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Chapter 9

A COMPARISON OF PALAEO-ECOLOGICAL AND ARCHAEOLOGICAL EVIDENCE OF HUMAN HABITATION AT KEAVA

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Abstract

Peat record from a very small basin, the former mire of Verevainu, in the nearest vicinity of the prehistoric settlement centre at Keava (4th century BC – early 13th century AD), was investigated by palaeo-ecological means, namely by pollen, charcoal, and loss-on-ignition analyses and radiocarbon dating. The study aimed at ascertaining the appearance of prehistoric man in the area and reconstructing the local vegetation history and human impact on the environment around the settlement centre. According to palaeo-ecological evidence the first sporadic cereal pollen grains appeared in the sediments in the Late Bronze Age. Both peat ignition residue values as indicators of topsoil erosion and pollen evidence suggest forest clearance, opening of landscape, and cultivation of cereals from the Pre-Roman Iron Age. Approximately at AD 350–500 the rate of human impact upon environment increased notably. The comparison of palaeo-ecological data with archaeological evidence of human inhabitation displays not only large coincidences but also some discrepancies.[1]

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Introduction

The scarcity of archaeological artefacts and the complexity of interpretation of such sources of information often make it necessary to collaborate in an interdisciplinary manner. Palaeo-ecological investigations, particularly pollen analysis, have greatly contributed to our knowledge of prehistoric environments and the manner in which human activity affected them (e.g. Veski 1998; Poska 2001; Poska et al. 2004). In Estonia long and well-established co-operation traditions have existed between palaeo-environmental scientists and archaeologists already since the times of Paul Thomson and Richard Indreko in the 1920s (e.g. PACT 51; 57; Veski et al. 2005a). Being one of the pioneers of the palynological analysis method, Thomson initiated a viable and continued tradition of palynological research in Estonia; in addition to describing post-glacial vegetation history on pollen assemblages from peat and lake sediments (e.g. Thomson 1929), he also applied pollen analyses in archaeological investigations (Thomson 1928).

However, quite often prehistoric settlements and other finds of archaeological source material and possible sediment archives, such as deposits of small-sized lakes and mires that mostly trap local natural and man-made environmental signals like wind-dispersed pollen grains, fire-induced microscopic charcoal particles, and erosion-generated soil dust particles, are located too far from each other. More local pollen signals can only be detected by investigations at small-scale sites (Broström et al. 1998; Veski et al. 2005b; Poska et al. 2008). In Keava, three settlement sites and two hill forts within the radius of 1 km are located very close to small basins filled with sediments suitable for palaeo-environmental studies (Fig. 1).

In the course of fieldwork, we detected a small hollow with peat infilling at the foot of the Keava hill fort. The former mire (58°57′03″N; 24°56′48″E) with a size of 100 × 150 m, which we call Verevainu Mire, is drained, reclaimed, and transformed into pasture, whereas the edge of the fen close to the hill fort is overgrown with bushes of alder and willow. The topmost peat layer has been destroyed during land amelioration works and desiccation/oxidation of the peat has resulted from the drainage of the peat bog. In addition to the proximity to the Keava hill fort, Verevainu Mire lies less than 100 m from other archaeologically significant Pre-Viking/Viking Age settlements Linnaaluste I and III, and ca 750 m from an early hilltop site at Võnnumägi.

Palaeo-ecological studies of sediment core from Verevainu Mire have been carried out, where previous pollen studies or other palaeo-ecological investigations were lacking. Moreover, detailed pollen diagrams, which could reflect early indications of human impact on the environment, are absent from most of the inland areas of central Estonia. This study seeks (1) to determine whether there exists earlier palaeo-ecological evidence of the presence of man at Keava as the archaeological dataset shows; (2) to follow the land-use history and human impact on local environment using pollen, charcoal, and loss-on-ignition analysis and ^{14}C chronology of peat sequence; and (3) to perform comparison of the palaeo-ecological evidence and results of archaeological excavations.

In July 2002, a set of replicate sediment cores was taken from the Verevainu Mire using a 7.5-cm diameter and 1-m long Russian peat sampler (Fig. 1). Sediments down to the bottom were recovered, maximum sediment thickness of 3.88 m was recorded, sediment cores were described, photographed, carefully packed into 1-m plastic semi-tubes, wrapped in polyethylene film, labelled and transported to the laboratory. Additional parallel cores were taken for radiocarbon analysis. Detailed description of the palaeo-ecological methods applied, and sediment lithostratigraphy and detailed pollen diagram is presented in Heinsalu & Veski (2010).

The chronology of the Verevainu Mire core is based on three conventional radiocarbon dates. All dates were obtained from 5 cm thick bulk ombrotrophic peat samples. The radiocarbon dates were converted to calendar years using the IntCal04 calibration dataset (Reimer et al. 2004) and OxCal 4.0 program deposition model (Bronk Ramsey 2001; 2008) with the 2σ (95.4% confidence) level. In order to construct an age–depth model, weighted average estimates of the probability distributions of the calibrated age were calculated. All ages mentioned in this text are given in calendar years BC or AD.

In addition to this, another peat bog, called Linnaaluste Mire (58°57′11″N; 24°57′00″E), situated 300 m north of the Keava hill fort was cored, studied for pollen analyses and radiocarbon dated (Heinsalu & Veski 2010). However, as that record had unexpectedly low sedimentation rates and therefore a poor resolution, the pollen diagram from the Linnaaluste Mire did not add any relevant information about the human impact history of the Keava area, and we excluded the results of this site from the current discussion.

Palaeo-ecological and archaeological evidence of local environmental and human impact history

The environmental and general vegetation history, with special emphasis on the impact of human habitation of the Keava area (Fig. 9.1), is mostly based on the pollen diagram and peat mineral content curve from the ancient Verevainu Mire, covering the time-span from 3500 BC to about AD 1500 (peat ignition residue; IR) and from 2200 BC to about AD 600 (pollen) (Heinsalu & Veski 2010). The results of archaeological excavations of these sites are in greater detail presented above in this volume.

The Neolithic and Bronze Age

Palaeo-ecology

From about the Late Neolithic ca 2000 BC, the Keava area was forested and mixed forest of *Betula* (birch), *Pinus* (pine), and *Picea* (spruce) grew on dry ground, whereas *Alnus* (alder) formed alder thickets around the Verevainu Mire on wet ground. Broad-leaved trees, particularly *Quercus* (oak), *Corylus* (hazel),

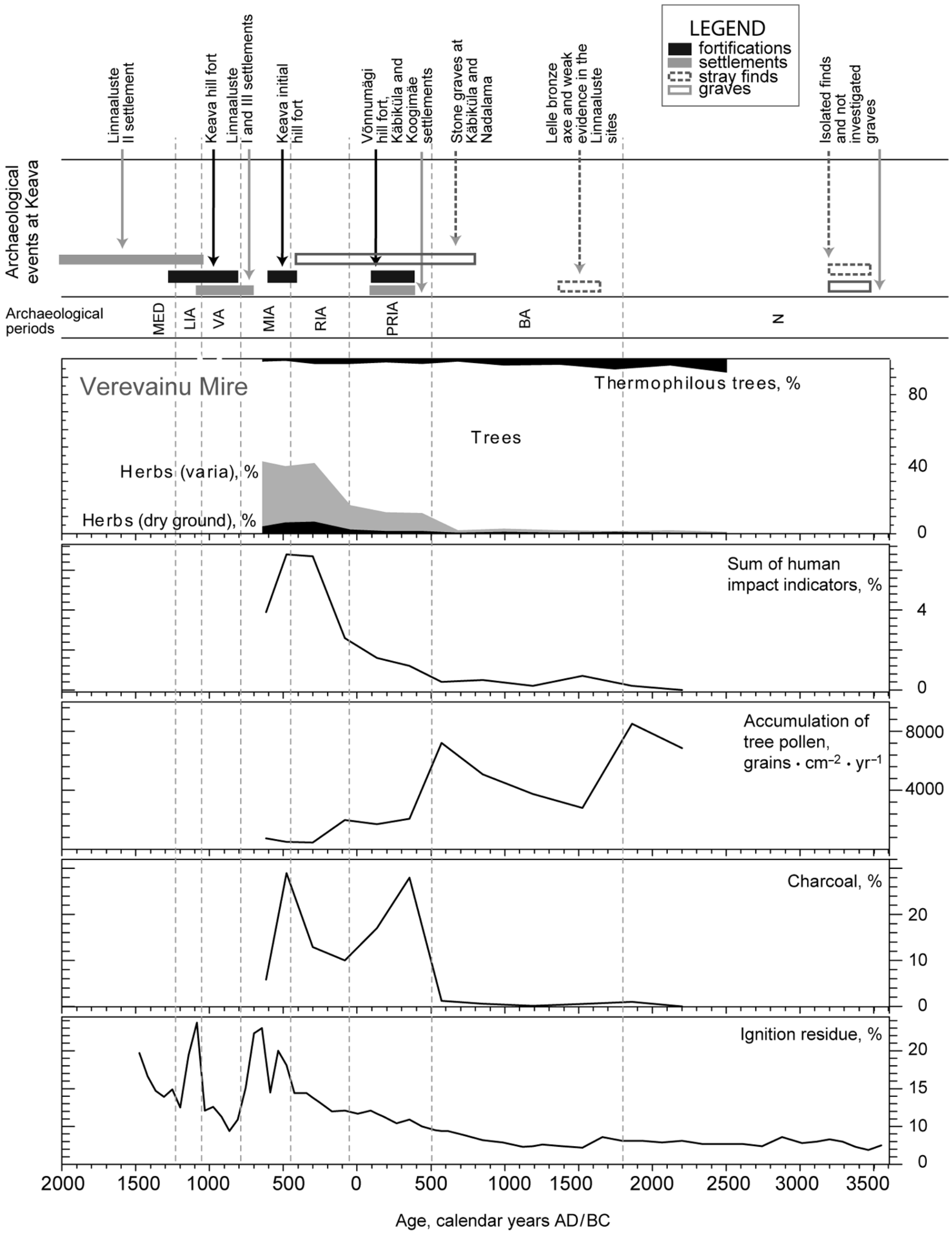

Fig. 9.1. Summary proxy data describing the palaeo-ecological evidence of human impact on the environment at Keava and archaeological data.

and *Tilia* (lime), were more abundant than today but rather rare. In general, the pollen diagram indicates very low non-tree pollen values (herbs) without any evident changes. Moreover, the tree pollen curves do not show any apparent disturbances of the forest cover and imply that there was no particular human impact in the nearest vicinity of the studied area. The tree pollen accumulation rate was also high, indicating closed conditions.

In small ombrotrophic *Sphagnum*-dominated peat bogs, the deposition of mineral particles often reflects soil erosion associated with human activity in the vicinity of the bog (e.g. Vuorela 1983; Dörfler 1992). Mineral material originates from particles transported by wind and rain and consists mainly of particles derived from eroding soils. Smaller peat bogs closer to cultivated fields have greater ability to trap mineral soil influx arising from human-induced soil erosion. Therefore peat profiles of small-sized bogs are expected to be especially suitable for the investigation of ancient human agricultural activity. Ombrotrophic peat bogs, dominated by *Sphagnum* mosses, are solely fed by atmospheric deposition, i.e. they receive all their water, nutrients, and mineral particles from precipitation falling directly on their surfaces. Ombrotrophic peat studies in Estonia have shown that in natural conditions the content of organic matter in *Sphagnum*-dominated bogs is very high and regular, whereas the proportion of mineral matter is low, less than 5%. In transitional bog peat IR values, i.e. the mineral content of the peat, are slightly higher, 5–10% (Valk 1988). We have to consider that the past Verevainu Mire was similar to the transitional type of bogs; therefore it was not solely fed by atmospheric deposition but also received moisture by means of groundwater seepage from the slopes of the esker. In the Verevainu Mire peat sequence from about 3500 BC to ca 1100 BC the IR values are low (7–8%) and fluctuations are lacking, thus additionally implying native forests without any clearings of woodland and mineral soil influx arising from soil erosion induced by ancient agricultural activity.

The first single cereal pollen finds of *Triticum*-type (wheat) pollen appeared during the Early Bronze Age ca 1500 BC together with cultural indicators such as apophytes *Artemisia* (wormwood) and *Taraxacum* type (dandelion). The pollen evidence suggests that small-scale attempts at crop tillage may have been made, but the human population possibly living in the Keava area was scarce and did not significantly influence the plant cover structure and local environment.

Recent records of *Triticum*-type pollen accompanied by *Cannabis*-type (hemp) pollen ca 5600 BC at Akali, middle-eastern Estonia, by Poska & Saarse (2006) can be interpreted as the first possible traces of the acquaintance of foragers with crop farming through contacts with southern European agrarian tribes already in the Late Mesolithic. During the Bronze Age, crop cultivation already played an important role in the farming economy in northern Estonian coastal alvar areas, e.g. in Maardu (Poska et al. 2004), Kahala (Poska & Saarse 1999), and Mustjärve (Veski 1998). However, the inland parts of northern and central Estonia were obviously economically marginal areas during the Bronze Age. The first sporadic finds of cereal pollen grains, namely *Triticum* and *Avena* type (oat) were detected in the pollen diagram from Ruila, ca 40 km north-westwards of Keava in the early Bronze Age ca 1500 BC (Poska & Saarse 2002), i.e. at the same time as in Keava.

Archaeology

The presence of people in the Stone or Bronze Ages is probably evidenced by the small amount of quartz and flint items obtained from the excavation of the Linnaaluste III settlement site by Jüri Peets in 2005 (see chapter 6). The low density of finds (0.5 pieces per square metre) probably indicates the presence of a nearby settlement site, or at least a periphery of a certain activity area. A quartz core that was found there is a clear sign of certain activities (stone working) performed at the place. Similarly, the find assemblage of the Linnaaluste I settlement included a few flint flakes worked by human hand, which can be related to human activity. The mentioned flint and quartz finds do not allow dating the occupation of the area to any definite period of the Stone Age, although it is assumed that stone finds not coupled with ceramics indicate a Mesolithic settlement. The absence of ceramics, however, does not preclude a later date for the find spot of the quartz flakes – for instance the early Bronze Age when the first human disturbance in this area has been proved by pollen indicators. The use of flint and quartz at least for some human activities has been proved in Estonia and western Finland until the start of the Iron Age (e.g. Miettinen 1994; Lang 2000a, 160). Be it as it may, in any case the worked stone items suggest that the surroundings of Keava were already 'discovered' in the Stone or Bronze Ages, and that other traces of earlier settlement are to be found in the future.

The end of the Neolithic and/or the beginning of the Bronze Age are represented by some shaft-hole stone axes found as stray finds in the more distant surroundings of Keava (from Juuru, Hagudi, Käbiküla, Paluküla, Ohekatku and Haakla), and by a bronze palstave from period II of the Bronze Age, found in Lelle (Fig. 9.2; Jaanits et al. 1982, fig. 89: 2; Lang 2007a, fig. 10: 1). As mentioned above, the human impact on the environment remained quite modest; there was no significant opening up of the landscape, and even the grain growing ceased after a while. We may assume that the permanent agricultural settlement did not fully develop in the surroundings of Keava during the Late Neolithic and the Bronze Age, although there were people around who cultivated their small-sized flash-and-burn field plots and raised stock in the context of the first *landnam*.

The Early Iron Age

Palaeo-ecology

The Verevainu Mire pollen diagram indicates that the landscape around Keava remained constantly forested primarily with birch, pine, and spruce trees without considerable fluctuations in the tree population, arboreal pollen accumulation, and disturbances in the woodland structure until 350 BC, followed by an abrupt change in the pollen record. A sharp and persistent rise in total herb pollen

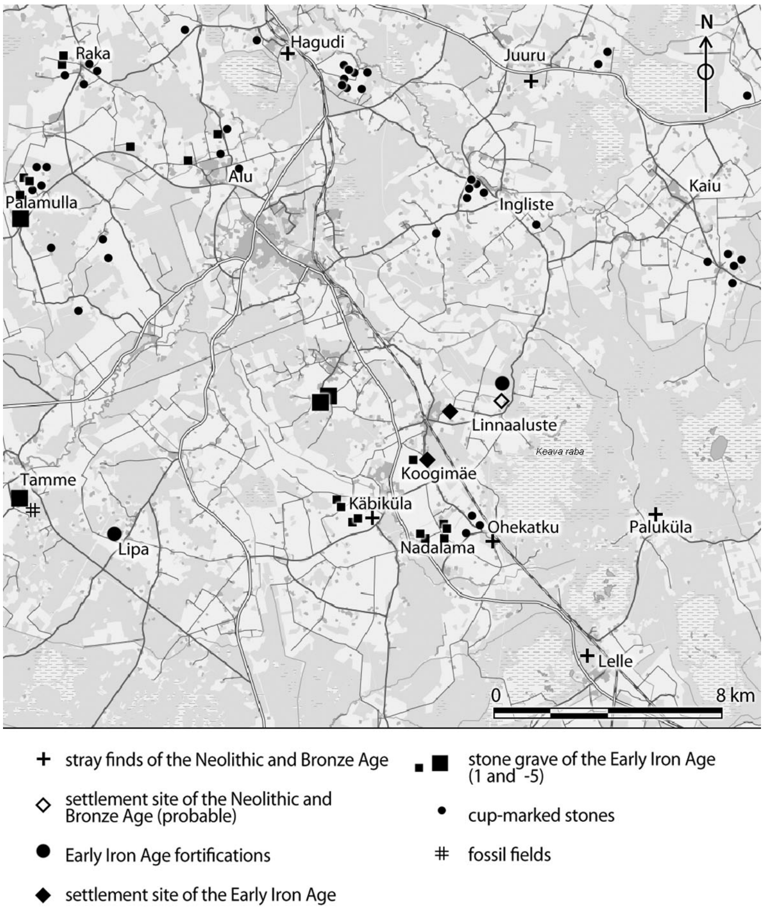

Fig. 9.2. Archaeological sites from the Neolithic to the Roman Iron Age in prehistoric southern Harju district.

percentage and somewhat higher herb pollen accumulation with corresponding decrease in the tree pollen accumulation possibly suggests degeneration of forests and a change towards a partially open landscape. Not only a decrease in tree pollen percentage was seen, but also tree pollen accumulation rates dropped 2–3 times, indicating major ecological changes in the vicinity of Keava, recession of forest, and opening of the landscape. The distribution of non-tree vegetation and opening up of the landscape were evidently achieved by clearance combined with the effects of fire, as indicated by high values of charcoal particles. Somewhat earlier, at ca 600 BC, the pollen curve of cereals contains only few grains of *Triticum* type. However, the curve remains unbroken, pointing to crop cultivation at least in limited areas close to the Verevainu Mire and is most likely associated with the appearance of cultivated fields. The pollen evidence also has additional clear signs of human activities, such as *Artemisia*, Chenopodiaceae (goosefoot family), ruderals, *Plantago* types (plantains), and *Juniperus* (juniper), suggesting creation of pastures, forest grazing, and onset of the formation of an agrarian landscape at Keava in the Early Pre-Roman Iron Age. The palaeo-ecological evidence implies colonization of former marginal lands in the Keava area and suggests implementation of crop farming, exploitation of landscape, and significant change in the natural vegetation composition during the Pre-Roman Iron Age around 350 BC. Moreover, this is consistent with an earlier consideration that the cereal cultivation had expanded spatially into more extensive areas in inland Estonia by the Iron Age (Poska et al. 2004; Saarse et al. 2010).

The deforestation and opening up of landscape leading to reduction in plant cover may have contributed to topsoil disturbances and increased erosion intensity. However, the mineral content of the peat of the Verevainu Mire starts to increase, and a rise in IR values is steady somewhat earlier than observed in the pollen evidence, from around 1000 BC, which might indicate elevated fluxes of soil dust resulting from man-induced soil erosion. The earlier indication of human interference, detected more sensitively by the erosion signal rather than by pollen evidence, may result from the relatively coarser sampling interval employed for pollen analyses than for loss-on-ignition analyses of the Verevainu Mire profile, as well as from the fact that early cultivation signals are very weak.

Archaeology

The information provided by the pollen diagrams has been supported by archaeological evidence, although in Keava there are neither monumental stone graves nor cup-marked stones, which usually are the most characteristic representatives of the period. In 2002, an early hilltop site was discovered on the hill called Võnnumägi (chapter 7). The cultural layer of the site is very poor; only a handful of ceramics has been found so far. Five radiocarbon dates of the charcoal obtained from inside the transverse rampart indicate that the latter was built in the 4th or 3rd century BC. It is not entirely clear what the purpose of the site was; perhaps we are dealing here with an enclosed cult site without permanent occupation. In any case, archaeological record – similarly to the pollen diagrams – provides evidence for human presence in Keava through the early Pre-Roman Iron Age.

In the Late Bronze and Early Iron Ages the settlement became denser and archaeologically more visible also outside Keava. We are dealing here with a process called the first *landnam* (see Lang 1996, 441 ff.), which in Harju district took place somewhat later than in northern Estonian coastal areas (Lang 2002, 145). There is a group of stone graves and cup-marked stones 6–7 km south-west of the Keava hill fort, on the lands of the villages of Nadalama, Käbiküla and Ohekatku in the surroundings of present-day Kehtna. The date of the stone graves is a moot point, but at least some of them are quite early, as evidenced by a bone pin with cylindrical head and fragments of some bronze artefacts (razor?) found in the early 20th century at the excavations of a stone grave in Käbiküla, which allegedly contained a stone cist (AM 260: 1–6; see Lõugas 1970). In 2002 settlement sites with thin cultural layers were discovered in Koogimäe and Käbiküla; the sites yielded a few potsherds of Early Iron Age date. Seven stone-cist graves (which represent the oldest stone grave type in Estonia) are known in the village of Tamme (Kabala), and four graves in the village of Palamulla. This area also accommodates one of the densest concentrations of cup-marked stones in southern Harju district. If a single radiocarbon date is to be trusted, a fossil field located at Tamme belongs to the Early Roman Iron Age, and is therefore the oldest known field in prehistoric Harjumaa. An early ring fort on flat ground is known at Lipa, which probably also dates from the Early Iron Age (Konsa et al. 2006).

From the Late Roman Iron Age to the Viking Age

Palaeo-ecology

The overall impression from the pollen and soil erosion data implied only insignificant expansion of agricultural activities from 350 BC to AD 300. However, around AD 300 the pollen record provided distinct evidence of increase in both arable and pastoral farming activity in the area. The landscape in the vicinity of Keava was progressively cleared, as tree pollen decreased notably and herb pollen increased. Herbaceous pollen that was recorded at higher frequencies includes mainly Cyperaceae, Poaceae, but also *Rumex* (sorrel), *Taraxacum* and others, as well as indicators of grazing like *Juniperus* and *Pteridium* (ferns), which may hint at pastoral farming. Pollen evidence for arable farming continued to increase as an abrupt rise in cereal pollen in the pollen diagram, which showed intensified cultivation farming. Moreover, new crops, such as *Secale* (rye) and *Hordeum* (barley), were introduced. These changes coincided with a short-lived peak of microscopic charcoal, which might have resulted from slash and burn close to the study site. Throughout this period, which lasted from AD 300 to 600, microscopic charcoal was present at very high values; in addition, charcoal occurred in macroscopic form, which suggested very local origin.

The comparison of the IR curve with the respective human-impact indicators in the pollen record from the study site showed a clear link to human land use at the time of IR peaks. The IR content continued to increase until AD 350 and afterwards, showing that the topsoil erosion and wind-blown accumulation of mineral dust particles in the Verevainu Mire had drastically increased. The data suggest considerable deforestation and destruction of vegetation, and the increasing intensity of agricultural practices in the Late Roman Iron Age, in the Migration Period, and in the Pre-Viking Age.

The topmost subsurface sediment record of the Verevainu Mire was visibly disturbed and therefore pollen analysis further upwards was not performed. In addition, the irregular shape of the IR curve after AD 1000 should be interpreted with some caution. However, extensive deforestation and expansion of arable farming during the Viking Age and in the early 13th century can be expected.

Archaeology

After the site on the Võnnumägi hill was abandoned, the next sign of human presence in Keava is the layer I of the main hill fort, dating to the 5th–6th centuries (chapter 1). The settlement site I of Linnaaluste, a hundred metres south-west of the hill fort, has yielded no traces of such an early occupation (chapter 3), but their presence can by no means be precluded. To date, the site has been explored only through two small excavations; moreover, it has been seriously damaged by centuries-long field cultivation and recent gravel digging so that the cultural layer has been entirely turned over and mixed, and in places even heaped on the edges of the former quarry. Archaeologists were able to identify only a bottom of one *keris* stove, which has been dated to the 7th–8th centuries by the radiocarbon method. Approximately 1500 potsherds collected from the site are the typical ceramics of the Pre-Viking and Viking Age settlements in northern Estonia. Other finds of the site, very few in numbers, appear to belong to the same periods. Based on the radiocarbon dates (four altogether), the settlement site I can be dated to the 7th (?) or 8th to 11th century (most probably until the mid of the century).

The settlement site III of Linnaaluste, 100 m north-north-west of the hill fort and 200 m north-north-east of the northern edge of Linnaaluste I, is quite a small patch of occupation layer on a crescent ridge rising above the mire of Verevainu (chapter 3). The excavations showed that the main preoccupation at this settlement (resp. part of the settlement) was smithing: the cultural layer was very rich in charcoal and yielded iron slag and forge scales; in addition, pieces of crucibles and remains of a wattle-and-daub construction were found. More than 1100 potsherds obtained from the site are characteristic of only Pre-Viking and Viking Ages while the later finds are absent. Two radiocarbon dates belong to the late 7th–9th centuries, the third is later indicating the 11th–12th centuries. Finds (mostly pottery) allow dating of this site to no later than the middle of the 11th century.

Contemporary with the settlement site I/III of Linnaaluste are the layers II and III on the hill fort, dating to the 8th–9th and 10th–11th centuries, respectively (chapter 1). As there are no signs of permanent habitation in the hill fort during the phases I and II of its use, we may conclude that the people lived in the open settlement while the hill fort was used as a refuge in times of peril. The find assemblage of the hill fort include a few pieces of ceramics and other finds that probably originate from fort III (chapter 2), thus indicating that a small group of people could have inhabited the hill fort more or less permanently. This is also evidenced by a *keris* stove, which most probably originates from the same phase of the hill fort.

In recent years, a number of settlement sites from the same time have been discovered in the surroundings of Keava. As evidenced by surface surveys, the settlements were established in the second half of the 1st millennium and were also in use at the beginning of the 2nd millennium. This was quite a dense network of settlements, mainly south and west of the hill fort of Keava.

Conclusions

As we can see from the discussion presented above, palaeo-ecological evidence, namely the results of pollen, charcoal, and loss-on-ignition analyses, for human impact coincide largely with data achieved by archaeological investigations. Both sources demonstrate weak signs of human presence in the surroundings of Keava prior to the mid-first millennium BC. Although archaeological evidence is not precisely datable, pollen-analytical observations tend to date this event to the Early Bronze Age. However, the human population who possibly rearranged the surrounding nature was small and did not considerably influence the local environment. The next well-grounded coincidence falls to the early Pre-Roman Iron Age when forest clearance was undertaken, the landscape was rapidly opened up, cultivation of cereals developed and the hilltop site at Võnnumägi was erected. All palaeo-ecological data suggest increasing population, expansion of agriculture and clear evidence of human-induced disturbances on the environment. Evidence for early agriculture is remarkable at that time in the pollen diagram, whereas it is missing in archaeological sites; the Võnnumägi site was most likely either an enclosed cultic or refuse place for the local people to withdraw in case of threat and without permanent settlement. In spite of that, at least some farms practising agriculture had to be somewhere round already before the rampart was erected on the hill of Võnnumägi (as proved by the occurrence of *Triticum* in ca 600 BC and increased mineral content and IR values in the mire sediments since ca 1000 BC) and, perhaps, they will be discovered in the future.

There is no archaeological data so far proving the human inhabitation in the Late Roman Iron Age when all signs in the palaeo-ecological evidence demonstrate the new major expansion of arable farming. The indicators of permanent farming in the pollen diagram of the Verevainu Mire reached a peak in the Migration Period – when the first fortifications were erected at the hill fort of Keava – only to be gradually decreased in the Pre-Viking Age. The landscape remained open even in the periods of decreasing human impact; at the same time, the amount of eroded mineral particles increased remarkably. At first glance, this information seems to be in contradiction with the archaeological data about the steady enlargement of the settlement area at the foot of the hill fort. On the other hand, it may be that the Verevainu diagram reflects a situation where new settlements (Linnaaluste I and III) were established near the mire and the earlier fields – which had left prominent traces in the mire sediments – were abandoned, while new fields were established farther from the place where the pollen diagram was obtained. More likely the topmost 45 cm peat layer which has been destroyed (overturned, ploughed) during recent land amelioration works shows an altered picture of the vegetation history in the surroundings and therefore strict conclusions on palaeo-ecological evidence about the shift of habitation and cultivation pattern should be avoided since AD 800.