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Pollen Analytical Evidence for Iron Age Agriculture in Hälsingland, Central Sweden

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Abstract

Pollen analyses were made of peat and lake sediment samples from sites in the vicinity of Iron Age settlements in Hälsingland, Central Sweden. The results indicate that an agricultural economy based on animal husbandry and cereal production started there about 400 BC and continued for about a millennium. The marked decline about 500 AD continued until the early Medieval Period, about 1100 AD.

Introduction

Archaeological investigations carried out in Central Norrland during the last few years have revealed numerous prehistoric sedentary settlements (Baudou 1981; Liedgren 1981, 1984; Ramqvist 1983). In the coastal part of Hälsingland the remains of more than 200 house foundations have been discovered. All of them are considered to belong to the Roman or Migration Periods (1–500 AD). So far no house sites from any other Iron Age Periods have been found in that region except a Viking Period settlement at Björka (Broberg 1983). Excavations of Iron Age graves have yielded similar results. Both the Roman and Migration Periods are times of extensive settlement compared to the Late Iron Age (500–1050 AD), the Celtic Iron Age being hardly represented at all in the archaeological material. The regression at the beginning of the Late Iron Age, found over a wide area of Scandinavia, is also quite clearly seen in the archaeological evidence from Central Norrland.

To investigate to what extent the practices of agriculture and stock-breeding were involved during the above periods pollen analyses were made of samples of lake sediments and peats from sites situated close to Iron Age settlements, both in the more central, densely settled areas and in the more marginal parts. To gain a picture of the local vegetational development around the settlements, small drainage basins were selected for these investigations.

The possibilities of identifying and quantifying the different types of agricultural economy pollen analytically are very restricted. Since very few of the main crop species are wind-pollinated, the pollen production from arable fields is greatly underrepresented, compared to that from meadows and pastures. The proportional representation of the pollen of crop plants and of grassland plants is, furthermore, conditioned by the particular respective situations of the cropped fields, meadows and pastures in relation to the depositional basin to a greater extent than by the differences in their pollen production. Nevertheless, as a method for detecting the occurrence of agriculture in an area and following the relative changes in farming practices throughout time, pollen analysis is a useful tool.

The settlement economy

Important information about the nature of the agrarian economy is obtainable from a study of the biological remains found during the excavations of the foundations of houses from the Roman and Migration Periods. Bones of domestic animals are dominant (cattle, sheep/goat, pig and horse), compared to those of wild animals (M. Backe, pers. com.). The plant remains, too, indicate the importance of animal husbandry. Wet-meadow plants, mostly sedges, form a substantial part of the seeds recovered from post-holes (Wennberg 1980, Engelmark 1985).

The main crop grown was barley, which was cultivated on well-worked and manured fields. Rye and oats were secondary crops. Flax and hemp may have been locally important for textile production.

Because the vegetation of the drier meadows and pastures is largely composed of wind-pollinated plants, such plant communities are often well represented in pollen diagrams. Hay-making, on natural wet meadows is scarcely detectable in pollen diagrams. The crops were probably usually threshed indoors, but in a cross-draught, whereby any pollen grains retained in the

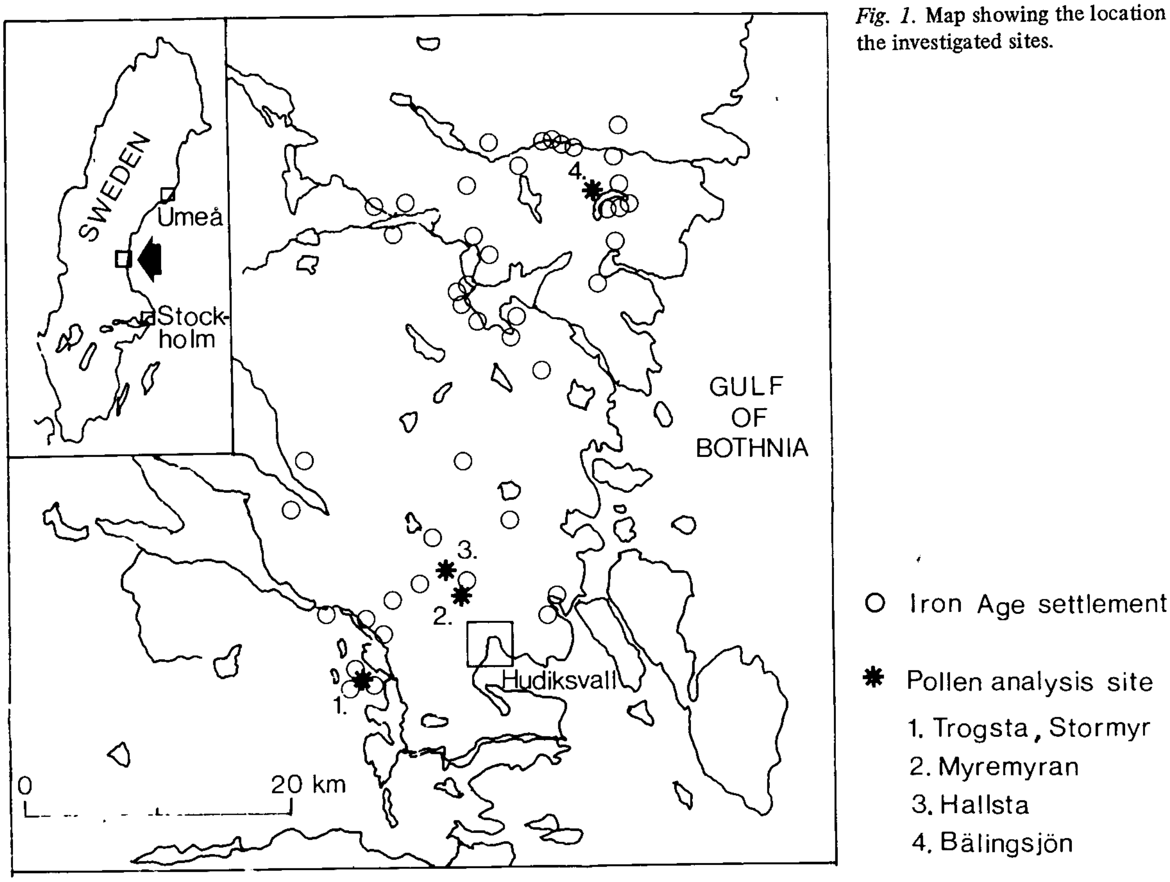


Fig. 1. Map showing the location of the investigated sites.

husks would be released and spread by the wind. Indications of crop cultivation and of stock-breeding may thus be found in pollen diagrams from settlement sites, but their relative importance in the local economy is certainly not predictable from pollen diagrams alone. Too many unknown and unmeasurable factors affect pollen dispersal and deposition. However, the two types of economy must be kept in some specific relationship to each other, since enough manure must be produced to fertilize the crop fields, and enough winter fodder must be obtained for the animals. In the type of climate and environment prevailing in Central Norrland the energy and nutrient flow involved in agrarian production have always needed to be kept in balance.

Methods

Both peat and sediment samples were obtained with a Russian peat corer (Moore & Webb 1978). Slide preparation for the pollen analyses followed standard methods (Assarsson & Granlund 1924, Erdtman 1934). Relative pollen counts were made on safranin-stained, glycerin-mounted pollenslides. Between 500 and 1000 arboreal pollen grains were counted at each level. The vertical sample density varied (2.5–20 cm interval), depending on the importance attached to any particular sequence of samples. The results are presented both as customary and modified diagrams. The pollen types were divided into four categories, (*a*) arboreal pollen, (*b*) pollen from plants indicative of agriculture, (*c*) pollen produced by the local vegetation, and (*d*) spores. The frequencies of each pollen or spore type in categories (*b*), (*c*) and (*d*) have been calculated as a percentage of the sum of (*a*) and the pollen type in question. In the modified diagrams the curves for spruce, for the sum of (*b*) (excluding cerealia) and for cereals are presented separately (calculated as above) in order to show more clearly the effect of human impact on the vegetation and to facilitate comparisons of the diagrams from the different sites. Organic matter and mineral contents of the samples from Lake Bälingsjö were determined by ashing at 550°C for four hours. The mineral content

Table 1. C-14 datings.

Local		Depth	δC-13 %	Age BP corrected for δC-13
Hallsta	St 9712	45.0–47.5	–26.1 ±0.5	1475 ±85
	St 9713	97.5–100.0	–25.3 ±0.5	2065 ±85
	St 9714	142.5–145.0	–24.7 ±0.5	2320 ±120
Bälingsjön	St 9321	35.0–37.5	–30.9 ±0.5	1440 ±160
	St 9322	52.5–55.0	–31.5 ±0.5	1715 ±155
	St 9323	65.0–67.5	–30.3 ±0.5	1870 ±265
Hög	St 8459	155.0–160.0	–26.4 ±0.5	830 ±165
	St 8458	215.0–220.0	–25.7 ±0.5	1495 ±85
	St 8457	360.0–365.0	–26.9 ±0.5	2795 ±150
Trogsta	U 4248	110.0–115.0	–24.7	1610 ±90
	U 4249	130.0–135.0	–24.7	1845 ±75

results are presented (as percentage dry wt.) in the main Bälingsjö diagram.

Dating

Dating of changes visible in the pollen diagrams are mainly based on C-14 dates (Tab. 1). The time of isolation of each basin from the Gulf of Bothnia has been determined on a basis of the land-rise curves (Lundqvist 1963). In the case of the peat bogs, the radiocarbon dates are considered to be reliable. Only the date obtained for the basal sediment sample from Lake Bälingsjö has been taken into account, since this pre-dates the start of surface erosion from the surrounding slopes. The run-off afterwards would, necessarily in this area, contain a considerable proportion of older organic matter, including charcoal, and the sediment samples would therefore have yielded C-14 dates which were too old. The natural breakdown rate of organic matter in this area is extremely slow, and the mor humus also contains charcoal fragments derived from earlier forest fires.

All the C-14 dates have been corrected to allow for the deviation due to C-13. No calibration to allow for the variation in the C-14/C-12 ratio has been done, since this was minimal during the time-span of interest in the present investigation.

The sites

Trogsta Stormyr, Forsa parish

The sampling site chosen for pollen analysis lies about 500 m SE of the prehistoric site of Trogsta (No. 71, Forsa sn). House foundations and graves from Roman and Migration Periods have been excavated from 1978 onwards by the Department of Archaeology at Umeå University (Westfal 1978, Baudou 1981, Liedgren 1981). Five houses and twelve graves constitute the settlement. The carbonized seeds recovered from two of the houses have been studied (Wennberg 1980, Engelmark 1985).

The pollen samples were taken from a small peat bog, Stormyren, the former extent of which has been reduced by peat cutting and drainage during the past hundred years. The central bog surface is still intact, however, with the wetter areas covered by ombrotrophic mosses. Pines (*Pinus sylvestris*) and ericaceous dwarf-shrubs cover the marginal, drained areas.

The forest surrounding the bog is predominantly composed of pine, with some spruce (*Picea abies*) in the lower-lying parts. Birch (*Betula pubescens*), aspen (*Populus tremula*) and sallow (*Salix caprea*) border the present-day fields. The Trogstaån valley and the slopes running down to the Kyrksjön lake are cultivated.

The Stormyren basin lies about 50 m above s. l. and became isolated from the Gulf of Bothnia in the middle of the Subboreal period (*c.* 2500 BC). The basin existed as a lake up to 300 AD, before becoming naturally filled in and transformed into a peat bog.

The pollen diagram starts in the middle of the Subboreal period at the time of the isolation from the Gulf of Bothnia. Only a part of this period is presented in the diagram. Deciduous trees are predominant, and even thermophilous trees, such as elm (*Ulmus*), hazel (*Corylus*) and lime (*Tilia*), were an important component in the forests.

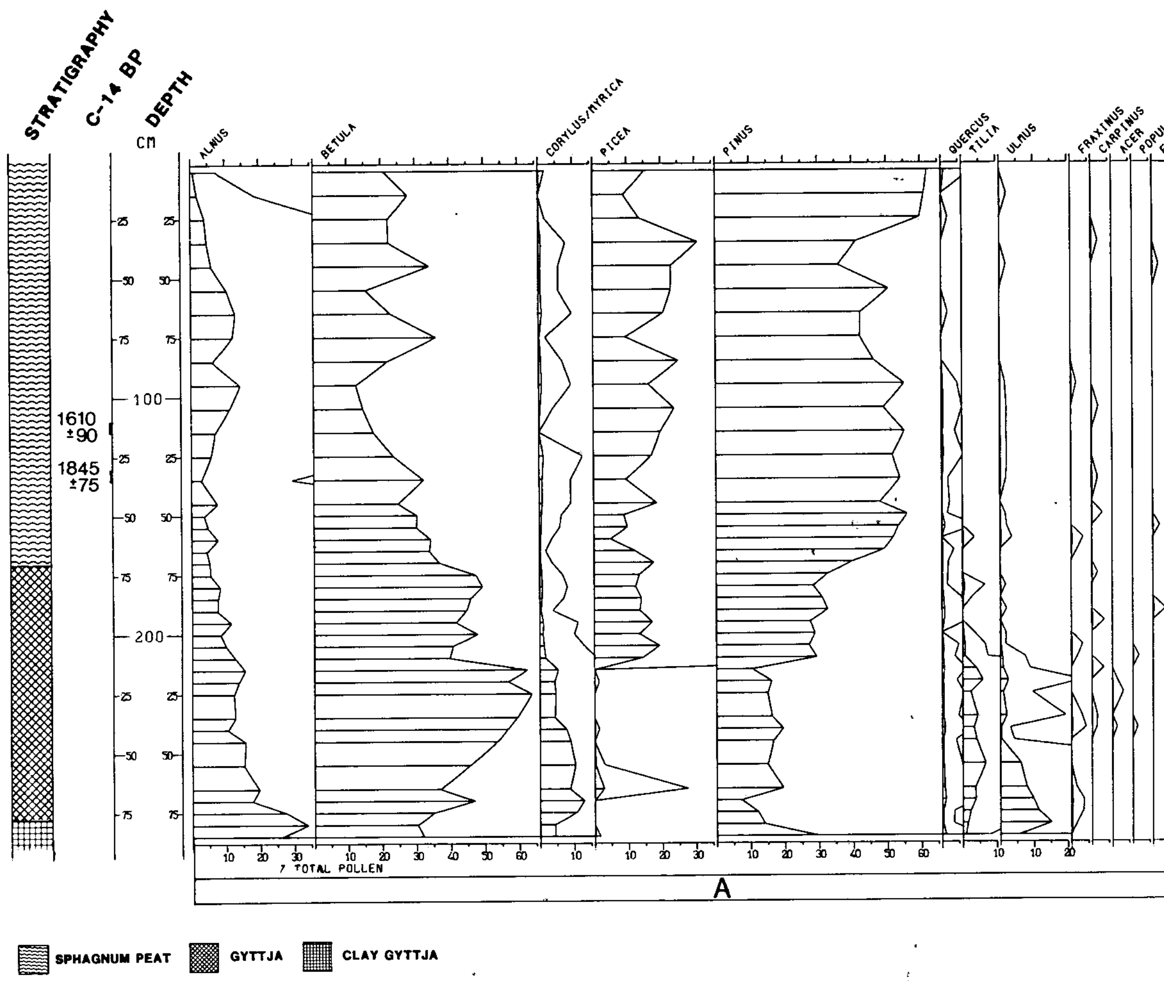


Fig. 2. Pollen diagram from Trogsta Stormyr, Forsa parish.

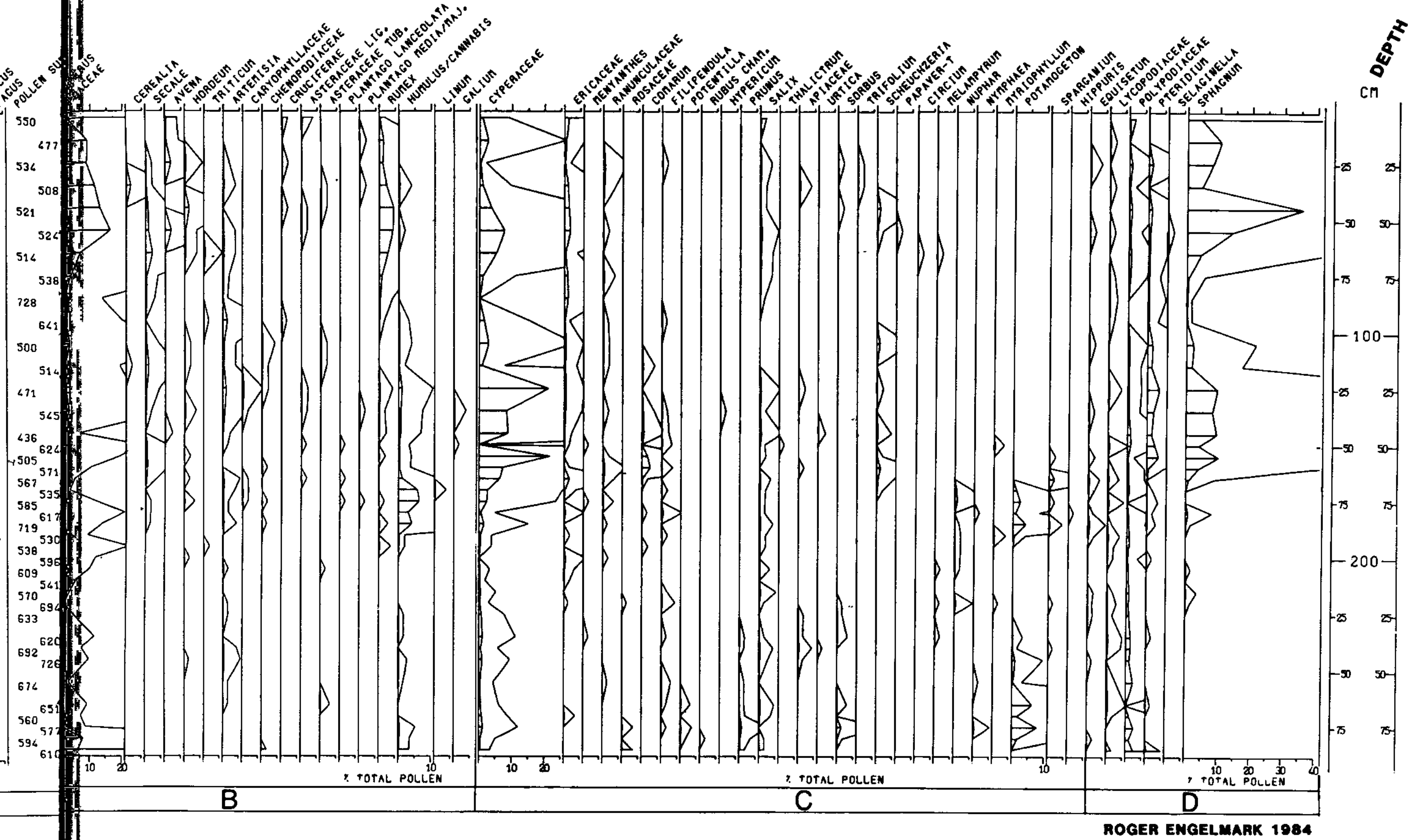
Unfortunately, sedimentation disturbance has led to a hiatus in the sediment succession during the Bronze Age and Early Iron Age (about 1500 BC to 1 AD). From *c.* 1 AD onwards, sedimentation is continuous once more, but the forest is now dominated by coniferous trees.

Because of the sedimentation hiatus nothing can be said about human influence in the area until the Roman Iron Age, but the presence of cereal pollen grains and pollen of grassland plants then indicate that at that time certain areas around the bog were utilized for farming. The bog was furthermore used for the retting of hemp and flax during the Roman Iron Age which explains why the pollen of these plants are overrepresented in the pollen diagram. A decrease in human influence occurs during the Late Iron Age (about 500–1000 AD), followed by a renewal in early historical time (about 1100 AD).

Myremyran, Hälsingtuna parish

The fen occupies an infilled kettle-hole on the south side of the Hallstaåsen, an esker running NW–SE. Along most of the esker slope facing the fen there are sand-pit workings. South of the fen a valley runs parallel to the esker. The valley is cultivated ground today, but according to early historical records it was formerly used as meadows and pastures. It is cut off from the main Hornån river valley by a morainic ridge, Klockarberget.

The sandy and gravelly soils on the esker Hallstaåsen are covered by pine forests, with cowberry (*Vaccinium uva-ursi*), heather (*Calluna vulgaris*), crowberry (*Empetrum hermaphroditum*), and lichens forming the field layer. In depressions, and along the valley slopes, spruce predominates with a field layer of bilberry (*Vaccinium myrtillus*) and woodland mosses. The fen is at present in a transitional stage to



a sphagnum bog, with few fen species remaining. It is surrounded by a weakly-developed lagg, bordered by alder and willow scrub.

Several gravefields are situated around the sampling site, the largest one, with 16 mounds and stone settings, lying about 50 m W of the fen. None of them have yet been excavated, but the gravefield is considered to date from the Roman and Migration Periods (Halén 1985). The area about 1 km SW of Myremyran, along the southern slope of the hill Klockarberget and around the parish church, is extraordinarily rich in ancient monuments.

The fen surface is now about 30 m above s. l. The fen became isolated from the Gulf of Bothnia around 3000 BP and remained as an openwater lake for a few hundred years afterwards, with a flora of water-lilies (*Nymphaea*) and pondweeds (*Potamogeton* spp.). The spruce spread in this area has been C-14 dated to 2800 BP, but it never attained any great importance in the surrounding forests, perhaps because the patches of suitable soils were used for agriculture and grazing, thus actively preventing spruce colonization. About 2000 BP the lake basin had become filled with *gyttja* and the open-water obliterated by peat-forming mosses and by sedges. The local thickets of alder and birch around the lake shores degenerated, resulting in a spurious increase in pine pollen. The vegetation around the site was strongly influenced by man from about 400 BC onwards, and since the fen covers only a small area (about 50× 100 m) the pollen diagram is only representative of the local vegetation. The curves for both cereal pollen and grassland pollen are relatively high during the Early Iron Age, indicating that the settlements and cultivated fields lay close to the fen. More convincing still is the occurrence of occasional seeds of arable weed species in the upper

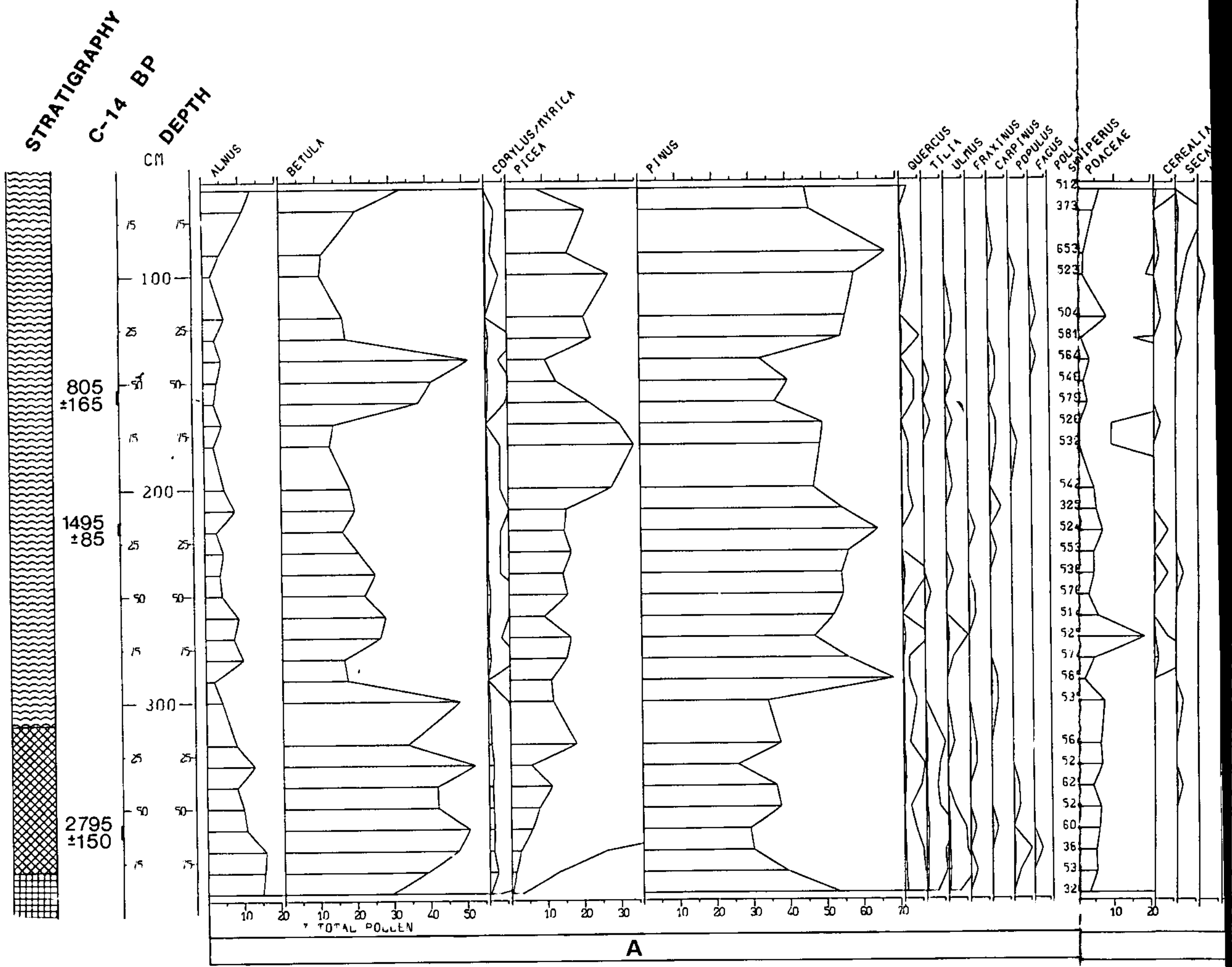


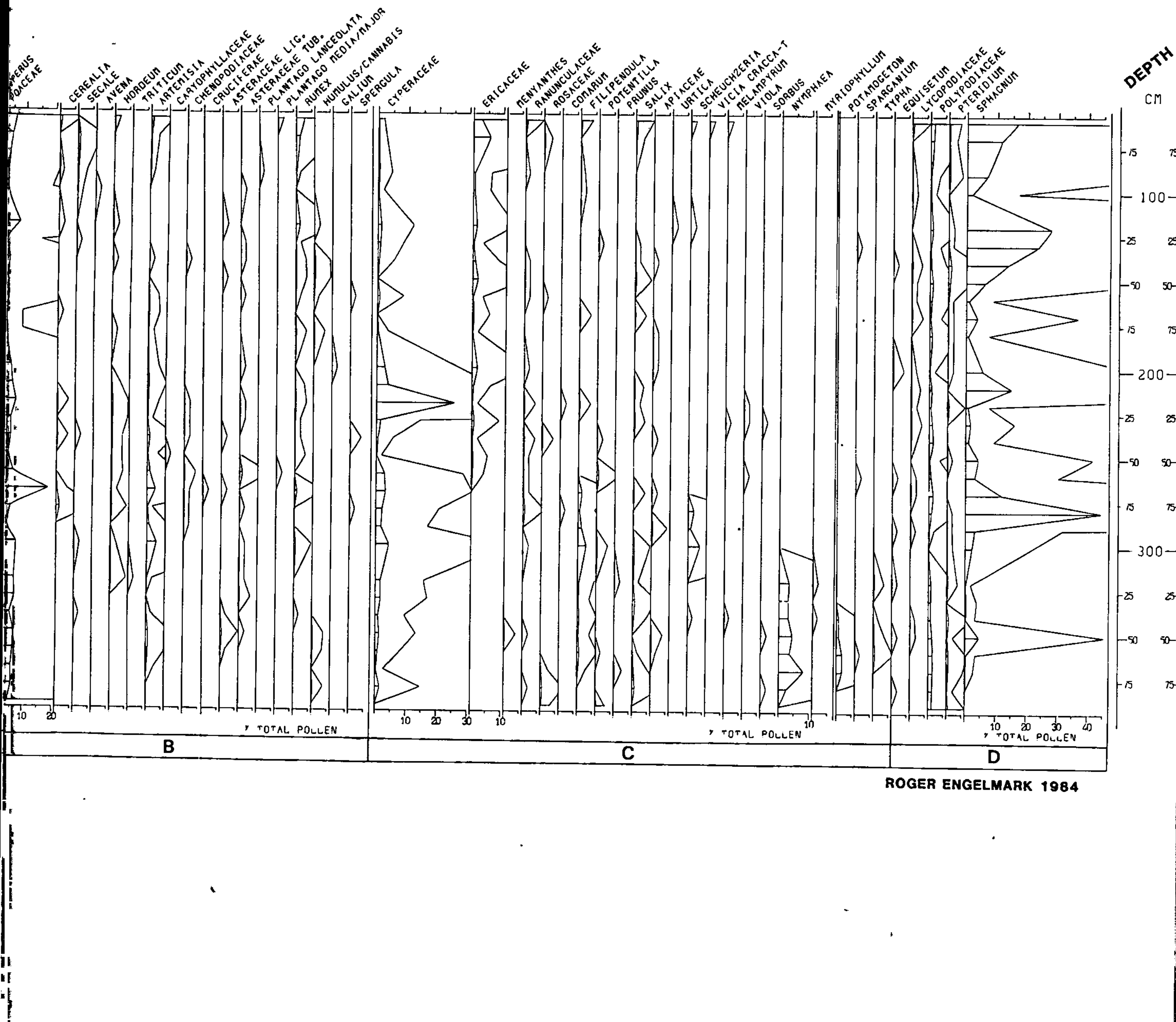
Fig. 3. Pollen diagram from Myremyran, Hälsingtuna parish.

gyttja samples, viz. 2 seeds of field penny-cress (*Thlaspi arvense*) and 1 of shepherds-purse (*Capsella bursa-pastoris*) at about 310 cm depth. Apart from peaks in cereal and grassland pollen curves about 1 AD, there are no indications of any changes in agricultural practice during the Early Iron Age.

About 500 AD the area around Myremyran was abandoned for agricultural purposes and spruce expanded in the area. First in Early Medival Time (*c.* 1100 AD) did the area once again become utilised, and then probably mainly for grazing and hay-making.

Hallsta, Hälsingtuna parish

The site is a bog north of the esker Hallstaåsen, 750 m NW of Myremyran in Hög. The Hallstaån river valley runs parallel to the esker on the northern side of the bog. The valley is now cultivated land. The bog and the N slope of the esker Hallstaåsen are mainly covered with pine woods. The field-layer on the bog is dominated by bog myrtle (*Ledum palustre*) and bog bilberry (*Vaccinium uliginosum*). The bog has been drained to allow peat cutting to take place on the northern parts.



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On the opposite valley slope, less than 600 m away from the bog, there are three farm-steads, all with *sta*-names (Knösta, Narsta and Hallsta), as well as several Iron Age gravefields.

During the Bronze Age the Hallstaån river valley formed a narrow off bay of the Gulf of Bothnia. The bog, now lying at 30 m above s. l., became isolated from the sea at the end of the Bronze Age (about 3000 BP) and remained as a shallow freshwater basin for a few hundred years, with an openwater flora. At the transition to the Iron Age the lake became overgrown with bulrushes (*Typha latifolia*), sedges (*Carex* spp.) and finally peat-forming mosses. About 2000 BP the bog surface was dry enough for pine to colonize.

Human influence on the area started about 400 BC. This is represented in the pollen diagram by the occurrence of cereal, weed and grassland plant pollen, indicating that both crop production and animal husbandry were carried out. In the Roman Iron Age, unfortunately, pine pollen is so heavily overrepresented, from local sources, that the other pollen curves are grossly distorted. This pollen diagram is consequently

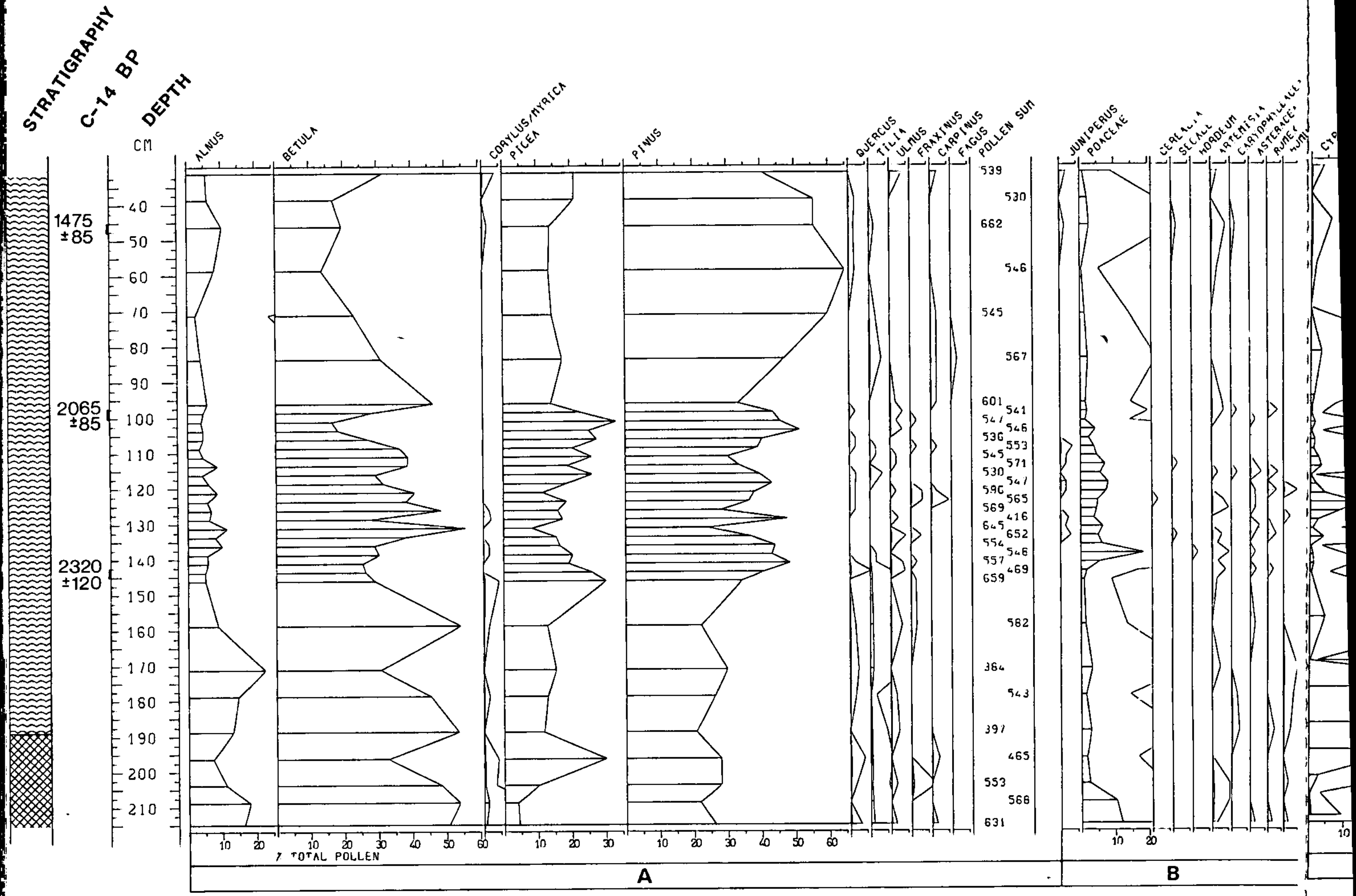


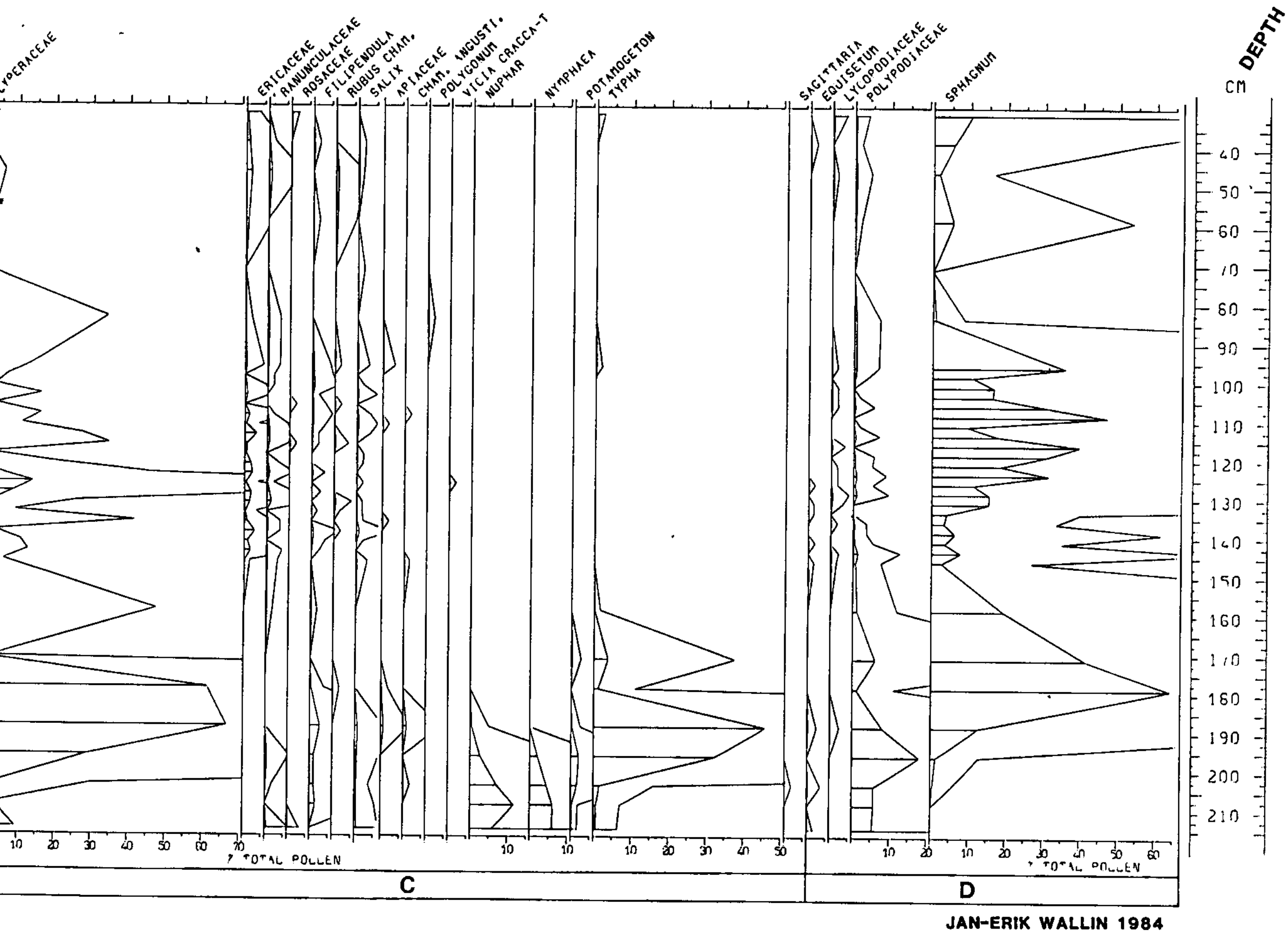
Fig. 4. Pollen diagram from Hallsta, Hälsingtuna parish.

unsuitable for any interpretation of the agriculture carried out during the Roman and Migration Periods.

Bälingsjön, Jättendal parish

Bälingsjön is a shallow lake (about 1.5 m deep) with a water surface of about 88 ha and a drainage area of about 1500 ha. The silty soils around the lake are cultivated and the hills are covered with a mixed pine-spruce forest. Alder (*Alnus incana*) grows along the lake shores and on the sides of the small drainage stream. Ten prehistoric settlements have been discovered on the eastern and northern sides of the lake. These take the form of house foundations and single grave mounds (Liedgren 1984). One of the houses has been C-14 dated to the Roman Period. The medieval and present-day hamlet of Bäling is situated on the western side of the lake. Only a few summer shielings (*fäbodar*) existed on the eastern side up to the time of the recent colonization in the 19th century. Grave mounds found within Bäling hamlet itself indicate that Iron Age settlements also existed on that side of the lake. One of these graves was destroyed in 1860 and the grave goods then found indicate a Late Roman Period date (Ekholm 1955). The Bälingsjön area is separated from the two main areas of cultivation, the parish centres of Gnarp to the north and Jättendal to the south, by about two km of forest.

The lake lies at about 45 m above s. l. and became



isolated from the Gulf of Bothnia about 4000 BP. During first two millennia after its isolation the lake had a rather poor and sparse aquatic vegetation. Subsequent human activity led to an increase in the influx of nutrients and mineral matter. The former was favourable for the aquatic plants. The increased mineral content, due to increased erosion of the surrounding slopes, led to a marked increase in quillwort (*Isoetes*).

The first indications of agriculture are dated to 2000 BP. The increase in the pollen of pasture plants, e.g. grasses and juniper, is particularly noticeable. Since very few cereal pollen and weed pollen were found, crop cultivation may have been far less important than animal husbandry in the local economy. The increased influx of mineral matter may have resulted from field cultivation, but were arable land the site of erosion then some inwash of cereal and weed pollen would perhaps have been expected at the same time. The spruce curve is low during Roman and Migration Periods, the silty soils around the lake occupied by spruce were obviously cleared by man. After several centuries of settlement the spruce curve rises again and the curve for pollen of grassland plants falls as does the mineral content of the lake sediment. These changes are provisionally dated to 500 AD by means of sedimentation rate. Human impact on the Bälingsjön area remains very insignificant for some time afterwards, until renewed agricultural exploitation starts, probably in the Early Medieval Period.

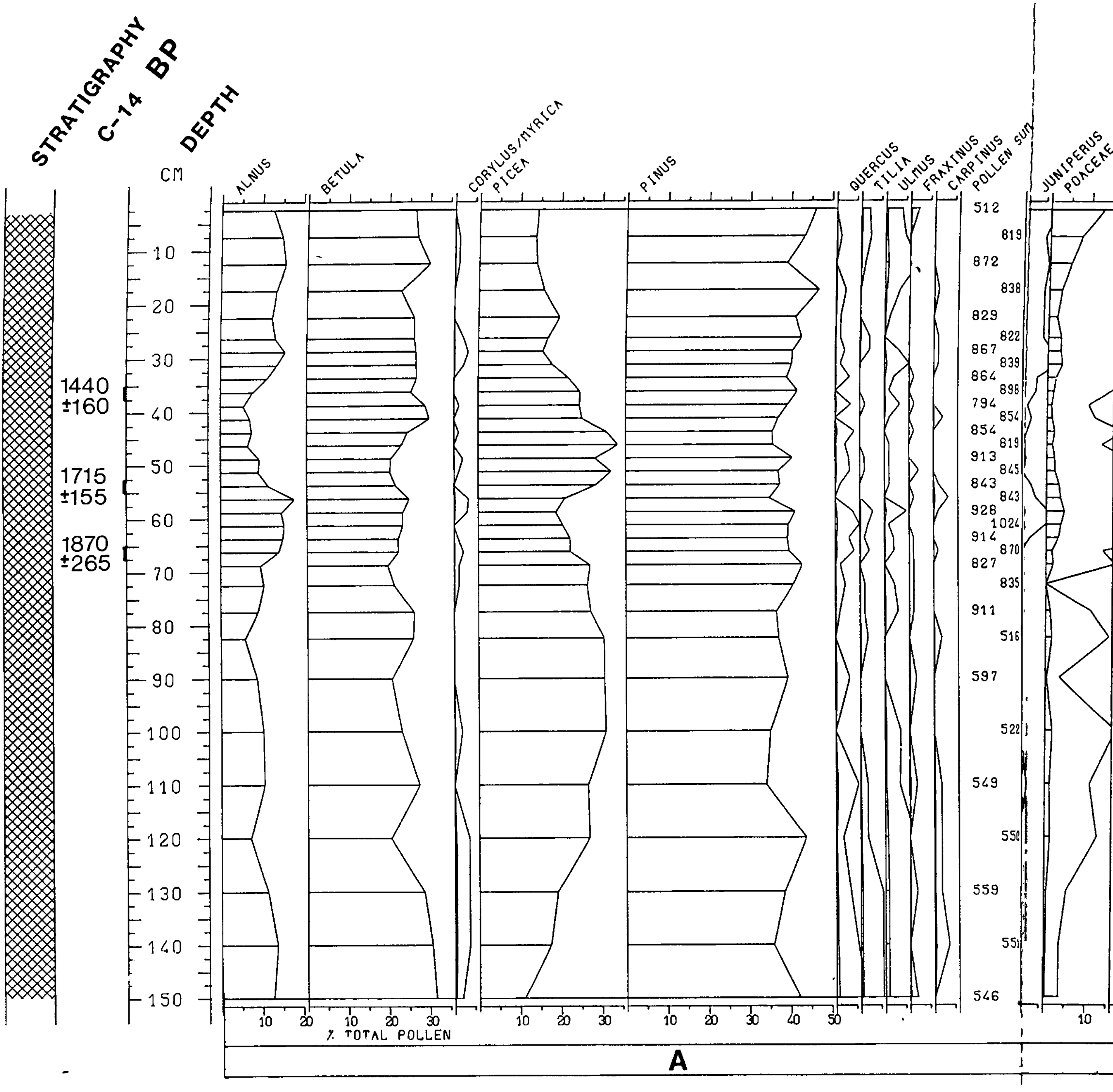
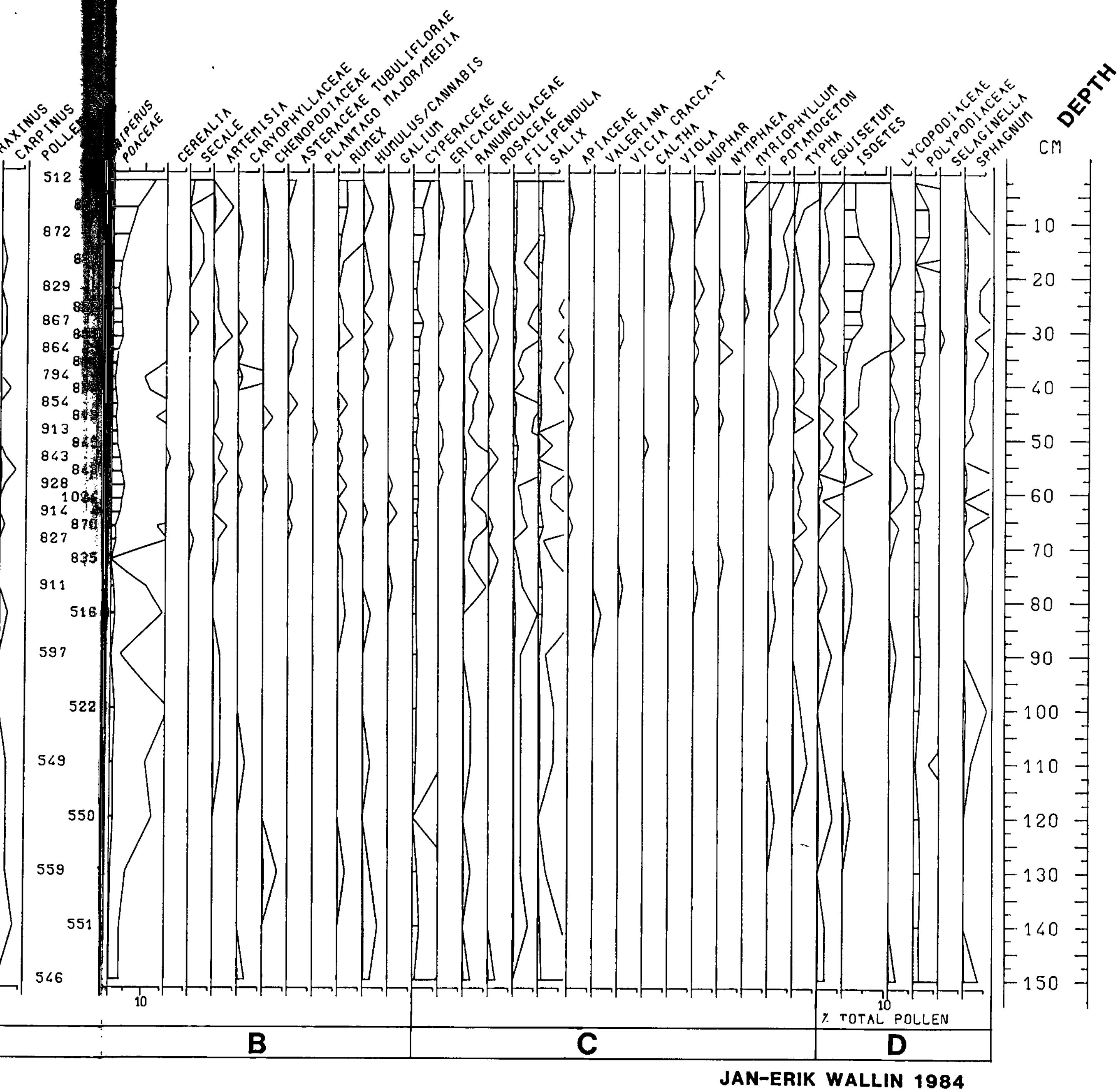


Fig. 5. Pollen diagram from Lake Bälingsjön, Jättendal parish.


CARPINUS
POLLEN
POACEAE
CEREALIA
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ARTEMISIA
CARYOPHYLLACEAE
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ASTERACEAE TUBULIFLORAE
PLANTAGO MAJOR/MEDIA
RUMEX
HUMULUS/CANNABIS
GALIUM
CYPERACEAE
ERICACEAE
RANUNCULACEAE
ROSACEAE
FILIPENDULA
SALIX
APIACEAE
VALERIANA
VICIA CRACCA-T
CALTHA
VIOLA
NUPHAR
NYMPHAEA
MYRIOPHYLLUM
POTAMOGETON
TYPHA
EQUISETUM
ISOETES
LYCOPODIACEAE
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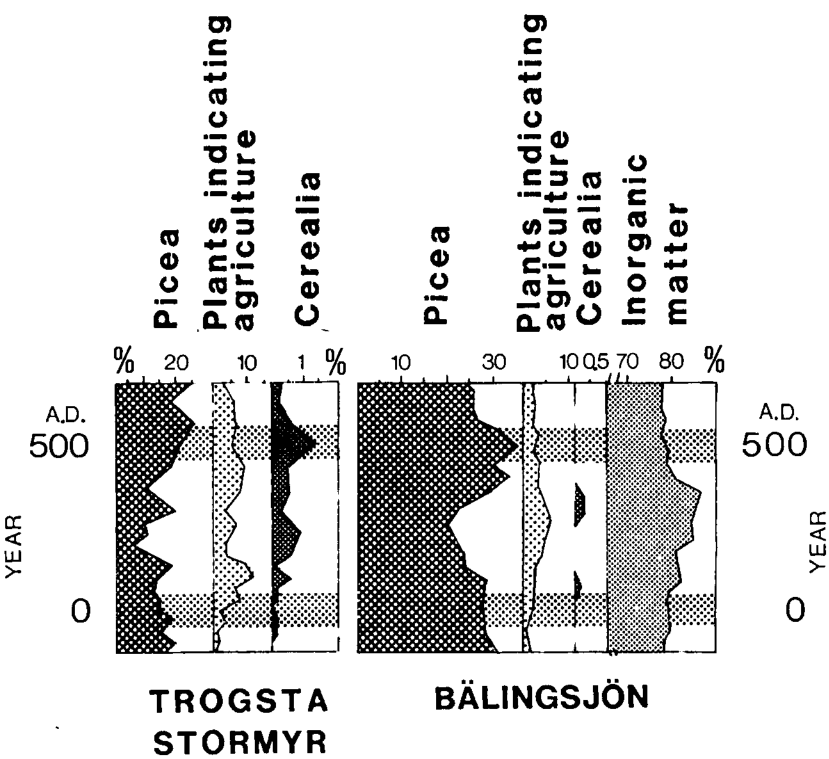


Fig. 6. Modified pollen diagrams from Trogsta Stormyr and Lake Bälingsjön.

Regional development of the vegetation

None of the diagrams provide a true regional representation of the vegetational history of the area. The bog diagrams are strongly influenced by the local vegetation, both at Trogsta and Hallsta, the bog surface itself was colonized by pine. The lake site Bälingsjön is the most suitable since it has quite extensive surface area for pollen catchment and the only local disturbance will have been from the alder thickets along the lake shores. Because of the special aims of the investigation, only the Iron Age Periods of the diagrams have been carefully prepared.

Forest composition did not apparently change much during the Iron Age on account of climatic fluctuations. Pine was dominant, with rather stable values, throughout the period. Spruce had become established on the more favourable, moisture-retaining soils. The fluctuations in its pollen values bear some relation to the human impact with depressed pollen curves during periods of intense agriculture. Farmers would tend to clear the spruce forest areas as indicative of good arable soil.

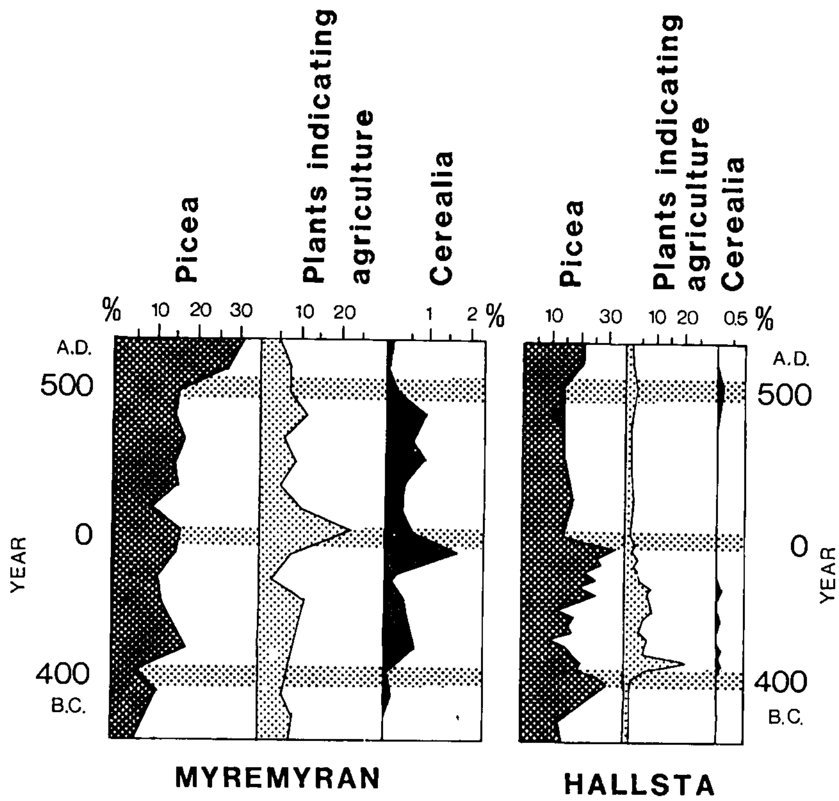
Indications of agriculture

In the two pollen diagrams from the sites close to the more closely settled rural districts of today (Myremyran and Hallstamyren) Iron Age agriculture begins about 400 BC. There are no indications of any cereal growing or animal husbandry having occurred there in the Bronze Age. The pollen curves of both cereals and grassland plants are at the same time indicating that the farming economy was based both on cultivation and grazing during the Celtic Iron Age as it was during the Roman and Migration Periods.

The Bälingsjön area was first colonized about 1 AD, and the Trogsta area at least no later than that date.

During the Early Iron Age, the courses of the pollen curves for cereals, weeds and grassland plants usually fluctuate in much the same way. The magnitude of this variation could lie within the normal range for pollen analytical uncertainty but might also be a reflection of quantitative changes in farm production. The relationship between cropping and stock farming (cereal pollen curve/grassland pollen curve)

Fig. 7. Modified pollen diagrams from Myremyran and Hallsta.



seems to stay fairly constant throughout the Iron Age. The main crop was barley. Few finds of pollen grains of rye and oats were made. Flax and hemp may also have been important crops, but evidence for them is normally only found when parts of the investigated sites were used for retting, as at Trogsta. The pollen grains of arable weeds are too sparse to provide any reliable indications of the type of agriculture practised.

In all the diagrams the pollen curves for plants indicative of agriculture show a clear decline about 500 AD. The two datings for this decline, at Myremyran and Hallstamyren, are in good accord (1505±85 and 1475±85). In this region the areas used for farming during the Late Iron Age would seem to have been considerably smaller than those used during the Early Iron Age. A fresh expansion of farming activity starts first in the Early Medieval Period.

Discussion

Sedentary farming settlements appear to have been established in the coastal part of Central Norrland during the Early Iron Age. Since there appears to be no continuity, spatial or temporal, between these and the Bronze Age agricultural areas a fresh colonization from other areas seems plausible. According to the pollen data, the basic pattern of land use in the Celtic Iron Age would seem to be similar to that found in the Roman and Migration Periods. Without excavation of further settlements to provide a more substantial body of data, this must remain simply a hypothesis. In fact, our information for the Bronze Age and the Celtic Iron Age is so scanty that further discussion about internal developments, or of immigration, would be unrewarding.

An expansion of the area of sedentary farming occurred around 2000 BP. New settlements then became established in the inland areas of Central

Norrland (Engelmark 1978), and the coastal settlement area also increased. The agricultural practices of that period were already well-adapted to the natural environment of the Boreal Coniferous zone. These fundamental farming methods were not discarded until very recent times. The harsh climate, the acidic, leached soils and the vast expanses of coniferous forest set the limits for peasant activity. By selected breeding, the domestic stock and the crop plants will naturally, and/or artificially, have become modified to suit these conditions. Within the more favourable parts of the coastal Norrland, the Celtic Iron Age may have formed the necessary prelude for the subsequent Roman Period expansion. In consequence the latter expansion was mainly an internal colonization, a fact which may explain the local features of the Iron Age culture found in Central Norrland.

However, an urgent need remains for excavations of sites from the earlier phases of the Iron Age, so that we can gain osteological and botanical evidence for the racial characteristics of the domestic animals and the crop plants, in order to elucidate properly the possible origins of the farming communities.

The agricultural decline noticeable in the pollen curves during the latter half of the 6th century AD is not very abrupt, but even when a settlement is abandoned, regeneration of the forest takes some time, and the floras of meadows and pastures only gradually die out. Investigations of sites with varved sediments, allowing yearly, absolute pollen counts to be made, could give us some idea of the true progress of the agrarian regression. The present data provide no indications of any over-exploitation of the natural resources, or of any climatic deterioration serious enough to have had adverse effects on farming, or of any local environmental change which may have necessitated a relocation of the settlements.

Acknowledgements

This investigation touches upon two of the main themes studied by the Department of Archaeology at the University of Umeå and initiated by Professor Evert Baudou, i.e. the transition from hunting-gathering to agriculture and the development of Iron Age society in coastal Norrland during the first millennium AD.

The archaeological adviser has been Lars Liedgren, who together with Lassi Markkanen has also helped with the field sampling. The English text has been revised by Philip Tallantire. To all these people we express our sincere thanks.

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