DEVELOPMENT OF VEGETATION AND CHANGES IN LANDSCAPE CAUSED BY TRADITIONAL LAND USE IN THE PAIMIO AREA

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Abstract

The vegetational history is reconstructed through pollen analysis of the Paimio River Valley and its environs. The data were obtained from a total of 5 peat and lake sediment cores, which provide a record of vegetational change that spans from 8000 years B.P. to the present. The period dating from the last 2000–3000 years is emphasized as human activities are reflected in the pollen profiles by the expansion of grassland and other cultural herbs, followed by what are interpreted to indicate the spread of cultivation and contemporaneous reduction of forests.

The pollen record from this region suggests diverse development in vegetation during the past 8000 years, as revealed by local landscapes, each of which possessed unique geological, topographical, or historical characteristics or any combination of these.

The paper presents progress to date as part of ongoing research of an interdisciplinary project from South-West Finland which is investigating the early development of settlement, vegetation and landscape history, financed since 1983 by the Research Council for the Natural Sciences at the Academy of Finland. The project will be finished by the end of 1985. Palaeoecological methods, mainly pollen and charcoal analysis, are being used to reconstruct past vegetation and vegetational changes, ascribed primarily to human activity. The data focus on five main profiles that have been radiocarbon dated and analysed for pollen in detail. Some preliminary results are outlined here. The location of the study sites is given in figure 1.

Interpretations of *regional vegetation history* are based on pollen diagrams from long profiles collected from the raised bog *Preitilänsuo* (60°26′N, 22°46′E, 58 m asl.) and *Lake Kankareenjärvi* (60°26′N, 22°58′E, 78 m asl.). These profiles span the last 8500 years of Holocene time. The precise level reflecting isolation from the sea is evident in the lithostratigraphy and diatom stratigraphy in the cores. Relative pollen diagrams are divided into local pollen assemblage zones on the basis of major pollen changes. The Kankareenjärvi pollen profile is presented in Fig. 2. The main features in the pollen stratigraphy at this site are interpreted to reflect regional pollen assemblages, as defined by Donner (1971) for all of SW Finland. The lowermost zone in the diagram includes the Pine Zone, which approximately corresponds to the Boreal chronozone (9000–8000 B.P.). The middle zone includes the Birch – alder – hazel – elm Zone, which corresponds to the Atlantic and Subboreal chronozones

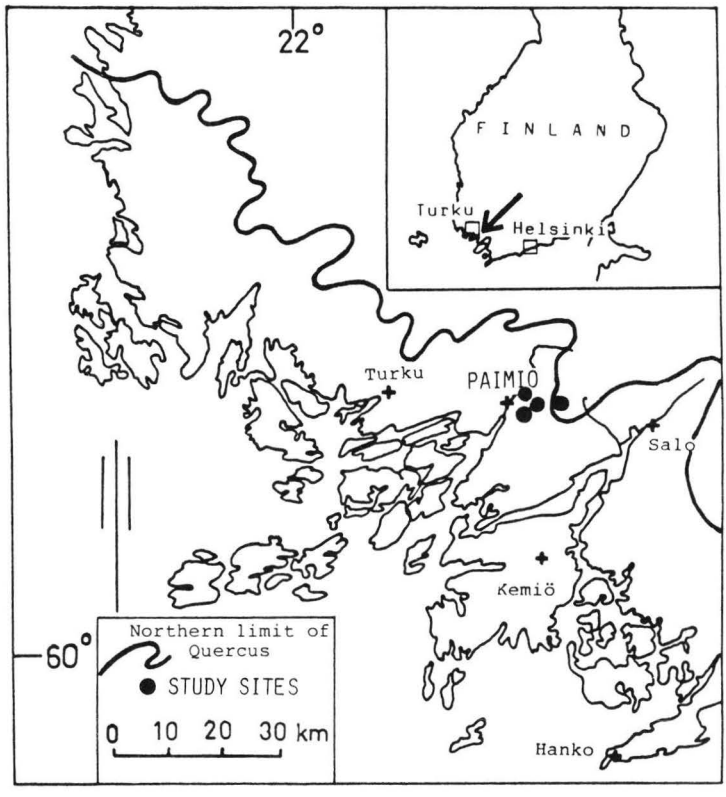

Fig. 1. Map showing the study area with the pollen study sites.

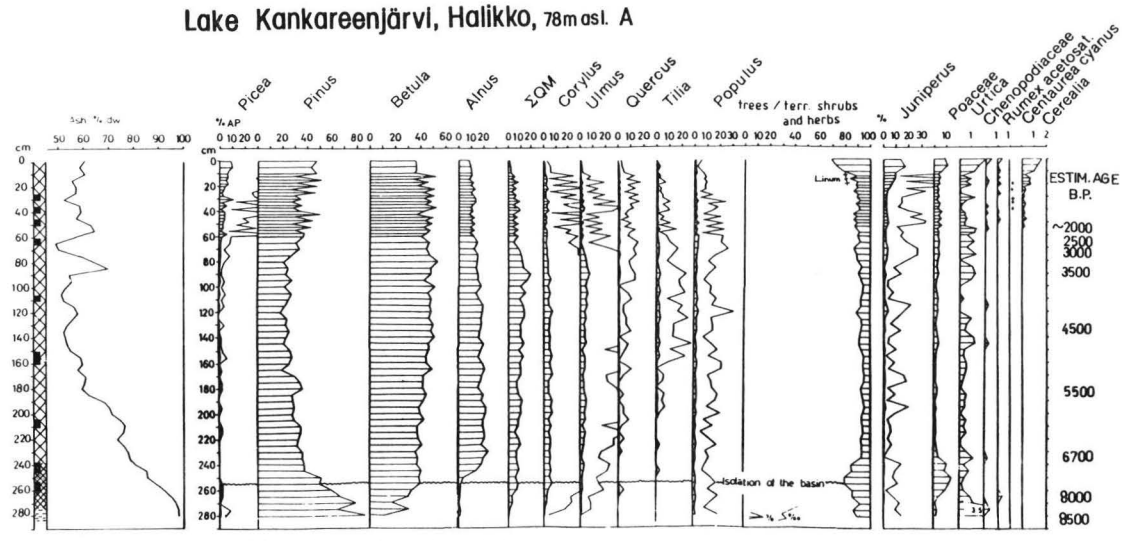

Fig. 2. **Relative pollen diagram from the Lake Kankareenjärvi profile.**

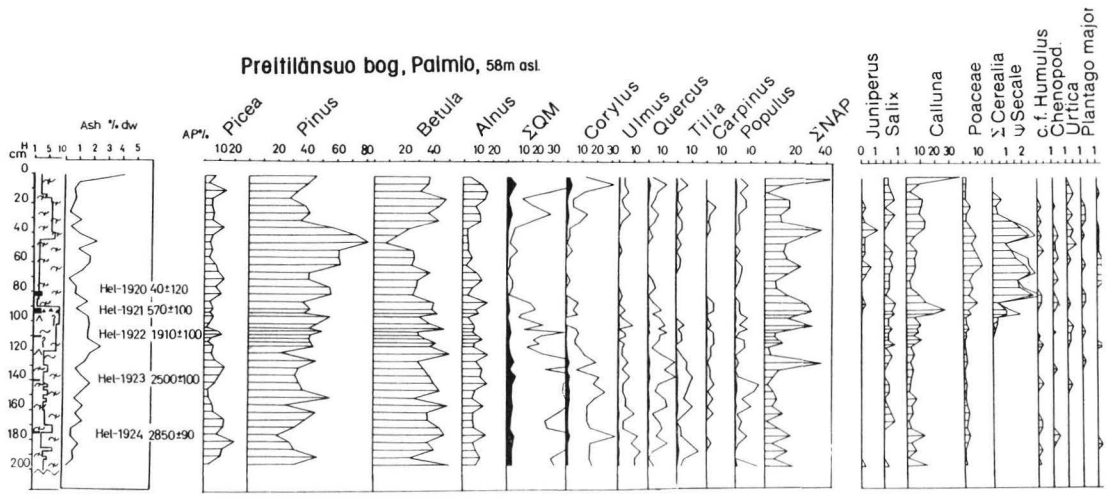

Fig. 3. Preitilänsuo bog. Relative pollen diagram from profile B.

(8000–2500 B.P.), and the upper zone of the profile, above the rise of spruce, corresponds to the Pine – spruce Zone. Specifically, *Alnus*$^{+}$, *Picea*°,$^{+}$ and Cerealia°,$^{+}$ from both study sites serve as pollen stratigraphic markers that have been dated at the Radiocarbon Dating Laboratory, University of Helsinki. More detailed analyses are underway at this time. A number of radiocarbon dates are available for spruce-rise, which has been dated to about 3200–3000 B.P. from this area (K. Tolonen 1983, Glückert 1976).

The Lake *Kankareenjärvi* diagram shows that human influence during the last 2000 years has been relatively insignificant at the site as revealed by low proportions of cultural pollen, the pollen rain of which is interpreted as being general »background» pollen grains expected for the region. The record of *Linum usitatissimum* pollen is dated to the late 1600's and to the early 1700's A.D. by extrapolating from ^{210}Pb dates obtained for the uppermost part of the profile. The *Linum* pollen probably shows that the lake basin was used for soaking of flax in former times.

A highly humified dark horizon at the level of 90–120 cm with abundant charcoal is present in the *Preitilänsuo B.* profile (Fig. 3), which may be due to a fire or several fires at the site. The rise of herb pollen (Poaceae, Cyperaceae) occurs at this time, probably due to development of open vegetation communities. Simultaneously, there is an increase of *Juniperus* and *Pteridium,* possibly in response to open mineral soils that were available along the hilly margins of the bog. These latter species, are often ascribed to open pastures used for cattle-grazing. Also possible is, that these floristic changes represent natural succession in forest openings, however, it is tempting to speculate, that the local surroundings at the study site were used as pastures. This latter hypothesis is supported further by the first appearance of Cerealia pollen grains in the profile at the 100 cm depth, which indicates the onset of farming activity in the study area. The horizon slightly above the lower boundary of the humified layer (110 cm level) yielded a ^{14}C date of 1910 ± 100 B.P. The dates indicate a low sediment accumulation rate, of an average of 0.2 mm/yr. High sediment decomposition, obvious fires or some other factor may be responsible for such slow sediment accumulation.

The pollen analyses reflect increased agricultural and more intensive human

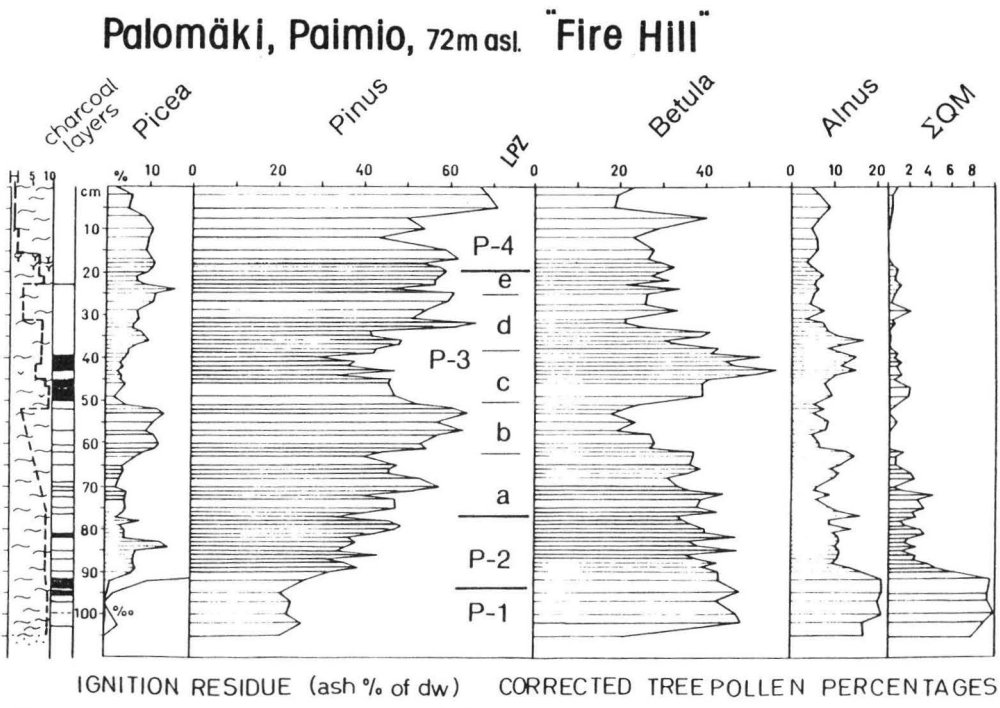

Fig. 4a. Relative tree pollen diagram from the Palomäki peat deposit. Column next to the stratigraphy shows the burnt horizons observed in the field. Local pollen phases (Tolonen 1984) are shown in the column for *Pinus*.

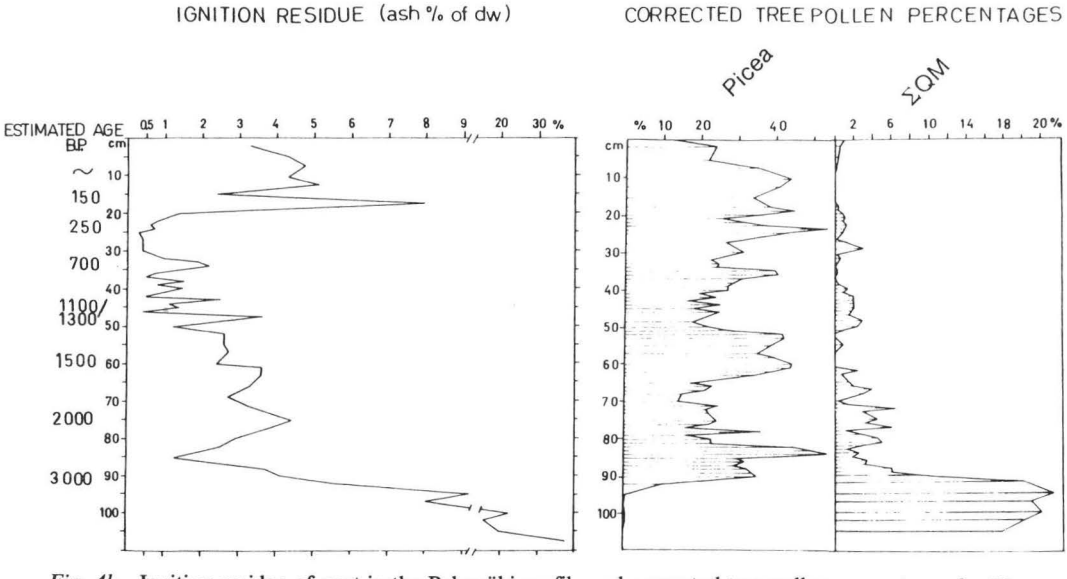

Fig. 4b. Ignition residue of peat in the Palomäki profile and corrected tree pollen percentages for *Picea* and QM. The recalculations are based on Donner's (1972) R values.

activity above the 85–90 cm level, estimated to date to the Younger Iron Age and Medieval Times. It is suggested that there was an expansion of human activity and hence an enlargement of cleared land at this time. It is concluded that crop growing, among which *Secale* was dominant, was extensive, as were slash-and-burn practices, based on the stratigraphy from the Preitilänsuo site.

The obvious and abrupt decrease in the frequencies of the cultural pollen types in the uppermost part of the diagram (ca. 30–20 cm level upwards) probably represents not only a general change in farming methods, but also a displacement of farming activity into lowland clayey river valleys elsewhere in the region, where it remains today (the establishment of the present fields).

The *Palomäki* (»Fire Hill») (60°25′N, 22°43′E, 72 m asl.) site provides an example of the utility of combined pollen and charcoal analyses for evidence of *local changes in vegetation*. The profile was collected from a small shallow bog, that is surrounded by sandy and gravelly upland hills and bare bedrock outcrops. Numerous charcoal horizons (Fig. 4) could be observed on the fresh core in the field, that might indicate the adaptibility of dry heath forests to fire. Thus, it was possible to differentiate local fires at the sampling site from those which occurred outside the basin from microscopic examination of charcoal and charred plant fragments.

The data spans c. 3500 years. Therefore, it is concluded that the forested area around the study site has varied considerably both in extent and composition in the past. A distinct QM decline is evident in the lowest part of the diagram, as well as is a contemporaneous rapid increase of *Picea*. Fires had only minor impact on forest before the expansion of spruce. The data shows that prior to 2000 years B.P., forest fires were primarily natural wild fires (the mean forest fire frequency being one fire every 80 to 85 years). However, after this time, fires were both natural ones, and fires caused by the spread of slash-and-burn practices in the area; the results require

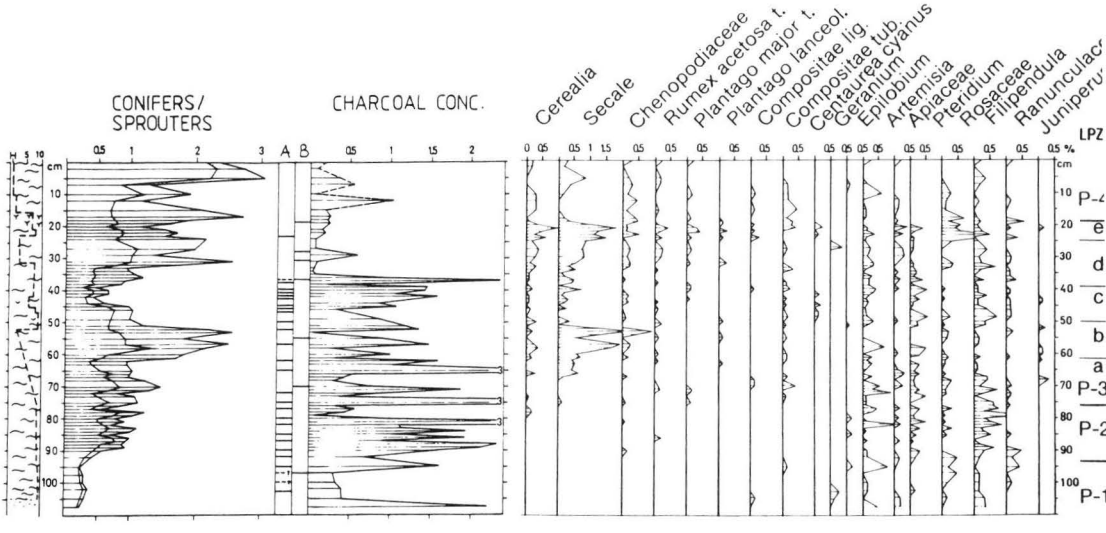

Fig. 5. Diagram showing conifer *(Picea, Pinus, Juniperus)*/sprouter *(Betula, Alnus, Populus, Poaceae, Pteridium, Epilobium, Rumex)* ratios and microscopic charcoal/pollen ratios at Palomäki. A) samples, from which it was concluded that fires occurred on the site *(in situ)* and B) levels where fires occurred outside the basin at a shorter or longer distance, as concluded from different charred plant fragments and charcoal pieces. To the right are shown relative pollen frequencies of selected herb species and pollen types suggesting local changes in vegetation. Calculation base is the sum of all pollen.

such complex interpretations (Tolonen, in press). Climatic and edaphic changes, species migration and competition, as well as wild and intentional fires, all influenced the development of vegetation. In the pollen diagram there appears three progressive stages attributed to human interference, viz. temporary slash-and-burn clearance (from about A.D. 300 – A.D. 700) in the vicinity of the site, intensive, continual slash-and-burn practice (from about A.D. 700/900–1500/1700) on the area, and predominantly arable cultivation (from about A.D. 1700–) farther from the site. This inferred time scale should be considered tentative at this time.

A pollen profile from the *Oinilanmäki* mire (66°27′N, 22°42′E, 56 m asl.) profile is comparable to the Palomäki site (Fig. 5). The Oinilanmäki study site is situated in a small, shallow depression bordered by rocky and gravelly upland soils. The lowermost zone in the pollen diagram corresponds to the Birch – alder – hazel – elm Zone. Radiocarbon dates are unavailable as yet for this profile, however, the rapid spread of spruce (P^+), provides an inferred date of about 3000 B.P. Paludification and *Sphagnum* growth at the site started before this time as a consequence of a fire (charcoal pieces above sand). The pollen and charcoal stratigraphy clearly correlates with the Palomäki results. The development of the two sites can be interpreted in terms of local vegetational phases, with the exception of the following characteristics:

– Pollen and charcoal data imply that human activity immediately at the study site was more discontinuous or less intensified or both at Oinilanmäki than at Palomäki. The relatively high frequencies of Cerealia pollen type as well as *Centaurea cyanus* for example, suggest that clearances and cultivation were carried out in the immediate vicinity. There is an example in the Oinilanmäki profile, where the frequent *Triticum* and *Hordeum* -type pollen grains form the dominant part of the pollen rain, when taking into consideration their poor pollen production. The results suggest that cultivation may have been practiced on the slopes of the hilly area bordering the northern side of the clayey Vähäjoki river valley. These results favour the interpretation that the clearings were possibly infields close to the Iron Age settlement site (Luoto 1984). Rye was the most common crop species on the soils that were slashed and burned (Soininen 1974, Vuorela 1975), as was apparent in the Palomäki and Preitilänsuo diagrams. These latter sites, in contrast to Oinilanmäki could have served as outfields. The Oinilanmäki results correlate well with the charred seeds and grains obtained by Seppä-Heikka (1984) from archaeological excavations dated to the Younger Roman Iron Age at a distance of 1200 m south of the pollen study site.

Some preliminary conclusions:

- The regional forest history inferred from this study follows the pattern characteristic of SW Finland.
- In particular, there was a retrogressive development in the forest during the last 3000 years, as a consequence of both climatic and edaphic reasons, as well as those due to human impact. Contemporaneously with the spread of *Picea*, deciduous broad-leaved trees (QM, most abundantly *Tilia* and *Corylus*) suffered a distinct reduction. Locally, human activity facilitated, likely in part, the opening of forests.
- Numerous forest fires favoured growth of *Sphagnum* on poor soils and oligotrophic mires.
- Short-term decreases in spruce, registered in every pollen diagram before the

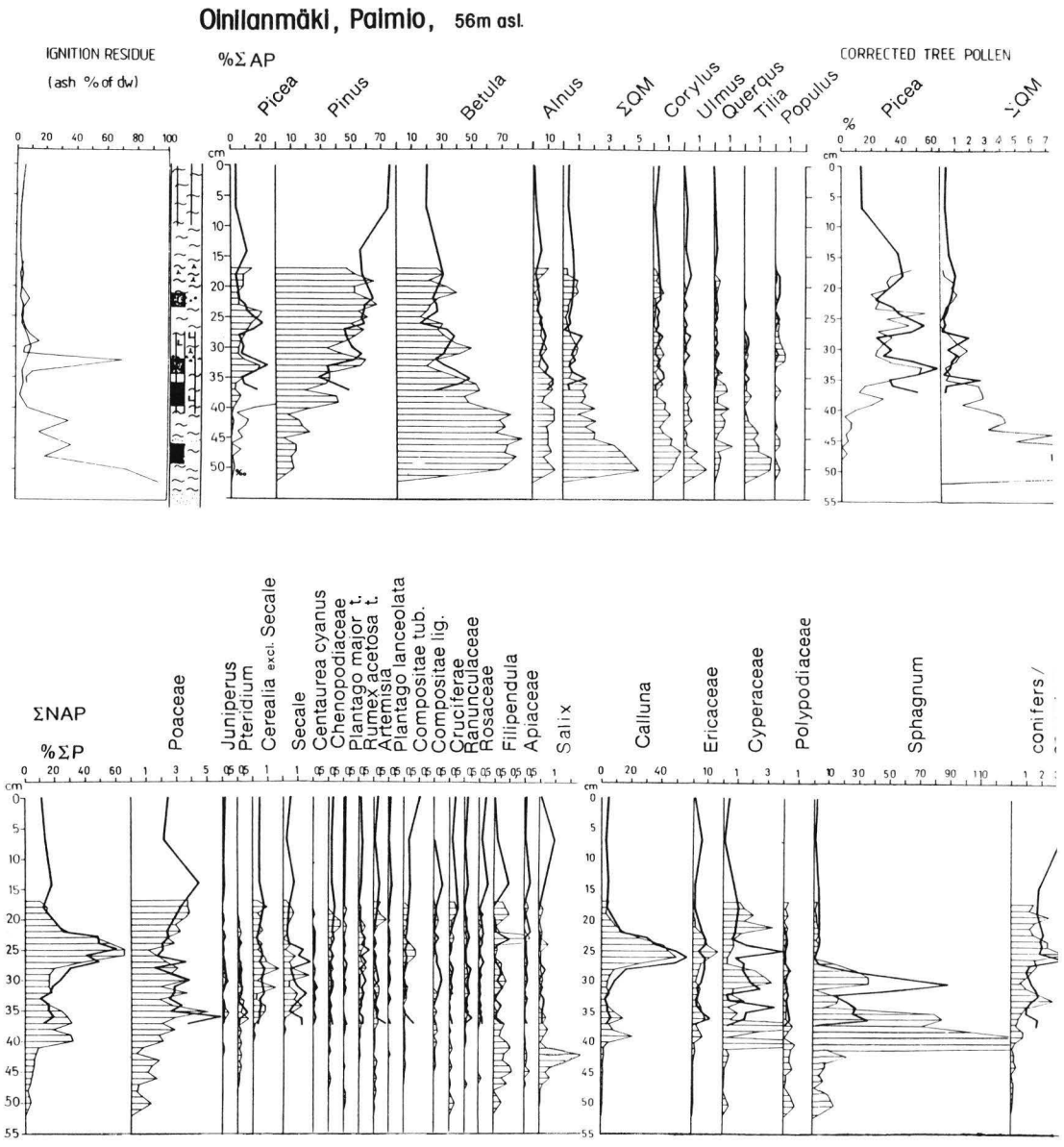

Fig. 6. Pollen diagram from the Oinilanmäki profile. For explanations see Fig. 4 and 5.

beginning of cereal cultivation, may often be due to increased human activity in the area.

- Cereal cultivation started at Pre-Roman Iron Age – Early Roman Iron Age.
- The mode of farming was possibly an infield – outfield system by slash-and-burn method, which caused great changes in the environment.
- In this study pollen analysis revealed only slight if any unequivocal evidence for cattle-grazing before farming.
- During the last two decades, the cultivation method has changed markedly as reflected strongly in the low pollen frequencies of cereals.

REFERENCES

Donner, J. 1971. Towards a stratigraphical division of the Finnish Quaternary. Soc. Sci. Fennica, Comm. Phys. – Math. 41, 281–305.

Donner, J. 1972. Pollen frequencies in the Flandrian sediments of Lake Vakojärvi, south Finland. Comment. Biol. 53, 1–19.

Glückert, G. 1976. Post-Glacial shore-level displacements of the Baltic in SW Finland. Ann. Acad. Sci. Fenn. Ser. A III 118, 92 pp.

Luoto, J. (in press).

Seppä-Heikka, M. 1985. Grains and seeds from Younger Roman Iron Age excavations in Spurila, Paimio.

Soininen, A. 1974. Vanha maataloutemme. Maatalous ja maatalousväestö Suomessa perinnäisen maatalouden loppukaudella 1720-luvulta 1870-luvulle. (Abstract: Old traditional agriculture in Finlan in the 18th and 19th centuries.) J. Scient. Agric. Soc. Finland 46 (Suppl.), 1–459.

Tolonen, K. 1983. Kuusen levinneisyyshistoriaa Suomessa. (Summary: The history of Norway spruce, Picea abies, in Finland.) Sorbifolia 14, 53–59.

Tolonen, M. 1984. Palaeocological records on local fire history from a peat deposit in SW Finland. Ann. Bot. Fennici 21 (4), in press.

Vuorela, T. 1975. Suomalainen kansankulttuuri. 776 pp. Helsinki.