Laborativ Arkeologi 10–11, pp. 5–15 (1998)

Archaeobotanical investigations at Vendel and Valsgärde

Ann-Marie Hansson

A summary is given of archaeobotanical investigations (early and recent) performed at Vendel and Valsgärde and to some extent also at Gamla Uppsala. The main methods used are the analysis of fossil plant remains, plant tissues in charred bread and imprints on ceramics. Barley (*Hordeum* sp.) is the dominant cereal, but bread-clubwheat (*Triticum aestivo-compactum*), emmer/spelt wheat (*T. dicoccum/spelta*), oats (*Avena* sp.) and rye (*Secale cereale*) also occur, though rye only as an imprint on ceramics. Other cultivated plants include flax (*Linum usitatissimum*), hemp (*Cannabis sativa*) and peas (*Pisum sativum* var. *arvense*), the two latter as imprints, but pea flour is also found in charred grave bread. Field weeds and wet meadow plants occur, as do hazelnuts (*Corylus avellana*), bilberries (*Vaccinium myrtillus*) and possibly cowberries (*V. vitis idaea*), evidently the results of gathering. Juniper berries (*Juniperus communis*) may also have been gathered. Can the cause for the striking increase in finds of bread-clubwheat (*Triticum aestivo-compactum*) in eastern central Sweden during the Late Iron Age be discussed in terms of south-eastern contacts and impact from high-status settlements such as Vendel and Valsgärde in this region, or are there other explanations?

Introduction

The plant macrofossil analyses reported here were performed within the framework of the joint SIV (*Svealand in the Vendel and Viking Periods*) project arranged by the Archaeological Research Laboratory of Stockholm University and the Archaeological Department of Uppsala University, which started in 1996 under the leadership of Professor Birgit Arrhenius of Stockholm and Docent Frands Herschend of Uppsala. Archaeological investigations at the Late Iron Age settlements at Vendel in the parish of the same name and at Valsgärde in the parish of Gamla Uppsala in the northern part of the province of Uppland, east central Sweden, form part of the project, in which these settlements occupy a key position.

When analysing the economic basis for power and wealth in specific key settlements, cultivation and livestock raising are of the utmost importance – with special consideration being given to food for horses and humans and the interaction between man and nature. This means that both vegetational and agricultural development are of great importance as aspects of the use of natural resources and of the basis for the economy and should be examined in detail. Archaeobotanical investigations therefore have an important function within the SIV project. We know very little about the importance of cultivation in this area, for instance, what crops were used and what edible plants or prepared cereal-based foods were included in the diet. We also need more information on the use of these plants as such, in the form of prepared food and as grave gifts carrying a symbolic value. Plant food, being of organic origin, is easily destroyed, and survives almost exclusively in carbonized condition at Late Iron Age settlements. This fact made information difficult to obtain in earlier times, but the technical equipment available at the Archaeological Research Laboratory now makes it possible to perform the necessary analyses within the framework of the SIV project.

Loaves of bread are mainly found deposited in wealthy graves, at least in the analysis of the grave bread at Birka (Hansson 1996), and cereals and other cultivated crops can also be expected to be found in graves or settlements belonging to the upper strata in society. This led to the speculation that it might be possible to find a rich, informative body of plant material in the Late Iron Age settlements and graves at Vendel and Valsgärde. The analyses of fossil plant material performed so far do not contradict this.

Earlier archaeobotanical investigations

The Iron Age settlement at Gamla Uppsala is also of importance in this connection, partly because of its high status, like the settlements of Vendel and Valsgärde, and partly because of the waterway that linked the sites, the River Fyris. The settlements at Gamla Uppsala and Valsgärde were both situated beside the river, and that at Vendel near Lake Vendel, which is con-

Table 1. Imprints of plant remains on grave ceramics from Vendel and Gamla Uppsala. Compilation after Hjelmqvist 1955, p. 127.

Findplace	Dating	Hulled barley	Naked barley	Oats	Rye	Wheat	Flax	Others
VENDEL								
Bergby								
SHM 19416:23	Viking Age	—	—	1	—	—	—	—
SHM 19416:35, 42	Late Iron Age		3	4	1	—	2	17 —
Brunnby								
SHM 20521:2	Migration Period?	2	—	—	—	—	—	—
SHM 20521:4	Rom. Iron Age –Migration Period	1	—	—	—	—	—	—
Hovgårdsberg								
SHM 19963	Vendel Period	2	—	1	—	—	—	—
SHM 19963:22	Migration Period	—	—	1	—	—	—	—
SHM 20523:29	Vendel Period	—	—	—	—	1		1 pea? 1 vetch
Husby (Laberga)								
SHM 24985 A	Viking Age	—	—	—	—	—	—	1 vetch
Karby								
SHM 9521:10	Viking Age	—	—	—	—	—	—	1 hemp 1 vetch
GAMLA UPPSALA								
SHM 24570:1	Late Iron Age	1	—	—	1	—	—	—
West mound, SHM 5308	Migration Period –Vendel Period	1	—	—	—	—	—	—

nected with the river. Thus there must have been communication between the settlements.

Archaeobotanical investigations have been performed at the sites earlier by Professor Hakon Hjelmqvist of Lund, who analysed imprints on ceramics from graves (table 1) and identified the structures of cell tissues from cereals in carbonized bread loaves deposited as grave gifts in various cemeteries at Vendel and Gamla Uppsala (table 2, fig. 1).

The history of the vegetation around the cemeteries and the settlement close to the church of Vendel is illustrated in a pollen diagram produced by Helen Atkinson (1994), Department of Physical Geography, Stockholm University.

Recent archaeobotanical investigations *(table 3)*

Method

Soil samples of sizes varying between 1.5 and 10 l were taken during the excavations, including one of 10 l from the oven in the sunken-floor hut construction. For more detailed information, see the reports on Vendel and Valsgärde (Hansson 1997a, b). The soil samples were separated out in water in a specially constructed flotation vessel. The light organic material floating on the surface was captured in sieves with a minimum mesh size of 0.5 mm, and the inorganic material remaining was dried and examined. This fraction may also contain metal, ceramics, glass or stone artefacts or heavier bone remains. The organic material then was carefully sorted in a wet condition with the help of a fine brush under a low magnifying microscope, 10×, or higher magnification when necessary. Some of the fossil plant remains that were difficult to identify because they were embedded in a fine inorganic matrix were cleaned in hydrofluoric acid (48% HF). All diaspores were put aside for analysis. The following reference literature was used for identification purposes: Anderberg (1994), Beijerinck (1947), Berggren (1969; 1981), Katz et al. (1965), Lange (1979), Tallantire (1976) and the collection of modern diaspores at the Archaeological Research Laboratory. The nomenclature follows Krok & Almquist (1985).

Vendel – graves

A Viking Age grave urn (female grave) was found inserted into an older construction, probably a house (Isaksson & Arrhenius 1995), and its soil content was analysed. Besides the artefacts deposited as grave gifts, there were also fossil plant remains in the form of thirteen charred cereal caryopses, four of them identifyed as barley (*Hordeum* sp.). The remaining nine were fragmentary and could only be identified as cereals (Pelve 1995:20).

Table 2. Ingredients of botanical origin in carbonized grave bread from Vendel and Gamla Uppsala. Compilation after Hjelmqvist 1990, pp. 11, 13, 15, 16, 19. ×=present, — =not present.

Findplace	Dating	Hulled barley	Naked barley	Oats	Rye	Wheat	Flax	Others
VENDEL								
Hovgårdsberg								
Grave 29, SHM 20523[1]	Vendel Period	×	×?	—	—	—	—	pea, rye-brome
Grave 53a, SHM 20523	Vendel Period –Viking Age	×	—	—	—	—	—	—
Bergby								
Grave 26, SHM 19416	Vendel Period	×	—	×	—	—	—	—
Husby, Järmas hed								
SHM 15848	Vendel Period –Viking Age	×	—	—	—	—	—	—
Not analysed bread								
Hovgårdsberg, Site 32, A21, SHM 19963[2]								
Bergby, Site 38, grave 35, SHM 19416[2]								
Karby, SHM 9521:10								
Cemetery W. of the church, SHM 10033:17								
GAMLA UPPSALA								
Grave 2, SHM 24570:2	Viking Age	×	—	—	—	—	—	emmer wheat?
At the kings' mounds, Grave 31, SHM 23316:31	Viking Age	×	—	×	—	—	—	—

[1] Atterman 1935, p. 145 [2] discovered in 1997 among old grave gifts

There is no information on finds of seeds, fruits or loaves of bread as grave gifts in the boatgraves at Vendel (Stolpe & Arne 1912), but a systematic analysis of fossil plant material was performed on soil samples from two cremation graves, A1 and A2, dated from their grave gifts to the Late Migration Period and to the earliest Vendel Period or somewhat older, respectively (Seiler 1997). Accelerator dating of a charred caryopsis of barley from grave A2 gave 1405±60 BP (Ua-11894), or AD 600–690 when calibrated with one sigma (Stuiver & Becker 1993; Stuiver & Reimer 1993).

The soil samples taken from cremation grave A1 (female) contained carbonized shells of hazelnuts (*Corylus avellana*) but no cultivated plants apart from a possible seed of gold of pleasure (*Camelina sativa*). This oleaginous plant was probably cultivated in monoculture, but it could also have existed as a contamination in flax fields. A fruit of false cleavers (*Galium spurium*) was also found, this being a common field weed in central Sweden during the Iron Age. Chickweed (*Stellaria media*), violet (*Viola* sp.) and a seed of juniper (*Juniperus communis*) were also present.

Some of the soil samples from cremation burial A2 (male) contained cereals, but unfortunately the plant

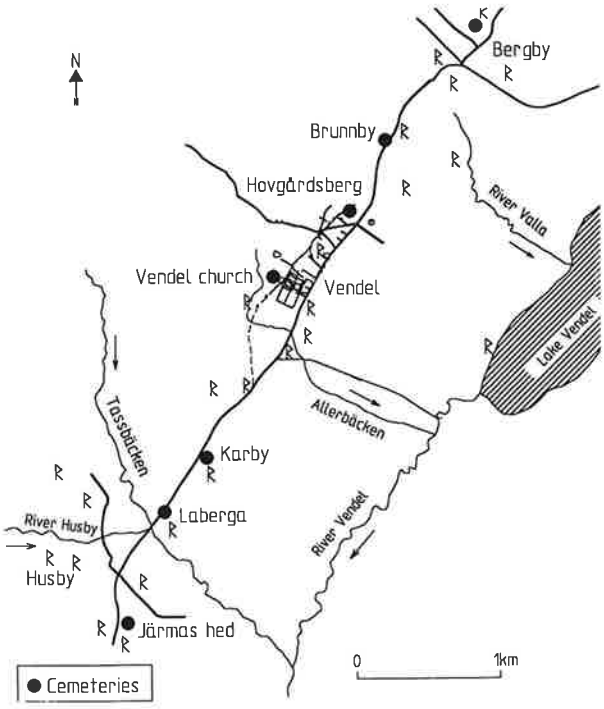

Figure 1. Burial grounds in the parish of Vendel mentioned in tables 1–2. CAD drawing by Kjell Persson.

Findplace	Structure	Dating	Hulled barley	Barley	Oats	Bread wheat	Emmer/ spelt wheat	Cerealia indet.	Flax	Others
VENDEL										
Cremation grave, Vendel 1:1	F134	Viking Age	—	4	—	—	—	c. 9	—	—
Cremation grave, Site 26	A1[2]	Migration Period	—	—	—	—	—	—	—	1 cf. gold of pleasure (*Camelina sativa*), 1 Chenopodiaceae, 3 hazelnut shells (*Corylus avellana*), 2 false cleavers (*Galium* cf. *spurium*), 1 Juniper (*Juniperus communis*), 1 chick weed (*Stellaria media*), 1 Violet (*Viola* sp.)
Cremation grave, Site 26	A2[3]	Vendel Period	8	22[4]	—	1?	3?	c. 104	—	2 Cyperaceae, 1 Fabaceae, 1 cf. Annual knawel (*Scleranthus annuus*)
Settlement, Vendel 1:1	A2, post-hole, Sample no. 8	Medieval Period	—	1	—	—	—	—	—	1 orache (*Atriplex* sp.), 1 Brassicaceae, 20 sedge (*Carex* spp.), 2 goosefoot *Chenopodium* sp.), 1 fat hen (*Chenopodium* cf. *album*), 5 Cyperaceae, 3 common spike-rush (*Eleocharis* cf. *palustris*), 1 willow-herb (cf. *Epilobium*), 1 Fabaceae, 1 grass (Poaceae), 1 *Polygonum* sp., 3 cf. *Potentilla* sp., 1 common tormentil (*Potentilla* cf. *erecta*), 2 spring cinquefoil (*Potentilla* cf. *verna*), 2 *Rumex* sp., 5 club-rush (*Scirpus* sp.), 1 Scrophulariaceae, 1 marsh stich-wort (*Stellaria* cf. *palustris*)
Settlement, Vendel 1:1	A12, Groove, Sample no. 7	Late Iron Age	—	1	—	—	—	—	—	4 lady's mantle (*Alchemilla vulgaris*), 1 *Cardamine* sp., 4 Caryophyllaceae, 1 *Chenopodium* sp., 2 fat hen (*Chenopodium* cf. *album*), 1 maiden pink (*Dianthus deltoides*), 1 eyebright (*Euphrasia* sp.), 1 lady's bedstraw (*Galium* cf. *verum*), 1 knot grass (*Polygonum aviculare*), 1 cowberry/bilberry *(Vaccinium vitis idaea/ myrtillus*), 1 bilberry (*Vaccinium* cf. *myrtillus*)
Settlement, Site 26	A10	Neolithic Period	—	—	—	—	—	—	—	3 hazelnut shells (*Corylus avellana*)
VALSGÄRDE										(I–V = Ecological plant group)
Grave	Boatgrave 7	Vendel Period	—	—	—	—	—	—	—	hazelnuts (*Corylus avellana*)
Settlement, Site 295	Longhouse, Samples from 8 post-holes[5]	Vendel Period	1	2	—	1	—	c. 8	—	1 lady's mantle (*Alchemilla vulgaris*) (III), 1 false cleavers (*Galium spurium*) (II), 1 bedstraw (*Galium* sp.)(II?), 1 mint (*Mentha* sp.) (II, V), 1 bittersweet (cf. *Solanum dulcamara*) (V), 1 cowberry/bilberry (*Vaccinium vitis idaea/myrtillus* sp.) (IV)
Settlement, Site 295	A 111, oven in sunken-floor hut	Vendel Period	6	10	2[6]	2[6]	—	c. 40	2	2 Characeae (cf. *Chara* sp.) modern? (V), 1 Chenopodiaceae (II), 1 fat hen (*Chenopodium album*) (II), 1 hazelnut shell (*Corylus avellana*) (IV), 2 Cyperaceae spp.(III), 4 juniper (*Juniperus communis*) (4,5), 3 Poa (cf. *Poa* sp.) (III, V), 1 butter cup (*Ranunculus* sp.) (III), 1 speedwell (*Veronica* sp.) (III)

[1] A further four soil samples from various types of structures were analysed at the settlement: A10 hearth (sample 1); dark coloured soil, x1679.8, y4758.3, z37.11 (sample 3); dark coloured soil, x1679.2, y4762.2, z37.3 (sample 4); border between A8a and A8b (possibly a cooking pit) (sample 6). Only *Chenopodium* sp. and knotgrass (*Polygonum* sp.) were found (Strage 1995, pp. 14f).

[2] Two samples from A1: 9, 14 and picked plant material in water sieving.

[3] Three samples from A2: 26, 27, 28 and picked plant material in water sieving.

[4] Ten of these are somewhat uncertain.

[5] A169, A173, A181, A188, A230, A236, A253, A245

[6] Identification is somewhat uncertain.

◁—— *Table 3. (left) Fossil plant remains found in plant macrofossil analyses at graves and settlements in Vendel and Valsgärde performed within the SIV project. Ecological plant groups: (I) Cultivated plants, (II) field weeds and ruderals, (III) meadow plants, (IV) collected plants, (V) others.*

material was extremely badly burnt and therefore difficult to identify. Eight of the caryopses were identified as hulled barley (*Hordeum vulgare*), twelve as barley (*Hordeum* sp.), and ten were probably barley (cf. *Hordeum* sp.). One caryopsis was identified (with some uncertainty) as bread-clubwheat (*Triticum aestivo-compactum*) and three may possibly be emmer or spelt wheat (*Triticum dicoccum/spelta*), but had been damaged by fire to such an extent that their identification was questionable. It is extremely difficult to distinguish between caryopses of emmer and spelt in a carbonized condition, and they are therefore treated together here. One hundred and four grains of cereals (including fragments) could not be identified. The plant remains described above are the results of both the systematic analysis of fossil plant remains and the careful sieving of soil from the cremation layer in water, performed indoors at the Archaeological Research Laboratory. Thus a comparatively large number of caryopses were found, together with a few remains of other plant species. Surprisingly enough, no shells of hazelnuts (*Corylus avellana*) were found (Hansson 1997a).

We do not know why there should be such a marked difference in the composition of the fossil plant material between the two graves, but there are some facts that might have influenced the choice of grave gifts: the different sexes, and/or the social positions of the deceased. The graves also differed somewhat in chronology, and there is also the possibility that further plant food was deposited in places where no samples were taken.

Vendel – settlement

Analysis of fossil plant remains in six soil samples taken from various types of structures at the settlement revealed cultivated plants in the form of two caryopses of barley (*Hordeum* sp.), one in the sample taken in a gully (A12) dated to the Late Iron Age (sample no. 7), and one in that from a post-hole probably belonging to a medieval cottage (A2) (sample no. 8). The composition of the total material of plant remains may be used in a cautious attempt to deduce the function of the structures, or what they represented (*cf.* Engelmark 1981; Wennberg 1986; Engelmark & Viklund 1990). The plants identified in the gully (A12) represent species which can be found in a dwelling house or the part of a house used for living in. The plant species found in the post-hole (A2) probably represent fodder plants, so that the post may have been part of the structure of a fodder barn of some type (Strage 1995:18f) (table 3).

A10 (sample no. 1) represents a hearth, with finds of slag. No plant remains were found, a fact which might be used as negative evidence regarding the activity going on here. It implies that most likely no cooking or processing of cereals took place but that this hearth may have belonged to some kind of metal workshop. The three other soil samples contained a few seeds of *Chenopodium* and one diaspore of knot grass (*Polygonum* cf. *aviculare*), showing that the soil was probably nitrophilous and the ground may have been trampled.

Five soil samples for phytolith analysis were taken from various types of structures. This was a pilot study for this type of analysis as applied to archaeological material in Sweden. The analysis enabled clear differences in character to be discerned between the structures (Bergström 1996:29f).

A great number of soil samples were taken from the Vendel settlement for future analysis, above all from the post-holes, where the chances of finding charred plant remains are good, as concluded in connection with the archaeobotanical investigations into the Iron Age house structures at Gene and Trogsta, where systematic plant macrofossil analyses of carbonized plant material were performed (Engelmark 1985).

Valsgärde – graves

No systematic analyses of fossil plant remains from the uncremated boat-grave burial constructions at Valsgärde were performed, but hazelnuts (*Corylus avellana*) were found in the stem of the boat in grave no. 7 (Arwidsson 1977:91). On going through the botanical material in the graves at Birka, Greta Arwidsson commented on the hazelnuts (*C. avellana*) in the Valsgärde boatgrave as follows: "Bei den in Häufchen gefundenen Haselnüssen sei zum Vergleich an die Funde von kleinen, mit Haselnüssen gefüllten Holzschalen erinnert, die in einem der vendelzeitlichen Bootgräber von Valsgärde angetroffen wurden. Hier gehörten die Nüssen offenbar zu dem reichlich bemessenen Proviant des Toten" (Arwidsson 1984:274).

Valsgärde – settlement

Analyses of fossil plant macroremains were performed on soil samples originating from eight post-holes in a longhouse dating from the first half of the seventh century and one sample from an oven at the southern end of a sunken-floor hut (figs. 2–3) of a similar date (Norr & Sundkvist 1997).

The soil from the settlement area contained glacial clay (Norr & Sundkvist 1997) and was calcareous. Apart from the fossil plant material (table 3) and bone fragments, burnt and unburnt, the site also produced 17 molluscs, of which one was modern, to judge from the outer layer of its shell. Oospores of aquatic Characeae

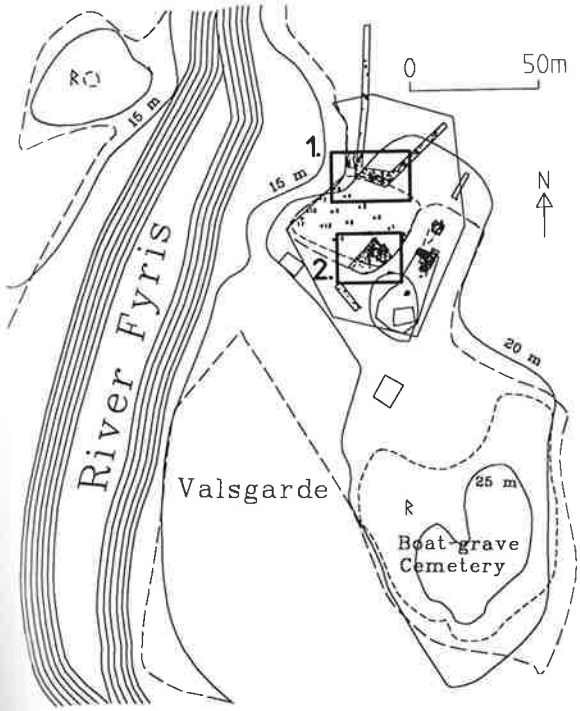

Figure 2. The Valsgärde site with the location of the longhouse (1) and the sunken-floor hut with the oven A111 (2) marked. After Norr & Sundqvist 1997, modified by Kjell Persson.

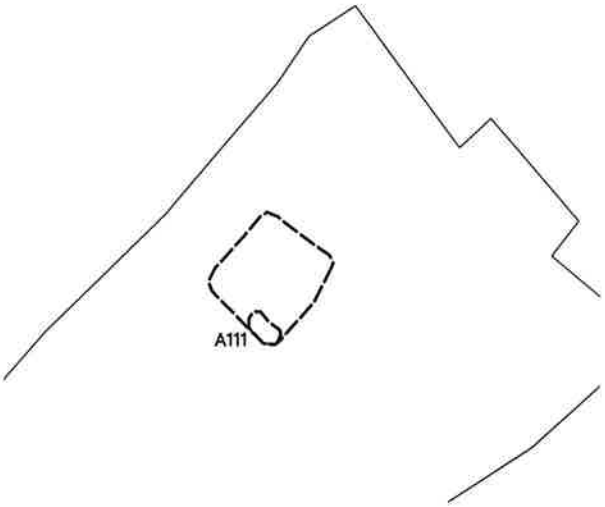

Figure 3. The sunken-floor hut (within hatched lines) at the settlement of Valsgärde. The oven A111 is situated in the southern corner. After Norr & Sundqvist 1997, modified by Kjell Persson.

(cf. *Chara* sp.) may also indicate calcareous soil. These were uncharred and may be recent or subrecent, as it is difficult to judge whether they are modern or originate from older periods, being heavily encrusted with lime, which has contributed to their survival. These algae most likely originally grew in the River Fyris.

Three caryopses of cereals from the longhouse (fig. 6) were identified as barley (*Hordeum* sp., one of them somewhat uncertain), and there was also one caryopsis of bread-clubwheat (*Triticum aestivo-compactum*) and about eight unidentified caryopses or fragments representing cereals of some kind. A fruit of false cleaver (*Galium spurium*) was also found here, possibly grown as a field weed and deposited at the same time as the cereals. Diaspores of a mint (*Mentha* sp.) not identified to species, a possible bittersweet (*Solanum dulcamara*) and lady's mantle (*Alchemilla vulgaris*) and a seed of bilberry (*Vaccinium myrtillus*) or cowberry (*V. vitis idaea*) were also discovered.

Both carbonized and uncarbonized bone fragments were also found in four of the post-holes, unburnt bones, some of them of fish, being predominant.

Traces of cultivated plants were found in the oven of the sunken-floor hut, comprising two possible caryopses of oats (*Avena* sp.), six of hulled barley (*Hordeum vulgare*), ten of barley (*Hordeum* sp.), one of bread-clubwheat (*Triticum aestivo-compctum*) (fig. 4), one possible caryopsis of bread-clubwheat (*T. aestivo-compactum*) and about 40 unidentified caryopses or fragments representing cereals. Two flax seeds (*Linum usitatissimum*) could also be identified. Of the non-cultivated plants, mention can be made of one diaspore of Chenopodiaceae, one of fat hen (*Chenopodium album*), two of Cyperaceae, four of juniper (*Juniperus communis*), three of grass (cf. *Poa* sp.), one of buttercup (*Ranunculus* sp.), one of speedwell (*Veronica* sp.) and one piece of hazelnut shell (*Corylus avellana*). Bone fragments, both charred and uncharred, were also present in the sample from the oven.

Discussion

The charred loaves of bread in the graves at Vendel and Gamla Uppsala contained no bread wheat and were not leavened, the normal condition for grave bread (Hansson 1996). It is significant that one of the loaves from Gamla Uppsala may have contained emmer wheat (*Triticum dicoccum*), a cereal which was used for baking during Classical Antiquity and thereafter because of its good, sweet taste (*cf.* Plinius' *Natural History*, transl. Rackham 1971:245ff). Many of the loaves found in the graves of the Pharaoes were also baked from emmer wheat (Samuel 1994). One of the loaves at Vendel contained flour from peas (*Pisum sativum* var. *arvense*). It is not unusual to find cells of peas in prehistoric Swedish bread, and flour made from peas may have been a highly valued ingredient in bread (Hansson 1987:33ff; 1995b).

The juniper seed (*Juniperus communis*) from grave A1 may have originated from the fuel used for the funeral pyre, but it could also have been deliberately deposited as a grave gift. As for the four juniper seeds found in the oven in the sunken-floor hut, it is less likely

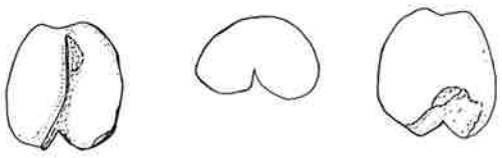

*Figure 4. Bread/clubwheat (*Triticum aestivo-compactum*) from the oven in the sunken-floor hut at Valsgärde. Ventral view (left), cross-section (middle), dorsal view (right). 4.0×3.7×2.4 mm. Drawing by Ann-Marie Hansson.*

that juniper was used for the fire, unless the smoke was to be generated for a special reason, e.g. for smoking fish and meat or for curing diseases. A more plausible explanation may be that the juniper berries had been collected. Both juniper wood and the berries had numerous uses – the latter for food, flavouring beer, as bon-bons rolled in honey or as spices or herbal remedies (Arnborg 1992; see also Høeg 1985:61).

The find of flax seeds (*Linum usitatissimum*) in the oven of the sunken-floor hut at Valsgärde is very interesting, as evidence of flax seeds is provided by imprints on grave ceramics found at Bergby in the parish of Vendel. Grave bread recovered at Birka also contains cells from flax seeds (Hjelmqvist 1984:269). We can therefore say with certainty that flax, the seeds of which contain c. 40% oil, was used not only as a spinning plant but also for food. The flax at Valsgärde can be interpreted as implying local cultivation for a dual purpose, for nutrition and as a basis for textiles. The analysis of the textiles in boatgrave no. 5 points to cloth made of linen (Malmius 1997), and the flax seeds found in the sunken-floor hut with the huge oven certainly call to mind the cooking of food, as cereals and small bone fragments were also found there. No similar analysis of textiles was performed at Vendel, but as flax seeds are also documented there as imprints on ceramics, it may be assumed that the plant had similar uses.

A fruit of hemp (*Cannabis sativa*), identified as an imprint on ceramics from a Viking Age grave at Karby, Vendel, may indicate a need for rope material, especially for boat fittings, as hemp fibres have a very high tensile strength and withstand water very well (Frankow 1982:25). They could also be used for textiles in the same way as flax, and the fruits, containing 30–35% oil (Vaughan 1970:23), likewise had a culinary use. The wild form originates from the east, probably from Central Asia (Körber Grohne 1988:388). In Medieval Eastern Europe the fruits were made into a soup together with flax seeds (von Stokar 1951:61). Hemp was already being used for both food and textiles during the Yang Shao culture, Neolithic Period in China (Körber-Grohne 1988:387). As with flax, different parts of the plant were used in different ways. The narcotic properties of the plant were also exploited in the Scythian culture (Trippet 1974:106), while in Novgorod, Russia, pollen of the cannabis type occurs regularly around AD 800 (Königsson & Possnert 1997), and fruits of hemp are found in analyses of plant macrofossils mainly in layers dated to the ninth and early tenth centuries (Aalto & Heinäjoki 1997). In Sweden the cultivation of hemp seems to have already started during the first centuries AD and to have culminated during the Migration Period, continuing into the Medieval Period, according to pollen evidence (Påhlsson 1981a:12; 1981b:81; Eriksson 1996:162). In the Viking Age ship burial of Oseberg, fruits of hemp were discovered as well (Holmboe 1927:33).

To trace the activity that took place in the longhouse and the sunken-floor hut in Valsgärde, if possible, the fossil plant material should be arranged into ecological groups, allowing for the possibility of some plants falling into more than one group (table 3, fig. 5). It should be stressed that there is only one sample from the sunken-floor hut – that from the oven – and no samples from the floor layer, while the samples from the longhouse were taken from the post-holes (figs. 6–7). The samples from the two types of houses therefore represent different structures as well. The analysis shows the difference in the occurrence of fossil plants between the two houses to lie firstly in the much greater varia-

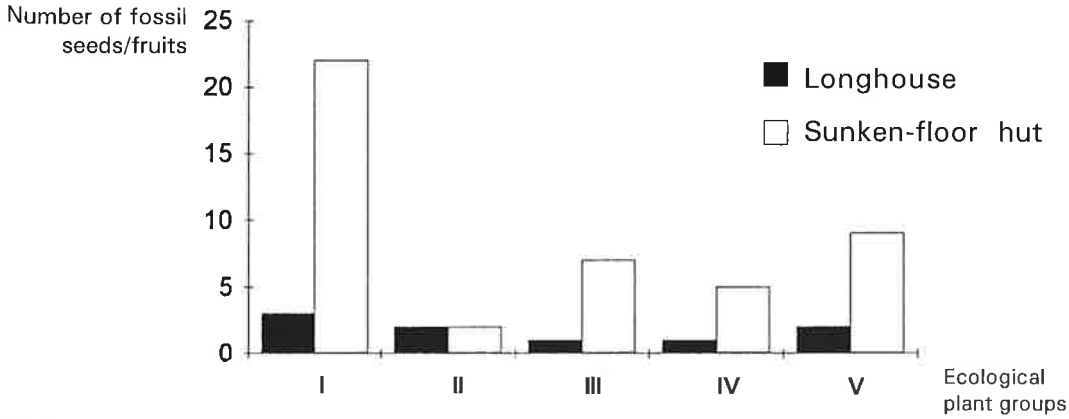

Figure 5. Distribution of ecological plant groups in the longhouse and the oven of the sunken-floor hut at Valsgärde. (I) Cultivated plants, (II) field weeds and ruderals, (III) meadow plants, (IV) collected plants, (V) others.

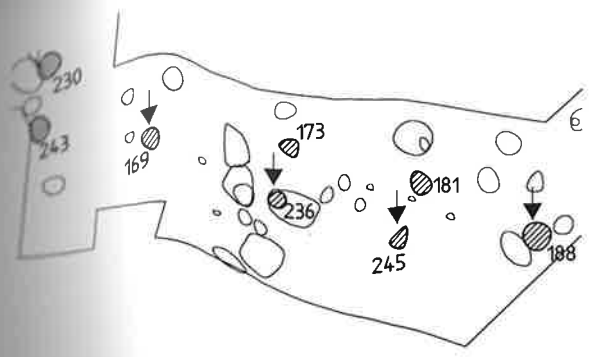

Figure 6. The longhouse (3a) at Valsgärde. Soil samples were taken in the shaded post-holes. Post-holes with arrows represent finds of cereal grains or fragments. After Norr & Sundqvist 1997, modified by Kjell Persson.

tion in the distribution of ecological groups in the sample from the sunken-floor hut (fig. 5).

The mixed plant material from the oven in the sunken-floor hut at Valsgärde, together with the bone fragments, reminds one very strongly of the sunken-floor hut at V. Ledinge in the parish of Skederid, province of Uppland, eastern central Sweden, which is of a similar date. This mixed material also seems to fit in very well with the known composition of fossil plant remains in earlier archaeobotanical analyses of sunken-floor huts, and may indicate that the huts functioned as dwelling houses, unless the soil fill in them was contaminated with material from other parts of the settlement (Viklund 1992). One has to be very careful when deducing the activity associated with the sunken-floor hut at Valsgärde from the archaeobotanical material, since only soil from the oven has been analysed. When further plant material from Vendel has been examined, it will be reasonable to compare the two settlements in archaeobotanical respects, whereupon grave material (including plant macrofossils and carbonised bread) will be compared with the settlement material, the group to which the imprints on ceramics also belong, as they were made in the moist clay during manufacture, which ought to have taken place at the settlement. Analyses of cell structures in bread may add a further dimension to the interpretation, and these analyses are very important, as the bread content may vary from what is normally identified in an analysis of fossil plant remains (Hansson 1996, forthcoming). Food is a "tough" structure, a habit which people hang on to as long as possible. Food may also express regional identity (*cf.* Keyland 1919, Olsson 1958). This may well apply to the grave loaves, as a manifestation of a common, symbolic ritual, covering the whole of eastern central Svealand (Hansson 1996).

Thus it is of the utmost importance that we should use different supplementary forms of archaeobotanical investigations on various structures, in order to obtain as much information as possible on both cultivation and the plants used for food. By comparing the archaeobotanical remains deposited as grave gifts, in prepared and/or unprepared form, with the plant remains found at the settlement, we could come closer to the real nature of cultivation and both the symbolic meaning of the plant food and its role in daily life.

Barley (*Hordeum* sp.) is the predominant cereal in these plant macrofossil analyses, as in most other parts of central Sweden during this period, but both Vendel and Valsgärde feature the production of bread-clubwheat (*Triticum aestivo-compactum*), which is considered a cereal indicative of status.

A distinction is sometimes made between our modern bread wheat (*T. aestivum* L.) and the clubwheat type (*T. compactum* Host.) in which the caryopsis has a somewhat divergent length/breadth index, which is mainly found in connection with the early agricultural cultures of Europe (Zohary & Hopf 1994). A few neolithic finds are reported in Sweden (Hjelmqvist 1955:47), and the clubwheat (*T. compactum*) is the only wheat type found during the Neolithic Period (Hjelmqvist 1992:359), as is also the case in the other Nordic countries (Hjelmqvist 1973–74:211).

Behre, however, mentions that clubwheat (*T. compactum*) was cultivated alongside bread wheat (*T. aestivum*) in Central Europe from the Neolithic period onwards, but that its was replaced by other crops during the Early Medieval period, especially in northern Germany and played an insignificant role after that (Behre 1983:23). Clubwheat has also been found in Iron Age contexts in Finland (Lempiäinen 1995:152f; Matiskainen 1984), while three carbonized caryopses of bread wheat (*T. aestivum* s.l.) have recently been found at Gullhögen in the parish of Husby-Långhundra, province of Uppland (Hansson 1995c). These

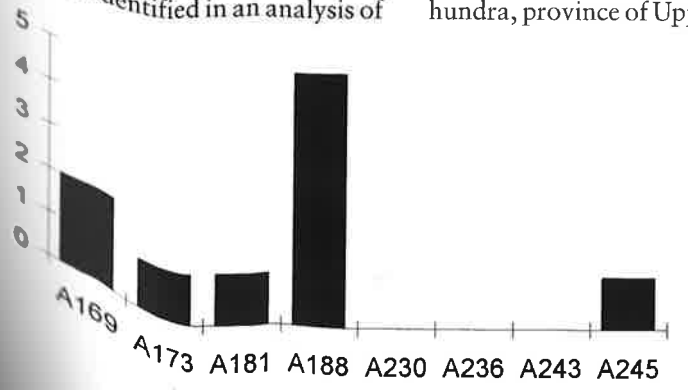

Figure 7. Numbers of fossil seeds and fruits in the soil samples analysed from the post-holes in the longhouse at Valsgärde.

caryopses were found in soil samples from a Viking Age burial secondarily deposited in a grave mound. Accelerator dating of the charred caryopses gave, for the first one, 1120±70 BP (Ua-11898) or AD 783 (900, 920, 980) 998 when calibrated with one sigma and from the analysis of the probability distribution a date to AD 870–1000 has a relative probability distribution at 0.83. For the second caryopsis the accelerator dating gave 1230±75 BP (Ua-11899) or AD 689 (780, 790, 800) or 940 when calibrated with one sigma and from the analysis of the probability distribution a date to AD 710–890 has a relative probability distribution at 0.90 (Stuiver & Becker 1993; Stuiver & Reimer 1993).

The length/breadth index of the charred caryopses pointed to an identification as clubwheat (*Triticum compactum*) (*cf.* Henriksen & Robinson 1996:5), but they are assigned to *Triticum aestivo-compactum* for the following reasons. On account of the difficulties in identifying occasional carbonized caryopses of bread wheat, the two groups are classed together by Schiemann (1948) to form a subgroup *Triticum aestivum* L. grex *aestivo-compactum* Schiem. This procedure, Jane Renfrew points out, overcomes the difficulty of nomenclature but it does not resolve the identification problem (Renfrew 1973:62; see also Maier 1996 and literature cited therein).

Caryopses of carbonized bread wheat were also found in the Viking Age town of Hedeby, but they were few in number. One of the finds consisted almost entirely of bread-clubwheat (*Triticum aestivo-compactum*), which shows that it formed the main crop and may indicate that it was cultivated for a specific reason. Another striking find at Hedeby is a piece of charred dough consisting of complete caryopses of bread wheat (Behre 1983, 22f). Bread wheat was not a common cereal either in the rest of Denmark (Robinson 1991:544, 1993:37) or in southern Sweden during the Late Iron Age, a time when the use of rye increased in these areas.

Bread wheat was already considered to be a "finer" cereal during Classical times, due mainly to the fact that it is free-threshing, and thus less labour demanding than the speltoid wheats. Also, its very special gluten content makes the dough produce a viscous substance upon leavening, so that the gas bubbles become enclosed. This gives a light, porous white bread after baking, which was much coveted. Pliny states in his *Natural History* (transl. Rackham 1971:245) that "common wheat [for Pliny this means bread wheat] flour makes bread of the highest quality and the most famous pastry". This was the case in Classical Antiquity, but what was the situation in Scandinavia almost one thousand years later? The Icelandic Sagas are a potential source of information. Though written during the Early Middle Ages, these appear to reflect Late Iron Age society. In *Egil Skallagrimsson's Saga* (transl. Alving & Lönnroth 1983) mention is made of purchasing wheat, wine, honey and cloth in England in exchange for furs and dried fish. It is thus not unreasonable to deduce that the products traded must have been lucrative items, i.e. highly desirable and luxurious.

The Icelandic poem fragment *Rigsthula* in the Poetic Edda (thought to have been composed during the 14th century), which is often cited when discussing Viking Age food, describes how the god Heimdall, calling himself Rig, travels around among the humans on Earth. He visits the three social classes: thralls, farmers and nobles, whose distinctive social circumstances are characterized in poetic form with regard to diet and especially the various types of bread, which distinguish the classes. Unfortunately the passage dealing with the bread of the farming class is missing, but the bread of the thralls is described as "densely baked, heavy and filled with bran", and that of the nobles as "thin loaves, white of wheat placed on a white linen cloth on the table" (*Den poetiska Eddan*, transl. Collinder 1993:150f; see also Hansson 1994:8).

Only a small amount of charred cereal has so far been found in the Viking Age town of Birka, but the composition of the various cereals shows a high proportion of bread wheat (*T. aestivum* s.l.) (Hansson 1995a; forthcoming). The fact that bread wheat was considered indicative of status during the Late Iron Age seems to be beyond doubt.

Bread wheat is found sporadically in eastern central Sweden during the Early Iron Age and thereafter its occurence increases considerably during the Late Iron Age (Viklund 1992, 1994). Why this increase should happen in eastern central Sweden is very interesting. Hjelmqvist considers these finds remarkable, as the conditions for cultivation of the cereal in this region are by no means any more favourable than in southern Sweden or Denmark (Hjelmqvist 1979:54). Thus the increase is not a result of agricultural factors. Besides status factors, a possible cause for the adoption of bread wheat could have been influences from the east. During the Late Iron Age a high frequency of bread wheat has been recorded in, for instance, the Kiev area and also in other eastern and east central European areas. Free-threshing wheats (*T. aestivum* s.l.) were the most common type in Old Rus' at least from the ninth century onwards (Pashkevich 1989). Differences in sampling strategies nevertheless make the comparative material difficult to assess.

Eastern links through trading or cultural diffusion – is this what the wheat evidence indicates? Are such contacts in themselves indicators of high status? Did Vendel and Valsgärde, as settlements for the elite, serve an intermediary role in the acceptance of wheat by the rest of society?

The archaeobotanical work at Vendel and Valsgärde will continue, and we hope that future evidence will enlighten us further regarding the role and importance of cultivation and plant foods in past societies.

References

Aalto, M. & Heinäjoki, H. 1997. Archaeobotany and palaeoenvironment of the Viking Age town of Staraja Ladoga, Russia (Old Ladoga). In U. Miller, H. Clarke, T. Hackens, B. Ambrosiani, A.-M. Hansson, & B. M. Johansson (eds.): *Environment and Vikings. Scientific methods and techniques.* PACT 55/Birka Studies 4. Rixensart, pp. 13–30.

Alving, H. & Lönnroth, L. (transl.) 1983. *Egil Skallagrimsson's Saga.* Södertälje

Anderberg, A.-L. 1994. *Atlas of Seeds and Small Fruits of Northwest-European Plant Species with Morphological Descriptions.* Part 4 *Resedaceae – Umbelliferae.* Swedish Museum of Natural History, Stockholm.

Arnborg, G. 1992. *Eneboken.* Laholm.

Arwidsson, G. 1977. *Valsgärde 7. Die Gräberfunde von Valsgärde.* 3. AMAS. 5. Uppsala, pp. 273–274.

Arwidsson, G. 1984. Haselnüsse und Kerne. In G. Arwidsson (ed.): *Birka II:1. Systematische Analysen der Gräberfunde.* KVHAA. Stockholm, pp. 273–274.

Atkinson, H. 1994. Landuse and the natural environment during the Late Iron Age in Vendel, eastern Svealand, Sweden. Unpublished manuscript.

Atterman, I. 1935. Nya fynd från Hovgårdsberg i Vendel. *Fornvännen* 30, pp. 137–157

Behre, K.-E. 1983. *Ernährung und Umwelt der wikingerzeitlichen Siedlung Haithabu. Die Ergebnisse der Untersuchungen der Pflanzenreste.* Neumünster.

Beijerinck, W. 1947. *Zadenatlas der Nederlandsche Flora.* Wageningen.

Berggren, G. 1969. *Atlas of Seeds and Small Fruits of Northwest-European Plant Species with Morphological Descriptions.* Part 2 *Cyperaceae.* Swedish Natural Science Research Council. Lund.

Berggren, G. 1981. *Atlas of Seeds and Small Fruits of Northwest-European Plant Species with Morphological Descriptions.* Part 3 *Salicaceae – Cruciferae.* Swedish Museum of Natural History. Arlöv.

Bergström, L. 1996. Arkeobotaniska växtstenar: En metodstudie och morfologisk analys av kiselfytoliter ur jordprover från Vendel. In: *CD-uppsatser i Laborativ Arkeologi 95/96. Del 1.* Archaeological Research Laboratory, Stockholm University. MA thesis.

Collinder, B. (transl.) 1993. Sången om Rig. *Den poetiska Eddan.* Juva, pp. 147–153.

Engelmark, R. 1981. Carbonized plant material from the Early Iron Age in N. Sweden. *Wahlenbergia* 7, pp. 39–43.

Engelmark, R. 1985. Carbonized seeds in postholes – a reflection of human activity. *Iskos* 5, pp. 205–209.

Engelmark, R. & Viklund, K. 1990. Makrofossilanalys av växtrester – kunskap om odlandets karaktär och historia. *Bebyggelsehistorisk Tidskrift* 19, pp. 33–41.

Eriksson, J. A. 1996. Markanvändningshistoria i Gamla Uppsala skildrad med hjälp av pollenanalys. In W. Duczko (ed.): *Arkeologi och miljögeologi i Gamla Uppsala. Studier och rapporter.* Vol II. Occasional Papers in Archaeology 11. Uppsala, pp. 159–165.

Frankow, I. 1982. Hampa som textilmaterial. Orsaker till användning. Materialets roll i självhushållet. Uppsats för fördjupningskurs i etnologi. Unpublished diploma work.

Hansson, A.-M. 1987. Forntida bönor och ärter. *Laborativ arkeologi* 2, pp. 3–56.

Hansson, A.-M. 1994. Grain-paste, porridge and bread. Ancient cereal-based food. *Laborativ Arkeologi* 7, pp. 5–20.

Hansson, A.-M. 1995a. Seeds and fruits found in the Black Earth of Birka: Excavation season 1990. In B. Ambrosiani & H. Clarke (eds.): *Excavations in the Black Earth 1990. Birka Studies.* Volume 2, Stockholm, pp. 117–122.

Hansson, A.-M. 1995b. The bread from Ljunga in central Sweden. New analyses. *Laborativ arkeologi* 8, pp. 38–49.

Hansson, A.-M. 1995c. Analys av fossila växtrester från Gullhögen, Husby Långhundra sn, Uppland, Unpublished report.

Hansson, A.-M. 1996. Bread in Birka and on Björkö. *Laborativ Arkeologi* 9. pp. 61–78.

Hansson A.-M. 1997a. Bilaga 3: Vegetabilier som gravgåva. Rapport av växtmakrofossilanalys av två brandgravar, A1 och A2 samt sotfläck A10 under grav A2, RAÄ 26, Up, Vendel sn, Vendel In B. Arrhenius & G. Eriksson (eds.): *SIV Svealand i Vendel- och Vikingatid: Rapport från utgrävningarna i Vendel.* Archaeological Research Laboratory, Stockholm, pp. 93–97.

Hansson, A.-M. 1997b. Analys av fossilt växtmaterial från långhus och ugn i grophus – Valsgärde, Gamla Uppsala sn, Uppland. Unpublished report.

Henriksen, P. S. & Robinson, D. 1996. Early Iron Age agriculture: archaeobotanical evidence from an underground granary at Overbygård in northern Jutland, Denmark. *Vegetation History and Archaeobotany* 5, pp. 1–11.

Hjelmqvist, H. 1955. Die älteste Geschichte der Kulturpflanzen in Schweden. *Opera Botanica* 1. Stockholm.

Hjelmqvist, H. 1973–74. Några vittnesbörd om sädesodlingen på Jylland i äldre romersk järnålder *KUML*, pp. 209–214.

Hjelmqvist, H. 1979. Beiträge zur Kenntnis der prähistorischen Nutzpflanzen in Schweden. *Opera Botanica* 47.

Hjelmqvist, H. 1984. Botanische Analyse einiger Brote. In G. Arwidsson (ed.): *Birka II:1. Systematische Analysen der Gräberfunde.* KVHAA, Stockholm, pp. 261–274.

Hjelmqvist, H. 1990. Über die Zusammensetzung einiger prähistorischer Brote. *Fornvännen* 85, pp. 9–21.

Hjelmqvist, H. 1992. Some economic plants from the Prehistoric and Mediaeval Periods in southern Scania. In L. Larsson, J. Callmer & B. Stjernquist (eds.): *The Archaeology of the Cultural Landscape. Field Work and Research in a South Swedish Rural Region.* Acta Archaeologica Lundensia Series in 4°, N° 19. Stockholm, pp. 359–367.

Høeg, O. A. 1985. *Ville vekster til gagn og glede.* Universitetsforlaget AS. Oslo-Bergen-Stavanger- Tromsø.

Holmboe, J. 1927. Nytteplanter og ugraes i Osebergfundet. *Osebergfundet*, Bind V. Oslo.

Isaksson, S. & Arrhenius, B. 1995. Rapport avseende de arkeologiska undersökningarna vid Vendels kyrka, Vendels sn, Uppland 1994. Arkeologiska Forskningslaboratoriet, Stockholms Universitet. Unpublished report.

Katz, N. J., Katz, S. V. & Kipiani, M. G. 1965. *Atlas and Keys of Fruits and Seeds occuring in the Quaternary Deposits of the USSR.* Moskva.

Keyland, N. 1919. *Svensk Allmogekost.* Carlssons i samarbete med Institutet för folklivsforskning och Nordiska Museet.

Königsson, L.-K. & Possnert, G. 1997. Pollen analysis covering the past 4000 radiocarbon years of the cultural landscape of the Novgorod area, Russia. In U. Miller, H. Clarke, T. Hackens, B. Ambrosiani, A.-M. Hansson, & B. M. Johansson (eds.): *Environment and Vikings. Scientific methods and techniques.* PACT 55/Birka Studies 4. Rixensart, pp. 73–89.

Körber-Grohne, U. 1988. *Nutzpflanzen in Deutschland. Kulturgeschichte und Biologie.* Stuttgart.

Krok, T. O. B. N. & Almquist, S. 1985. *Svensk Flora. Fanerogamer och ormbunksväxter.* Tjugosjätte upplagan, bearbetad av Lena Jonsell och Bengt Jonsell. Uppsala.

Lange, E. 1979. Verkohlte Pflanzenreste aus den slawischen Siedlungsplätzen Brandenburg und Zirzow (Kr. Neubrandenburg). (Ed. U. Körber-Grohne), Festschrift Maria Hopf zum 65. Geburtstag am 14 September 1979, *Archaeo-Physika* 8, Köln, pp. 191–207.

Lempiäinen, T. 1995. Macrofossil finds from the Medieval Turku, SW Finland. In H. Kroll & R. Pasternak(eds.): *Res archaeobotanicae*. International Workgroup for Palaeoethnobotany. Proceedings of the ninth Symposium Kiel 1992. Kiel, pp. 149–164.

Maier, U. 1966. Morphological studies of free-threshing wheat ears from a Neolithic site in southwest Germany, and the history of the naked wheats. *Vegetation History and Archaeobotany* 5. Berlin, pp. 39–55.

Malmius, A. 1997. Textilfragmenten i båtgrav 5, Valsgärde, en första analys. In B. Arrhenius & G. Eriksson (eds.): *SIV Svealand i Vendel- och Vikingatid: Studier från delprojekten vid Stockholms Universitet*. Archaeological Research Laboratory, Stockholm, pp. 42–57.

Matiskainen, H. 1984. Getreidekörner aus der späteisenzeitlichen Siedlungskammer Domargård 1 in Karjaa, Südfinnland. *Fennoscandia Archaeologica* I, pp. 43–50

Norr, S. & Sundkvist, A. 1997. Boplatsundersökningar i Valsgärde 1994–1996. *SIV Svealand i Vendel- och Vikingatid: Rapport från utgrävningarna i Valsgärde*. Arkeologiska Institutionen, Uppsala Universitet, Chapter 2.

Olsson, A. 1958. *Om allmogens kosthåll. Studier med utgångspunkt från västnordiska matvanor*. Lund.

Påhlsson, I. 1981a. *Västannorstjärn – en pollenanalytisk undersökning*. The Central Board of National Antiquities and the National Historical Museums. Rapport RAÄ 1981:6. Stockholm, pp. 4–24.

Påhlsson, I. 1981b. *Cannabis sativa* in Dalarna. *STRIAE*, pp. 79–82

Pashkevich, G. A. 1991. The palaeoethnobotanical examination of cultivated plants of old Russian state. Palaeoethnobotany and Archaeology. International Work-Group for Palaeoethnobotany 8th Symposium in Nitra-Nove' Vozokany 1989. *Acta Interdisciplinaria Archaeologica* Tomus VII. Nitra, pp. 249–268

Pelve, E. 1995. Makrofossilanalys av en vikingatida grav i Vendel: Undersökning av innehållet i ett lerkärl. In: *C/D-uppsatser i laborativ arkeologi 94/95. Del 1*, Archaeological Research Laboratory, Stockholm University. MA thesis.

Rackham, H. (transl.) 1971. Plinius Secundus, Gaius. *Natural History with an English translation in ten volumes*. Volume V. London.

Renfrew, J. 1973. *Palaeoethnobotany. The Prehistoric Food Plants of the Near East and Europe*. London.

Robinson, D. 1991. Plants and vikings: everyday life in Viking Age Denmark. *Botanical Journal of Scotland* 46(4), pp. 542–551.

Robinson, D. E. 1993. Crop plants in Danish prehistory. *Arkæologiske Udgravninger i Danmark*, pp. 36–39.

Samuel, D. 1994. *An Archaeological Study of Baking and Bread in New Kingdom Egypt* (diss). Cambridge.

Schiemann, E. 1948. *Weizen, Roggen, Gerste. Systematik, Geschichte und Verwendung*. Jena.

Seiler, A. 1997. Ett litet brandgravfält i närheten av båtgravarna. Arkeologisk delundersökning av RAÄ 26, Vendel, Vendels sn, Uppland. In B. Arrhenius & G. Eriksson (eds.): *SIV Svealand i Vendel- och Vikingatid: Rapport från utgrävningarna i Vendel*. Archaeological Research Laboratory, Stockholm, pp. 56–83.

von Stokar, W. 1951. *Die Urgeschichte des Hausbrotes. Ein Beitrag zur Entwicklunsgeschichte der Nahrung*. Leipzig.

Stolpe, H. & Arne, T. J. 1912. *Graffältet vid Vendel*. Undersökt af Hjalmar Stolpe. Beskrifvet af Hjalmar Stolpe & T. J. Arne. Teckningar utförda af O. Sörling. KVHAA. Stockholm.

Strage, K. 1995. Makrofossilanalys av växtlämningar på material från Vendel och Sigtuna. In: *C/D-uppsatser i Laborativ Arkeologi 94/95. Del 1*. Archaeological Research Laboratory, Stockholm University. MA thesis.

Stuiver, M. & Becker, B. 1993 High-precision decadal calibration of the radiocarbon time scale, AD 1950–6000 BC. *Radiocarbon* 35, pp. 35–65.

Stuiver, M. & Reimer, P. J. 1993. Extended ^{14}C data base and revised CALIB 3. 0 ^{14}C age calibration program. *Radiocarbon* 35, pp. 215–230.

Tallantire, P. A. 1976. Provisional key for the identification of sub-fossil seeds of *Vaccinium* spp. *Folia. Quaternaria* 47. Studies in Paleoethnobotany part II. Krakow, pp. 39–40.

Trippet, F. 1974. *The First Horsemen*. Alexandria, Virginia.

Vaughan, J. G. 1970. *The Structure and Utilization of Oil Seeds*. London.

Viklund, K. 1992. Analys av växtmakrofossil från utgrävning vid boplatserna Raä 106 och Raä 190, Skederid sn, Norrtälje kommun. Unpublished report.

Viklund, K. 1994. The long history of Swedish bread. Continuity and change in Swedish regional bread-cereal traditions. *Laborativ Arkeologi* 7, pp. 30–36.

Wennberg, B. 1986. Iron Age agriculture in Trogsta, North Sweden, *Fornvännen* 81, pp. 254–262.

Zohary D. & Hopf M. 1994. *Domestication of Plants in the Old World*. Oxford Science Publications. Oxford.