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MAN AND ENVIRONMENT AT 9500 BP. A PALYNOLOGICAL STUDY OF AN EARLY-MESOLITHIC SETTLEMENT SITE IN SOUTH-WEST ESTONIA

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ABSTRACT. A pollen diagrams from South-West Estonia within the Early Mesolithic Pulli settlement site and from a contemporary buried humus layer at Paikuse without known archaeological finds were compared in order to evaluate the impact of Mesolithic people upon vegetation. The pollen data indicate the occurrence of closed willow-birch thickets at Paikuse in contrast with open woods and meadows at Pulli. The general openness of the landscape at Pulli was probably natural. The impact of people on the woodland is difficult to estimate on the basis of the data available. However, the extremely high diversity of ruderals probably represents the result of human activities.

KEY WORDS Pollen analysis, Mesolithic settlement, buried organic matter, environment, Estonia

INTRODUCTION

Were hunter/gatherers able to change the environment they lived in or were they barely dependent on the natural conditions? If they did, whether we able to detect those changes are questions discussed by scientists for decades (Iversen 1949, Proudfoot 1969, Oeggl & Wahlmüller 1994, Hicks 1995). However, these questions are not solved yet, as the impact of Mesolithic people upon the environment was probably moderate. Still, the human activities must have introduced soil disturbance in the settlement area and their waste must have increased the amount of nutrients in the soil, at least locally, so creating conditions for growth of ruderal plants. Pollen records of some hemerophilous plant taxa (e.g. *Artemisia*, Brassicaceae, Caryophyllaceae, Chenopodiaceae, Rubiaceae, *Urtica*) often increase in Mesolithic layers (Vuorela 1977). These taxa are also fairly common in natural shore communities. Mesolithic people also collected firewood, opened paths and built huts, and in so doing decreased the amount of trees in the close surroundings.

New palynological investigations in the lower reaches of Pärnu River were carried out to trace the impact of Mesolithic man on the environment by means of pollen analysis. Pulli (58°25´ N, 24°40´ E), situated on the right bank of Pärnu River, is the oldest known settlement site in Estonia and belongs to the earliest stage of the Mesolithic Kunda Culture (Jaanits & Jaanits 1975). The site was accidentally discovered in 1967, but stray finds of Mesolithic antler, bone and black flint were discovered much earlier during river dredging (Lõugas 1989). The black flint is thought to originate from as far as southern Lithuania. The osteological material suggests that the people of Pulli lived by hunting and fishing, their diet being elk, beaver, bear and fish (Jaanits *et al*. 1982). A tooth of a dog is the earliest sign of animal domestication in Estonia. The settlement was exploited for a short period after the drainage of the Baltic Ice Lake, before the site was submerged by the Ancylus Lake transgression. Nowadays the cultural layer is found under a 2–3 m thick layer of sand.

The material from Paikuse is here used as an example of an undisturbed natural development of vegetation in the same period. The material from Paikuse is discussed in detail by Veski (1998) and Heinsalu *et al.* (1998).

STRATIGRAPHY

The investigated sites, Pulli (~9 m a.s.l.) and Paikuse (5.24 m a.s.l.), are outcrops of layer of buried organic matter (varies from soil to Bryales peat) found sporadically over an area of several square kilometers (Fig. 1, Tab. 1). The stratum formed during a low-stand of the Baltic Sea about 9400 BP. A river and lagoon network that was different from today's formed. Extensive low-laying coastal plains were covered with fen vegetation (Veski 1998).

The alternating sand, silt and organic microlayers above the buried organic matter, probably reflects a balance between the rates of rising Ancylus Lake water

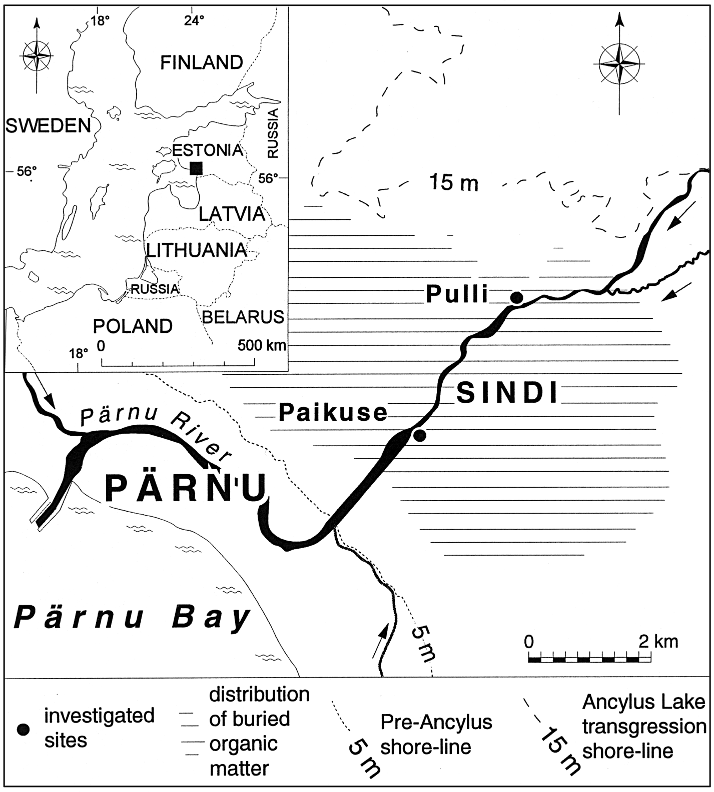

Fig. 1. Location of the investigated sites. Buried organic matter is found sporadically over the hatched area

Table 1. Lithology

Site	Altitude, m a.s.l.	Lithology
Paikuse	5.50–5.24	Sand with organic micro-layers
	5.24–5.13	Woody fen peat
	5.13–5.10	Silty sand
	5.10–5.00	Coarse sand with gravel
Pulli	9.75–9.10	Sand with organic micro-layers
	9.10–9.00	Clayey silt
	9.00–8.90	Cultural layer
	8.90–8.85	Sand

level and land uplift leading to periodical flooding, when sand or re-sedimented organics was deposited, and emergence, when organic rich sediments were formed.

CHRONOLOGY

Conventional and AMS dates of different materials give the age range from 9600 BP to 9100 BP (Tab. 2). AMS dates of terrestrial macrofossils place the age of the fen peat and the cultural layer at both sites at ca 9350 BP, suggesting that the accumulation of these layers was simultaneous.

Dating the settlement itself by an AMS date of an elk bone from the cultural layer gives an age about 300 years younger. Considering the difficulties of bone dating and possible sources of contamination (infiltration of recent water etc.), the date from charcoal is considered to be a more reliable determination of the age of the site. It is comparable with dates from other plant macrofossils.

Table 2. Uncalibrated ^{14}C dates from Paikuse and Pulli

Site	^{14}C date, years BP	Altitude, m a.s.l.	Dated material	Lab. Code*
Paikuse	9575±90	5.25–5.15	peat with wood pieces	TA–2547
	9350±75	5.23	wood piece	Ua–11691
	9340±130	5.05	terrestrial seeds	Ua–12446
Pulli	9385±105	8.95	charcoal	Ua–13351
	9095±90	9.00	elk bone	Ua–13352
	9145±115	9.27	terrestrial seeds	Ua–13353

*Ua: AMS ^{14}C date made in Uppsala Ångström Laboratory; TA: Conventional date made in Tartu University

POLLEN ANALYSIS

The standard method of pollen sample preparation presented by Erdtman (1936) was used. Pollen percentages are based on the total sum of tree pollen (AP) and non-arboreal pollen (NAP). The percentages for aquatic plants and other identified microfossils were calculated

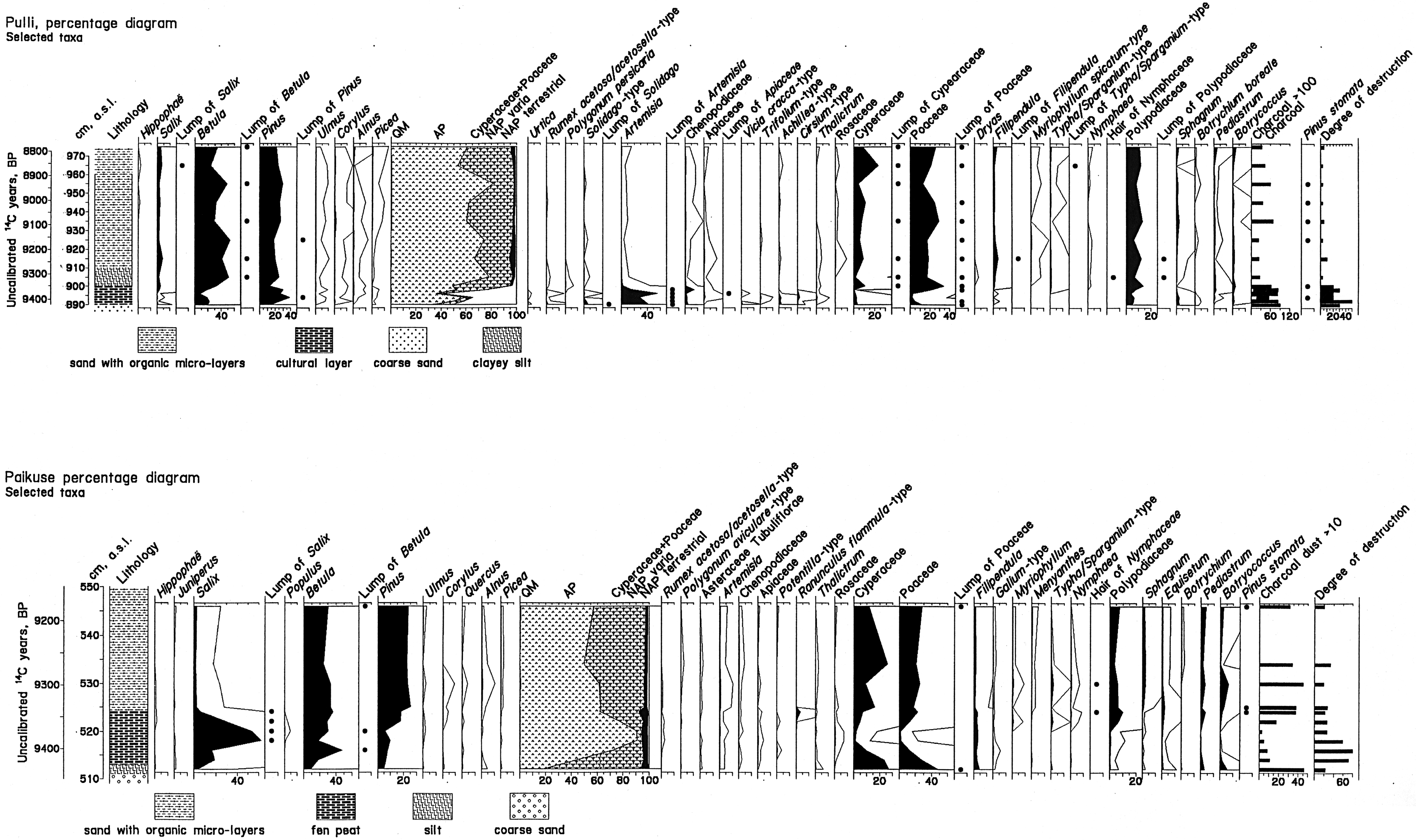

Fig. 2. The percentage pollen diagrams from Paikuse and Pulli, plotted on a linear time scale. The white silhouettes show an exaggeration by twenty

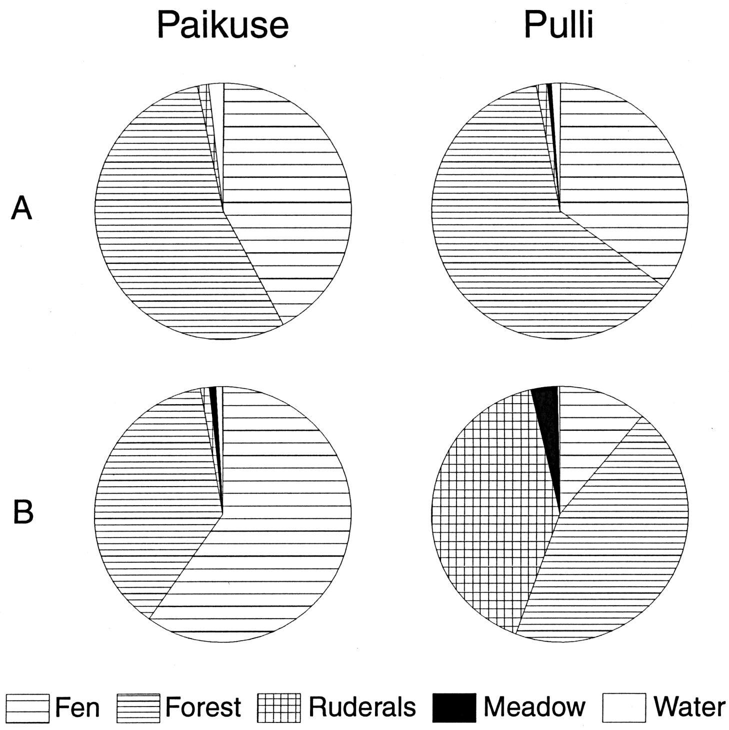

Fig. 3. The relationship of vegetation communities on the basis of averaged pollen data. A – sand with organic micro-layers; B – buried organic matter

on the basis of this main sum plus the actual microfossil sum.

Pollen diagrams (Fig. 2) were plotted with TILIA and TILIA.GRAPH programs (Grimm 1990). In the pollen diagram pollen taxa are grouped to four categories: trees and shrubs, terrestrial herbs, ecologically indifferent herbs and aquatics. Trees and shrubs are listed in immigration order as suggested by Berglund and Ralska-Jasiewiczowa (1986).

The pollen clumps (see Fig. 2) are defined as several pollen grains of the same type stuck together. Such an aggregate is probably unable to travel over long distances from source, and therefore gives information of vegetation directly around the sampling site. However, it must be taken into consideration that at both investigated sites the main part of pollen derived from the immediate surroundings.

In the cultural layer at Pulli, AP and NAP values are similar, showing the existence of an open landscape with pine and birch (Figs 2, 3) which dominate among the trees. From other tree species present in the diagram, *Ulmus* and *Corylus* could appear as scattered trees in the area. Pollen grains of *Alnus* and *Picea* are probably long distance transported or re-deposited. The NAP from cultural layer is represented by high variety of different ruderals and meadow indicators. For example, there are large amounts of *Artemisia*, Asteraceae (such as *Achillea*-type, *Cirsium*-type, *Solidago*-type) and Chenopodiaceae pollen, appearance of *Urtica*, *Rumex acetosa/ acetosella*-type, Apiaceae and different Fabaceae (such as *Vicia cracca*-type and *Trifolium*-type).

In the overlying sand with organic micro-layers the representation of Poaceae and Cyperaceae rises considerably (up to 30%). The input of pine and especially birch pollen is also somewhat higher. The share of ruderals is negligible (Fig. 3). The continuous appearance of different aquatic types shows that the area was submerged. The composition of aquatic species and steady tree pollen values indicate that water depth was not large and the coast was probably not far from the sampling site.

At Paikuse in the organic matter layer *Salix* and *Betula* dominate (both with high values and appearance of pollen clumps) in tree pollen (Fig. 2). A great part of pollen is derived from fen communities (Fig. 3). Among NAP, Poaceae, Cyperaceae (probably *Phragmites* and *Carex* spp.) and *Filipendula* dominate. In the lower and upper part of the peat pollen grains of aquatics and species of algae are present indicating the increased wetness of basin and/or occasional submergence of the peat.

In the overlying alternating peat/sand micro-layers *Betula* and *Pinus* dominate among trees. The proportion of NAP is high and is made up mainly of Poaceae and Cyperaceae. The number of Polypodiaceae spores rises considerably and the continuous presence of different aquatics and algae is recorded.

DISCUSSION AND CONCLUSIONS

Comparison of the pollen data from the investigated sites stresses the growth of closed willow-birch thickets at Paikuse in contrast with the open light woods and meadows at Pulli during the accumulation of the buried organic matter. The question arises, therefore, whether this contrast was created by the influence of people or whether it was a result of natural vegetation development. This is difficult to answer. Naturally open spots in landscape must have been more attractive to settle. From the two sites, Pulli, with its drier soil and birch-pine communities, was certainly more attractive as a settlement area than Paikuse with its wet willow thickets. The scale of human impact on the surrounding woodland is difficult to estimate. As the area was submerged by the Baltic Sea shortly before and after the habitation phase no comparison with long term natural woodland development can be made. Pine was a dominant tree species at the site, as, along with high pollen frequencies, pollen clumps and stomata are recorded. However, the extremely high diversity of different ruderals can not be explained only as seashore communities, and more likely it represents the result of human activities.

Due to the Ancylus Lake transgression which inundated the area at about 9350 BP, forcing Mesolithic people to move upstream the Pärnu River, both sites were submerged and hence similar pollen sedimentation conditions were established (Tab. 3).

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