

The Farming Economy in South and Central Sweden during the Bronze Age

A Study Based on Carbonised Botanical Evidence

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The article provides a survey of carbonised seed finds in south and central Sweden which can be attributed to the Swedish Bronze Age, 1800–500 B.C. This period must be considered one of the most dynamic with regard to prehistoric agriculture. The material has been collected at prehistoric dwelling sites and largely consists of household refuse. During the Early Bronze Age agriculture was based on speltoid wheat's and naked barley. Around 1000 B.C. the speltoid wheats and the naked barley decline strongly, while hulled barley takes over as the most important crop. This shift in the choice of crop indicates the introduction of agricultural fertilization and systems with permanent, manured fields.

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INTRODUCTION

The aim of the article is to summarise the archaeobotanical research results of recent years concerning the Bronze Age, 1800–500 B.C. in south and central Sweden. The geographical area of research stretches from the province of Scania to the province of Uppland (fig. 1a).

Research on the Scandinavian Bronze Age economy has been rather single-minded. One theory which has gained considerable ground suggests that the Bronze Age economy was based on herds of cattle which grazed on the increasingly extensive grassy areas. The large herds of cattle caused serious erosion of the land as well as the development of heaths. Agriculture is often seen as a complement to cattle breeding without deeper consideration for the character of the agriculture. It is now much more difficult to determine whether one form of husbandry was more important than

the other, though one thing is clear; namely, that Bronze Age agriculture was in a very expansive and dynamic phase. Bronze Age farmers were skilled, and they cultivated more varied crops than their Neolithic predecessors. They also devised a system with permanent manured fields and developed implements such as the sickle of metal and the ard.

A system of agriculture developed during the Bronze Age which remained substantially unaltered for almost 1000 years and which may be viewed as the basis of modern agriculture.

MATERIALS AND METHODS

The article deals with carbonised botanical remains found at archaeological settlements from the Bronze Age, 1800–500 B.C. The carbonised material has been removed from the soil samples by flotation in water.

The carbonised material consists primarily of household refuse deriving from the prepa-

ration of various kinds of foodstuffs, for example from roasting or drying processes. Two important factors operate so that household refuse can provide a relatively representative picture of the kinds of cereals cultivated and consumed at the settlements. Firstly, seeds from the various types of cereal have an equal chance of being carbonised, and secondly, this type of material has often been deposited for a lengthy period of time and may therefore consist of a large number of harvests (Engelmark 1992; Engelmark & Viklund 1990). As the deposit occurs over a number of years and harvests, the variations in cultivation between the different years are reflected in the carbonised material. We obtain a more complete picture of agriculture even if the annual varia-

tions of planting sequences cannot be traced in this type of material. Finds of seed stores are more suitable for the study of planting sequence (Engelmark & Viklund 1990).

Depositions of ritual character or grain stores have not been included in the figures in this article. A discussion on the ritual repositioning of carbonised grains in postholes has emerged during the last years. I don't believe in this theory even if some exceptions may occur. Large amounts of carbonised grains in a single posthole in a house cannot generally be regarded as ritual behaviour. A more plausible explanation is that this kind of find comes from storage in the house, for example, grains in a pottery vessel. We must keep in mind that a large quantity of seeds, say 3000 grains,

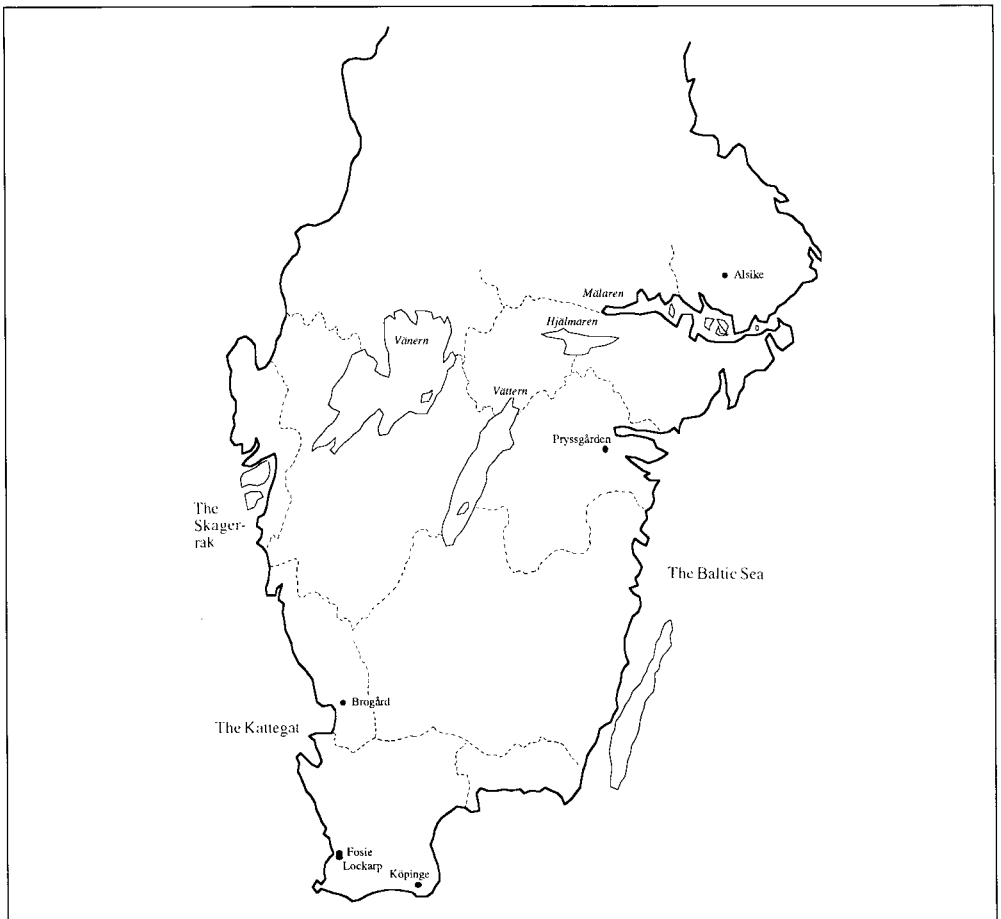


Fig. 1a. Geographic map with analysed sites from the Early Bronze Age.

corresponds to a very small volume (less than 0.1 litre). The probability of several hundreds of thousand of grains from a storage ending up in a posthole after a major fire (or a minor fire during food preparation), is probably substantial.

The results of these compilations make it appropriate to divide the Bronze Age into two periods of time, an Early period extending from 1800 B.C. to about 1000 B.C., and a Late period extending from about 1000 B.C. to 500 B.C.

THE EARLY BRONZE AGE

The carbonised seed material from the Early Bronze Age is meagre. The problem is that we find few settlements from this period, and only a few investigations are documented

concerning the period 1800–1200 B.C. The few buildings and other structures which have been investigated have usually not been ravaged by fire, and therefore the number of carbonised seed finds is small.

Archaeobotanical material from the Early Bronze Age derives from a total of six settlements (fig. 1a; Engelman 1992, 1993; Gustafsson 1993, 1995d, e; Hjelmqvist 1992; Regnell 1992). A summary of the results indicates that agriculture was based on cultivation of speltoid wheats (most probably emmer wheat) and to a lesser extent naked barley. Hulled barley may have some significance. Rye brome, *Bromus secalinus* is found at most of the Bronze Age settlements and in such quantity that it was probably cultivated, which



Fig. 1b. Geographic map with analysed sites from the Late Bronze Age.

is also the case for the Neolithic (Engelmark 1992:370-372). Naked wheat, *Triticum aestivo-compactum*, is only represented in small quantities and we know little of its significance during this period. It was definitely cultivated, and there are carbonised seed stores consisting entirely of naked wheat (Engelmark 1993; Gustafsson 1995d).

A completely new crop during the Bronze Age is gold of pleasure, *Camelina sativa*, which was probably cultivated as an oil plant as its seeds are very rich in oil (Engelmark 1992).

Yet another crop that appears during this period is millet, *Panicum miliaceum*. It has only been found at a few locations, but the circumstances of the finds suggest that it was introduced in the Early Bronze Age and became successively more common during the Late Bronze Age. One exceptional find of millet must be mentioned: On a dwelling site in the province of Småland at least 400 seeds of millet were found in a pit (Sarnäs 1994; Viklund 1993). This find has been dated to 1880-1530 BC. Millet disappears entirely and rather abruptly during the transition of the

Late Bronze Age to the Pre-Roman Iron Age, in about 500 B.C. Oats, *Avena sativa/Avena sp.* also appear as individual finds, but in most instances it is not possible to determine whether it is cultivated oat, *A. sativa* or wild oat, *A. fatua*.

In comparison with Hjelmqvist's survey of the distribution of grain impressions on pottery, carbonised plant material shows a striking similarity (Hjelmqvist 1979). The emmer wheat is predominant among the imprints, followed by naked barley and to a much lesser extent hulled barley.

One further comparison could be relevant to this study and that is David Robinson's survey of prehistoric cultivated plants in Denmark (Robinson 1993). In Denmark the emmer wheat and naked barley seem to have had the same significance during the Early Bronze Age. However, the hulled barley occurs in quite the same proportions in Denmark as in Sweden, and this cereal must not have been important in the Early Bronze Age agriculture.

THE LATE BRONZE AGE

The material from the Late Bronze Age is much greater than the material from the Early Bronze Age, as regards the number of cereal grains and weed seeds. Altogether, material from nine settlements has been examined (fig 1b; Engelmark 1988, 1992 *et al.* & 1993; Gustafsson 1993, 1995 b, c, d, e; Hjelmqvist 1992; Ullén 1995).

The difference compared with the Early Bronze Age is striking. Hulled barley obtained a manifestly predominant position, while the speltoid wheats and naked barley declined steeply (fig. 2). Oats, naked wheat, rye brome and gold of pleasure increase in relation to the previous period. The number of millet seeds bears the same percentage proportion as in the previous period, but the number of find locations is significantly greater.

A new crop which appears during the Late Bronze Age is flax, *Linum usitatissimum* (Gustafsson 1995a). The number of seeds found is few and does not have any visible effect in the diagram in fig. 2. The finds are nevertheless of great interest as flax seeds are

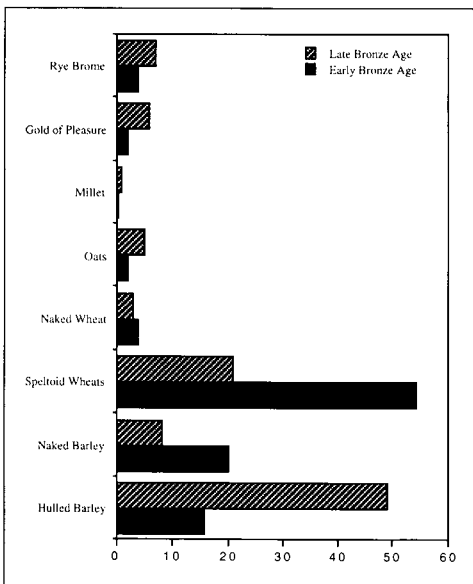


Fig. 2. The distribution of cereal grains and other cultivated plant seeds in the Early and Late Bronze Age.

rarely preserved in carbonised condition. The seed contains a high proportion of oil, and if heated the oil boils and destroys the seed. Experiments indicate that only 1% of flax seeds are carbonised to such condition that they may be identified (Gustafsson 1989). Consequently we can assume that a single find of a flax seed actually could, theoretically, indicate a cultivation of the crop.

Changes within agricultural practice are not only limited to the choice of crop. Studies of the weed flora and changes in it, as regards both time and location, provide important information concerning the cultivation of the soil and condition of the fields (Engelmark 1985, 1989; Viklund 1989). Generally there are no weed seeds from the Early Bronze Age, but they are abundant during the Late Bronze Age (Engelmark 1992; Gustafsson 1995d). The fields during the first half of the period were undoubtedly not weed-free. The absence of weed seeds may depend on other factors, for example harvesting techniques (Behre 1983; Engelmark 1989, 1993; Hillman 1981; Reynolds 1981). Two techniques could have been used: plucking or cutting the ears only. Both methods render a crop virtually free of weed seeds (Engelmark 1992:371). During the Early Bronze Age there were large quantities of field weeds which may be a result of cutting the straws immediately above the soil. Consequently some weed seed was also borne with the harvest from the field to the threshing place (the settlement).

The change in the weed flora around 1000 B.C. to 800 B.C. suggests that the use of manure was introduced at this time, at least as far as the southern part of the investigated area is concerned (Gustafsson 1995d). Fat hen (*Chenopodium album*) which is a (nitrofilious) summer annual weed seed with great demands for nitrogen, was clearly the predominant weed type. The predominance is most obvious in the initial phase of manured cultivation but continues during the Late Bronze Age and also during the entire Iron Age (fig. 3A). Somewhat later, about 800 B.C. to 500 B.C., the relative proportion of weed species shifts slightly (fig. 3B). The strong predominance of fat hen in the later part of the Late Bronze Age is probably the result of the establishment of manured cultivation at this very time. It appears that fat hen predominated most strongly during the first period when a field was manured and then declined somewhat in line with changes in soil chemistry and the advance of other weeds into the fields. The latter is indicated by fig. 3B where above all "other" weeds have increased. Which type of weed that increased is dependent on the physical condition of the land.

The increase in weeds coincides in time with hulled barley becoming the most important kind of cereal. This can not be a coincidence. Hulled barley requires significantly more readily soluble nutriment, particularly nitrogen, than speltoid wheats or naked barley and in order to obtain reasonable yields the fields

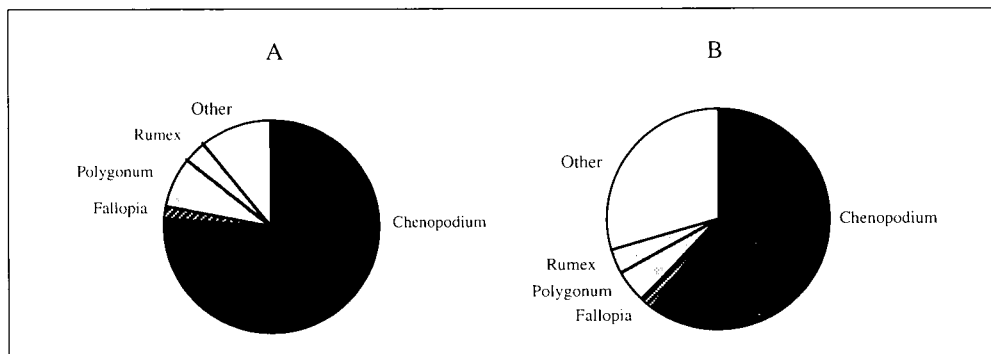


Fig. 3. The percentage distribution of arable weed seeds from: A. 1000 B.C. - 800 B.C.; and B. 800 B.C. - 500 B.C.

must be manured (Engelmark 1992:372; Gustafsson 1997; Viklund 1989). There is no doubt that the extensive agriculture which existed during the Neolithic and early part of the Bronze Age was abandoned during the middle and later Bronze Age, at least in the southern part of the investigated area. The period of the later Bronze Age is characterised by changes in social structure, economy, and the character of the landscape (Björhem & Säfstad 1993; Gustafsson 1995d). The intensification in the use of the landscape is clear as well as the intensification in agricultural practice, and the farming system with permanent, manured fields was established at this time.

For the Late Bronze Age, we can make the same comparison with Hakon Hjelmqvist's survey of impressions of grains and seeds in pottery as was done for the Early Bronze Age. There is a tendency among the imprints which is quite similar to the one in the carbonised

plant material, that is, the hulled barely increases at the same time as emmer wheat and naked barley decrease. The increase in hulled barely among the imprints is not so large as in the carbonised plant material, and the emmerwheat and the hulled barley occur in the same proportions in Hjelmqvist's survey (Hjelmqvist 1979). One explanation for this difference between the various types of material (impressions and carbonised material) lies in the fact that the ears of the speltoid wheats produce more resistant and more easily identifiable fragments when threshed than does hulled barley (Engelmark 1992; Engelmark & Viklund 1990).

The increase in hulled barley during the Late Bronze Age in Sweden does not have any correspondence in the plant material from the Danish Late Bronze Age (Robinson 1993). In Denmark naked barley is the most dominant cereal followed by emmer wheat. This dominance of naked barley lasts throughout the Late

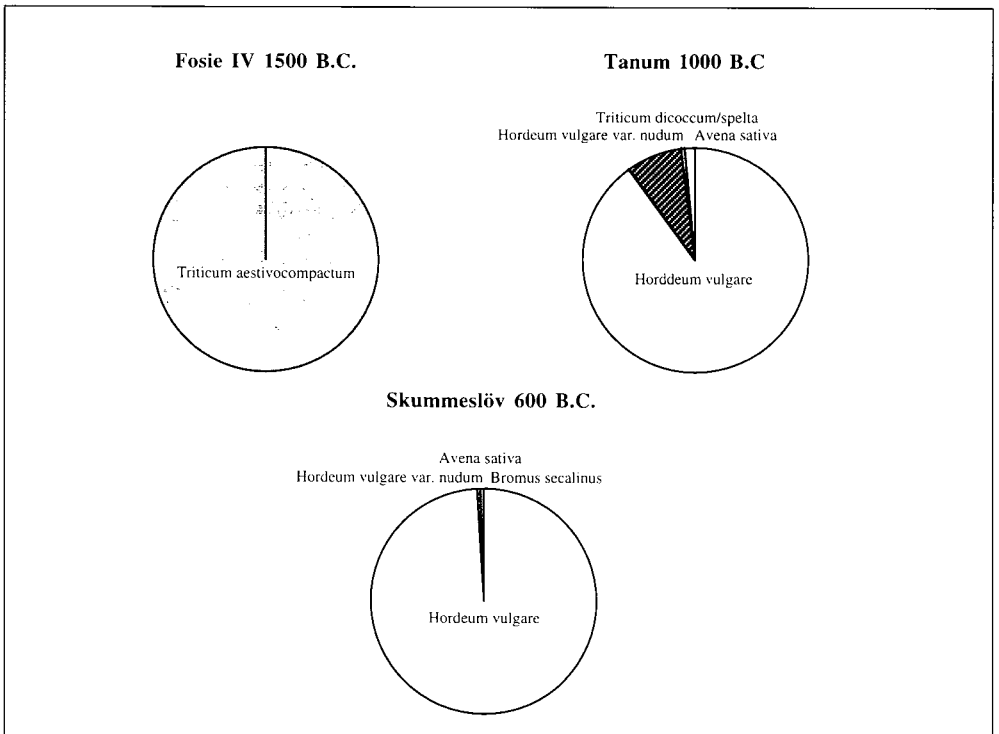


Fig. 4. The percentage distribution of cereals in grainstores from the Bronze Age in southern and south-western Sweden.

Bronze Age and in to the Pre-Roman Iron Age. Naked barley began to decrease in the Roman Iron Age when hulled barley increased and took over as the most important cereal.

SEED STORES

Some finds of seed stores should also be mentioned. There are at least three substantial finds of carbonised seed dating to the Bronze Age (fig. 4). The oldest is from 1500 B.C. and was found at Fosie IV in the province of Scania. This grain store contained only naked wheat, a cereal which was probably of little significance during the Early Bronze Age. Perhaps it was an exclusive kind of cereal which was cultivated under special circumstances or for a special purpose (Gustafsson 1995d; Rowley-Conwy 1984:109). The seed store from Tanum contained 10 litres of carbonised seeds stored in a jar made of birch-bark (Gerdin 1992). The sample contained mostly hulled barley mixed with some naked barley. Besides these two cereals there were small quantities of emmer wheat, speltoid wheat, oat, rye brome, and seeds from juniper, *Juniperus communis*. The youngest seed store sample from Skummeslöv consisted of four litres of carbonised seed. This store was also dominated by hulled barley but there were also small amounts of naked barley, oats, rye brome and flax (Larsson 1993). Further interpretation of these stores lies outside the scope of this article. Nevertheless they ought to be mentioned as they contribute to our knowledge when interpreting the cultivation methods of individual settlements.

Another interesting find from the Bronze Age is carbonised stem tubers of oat grass, *Arrhenatherum elatius ssp. bulbosum* (Engelmark 1984; Gustafsson 1995a). These stem tubers are rich in starch and may be compared to small potatoes.

CONCLUSIONS

This picture of Bronze Age agriculture is general and there are small local and regional differences regarding what was grown and when it was grown. The trend of decline in

speltoid wheats and naked barley in favour of hulled barley seems absolutely clear, however. The speltoid wheats and naked barley do not completely lose their significance, and they were cultivated in small amounts up into the Viking Age. Occasional cultivation of these cereals (at least naked barley) has taken place even later, in historical time. This cultivation has not been as important as the cultivation of hulled barley, but may rather be viewed as a complement to it, perhaps with a special purpose.

The Bronze Age consequently stands out as an age of agricultural experimentation, intensification and expansion. But this transformation of the farming system should not be regarded as an isolated occurrence, but rather as a radical change of the whole society which took place throughout Europe. A general tendency, which clearly can be seen after the fall of Mycenae around 1200 B.C. and onwards, is a more intensified agriculture aiming at a surplus production. During this time of continental changes, similar changes occur in the Scandinavian archaeological record around 1000/800–500 B.C. This change is also obvious in the archaeobotanical record; in the pollen diagram from south Sweden there is a clear expansion in the effect on the cultural landscape from the later part of the Neolithic to the transition between the Early and the Late Bronze Age. During the same time there is a trend of decline in speltoid wheats and an increase in the importance of hulled barley. The increasing number of nitrofilious weeds indicates nitrogen-rich soils, which is a prerequisite if hulled barley would produce an acceptable yield. This indicates the introduction of permanent, manured fields, and this farming system forced the farmers to obtain a balance between the area of arable field and fodder-meadows. One result of this transition was a more restricted land use, which developed further during the Iron Age.

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REFERENCES

- Behre, K-E. 1983. Ernährung und Umwelt der wikingerzeitlichen Siedlung Haitabu. Die Ergebnisse der Untersuchungen der pflanzenreste. *Die Ausgrabungen in Haitabu*. Band 8.
- Björhem, N. & Säfvestad, U. 1993. *Fosie IV. Bebyggelsen under brons- och järnålder*. Malmöfynd 6. Malmö.
- Engelmark, R. 1984. Two Useful Plants from Iron Age Graves in Central Sweden. *Archaeology and Environment* 2. Pp 87–92. Umeå.
- 1985. Ogräs för tolkning av agrara system. In: Regnell, G. (Ed). *Kulturlandskapet – Dess Framväxt och förändring*. Sept. 1984. Växt-ekologiska institutionen vid Lunds universitet. Lund. Pp 109–111.
- 1988. Bjäresjö 19:17. *Analys av förkolnat växtmaterial*. Unpublished report. University of Lund. Lund.
- 1989. Weed seeds in archaeological deposits. Models, experiments and interpretations. In: Larsson, T. B. & Lundmark, H. (Eds). *Approaches to Swedish Prehistory. A spectrum of problems in contemporary research*. BAR International Series 500. Pp 179–187. Oxford.
- 1992. A review of farming economy in South Scania based on botanical evidence. In: Larsson, L., Callmer, J. & Stjernquist, B. (Eds). *The Archaeology of the Cultural Landscape. Field work and research in a south Swedish rural region*. Acta Archaeologica Lundensia. Series in 4^o. No 19. Pp 369–375. Lund.
- 1993. Makrofossilanalyser från Fosie IV. In: Björhem, N. & Säfvestad, U. 1993. *Fosie IV. Bebyggelsen under brons- och järnålder*. Pp 406–407. Malmöfynd 6. Malmö Museer. Malmö.
- Engelmark, R. & Viklund, K. 1990. Makrofossilanalys – kunskap om odladets karaktär och historia. *Bebyggelsehistorisk Tidskrift* Nr. 19. Pp 33–42.
- Gerdin, A-L. 1992. Ett sädesförråd från bronsålder och mycket annat. Om nya spännande fynd i Tanum. *Fynd 1/92*. Pp 22–31. Tidskrift för Göteborgs Arkeologiska Museum och Fornminnesförening i Göteborg. Göteborg.
- Gustafsson, S. 1989. *Ett försök inom experimentell arkeologi med förkolning av frön*. Seminar paper. Arkeologiska institutionen, Umeå universitet. Umeå
- 1993. *Alsike. En undersökning av förkolnade växter från fornlämning 16 på fastigheten Vrå 1:50, 1:51, Knivsta socken i Uppland*. Rapport, Arkeologiska institutionen vid Umeå universitet. Umeå.
- 1995a. Förkolnade fynd av knylhavre *Arrhenatherum elatius* ssp. *tuberosus* från brons- och järnålder i Syd- och Mellansverige. *Svensk Botanisk Tidskrift*. Vol. 89. No 6. Pp 381–384.
- 1995b. *Tanum. Arkeobotanisk analys av förkolnade växtrester från Tanum socken i Bohuslän*. Rapport, Arkeologiska institutionen vid Umeå universitet. Umeå.
- 1995c. Sallerup Mhm 7832. *Arkeobotanisk analys av förkolnade växtrester från härdar och kokgropar i Sallerup, Skåne*. Rapport, Arkeologiska institutionen vid Umeå universitet. Umeå.
- 1995d. *Fosie IV. Jordbrukets utveckling och förändring under senneolitikum till yngre järnålder*. Rapport 5. Stadsantikvariska avdelningen, Malmö Museer. Malmö.
- 1995e. Arkeobotaniska analyser. In: (Eds). Billberg, I., Björhem, N., Thörn, R. & Ödman, A. *Öresundsförbindelsen*. Rapport över arkeologiska förundersökningar 1995. Pp 191–208. Stadsantikvariska avdelningen. Malmö Museer. Malmö.
- 1997. Bronsålderns odlingsystem i Syd- och Mellansverige – En diskussion kring begreppet svedjebbruk. In: *Bulletin för arkeologisk forskning i Sydsverige. Nr. 1/1987*. Pp 44–52. Lund.
- Hillman, G. 1981. Reconstructing Crop Husbandry Practices from Charred Remains of Crops. In: Mercer, R (Ed). *Farming Practice in British Prehistory*. Pp 123–162. Edinburgh.
- Hjelmqvist, H. 1955. Die Älteste Geschichte der Kulturpflanzen in Schweden. *Opera Botanica* Vol. 1:3. Stockholm.
- 1979. Beiträge zur Kenntnis der prähistorischen Nutzpflanzen in Schweden. *Opera Botanica* 47. Lund.
- 1992. Some economic plants from the Prehistoric and Mediaeval periods in southern Scania. In: Larsson, L., Callmer, J. & Stjernquist, B. (Eds). *The Archaeology of the Cultural Landscape. Field work and research in a south Swedish rural region*. Acta Archaeologica Lundensia. Series in 4^o. No 19. Pp 359–367.
- Larsson, E-L. 1993. Storfynd av bronsålderssäd i Skummeslöv. *Halland*. 76. Årsbok för kulturhistoria och hembygdsvård i Hallands län. Halmstad.
- Regnell, M. 1992. *Makrofossilanalys av botaniskt material från fastigheten Brogård 1:9, Snöstorp s.n. Halland*. Rapport, Kvartärbiologiska Laboratoriet vid Lunds universitet.
- Reynolds, P. 1981. Deadstock and livestock. In: Mercer, R. (Ed). *Farming Practice in British*

- Prehistory*. Pp 97–122. Edinburgh.
- Robinson, D. E. 1993. Dyrkede planter fra Danmarks forhistorie. *Arkeologiske udgravninger i Danmark 1993*. Pp 21–39.
- Rowley-Conwy, P. 1984. The Egehøj Cereals. Bread Wheat (*Triticum aestivum* s.l.) in the Danish Early Bronze Age. *Journal of Danish Archaeology*, volume 3. Pp 104–110. Odense.
- Sarnäs, P. 1994. *Herrmanstorp under bronsåldern. Herrhagen 1:1, Rössle 4:1, Stg 1, Västerviks och Törnfalls sn:ar; Småland*. Rapport Kalmar Läns Museum 1994:6. Kalmar.
- Ullén, I. 1995. Det goda exempelts makt. Närstudie av en bronsåldersboplats i Uppland. In: Larsson, M. & Toll, A. (Eds). *Samhällsstruktur och förändring under bronsålder*. Arkeologiska skrifter nr. 11. Pp 68–75. Riksantikvarieämbetet och Norrköpings Museum.
- Viklund, K. 1989. Jordbrukskris i Norrland i slutet av den äldre järnåldern? *Arkeologi i Norr* 2. Pp 95–105. Umeå.
- 1993. *Makrofossilanalys av jordprover från Törnfalls, Gladhamra, Västra Ed, Västervik och Järnvalla socknar*. Rapport Miljöarkeologiska laboratoriet, Arkeologiska institutionen vid Umeå universitet. Umeå.

