CHAPTER 18

VEGETATION HISTORY AND ANTHROPOGENIC IMPACT ON VEGETATION AT LOCALITIES WITH MULTI-ROOM HOUSES IN FINNMARK, NORWAY

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Introduction

The present paleo-ecological investigation was carried out during an early phase of the multi-room house project. The aims were to provide background information from prehistoric time until the present about available plant resources, especially the presence of forest trees, and to trace periods of human impact and, if possible, the nature of the impact on the vegetation. The main approach is pollen analysis and radiocarbon dating of peat profiles from the environments of five localities with remains of multi-room houses and Iron Age settlements.

There are two major limitations to the paleo-ecological approach in this investigation. First, the lack of sediments for pollen analysis close to the house remains. Second, the presence of other types of settlements near the multi-room houses, which partly overlap in time with the multi-room houses. This makes it difficult to get an unambiguous pollen signal from the settlements of interest. Relevant paleo-ecological investigations focusing on anthropogenic impact are Vorren (1983, 2005), Jensen (2004) and Sjøgren (2009) from western Finnmark, and Høeg (2000) from western, northern and eastern Finnmark. The forest history of northeastern Fennoscandia has been investigated by Helama et al. (2004), Hyvärinen (1976, 1985) and Seppä (1996).

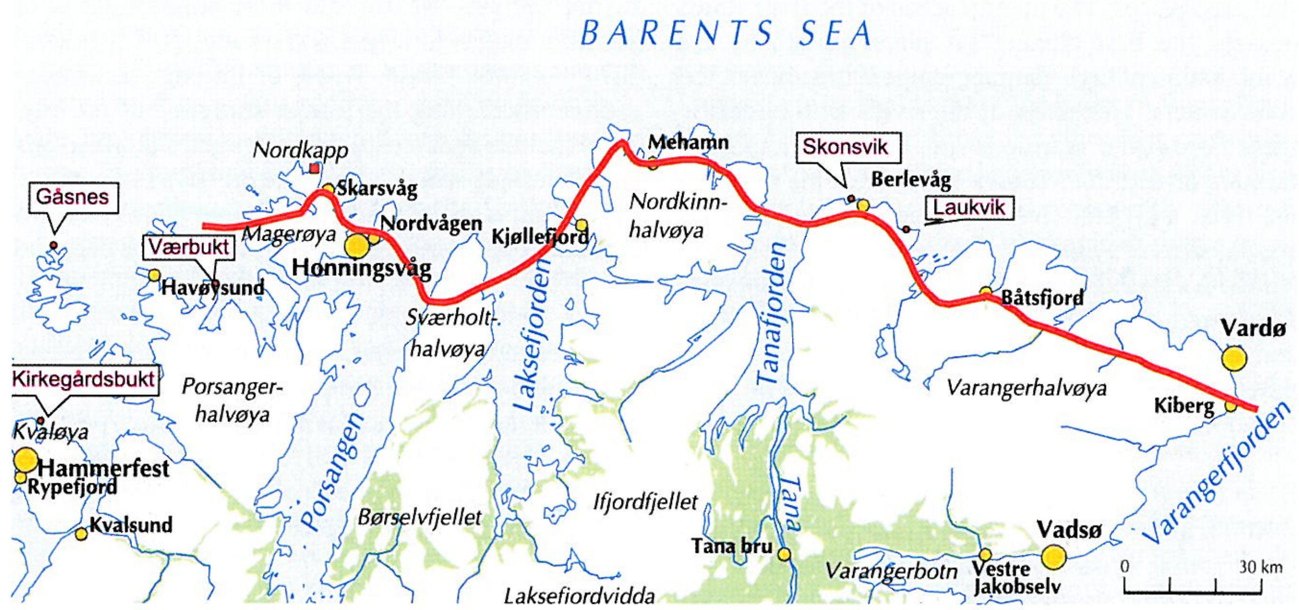

Figure 18.1: Map of northern Finnmark, Norway, with the arctic woodland limit as a red line (Moen 1999). Green shading indicates birch forest. Map reprinted with permission from the editor A. Moen, 2006. The multi-room house localities presented in this paper are added to map

Description of localities

Five of the multi-room house sites recorded in 2001 had peat sediment within satisfactory distance from the houses to allow investigations on pollen content (Figure 18.1). At Værbukta, Skonsvika and Løkvik (Laukvik) the mires were too far from the multi-room houses to reflect their household or infield activity in an optimal way. However, these sampling sites are close to potential outfields, and may thus reflect use of the local natural environment.

The climate of northern Finnmark changes along a west-east and a coast-inland gradient. There is a change from slightly oceanic (O1) to indifferent (OC) climate at the Nordkinn Peninsula (Moen 1999). Eastern Finnmark is thus subject to slightly lower annual humidity and larger seasonal variation in temperature. This climatic effect increases inland. The difference in climate is reflected in the dominating vegetation types. The three northwestern localities included in my study, Kirkegårdsbukt, Gåsnes and Værbukt, all belong to the northern boreal vegetation zone while the eastern localities, Skonsvik and Laukvik, belong to the southern arctic vegetation zone, hemi-arctic sub-zone (Moen 1999).

The boundary between the northern boreal and arctic vegetation zones is the present climatic woodland limit, i.e. the northern limit of birch stands (*Betula pubescens* ssp. *tortuosa*) in Norway (Figure 18.1). The hemi-arctic sub-zone is characterized by shrubs and dwarf shrub heath, but tree size (>2m) birches, rowans (*Sorbus aucuparia*) and willows (*Salix myrsinifolia*, *S. phylicifolia*, *S. glauca* and *S. lanata*) may occur at sheltered places. The inner reaches of the large fjords possess the best climate for plant growth by the combination of high summer temperature and not too cold winters. The banks of the rivers with outlets in these fjords offer nutritious soil. The most important farming district in Finnmark is thus near the mouth of the Tana and Alta rivers. Farming at the exposed coastal areas of Finnmark, and in particular the eastern part with a shorter duration of the growing season than the western part, is very marginal. The soil is shallow and with low nutrient content. Farming activity is based on sheep husbandry in combination with other economies, mainly fishing.

Alder (*Alnus incana*) grows in the inner fjord districts, forming swamp forests along rivers and growing in mesic birch forest, sometimes together with bird cherry (*Prunus padus*) and aspen (*Populus tremula*). The distribution of alder is limited by the bedrock as well as climate. The bedrock of northern Finnmark consists mainly of sedimentary rocks, predominantly sandstones and quartzite. The northernmost locality for pine (*Pinus sylvestris*) is at Børselv in Porsanger. Pine forest is also present south of the Varanger Fjord. The present distribution of woodland in Finnmark is much affected by a former extensive utilization of forest trees.

Three of the multi-room house sites presented in this chapter were excavated and radiocarbon dated: Skonsvika (Amundsen et al. 2003, Henriksen et al. 2006, Henriksen 2008, see Chapters 5, 7 and 16), Værbukta and Løkvik (Henriksen 2002, see Chapters 5, 10, 16). The Kirkegårdsbukt site was partly excavated and radiocarbon dated by the Finnmark County Authority in 1995 (Bratrein 1996, see Chapters 5 and 22), while Gåsnes is yet to be excavated.

Kirkegårdsbukt, Forsøl

Kirkegårdsbukt is a small eastern exposed bay. A low isthmus separates it from the fjord, Indre Forsøl. Low granite outcrops (knolls), c.50 m a.s.l. rise to the north and south. Much of the bedrock is exposed. The knolls are partly covered by very shallow *Empetrum nigrum* ssp. *hermaphroditum* heaths. Shallow *Sphagnum* peat (max. 40 cm deep) exists in minor depressions on the isthmus and as sloping mires. A brackish sedge-mire is formed just above the tidal zone of the bay, fronting a marked shoreline terrace. The multi-room house is situated on a grass- and herb-rich meadow (*Rumex acetosa, Ranunculus acris, Rhinanthus minor, Achillea millefolium* a.o.), c. 4 m a.s.l., and close to the terrace. The house covers an area of c. 23 x 25 m and contains six rooms and an adjacent boathouse facing the sea. Nearby are three single houses of possible medieval origin and a long, post-medieval Sámi common house. Traces of Iron-age settlement are recorded along the former shoreline of the bay. They include boathouses, tent rings and slab-lined pits for processing seal and/or whale oil. Two radiocarbon dates from test pits in the multi-room house render a calibrated age period of 1270-1340 AD (see chapters 5 and 22).

The scattered occurrences of peat resulted in a compromise between sampling close enough to trace the settlements and achieving high quality peat for pollen analysis. The analysed peat sequence is sampled only 30 m southeast of the multi-room house, and 5 m from a brook (Figure 18.2).

Gåsnes, Ingøy

Gåsnes is a small headland on the northeastern coast of the island Ingøya, Måsøy Municipality. The landscape on this part of the island is dominated by open *Empetrum* heathland, ombrotrophic peatland and low outcrops. A 15 x 15 m multi-room house with six or seven rooms (the site is not excavated) is located close to the sea, the present shoreline being c. 5 m from the walls of the house grounds. Close by is a modern house ruin, and c. 150 m to the north, behind a ridge of schisty knolls, is a large farm mound covered by *Ranunculus repens*. A road made of rock slabs runs between this mound and the multi-room house. The sampling site is an intermediate mire on a terrace extending c. 10-30 m from the seashore and c.15 m north of the multi-room house (Figures 18.3). The maximum depth of the mire is 75 cm. The mire is dominated by *Eriophorum angustifolium*, *Carex rariflora*, *Potentilla palustris* and *Sphagnum riparium*. The remains of the multi-room house are dominated by grasses; *Agrostis capillaris*, *Calamagrostis stricta*, *Deschampsia flexuosa*, *Festuca rubra*, and herbs like *Achillea millefolium*, *Rumex acetosa* and *Ranunculus acris*. *Angelica archangelica*, *Campanula rotundifolia* and *Rhinanthus minor* are less abundant. Character - istic species just above the tidal level are *Angelica archangelica*, *Ligusticum scoticum* and *Galeopsis tetrahit*. *Rumex acetosella* and *Sedum acre* grow upon the stone paved road between the seashore and the sampled mire. The area southeast of the site consists of a shallow mire, 40-50 cm deep, characterized by *Empetrum hermaphroditum*, *Rubus chamaemorus*, *Vaccinium uliginosum* and *Cornus suecica* and a small *Carex aquatilis* swamp.

Værbukta, Måsøy

Værbukta is located north of the outlet of Ryggefjord, Måsøy Municipality. It is a c. 500 m long northeast-southwest oriented marine bay lined with c. 400 m high mountains. The landscape is completely treeless, *Empetrum* heath and exposed mountain ridges being the dominant features. Mire formation is only found at the inner reaches of the bay (see Figure 5.12), and this is where the peat core for pollen analysis is sampled. A brook with some willow (*Salix*) carr is in the vicinity. There are no modern settlements in the area. Several Iron Age dwellings, mostly round turf houses, and six slab-lined pits are found around the bay, but most frequently on the northern side. A round Slettnes-type turf house (Hesjedal et al. 1996) is located less than 100 m from where the peat core is sampled, and dated to 937 ± 102 BP (Wk-10192) and 943 ± 62 BP (Wk-10308). Two multi-room houses are recorded on the northern and southern side of the neck of the bay. The

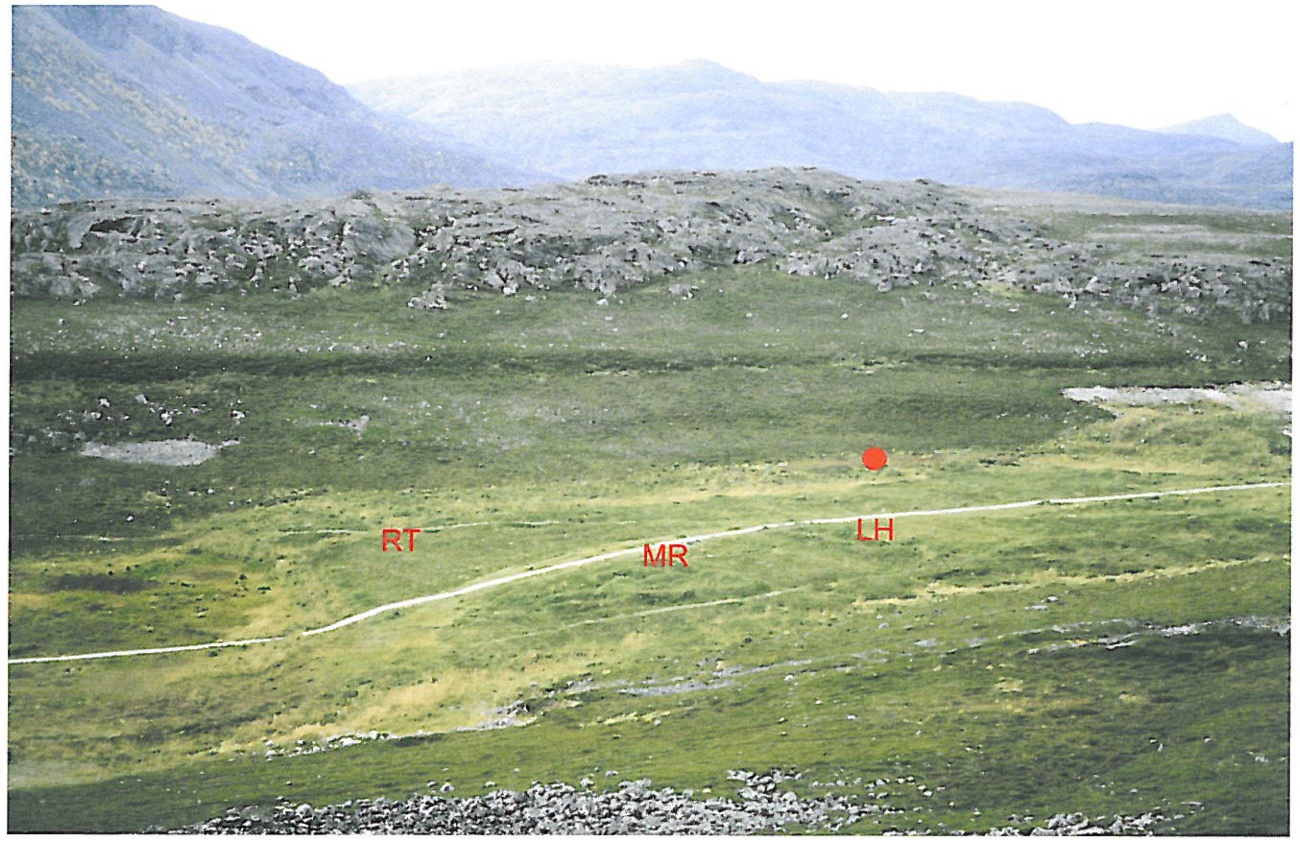

Figure 18.2: Kirkegårdsbukt. Red dot indicates the sampling site for pollen-analysis. RT is remains of two round turf houses, MR the multi-room house and LH (the Sámi common house)

Figure 18.3: Gåsnes. The sampling site for pollen-analysis is marked with a red dot, and the multi-room house ground as MR

northern one, a twelve room house now covered by grass vegetation, is test excavated. The distance to the peat core sampling site is c. 400 m. Charred fish bones from a midden near the house are dated to 813 ± 62 BP (Wk-10322). When corrected for marine reservoir effect, the calibrated age is 1440-1690 AD (95.4% prob.).

Skonsvika, Berlevåg

This is a shallow, wide bay at the outlet of the Skonsvika valley and Skonsvika River facing the Barents Sea towards the northeast. The Skonsvika area has been used for grazing and hay production in modern times but is now mainly used for leisure. Dwellings from the Early and Late Stone Age and Iron Age are recorded along the western part of the bay. One multi-room house, several medieval and Iron Age houses, two boathouses and nine slab-lined pits are recorded at Svartnes, a small headland at the east side of the Skonsvika bay. The area consists of shallow grass turf on sand, much exposed to wind erosion. The multi-room house is partly excavated and a number of radiocarbon dates suggest a habitation phase from c. 1210-1460 (two sigma calibration range) (see Chapters 7 and 16).

The nearest peat formation is on the plain surrounding the innermost area of the Skonsvika bay (Figure 18.4a). This is an oligotrophic to intermediate mire, formed between two small lakes and a marked raised beach terrace (Tapes shoreline). The slope of the ridge, facing the mire, consists of a well developed sheep pasture characterized by *Alchemilla alpina* (Figure 18.4b). An abandoned hay field dominated by *Deschampsia cespitosa* is close by. *Salix* carr occurs along brooks and at the lake shore; no birch stands could be seen in the area. The sampled mire is dominated by *Empetrum nigrum* ssp. *hermaphroditum*, *Betula nana* and *Rubus chamaemorus* with *Trichophorum cespitosum* and *Eriophorum angustifolium* in lawns. It has a maximum depth of 50 cm. Distance to the multi-room houses is c. 500 m. The sampling site was a potential grazing area for the Skonsvika settlements.

Løkvik, Berlevåg

The investigation site, Løkvik, is a small north-south oriented inlet of the wide fjord Sandfjorden, c. 5 km southeast of Berlevåg. The north exposed Sandfjorden is bordered by mountains with an altitude of 200-400 m. Beach terraces are formed close to the base of the mountains, the Tapes terrace being the most distinct

Figure 18.4a: Skonsvik. The sampling site for pollen-analysis is marked with a red dot. The multi-room house ground (MR) is at the Svartnes headland

Figure 18.4b: Skonsvik. View of the sampling site for pollen analysis in front of a sheep pasture and the Tapes terrace

one. Wide mires, c. 50 cm deep, with some small and shallow lakes and patches of dwarf shrub heath front the Tapes terrace and extend towards the main road running c. 100 m from the present shoreline. The stream Laukvikelva has formed a valley cutting the Tapes terrace at Løkvik. The area possesses numerous remains of ancient settlement, such as 21 Stone Age dwellings, two slab-lined pits, four houses from the Iron Age to medieval period, four partly over-lapping multi-room houses and several younger houses. There is no permanent modern settlement in the area. The four multi-room houses are recorded at the small headland Sandstøberget at the western side of the inlet. Trial excavation (test pitting) are carried out in multi-room house 2 and 3, and a more substantial excavation in multi-room house 1. Finds and radiocarbon dates suggest early post-medieval habitation, possible spanning the 16[th] and early 17[th] century (see Chapters 10 and 16).

The cover vegetation of the multi-room houses is grass- and herb-dominated, while the surrounding area consists of meadow, outcrops and shallow minerotrophic mire. The analysed peat core was collected from

Figure 18.5: Løkvik with the remains of the multi-room houses in front. The mire where the pollen core was sampled can be glimpsed between the road and the foot of the mountains

the mire fronting the Tapes terrace, c. 150 m south of the multi-room house site (Figure 18.5). The flora of the mire is dominated by *Betula nana*, *Salix lapponum*, *Vaccinium uliginosum*, *Andromeda polifolia* and *Potentilla palustris*, and on low hummocks also *Empetrum nigrum* ssp. *hermaphroditum*, *Rubus chamaemorus*, small individuals of *Salix phylicifolia* and, occasionally, *Astragalus frigidus*. *Caltha palustris* may dominate locally along brooks.

The Tapes terrace consists of shallow dwarf shrub heath (*Empetrum nigrum* ssp. *hermaphroditum*, *Vaccinium vitis-idaea*, *Betula nana* and *Dryas octopetala*). Forest stands of *Salix phylicifolia*, *Salix glauca* and *Betula pubescens* grow in the river valley. The present marine shore consists of calcareous sand where *Leymus arenarius* and *Potentilla anserina* are characteristic species.

Material and methods

The sediment cores were collected by hammering plastic tubes of 10 cm diameter into the peat, except for the Kirkegårdsbukt peat monolith that was cut by spade. The depth of the peat sediments varies from 38 cm at Kirkegårdsbukt to 60 cm at Gåsnes and Værbukta. The material is stored at the Department of Arctic and Marine Biology, University of Tromsø.

Subsamples of 1 cm^3 peat were prepared for pollen analysis by acetolysis (Fægri and Iversen 1989). One tablet containing 12627 ± 180 *Lycopodium*-spores was added each subsample as a marker for calculations of pollen concentration (grains cm^{-3}) and pollen accumulation rate (PAR = grains cm^{-2} $year^{-1}$) (Stockmarr 1972). Identification of pollen types follows Fægri and Iversen (1989), Moore et al. (1991) and the reference collection of modern pollen at the Department of Biology, University of Tromsø. The distinction between *Betula pubescens*-type and *Betula nana*-type pollen is based on morphology and size (Eneroth 1951). The Løkvik site in particular, has a distinct amount of an intermediate type which is counted separately. This may be from local birch, possibly crossed with *B. nana*. Pollen percentages of each pollen taxon are calculated on the base of a pollen sum (equaling 100%) consisting of all terrestrial pollen taxa excluding the local mire taxa. The percentages of the latter pollen taxa, spore taxa and charcoal fragments, are calculated on the base of

the pollen sum plus the actual taxon. Dwarf shrubs (Ericales) are included in the pollen sum at sites with dominance of dwarf shrub heath (Kirkegårdsbukt and Værbukta). Calculations are performed by TILIA ver. 2b4 (Grimm 1993). Pollen diagrams are made in TgView ver. 2.0.2 (Grimm 2004) and CorelDRAW(R) Graphics Suite, ver.12.0 (2003). Zonation of the pollen diagrams are a combination of subjective interpretation and binary splitting, using psimpoll ver. 4.25 (Bennett 2005).

Subsamples for radiocarbon dating were taken prior to the pollen analyses to estimate the possible depth interval of the multi-room house periods. In general, two stratigraphic levels per profile were selected for dating: one near the base and one at a distinct change in peat stratigraphy. The fraction of 0.063-1 mm peat was preferably dated, but sometimes the fraction below 0.063 mm had to be added to gain a sufficiently high weight. The radiocarbon dating was performed by the Radiocarbon Dating Laboratory, University of Waikato, New Zealand. Calibration is performed by Bayesian statistics using the BCal 2004 software (Buck et al. 1996, 2004) and the decadal IntCal04 atmospheric calibration curve (Reimer et al. 2004). Linear age-depth models are performed in psimpoll ver. 4.25 (Bennett 2005) and based on the weighted average mean of 95% probability confidence intervals of the calibrated dates.

Results and discussion

Kirkegårdsbukt, Forsøl:

Sedimentology and age-depth modelling

A distinct change in peat type is recognized at 21.5 cm by a c. 1 cm thick dark brown/blackish peat layer separating the lower, strongly humified *Eriophorum* peat from the upper, less humified *Sphagnum*-dominated peat (Figure 18.6). This boundary reflects a change from a mesotrophic to an oligotrophic nutrition regime of the mire, meaning that the mire surface is not so much affected by moving ground water after this event. A radiocarbon date of the *Sphagnum* peat at 20-21 cm dates the event to older than 310 ± 61 BP (Table 1). Such development may be initiated by natural causes lowering the ground water level, being a regional climatic event or a local event caused by a change in the course of a small stream nearby, for example. Given the more or less continuous settlement history of the site, human interference may also be considered. The mire is very close to the Iron Age and medieval house remains and it is likely that it has been influenced by human activity. During sampling, the peat monolith was fractured just below the peat boundary. The presence of a hiatus (i.e. time gap) in the peat stratigraphy cannot be ruled out. The local people may have removed peat for heating or house construction, but also trampling or grazing may hamper the peat growth to such a degree that a hiatus occurs. In modelling the age-depth relationship, two scenarios are presented: one reflecting a continuous sedimentation process

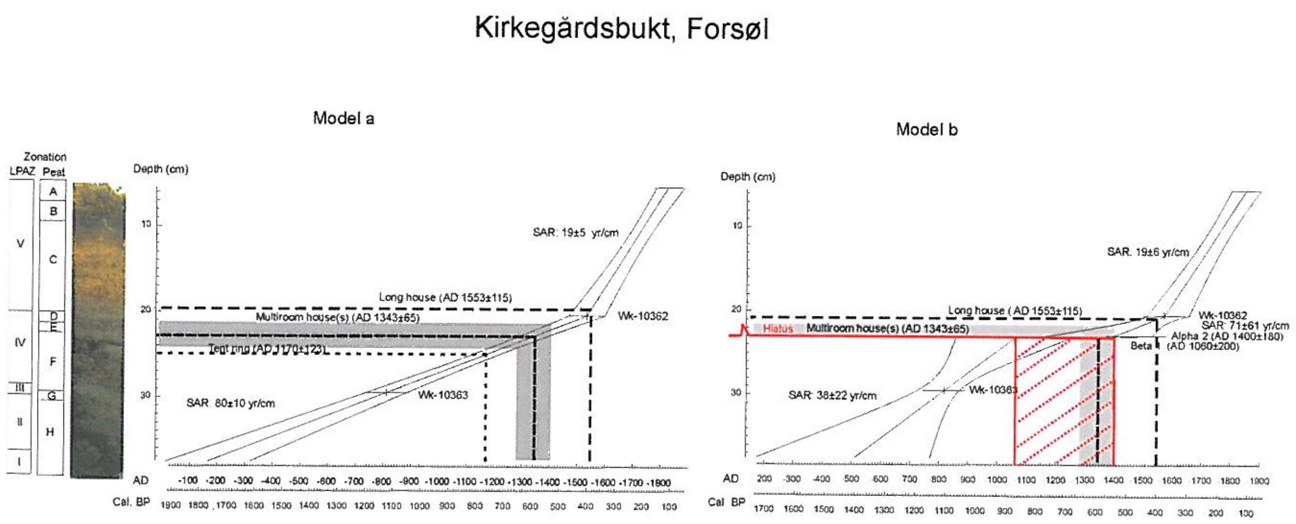

Figure 18.6: Age-depth model and stratigraphic description of the peat monolith at Kirkegårdsbukt. Local pollen assemblage zones (LPAZ): see pollen diagrams. Peat stratigraphy: A: 0-5 cm, raw humus, B: 5-9 cm, Sphagnum-peat H5, C: 9-19 cm, Sphagnum-peat H4, D: 19-21.5 cm, Sphagnum/Eriophorum-peat H5, E: 21.5-22.5 cm, black peat H6-7, F: 22.5-29.5 cm, Eriophorum-peat H5 (fracture at 23.5 cm), G: 29.5-30.5 cm, black peat H6-7, H: 30.5-38 cm, Eriophorum-peat H6. A hiatus is modelled at 23 cm and tentatively set between the midpoints of beta 1 and alpha 2. A 95% confidence interval around a pooled mean of the radiocarbon dates from the multi-room house is shadowed

(Figure 18.6a), and one with a hiatus (Figure 18.6b). The location of the hiatus is supposed to be between the transition to *Sphagnum*-dominated peat at 21.5 cm and the fracture zone, and is tentatively set to 23 cm, rendering an age of 1230 ± 170 AD. The modelling results in an estimated duration of the hiatus to between 1 and 680 years (95% probability) or 1 and 410 years (68% probability). The probability of the hiatus representing only a few years is thus possible. A time gap of such short duration will not be reflected in the bio-stratigraphy. The estimation of a longer time gap, will cover the period of the multi-room house settlement (Figure 18.6b), and may explain the low anthropogenic pollen and charcoal signal of this interval (Figure 18.7). Depending on which age-depth model that is preferred, the peat profile extends c. 1800 years (model a) or c. 1500 years (model b) back in time.

Pollen analysis

The pollen stratigraphy of the profile reflects a development from a forested landscape to open heath (Figure 18.7). A continuous presence of charcoal and adventitious herb taxa (anthropochores and apophytes) indicates human impact on the area. *Betula pubescens*-type achieves as much as 60% and 1700 grains cm^{-2}year^{-1} during zone I (c. cal. 490-570 AD), which indicates that birch has grown close to the sampling site. Modern pollen monitoring by means of pollen traps at ground level (Tauber 1974, Hicks et al. 2001) has resulted in *Betula pubescens*-type PAR records of < 350 (mean of 5 years) from the open coastal birch woodland of the Vesterålen archipelago at 68-69°N (Jensen et al. 2007) and 1000-1600 (mean of 22 years) from open inland birch forest in northern Finland (Hicks and Sunnari 2005). Much of the birch pollen loading at Kirkegårdsbukt, is most probably coming from birch growing in the mountain slopes southeast of the site, but also from local birches. During zone II the local landscape opens up. This is seen in the combination of a birch decline and an increase in dwarf shrubs (Ericales), grass (Poaceae) and herbs. The birch decline dated as 310 ± 130 AD or 570 ± 230 AD (according to age-depth model a and b, respectively) is very distinct and may thus be a result of man's impact. Grasses increase gradually to a

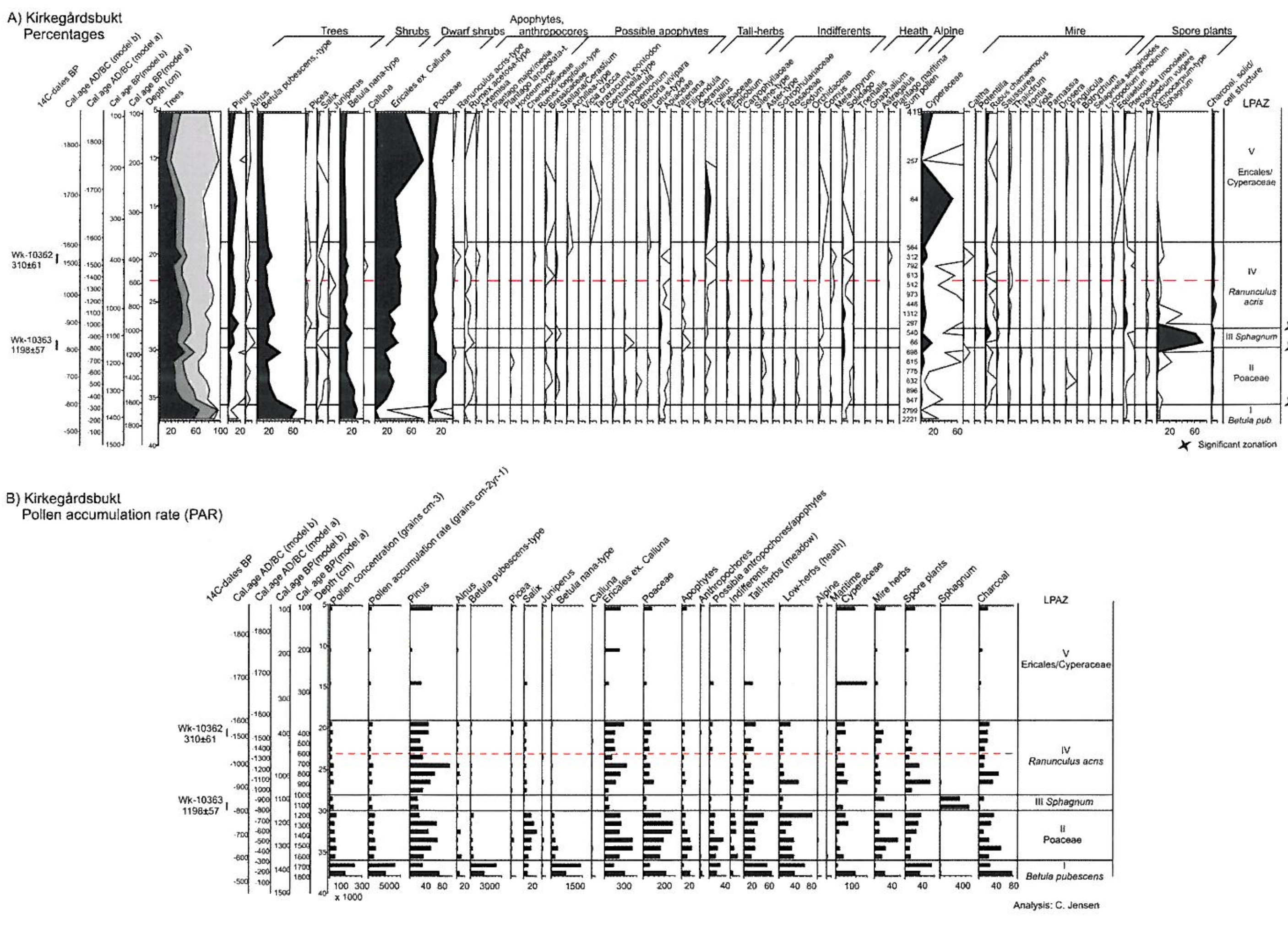

Figure 18.7: Pollen diagrams for Kirkegårdsbukt. Red line indicates a hiatus

maximum around 600 or 700 AD (avarage age), and *Rumex acetosa*-type is regularly present. This may be a combined effect of a more open landscape and an increased input of nutrients. The high diversity in herb taxa suggests herb rich meadow communities, probably where the remains of the medieval settlements are today and near the seashore. Given the proximity to sandy seashore, the record of *Hordeum*-type pollen may derive from *Leymus arenarius*, which is a "wild-grass". Zone III with a *Sphagnum* maximum and increase in *Rubus chamaemorus*, represents a hydrological change of the peat that may have been caused by a temporary lowering of the ground water level. The pollen concentration is lower during this zone than before and after, which may be interpreted as a more rapid peat accumulation during this interval. Zone IV reflects an open heath landscape with grass meadows. A charcoal maximum is recorded at 1150 ± 50 AD or 970 ± 120 AD. This is before the start of the period of multi-room houses, and may, in the case of the latter (earliest) date, be connected to the use of the slab-lined pit. *Plantago major* is recorded from c. 1400 AD onwards. It grows on trampled and grazed ground, and is likely to reflect activity connected with the multi-room houses and/or the subsequent common house. Considering the short distance between the sampling site and the dwelling area, the anthropogenic impact is weak. This applies in particular to the charcoal curves, especially when compared with the Gåsnes site at Ingøy (see below). A hiatus in the stratigraphy may explain this. The most active local settlement phase may thus not be represented.

Gåsnes, Ingøy

Sedimentology and age-depth modelling

The analysed sediment core is 66 cm. The peat is formed on sand with much stone, formerly a seashore. At c. 40 cm there is a change from loose, low-humified *Sphagnum*-dominated peat to more compact, well humified Cyperaceae (*Eriophorum*)/*Sphagnum* peat, rich in microscopic charcoal (Figure 18.8), accompanied by a distinct change in total pollen concentration (Figure 18.9). The very low pollen concentration and the loose peat is an indication of rapid peat accumulation, which is supported by the radiocarbon date at 31-32 cm (Table 1) suggesting that the upper peat sequence has accumulated during modern time. The level at 41-42 cm is radiocarbon dated as 778 ± 55 BP. Given this information, it is likely that there is a hiatus between the two radiocarbon dates, and that it is located around 40 cm. The upper peat sequence (0-39 cm) is thus excluded from the age-depth model and 39-40 cm (beta 1) is calculated to 418 ± 210 cal. BP (1530 ± 210 AD), using Bayesian statistics (Figure 18.8). In comparison, an interpolation between the radiocarbon dates Wk 10933 and Wk 10354 date the level 39-40 cm to c. 550 cal. BP (c. 1400 AD).

Pollen analysis

The bio-stratigraphy reveals an open, non-forested landscape throughout the entire period. The local vegetation around the ancient settlements is well reflected in the pollen assemblage, as seen in the upper five spectra of the pollen diagram (Figure 18.9) where taxa reflecting the local mire (Cyperaceae, *Potentilla*-

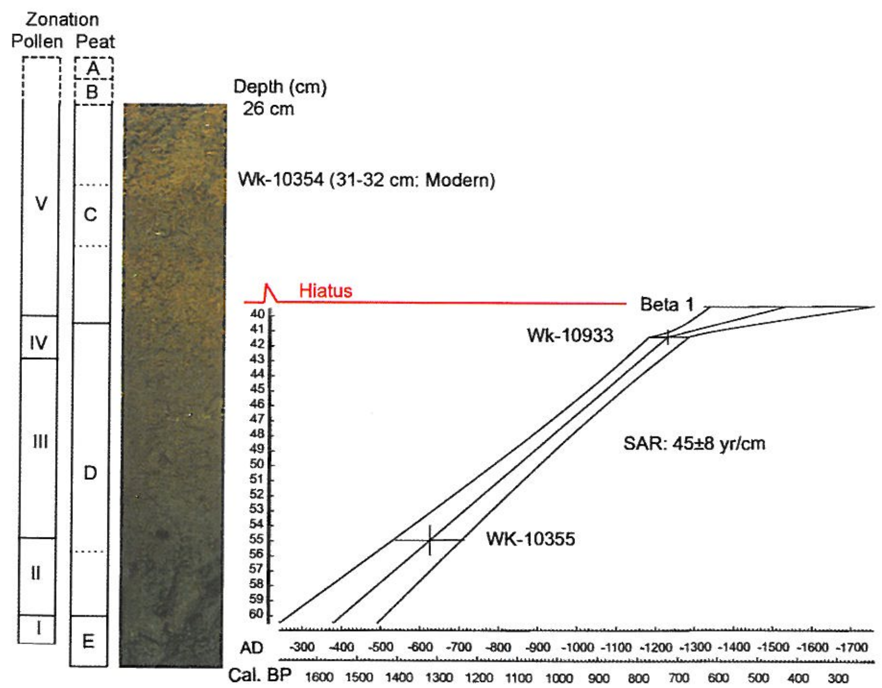

Figure 18.8: Age-depth model and stratigraphic description of the peat core at Gåsnes. Local pollen assemblage zones (LPAZ): see pollen diagrams. Peat stratigraphy: 0-4 cm: Sphagnum riparium, live, 4-7 cm: Sphagnum-peat H2, C: 7-40.5 cm: Sphagnum/Cyperaceae-peat (7-33 cm: H3, 33-37 cm: H3-4, 37-40 cm: H3), C: 40-42.5 cm, Cyperaceae/Sphagnum-peat H4, D: 42-60 cm, Sphagnum/Cyperaceae-peat H5 (dissolved schist-stone at 46-47 cm, Equisetum fluviatile macro remains in lower part of zone D), E: 60-66 cm, Sand, stones. A hiatus is modelled at 40 cm

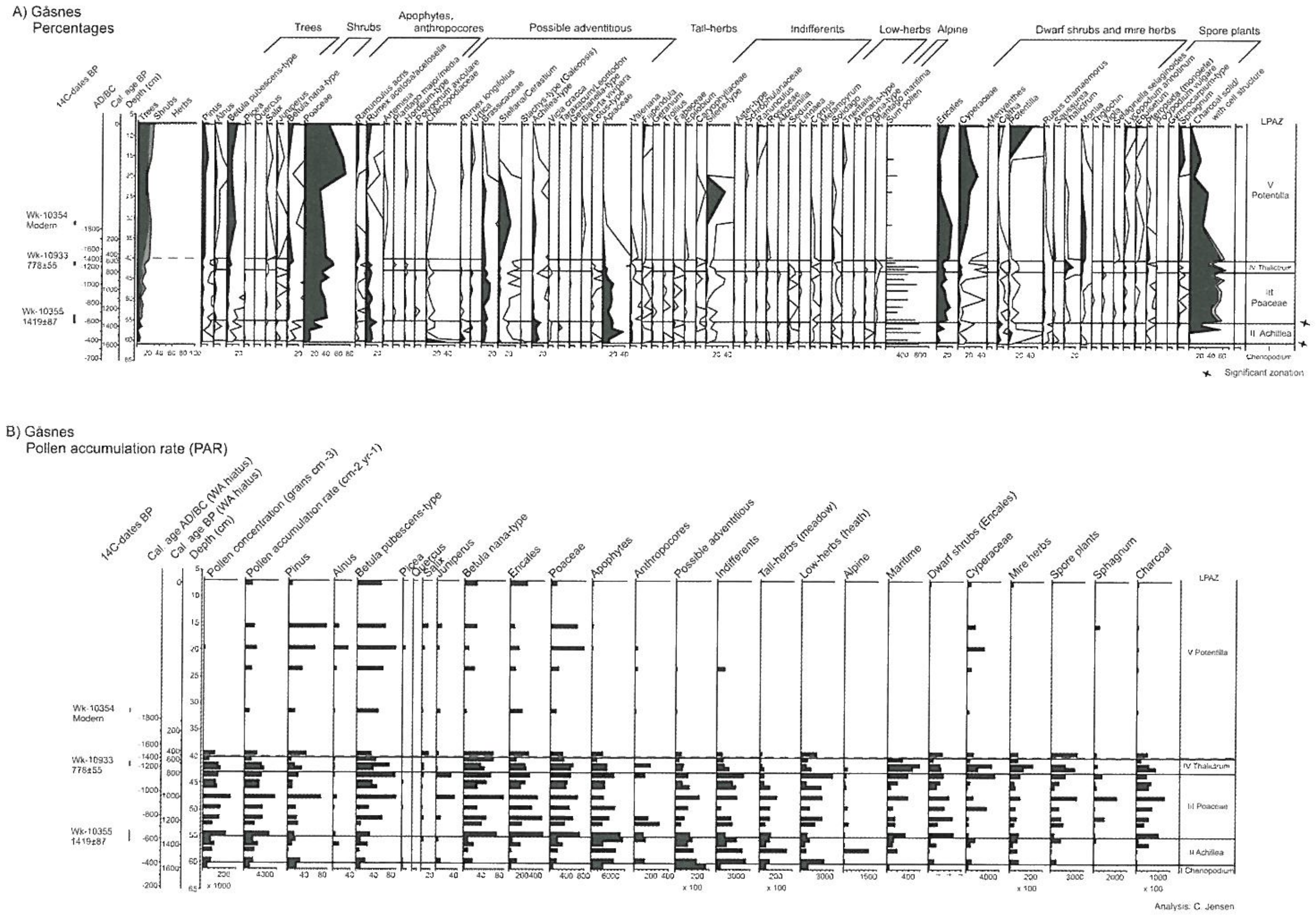

Figure 18.9: Pollen diagrams for Gåsnes. Red line indicates a hiatus

type and *Sphagnum*) and the farm mound (Poaceae and herb taxa) dominate. Some of the Apiaceae pollen may come from *Ligusticum scoticum* and *Angelica archangelica* at the seashore, but also from *Anthriscus sylvestris* from the present farm mound. Brassicaceae may include *Cochlearia officinalis* growing at the seashore. *Stellaria/Cerastium* may include *Stellaria media* from the seashore and/or *Stellaria longipes* or *Cerastium fontanum*, while *Silene*-type may include *Honckenya peploides* from the seashore and *Silene dioica* from the present farm mound. Five zones may be distinguished from the pollen record. The two zones at the base of the profile reflect seashore vegetation with dominance of Chenopodiaceae (probably *Atriplex prostrata*) and *Achillea*-type (probably *Matricaria inodora* ssp. *maritima*), respectively. The start of human impact may occur near the upper boundary of zone II, where there is a charcoal peak, cal. 560 ± 100 AD, but the most intense anthropogenic impact is seen in the zones III and IV that consist of a marked culture layer with very high charcoal values (up to 60% and 1000 grains $cm^{-2}yr^{-1}$), a high abundance of grass and apophytes, and a variety of possible anthropogenic indicators. Many of these may have spread from the seashore to the domestic area. These apophytic pollen taxa together may indicate management of the vegetation, like hay making and/or grazing. *Ranunculus acris*-type may however, represent *Ranunculus repens*, growing on dung and moist places within the dwelling area and *Rumex acetosa*-type may represent *Rumex acetosella*, primarily growing on dung and trampled ground. The "possible adventitious" taxa are well represented, especially by Brassicaceae and Apiaceae. Within the Brassicaceae-group there may be pollen from introduced weeds like *Capsella bursa pastoris* thriving on paths and open, dunged soil. Apiaceae may include *Anthriscus sylvestris*, which is common along field and meadow margins. The zone has several meadow species like *Geranium*, *Trollius* and *Valeriana* which supports the latter scenario. Zone III (620 ± 90-1200 ± 50 AD) may thus primarily represent the activity at the house, but maybe also husbandry. Zone IV (1200 ± 50-1450 ± 100 AD) is characterized by *Thalictrum*, which is presumably *Thalictrum alpinum*. This species is typical for nutrient rich mire

and meadow. Given the high percentage of Poaceae, the zone may represent a grazing phase. The large farm mound to the north is not expected to have much influence on the pollen deposition at this mire, the knoll separating the two settlements acting like a barrier to deposition. Most of the herbs that are indicative of human impact produce insectogamous pollen with a short dispersal radius. Anemogamous pollen, such as Poaceae, and charcoal dust may though reach further away from the source.

Værbukta, Måsøy

Sedimentology and age-depth modelling

The upper 39 cm of the peat core consist of heath-like dwarf shrub dominated peat with a high root content (Figure 18.10). The interval from the base at 61 cm and to 39 cm is strongly humified sedge peat containing some sand and silt at the base. The profile covers a period of c. 2500 years. Two compact dark brown/blackish peat layers are radiocarbon dated (Table 1, Figure 18.10).

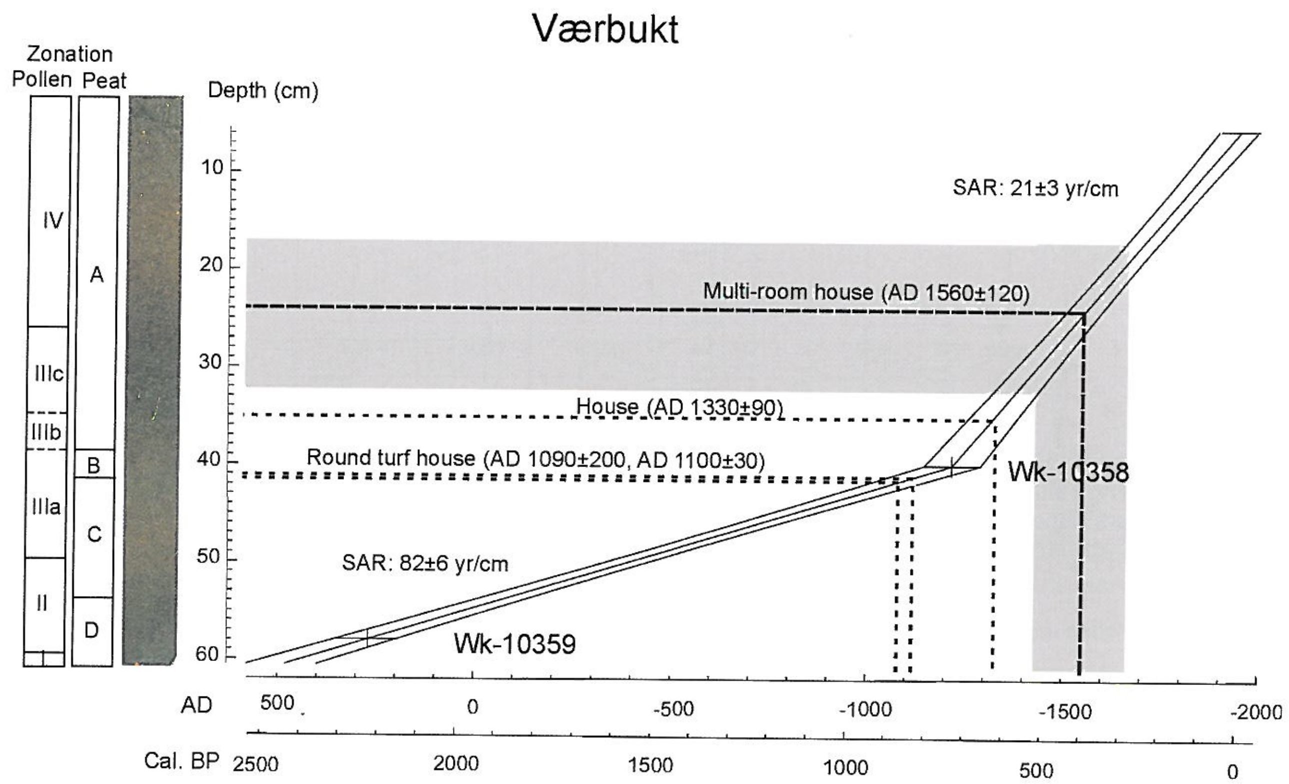

Figure 18.10: Age-depth model and stratigraphic description of the peat core at Værbukt. Local pollen assemblage zones (LPAZ): see pollen diagrams. Peat stratigraphy: A: 0-39 cm, Ericales peat with high root content, B: 39-42 cm, Eriophorum-peat, dark brown H5-6, C: 42-55 cm, Eriophorum-peat, medium brown H5, D: 55-61 cm; Sandy Eriophorum-peat, dark brown

Wk-number	Sample name	Depth (cm)	Dated material	^{14}C-age BP	Cal.age BP 68% prob.	Cal. age BP 95% prob.	$\Delta^{13}C$ (‰)
10362	Fors/20-21	20-21	Cyperaceae peat	310±61	440-300	500-280	-26.9±0.2
10363	Fors/29-30	29-30	Cyperaceae peat with charcoal	1198±57	1230-1060	1270-990	-25.5±0.2
10354	Gaas I/31-32	31-32	*Sphagnum* peat	Modern	Modern	Modern	-25.3±0.2
10933	GaasI/41-42	41-42	*Sph.*/Cyp.peat	778±55	740-670	900-650	-28.1±0.2
10355	Gaas I/54-56	54-56	*Sph./Equis.*peat[1]	1419±87	1400-1260	1520-1170	-28.7±0.2
10358	Vaer/39-41	39-41	Cyperaceae peat	775±74	770-670	910-570	-28.0±0.2
10359	Vaer/57-59	57-59	Cyperaceae peat	2224±65	2320-2150	2350-2060	-28.6±0.2
10356	SvartnesII/14-16	14-16	Cyperaceae peat	292±57	450-300	500-290	-29.0±0.2
10357	SvartnesII/30.5-31.5	30.5-31.5	Cyperaceae peat	2588±57	2770-2540	2790-2490	-28.0±0.2
10360	LaukII/18-19.5	18-19.5	Cyperaceae peat	441±64	540-460	620-320	-29.1±0.2
10361	LaukII/31-32	31-32	Cyperaceae peat	1824±57	1830-1700	1880-1610	-29.6±0.2

[1]: *Sph./Equis.: Sphagnum/Equisetum*

Table 1: Radiocarbon dates of the peat profiles. All dates are AMS, except for one radiometric express date (Wk-10355)

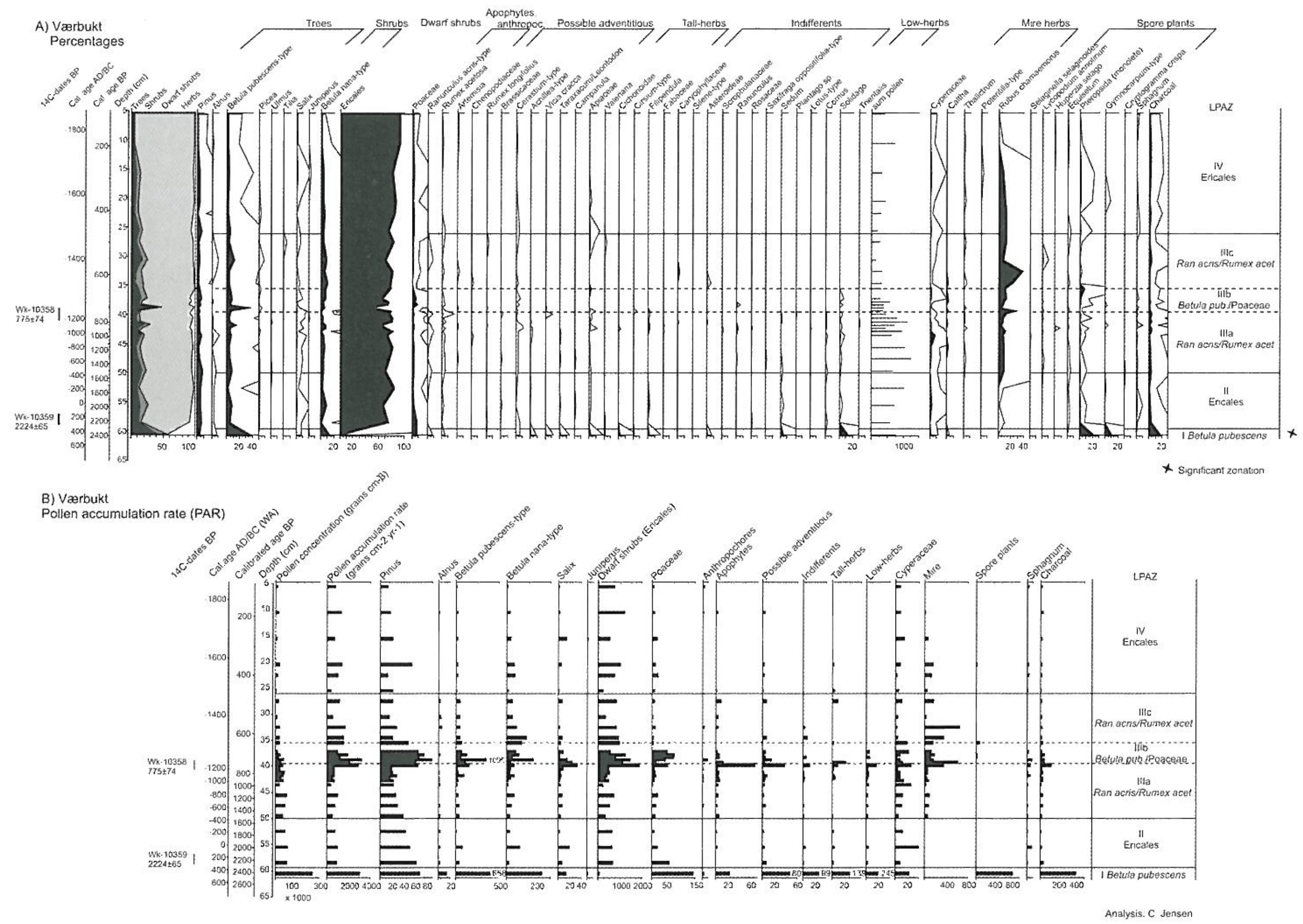

Figure 18.11: Pollen diagrams for Værbukt

Pollen analysis

The overall pollen picture of the diagram reflects an open, heath dominated landscape (Figure 18.11) with weak anthropogenic signals. The pollen profile is divided into four zones: The pollen concentration at the base of the profile may be exaggerated due to compaction of the peat. Pollen taxa indicative of mesic birch forest or carr (*Betula pubescens*, tall herbs, low herbs and ferns (monolete Pteropsida, *Gymnocarpium*) and of human impact (Poaceae, apophytes, charcoal) are, however, more abundant than dwarf shrubs and mire taxa. Zone I (c. 520 ± 90 - 390 ± 90 BC) may thus reflect local growth of birches and a nearby dwelling. Zone II reflects an open landscape with little or no human impact. Zone III begins with the start of a continuous *Ranunculus acris-* and *Rumex acetosa*-type curve, 390 ± 50 AD. At the same time there is a change in the local mire, by a marked increase in *Rubus chamaemorus*, and *Thalictrum* and *Lycopodium annotinum* being present. Meadow and heath communities with herbs may have existed locally during zone III. The charcoal is slightly increased during the zone, although at low values. Given the generally low abundance of charcoal and adventitious herbs in the rest of the profile, probably caused by the wind conditions in this open landscape, it is interpreted as coming from settlements in Værbukta. A local birch event is recorded at c. 1230 ± 70 - 1310 ± 60 AD (zone III b) by a maximum in *Betula pubescens*-type pollen, followed by an increase in Poaceae and ferns. A birch carr has probably developed locally (no gradual increase in *B. pubescens* or *B. nana* though, but some birches may have been present all the time, and then expanded due to better growing conditions, perhaps climatically induced) and then been cut. Note that the peak in PAR (Figure 18.11) is exaggerated due to the linear interpolation method causing an abrupt change in the sedimentation rate. From c. 1510 ± 50 AD onwards (zone IV) the anthropogenic impact is weaker or absent, and dwarf shrubs become more dominant.

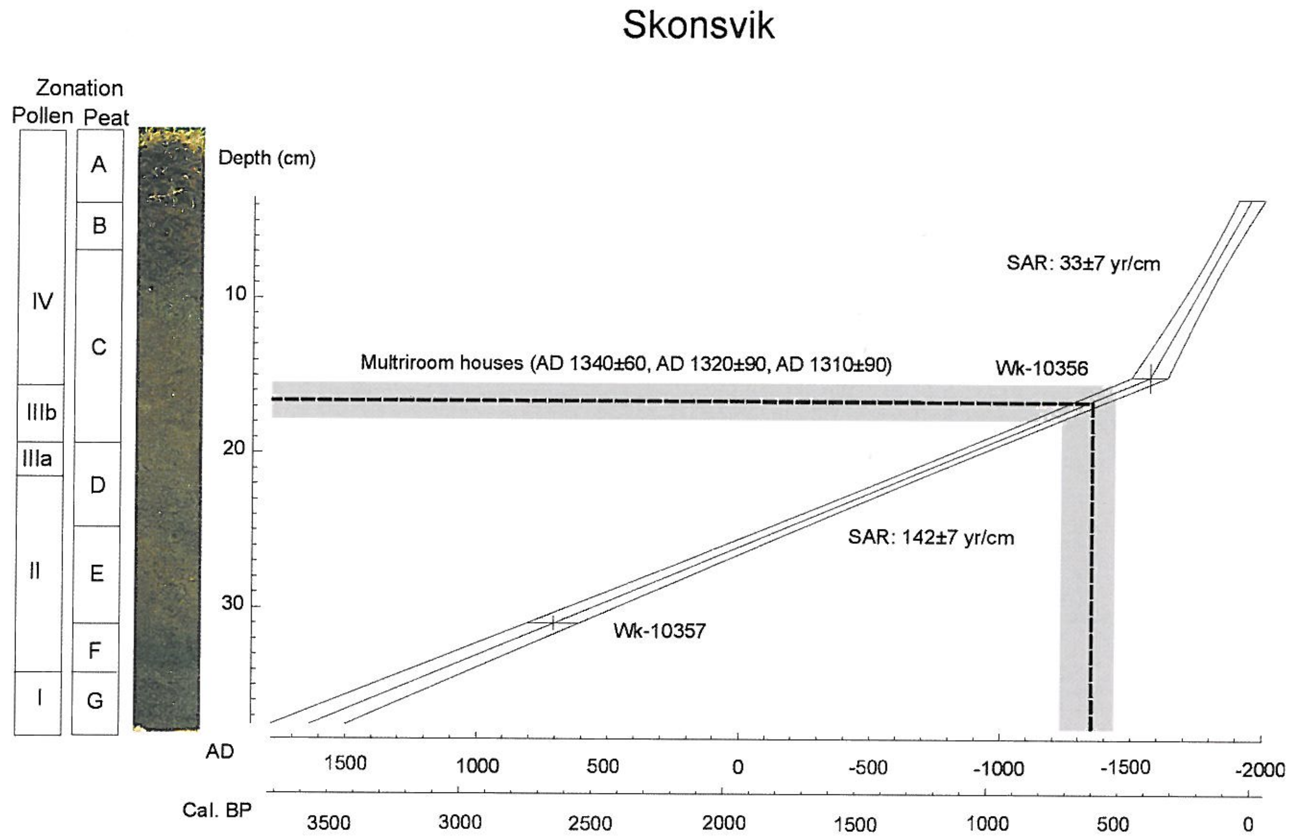

Figure 18.12: Age-depth model and stratigraphic description of the peat core at Skonsvika. Local pollen assemblage zones (LPAZ): see pollen diagrams. Peat stratigraphy: A: 0-4 cm, mosses, Empetrum nigrum ssp. hermaphroditum, live, B: 4-7.5 cm, raw humus, C: 7,5-19,5 cm, Eriophorum-peat, dark brown, with sand (mixture of pure organic and sandy layers), D: 19.5-25 cm, dark brown/black organic soil with sand, E: 25-31 cm, Eriophorum-peat, olive-brown, F: 31-34.5 cm, Eriophorum-peat, dark brown-black, G: 34.5-40 cm, Black, organic soil with high sand and stone content

Skonsvika, Berlevåg

Sedimentology and age-depth modelling

The analysed peat core consists of sedge- and moss-dominated peat with a rather high content of sand and silt. The peat profile covers a period of c. 3600 years (Figure 18.12). The basal sedge peat, without sand, is dated as cal. 2588 ± 57 BP (850-520BC) (Table 1).

Pollen analysis

The pollen profile reflects a development from an open landscape with local meadow and seashore communities to willow and birch forest or carr, followed by deforesting and pasture development. Four local pollen assemblage zones are recognized (Figure 18.13). Zone I, 1700 ± 140 - 1190 ± 140 BC, has a high diversity in herbs. The sea level was higher and seashore vegetation closer to the sampling site than today. Some of the apophytes and possible adventitious taxa may thus originate from the seashore, but the relatively high charcoal curve indicates human activity which is consistent with the numerous houses from the Late Stone Age and Early Metal Age. Zone II shows no obvious signals of local human impact. The pollen record reflects a hydrological change of the mire, caused by a lowering of the ground water level. Oligotrophication is seen by the increase in dwarf shrubs (Ericales), *Rubus chamaemorus* and *Betula nana*-type pollen. A willow (*Salix*) carr develops during the last part of the zone. This development probably reflects the gradual regression of the sea, lake formation and colonisation of the lake shores. The transition to zone IIIa is set at the increase in *Betula pubescens*-type pollen at 500 ± 60 AD. The abundance of *Betula nana*-type pollen is also high during this zone. Dwarf birch has probably grown on the mire, and birches at the fringe and on the mineral soil south of the mire. From 19 cm on, 1000 ± 60 AD, Poaceae, *Rumex acetosa*-type pollen and charcoal accumulation rates increase (Figure 18.13). This may reflect a grassland development and the start of permanent settlement in the area. At 18.3 cm, 1100 ± 60 AD, the concentration of *Betula pubescens*-type pollen is extremely high and the pollen accumulation rate is 56000 grains $cm^{-2}yr^{-1}$. Catkins from birch growing on the mire have fallen on the sampling spot, indicating an expansion of the local birch stand. These birches may filter the pollen signal from the surroundings, but it is evident that these local shrub and/or tree resources have not been utilized by humans.

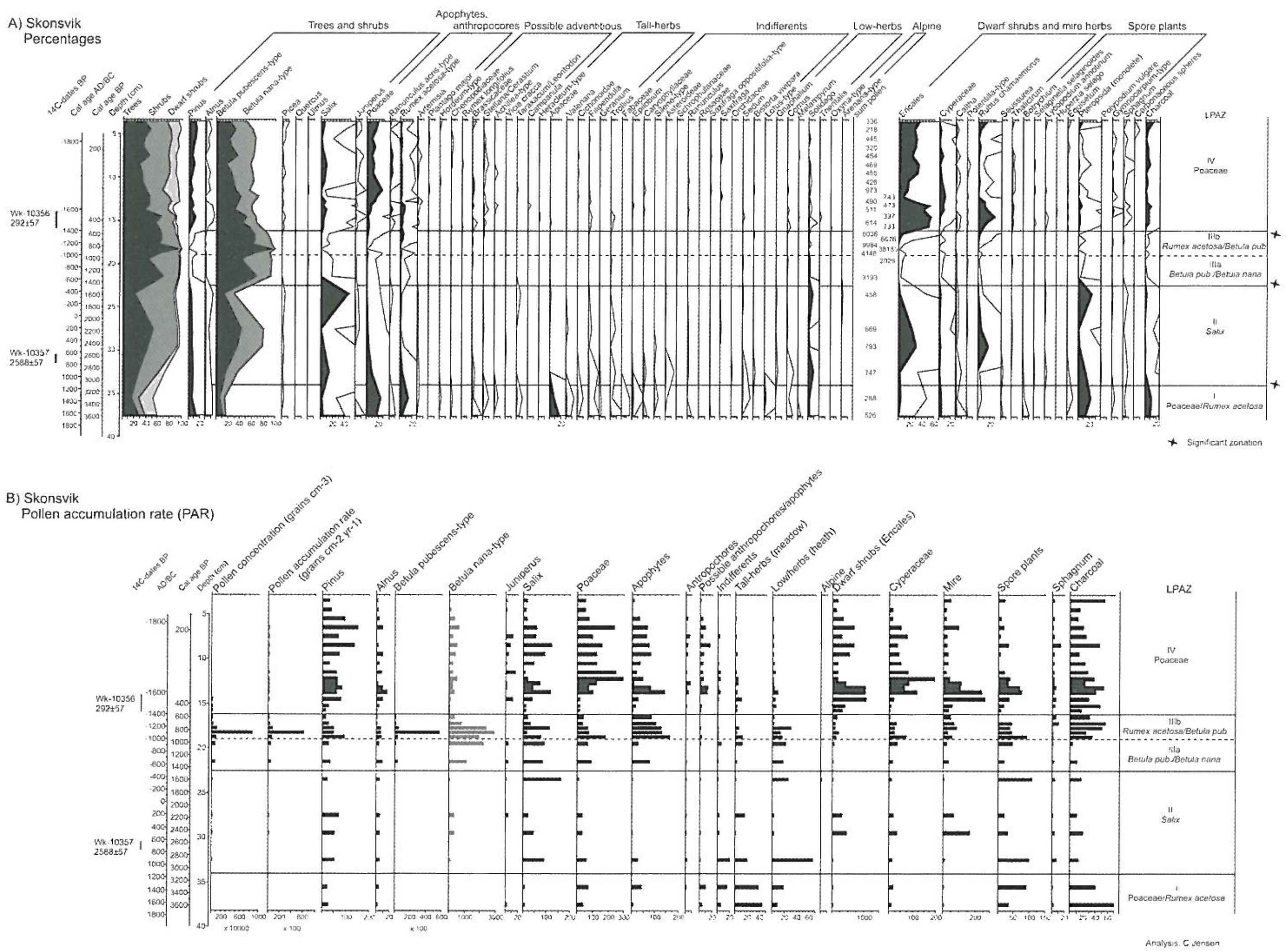

Figure 18.13: Pollen diagrams for Skonsvika

During zone IIIb the local birch declines, however, probably by cutting. Zone IV, 1550 ± 60 AD until present, reflects an open landscape. Local mire and dwarf shrub heath is reflected by the increase in Ericales and *Rubus chamaemorus*. Increasing input of nutrients is evidenced by the gradual increase in Poaceae and *Ranunculus acris*-type. At the grass-peak (1650 ± 50 AD) there are several taxa indicative of grazing and trampling. The local pasture, as seen today, is well developed at this time. The increased Cyperaceae and *Thalictrum* curves may be an indication of sedge mires being grazed as well.

Løkvik

Sedimentology and age-depth modelling

Peat is formed on a substrate of silt and sand. From about 35 cm and upwards, peat mosses (*Sphagnum)* are present. The *Sphagnum* peat at 31-32 cm is dated as cal. 1824 ± 57 BP (Table 1, Figure 18.14). A change towards dwarf shrub peat at 20 cm is dated as cal. 441 ± 64 BP. At this level a possible hiatus is recognized in the pollen stratigraphy (see below).

Pollen analysis

The major changes in the bio-stratigraphy reflect the development of the local mire, but expansion of birch forest and a phase of anthropogenic impact are recognized as well. Three main zones are outlined (Figure 18.15, Table 2). The dominance of Poaceae and Cyperaceae during zone I indicates that the local mire is a sedge/grass mire at this time. *Stellaria/ Cerastium* and other Caryophyllaceae taxa as well as *Rumex longifolius*-type (probably *R. aquatilis*) may come from seashore vegetation, the sea level being higher than at present. At the transition to zone IIa, 600 ± 60 AD, the mire changes to *Salix* and *Betula nana* carr with *Potentilla palustris* growing in wetter parts. Zone IIb, 800 ± 50 – 1400 ± 70 AD, reflects an expansion of local willows (*Salix*) and probably birch. Charcoal is slightly increased and apophytes like *Rumex acetosa*-type and *Ranunculus acris*-type are

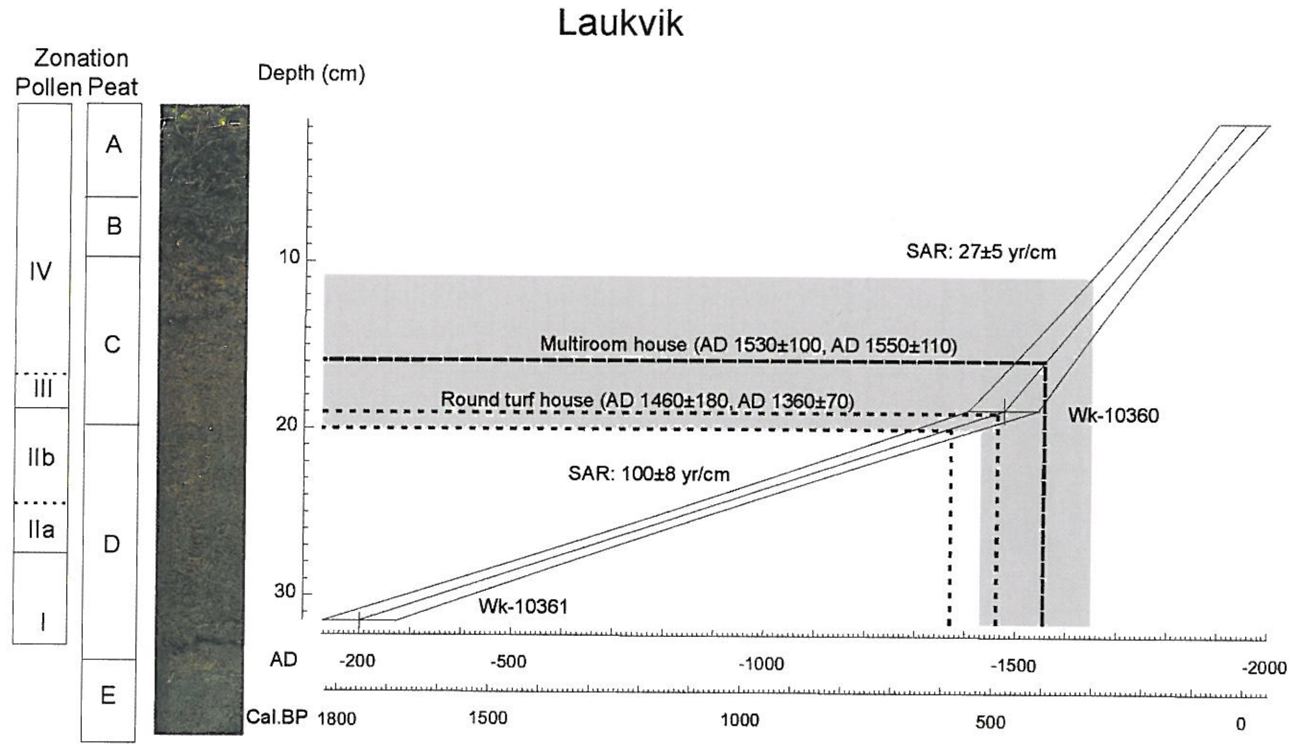

Figure 18.14: Age-depth model of the peat core at Løkvik. Peat stratigraphy: A: 0-6 cm, Empetrum nigrum ssp. hermaphroditum/Rubus chamaemorus live and raw humus, B: 6-10 cm, Sphagnum-peat, H2, C: 10-20 cm, Ericales/Sphagnum-peat H3, D: 20-35 cm; Sphagnum/Eriophorum-peat, H4, E: 35-42 cm, Eriophorum-peat H4-5, with sand. The basal sequence, 42-72 cm, consisted of sand. Pollen zones: see pollen diagrams

Locality	LPAZ	Depth (cm)	Age AD/BC	Age Cal. BP
Kirkegårdsbukt	V Ericales/Cyperaceae	0-19	AD1950-1600±50	0-350±50
	IV *Ranunculus acris*	19-28	AD1600±50-910±80	350±50-1080±80
	Hiatus	23	AD1220±360	730±360
	III *Sphagnum*	28-30	AD910±80-800±70	1080±80-1150±70
	II Poaceae	30-36	AD800±70-570±230	1150±70-1380±230
	I *Betula pubescens*	36-38	AD570±230-490±230	1380±230-1460±230
Gåsnes	V *Potentilla*	0-40	AD1950-1450±100	0-500±100
	Hiatus	39,5	AD1530±210	420±210
	IV *Thalictrum*	40-42,9	AD1450±100-1200±50	500±100-780±50
	III Poaceae	42,9-55	AD1200±50-620±90	780±50-1320±90
	II *Achillea*	55-60	AD620±90-400±120	1320±90-1550±120
	I *Chenopodium*	60-61	AD400±120-350±120	1550±120-1590±120
Værbukta	IV Ericales	0-26	AD1950-1510±50	0-410±50
	IIIc *Ran.acris/Rumex acetosa*	26-35,5	AD1510±50-1310±60	410±50-640±60
	IIIb Betula pub./Poaceae	35,5-39,5	AD1310±60-1220±70	640±60-720±70
	IIIa *Ran.acris/Rumex acetosa*	39,5-50	AD1220±70-390±50	720±70-1480±50
	II Ericales	50-59,5	AD390±50-BC390±90	1480±50-2320±90
	I *Betula pub.*	59,5-61	BC390±90-520±90	2320±90-2500±90
Skonsvik	IV Poaceae	0-16,2	AD1950-1380±60	0-570±60
	IIIb *Rumex acetosa/Betula pub.*	16,2-19	AD1380±60-1000±60	570±60-950±60
	IIIa *Betula pubescens/B.nana*	19-22,5	AD1000±60-500±60	950±60-1450±60
	II *Salix*	22,5-34	AD500±60-BC1190±140	1450±60-3140±140
	I Poaceae/*Rumex acetosa*	34-38	BC1190±140-1700±140	3140±140-3650±140
Løkvik	IV *Betula*/Ericales	0-16	AD1950-1550±60	0-390±60
	III Cyperaceae/*Ran.acris*	16-19,5	AD1550±60-1400±70	390±60-550±70
	IIb *Salix/Rumex acetosa*	19,5-25,5	AD1400±70-800±50	550±70-1150±50
	IIa *Salix/Potentilla*	25,5-27,5	AD800±50-600±60	1150±50-1350±60
	I Poaceae/Cyperaceae	27,5-33	AD600±60-250±70	1350±60-1800±70

Table 2

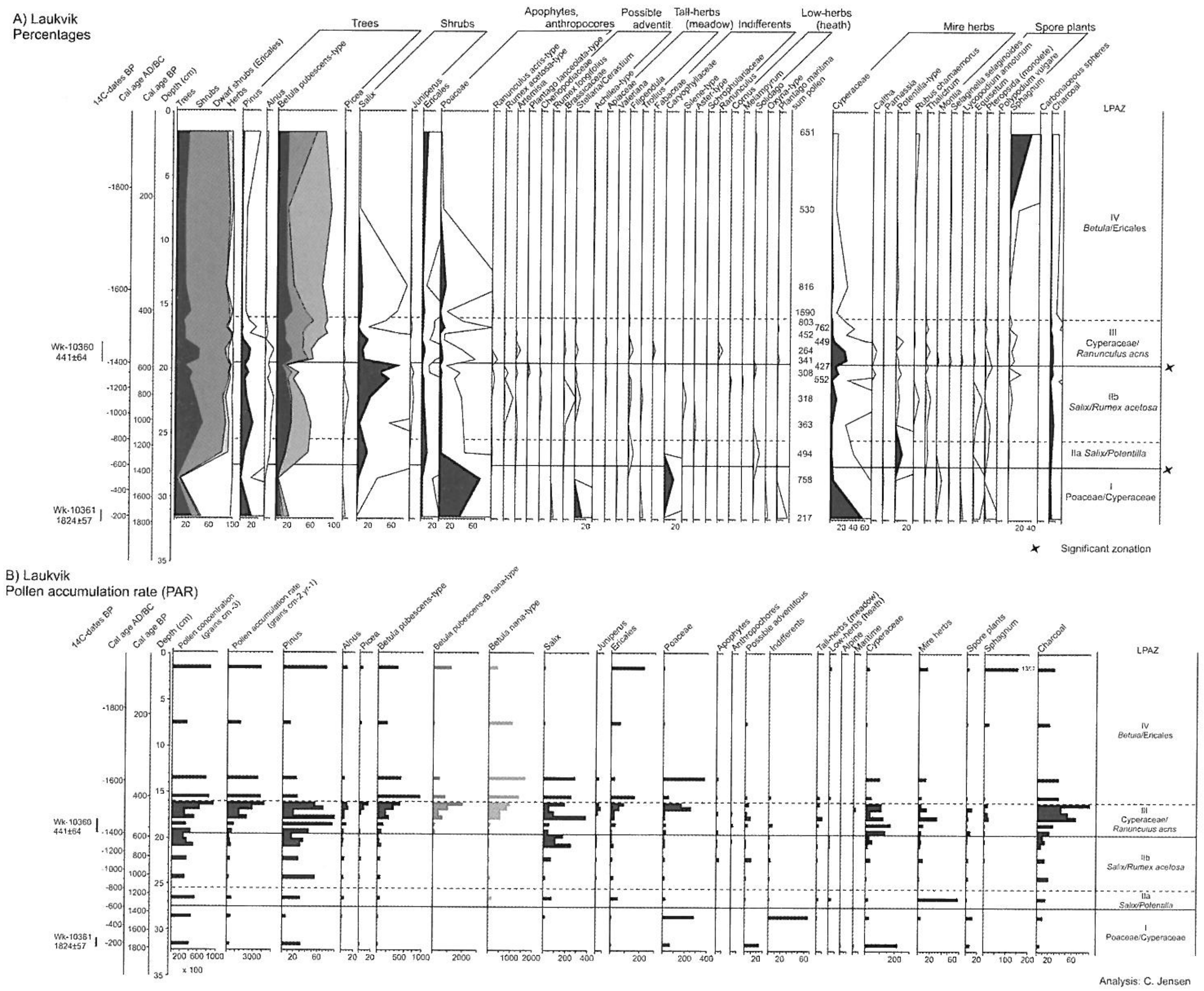

Figure 18.15: Pollen diagrams for Løkvik

present and indicate human impact on the area. The transition to zone III is at an abrupt decrease of *Salix* and increase of Cyperaceae. The sudden *Salix* decline may represent a minor hiatus caused by e.g. high grazing pressure. Charcoal is unchanged and apophytes are still present. Zone III may thus represent a period with grazing and perhaps hay production impact on and near the mire. The increased input of *Betula* pollen reflects local birch stands and carr of mountain birches and dwarf birch at and near the mire, which may have weakened the pollen signal, e.g. from grazed vegetation in the neighbourhood. The intermediate *Betula pubescens/B.nana*-type occurs continuously from this level on. The upper zone limit is set tentatively at the decline of sedges (Cyperaceae), 1550 ± 60 AD, and before a decline in birch. Zone IV reflects development towards the present open heath and mire landscape.

Human impact

Hay production and grazing

In a marginal farming district like Finnmark, all available fodder resources must be utilized to sustain domestic animals through wintertime. The changes in climate during the period covered by this investigation are too small to have altered this situation. Husbandry would thus result in a heavy exploitation of natural grass meadows, sedge mires and shrubs near the settlements. The impact on vegetation is a combination of hay production (mowing or cutting) and grazing. Traditionally, mowing took place towards the end of the growing season this far north. Most herbs would thus manage to flower before being cut. The removal of leaves and loss in biomass changes the interspecies competition. Some species, like *Leontodon autumnalis* (fall dandelion) and *Taraxacum officinalis* (dandelion),

may adapt to repeated cutting by development of buds and leaves at ground level, and thereby gain dominance. Natural heaths and meadows that become fertilised by grazing animals will in time be dominated by more nutrient demanding species and species that have developed defence against grazing and trampling.

It is not easy to separate mowing and grazing in the pollen record, as this traditionally is a combined management. Mowing puts an extra stress on the vegetation, and the increase in apophytes at permanent settlements is probably a result of mowing in addition to stronger local grazing impact by e.g. fencing in the animals. The three apophytes Poaceae, *Ranunculus acris*-type and *Rumex acetosa*-type in combination with an increase in charcoal dust, are the most typical indicators of husbandry (Vorren 1986; 2005). *Ranunculus acris* (buttercup) produces an itchy, bitter tasting poison, anemone, and is left behind by grazing animals (the species is, however, not dangerous when dried, and may be included in hay fodder). *Rumex acetosa* (common sorrel) and most Poaceae (grass) species are favoured by an increase in nutrients. Some grass species are in particular favoured by grazing, due to high content of silica. If these species are grazed, it is mainly in spring when the leaves are soft. *Nardus stricta* may gain dominance on grazed heathland. *Deschampsia cespitosa* is common in fresh, coastal meadows with little nutrients, often in combination with *Ranunculus acris*, *Rumex acetosa* and *Filipendula ulmaria* (meadowsweet). On shallow soil, *Achillea millefolium* (yarrow) may dominate together with *Rumex acetosa* and a number of other herb species.

Sedge mires are important grazing areas for reindeer, especially during early springtime before upland plant species are available. Young shoots of *Eriophorum vaginatum*, and herbs like *Potentilla palustris* and *Menyanthes trifoliata* have high content of sugar and proteins in leaves and roots, and provide important food. Mire plants are also grazed during late autumn when herbs and grasses are decaying. The young buds and leaves of *Betula nana* (dwarf birch), *Betula pubescens* (birch) and *Salix* species (willows) are also grazed by reindeer during early summer, and dwarf shrubs like *Empetrum nigrum* ssp. *hermaphroditum* (crowberry), *Vaccinium myrtillus* (bilberry), *Vaccinium uliginosum* (bog bilberry) and *Vaccinium vitis-idaea* (lingonberry) are eaten during wintertime.

The coastal areas of Finnmark are most commonly used as summer pasture. The Løkvik area provides good grazing grounds for reindeer, and is used as such today. The grazing impact seen in the pollen profile from Løkvik may derive from reindeer, but impact from other domestic animals may be relevant as well, especially sheep and/or goat, in combination with mowing. Sheep pastures tend to be dominated by grass over time, due to the selective grazing technique of sheep. The present pasture at Skonsvika is a good example of this. The grazing impact from reindeer is not as intense and hardly seen on the vegetation, unless the animals are gathered for milking, tagging or slaughtering at the same place in due time. On milking places, small grass- and herb-rich meadows develop (Sámi: *gieddi*), and may be reflected in the pollen deposition. Alm and Sommersel (1994) found *Leontodon autumnalis* and *Bistorta vivipara* as characteristic species on a gieddi in Stabbursdalen, Porsanger. *Solidago virgaurea* and *Melampyrum* spp. are recognized as preferred grazing plants for reindeer by Warenberg et al. (1997), but these are common plants on pastures and grazed heathland in general, as well as in sub- and low-alpine heath woodland. Likewise, apophytes like *Rumex acetosa*-type and *Ranunculus acris*-type may be present in pollen records from sites with reindeer herding as well (Aronsson 1991, Jensen et al. 1998, Jensen and Alm 2003). This makes it difficult to separate reindeer herding from other forms of small-scale husbandry without more detailed analyses of dwellings and surrounding environments. Aronsson (1991, 2005) defined four anthropogenic stages in his investigation of settlements with historical information of reindeer herding in Swedish Lapland: Semi-nomadism, c. 500-1700 AD, reindeer nomadism during 1700-1800 AD, sedentary settlements with mowing of mires during the 19th century and forest clearing and farming (cattle, sheep, horses) after 1900. He based his interpretation on modern pollen analyses from meadows still used for reindeer tagging as reference material. If the meadows have been used earlier or contemporary by livestock animals, like sheep and cattle, the impact from reindeer can hardly be singled out.

Midden and activity area

The vegetation in the immediate vicinity of the house or dwelling area is exposed to erosion by trampling and to increased nutrient content, especially nitrogen and phosphor, from food waste and latrines. This results in a significant floristic change, generally consisting of a dominance of annual herbs, which is well recognized in the pollen deposition. Many of the most characteristic species thriving on middens and activity areas are, however, low pollen producers. The dwellings are best reflected if the pollen sampling is very close, like at Gåsnes.

Woodland utilization

Local birch and willow seems to be connected with some anthropogenic phases in this study. There is too little data available from this region to sort out the human impact versus the climatic impact regarding the birch development. The component of long distance transported anemogamous pollen may be higher in the open, low-productive hemi-arctic environment, than further south. As much as 50 % of the total pollen loading may derive from beyond where the vegetation types can be recognized in the pollen assemblage, i.e. the background pollen component (Prentice 1985, Sugita 1993, 1994). However, the regional climatic changes in forest distribution are generally gradual, while human impact on local woodland is abrupt.

The probable human-induced decline in birch around cal. 2400 BP at Værbukta falls within a period of climatic deterioration that is recorded in other palaeo-records from Northern Europe (Helama et al. 2004, Jensen and Vorren 2008). The regeneration after periods of strong anthropogenic impact and/or animal grazing may have been hampered by the less favourable climate compared to the earlier centuries. Historical sources from Finnmark from 1600-1900 inform about a traditionally extensive utilization of shrubs and trees for fuel. Branches of birch were used for the hanging of fish to dry and bark and branches from birch and willow have been used as supplementary animal fodder in addition to dwarf shrubs (Alm 1994). *Betula nana* (dwarf birch) was called "skappe" by the Varanger Sámi people, probably from Norwegian "skav" meaning cut, strip or peel, and was used as emergency fodder for sheep and goat. The impact of domestic animals grazing seedlings as well as buds and leaves on shrubs, maintained an open landscape.

Pine, alder and bird cherry have not been part of the local woodland at any of the investigated sites. The nearest potential sources for pine and alder would be Kvalsund and the Alta region for Kirkegårdsbukt, Børselv and Stabbursdalen region for Gåsnes and Værbukta, and the southeastern headland of the Tana Fjord (Austertana) for Skonsvik and Laukvik (only alder is present in Tana today). Pollen from aspen is fragile and often lost during the chemical processing

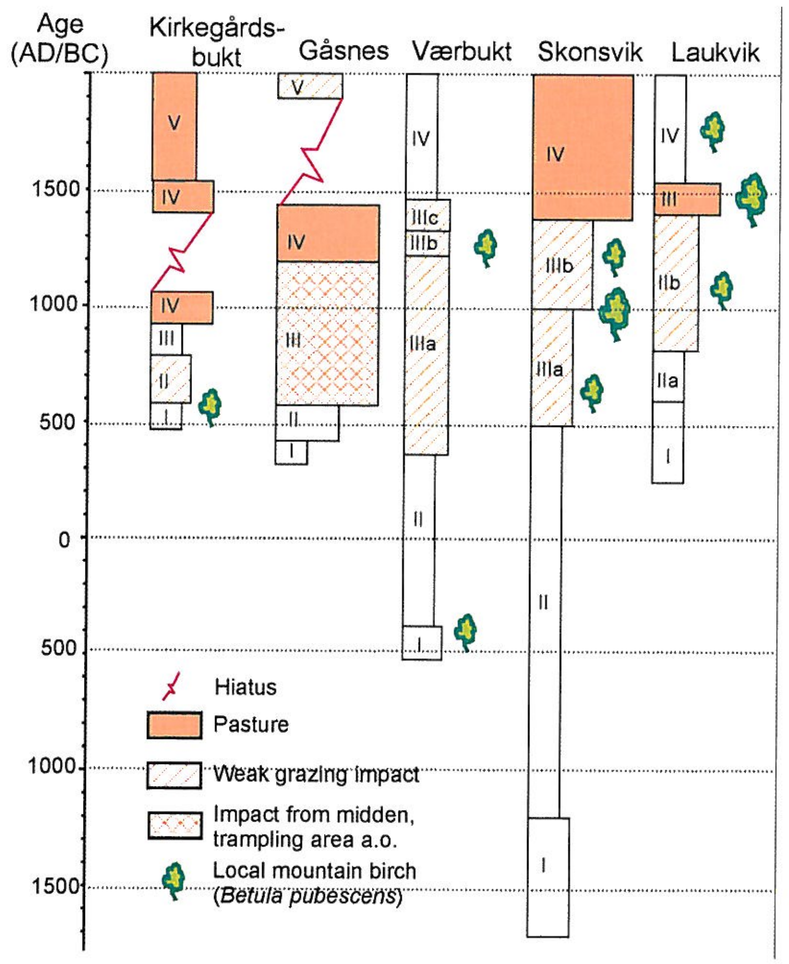

Figure 18.16: Local pollen assemblages zones (LPAZ) of the five localities. The degree of human impact is indicated by increase in horizontal scaling. The chronology of Kirkegårdsbukt is based on the age-depth model b, including a hiatus around AD 1200

in the laboratory. Macro remains from aspen are, however, recorded from Skonsvika (see Engelmark, Chapter 20). Local tree-size aspen is not very likely, but prostrate individuals may have grown at Skonsvika. Rowans might have grown locally and may be favoured by cultivation, but produce little pollen and may not be reflected in the pollen record. Juniper is a characteristic species for pastures, and may have grown at all localities. Juniper pollen is recorded during periods of human impact at all localities in this investigation, except for Værbukta.

Settlement history

Local settlements are seen in the presence of adventitious taxa (apophytes and anthropochores) and charcoal abundance higher than the general background level. Except for Gåsnes, the charcoal values are very low in this investigation, even during periods with known settlement in the area. There is, however, an increase in charcoal at intervals with presence or increase in adventitious pollen taxa. Regarding Værbukt, Skonsvika and Løkvik, this matter may be explained by long distance (150-500 m) to the dwellings and an open coastal landscape with prevailing wind directions away from the pollen site during much of the year. At Kirkesgårdsbukt, the low impact is explained by a possible hiatus covering the period when the houses close to the pollen site were inhabited.

Early Metal Age and Iron Age:

Two of the profiles extend beyond the first millennium BC (Værbukta and Skonsvika), both revealing human impact during the Early Metal Age. Skonsvika LPAZ I includes the first part of the Early Metal Age, 1700 ± 140-1190 ± 140 BC (Table 2, Figures 18.13, 18.16). Høeg (2000) recorded human impact during approximately the same interval at Petterbuktmyra on the Nordkinn Peninsula; 3800-3600 BP. Værbukta LPAZ I includes the middle part of the Early Metal Age, 520 ± 90-390 ± 90 BC (Table 2, Figures 18.11, 18.16) and reflects local settlement with utilization of local birch and maybe grazing. Summer settlement without domestic animals as part of a hunter-gatherer economy is suggested by Vorren (2005) for the period cal. 7100-1000 BP at Vatnan, Sørøya, western Finnmark, while farming activity (husbandry) is not likely until medieval time. Possible abandonment during the centuries around the end of the first millennium BC is recorded at Værbukta, Skonsvika and at Løkvik from c. 250 AD (base of profile). Skonsvika may have an abandonment phase until 500 AD. From then on, settlements with domestic animals or reindeer may have been in the area, but birch and willow near and at the mire may weaken the pollen signal from upland dwellings and pasture. The start of a longer period with continuous human impact is recorded at Værbukta from c. 390 AD, while Løkvik comes later, c. 800 AD. Kirkegårdsbukt reflects utilization of local birch around 500 AD. Gåsnes has indications of settlement from c. 500 AD. The impact is mainly from the midden and trampling area.

Medieval and modern time

The period of the multi-room houses, as estimated by radiocarbon dated house remains, coincides pretty well with periods of increased human impact visible in the pollen records. At Kirkegårdsbukt and Gåsnes, the peat of the sampling sites was probably exploited by people after the abandonment of the multi-room houses, resulting in a time gap during the relevant period. It is likely that husbandry has been a part of the economy at Kirkegårdsbukt, given the grazing impact before and after the hiatus. If a hiatus is not present, the activity at and around the multi-room settlement may have been of short duration. Presence of domestic animals and increased anthropogenic impact is seen at Sørøya (Vorren 2005, Sjøgren 2009) and at Sundfjæra on Melkøya (Jensen 2004) from c. 700 cal. BP onwards. The Gåsnes site is not radio-carbon dated yet, but the chronology of the peat profile suggests that most of the medieval period is intact, the upper limit of the peat culture layer being 1530 ± 210 AD. The anthropogenic impact seen in LPAZ IV and/or the upper part of LPAZ III is probably the reflection of the multi-room house settlement. The main impact is from the activity at the house, but husbandry is relevant as well. Given the nature of the surroundings, with dominance of mires, the keeping of domestic animals has not been a major source of income. Skonsvika reflects farming activity with domestic animals and utilization of local birch. Micromorphology analyses of sediments from within the multi-room houses at Skonsvika revealed residues from wood fuel in such large numbers and in various site contexts, that other activities than household cooking and heating must have occurred (see Chapter 19). Numerous pits with clear indication of firing may be a result of hide and fur processing (see Chapter 7). It is likely that there is a connection between these activities and the reduction in local woodland that is seen from the pollen results. The character of the pasture as a sheep pasture is supported by the finds of lamb/sheep/goat bones in the house remains (see Chapter 17). Two grains of barley (*Hordeum vulgare*) and one possible corn cockle (*Agrostemma githago*) embryo were recorded among the macro-remains from the multiroom houses at Skonsvika, and were most probably derived from imported cereals (see Chapter 20). The pollen sampling site is too far from the houses to detect fields, but the nature of the local climate and soils makes cereal growth unlikely. Værbukta and Løkvik both show grazing impact that may derive from domestic animals using the outfields, but also by reindeer. Husbandry at these localities has hardly been a major activity. Utilization of local birch and willow is reflected at Løkvik, and at a smaller scale at Værbukta.

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