sp.	ulna dex. fr. prox.	1
371, 406	—		
409	Phocidae sp.	humerus dex. fr. dist.	1
13067:7, 13	—		
22	*Castor fiber*	bulla auditorius sin. fr.	1
	Alces alces	phal. 2 epiph. fr. prox.	1
30, 39	—		
58	*Alces alces*	costa fr. prox.	1
	»	phal. 2 fr. prox.	1
	» ?	phal. 1 fr. dist.	1
73	—		
81	Mammalia sp.	vertebra fr.	1
	Esox lucius	dentale fr.	1
89	*Castor fiber*	mc. III dex. fr. prox.	1
100, 110	—		
127	*Castor fiber*	vertebra thor./lumb. fr.	1
	Mammalia sp.	vertebra fr.	1
	Esox lucius	dentale dex. fr.	1
134	Mammalia sp.	phal. fr. dist.	1
	Esox lucius?	dentale dex. fr.	1
141, 150	—		
163	Teleostei sp.	denti fr.	1
167, 170, 196	—		
13067:197	Teleostei sp.	vertebra fr.	1
201, 206	—		
211	Salmonidae sp.	vertebra fr.	1
225	—		
252	Phocidae sp.	bulla auditorius sin. fr.	1
	Castor fiber	tibia sin. fr. prox.	1
262	—		
272	*Alces alces*	os sesamoideus tarsi fr.	1
289	Mammalia sp.	phal. diaph. fr.	1
301*, 305, 309, 321	—		

341	*Alces alces*	costa fr. prox.	1
	»	phal. 2 fr. prox.	1
346	*Alces alces* ?	phal. carpi ? 3 fr. prox.	1
	Mammalia sp.	phal. fr. diaph.	1
349, 352, 361, 362, 370, 378	—		
394	Phocidae sp.	phal. carpi 2 fr. prox.	1
	Teleostei sp.	dentale fr.	2
402	*Alces alces*	phal. 1 fr. dist.	1
412, 417, 420, 441	—		
449	*Castor fiber*	ulna dex. fr. prox.	1
450	Teleostei sp.	vertebra fr.	1
459	Teleostei sp.	dentale fr.	1
465, 466	—		
469	*Alces alces*	os malleolare sin. fr.	1
471	Cyprinidae sp.	vertebra fr.	1
472, 483	—		
496	*Alces alces*	vertebra cervicalis fr.	1
	Mammalia sp.	vertebra fr.	2
	Teleostei sp.	dentale fr.	1
504	Mammalia sp.	vertebra lumbalis fr.	1
516, 522, 534*, 535, 549, 550	—		
563	Mammalia sp.	vertebra fr.	1
572	—		
584	*Alces alces*	scaphoideum sin. fr.	1
585	—		
597	*Esox lucius*	dentale sin. fr.	1
13067:612	*Castor fiber*	mc. III dex.	1
623, 633	—		
660	*Castor fiber*	squamosum dex. fr.	1
	»	mt. V dex. fr. prox.	1
	»	phal. carpi 1	1
682	*Castor fiber*	maxillare dex. fr.	1
	»	radius sin. fr. dist.	1
	»	vertebra cervicalis fr.	1
	Capreolus capreolus	ulna sin. fr. prox.	1
	Mammalia sp.	phal. fr. dist.	1
704	Phocidae sp.	phal. carpi IV/1	1
	Mammalia sp.	vertebra fr.	2
	»	phal. fr. dist.	1
716	—		
717	*Castor fiber*	humerus dex. fr. dist.	1
	»	fibula dex. epiph. fr. dist.	1
	»	mt. IV dex. fr. prox.	1
	»	» dist.	1
	Alces alces ?	phal. 2/3 fr. prox.	1
	Mammalia sp.	vertebra fr.	3
723, 729	—		
731	Teleostei sp.	vertebra fr.	1
734, 741, 753, 762, 767, 771, 777, 783	—		
791	*Castor fiber*	humerus dex. fr.	1
804	—		
805	Mammalia sp.	vertebra fr.	1
814	*Castor fiber*	radius dex. fr. prox.	1
	»	vertebra lumbalis fr.	1
832	*Castor fiber*	scaphoideum sin.	1
	»	vertebra caudalis fr.	1
	Esox lucius ?	praemaxillare/vomer fr.	1
13067:843	*Castor fiber*	ilium dex. fr.	1

	Castor fiber	tibia sin. fr. dist.	1
	»	vertebra thoracalis fr.	1
	Lepus sp.	scapula sin. fr. prox.	1
	Artiodactyla sp.	phal. fr. dist.	1
	Mammalia sp.	vertebra fr.	6
	Esox lucius ?	dentale fr.	1
	Teleostei sp.	dentale fr.	1
844	*Castor fiber*	vertebra caudalis fr.	1
	Carnivora sp.	canine fr.	1
871	Phocidae sp.	bulla auditorius sin. fr.	1
	»	mt. V dex. epiph. fr. dist.	1
	Esox lucius ?	dentale sin. fr.	1
13068:6, 59, 94, 144	—		
153	Phocidae sp.	cuboideum dex. fr.	1
160, 166, 171, 180	—		
234	Phocidae sp.	phal. carpi I/1 sin. fr. dist	1
	Ursus arctos	phal. carpi 2 fr. dist.	1
264, 274, 282	—		
13138:5, 8	—		
13139:2	—		
13302:10	Phocidae sp.	humerus sin. fr.	1
25	Teleostei sp.	vertebra fr.	1
26	*Pusa hispida*	squamosum fr. sin.	1
	Phocidae sp.	naviculare sin.	1
	»	» fr.	1
	»	calcaneum sin. fr.	1
	»	mt. II sin. fr. prox.	1
	Mammalia sp.	vertebra fr.	2
	Esox lucius ?	praemaxillare/vomer fr.	2
36	Phocidae sp.	vertebra cervicalis fr.	1
45, 51	—		
56	Phocidae sp.	mt. I sin. fr. dist.	1
85	Phocidae sp.	mt. IV sin. fr. prox.	1
104, 119, 127, 135, 152, 153, 157, 171, 194	—		
13303:6, 10	—		
31	*Castor fiber*	vertebra caudalis fr.	1
39, 40, 65	—		
71	*Alces alces*	phal. carpi 2 fr. prox.	1
83, 88, 92, 95*, 100	—		
110	Phocidae sp.	phal. tarsi I/1 sin. fr. dist.	1
	Alces alces	phal. carpi (II/V)/1 fr. dist.	1
124	—		
137	Phocidae sp.	tibia dex. epiph. fr. dist.	1
	Mammalia sp.	vertebra fr.	1
	Teleostei sp.	vertebra fr.	1
148	—		
10414:5	—		
12264:4	Phocidae sp.	mt. IV sin. fr. prox.	1
12928:60, 72, 87	—		
12929:28, 162, 169, 189, 211, 296, 446	—		
12960:13	—		
12974:15	—		
13068:37, 67	—		
14954:12	—		
15325:21	—		
9213:5	Phocidae sp.	phal. 3 fr. prox.	1
11725:3	—		
12159:27	—		
12266:11	Phocidae sp.	bulla auditorius sin. fr.	1

	Phocidae sp.	mc. I sin. fr. dist.	1
	»	phal. 1 fr. prox.	1
	Castor fiber	vertebra caudalis fr.	1
	Esox lucius ?	dentale dex. fr.	1
56	*Castor fiber*	squamosum dex. fr.	1
	Alces alces ?	mc./mt. fr. dist.	1
68	—		
83	Phocidae sp.	pisiforme sin.	1
90	*Castor fiber*	tibia sin. epiph. fr. dist.	1
93	—		
12373:7	—		
12432:8	—		
12496:7	—		
12600:8	—		
14	Phocidae sp.	phal. carpi fr. dist.	1
	Castor fiber	mc. III sin. fr. prox.	1
20	Anatidae sp.	scapula dex. fr. prox.	1
31	*Castor fiber*	tibia dex. diaph. fr. dist.	1
42	*Castor fiber*	entocuneiforme sin. fr.	1
	Alces alces ?	mc. II/V fr. dist.	1
58*	Phocidae sp.	mc. II dex. fr. prox.	1
	Castor fiber ?	vertebra cervicalis fr.	1
	Mammalia sp.	mc./mt. fr. dist.	1
	»	vertebra fr.	2
	Esox lucius ?	praemaxillare/vomer fr.	1
	Teleostei sp.	vertebra fr.	4
	»	dent./praemax./vomer fr.	1
70*	*Castor fiber*	trapezium sin.	1
	Mammalia sp.	vertebra fr.	1
	» (*Lepus* ?)	phal. fr. dist.	1
83	Phocidae sp.	astragalus sin. fr.	1
	»	cuneiforme dex. fr.	1
	Teleostei sp.	vertebra fr.	1
102	*Pusa hispida*	dentale sin. fr.	1
	Phocidae sp.	phal. tarsi 2 fr. prox.	1
	» ?	bulla auditorus fr.	1
	Castor fiber	dentale dex. fr.	1
	Alces alces	costa fr. prox.	1
	»	phal. carpi 3 fr. prox.	1
	Esox lucius ?	praemaxillare/vomer fr.	1
124	Phocidae sp.	ulna dex. fr. prox.	1
	»	mt. III/IV fr. dist.	1
	Salmonidae sp. ?	vertebra fr.	1
	Teleostei sp.	dentale dex. fr.	1
12600:146	Phocidae sp.	naviculare sin. fr.	1
	Esox lucius ?	dentale dex. fr.	1
	Teleostei sp.	vertebra fr.	1
	»	dentale fr.	1
	»	dent./praemax./vomer fr.	2
172	Phocidae sp.	scaphoideum sin. fr.	1
176	*Castor fiber*	humerus dex. fr. dist.	1
	Alces alces	phal. tarsi 1 fr. dist.	1
	»	» prox.	1
	Mammalia sp.	patella	1
	Esox lucius ?	dentale fr.	1
	Teleostei sp.	vertebra fr.	1
189	—		

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11617:37	Phocidae sp.	astragalus dex. fr.	1
	»	naviculare dex. fr.	1
	»	mc. III sin. fr. prox.	1
	»	mc. V sin. fr. prox.	1
	»	phal. tarsi sin. fr. prox.	1
	Castor fiber	tibia dex. fr. dist.	1
	»	fibula dex. diaph. fr. dist.	1
	»	condylus occipitalis dex.	1
	»	mc. III sin. fr. prox.	1
	».	phal. tarsi II/1sin. fr. prox.	1
	»	phal. 3 fr.	1
	Esox lucius ?	praemaxillare/vomer fr.	1
43	Phocidae sp.	mc. II sin. fr. prox.	1
	Mammalia sp.	vertebra fr.	1
45	Phocidae sp.	phal. 2	1
	Castor fiber	astragalus dex. fr.	1
	»	calcaneum sin. fr.	1
	»	humerus dex. fr. dist.	1
	»	mt. III sin. fr. dist.	1
	»	mc. III dex. diaph. fr.	1
	Esox lucius	dentale fr.	1
46, 53	—		
54	Mammalia sp.	os sesamoideus	1
57	Teleostei sp.	vertebra fr.	1
58	Phocidae sp.	phal. 3 fr. prox.	1
59	—		
66	Phocidae sp.	tibia sin. fr. dist.	1
	»	entocuneiforme dex.	1
	Alces alces	phal. tarsi 2 fr. prox.	1
	Mammalia sp.	vertebra fr.	1
69	—		