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Buried plants
Fossil plant remains from two Early Medieval burial mounds in east-central Sweden

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Fossil plant remains from two large Early Medieval burial mounds in Uppland, eastern central Sweden, are analysed and the results discussed. Four graves are examined: a Viking Age cremation inside Gullhögen, and three graves dating from 600–750 to c. 800 AD inside Vendla's Mound. The remains of cereals, collected berries, nuts, root and stem tubers as well as ruderals, field weeds and meadow plants were recovered. It is suggested that the meadow plants in the graves from Vendla's Mound were placed there as bedding material for the deceased, or as token fodder for a cremated horse. The deceased in Vendla's Mound were buried in boats burnt on funeral pyres. Cereal crops were of crucial importance in Early Medieval society, and the cereals recovered from these graves had been deposited, perhaps as food and for mead production in the afterlife, but perhaps also as bearers of a resurrection symbolism.

Keywords: plant macrofossils, grave mounds, Early Medieval Period, cereals, meadow plants, grave layout

Introduction

In Sweden, as in Western and Central Europe, it is usual for fossil plant analyses to be confined to settlement material such as habitation layers, post holes, refuse layers, wells, building materials and imprints on pottery (Willerding 1991:30). In contrast, the present paper is concerned with fossil plant remains in graves, with special focus on the problems of large burial mounds. Four cremation graves are examined, representing two large mounds in the province of Uppland in eastern central Sweden: Gullhögen (the "Golden Mound") and Vendla's Mound, dated to the Early Medieval Period. The four cremation graves analysed within these mounds are dated between c. 600–750 AD and 800–1050 AD (Fig. 1).

The fossil plant material in large grave mounds may sometimes be difficult to interpret, as these mounds are commonly constructed over more than one burial, often belonging to different time periods. A further complication is often the finding of a settlement layer below or in close proximity to the mound (Küster 1985:15; Ramqvist 1992:152; Seiler 2001a), or else that the graves lie beneath a settlement layer (Hansson 2003a; Pelve 1995). The dangers of such potential stratigraphical contamination are nevertheless outweighed by the important evidence provided by study-

Figure 1. Map of Sweden showing the two grave mounds, Gullhögen and Vendla's Mound. CAD drawing by Kjell Persson.

ing the botanical material in prehistoric graves. The plant material found in burial contexts can enrich our understanding of the content of a grave far beyond that provided by the study of artefacts and skeletal evidence alone. It is important that the plant material found in graves can be compared with plants used by the living community and that differences can be explained. In this way we can gain a better understanding of current ideologies with regard to cultivation, food use and plant symbolism. The study of plant material in graves can even be used to trace indicators of continuity and change in prehistoric societies (cf. Hansson & Bergström 2002).

Though it is still unusual to analyse soil samples from graves, we are now beginning to see an awareness of the importance of this material and the publication of results of new analyses in contexts of this type (Hansson & Bergström 2002; Lempiäinen 2002; Viklund 2002; Bouby & Marinval 2004). The present paper is offered as a contribution to the study of large burial mounds.

Some previous archaeological investigations focused on major burial mounds have included a study of the plant evidence (cf. Holmboe 1927), motivated partly by especially favourable preservation conditions and partly by a genuine concern for how plants were used in prehistoric times. The result is a rich botanical material. These investigations do not include the method used by the author here, however, in which soil samples are analysed systematically.

One of the most important investigations to include archaeobotanical analyses is that of the mound at Hochdorf, a princely burial at Eberdingen-Hochdorf, Kreis Ludwigsburg, near Stuttgart, Germany, dated to the Hallstatt period, c. 500 BC. The archaeobotanical investigation included not only the macrobotanical material in the grave itself but also the contents of a huge cauldron/flagon which was analysed for pollen and microbotanical remains. The deceased lay resting on a bronze deathbed, its mattress made from plants, textiles and other material. Most unusually, great quantities of fossil plant remains had also been placed underneath the bed (Körber-Grohne 1985).

Gullhögen

The Viking Period burial mound Gullhögen (Raä 30, Fig. 2) is situated in a prehistoric cemetery at Husby in the parish of Långhundra, province of Uppland, eastern central Sweden (cf. Arrhenius & Eriksson 2005). It is a huge mound, the largest in the cemetery, c. 30 m in diameter and c. 4.5 m high. It was erected on a small

Figure 2. Excavation of Gullhögen, view from south. From Arrhenius & Eriksson 2005.

crag-and-tail, now overgrown with a thin forest of Scots pines (*Pinus silvestris*) and with thickets consisting mainly of juniper (*Juniperus communis*) at its perimeter. Gullhögen is thus situated on a prominent height commanding a wide view over the flat field landscape. The location of the grave would appear to have been chosen with great care, enabling the mighty and prominent men in Viking Age society to mark out their territories from here. In the immediate vicinity we find the *Långhundraleden*, the water-course leading through the Old Uppsala area that emptied into the Baltic Sea – a very important trade route (Ambrosiani 1981).

The Archaeological Research Laboratory (ARL) at Stockholm University investigated the mound as a teaching excavation from 1988 to 1992 under the guidance of Professor Birgit Arrhenius. It proved on excavation to be constructed of grass sods and to contain three circular ditches of considerable dimension filled with charcoal. The horizontal placing of the grass sods indicates that the mound had been built up systematically level-by-level. The outer charcoal circle was built at an initial stage, and then the central circle, with the final charcoal circle built near the top of the mound. The measurements varied throughout each circle, but each ditch was approximately 15 cm deep and up to 50 cm wide. The outer circle had a possible diameter of 21 m, the centre circle c. 16 m and the upper circle c. 3.5–4.5 m. The vast charcoal lenses found inside Gullhögen were dated to the Viking Period, and are thus associated with the later burial (see below).

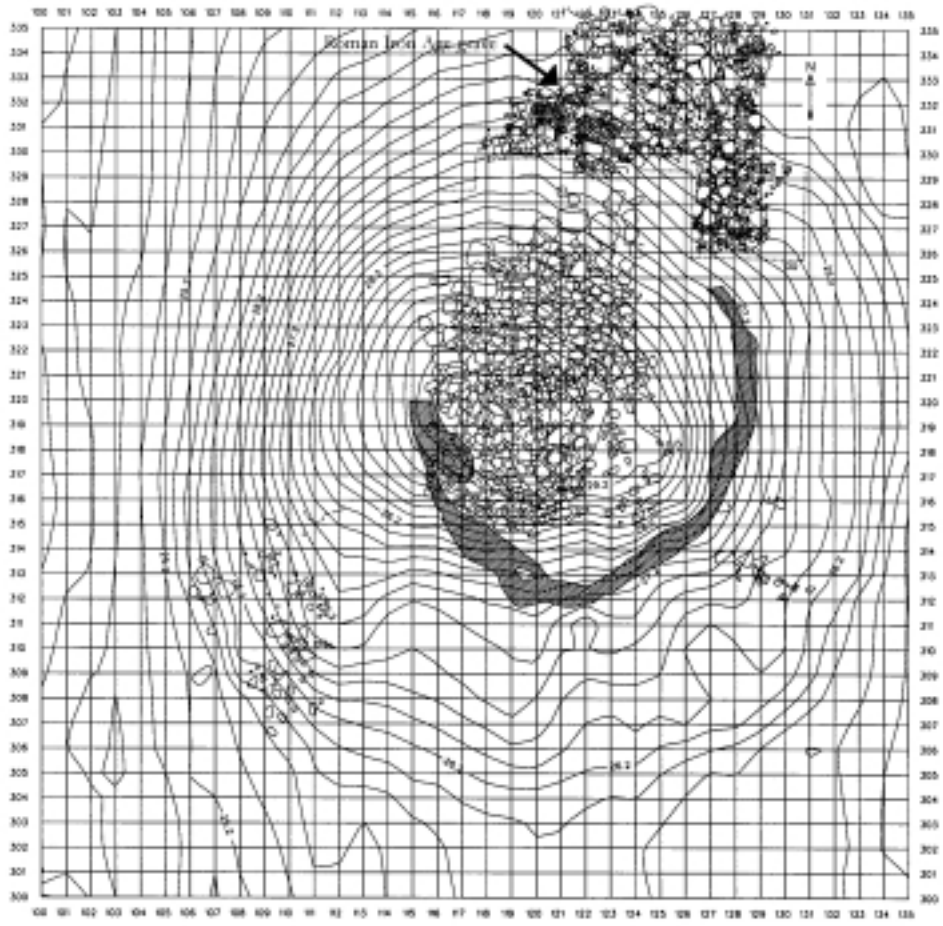

Figure 3. Plan of Gullhögen, with the central cairn and the Roman Iron Age cremation grave. A part of one of the charcoal rings is marked in grey.

During the excavation a Viking Period cremation grave was found, consisting of burnt bones contained in three pottery vessels. In addition, a sword was found placed vertically at the top of the central cairn. The sword showed the influence of fire and had fragments of burnt bone impregnated into its corroded surface – a process likely to have occurred during a cremation. Furthermore, this find of a sword indicated that the cremation had not taken place *in situ* in the burial mound. This Viking Period grave was secondary to the central cairn of this huge mound and lay above it. The vast charcoal lenses found inside Gullhögen were dated to the Viking Period, and are thus associated with the later burial. No grave was found under the central cairn, but instead, scattered burnt bones were uncovered both to the south and southwest of the central cairn. These bone remains probably originated from an even older, destroyed cremation burial. Beneath the empty central cairn there lay a flat rock covered by a thin layer of humus. The heather, *Calluna vulgaris*, that had once grown on the rock when exposed to the open air had been preserved and could still be identified.

A further, older cremation burial, a soil-filled cairn, was found north of the central cairn. This smaller grave contained a large concentration of bones. Here fragments of very costly grave goods were found, including a golden snake-head bracelet and shards of glass from a magnificent "circus" beaker which date the grave to the Roman Iron Age, c. 4th century AD (Fig. 3).

Vendla's Mound

Several structures near Vendel Church in the parish of Vendel in the northern part of the province Uppland in eastern central Sweden were investigated by the Archaeological Research Laboratory during the greater part of the 1990s and up to 2001, within the scope of the research project *Svealand in the Vendel and Viking Age* (SIV), a collaboration between the univer-

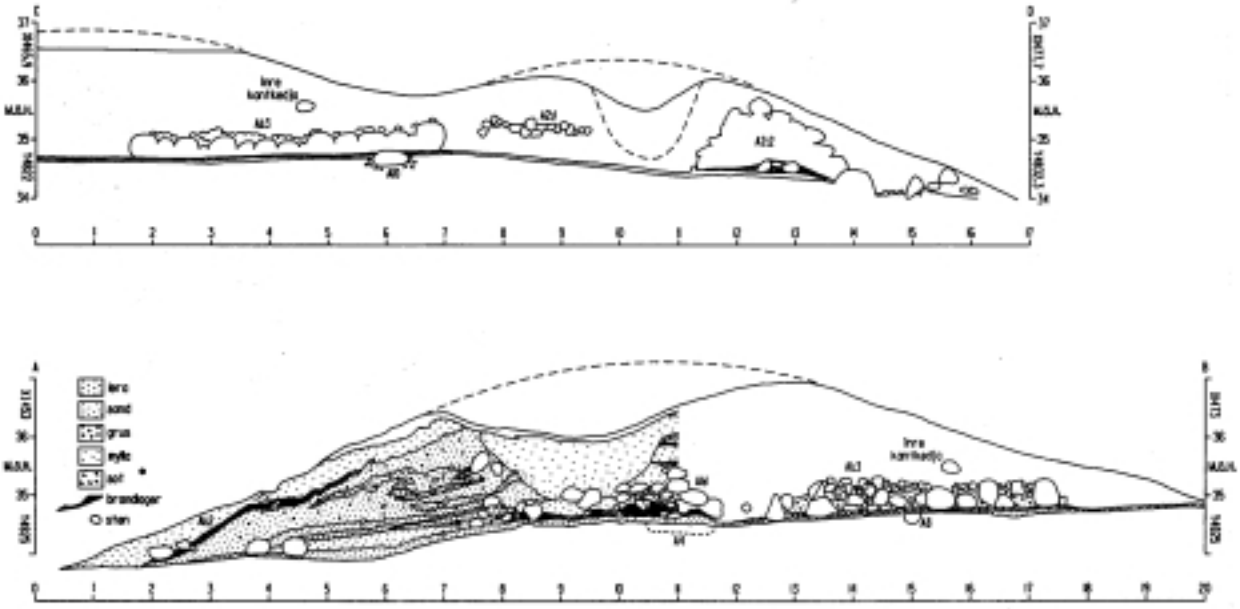

Figure 4. Cross-section through Vendla's mound, with the numerous layers making up the upper part of the mound and the position of grave A2:1 in relation to the other graves. As a mechanical digger was used at the beginning of the excavation, the northern part of section A–B has not been documented in detail. From Seiler 2001:60, Fig. 23.

sities of Stockholm and Uppsala led by Professors Birgit Arrhenius, ARL, and Frands Herschend, Department of Archaeology, Uppsala University.

One of the structures examined was Vendla's Mound (Raä 8, Fig 4), situated on an esker and commanding a central, exposed position c. 300 m south-southeast of Vendel Church. It is situated near Lake Vendel, which flows into Lake Mälaren – at that time a gulf of the Baltic Sea – via the River Fyris. This river was an important trade route which connected Vendel with other major Early Medieval sites, such as Valsgärde and Old Uppsala. The mound is also situated near the famous Vendel boat-grave cemetery that has given its name to the period succeeding the Migration Period: the Vendel Period. The mound has usually been dated to the Early Medieval Period and had a plundering pit on the top. In popular speech it is known as "Vendla's Mound" (Sw. *Vendlas hög*), marking its possible role as a cemetery for women-folk complementary to the apparently all-male Vendel cemetery.

Vendla's Mound was excavated as a teaching excavation under the guidance of a PhD student, Anton Seiler, of the ARL, and formed the main body of his doctoral thesis (cf. Seiler 2001a, 2001b, 2002). The archaeological investigation identified two mighty cairns within Vendla's Mound: a southern one, A1, 16 m in diameter and 2.1 m high, damaged at its centre and on its south-eastern slope, and a northern one, A2, which was smaller, being 8 m in diameter and 1.6 m high, and also damaged, with a crater-like pit at the centre of its top surface. No distinct boundary between these cairns could be discerned and they were partly constructed together.

A1 contained two cairns: A1:1, dated to c. 600–750 AD, and A1:3, dated to the Pre-Roman Iron Age, while a third grave, A1:2, was situated in the southern section and consisted of a soot-filled pit with a surrounding cremation layer dated to c. 800 AD. The remains of a probable building were also found in an underlying cultural layer dated to the Pre-Roman Iron Age (Seiler 2001a:61). In addition, a bone assemblage identified as a grave, A10, was discovered that had been dug down around and under a stone c. 0.6 m in diameter. A2 was found to contain a cairn, A2:2, dating to the 6th century AD and an almost rectangular stone setting, A2:1, not dated. The cremation layers in A1:1, A1:2 and A2:2 contained a large number of rivets, indicating burned boats. These graves contained a great number of finds, and A2:2 included two beads and mounts and rivets belonging to horse equipment. An adult man was buried in A2:1, and remains of children aged of 4 to 6 years and/or teenagers were found in all the graves. At least two humans were buried in A2:2 and possibly also in A1:1 and A1:2 (Fig. 5). (For further details of the graves, see Seiler 2001a:68.)

Figure 5. Six graves have been found in Vendla's Mound. From Seiler 2001:61, Fig. 24.

These six cremation graves in Vendla's Mound were investigated archaeologically together with a lower layer, which produced postholes, a gully, a hearth and other structures. The burnt nature of the grave contents enabled the performance of fossil plant analysis. Fossil plant material from prehistoric times can only be preserved in carbonized form in Sweden, except for permanently moist or waterlogged layers, e.g. in soil from wells, where subfossil organic material may also be preserved.

The fossil plant evidence

The sampling methods used on the two mounds differed considerably, in accordance with the differing excavation strategies. In the case of Gullhögen, plant macrofossil analysis was not planned from the beginning but only undertaken when charred fossil plant remains were discovered by eye north of the central cairn. By that time the Viking Period grave had already been excavated and no soil samples had been collected there. In those days it was very unusual to analyse fossil plant remains in soil from graves. Later, when Vendla's Mound was being investigated, the positive experiences with archaeobotanical analyses in the Gullhögen excavation had taught us to consider sampling strategies at an early stage in the planning of the excavation.

During the excavation of Gullhögen soil samples were taken near the cremation layer of the burial dating to the Roman Iron Age, which lay c. 1–2 m north of the central cairn (Fig. 6). These soil samples were brought to ARL for water-sieving and careful examination under laboratory conditions. Besides burnt bones and funeral deposits of inorganic origin, it was possible to observe by eye caryopses from cereals, shells of hazelnuts (*Corylus avellana*) and a seed of juniper (*Juniperus communis*). Bearing these finds in mind, it was decided to try flotation of some of the soil samples in order to retrieve smaller seeds as well, ones that would not be visible to the naked eye. A container and sieves down to a minimum mesh size of 0.5 mm were used for the flotation process. Some of the seeds and fruits had a coating of inorganic material, which complicated identification, and these were therefore cleansed in hydrofluoric acid (HF, 48%). The quantity of soil in the five samples varied between c. 8 litres in the 1 m squares F661 and F662, 2 litres in F663 and 5 litres in F664 and F665 (Fig. 6).

In the case of the graves in Vendla's Mound, soil samples were systematically collected from 1 m squares throughout the excavation, and the locations of some of the samples, those deemed especially interesting, were recorded with even greater precision. The samples from the cremation graves were brought to the ARL for flotation and water-sieving. Charred plant remains were observed during water-sieving and were retrieved. Both the organic material from flotation and the inorganic material in the samples were dried after flotation. The liquid used for flotation was water, and two methods were used, owing to the large quantity of soil for examination. The usual flotation method was followed (see above), but also a swifter method, in which the soil, a minimum of two litres from each 1 m square, was placed in a bucket and water poured on it while stirring it carefully. Thereafter the water was decanted into a series of sieves, the smallest mesh size, as earlier, being 0.5 mm, after which the sample was dried. When the fossil plant material was examined under a low magnifying microscope it was first soaked in water and the plant remains identified were retrieved with a small brush. The most seriously soiled plant remains were subsequently cleansed in HF in the manner outlined above for Gullhögen.

Twenty-four of the samples collected from Vendla's Mound were chosen for further analysis, representing

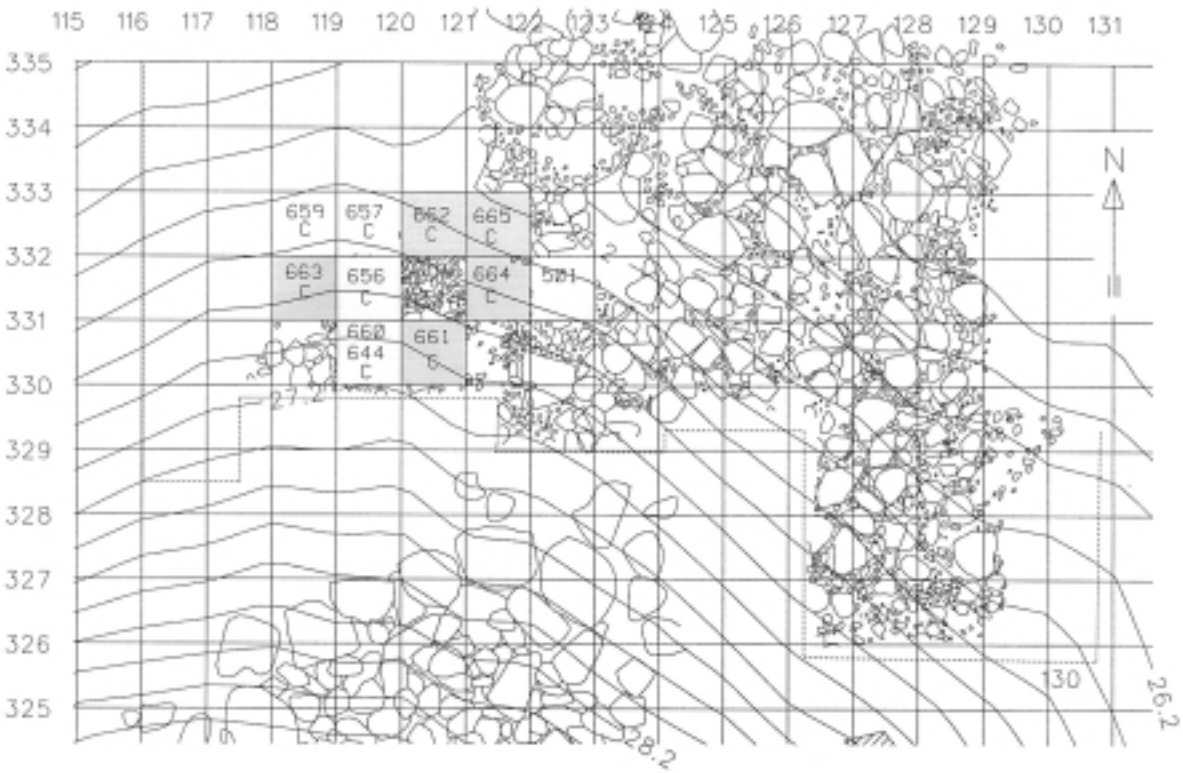

Figure 6. Sampling area in the northern part of Gullhögen. The grey squares with sample numbers mark where soil samples were taken. Cereals were found in the squares marked C. CAD drawing by Kjell Persson.

c. 117 litres of soil. One sample was taken from A1:1, eight from A1:2, one from the vessel, six from A2:2, one from the small pottery vessel and seven from the lower settlement layer (Tables 1–2). Grave A2:2 was especially rich in fossil plant remains, and several samples were analysed (Fig. 7). None of the graves contained carbonised material which could morphologically be determined as bread (known otherwise from contemporary graves; cf. Hansson 1996), but fragments of organic material did occur which could have originated from food of some type.

Use was made of the Archaeological Research Laboratory's reference collection of modern seeds and fruits for identification purposes, together with the following reference literature: Bertsch 1941; Beijerinck 1947; Katz et al. 1965; Berggren 1969, 1981; Anderberg 1994. The nomenclature follows Mossberg et al. 1992 and the English plant terminology follows Blamey & Grey-Wilson 1989.

Discussion

The importance of detailed contexting

For correct interpretation, it is vital that the fossil plant remains be collected according to their specific contexts. A case in point is the problem of Gullhögen, and what at the time of the excavation seemed sufficient contextual information. Here fossil plant remains were recorded as having been found north of the large central cairn and close to the older grave from the Late Roman Period. Some of the squares where soil samples were taken were situated near the cremation layer of the older grave but at a higher level. The Viking Period burial is situated on top of the large central cairn and at a higher level than the Late Roman grave. Two of the wheat grains have the same radiocarbon date as the Viking Period grave. The question is how the carbonised plant remains ended up here if they belonged to the Viking Period grave, as their date suggests.

One possibility could be that the cereals and other plants deposited as grave goods were placed on the funeral pyre in the same way as standard grave goods, that the cremation took place elsewhere and that some of the carbonised bones were put into the pottery vessels, after which the ash residue together with the carbonised cereals was sprinkled over the grave and even over the slopes of the mound. At the final construction of the Viking Period grave, the soil around the grave and on the top of the older Late Roman Period grave may have been disturbed.

Table 1. Fossil plant remains in the Gullhögen grave mound.

		Samples											Total
EG	Taxa	501[1)]	644[1)]	656[1)]	657[1)]	659[1)]	660[1)]	661[1,2)]	662[1,2)]	663[1,2)]	664[2)]	665[2)]	
	Cultivated plants												
1	Oats (*Avena* sp.)											1	1
1	Barley (*Hordeum vulgare*)				11		9	19	8		6		53
1	Cf. barley (*Hordeum* sp.)					2		2	2		3	1	10
1	Wheat (*Triticum aestivum* s.l.)					1	1		1				3
1	Emmer/spelt wheat (*T. dicoccum/spelta*)			1	4			2	1			1	9
1	Cf. emmer/spelt wheat (cf. *T. dicoccum/spelta*)		1		2			2					5
1	Cerealia indet.		2		9		14	19	39	7	6	5	101
	Total number	0	3	1	26	3	24	44	51	7	15	8	182
	Wild plants												
4	Lady's mantle (*Alchemilla vulgaris*)								1			2	3
5	Caryophyllaceae								1				1
3,5	Hazel (*Corylus avellana*)	1			1				1	1			4
2,4	Cyperaceae							5	4				9
5	Pea family (Fabaceae)								1			2	3
3	Wild strawberry (*Fragaria vesca*)								1				1
2	Common hemp–nettle (*Galeopsis tetrahit/bifida*)								1	1			2
2	False cleavers (*Galium spurium* ssp. *spurium*)								5	1		8	14
2	Cf. false cleavers (*G. spurium* ssp. *spurium*)							1					1
3,5	Juniper (*Juniperus communis*)		7		1		1	5	18	4	5	13	54
	(seeds, needle fragments in brackets)							(1)	(31)	(5)	(2)	(25)	(64)
5	Spruce (*Picea abies*) (needle fragments)								(2)				(2)
5	Grass family (Poaceae)								10		4	6	20
4	Cinquefoil (*Potentilla* sp.)								4			4	8
4	Sheep´s sorrel (*Rumex acetosella*)											2	2
2	Annual knawel (*Scleranthus annuus*)							1	17		1	19	38
2	Chickweed (*Stellaria media*)								2				2
3,5	Cowberry/bilberry (*Vaccinium* sp.)								1			1	2
2,4	Wall speedwell (*Veronica* cf. *arvensis*)								1		1		2
2,4	Wild pansy (*Viola* cf. *tricolor*)										1		1
	Total number of seeds in each sample	1	10	1	28	3	25	57	152	19	29	90	415

[1)] Plant remains picked out at wet sieving
[2)] Sample treated by flotation

Ecological and functional groups
1. Cultivated plants
2. Field weeds, ruderals, plants from open soil and shores
3. Collected berries, fruits, nuts and roots
4. Meadow plants
5. Others

Of the cereals found at Gullhögen, the three wheat grains occurred in different squares (659, 660 and 662), which are not connected to one another. The grains of emmer wheat/spelt wheat were distributed between six of the squares (Fig. 6). The possibility of contamination from a hypothetical settlement of the Viking Period is not likely, as no remains or cultural layers from settlements of Viking date have been found at or near Gullhögen. The only possible signs of other activities are a few fragments of burned clay, but this is a common find in large grave mounds from the Early Mideival Period, probably belonging to the construction of the grave or derived from the pyre (Lindqvist 1936:153ff). (Burned clay is also present in the graves in Vendla's Mound, see Seiler 2001a:58ff). The fossil plant remains from three of the graves in Vendla's Mound – A1:1, A1:2 and A2:2 – are without contextual ambiguity and clearly associated with their respective grave contexts (Fig. 7). Here the plants occur in the central parts of the graves and immediately north of centre. Even though sampling was not specific enough to provide information on the detailed context and location, the Viking Period burial in Gullhögen seems to have contained a more widespread deposit of

Table 2. Fossil plant remains in Vendla´s Mound.

		A1:1				A1:2						LV		A2:2											SV	Lower layer						Tot
EG	**Taxa**	F125	F136	F778	59	1	13	30	114	165	168	1	F642	F654	F673	F681	F700	F707	13	24	26	27	34	36		1	2	3	4	6	A4	
1	Cf. oats (*Avena* sp.)																												1			1
1	Hulled barley (*Hordeum vulgare*)											1						1				1								1		4
1	Barley (*Hordeum* sp.)							1																						1		2
1	Cf. barley (*Hordeum* sp.)											1																				1
1	Wheat (*Triticum aestivum s.l.*)	1																														1
1	Cf. wheat (*Triticum* sp.)					1																										1
1	Cerealia indet.	3					1	1	1	1								1		1	1	5	1					1	2	1		20
1	Cf. flax (*Linum usitatissimum*)		1?																													1
	Total:	4	1	–	–	1	1	2	1	1	–	2	–	–	–	–	–	2	–	1	1	6	1	–	–	–	–	1	3			
	Wild plants																															
5	Common alder (*Alnus glutinosa*)																														1	1
3,4	Oat–grass (*Arrhenaterum elatius* ssp. *elatius*)														3																	3
2	Common orache (*Atriplex patula*)																			1												1
5	Cress family (Brassicaceae)				1																											1
4	Spring–sedge (*Carex* cf. *caryophyllea*)																				22											22
4	Sedge (*Carex* sp. *distigm.*).																			2	8											10
4	Sedge (*Carex* sp. *tristigm*.)																			11	3											14
4	Cf. sedge (*Carex* sp.)																		1													1
5	Pink family (Caryophyllaceae)																				1			3								4
–	Cf. centaury (*Centaurium* sp.)?				1														1	58	73	129	65	8	3							338
2	Field mouse–ear (*Cerastium cf. arvense*)																				1											1
2	Fat hen family (Chenopodiaceae)							1												1			2	1								5
2	Fat hen (*Chenopodium album*)							1				1								1	3	1	12	1								20
2	Oak–leaved goosefoot (*Chenopodium glaucum*)				1																											1
2	Oak–leaved/red goosefoot (*Chenopodium glaucum/rubrum*)				1																1											2
2	Goosefoot (*Chenopodium* sp.)																													1		1
2	Cf. goosefoot (*Chenopodium* sp.)	1					1																									1
3,5	Hazel (*Corylus avellana*)	1															1															1
4	Sedge family (Cyperaceae)																					13	8	4								25
4	Maiden pink (*Dianthus deltoides*)	1																		1	1											2
4	Cf. maiden pink (*Dianthus deltoides*)																				1											1
5	Pea family (Fabaceae)																					2								2		4
2	Black bindweed (*Fallopia convolvulus)*									1																					1	
3,4	Dropwort (*Filipendula vulgaris*)	1											1			1	1	1														5
2	Cf. upright bedstraw (*Galium album*)																			1		2										3
2	False cleavers																															

EG	Taxa	A1:1				A1:2						LV		A2:2										SV	Lower layer						Tot
		F125	F136	F778	59	1	13	30	114	165	168	1	F642	F654	F673	F681	F700	F707	13	24	26	27	34	36		1	2	3	4	6	A4	
	(*Galium spurium* ssp. *spurium)*																												1		1
4	Lady's bedstraw (*Galium verum)*																				1										1
4	Lady's bedstraw (*Galium* cf. *verum*)																				1										1
4	Bedstraw (*Galium* sp.)																				1										1
3,5	Juniper (*Juniperus communis*)																				1									13	14
2	Henbit deadnettle (*Lamium amplexicaule*)																											1			1
4	Cf. common bird's–foot Trefoil (*Lotus corniculatus*)																				1										1
4	Sticky catchfly (*Lychnis viscaria*)							1											1	2	2	1	3	3							13
4	Catchfly (*Lychnis* sp.)																				3										3
5	Mint (*Mentha* sp.)																		1												1
4	Cf. timothy (*Phleum* sp.)																						1								1
4	Burnet saxifrage (*Pimpinella saxifraga)*																			1											1
2	Greater plantain (*Plantago major)*																									1					1
5	Grass family (Poaceae)																				5		1							2	8
5	Cf. grass family (Poaceae)																		1										1		2
2	Knotgrass (*Polygonum aviculare*)				1						1										1										3
5	Cinquefoil (*Potentilla* sp.)																				1										
2	Creeping buttercup (*Ranunculus repens*)																				1										1
5	Buttercup (*Ranunculus* sp.)																				1										1
4	Sheep's sorrel (*Rumex acetosella*)								1												5			1							7
2	Cf. Annual knawel (*Scleranthus* sp.)																						8								8
4	Lesser stichwort (*Stellaria graminea*)																					1		1							2
2	White clover (*Trifolium repens*)																				4	1									5
2,4	Clover (*Trifolium* sp.)																			2	2								1		5
2	Stinging nettle (*Urtica dioica*)																										1				1
2,4	Speedwell (*Veronica* sp.)																						1								1
2,4	Thyme–leaved speedwell (*Veronica serpyllifolia*)																				1	1	1								3
2	Cf. field pansy (*Viola arvensis*)																									1					1
	Unidentified plant remains			1										3																	
															150	150	50	30		60		18	11	2			1					476
	Total number of seeds in each sample	5	1	1	5	1	2	5	2	1	2	3	1	3	153	151	52	33	5	142	146	175	114	24	3	2	2	2	4	10	14	1064

EG = Ecological and functional groups
SV = Small vessel
LV = Large vessel

Ecological and functional groups:
1. Cultivated plants
2. Field weeds, ruderal plants, plants from disturbed soil and shores
3. Collected fruits and berries
4. Meadow- and wetland plants
5. Others

No identifiable fossil plant remains were found in the following samples:
A1:2, sample 5
A1:2, sample 95
Lower layer, sample 5

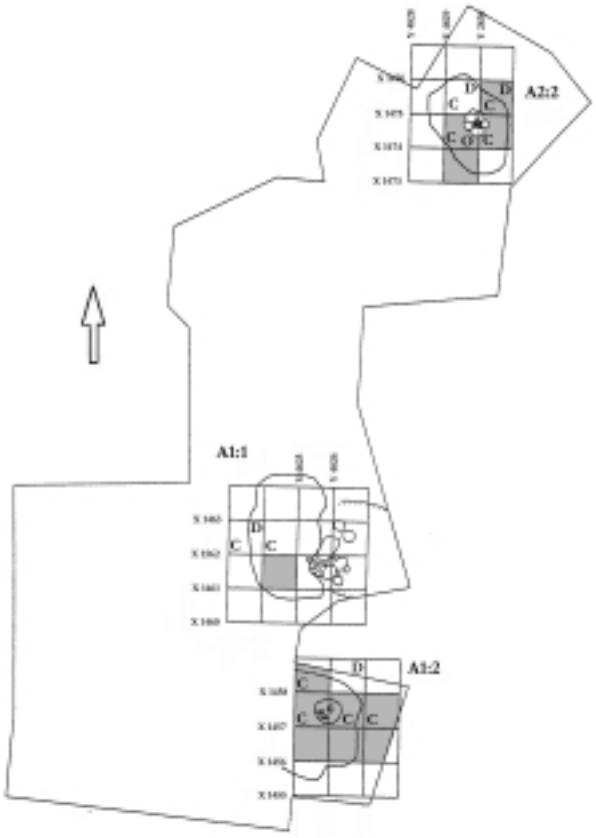

Figure 7. Three of the graves in Vendla's Mound. The squares from which soil samples were taken are marked in grey. C = cereals, O = stem tubers of oat-grass (*Arrhenaterum elatius* ssp. *bulbosum*), D = root tubers of dropwort (*Filipendula vulgaris*). Drawing by Anton Seiler, adapted by Liselotte Bergström.

fossil plant remains than was recorded for Vendla's Mound. We do not know, however, whether plants were also present in the central part and around the whole grave, or only north of it.

Distribution of ecological and functional plant groups

The species of cultivated plants dominated over all the other ecological and functional groups at Gullhögen, accounting for 45% of the total (Fig. 8), and this was also the case in the graves in Vendla's Mound, the cultivated plants accounting for 46% in A1:1 and 47% in A1:2. Here, however, the total number of diaspores was low, so that this statement may not be entirely representative. A larger quantity of plant remains was found in grave A2:2, and here the meadow plants formed the dominating group (58%) . It is unclear whether this result is affected by the fact that more samples were analysed from this grave (eight) than from the other graves, e.g. only one soil sample was examined from A1:1.

Similar evidence elsewhere

The same distribution pattern of ecological and functional groups as found in Gullhögen was also observed in a plant macrofossil analysis of soil samples from a cremation burial in a stone setting dated to the Late Bronze Age/Pre-Roman Iron Age transition (c. 500 BC) at Odensala vicarage, parish of Odensala, in the province of Uppland (Hansson 1995). Cultivated plants were even more dominant in this grave, amounting to 95%. The plant materials in Gullhögen and in the stone setting in Odensala differ, however, when it comes to field weeds, a group that is completely missing at Odensala. An absence of field weeds is not unusual in fossil plant remains, at least from the South Scandinavian Early Bronze Age, however, probably owing to the harvesting methods, i.e. the cereals may have been cut just below the ears (Lagerås & Regnell 1999:267). The grave at Odensala is somewhat later and situated further north, and one may assume that harvesting was still performed in the same way here as during the Early Bronze Age, by cutting below the ear, or alternatively the cereals and seeds from other cultivated plants had been cleaned. In Gullhögen the cereals had probably been at least partly cleaned, or when sprinkled, the heaviest seeds ended up closer together but the smaller and lighter seeds did not fly as far as the fully mature carbonised cereals.

The distribution of ecological plant groups in Gullhögen is less similar to that of the plants in the Vendla graves than to that found in graves dated to the Early Roman Iron Age (0 BC/AD–200 AD) at Spurila, Finland, for instance (Seppä-Heikka 1985) The carbonised plant material in the fifteen soil samples from Spurila included only a small amount of weed seeds in contrast to a large proportion of cereal grains (Seppä-Heikka 1985:460).

Cultivated plants

The cereals in Gullhögen included barley (*Hordeum vulgare*), wheat (*Triticum aestivum* s.l.) emmer/spelt wheat (*Triticum dicoccum/spelta*) and oats (*Avena* sp.), but no rye (*Secale cereale*) was found. Hulled barley dominated, as in earlier results for the Viking Period in central Sweden. Hjelmqvist (1979:53) noted that hulled barley formed about half of all imprints of cer-

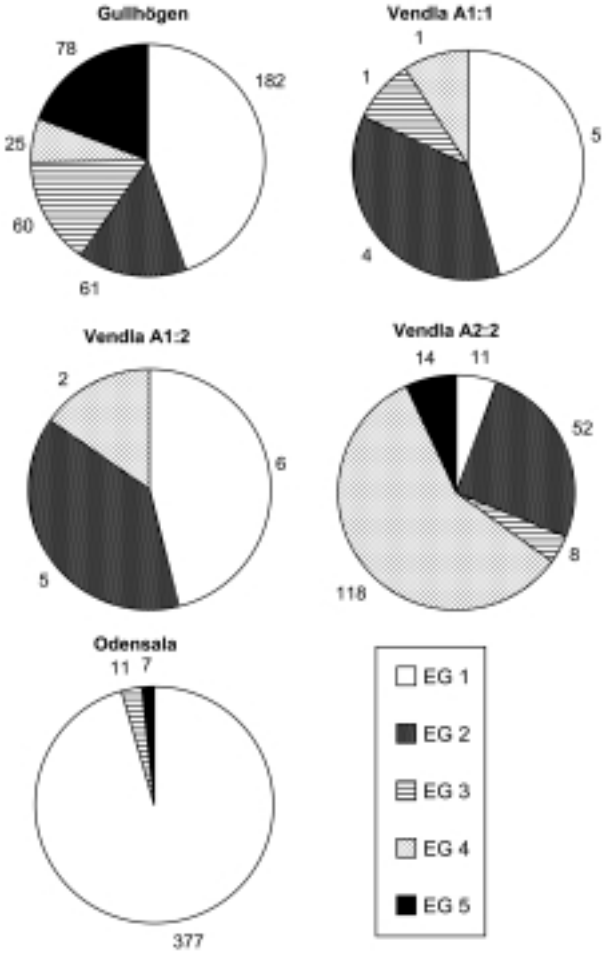

Figure 8. Distribution of ecological and functional plant groups in Gullhögen, in three graves in Vendla's Mound, A1:1, A1:2, A2:2 and in grave A8 at Odensala. EG = Ecological groups: (1) Cultivated plants, (2) Field weeds, (3) Collected berries, fruits, nuts and roots, (4) Meadow plants, (5) Others.

eals on ceramic vessels from the Viking Period in south and central Sweden and slowly decreased thereafter. Emmer wheat may still be present during the Viking Period, but is in decline, while wheat (*Triticum aestivum* s.l.) is increasing progressively and becoming more common, especially in the Mälaren Valley during the Early Middle Ages. Oats, which arrived during the Bronze Age, is often found to some degree, and rye is present sporadically, with a slight increase during the Early Medieval Period (Viklund 1994:33).

Viking Age spelt wheat

The proportion of emmer wheat/spelt wheat found in Gullhögen, 7.7%, i.e. 14 out of a total of 182 cereal grains identified, does not quite agree with Hjelmqvist's analyses of imprints on pottery shards from the Viking Age in southern and central Sweden, which produced a figure of 0.3% (Hjelmqvist 1979:53). There may also be other explanations for this. There may be a difference in the assortment of cereals between a grave complex and a settlement complex, and the imprints on pottery from graves presumably mirror conditions in the settlements where the pottery was produced and where the plant material stuck to the wet clay during the manufacture of the pots. Thus Hjelmqvist's analyses of imprints of fossil plant remain focuses on settlements. Only the four most common cereal species, bread wheat, rye, oats and hulled barley, have been found in the Black Earth of Viking Birka (Hansson 1997:24), while the small bread buns in the cremation graves were baked of a mixed dough containing flour from peas, flax and emmer wheat, and possibly also spelt wheat and einkorn (*Triticum monococcum*). Hjelmqvist, who conducted these analyses, considered the speltoid wheats old-fashioned (Hjelmqvist 1984). Out of the 65 small buns recovered from cremation graves at Birka, 33 have been analysed and 7 of these contained speltoid wheats (Hansson 1996:64).

Different cereals, different traditions?

Does the reason why we find no speltoid wheat species (or very few) at Viking Period settlements lie in the fact that they had a special symbolic value and were reserved for ritual occasions? If so, they may also have been stored separately from other species. It must be remembered, however, that only a very small part of the Black Earth has so far been analysed archaeobotanically. There is also a further possibility that these cereals were imported. Gullhögen is an aristocratic burial site, and Birka contains the graves of a well-off social group with widespread and even international contacts. Although it is very rare to find speltoid wheats in central eastern Sweden during the Viking Period, we know from the results of analyses of fossil plant remains from the soil of settlements with Scandinavian traits in the Kiev area that they were present in Russia at this time, for instance. Bread wheat, rye and peas were the dominant cultivated plant species found at these sites, but speltoid wheats were also cultivated (Pashkievich 1991:253).

The three unusually small carbonized wheat kernels found in Gullhögen (Fig. 9) are too meagre to allow us to assess whether these should be attributed to a special type of wheat with shorter, thicker caryopses, such as club or bread/club wheat (*compactum* type) rather than

the more common and more slender caryopses of bread wheat (*aestivum* type) (Behre 1990:155). For the reliable identification of non-carbonised wheat grains it is normal to refer to the rachis, but when only charred caryopses survive, it is usual to employ the length/breadth index. This latter can result in a size overlap between the two types, however, which complicates the identification of the wheat, all the more so when it is a matter of only a few grains (Behre 1983:22). The length/breadth index for charred wheat grains ideally lies between 1.32–1.56 for the *compactum* type and between 1.67–2.22 for the *aestivum* type (Rotmahler 1955; cf. Werneck 1955; van Zeist 1970:53f; Kuçan 1979:32). The average length/breadth index for the wheat in one of the more substantial finds from Viking Haithabu (no. 1275) is 1.49, so that this has been attributed to the *compactum* type (Behre 1983:22). The dimensions of the three wheat grains from Gullhögen lie within the limits for the *compactum* type being length: 3.1–4.1, breadth: 2.0–2.8 mm and thickness: 1.9–2.3.0 mm, giving an L/B index of 1.46–1.55. However, since Zohary & Hopf (1994) do not recommend the use of subgroups, all the wheat grains are assigned here to *Triticum aestivum* s.l.

In Vendla's Mound, cereals were recovered from all three graves and from the postholes in the lowest settlement layer, but the numbers of grains were small, no more than 23 altogether. Seven were identified as barley, and there were also two wheat kernels, one of which was somewhat uncertain. An uncertain oat grain was also recovered. Most of the cereals were heavily burnt and fragmented and could not be identified to species level. Thus both rye and speltoid wheats are missing here. It is interesting that bread wheat was found – the "finest" cereal species, which gives white flour and porous bread. These grains had a morphology common to Early Medieval grains, i.e. not as small as the specimens from Gullhögen. Also, a seed of flax (*Linum usitatissimum*) in a rather bad state was found in grave A1:1. Flax had previously been found in a posthole from a Migration Period house in Vendel, fairly close to Vendla's mound (Hansson 1999).

Field weeds

The field weeds/ruderals in Gullhögen can be distinguished according to their habitat demands into a first group of plants preferring dry, poor land, which includes sheep's sorrel (*Rumex acetosella)*, annual knawel (*Scleranthus annuus*), wall speedwell (*Veronica arvensis*) and wild pansy (*Viola tricolor*), and a second group requiring a habitat with more moist, nitrogen-rich conditions, represented by the common hemp-nettle (*Galeopsis tetrahit/bifida*), false cleavers (*Galium spurium*) and chickweed (*Stellaria media*). It can be noted that no species of the fat-hen family were observed. Plants of this group, and especially the fat-hen species, are very common in such contexts and usually indicate manured fields (Viklund 1998).

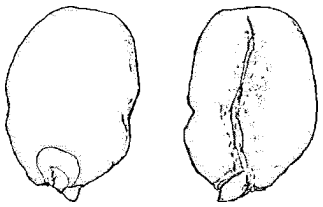

Figure 9. Wheat (*Triticum aestivum* s.l.). (a) dorsal view, (b) ventral view.

The oak-leaved and red goosefoot (*Chenopodium glaucum/rubrum*), which belong to the nitrophilous fat-hen family, are grouped together in the present analyses, as their seeds are similar and they occupy the same ecological niche. Fat-hen or other plants of this family were found in the three burials in Vendla's Mound but not in Gullhögen, which instead yielded the annual knawel, indicative of a dry, poor sandy field soil. This plant also occurred in Vendla's Mound, in grave A2:2, but it was the species of the fat-hen family that were dominant there.

Burial use

Most of the field weeds/ruderals in both Gullhögen and Vendla's Mound had probably accompanied the cereals into the burial, whether sprinkled around or placed either in a heap or in a container of some sort, which did not survive. The different biotopes of the field weeds indicate that the cereals may have originated from separate fields, though it must be remembered that conditions may have varied even in the same field. Knotgrass can grow on hard, trampled soil, on pathways, in yards and in similar habitats, but the species also thrives on sea shores.

Meadow plants from different biotopes – fodder or bedding?

The meadow plants from both Gullhögen and Vendla's Mound are similar to the plant material from byres, which is understood as representing hay used as fodder for cattle and horses. Various species of

Cyperaceae, dominated by the sedge species, together with other meadow plants from both wet and dry biotopes are known from the stable areas of prehistoric long-houses in the northern part of Sweden, which had a dwelling at one end and a stable at the other, within the same building (Engelmark 1981; Ramqvist 1983; Wennberg 1986; Engelmark & Viklund 1990, Viklund 1998). Similar plant evidence has been obtained from a separate byre in eastern central Sweden (Hansson 1999).

More than half (58%) of the diaspores found in grave A2:2 at Vendla's Mound come from meadow plants, the most plausible interpretation being that they were used for bed-making or as filling for a mattress or a bed-tick for the deceased, a practice that is documented for more recent times (Hansson 2003b). It is remarkable that hay should have been used in the graves and not straw, as hay would have been a scarce commodity and one of great importance as winter fodder for cattle during prehistoric times, as it has been during historical times. On the other hand, its use as bedding material for the dead is also known in historic and recent times, which suggests that the practice may have had some special significance. Another alternative, however, could be that the hay was meant as symbolic fodder for the horse, whose cremated bones were found in grave A2:2. It has been noted earlier that the grave goods in boat burials XII and VII at Vendel show that care was taken to provide for the horses in the afterlife, as the finds included not only rich horse bridles and other equipment but also everyday tools for horse care such as hoof picks (Lundström 1980:43).

Collectable plants

It is not possible to determine whether the juniper berries were collected for use as food or drink in some form, as juniper berries have been widely exploited from historic times up to the present day. The hazelnuts were probably deliberately collected, however, as also were the cowberries/bilberries and wild strawberries. Swollen stem tubers of oat grass (*Arrhenaterum elatius* ssp. *bulbosum*) (Fig. 10) and root tubers of dropwort (*Filipendula vulgaris*) (Fig. 11) were found in Vendla's mound. The latter were retrieved from grave A1:1 during water sieving, having originated from two 1 m squares immediately north of the square from which the soil sample was taken. As soil from a large number of squares was water-sieved, it is of great significance that the plant remains retrieved by this means occurred only near the centre of the grave and nowhere else.

Fossil plant evidence as an indicator of in situ pyres

A very important problem in connection with Vendla's Mound has been that of establishing the location of the cremation pyre. Was it located where the graves were later built or somewhere else? This is a crucial point, not least for archaeobotanical reasons, with regard to possible contamination from beneath, from the original vegetation at the site of the burial.

It seems most likely that cremation took place on the site of the mound, except in the case of grave A1:2, for which it had taken place elsewhere. If the oat grass stem tubers and dropwort root tubers had originated from natural growth at the site before cremation, they would have grown together exactly beneath the grave, with maximum interspaces of 1 m, an interpretation which does not seem probable. A further indication that both were the result of the deposition of collected plants may be that in grave A2:2 remains of the same

Figure 10. Swollen stem tuber of oat-grass (*Arrhenaterum elatius* ssp. *bulbosum*) from grave A2:2. Length 7 mm. Photo by Ann-Marie Hansson.

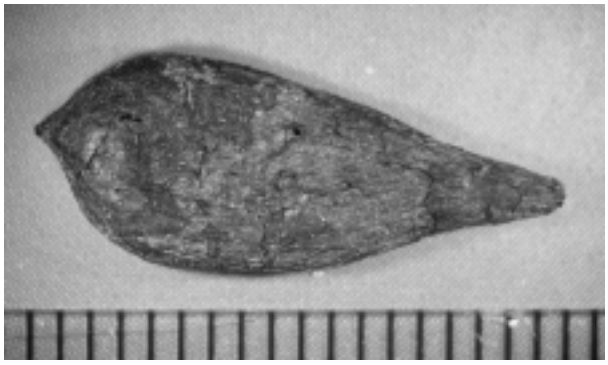

Figure 11. Root tuber of dropwort (*Filipendula vulgaris*). Photo by Ann-Marie Hansson.

kind were found in close proximity to the central area of the burial, in the same squares as the cereals, three of these squares containing tubers of dropwort as well and in one square oat grass. Most of the "unidentified material" (possibly the tips of roots and twigs) were found together with these plants. According to Artelius (1999), there are grave finds on the west coast of Sweden which suggest that these tubers had been deliberately placed in a special position, further strengthening the likelihood that at Vendla's Mound, too, they were collected for use as grave gifts.

There is other evidence that both stem tubers of oat grass and root tubers of dropwort could have been used as grave goods. The small stem tubers of oat grass are pear or fig-shaped, and the epidermis has longitudinal furrows, a pattern which differs from the epidermis of the dropwort. Hjelmqvist (1955:122) mentioned 11 dropwort root tubers in a Vendel Period grave, which he identified and described as being oval or somewhat pear-shaped, with a length of between 7.5 and 10 mm, while Engelmark (1984:89) published a photograph (magnification 30×) of the epidermal structure of a dropwort root tuber which is very characteristic and is identical to those found in grave A2:2 at Vendla's Mound. The modern distribution of dropwort in Sweden is restricted to dry, open, poor calcareous soils south of the river Dalälven.

Unidentified seeds (?)

The species whose seeds (?) occurred most abundantly has unfortunately not been identified and is simply listed under the heading "cf. centaury (*Centaurium* sp.)?" in Table 2. These seeds (?) are very small, c. 0.5–1.0 mm, ball-shaped, black and weakly patterned (Fig. 12). Similar seeds (?) have previously been found in another grave at Vendel, where they were identified as possibly centaury (*Centaurium* sp.) (Bergström 1998), but the identification is still very uncertain. They may not in fact be seeds at all!

Plants in buds

The unidentified heterogeneous plant material, resembling rootlets or the tips of twigs with buds (Fig. 13, Table 2), may be compared with the fossil plant material in the Hochdorf grave, where a great quantity of herbaceous plants and twigs were placed as a mattress. It is notable that twigs and herbs were also placed under the bronze deathbed, so that the space under the bed was completely filled with plant material (Körber-Grohne 1985:92f). This could hardly have had any practical function, but may have had a symbolic one. The "unidentified plant remains" in the present Uppland graves may have played a similar role. Thus there are at least two interpretations for the presence of this material in Vendla's Mound. The plants, with their budding growth, may have acted as a gift symbolizing growth and resurrection, representing a life-cycle – the re-birth of what has died, or they could have had a more practical function as filling for the mattress or as a decoration, as they coincide to a great extent in location with the four squares covering the central part of the grave.

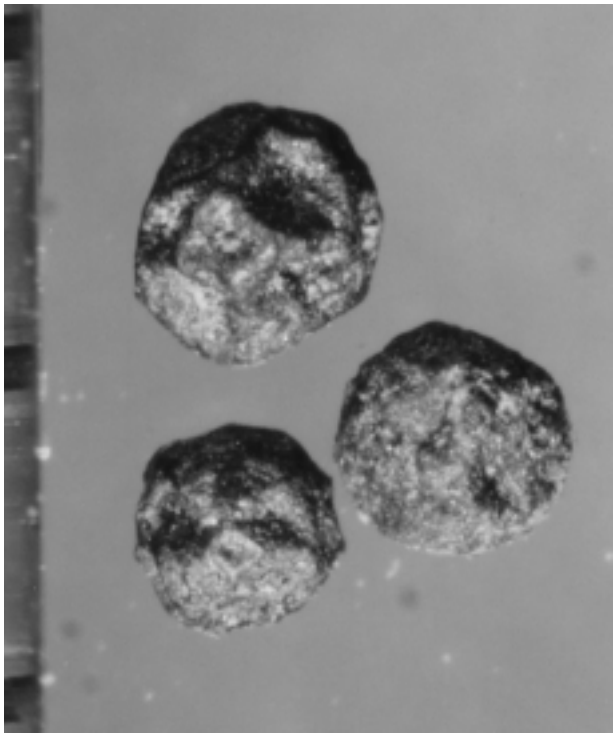

Figure 12. Unidentified seeds (?) from grave A2:2. Photo by Ann-Marie Hansson. Scale bar to the left 2 mm.

Location of plant material in the cremation graves

The soil samples taken from south of the centre of the graves in Vendla's Mound were on the whole devoid of fossil plant material. These three burials contained boat rivets (Seiler 2001b:78) and the graves are considered to be cremated boat burials (Seiler 2001a:62). The remains from the cremation pyre must then have been raked together towards the centre in order to fit under the intended grave construction.

Most inhumation boat burials from the Vendel Period have permitted archaeologists to study the position of the grave goods *in situ* in the burial boat and in relation to the placement of the deceased. Often front part of the boat was reserved for cooking utensils and provisions, including *hard* plant material that is easy to

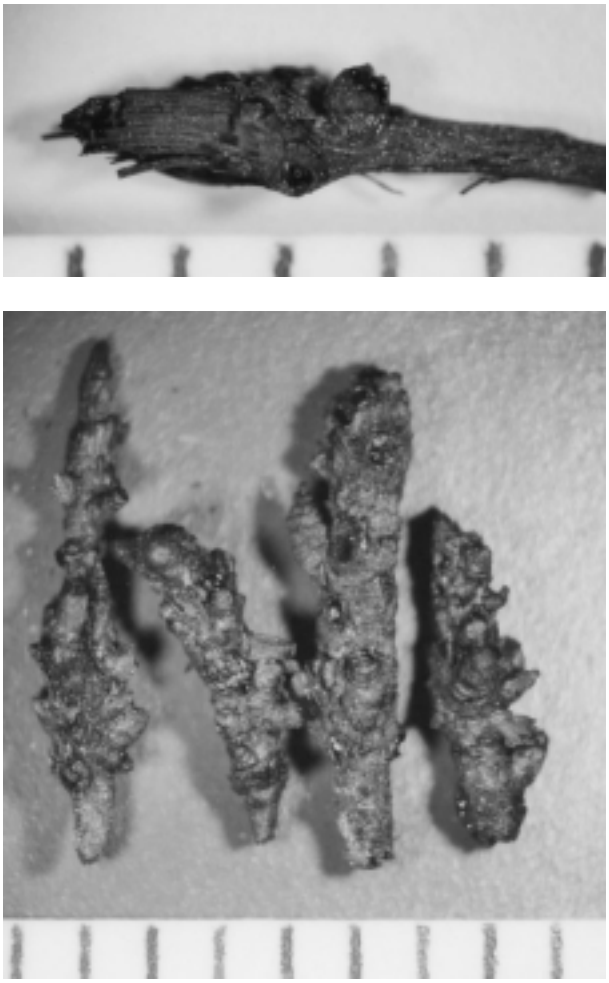

Figure 13. Unidentified plant material from grave A2:2. Photo by Ann-Marie Hansson.

recognise during excavations, such as hazel nuts (Arwidsson 1942, 1954; Lundström 1980). Did the grave goods in the cremated boats also have fixed positions?

A difference normally noted between burned and unburned boat graves concerns the food items placed in them as grave goods. The cult of ritual feasting formed a central part of Early Medieval aristocratic traditions, especially among boat-grave societies (Herschend 1997), and since the grave boats always contain evidence of the deposition of meat, it was evidently necessary to bring along equipment to allow feasts to be held "on the other side". Fruit or vegetables are not mentioned, except for hazelnuts. It is my belief, however, that cereals, berries and fruits also were deposited in the burial boats (cf. Holmboe 1927).

The cremation boat graves did not produce any exclusive cooking equipment indicative of the large-scale entertaining that took place at great halls, such as meat hooks, pot hooks or spits, as found in inhumation graves, but other very rare grave goods do occur which are usually only associated with aristocratic pastimes, such as gaming pieces made from whale bone and the birds of prey used for hunting. The inhumation boat burials seem to have been erected over members of the leading upper classes in society, which would suggest that the social difference between inhumations and cremation boat graves was not very great. According to Seiler there is one important difference between unburned and burned boat graves, however: only adult men were buried in the former, whereas we find children and teenagers, and perhaps even an adult man, as far as can be judged from the grave furniture, in the latter. Vendla's Mound contained young people, who, if they had lived a little longer, would probably have been buried as adults in inhumation boat graves (Seiler 2001a:88).

Vendel thus shows a combination of traditional cremation graves as known elsewhere in the Mälaren Valley with the inclusion of boats as an integral part of the burial rite. The fire could have acted as a link between the living world and the world of the dead (Kaliff 1997). In Gullhögen no boat rivets are found, and this is interpreted as indicating that it was not a cremated boat grave.

The importance of cereals in graves

It should be mentioned that cereals may serve a dual role in the burial ritual and are more than merely a means of making food and beer. They may have been of symbolic importance and were also used in the burial rites involving inhumation grave boats, but have eluded preservation. The use of cereals in the burial act may be an expression of rebirth and reproduction, as they symbolise conclusion of the old life at the same time as bringing the strength of new life to a new existence. The connection between agriculture and its products, human fertility and death rituals is well documented in many cultures (Kaliff 1997:75f). Human death and resurrection may be compared with a wheat grain, which seems to be dead until it starts to grow in the soil – it arises anew.

An example of the immense importance attached to cultivated plants, principlly cereals, during this period in the prehistory of Scandinavia can be gleaned from the Icelandic Sagas, in *Ynglingasagan* (in *Heimskringla*). Here we find the story of Domalde, who replaced his father as king in Uppsala. His reign was afflicted by years of crop failure, however, which led to

starvation and much distress. After several years of famine, during which both oxen and humans were sacrificed without any result, it was deemed necessary to sacrifice the king himself (Sturluson 1991:37). Näsström (1997:82f) considers the recipient of this sacrifice to be the goddess Freja, comparing her to Ceres, the Roman goddess of crops and fertility, arguing on several accounts why it should be Freja and not Odin as Ohlmarks (1961) believed.

The agricultural innovations that became available during Early Medieval times included the iron ploughshare and iron-shod spade. In addition, a more organised practice of ditch-digging began (Myrdal 1982; 1985). The oldest known Swedish iron ard share comes from the Vallhagar settlement on the island of Gotland and dates to the 5th or 6th century AD, but it was not until iron became more readily available that iron ploughshares became common, mostly during the second half of the first millennium (Myrdal 1982:86).

These innovations were vital for advances in agrarian technology, resulting in an increasing dependence on cultivation. Cereals developed an important role and it is hardly an accident that these two high-status sites, Gullhögen and Vendla's Mound, lay in a shallow-field landscape, and not just an area of good access to communication routes by water and land. Both large grave mounds were strategically erected so that their summits commanded a wide view over the cultivated field landscape below. This might have been an indication of the importance of cultivation, while at the same time confirming the high status of the dead persons buried there.

Conclusions

The focus here has been on some of the problems specific to the analysis of fossil plant remains from graves located within large mounds. This involves the study of extremely complex evidence. Each mound can contain several graves and even over/underlie settlement evidence. Careful sample retrieval is required to eliminate false associations and false interpretations.

Discrepancies in otherwise apparently similar grave situations which may affect the final resting place of the plant record must be looked out for and understood when interpreting the fossil plant material found in graves.

In the present study, for example, the graves in Vendla's Mound which contained cremations in burned boats have, with the exception of A1:2, been shown to have been erected over the site of the actual cremation. On the other hand, the Viking-Period grave in Gullhögen contained no traces of any boat rivets, and cremation obviously took place elsewhere. This affects the survival of the fossil plant evidence and its interpretation.

The cereals associated with these graves had thus been deposited in different ways. In Vendla's Mound the plant remains were found in the central part of the grave and north of the centre, while in Gullhögen we cannot tell whether there were any cereals in the centre of the grave, though they were spread over a large area. More cereals were found in Gullhögen than in the graves in Vendla's Mound, and the Gullhögen wheat showed a special morphology. In addition, speltoid wheats occurred there together with field weeds, indicating rather poor soils. The only wheat grain retrieved from Vendla's Mound had a common morphology, and the weeds were indicative of fertilised fields. Vendla's mound contained probably collected root tubers of dropwort and stem tubers of oat grass.

A rich botanical material consisting of probable twigs and root tips was found in Vendla's Mound, especially in grave A2:2, its location indicating that it had been intentionally placed under the deathbed for some reason, maybe as a symbolic deposition. This shows a similarity to the Pre-Roman Iron Age grave at Hochdorf.

The meadow plants (hay) deposited in the graves are interpreted by the author as being functional bedding material carefully brought for the deceased's deathbed. This may have had a symbolic significance. Thus the custom, surviving down to recent times, of using hay, a precious fodder commodity, as bedding material or floor covering under the deathbed was apparently already current during the 6th century AD in eastern Sweden. The hay may also have been intended as fodder for the accompanying horses.

To summarize, then, this study of the plant fossil evidence in these two large grave mounds confirms the importance of cereals and meadow plants in the Late Iron Age society of eastern Sweden. It also opens up many new areas of enquiry. One is the hitherto unrecognized possible role of cereals as resurrection symbols in the grave rituals of this period, and the associated use of plants both as symbolic food and for decorative purposes. Another is the previously undocumented apparent deposition during this period not only of artefacts but also of fodder for the daily maintenance of the owner's horses in the afterlife.

There has been very little published about fossil plant remains in graves, and we need more information concerning the role of these plants as grave goods and as symbols, and how this relates to their practical

function in the living society. There is an even greater need for methodological discussion on how the archaeobotanical evidence in graves can best be retrieved. As shown here, one necessary criterion is cooperation at the pre-excavation stage between the archaeologist and the fossil plant specialist in planning retrieval strategies.

The present study clearly shows the rich archaeological potential of analysing plant evidence, even at complex sites. It also shows that the results can be far more revealing than one might expect.

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English language revision by Malcolm Hicks.

Bibliography

Ambrosiani, B. 1981. Långhundraleden. In L. Thunmark-Nylén, J. P. Lamm, G. Tegnér & A. Sandvall (eds.): *Vikingatidens ABC*. Stockholm.

Anderberg, A. 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.

Arrhenius, B. & Eriksson, G. (eds.) 2005. Gulldens hög i Husby-Långhundra. Archaeological Research Laboratory, Stockholm University. In press.

Artelius, T. 1999. Arrhenaterum Elatius ssp. Bulbosum: Om växtsymbolik i vikingatida begravningar. In J. Nordbladh, A. Gustafsson & H. Karlsson (eds.): *Glyfer och arkeologiska rum*. Göteborg.

Arwidsson, G. 1942. *Valsgärde 6*. Uppsala.

Arwidsson, G. 1954. *Valsgärde 8*. Uppsala.

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

Behre, K.-E. 1990. Kulturpflanzen und Unkräuter der vorrömischen Eisenzeit aus der Siedlung Rullstorf, Ldkr, Lüneburg. *Nachrichten aus Niedersachsens Urgeshcichte* 59, pp. 141–165.

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 Museum of Natural History, Stockholm.

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, Stockholm.

Bergström, L. 1998. Växtmakrofossilanalys av material från 6 gravar, Raä 28 och 216, Vendel, Vendels sn, Uppland. Unpublished report.

Bertsch, K. 1941. *Früchte und Samen, Handbücher der praktischen Vorgeschichtsforschung. Band 1*. Stuttgart.

Blamey, M. & Grey-Wilson 1989. *The illustrated flora of Britain and Northern Europe*. London.

Bouby, L. & Marinval, P. 2004. Fruits and seeds from Roman cremations in Limagne (Massif Central) and the spatial variability of plant offerings in France. *Journal of Archaeological Science* 31, pp. 77–86.

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

Engelmark, R. 1984. Two useful Plants from IronAge Graves in Central Sweden. *Archaeology and Environment* 2, pp. 87–92. Umeå.

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

Hansson, A.-M. 1995. Bilaga IV: Analys av fossilt växtmaterial från RAÄ 235, Odensala Prästgård, Odensala socken. In M. Olausson: *Det inneslutna rummet – om kultiska hägnader, fornborgar och befästa gårdar i Uppland från 1300 f Kr till Kristi födelse*, pp. 262–269. Stockholm.

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

Hansson, A.-M. 1997. *On Plant food in the Scandinavian Peninsula in Early Medieval Times*. Theses and Papers in Archaeology B:5. Stockholm.

Hansson, A.-M. 1999. Fossilt växtmaterial från SIV-projektets undersökningar i Vendel, vid Vendels kyrka. Unpublished report.

Hansson, A.-M. 2003a. Plant remains from Borg I:1. In G. Stamsø Munch, O. S. Johansen & E. Roesdahl (eds.): *Borg in Lofoten: A chieftain's farm in North Norway*. Trondheim.

Hansson, A.-M. 2003b. Bilaga 3. Botanisk analys. In A. Bergman: *Klara kyrka: gravkorslänga 103: Stockholms stad, Norrmalm, RAÄ 103: arkeologisk undersökning 2001*, pp. 72—80. Arkeologisk rapport, Stockholms stadsmuseum, Kulturmiljöavdelningen 2003:9. Stockholm.

Hansson, A.-M. & Bergström, L. 2002. Archaeobotany in prehistoric graves – concepts and methods. *Journal of Nordic Archaeological Science* 13, pp. 43–58.

Herschend, F. 1997. *Livet i Hallen. Tre fallstudier i den yngre järnålderns aristokrati*. Opia 14. Institutionen för arkeologi och antik historia, Uppsala universitet.

Hjelmqvist, H. 1955. *Die älteste Geschichte der Kulturpflanzen in Schweden*. Opera Botanica 1:3. Stockholm.

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

Hjelmqvist, H. 1984. Botanische Analyse einiger Brote. In G.

Arwidsson (ed.): *Birka II:1. Systematische Analysen der Gräberfunde*, pp. 261–272. Stockholm.
Holmboe, J. 1927. Nytteplanter og ugraes i Osebergsfundet. In A. W. Brøgger & H. Schetelig (eds.): *Osebergfunnet* V, pp. 1–78. Oslo.
Kaliff, A. 1997. *Grav och kultplats. Eskatologiska föreställningar under yngre bronsålder och äldre järnålder i Östergötland.* AUN 24. Department of Archaeology, Uppsala University.
Katz, N. J., Katz, S. V. & Kipiani, M. G. 1965. *Atlas and Keys of fruits and seeds occurring in the Quaternary deposits of the USSR.* Moscow.
Körber-Grohne, U. 1985. Die biologische Reste aus dem hallstattzeitlichen Fürstengrab von Hochdorf, Gemeinde Eberdingen (Kreis Ludwigsburg) mit Beiträgen von J. Biel, K. Haas, G. Vorwohl & R. Wurster. In *Hochdorf 1. Landesdenkmalamt Baden-Württemberg, Stuttgart. Forshungen und Berichte zur vor- und Frühgeschichte in Baden-Würtemberg* Band 19, pp. 87–263. Kommissionsverlag Konrad Theiss Verlag, Stuttgart.
Kuçan, D. 1979. Mittelalterliche Kulturpflanzen und Unkräuter aus ostfriesischen Kirchen. *Probleme der Küstenforschung im südlichen Nordseegebiet* 13, pp. 23–38. Hildesheim.
Küster, H. 1985. *Hochdorf 1. Neolithische Pflanzenreste aus Hochdorf, Gemeinde Eberdingen (Kreis Ludwigsburg).* Stuttgart.
Lagerås, P. & Regnell, M. 1999. Agrar förändring under sydsvensk bronsålder. En diskussion om skenbara samband och olösta gåtor. In M. Olausson (ed.): *Spiralens öga – tjugo artiklar kring aktuell bronsåldersforskning*, pp. 263–276. Riksantikvarieämbetet Arkeologiska Undersökningar, Skrifter 25. Stockholm.
Lempiäinen, T. 2002. Plant macrofossils from graves and churches. The archaeobotany of graves from the Late Iron Age and the Middle Ages and of Medieval churches in Finland and the Karelian Isthmus (Russia). In K. Viklund (ed.): *Nordic Archaeobotany – NAG 2000 in Umeå*, pp. 161–172. Archaeology and Environment 15. Umeå.
Lindqvist, S. 1936. *Uppsala högar och Ottarshögen.* KVHAA. Stockholm.
Lundström, A. 1980. Gravgåvorna Vendel. *Vendeltid. Historia i fickformat*. Utgiven av Statens Historiska Museum, pp. 31–44.
Mossberg, B., Stenberg, L. Ericsson, S. 1992. *Den Nordiska Floran*. Stockholm.
Myrdal, J. 1982. Jordbruksredskap av järn före år 1000. *Fornvännen* 77, pp. 81–104.
Myrdal, J. 1985. *Medeltidens Åkerbruk. Agrarteknik i Sverige ca 1000 till 1520*. Nordiska Museet. Stockholm.
Nässtrom, B.-M. 1997. Stucken, hängd och dränkt. Rituella mönster i norrön litteratur och i Adam av Bremens notiser om Uppsalakulten. In A. Hultgård (ed.): *Uppsalakulten och Adam av Bremen*, pp. 75–99. Nora.
Ohlmarks, Å. (ed.) 1961. *Snorres konungasagor. Hednakungarna. Från äldsta tider till 1015.* Stockholm.
Pashkievich, G. A. 1991. The palaeoethnobotanical examination of cultivated plants of old Russian state. Palaeoethnobotany and Archaeology 8th symposium Nitra – Nove' vozokany 1989. *Acta Interdisciplinaria*. Nitra.
Pelve, E. 1995. Makrofossilanalys av en vikingatida grav i Vendel. Undersökning av innehållet i ett lerkärl. *C/D-uppsatser i laborativ arkeologi läsåret 94/95, Del 2.* Stockholms Universitet.
Ramqvist, P. 1983. *Gene. On the origin, function and development of sedentary Iron Age settlement in Northern Sweden.* Archaeology and Environment 1. Department of Archaeology, University of Umeå.
Ramqvist, P. 1992. *Högom. The excavations 1949–1984. Högom part 1.* University of Umeå, Department of Archaeology. Riksantikvarieämbetet. University of Kiel, Department of Pre- and Protohistory.
Rotmahler, W. 1955. Zur Fruchtmorphologie der Weizenarten Triticum L. *Feddes Repertorium* 57, pp. 212–216.
Seiler, A. 2001a. *I skuggan av båtgravarna. Landskap och samhälle i Vendels socken under yngre järnålder. Del 1. Text och figurer.* Theses and Papers in Archaeology B:7. Archaeological Research Laboratory, Stockholm University.
Seiler, A. 2001b. *I skuggan av båtgravarna. Landskap och samhälle i Vendels socken under yngre järnålder. Del 2. Appendix.* Theses and Papers in Archaeology B:8. Archaeological Research Laboratory, Stockholm University.
Seiler, A. 2002. Vendlas hög. Arkeologisk undersökning raä 8, Vendel, Vendels sn, Uppland. Archaeological Research Laboratory. Unpublished report.
Seppä-Heikka, M. 1985. Grains and seeds from Younger Roman Iron Age excavations in Spurila. *ISKOS* 5, pp. 460–461.
Sturluson, S. 1991. *Nordiska kungasagor. 1. Från Ynglingasagan till Olav Tryggvasons saga.* Översättning från isländskan av Karl G. Johansson med förord av Kristinn Jóhansson. Stockholm.
Viklund, K. 1994. The Long History of Swedish Bread. Continuity and change in Swedish regional bread-cereal traditions. *Laborativ arkeologi* 7, pp. 30–36.
Viklund, K. 1998. *Cereals, Weeds and Crop Processing in Iron Age Sweden. Methodological and interpretive aspects of archaeobotanical evidence.* Archaeology and Environment 14. Department of Archaeology, Environmental Archaeology Laboratory, University of Umeå. University of Umeå (diss.).
Viklund, K. 2002. *Issues in Swedish archaeobotany – a guide through twenty years of archaeobotanical research at the university of Umeå*. In K. Viklund (ed.): *Nordic Archaeobotany – NAG 2000 in Umeå*, pp. 193–202. Archaeology and Environment 15. Umeå.
Wennberg, B. 1986. Iron Age agriculture in Trogsta, North Sweden. *Fornvännen* 81, pp. 254–262.
Werneck, H. L. 1955. Der Obstweihefund im Vorraum des Mithraeus zu Linz-Donau, Ober-Österrich. *Naturkundliches Jahrbuch der Stadt Linz*, pp. 9–40.
Willerding, U. 1991. Präsenz, Erhaltung und Repräsentanz von Pflanzenresten in archäologischem Fundgut. In W. van Zeist, K. Wasylikowa & K.-E. Behre (eds.): *Progress in Old World Palaeoethnobotany. A retrospective view on the occasion of 20 years of the International Work Group for Palaeoethnobotany*, pp. 25–51. Rotterdam.
van Zeist, W. 1970. Prehistoric and Early Historic Food Plants in the Netherlands. *Palaeohistoria* 14, pp. 41–173.
Zohary, D. & Hopf, M. 1994. *Domestication of plants in the old world*. 2nd edition. Oxford.