POLLEN VALUES AND FIELD SIZE: AN EXPERIMENTAL EXAMPLE FROM HAILUOTO

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The island of Hailuoto, situated in the Gulf of Bothnia and lying some 8 km off the coast near the town of Oulu, represents an ideal control situation as far as pollen analysis is concerned. Its location off the west coast and in a position where winds are predominantly from the west ensures that the majority of the pollen, and particularly the non-arboreal pollen, deposited in the lakes and mires of the island originates from the island itself. At the same time being close to the centre of maximum isostatic uplift the size of the island has increased rapidly and is still increasing in a manner which can be followed with precision. At present it covers an area of just over 200 km^2. The existence of unique maps which show both the area of the island and the location and areal extent of the cultivated fields in 1766 and 1866 together with a wealth of documentary records of population, crop yields and animal husbandry going back to the mid 16th century enables the historical development of the island to be charted in detail. At this latitude and on the poor, predominantly sandy soils encountered the number of plant species is relatively few and their distribution is fairly closely related to edaphic conditions. Here then is a relatively simple but highly controlled situation which has nevertheless changed significantly with time.

An attempt is made to use this knowledge in the examination of pollen assemblages from the lake sediments and peat deposits of the island so as to obtain an idea of the pollen influx values for individual species or groups of species which can be deemed to be representative of particular vegetation communities, especially cultivated fields, in terms of areal extent, distance from sampling site etc. The aim is to establish precise numerical values for these known situations which can then be applied in the interpretation of undocumented situations in earlier periods. In establishing these values the evidence of modern pollen deposition as recorded by pollen traps situated within different vegetation communities on the island is invaluable.

The results presented here are highly preliminary and are given only to illustrate the possible lines of approach. Detailed pollen diagrams and trap results will be published later. A skeleton diagram from Patelanselkä, which is in the southern part of the present day settlement and not too far from the earliest fields, has been counted. The sediment consists of a silty gyttja which some 500 years ago was being deposited in open sea and at present is accumulating in a shallow, almost completely overgrown lake. The diagram has features, particularly in the pollen curves for cereals and those species associated with cultivation and in the Gramineae curve, which allow the dramatic increase in fields and cereal cultivation of the mid 18th century and the change in emphasis from cereal cultivation to hay production of 1930's—1940's to be located. If these two horizons are really of the dates mentioned (at present there is no independent dating control) then it can be calculated that the rate of sediment accumulation was on average 2 mm per year up until the early 20th century after which it rose to 2.8 mm per year. If these estimated rates of sedimentation are correct then pollen influx values for AP and total P in subrecent times are in the region of 4500 and 6800 grains cm^{-2} $year^{-1}$ respectively (Table 1).

A check on the feasibility of these figures can be made by looking at the pollen influx at the present time. It is true that the pollen traps used record pollen deposition on land and the pollen in the core has been deposited under water so that the situations are not entirely comparable but even so a good guide to the magnitude of pollen deposition can be obtained. Values from three different pollen traps situated in long established pine forest with a little spruce (H17), in amongst fields used predominantly for barley (H18) and at the shore in a dense *Phragmites-Scirpus* swamp (H19), are available for the years 1980—83. (Not all sites have values for all three years).

The trap values show immediately a strongly local influence. Each trap has highly characteristic values and the three can easily be distinguished from each other. A comparison between the trap assemblages and the assemblages from the mineral core shows that the mineral sediment is receiving pollen from all vegetation types i.e. the pollen values reflect the general situation in the area surrounding the water body. It is possible to say, and this has been noted elsewhere (Hicks 1985 in press), that the AP types are represented fairly uniformly in the sediments virtually wherever they are sampled thus giving a good picture of the regional situation but that the NAP types are deposited much more locally and as soon as the sampling site is any distance at all from the particular community in question then NAP values fall to a minimum.

If a mean value is calculated for the three traps for the one year for which values are available at all sites, 1981—82, values of 4 000 AP and 12 000 total P are obtained (Table 1). The AP values come close to that obtained from the sediment which gives credibility to the estimated rate of sedimentation and therefore also to the dating of the pollen diagram. The differences between the influx data for the traps and for the sediment can be explained as follows: — The higher *Picea* value in the sediment reflects (i) that the sediment sample covers more than one year and (ii) that spruce does not flower every year - - - the trap values are for a poor flowering year. The higher *Alnus* values in the sediment reflect the fact that alder is much more common around the shores of Patelanselkä than it is near the traps. The values for Cerealia and Gramineae are much higher in the traps than they are in the sediment and this reflects the highly local nature of NAP deposition. The sediment sampling site is situated too far from the fields and shore meadows to record their characteristic high NAP values.

Given that the material presented here is only preliminary it is impossible to draw

Table 1. Pollen influx cm^{-2} $year^{-1}$.

	Σ P	Σ AP	Betula	Pinus	Picea	Alnus	Cerealia	Gramineae
Patelanselkä 5 cms depth (c. 1962—66)	6 826	4 556	1 819	2 073	169	454	28	776
Mean for traps H17, H18 and H19 1981—82	11 916	3 999	1 311	2 526	19	144	982	2 534

Table 2.

Historical records		Pollen influx cm^{-2} year^{-1}
late 19th century		25 cms depth
total field area, 700 hectares		Secale 50
distance from sampling site to	represented in the	Hordeum 50
nearest fields 400—700 m	rapidly	Avena 17
cereal production	accumulating	Plants of cultivated
rye 3300 litres	sediment of the	land 167
bartey 5750 »	water body by	Cramineae 1104
oats 75 »		

detailed conclusions at this stage. Within these limits, though, tentative suggestions of the following type can be made. If just one point, the period of maximum cereal production in the late 19th century, is taken as an example then the relationship between the historical and pollen evidence is as set out in Table 2. With closer sampling of additional profiles (peat as well as lake sediments) from the immediate vicinity of the settlement area, with a higher pollen sum and critical identification of indicator pollen types, and with modern pollen rain values for the wider range of vegetation represented on the island and over a longer period, it should be possible to minimize the number of uncertainties and arrive at actual numerical values for different situations at different points in time.

REFERENCES

Hicks, S. 1985. Modern pollen deposition records from Kuusamo, Finland. Part II. The establishment of pollen vegetation analogues. Grana. In press.