

The spatial, social and political organisation of metalworking in southern Scandinavia during the Bronze Age (c. 1700–500 BCE)

Anna SÖRMAN

Abstract: Production and use of metalwork in southern Scandinavia during the Bronze Age (1700–500 BCE) has above all been attributed to emerging elites. Bronze crafting is often assumed to have been organised at two levels: elite-controlled prestige goods production at centralised workshop sites, set against widespread (controlled or independent) production of utility objects in common households. However, this model is inferred from a functionalist view of finished goods (utility versus prestige) and inspired by anthropological theories, rather than from the material remains of production itself. With evidence of casting increasing due to large-scale contract archaeology, this paper presents an analysis of the craft organisation in the Nordic Bronze Age through the physical casting sites. Mould and crucible fragments, and their spatial relation to contemporary buildings and other activities, form the main focus of the analysis. These data demonstrate that bronzes were cast at most, if not all, settlements during the Late Bronze Age. Metalworking also occurred at small single farms; a production argued to be dependent on visiting specialists. The results thus confirm the idea of a hierarchical organisation of production from Period III onwards, but also reveal a complex, user-oriented and multi-tiered craft organisation. Prestige objects were manufactured in both longhouses and cult-houses within larger settlement complexes, seemingly in settings related to the status and gender of their intended users. Furthermore, casting often appeared in central and highly visible locations, suggesting it had the character of a performance. Considering the motifs behind the making of new objects, castings were probably linked to transformations such as initiations, inaugurations or establishment of new households. Thus, metalworking played an active and conspicuous role in social reproduction at various levels and arenas in Nordic Bronze Age societies.

Keywords: Nordic Bronze Age, southern Scandinavia, bronze casting, copper-alloys, metalworking, craft production, craft organisation, workshops, social organisation, elite, hierarchy, heterarchy, prestige goods, social reproduction.

Résumé : Dans le sud de la Scandinavie, la production et l'utilisation du métal durant l'âge du Bronze (1700–500 av. J.-C.) ont surtout été attribuées à des élites émergentes. Accumuler, porter, offrir et sacrifier des objets en bronze pour acquérir et maintenir le pouvoir social est considéré comme un trait essentiel de l'économie politique de l'époque. Ainsi, l'influence politique exercée sur la production du métal constitue un thème récurrent des recherches antérieures. Depuis les années 1950, on suppose une organisation du travail du bronze en deux niveaux : une production centralisée de biens de prestige contrôlée par l'élite, associée à une forme de production domestique plus basique et plus répandue (contrôlée ou indépendante). Cet archétype à deux niveaux repose sur une classification fonctionnelle des objets en bronze, combinée à des modèles anthropologiques d'artisanat spécialisé dans des sociétés hiérarchisées ou des chefferies. Cependant, les données archéologiques provenant de véritables sites de production ont rarement été consultées ou analysées de manière systématique pour confirmer ou remettre en cause cette vision. Avec l'augmentation rapide des découvertes liées au travail du métal grâce à l'archéologie préventive à grande échelle, il est devenu évident que ces concepts et interprétations doivent être réévalués.

Cet article présente les principaux résultats de la thèse de doctorat de l'auteure, soutenue à l'Université de Stockholm en 2018, dans laquelle l'organisation artisanale de l'âge du Bronze scandinave a été analysée à travers l'étude de sites de fonderie. L'analyse spatiale s'est appuyée sur trois échelles contextuelles : le type de site (par ex. un habitat), le type d'espace dans lequel avait lieu la coulée (par ex. une maison longue, une structure funéraire), et l'emplacement précis de la coulée (par ex. un foyer particulier et la zone d'activité autour). Les fragments de moules et de creusets, ainsi que leur relation spatiale avec les bâtiments contemporains et avec d'autres activités, ont constitué le cœur de l'analyse.

Le bronze était fondu et allié dans des foyers ouverts où la température nécessaire était obtenue grâce à un système de ventilation, dirigé vers le creuset placé dans le foyer. Les preuves de cette méthode résident d'abord dans la forme et les indices de vitrification des creusets de l'âge du Bronze, puis dans la présence de tuyères coudées en forme de L. Les fourneaux n'étaient pas utilisés pour le travail du bronze, contrairement à ce que supposaient de nombreuses recherches antérieures. Les foyers de fusion du bronze ne peuvent être identifiés que

par la présence de déchets liés à la fusion et à la coulée, et sont rarement détectables. Les vestiges les plus manifestes de la production métallurgique sont donc les débris céramiques provenant des creusets et des moules de coulée. Il est ici admis que les creusets et les moules représentent principalement des déchets secondaires, déposés à proximité immédiate des lieux originels de coulée.

Les données issues des sites scandinaves montrent que le bronze était coulé dans la plupart - voire la quasi-totalité - des établissements durant le Bronze final (c. 1100-500 av. n. è). L'enquête menée confirme l'hypothèse selon laquelle le travail du bronze était une pratique largement répandue, et non limitée à quelques sites exceptionnels. Contrairement à la Suède et au sud de la Norvège, on trouve des preuves substantielles de métallurgie dès le Bronze ancien au Danemark. Les vestiges des périodes I-III (c. 1700-1100 av. n. è) montrent que le bronze était coulé dans les sites d'habitat, à l'intérieur de maisons longues qui sont en général légèrement plus grandes que la moyenne. Cette concentration du travail du bronze dans ces maisons plus vastes pourrait indiquer un degré plus élevé de monopolarisation spatiale - et sans doute politique - qu'aux périodes ultérieures.

Au Bronze final, le bronze était produit dans les habitations et sur les sites funéraires ou rituels, au sein du paysage habité. Le travail du métal avait également lieu dans de petites fermes isolées ; on suppose que cette production dépendait d'artisans itinérants. Les résultats confirment donc l'idée d'une organisation hiérarchisée de la production, tout en révélant une organisation artisanale complexe, axée sur les utilisateurs et à plusieurs niveaux. La distinction entre objets prestigieux et objets utilitaires ne structurait pas la production. L'organisation et la mise en scène des coulées dépendaient du rôle social des objets fabriqués. Les coulées semblent avoir eu lieu dans deux grands-types de structures : les maisons longues, où les gens vivaient et travaillaient, et les maisons cultuelles, davantage réservées aux enterrements et aux activités rituelles spécifiques. Des objets prestigieux étaient produits aussi bien dans les habitations que dans les maisons cultuelles. La production était mise en scène dans une variété d'espaces intérieurs et extérieurs, entre des tombes, près des maisons cultuelles, dans les maisons longues, dans les cours de ferme ou dans d'autres espaces communautaires. Cela montre que la production avancée de biens de prestige n'était pas organisée dans des ateliers spécialisés, isolés spatialement ou centralisés. Au contraire, des bronzes de grande valeur étaient fabriqués dans plusieurs types d'espaces et dans des circonstances variées.

À partir des empreintes identifiées dans les moules de coulée issus de maisons longues et de maisons cultuelles, l'auteure suggère que des types d'objets différentes étaient produits dans ces deux catégories d'espaces. Une séparation entre les armes associées aux hommes et les grands éléments de ceinture destinés aux élites féminines semble se dessiner. Cela signifierait que l'organisation artisanale était structurée par différentes institutions sociales. Plutôt que des ateliers spécialisés organisés pour le forgeron, les coulées étaient organisées spatialement en fonction de leurs futurs propriétaires. Les objets prestigieux étaient fabriqués à la fois dans les maisons longues et dans les maisons cultuelles, au sein de grands complexes d'habitat, dans des cadres liés au statut et au genre de leurs futurs utilisateurs. Enfin, le travail du métal se déroulait souvent dans des lieux centraux et très visibles, ce qui suggère qu'il revêtait parfois un caractère performatif. L'auteure discute donc de la manière dont la coulée - l'événement le plus spectaculaire du processus de fabrication du bronze - pouvait être exploitée dans des rituels publics ou semi-publics. Compte tenu des projets sociaux et des motivations derrière les nouveaux objets, les coulées étaient probablement liées à des transformations telles que des initiations, des inaugurations ou la fondation de nouveaux foyers. Ainsi, le travail du métal jouait un rôle actif et visible dans la reproduction sociale, qui prenait place dans différents lieux et à plusieurs niveaux dans les sociétés nordiques de l'âge du Bronze.

Mots-clés : âge du Bronze nordique, Scandinavie du sud, fonte du bronze, alliages cuivreux, métallurgie, production artisanale, organisation artisanale, ateliers, organisation sociale, élite, hiérarchie, hétérarchie, biens de prestige, reproduction sociale.

This study investigates the role of bronze casting in societies of the Nordic Bronze Age in the second and first millennium BCE. Instead of turning to the rich and often extravagant bronze objects, we will here turn our attention towards the subtle debris left over from this production process; fragments of crucibles and moulds.

Similar to many other regions and periods, studies of craft organisation in the Nordic Bronze Age have been preoccupied with the question of the link between metalworking and the elite. Accumulating, wearing, gifting, and sacrificing bronzes to gain and maintain social power is considered a key feature of Bronze Age political economy. Hence political influence over the production of the metal is a prevalent theme in previous research. The dominating interpretative model since the 1950s is that of a hierarchically organised production, with a domestic small-scale production at farms on the one hand, and a specialised crafting perhaps tied to workshops or elite residents, on the other (e.g. Oldeberg, 1960, p. 50; Rønne, 1987; Levy, 1991; Björhem and Säfstad, 1993, p. 80; Jensen, 2002, p. 365; Kristiansen and Larsson, 2005, p. 225-227; Björk, 2007, p. 55; Goldhahn, 2007; Karlenby, 2011, p. 168; Nilsson, 2011; Ängeby and Lindman, 2017, p. 133).

The link between the elite and the production of bronze objects has been envisioned in different ways; for example, as a centralised production for redistribution (e.g. Weiler, 1994, p. 120-121; Carlie, 2004, p. 169), as an elite-attached craft worker producing on commission in a larger area (e.g. Björhem and Magnusson Staaf, 2006, p. 166), or metalworkers as ritual specialists in a wider sense (e.g. Goldhahn, 2007). These interpretations have mainly been based on the products (where a significant part is indeed made up of items such as weapons and personal adornments), or from selected sites in the data. These questions have never been systematically studied and rarely demonstrated through the production debris from crafting activities.

This paper is based on my doctoral dissertation, which aimed to study the metalwork production through the actual remains from bronze casting (Sörman, 2018). Traces of bronze casting have increased over the last few years, thanks to data emerging from contract archaeology. Apart from revealing more casting debris, large-scale excavations have also dramatically advanced our understanding of Bronze Age landscape-use, settlement organisation, the relation between funerary and domestic sites etc., at least for more well-excavated regions (e.g. Arturs-

son, 2009; Karlenby, 2011; Boddum et al., eds., 2012). These new insights, and the accumulated data from more than 100 years of archaeological excavations can now provide important windows into the whereabouts of bronze artefact production in this period.

This study demonstrates that the organisation of metalworking was indeed structured in a hierarchical way. The most interesting insights, however, emerge when we approach the bronze casting at a human scale, and explore the variation *within* sites at various scales of the 'settlement hierarchy'. Casting appeared in the midst of almost all social arenas of the later part of this period, and I suggest that bronze casting events were sometimes used to manifest the social order, where this part of the production sequence could take the form of public rituals.

AIM, SCOPE AND QUESTIONS

This study investigates the spatial organisation of bronze working in the Nordic region during the second and first millennium before the current era (c. 1700–500 BCE). The aim is to reconstruct how casting was organised in space, and what this spatial organisation and contexts, in turn, indicate regarding its role in society. The study investigates three sets of questions:

1) What does the casting debris found in excavated Bronze Age contexts represent, and how does it relate to the original production loci?

2) Where was casting carried out in relation to the settled landscape, at what spatial and social arenas were different bronze objects manufactured, and which factors can explain the choice of casting locus?

3) How may these new observations regarding spatial and social organisation of production illuminate the role bronze casting played in Bronze Age societies, and in particular the relationship between metalworking and the social elite?

Finally, some remarks on the theoretical points of departure. It should be emphasised that bronze metalworking in the Nordic Bronze Age is here regarded as a specialised or skilled craft, meaning that parts of the procedures in its *chaîne opératoire* demanded skills (relying on training and know-how) only attained by a minority of the society's members (but not presuming a specialised, full-time activity, see e.g. Nørgaard, 2018; Molloy and Mödler, 2020, p. 174).

In small-scale societies, crafts demanding exceptional skills were often regarded as depending on exceptional, supernatural powers (Helms, 1993, p. 53). The process of making objects with advanced technologies is therefore often central for the meaning and value of an object (Costin 2001, p. 27) and often stood in special relation to institutions of power (e.g. Helms, 1993; Hayden, 1998). The connection between such skilled crafts and political elites is well-established in ethnographic studies, but is known to have taken many different forms (e.g. Helms, 1993, p. 69). Models of attached, independent and embedded

craft production in relation to the elite have been discussed (e.g. Earle, 1981). Such models have later been criticised for theorizing the connections between elites and specialised craft production in a too restrictive way (Costin, 2001, p. 300; DeMarrais, 2013). For the Nordic Bronze Age, with its many skilfully produced ritual and prestigious bronze objects, this aspect of bronze casting organisation and understanding the relations between bronze crafting and power is therefore crucial.

Ultimately, the aim is to better understand the socio-political role and cultural form of this craft, drawing inspiration from the scholarly discussion on technology as social action (e.g. Gell, 1998; Dobres, 2000). My primary interest thus lies in the socio-political aspects of production, rather than technological or archaeometallurgical issues.

BACKGROUND

To set the stage for the study, this background first introduces the Bronze Age of southern Scandinavia, with its metalworking tradition, society and archaeological remains. The second part discusses important trends and ideas in the previous scholarship about bronze metalworking and craft organisation in the Nordic Bronze Age.

The Nordic Bronze Age – an introduction

The Nordic Bronze Age is a loosely defined region, characterised by similar cultural expressions and joint influences in the period 1700–500 BCE (commonly divided into an early (c. 1700–1100 BCE, period I–III) and a late (c. 1100–500 BCE, period IV–VI) part). The 'Nordic' or 'south Scandinavian' Bronze Age encompasses Denmark with northernmost Germany, and the southern parts of the Scandinavian peninsula, within today's Norway and Sweden (Thrane, 2013; here: fig. 1). This area in northern temperate Europe is geologically and topographically varied; the south is part of the North European lowlands, while areas further north are marked by joint valley landscapes and mountainous areas. Populated zones during the Nordic Bronze Age were concentrated to the arable lands, primarily in low-lying valleys and plains, often in direct connection to bays, lakes and waterways. In this article this region is interchangeably named the 'Nordic area' and 'southern Scandinavia'.

The archaeological definition of the Nordic Bronze Age is primarily based on stylistic and functional similarities in the bronze metalwork (e.g. Montelius, 1885; Baudou, 1960; Sørensen, 1989, p. 458), but also on similarities in subsistence patterns and domestic architecture (e.g. Jensen, 2002; Thrane, 2013). It is important to note, however, that this region was far from uniform; there are regional and local variations in burial customs, the size and organisation of social formations, access to various exchange networks as well as in the production and use of material culture and metalwork.

Metals and metalworking

Bronze was used for making a variety of objects, notably in the Late Bronze Age when the repertoire of metalwork became more diversified (fig. 2). Throughout the period, local bronze objects have a strong element of prestige goods; with items such as cult and ritual props (including the famous curved bronze lure instruments, and the richly decorated horse tack and wagon ornaments), exclusive weaponry, and high-status adornments, signalling the bearers gender and social position in the politico-religious hierarchy (e.g. Levy, 1982; Sørensen, 1997; Jensen, 1997 and 2002). Common tools of bronze were socketed axes, socketed chisels, punches, awls and various sickles, however a large part of the tools used in the Bronze Age daily life were made from stone, horn and flint.

Copper was brought in to Scandinavia from other areas of Europe, as confirmed by compositional and isotopic studies of Nordic bronze objects over the last decade (Ling et al., 2013 and 2014; Melheim et al., 2018; Nørgaard et al., 2021). Local copper ore from the Scandinavian peninsula was thus not exploited in this period, at least not to any significant or detectable extent. External exchange networks and alliances for trade where Nordic communities participated in this ‘bronzeization’ and long-distance connections is well-established (Vandkilde, 2016). Finds of unalloyed copper and ingots of tin and lead show that metals were also acquired in their pure forms (Oldeberg, 1942; Ling et al., 2014). Gold (from foreign sources) is also present, especially up until Period V, circa 800 BCE (Sørensen 1989, p. 464). Iron production was gradually introduced during the final stages of the Bronze Age, in some areas already in Period V (c. 900–700 BCE; Hjärthner-Holdar, 1993).

Nordic metalwork has a strong emphasis on casting—large, thin-walled objects were cast with lost-wax technique rather than produced via hammering and annealing (e.g. Oldeberg, 1942; Nørgaard, 2015, p. 125 and 2018). Melting bronze was accomplished in open hearths, where the necessary temperatures were achieved through forced draught as testified both by the flat, open shape of the crucibles, which are often heavily sintered along the rim, and by finds of L-shaped ceramic *tuyères* (Jantzen, 2008, p. 299; Sörman, 2018, p. 49–51; here: fig. 3). As we will see, this direct melting technique left very few traces in the

ground, and the fire-places used for melting bronze can rarely be identified. Instead, the main body of Bronze Age casting remains in southern Scandinavia are indirect evidence from the production, the pear-shaped ceramic crucibles and pieces of the fragile ceramic moulds (bivalve or lost-wax). In some regions of the Nordic Bronze Age sphere stone casting moulds were also in use, however these were rarely left discarded at the production sites.

Bronze Age society and remains

The Nordic Bronze Age is characterised by small-scale agro-pastoral communities without defensive architecture or fortified central sites. The level of social hierarchisation probably varied between communities, but might have taken the form of small, unstable chiefdoms where power structures shifted over time (e.g. Levy, 1995; Artursson, 2009; Earle and Kristiansen eds, 2010). Habitations were loosely organised in multi-household settlements and single farms with longhouses for living and storage, complemented with smaller buildings and surrounding activity areas (Jensen, 2002; Artursson, 2009). The settlements, often covering several hectares, might be short-lived, or have long continuity throughout and beyond the Bronze Age. Settlement hierarchy is indicated both by size difference of longhouses, as well as multi-household settlements versus single farms (e.g. Artursson, 2009). Ritual sites and burial grounds are often located close to the settlements, sometimes on slightly (or dramatically, depending on the local topography) higher ground. Ritual depositions, mostly pieces or assemblages of metalwork intentionally placed at various points in the landscape, were abundant throughout the period (e.g. Levy, 1982).

In terms of geopolitical dynamics there are variations within southern Scandinavia. The southernmost areas and notably the Danish peninsula of Jutland is often seen as a bottleneck for access to the Continent; both via the landway, via Rhine, and via the North Sea and onwards to the Atlantic sea-board. This privileged access to southern networks can be seen, for example, in the early influences and establishment of local bronze production (e.g. Karlenby, 2008a, see below).

This study is focusing on the north-eastern parts of southern Scandinavia, a less densely populated area where some of the most extravagant elite expressions of

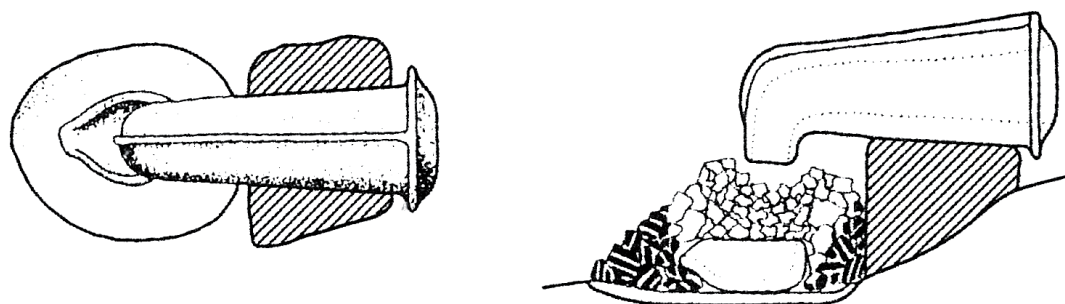


Fig. 3 – Principle for Nordic Bronze Age melting technique in simple hearth with L-shaped tuyère (drawing after D. Jantzen, 2008, fig. 5).

Nordic Bronze Age culture are not as pronounced as further south, and where local bronze casting seems to have made its appearance somewhat later.

The organisation of metalworking in southern Scandinavia – previous research

Surprisingly little research has specifically addressed the question of the organisation of bronze metalworking in southern Scandinavia (however see Levy, 1991; Jantzen, 2008). The interpretations and assumptions about this craft are numerous, but mostly occur in studies concerning other issues, such as political economy, settlement organisation or ritual specialists, or, in excavation reports for individual sites. In the following, I will highlight the theoretical and empirical underpinnings of current understandings of how bronze artefact production was organised.

1890–1950: The first ‘bronze casters’ workshops’

Local production of bronze metalwork in the Nordic area was suspected already by 19th century scholars, based on the indigenous design of Bronze Age metalwork (e.g. Worsaae, 1843). With time, more concrete evidence of this production emerged through finds of stone casting moulds and metallic casting debris, such as casting sprues in hoards. From the turn of the century 1800–1900 the first ‘bronze casting workshops’ were excavated in Scandinavia. These ‘workshops’ consisted of cultural layers containing ceramic crucible and mould fragments, found under presumed ‘grave mounds’—mounds that turned out to be middens of fire-cracked stones dating to the Bronze Age (e.g. Neergaard, 1908; Sarauw and Alin, 1923; Svensson, 1940; Oldeberg, 1942, p. 165–171). The primary interest at the time was the technical issues of Bronze Age casting.

In the accounts of these excavations, and in the wider archaeological literature, the Bronze Age metalworkers were mentioned as highly skilled professionals, performing their specialised activity in workshops (e.g. Neergaard, 1908, p. 273; Oldeberg, 1933, p. 189 and 1942; Svensson, 1940; Jensen, 1956; Vestergaard Nielsen, 1956). There was also some debate as to whether these workshops had been integrated in the settlements, or rather had formed specialised crafting places, for example based on the absence of post-holes in the miniscule trenches (e.g. Neergaard, 1908, p. 282ff; Sarauw and Alin, 1923; Oldeberg, 1942, p. 171). This debate was somewhat premature, since settlements themselves were not yet known. The concept of the workshop used from this point has strongly influenced Bronze Age archaeology in Scandinavia throughout the 20th century.

1950–1990: Domestic production versus prestige goods

In 1960, when Andreas Oldeberg published the material from Skälby—a ‘bronze casting workshop’ in eastern Sweden that he had excavated in the 1930s—he expressed

what had come to be the dominant understanding of Bronze Age metalworking organisation in Scandinavia up until today. Places like Skälby, with rich and numerous finds of ceramic casting residue (the site had yielded over 200 crucible fragments and over 400 mould fragments) were, according to Oldeberg, to be understood as ‘workshop sites in proper meaning’, while sites with only a few such finds probably represented small-scale domestic production (Oldeberg, 1960, p. 50). Two levels of production were thus envisioned for metalworking in Bronze Age Scandinavia—the specialists with their workshops, versus the domestic, small-scale production on farms.

With intensified construction projects in the 1960s and 1970s, leading to larger develop-led excavations, the first Bronze Age settlements were identified in Scandinavia. Questions about economic systems, subsistence strategies and economic specialisation were often main themes of interests during this period of processual archaeology. The presence and extent of bronze working was seen as an indication of the settlement’s relative economic status; intensive workshop production or small-scale household production (e.g. Jaanusson and Vahlne, 1975; Björhem and Säfvestad, 1993). The market economist and industrial terminology in older literature is striking; workshop production at larger sites was assumed to aim at clients in a larger region and sometimes portrayed as mass production (e.g. Jaanusson and Vahlne, 1975; Coles and Harding, 1979, p. 497; Jaanusson, 1981, p. 21–22; Herner, 1987).

During this period, there was also a strong interest in the social structure and political economy, inspired by neo-evolutionary anthropological models for chiefdoms. The political control of the production of bronze objects became seen as a key factor in social hierarchisation (Levy, 1982; Kristiansen, 1987; Kristiansen and Larsson, 2005, p. 52; Vandkilde, 2016). Regional expressions in style and manufacture were considered as mirroring political units, territories or ‘workshop spheres’ [Swe. *verkstadskrester*] (e.g. Levy, 1982; Larsson, 1986; Rønne, 1987; Kristiansen, 1987, p. 33–34; Herner, 1987; Kristiansen and Larsson, 2005, p. 35–37, 58). Such workshop spheres were regarded as distribution areas for centralised, chiefly controlled workshops/crafters (Levy, 1982, p. 93–100; Herner, 1987; Rønne, 1987; see also Costin, 2001, p. 306)—workshops defined based on the distribution of finished goods, rather than the workshops themselves.

This era also marked the discovery of the Hallunda workshop in eastern Sweden; a site which came to be a standard of reference in Swedish and Scandinavian research and to some degree also in northern Europe (Jaanusson and Vahlne, 1975; Vahlne, 1989). The Hallunda Bronze Age settlement, partially excavated in the 1960s and 1970s, featured extensive casting debris and a particularly large concentration of crucible and mould fragments, structures interpreted as bronze melting furnaces, and remains of a peculiar-looking building interpreted as a workshop (Vahlne, 1989; here: fig. 4). Hallunda, with its ‘furnaces’, strongly influenced the expectations of a Scandinavian Bronze Age bronze casting workshops in the coming decades.

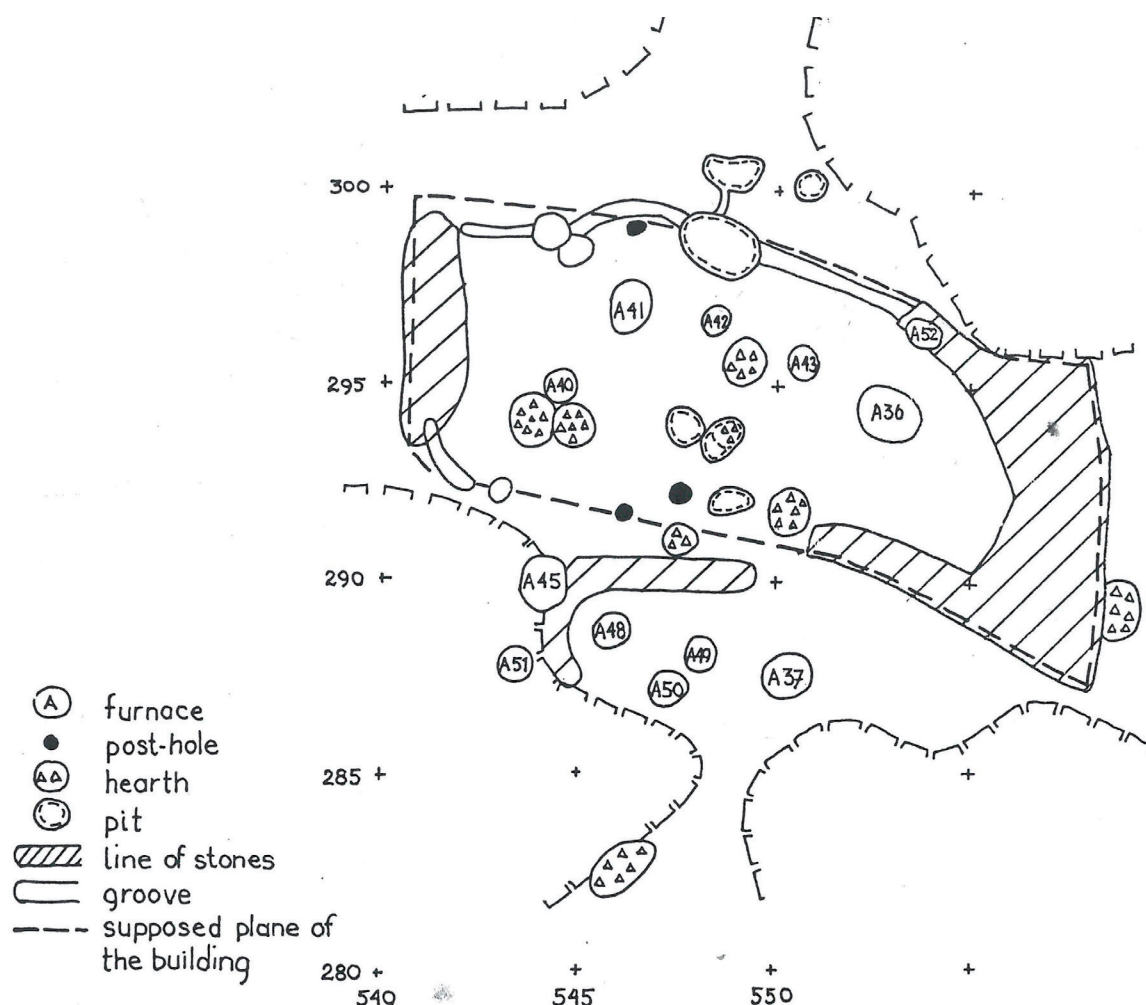


Fig. 4 – The bronze casting workshop with ‘furnaces’ at the Bronze Age settlement in Hallunda, Södermanland, Sweden (illustration: reworked after G. Vahlne, 1989, fig. 2).

1990–2010: Casting at cultic buildings and the bronze smith as ritual specialist

From the 1990s onwards, two new currents of thought can be observed in the research about bronze working. One of these currents was a critique against the idea of centralisation in craft where several texts pointed at the lack of empirical evidence supporting chiefly monopoly of bronze casting (e.g. Levy, 1991; Kuijpers, 2008 and 2013, p. 140). However, the link between craft and social power remained rather unexplored, as this critique did not result in clear counterproposals or new interpretative models.

Secondly, this period saw a growing interest in the ritual dimensions of prehistoric crafts, which also influenced the view on bronze casting in the Nordic Bronze Age (e.g. Budd and Taylor, 1995; Prescott, 2000). More attention was now given to the contextual evidence of casting remains at excavated sites. The find in 1986 of a cult-house with remains from casting activities at Sandagergård on the Danish island of Zealand was an important turning point. This stone-built, rectangular structure was associated with several urn burials, menhirs and

rocks engraved with hand-signs, but also featured crucible and mould fragments (Kaul, 1987; here: fig. 5). Flemming Kaul, who published the site, argued that the casting debris should not be seen as signs of a ‘profane’ use of the building, but instead pointed out that “many of the bronze objects of the period may be seen in a prestige or ritual context, so there is no reason why bronze casting might not in certain circumstances have involved particular rituals” (Kaul, 1987, p. 43; see also Levy, 1991, p. 70). Kaul later suggested that cult-houses like Sandagergård might have been the place where young men were initiated and got to cast their own razor as a symbol of adulthood (Kaul, 1998, p. 44–45). However, as no mould fragments allowed for the identification of the objects cast at the Sandagergård this was a purely speculative proposal.

The contextual link between cult houses, burials and bronze casting in Scandinavia was later thoroughly explored by Joakim Goldhahn in his essay *Dödens hand* [Eng. The Hand of Death] (Goldhahn, 2007). Goldhahn pointed out that bronze casting debris is often found in connection to burials, not only at Sandagergård, but also at many other sites in Scandinavia, and that these contexts had previously been overlooked as a consequence

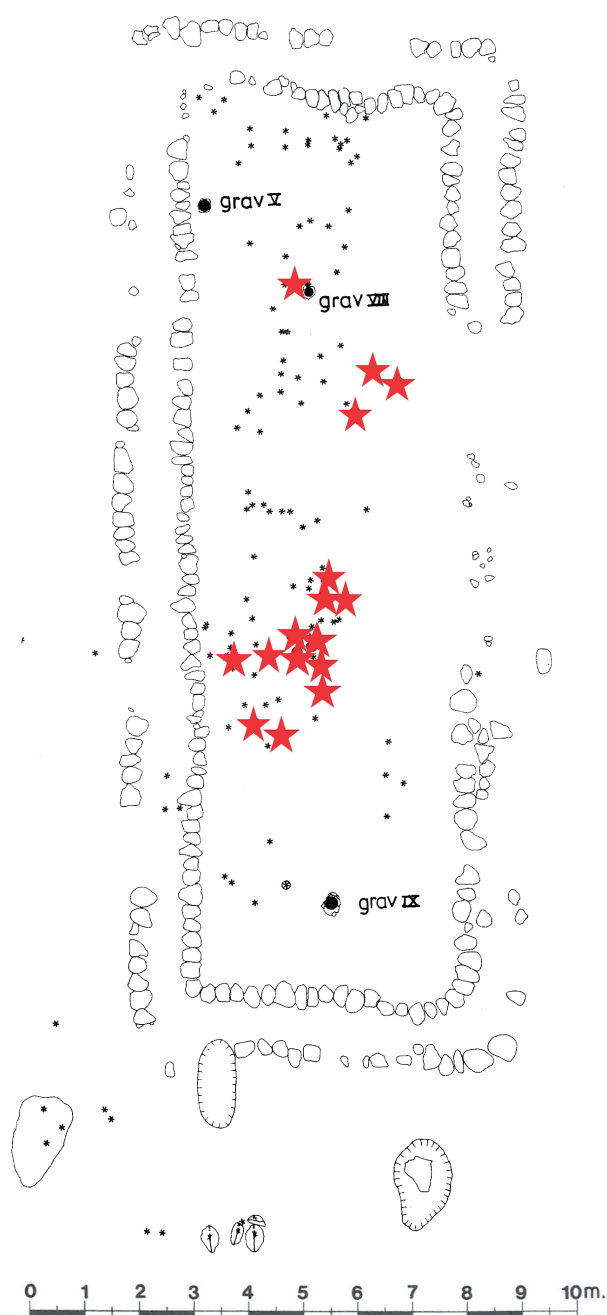


Fig. 5 – The cult-house at Sandagergård, Zeeland, Denmark, excavated in 1985. The small black stars illustrate the general distribution of Bronze Age finds. The red stars represent fragments of crucibles and ceramic moulds. Three urn burials recovered inside the structure are also marked on the plan (drawing by Stig Grummesgaard Nielsen and Flemming Kaul, edited by the author).

of functionalist thinking and inability to appreciate the ritual aspects of specialised crafts in prehistory. He re-interpreted the previously mentioned Hallunda workshop as a cultic building, where the bronze casting had been carried out in parallel to cremations and funerary rituals, contemporaneous to the surrounding burials (Goldhahn, 2007 and 2013).

Inspired by post-processual thinking, Goldhahn and others discussed the role of bronze casting as cultural metaphor used to mark social transformations, notably linking metallurgy with the process of cremation and transformation of the dead through fire (Goldhahn, 2007 and, 2013; Melheim 2012; see also Brück, 2001). Goldhahn argued that bronze smiths functioned as ritual specialists, mastering several overlapping technologies, and that bronze casting and death rituals were technologically, spatially and metaphorically linked in the Scandinavian Bronze Age. One of his overarching arguments was that bronze casting was esoteric, often carried out in secret, in hidden or closed-off spaces, away from view. In parallel, he still envisioned a ‘simple household production’ at Bronze Age farms (Goldhahn, 2007, p. 323). What emerged was thus the same two-tiered organisational model as before, but where the smith in service of the elites was now seen in a new, cultic and ritually charged light.

2010–today: Large-scale excavations and widespread evidence of casting

Since the beginning of the 2000s, the number of larger contract-led excavations have increased in several regions of southern Scandinavia. This has also led to increasing amount of casting finds, evoking a discussion about the spread and degree of centralised control in production, and appeals to study this material closer (Sørensen, 2015). Sites with casting generally continue to be seen as either workshop sites or small-scale domestic production. One interpretation which goes beyond this traditional view was presented by Anne Lene Melheim and colleagues 2016, discussing the important ‘workshop site’ at the large burial ground at Hunn in southern Norway. This large burial and cultic site is suggested to have functioned as a seasonal trade and crafting site, where larger assemblies were initiated by chiefs, for honouring the dead, trading and for producing bronze objects for redistribution (Melheim et al., 2016). This perspective is interesting because it proposes new angles on the character of production through studies of the context at the site —hypothesizing about the social realities that might hide behind terms like ‘central workshop site’.

During the last fifteen years there have also been efforts to synthesise the finds from bronze metalworking in southern Scandinavia, or parts of the region (Jantzen, 2008; Boddum et al. eds., 2015). The most ambitious study so far is the *Quellen zur Metallverarbeitung im Nordischen Kreis der Bronzezeit*, by Detlef Janzen. While published in 2008, the study was finished already in 1993, and it therefore does not include more recent, large-scale excavations of Bronze Age settlements and casting sites (Jantzen, 2008). Nevertheless, the detailed studies of refractory debris, casting techniques and find contexts led Jantzen to draw many important conclusions. Several of these conclusions are interesting stepping-stones for this study. In terms of

the social organisation, Jantzen broadly follows the traditional model, of workshop production versus small-scale household production (Jantzen, 2008, p. 300ff). Jantzen's most important result, in my opinion, is how he defines the character of production, based on a synthesising view of casting debris and casting sites, where the flexible and spatially wide-spread craft production is emphasised:

Nach diesen Beobachtungen läßt sich überall dort, wo das einfache Schmelzverfahren im Tiegel praktiziert wurde, der typische Arbeitsplatz eines bronzezeitlichen Gießers durch eine ebenerdige oder leicht eingetiefte Feuerstelle („Schmelzplatz“) definieren, die in einigen Fällen um eine Grube oder eine mit Steinen umgebene Fläche zum Vorheizen von Gießformen erweitert sein kann. Die Einfachheit des Verfahrens ermöglicht es sogar, bestehende Feuerstellen kurzfristig zum Bronzeschmelzen zu benutzen; vielfach dürften Fundstücke wie Bronzetropfen, Tiegel- und Formfragmente dann die einzige Möglichkeit bieten, diese Nutzung überhaupt nachzuweisen. Umgekehrt folgt daraus, daß ein derart einfaches Verfahren auch eine hohe Mobilität zuläßt und an nahezu jedem Ort betrieben werden kann, ohne daß zuvor besondere Anlagen errichtet werden müssen. (Jantzen, 2008, p. 299)

Summary

In the previous research, two central ideas regarding the organisation of bronze casting in the Nordic Bronze Age have been particularly influential. First, the notion of workshops as the prominent place for specialised metalwork. The idea was established early, with the discovery of the first ‘bronze casters’ workshops’ around 1900, and with time enhanced by theories promoting centralised and specialised forms of production. The idea of casting workshops became further established with the discovery of the Hallunda workshop in Sweden, published in the 1970s. As I have discussed elsewhere (Sörman, 2017), this steered expectations of what to find in the archaeological record, and might partly explain the low interest in the somewhat underwhelming casting finds that followed.

A second key idea is the concept of a two-tiered, hierarchical organisation of bronze artefact production in Nordic Bronze Age society. A specialised workshop production (more explicitly tied to the elite) on the one hand, and small-scale household production on the other. This idea was established in the mid-20th century, based on an observation of the difference in quantity of casting remains between sites. This is problematic, as the quantity of debris often reflect preservation conditions rather than original intensity of production. I argue that we, besides quantity, must give more attention to the quality, content and context of production within sites to better understand the organisation of the craft.

ANALYSING CASTING SITES IN SOUTHERN SCANDINAVIA

Introduction

Analytical approach

To study the spatial organisation of bronze working, three different levels of scale are considered in this analysis: the type of site (e.g. settlement), the type of arena where casting took place (e.g. longhouse, burial ground), and the precise setting of the casting (e.g. a particular fire-place and the immediately surrounding activity area). The contexts of casting debris and their distribution inside and outside houses and between activity areas are thus key. While the first level concerns the production in relation to the larger settlement pattern, the second and third levels concern the human scale, and let us hypothesize about aspects such as visibility, placement, and perception of the casting event.

Source criticism

Throughout this analysis, we must be aware of the source critical limitations of casting debris (principally crucible and mould fragments). I want to draw attention to three points in particular. Firstly, casting debris do not represent the full *chaîne opératoire* of making a bronze object, but only the process of casting the object into shape. Other steps in the manufacturing process, for example preparing ceramic moulds or making the finish on the object, possibly happened elsewhere, and are generally much more difficult to trace archaeologically.

Secondly, it must also be considered that casting debris is fragile and easily exposed to weathering processes. Sometimes mould fragments are observed during excavation, but too degraded to be collected (Eriksson, 2003, p. 129, 133). Experimental casting with lost-wax moulds has demonstrated that fragmented ceramic moulds, left on the ground and exposed to the elements and human passage, degrade quickly and can disappear completely within a few days (Nordez, 2019, p. 216). The preservation of cultural layers and ancient ground levels is another key factor. Therefore, ceramic casting debris in archaeological contexts is generally underrepresented, and this debris does not represent the original production or totality of debris once present.

Thirdly, this material is a bi-product from production, meaning indirect evidence in the form of waste. It raises questions about the relation between the find contexts for the debris and the context of the casting. The link between fragmented crucibles and ceramic moulds, and rare cases of metallic debris, and the original casting activity must be deduced from the location, context and conditions of deposition. In this exercise, a differentiation between production deposition (in primary, *in situ* position at the casting site), waste deposition (in secondary position, for example in waste pits or swept aside) and intentional

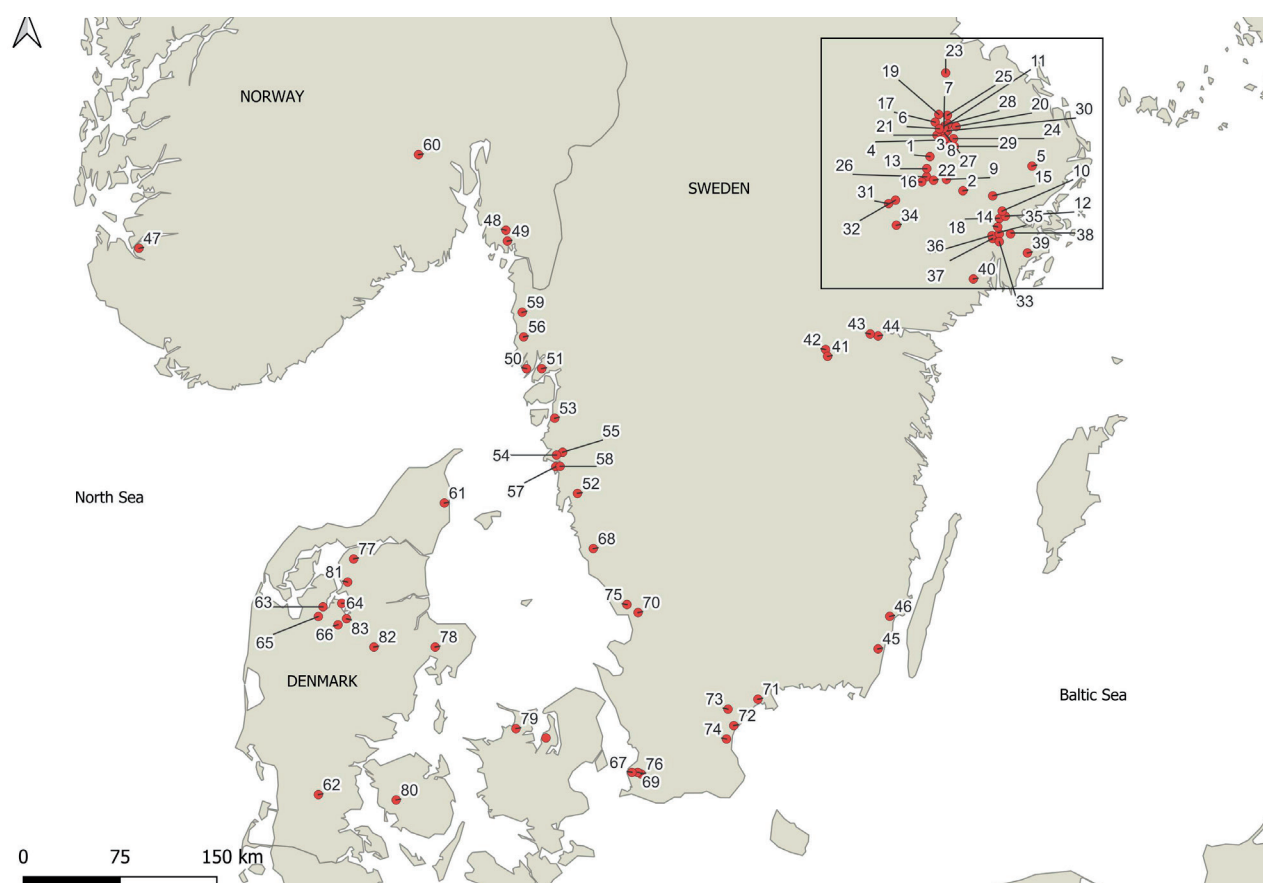


Fig. 6 – Map of southern Scandinavia with excavated sites featuring Bronze Age crucible and/or mould fragments included in this study. The case study area in southeastern Sweden is marked out with a rectangle. Numbers refer to the site list presented in table 1. For more detailed information and references, see Sörman (2018).

deposition (secondary or tertiary position where objects have been reused or buried as part of rituals etc.) is useful to distinguish the quality of the data (Sahlén, 2011, p. 150). Since intentional, ritual use of casting debris has been argued for find material in cult-houses and burial grounds (e.g. Melheim, 2012, p. 257; Ångeby and Lindman, 2017, p. 129, 133; as well as for British finds see discussion in Molloy and Mödler, 2020, p. 183), this question must also be evaluated in this study.

Introducing the dataset

A case study area in south-eastern Sweden, including the counties of Södermanland, Närke, Uppland and Västmanland (fig. 6) was chosen for a more thorough investigation. In this area, a full overview of excavated Bronze Age sites was sought for, and the presence and absence of casting finds was comprehensively evaluated against the full dataset of all excavated Bronze Age sites (Sörman, 2018, appendix 1 and 2). Other areas of southern Scandinavia, here including Denmark, Norway and the rest of southern Sweden, have also been included but treated more summarily (fig. 6). Studying the whole area in equal detail would have been far too time consuming, especially as the primary data (in the form of excavation reports) are still largely analogue and difficult to access. For these areas, the aim has been to contribute to over-

view, based on accessible reports and previously published finds. More sites certainly await discovery in the ‘grey literature’. However, the sites presented here; 40 in the case study area and an additional 44 sites in the rest of Scandinavia (see *infra* table 1), are numerous enough to create a representative overview of the phenomenon.

Results: What does the casting debris found in excavated Bronze Age contexts represent?

Production deposition

The clearest example of a melting hearth observed in the material included in this study, was found during a settlement excavation in Bredåker, eastern Sweden in the beginning of the year 2000s. Ceramic mould and crucible fragments were recovered from several locations within a partially excavated Late Bronze Age settlement (Frölund and Schütz eds., 2007). An area with a dense concentration of crucible fragments, mould fragments and small bronze droplets, was interpreted as a workshop area for bronze casting (Schütz, 2007). Small, pea-shaped bronze droplets were found around the hearth A1516 (one droplet was also found in the hearth-fill), revealing that this fireplace had been used for melting bronze (Schütz, 2007, p. 36; here: fig. 7). Experimental castings with ancient methods carried out by Anders

Söderberg have demonstrated that such metallic droplets and small melts, that occur when manipulating the crucible with molten bronze, is a strong archaeological indication of areas and fire-places used for bronze casting (Söderberg, 2002). Such metallic debris might not always be preserved, and might also be too corroded for identification with metal detectors. These preservation issues, and the fact that most spill-bronze is likely to have been collected for recycling, explains why such finds remain extremely rare.

Another possible example of a melting hearth where droplets were found close to a fire-place with casting debris, was found at the Late Bronze Age settlement at Fragtrup on Danish Jutland (Draiby, 1985). In Fragtrup, a charbon-rich layer deposited in the yard between two (partly contemporary) longhouses from Period V-VI (c. 900–500 BCE) contained ceramic mould fragments and two small bronze droplets, together with other waste (Draiby, 1985, p. 162–163; here: fig. 8).

Hearths or hearth pits with indirect evidence for bronze melting in the form of ceramic casting debris around and in certain features show the variety in both hearth construction and context of casting; from simple hearth pits at the yard of a longhouse: Tallboda (Äijä et al., 1996), to a stone-lined rectangular hearth on a terrace in front of a cult-house: Åbrunna (Strucke and Holback, 2006), large, stone-lined oblong hearths with casting debris and bronze melts at a burial ground: Bromölla (Petré, 1959), but also from indoor

hearths in longhouses, like at Early Bronze Age Store Thyrestrup (Nilsson, 1996) and Late Bronze Age Apalle (Ullén ed., 2003; Sörman, 2019; here: fig. 9). What characterises a hearth or hearth pit used for melting bronze, as pointed out by Thomas Eriksson (2003, p. 145), is not special construction details, but the addition of a forced air-flow.

Casting debris which can clearly be identified as production deposition—within or around particular fire-places—remains rare in the dataset over all. This rarity is due to the recycling of metallic debris and the limited preservation of crucible and mould fragments as ancient ground levels are generally heavily eroded or completely ploughed out.

Waste deposition

Most crucible and mould fragments have been recovered from cultural layers, and can be categorised as waste deposition (Sörman, 2018, appendix 2). The second most common find-contexts are secondary fills in features such as pits, pit-systems or post-holes. When found in burial structures, casting debris are part of fill-material rather than included in burial depositions or special deposits, indicating that they are re-deposited waste from earlier/contemporary activities at the site, rather than intentionally placed (Sörman, 2018, p. 133). Casting debris in cultural layers seems to be waste discarded near of where the casting took place, similarly to other waste material found within settlements, cultic sites or on burial grounds.

Intentional deposition

In a few cases, casting moulds have been subjected to intentional deposition as house offerings in Late Bronze Age longhouses. In two cases, complete bivalve moulds for socketed tools have been deposited intact (with both halves) in post-holes: one ceramic mould for a socketed chisel deposited in a house in Degeberga in Scania, southern Sweden, and one stone mould for a socketed axe from a longhouse at Forsandmoen, Rogaland in southern Norway (fig. 10). In these cases, the production of a tool for the household seems to have been associated to a protective or founding deposition in the house (Sörman, 2018, p. 190–191).

Conclusion – melting hearths and waste deposition

Production deposition of casting debris *in situ* in or around specific melting hearths is rare. Instead, fragments of moulds and crucibles are commonly found as secondary deposits in cultural layers, pits or mounds of fire cracked stones. Exceptions are a few cases of intact moulds for socketed tools, ritually deposited as house offerings during the Late Bronze Age. I therefore argue that most crucible and mould fragments found at excavated Bronze Age sites represent waste depositions, deposited in close vicinity to the original casting loci. This evidence can therefore often provide good indications about the spatial organisation of casting.

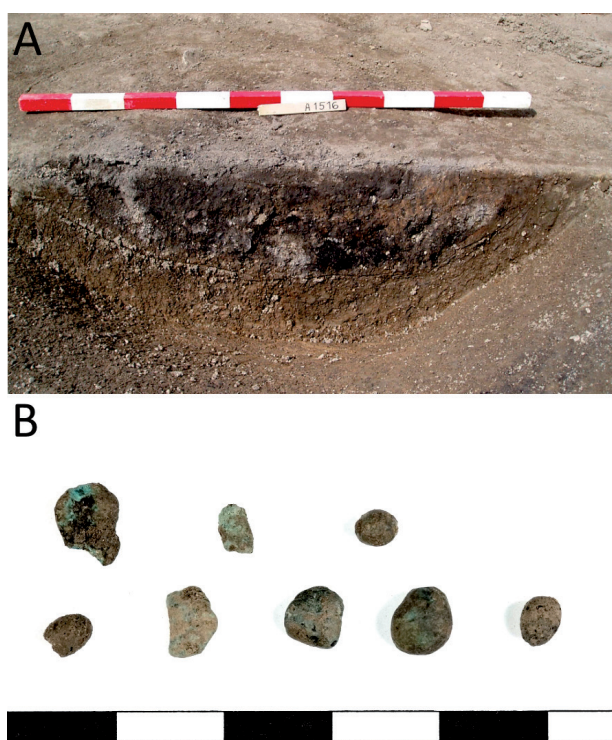


Fig. 7 – Melting hearth and bronze droplets from a Late Bronze Age settlement at Bredåker, Uppland, Sweden. A: Hearth identified as used for melting bronze, based on finds of bronze droplets and casting debris found in and around the feature (photo: Berit Schütz, Upplandsmuseet); B: Spill from bronze casting, in the form of small pea-shaped melts found at the casting loci (photo: Bengt Backlund, Upplandsmuseet).

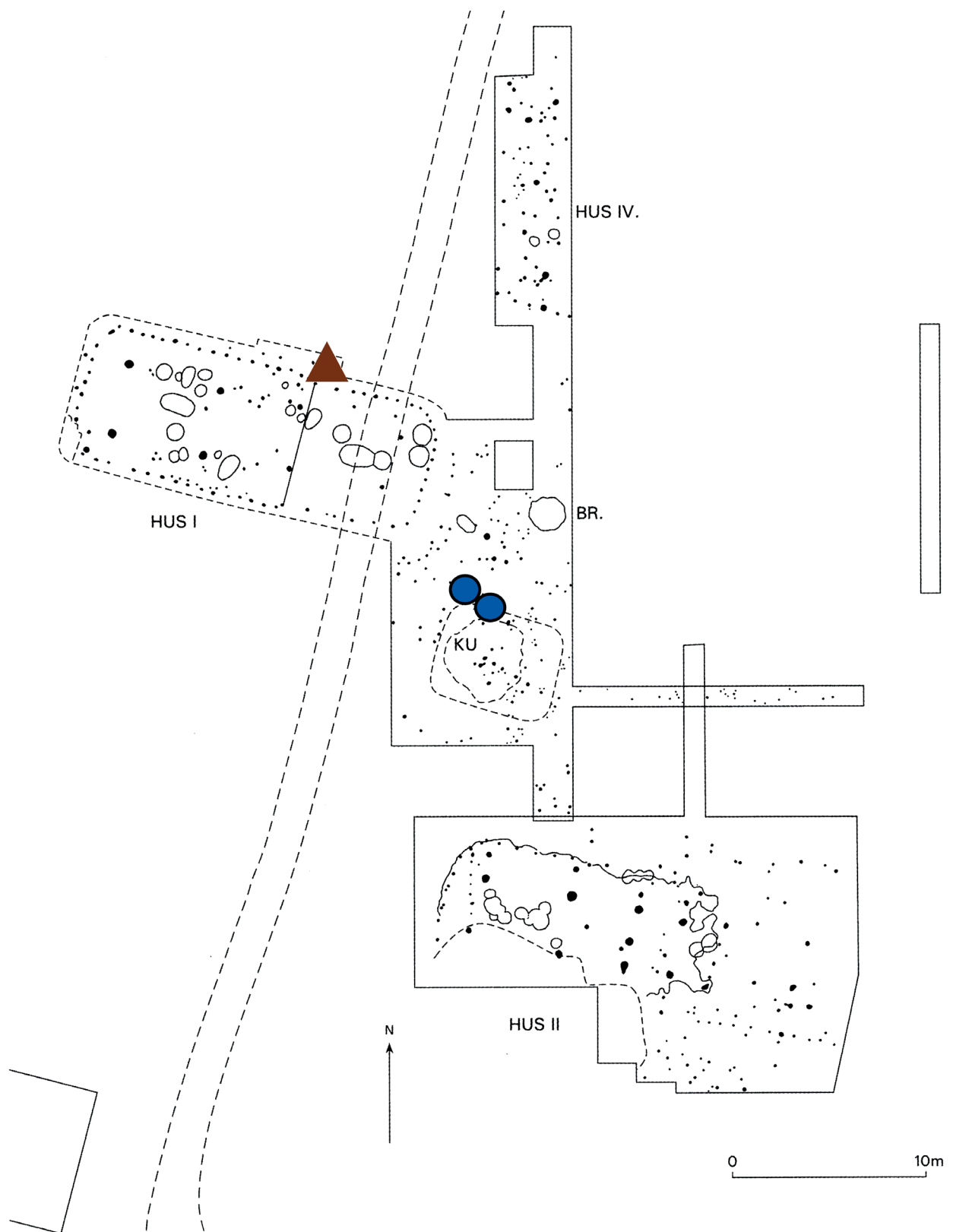


Fig. 8 – The Fragtrup settlement at northern Jutland, Denmark. Between the longhouse remains mould fragments (blue circles) and small metal droplets were found. Next to house 1 a crucible fragment (brown triangle) was also recovered. BR = well, KU = cultural layer with sand, coal and fire-cracked stones (reworked after B. Draiby, 1985, fig. 3, and D. Jantzen, 2008, plate 77).

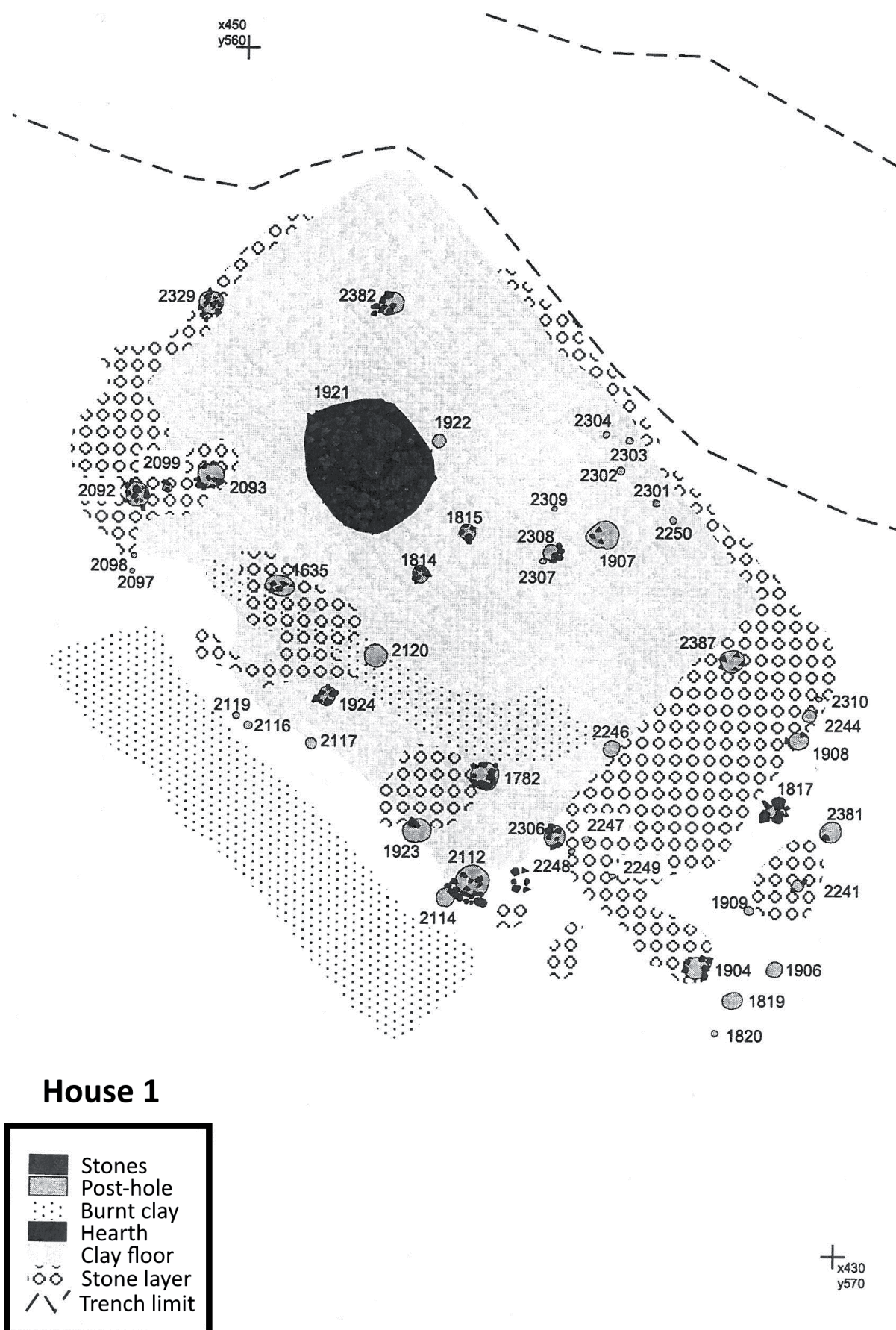


Fig. 9 – Longhouse (K2) from the Late Bronze Age at the Apalle settlement in eastern Sweden. The house is dated to settlement phase 5, roughly corresponding to Montelius Period V (c. 900–700 BCE). Recovered from the hearth (A1921) was a fragment of a casting mould, possibly for a hanging vessel (reworked after I. Ullén, ed., 2003, house catalogue).



Fig. 10 – Stone mould for socketed axe, intentionally deposited in post-hole of a Late Bronze Age longhouse at the Forsandmoen settlement in Rogaland, southwestern Norway. (photo: Olle Hemdorff & Trond Løken. Arkeologisk museum, UiS).

Results: In what spatial and social arenas were different bronze objects manufactured?

The following section presents an overview of the spatial organisation of bronze casting in southern Scandinavia, illuminated by a few representative examples. We will begin by the sparse evidence from Early Bronze Age. Thereafter, the two primary social arenas for bronze casting in the Late Bronze Age; longhouse milieus and cult-house milieus will be discussed. Finally, we will look at the rare cases where bronze metalworking is indicated at small, single farms, before ending this section with a summary and interpretation of the findings.

Early Bronze Age – casting at settlements and large longhouses

Casting debris that can be confidently dated (through context/stratigraphy or preserved mould imprints) to the Early Nordic Bronze Age (c. 1700–1100 BCE, Montelius Period I–III) is rare, compared to the evidence from the later part of the period (Jensen, 2002, p. 118; Jantzen,

2008; Sörman, 2018, p. 162–164). Most Early Bronze Age finds known so far are from Danish settlements (e.g. Kristensen, 2015; here: table 1). In several cases, settlements with bronze casting feature unusually long longhouses, with a length approaching 50 meters and with an inner surface of almost 500 m² (Jensen, 2002, p. 109ff).

One such example is the **Store Tyrrestrup** settlement at Jutland, with a 48-meter-long longhouse from Period II, dated to c. 1400 BCE (Nilsson, 1996 and 1997; Jensen, 2002, p. 115). In the house's westernmost room were traces of bronze casting, in the form of mould fragments by the hearth (fig. 11). The room also featured a pit with deposited metalwork (3.2 kg, including for example palstave axes and a bronze melt). This impressive house, with its casting debris and its hoard, has been interpreted as a chiefly household, indicating monopolisation of the early bronze crafting (Nilsson, 1996). At **Skudstrup**, also on Jutland, a settlement dating to Period II–III featured several houses of which the longest measured 50 meters (Ethelberg, 1995 and 2000; Jensen, 2002, p. 117). In the western room there were traces of both bronze casting and weaving. Several Early Bronze Age sites with casting are also known from northern Jutland, recently synthesised by Inge Kjær Kristensen, who has drawn attention to casting debris at the settlements of **Lundbro II**, **Virk-sund**, **Rosgårde** and **Kluborg** (Kristensen, 2015).

Looking further north, no excavated Early Bronze Age sites with casting are so far known from Norway (an Early Bronze Age settlement with 'furnaces', but no finds of casting debris was considered unconvincing and therefore excluded, see Sörman, 2018, p. 151). In southern Sweden finds occur, but are rare. In a longhouse of 23 meter from Period III at **Elinelund**, Scania, in southern Sweden, a crucible fragment was found in a post-hole in its western room (Sarnäs and Nord Paulsson, 2001). Another potential case is the 50-meter-long Period II longhouse at **Bruatorp** in Småland (Dutra Leivas, 2001), however as only bronze melts were found and there were no crucible or mould fragments, on-site casting is more uncertain. Finally, the large Bronze Age settlement at **Apalle** in central Sweden also bears traces of bronze casting in Period

Casting mould remains

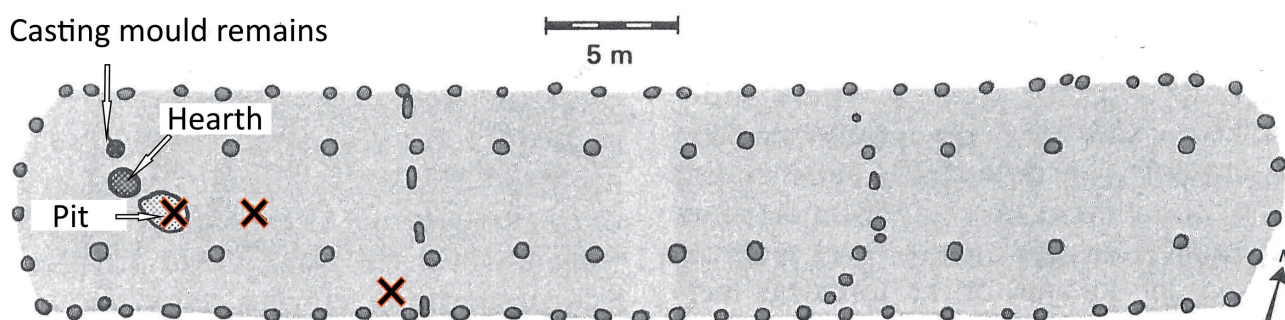


Fig. 11 – Period II longhouse from Store Tyrrestrup, Jutland in Denmark. The western room featured a pit with a metalwork hoard, and mould fragments from bronze casting close to the hearth. The crosses mark bronze items found in the plough soil (redrawn after T. Nilsson, 1997, p. 12).

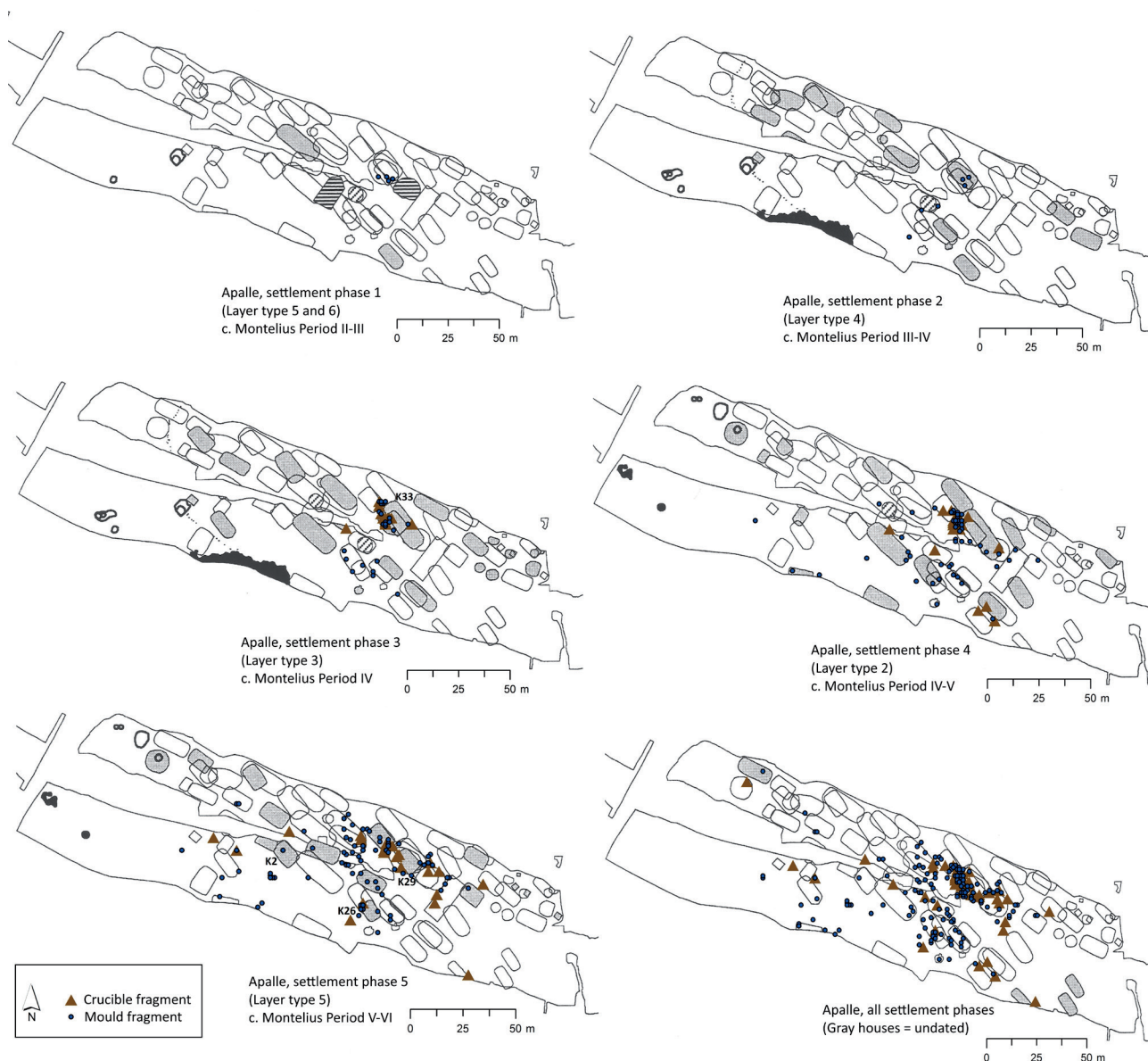


Fig. 12 – Major settlement phases at the Bronze Age settlement at Apalle, Uppland in eastern Sweden. Plans showing the distribution of fragments of casting moulds (blue circles) and crucible fragments (brown triangles), in settlement phases 1–5, and in total (reworked after I. Ullén, 2003, ed., figs. 34–38, with data from T. Eriksson, 2003).

II/III (settlement layer 5 and 6, here: fig. 12), where some casting mould fragments were recovered from a centrally located cultural layer, between the house, the farming plot and the midden of fire-cracked stones (Ullén ed., 2003; Sörman, 2018, fig. 32). To sum up, we have certain indications of Early Bronze Age bronze casting outside Denmark, but the examples are still too few to reconstruct its spatial organisation.

Late Bronze Age – casting at larger settlement complexes (longhouse milieus and cult-house milieus) and at small single farms

The find-contexts for casting debris from mid-late Bronze Age southern Scandinavia indicate that bronze casting was carried out in two main social milieus. On

the one hand, in connection to longhouses, in various settings within settlements. On the other hand, in connection to cult-houses and/or burials, within ritual activity areas. These two milieus are often located in close proximity to each other, forming integrated parts of vast grave and settlement areas. This pattern is particularly clear in the case study area in eastern Sweden, and the presentation below will have an emphasis on sites from this region.

Longhouse milieus

The longhouse milieus are contexts characterised by domestic buildings—longhouses—with surrounding yards and activity areas, often featuring pits, hearths, and cultural layers, sometimes also other forms of buildings such as small storage houses and, in some regions also middens or

mounds of fire-cracked stones. These milieus have several common traits; their topographic location, their composition and certain elements in the find material.

Topographically, longhouse milieus are often located on clay or sand in flat, or gently sloping or terraced terrain. Lower areas, below the longhouse milieus (often wetter before modern drainage for agriculture) were generally used for pasture in the Bronze Age. Higher grounds—whether the subtle, flat hills or eskers like in Denmark and southernmost Sweden, or rocky moraine hills, ridges or mountain areas like in the Swedish and Norwegian fissure valley terrain—feature monumental structures such as cairns and tumuli, as well as burial grounds which are thus often located on topographic elevations. In terms of composition, the key feature in longhouse milieus are the longhouses for dwelling. The find material often has a lower percentage of fine ceramic vessels and higher rate of crude storage and cooking pots compared to cultic sites; another difference is the absence of burials and only occasional finds of human bones (Sörman, 2018, p. 131–141).

The bronze casting remains in longhouse milieus are found in a wide variety of contexts, both within buildings and in outdoor areas (Sörman, 2019; here: table 1). This demonstrates that casting was not concentrated to special workshop buildings. Although it is often difficult to pinpoint the duration, intensity and chronological time-span of the casting based on the debris, it is not unusual, at least when excavations have covered larger parts of a settlement, with casting debris occurring at several different places within the settlement (e.g. Eriksson, 2003; Frölund and Schütz eds., 2007). To exemplify bronze casting in the south Scandinavian longhouse milieus, a few sites will be briefly described.

At **Apalle**, eastern Sweden, a uniquely well-preserved dwelling with intact stratigraphy allowed for the identification of several settlement phases, which included multiple longhouses and other buildings (Ullén ed., 2003). The distribution of casting debris indicates metalworking at the settlement throughout period II/III to period VI (fig. 12). A concentration of mould and crucible fragments at a centrally located circular building, previously suggested to be the main crafting hut/enclosure, seems to have been only one of several casting loci within the settlement during Period IV (c. 1100–900 BCE, settlement phase 3; Ullén ed., 2003). Over time, bronze-working featured at central courtyards, inside longhouses (fig. 9) and other buildings, as well as in a large, communal area in the southern part of the settlement (Sörman, 2018, p. 68–80). The production at Apalle included a wide range of objects, from simple neck-rings, dress pins and axes, to complex lost-wax-castings of prestigious objects such as belt ornaments and fibulas (Eriksson, 2003). Apalle, being one of the region's largest grave and settlement complexes, with its production of prestigious bronze objects and ornaments for local leaders, indicates the presence of social elite.

Other large Bronze Age settlement with extensive longhouse milieus such as **Pryssgården**, **Brogård** and

Vrå, all in Sweden, are much less informative as relatively little casting debris was recovered from these sites, probably due to the poor preservation of cultural layers which characterise these sites (see Sörman, 2018, p. 93–94, 147–148, 164–165). Only few, scattered crucible and mould fragments were found, and its chronological as well as temporal distribution within the settlements are harder to estimate.

There are also settlements complexes which are only partially excavated, providing insights into the casting activities at parts of the site. At the yard in front of a Period V (c. 900–700 BCE) longhouse in **Tallboda**, eastern Sweden, the production of an exclusive spectacle fibula (also Period V) was indicated through the finds of mould and crucible fragments in a sooty pit a few meters south of the building (Äijä et al., 1996; Sörman, 2019, p. 162–163; here: fig. 13 and 20). At the **Skuttunge kyrka** settlement in eastern Sweden, mould fragments, probably for a spectacle fibula, were recovered from the floor layer of a longhouse that appears to be from the Late Bronze Age (Sörman, 2018, p. 100–102). At the previously mentioned **Bredåker** settlement, the large spatial distribution of debris indicates more than one casting loci within the site (Schütz, 2007, p. 246; Sörman, 2018, p. 98). The well-preserved casting loci with melting hearth, discussed above, was part of a longhouse milieu, but the exact surroundings and its relation to other features and buildings are unsure due to the limited extent of the excavation (Schütz, 2007).

Cult-house milieus

Cult-house milieus include both large, complex burial grounds and smaller groups of graves, and sites with ritual activity areas and cult-houses. Many of the burial grounds where bronze casting debris have been found also have cult-houses and other activity areas among the graves. Like for the longhouse milieus, these sites can be characterised by their type of constructions, their find material and their topographical location.

Constructions under the umbrella term ‘cult-house’ refer to particular-looking buildings or building-like constructions related to funerary contexts (Victor, 2002). The term cult-house, when used for the Nordic Bronze Age, thus refers to several non-domestic buildings which differ by construction, location and find material compared to the longhouses on settlements (Victor, 2002; Goldhahn, 2007; Mattes, 2008). As demonstrated by Helena Victor (2002), they can be divided into two main groups; stone-frame cult-houses which are low, rectangular enclosures of cold-walled stones, and post-built cult-houses either with a simple four-post quadratic structure, or post-built D-shaped small buildings or huts. Whether some of these structures, notably the stone-foundation type cult-houses were foundations for actual buildings, or enclosures or platforms of some kind (or even burial monuments in themselves) is unclear (e.g. Kaul, 1987 and 2006; Svanberg, 2006). They generally have a connection to burials or appear in the vicinity of graves (Victor, 2002). In terms of find-material, they sometimes feature a higher concen-

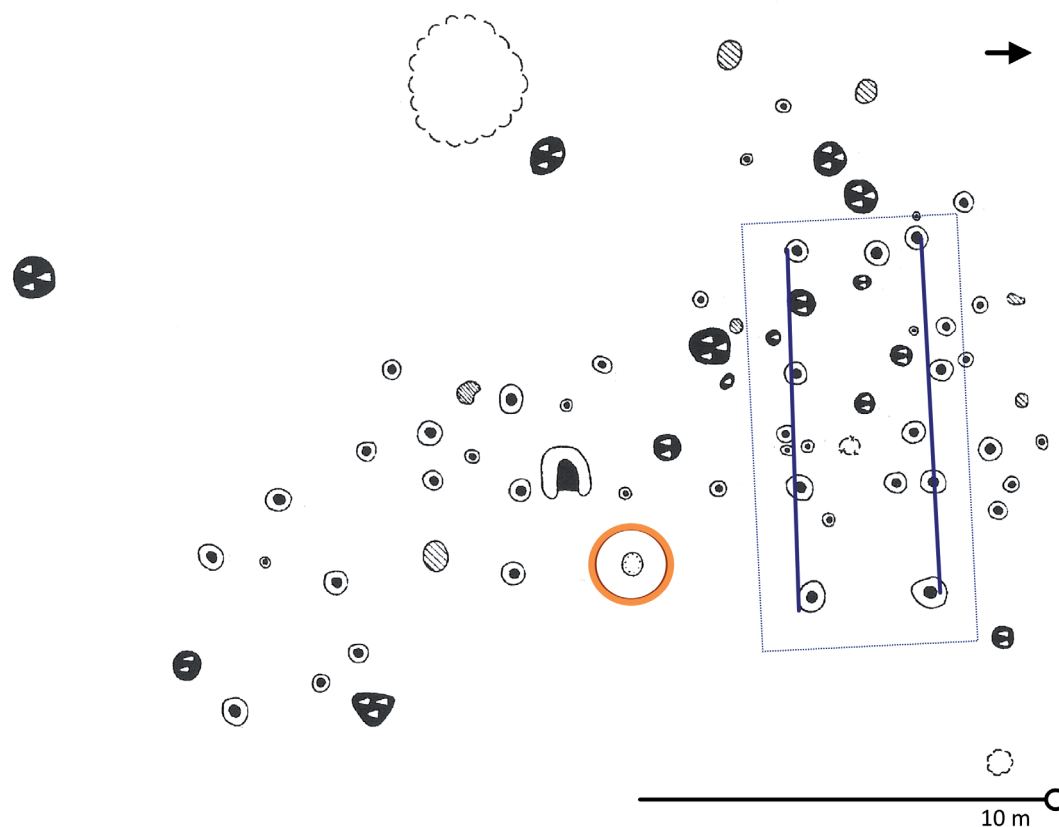


Fig. 13 – Plan of a longhouse (House 1) at one of the settlement areas (RAÄ 16) within the grave and settlement complex at Tallboda in Östergötland, eastern Sweden. Casting debris, in the form of mould fragments for a spectacle fibula (here: fig. 20) and an almost intact crucible, was recovered from a sooty pit in front of the entrance to the house. The pit where the casting debris was found is marked with an orange circle (reworked after K. Äijä, H. Lindborg and M. Schönbeck, 1996, fig. 7).

tration of bowls and fine tableware ceramics, interpreted as signs of feasting (Eriksson, 2008; Brorsson and Eriksson, 2011; Sörman, 2018, p. 136–138).

Topographically, cult-houses and burial sites tend to be located to slightly higher terrain, often on moraine or rocky hills in Sweden and Norway (Hjärthner-Holdar et al., eds., 2008; Sörman, 2018). Based on their location and find-material, these contexts often seem to have hosted various types of ritual activities, special ceremonies or feasts and funerary rites (Victor, 2002 and 2006; Kaul, 2006; Mattes, 2008). As testified by numerous such contexts with casting debris, production of bronze objects was also among the activities sometimes carried out in such arenas.

In **Ryssgärdet**, eastern Sweden, the dwelling area was less well-preserved; instead, ritual milieus with cult-houses situated at the topographically higher areas of the complex (which had not been ploughed, in contrast to the lower-laying settlement) were more well-preserved (Hjärthner-Holdar et al., eds., 2008). Most metalworking debris was found by the grave and cult-house contexts, located at two rocky hilltops in the northern area of the settlement (fig. 14). Bronze casting had been carried out in and/or in front of two small, robust post-built cult-houses. Casting debris was found both on the terrace/platform in front of one of the cult-houses, and on the slopes, where waste from the activities by the cult-houses had

been dumped (Hjärthner-Holdar et al., eds., 2008). The cult-house areas had probably been used for feasting, ritual drinking, mortuary rituals and ceremonial gatherings (Eriksson, 2008; Hjärthner-Holdar et al., eds., 2008; Sörman, 2018, p. 80–91). In addition, a possible link to warfare and hunting wild game is suggested (Sörman, 2018, p. 89). The Ryssgärdet settlement spanned from the Late Neolithic through the Bronze Age. The cult-houses were difficult to date, but appear to have been most intensely used during period III–V (Karlenby, 2008b, p. 91ff). The types of bronzes produced at Ryssgärdet cannot be reconstructed based on the casting moulds, but the chemical composition of the melts and artefacts point to local casting of at least tweezers and awls (Eriksson and Grandin, 2008, p. 358). A possible connection between cult-houses and production of tools for razor kits is suggested. Ryssgärdet was probably among the largest grave and settlement complexes in its region. It might occasionally have functioned as an arena for gatherings, cult and feasts for a wider community, and parts of the bronze-working likely related to such occasions.

Similar cases of small cult-houses on high terrain in connection to settlements have been found at **Åbrunna** (Strucke and Holback, 2006) and **Nibble** (Artursson et al., eds., 2011), both in eastern Sweden. These sites also featured small post-built buildings or huts on higher ground, with traces of casting at these high-laying areas.

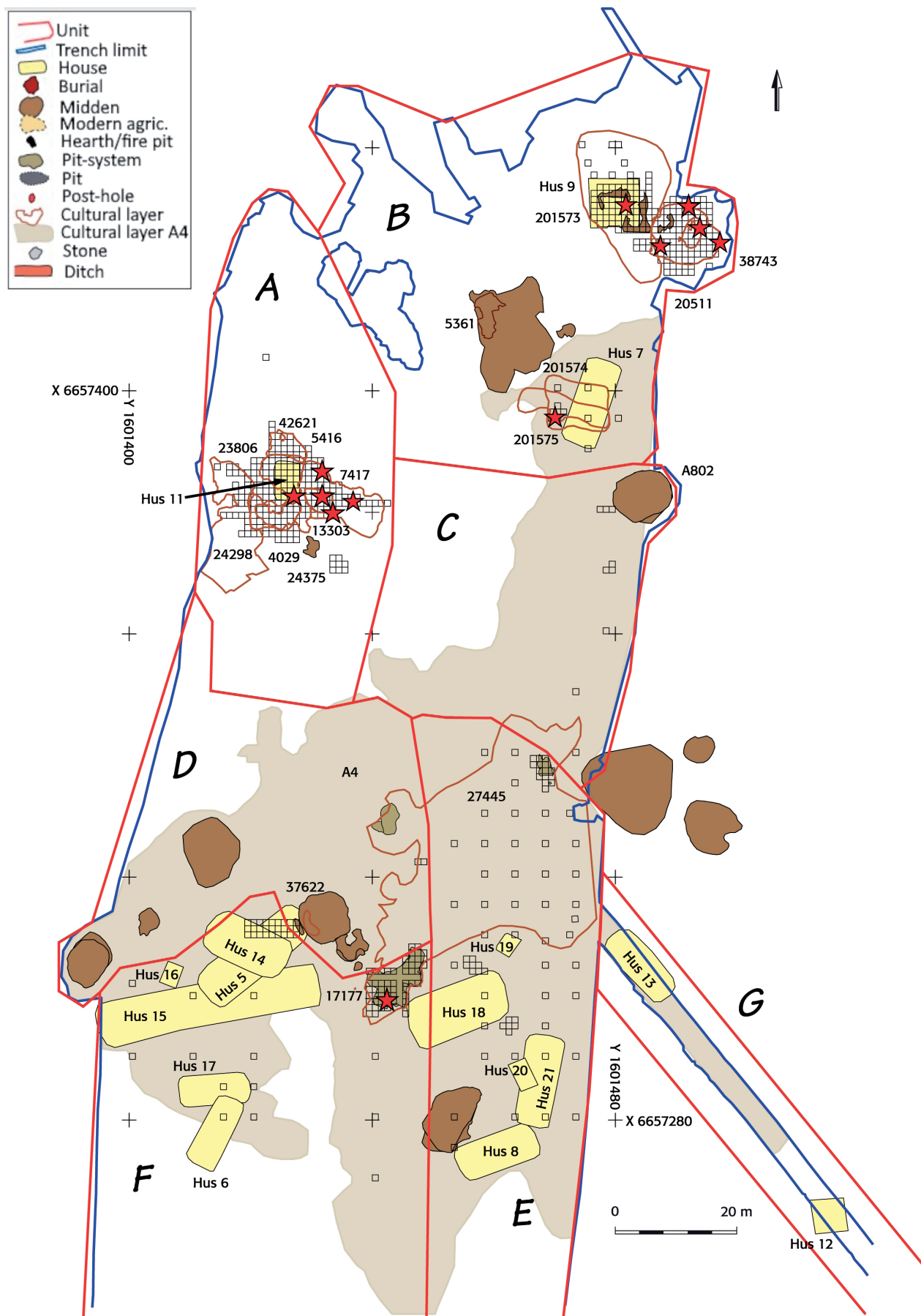


Fig. 14 – Plan of the settlement at Ryssgärdet, Uppland, eastern Sweden. Finds of crucible and mould fragments marked with red stars (reworked after T. Eriksson and A. Östling, 2005, fig. 5).

In Åbrunna, a crucible was found in a hearth at a platform in front of a small cult-house, exposing towards the settlement below (Sörman, 2018, p. 108–110; see here *infra* fig. 18). The same spatial set-up can be observed at **Hallunda**, the famous ‘workshop’ site at a high-laying burial ground within what was probably a larger grave and settlement complex (Jaanusson and Vahlne, 1975; Goldhahn, 2007; Sörman, 2018, p. 118–127). Like Joakim Goldhahn (2007, p. 293–306), I also regard this site as a cult-house milieu, however, I argue that the construction has more similarities with the post-built structures at Ryssgårdet and Åbrunna, and have proposed an alternative interpretation of this house where some of the most robust stone-lined ‘furnaces’ are instead suggested to be large post-holes to a quadratic building (Sörman, 2018, p. 124–126; here: fig. 15). Some of the well-preserved mould fragments found at this part of the site, show that swords, spearheads, neck-rings and socketed axes, were

produced in this cult-house milieu (Vahlne, 1974; Sörman, 2018, p. 125).

Excavated sites with large burial sites and cult-house milieus, such as Hallunda, in eastern Sweden (Jaanusson and Vahlne, 1975) and **Hunn** in southern Norway, could perhaps be seen as larger grave and settlement complexes with seasonal function as assembly sites (see Melheim et al., 2016). Bronze casting could then sometimes have been performed in relation to these ceremonial meetings, which would explain its exposed location, its contexts in waste of ceremonial drinking etc, and the production of items with strong political connotations, such as swords and spearheads (Vahlne, 1974; Melheim, 2012, p. 191f; Melheim et al. 2016, p. 52).

Although the cult-house phenomenon appears to be slightly different in Denmark, we still see examples such as **Sandagergård** (see above) on Zealand, and **Brobakken** (Mikkelsen, 2015; here: fig. 16) on Jutland,

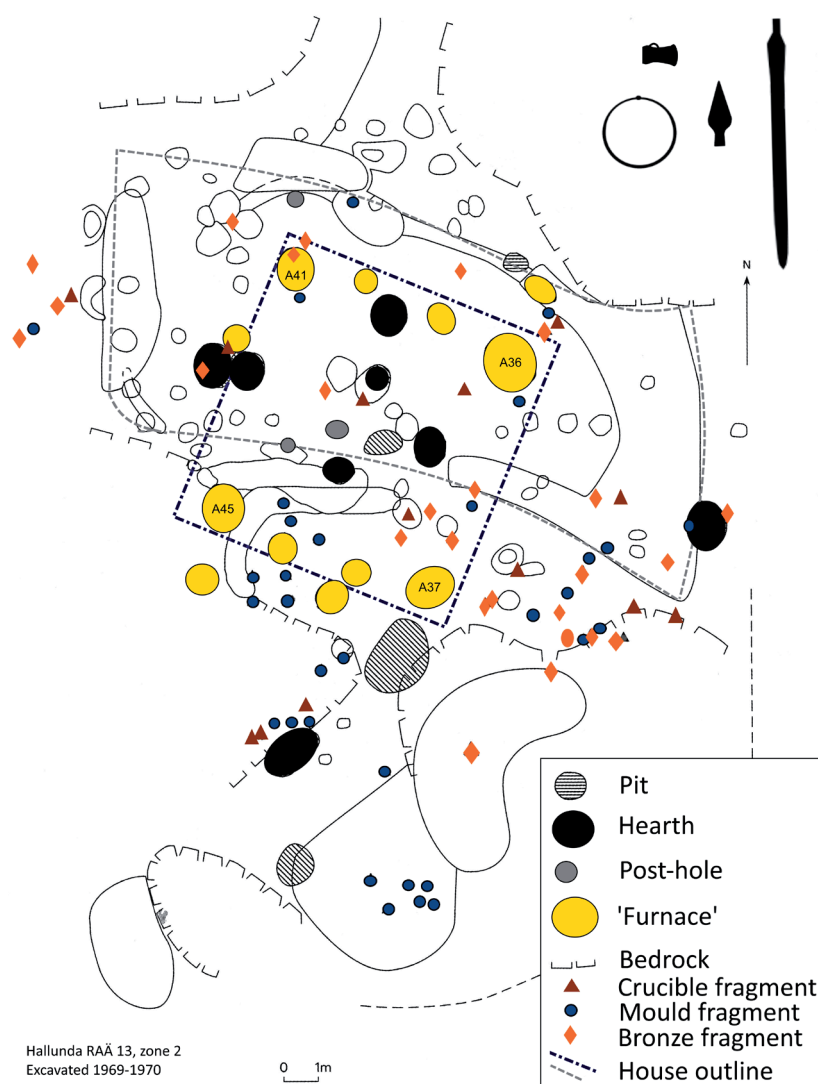


Fig. 15 – Plan of the ‘workshop’ or cult-house at the burial ground (RAÄ 13) at Hallunda, Södermanland in eastern Sweden. Two house interpretations are shown on this plan: grey dotted line corresponds to the original interpretation of this structure as a workshop/stone-foundation type cult-house, while the blue dotted line (forming a square shape) corresponds my proposed re-interpretation of some of the ‘stone-lined furnaces’ as corner post-holes in a four-post house. On the top left silhouettes of the objects cast (reworked after G. Vahlne, 1974, p. 16; 1989, p. 109, and D. Jantzen 2008, plate 95).

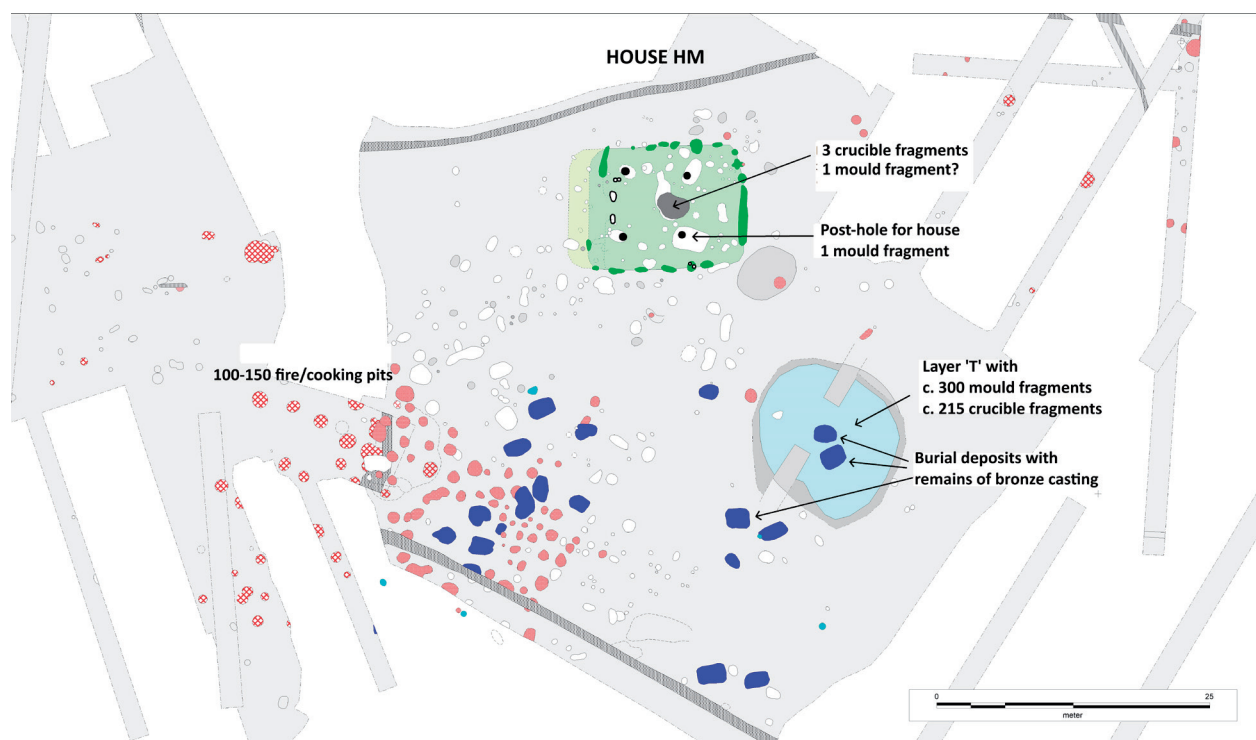


Fig. 16 – Parts of the excavated area at Brobakken, on Danish Jutland. The remains of a small house with traces of bronze casting were found next to a waste midden which included finds of casting debris and funerary depositions with human bones, dating to the Late Bronze Age. This context has here been interpreted as bronze casting in a grave and cult-house milieu, within a larger settlement complex (illustration from M. Mikkelsen, 2015, fig. 4).

where the association between burials, bronze casting and cult-house milieus is also evident. In Brobakken, casting debris, including casting moulds for swords, spearheads, a wide arm-ring and possibly spectacle fibulas, were found by a small, quadratic post-built house in connection to a waste midden which included casting debris and burial depositions, and a high degree of fine tableware ceramics (Mikkelsen, 2015). This find-pattern fits well with the ceremonial feasting and funerary ritual proposed for similar cult-house milieus in other parts of the Nordic area (Sörman, 2018, p. 170–173). These appear to be assembly sites at larger settlements, and important arenas for producing bronze objects in the Late Bronze Age.

Single farms

Finally, data from Sweden also testify of bronze casting in longhouse milieus at small, single farms. This interpretation is suggested for the Late Bronze Age settlements at Rambodal, Östergötland (Nyberg and Nilsson, 2012; Nilsson and Sörman, 2015), and Degeberga in Scania (Björk and Wickberg, 2011). Both sites, in use from Period IV to VI, were spatially limited to a few thousand square meters, and lacked obvious connections to contemporary ritual areas/burial grounds. In Degeberga, a mould for a Period IV-chisel had been deposited in a post-hole of a longhouse. In Rambodal a fragment of a broken soap stone mould for a socketed axe-head from Period V/VI was recovered from a cultural layer beside a longhouse (fig. 17). They seem to indicate a small-scale production of tools relating to smaller settlements, and

thus confirm that metalworking was carried out at various levels of the settlement hierarchy, at households of different social standing. The implications of this will be further discussed in section 5.

Results: where was casting carried out in relation to the settled landscape?

As we have seen through the sites presented above, bronze casting debris is found in the settled landscape in the Bronze Age—dwellings, ritual sites and burial grounds at the core of the populated areas. There are no casting debris from free-laying sites at wider distance from the settlements, such as remote sites for temporary activities, shepherds' stations or mineral extraction sites (Sörman, 2018, p. 59–64, appendix 1). Rather than hidden away, casting was carried out midst of the main arenas for Bronze Age life.

Summary and interpretation of findings

The contextual analysis of casting debris (Sörman, 2018), briefly synthesised and exemplified above, demonstrates several new insights about the casting debris, the production of bronze objects and its organisation in social space. These can be summarised as follows:

- It is often possible to reconstruct the approximate area/areas of production within excavated sites, despite the absence of specifically identified melting hearths. Discarded casting moulds and crucible fragments are largely present as secondary depositions in cultural layers, floor

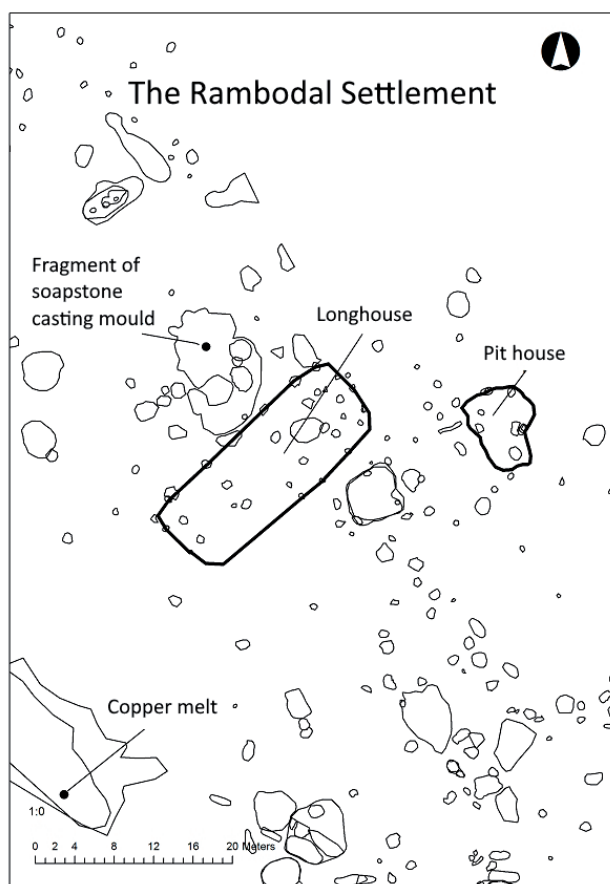


Fig. 17 – The small Late Bronze Age settlement at Rambodal, Östergötland, eastern Sweden, probably representing metalworking carried out at the lower level of the settlement hierarchy. Here, the making of a socketed axe head is indicated by the discarded fragment of a soapstone mould, recovered from a cultural layer just north of the house (reworked after P. Nilsson and A. Sörman, 2015, fig. 2).

layers and pits. The degree of preservation and level of excavation of cultural layers is decisive for the identification and recovery of bronze casting remains. Apart from a few cases of intact casting moulds placed as foundation offerings in Late Bronze Age longhouses, there are no other evidence suggesting intentional depositions of casting debris (in for example burials or cult-houses).

– Bronze casting sites from the Early Bronze Age, particularly Period I-II, are less well-known, and evidence has so far primarily turned up in Denmark, where casting debris sometimes feature at settlements with exceptionally long longhouses. Summing up, both the restricted presence of casting debris, and the strong representation of settlements with larger longhouses suggest that metalworking was more strictly centralised to certain farms and families in the Early Bronze Age (see Earle, 1997; Kristiansen, 1998; Vandkilde, 2017, p. 157). The data so far indicate that the Danish area, and the rich Jutland peninsula in western Scandinavia had a more developed presence of local casting in this period, and that metalworking was established later in for example eastern Sweden (Karlenby, 2008a, p. 64). As the number of excavated Early Bronze Age settlements are still low, notably in Sweden and Norway, this picture could change.

– In the Late Bronze Age, bronze casting remains turn up in two different social arenas. On the one hand in domestic areas within settlements, here called longhouse milieus. And on the other hand, in ritual areas with burials and/or cult-houses or other non-domestic structures, here called cult-house milieus. Thanks to the basic characteristics in topographic location, finds and feature types, these contexts can also be suggested for older excavations of sites where the methodology, lack of identified buildings etc., make them difficult to interpret, but where their similarities to data from modern excavations now allows for a better understanding (table 1). In this context, it can be mentioned that the famous Swedish ‘workshop’ at **Hallunda** has here been re-interpreted as a cult-house milieu with production amidst funerary monuments and a post-built cult-house (Sörman, 2018, p. 118–127; see also Goldhahn, 2007, p. 293–306 and 2013, p. 258–259), and that the famous **Skälby** site with two middens of fire-cracked stones with rich remains of casting—one of the first excavated ‘workshop sites’ in Sweden in the 1930s (Oldeberg, 1960)—is suggested to have been located midst of a low-laying longhouse milieu in a larger settlement (Sörman, 2018, p. 104–106).

– In longhouse milieus bronze casting was carried out indoors and outdoors, and has often left traces at several loci within larger excavated settlements. Indoors, there are traces in longhouses, such as at Apalle and Skuttunge kyrka, but also in other types of buildings, like the round building at Apalle settlement phase 3. There is also casting in open places in front of longhouses, such as for example at Tallboda and Fragtrup, or at yards in the middle of the settlement cluster, like at Apalle or Skuttunge kyrka. Object types produced are varied, but we can note the lack of clearly identified full-length swords, and the presence of moulds for belt ornaments and neck rings.

– In cult-house milieus and on burial grounds, the casting of bronze objects was also varied. The context of debris indicate production at activity areas outdoors, such as the platform in Åbrunna, and indoors in cult-house structures such as the cult-house in Sandagergård. There is often a relation between cult-houses and human bones and with burials. There is also a relation between such cult and grave areas and contemporary settlement sites—forming large complexes, clearly exemplified by sites such as Åbrunna, Nibble and Ryssgårdet. However, as the full extent of such sites is almost never determined it remains difficult to assess the relative stature and size of the various settlements with casting.

– Bronze casting was present at both larger and smaller settlements. The small ones, so far rarely subjected to excavation, perhaps for source critical reasons, have been identified in at least two cases, both from Sweden.

– Prestigious objects, such as weapons and large ornaments, were produced both in dwellings and at cult-houses. This demonstrates that advanced production of prestige goods was not organised in specialized, spatially secluded or centralized workshops. Instead, valuable bronzes came about in several different arenas and under various circumstances.

#	Site	Country	Type of remains	Type of artefacts cast (imprints in moulds)	Casting context	Dating	Reference	Comment
<i>Mälardalen valley area (case study region)</i>								
1	Alsta	Sweden	Ceramic mould fragments		Long-house milieu?	LBA?	Oldeberg 1960:45f	
2	Apalle	Sweden	Ceramic mould fragments, crucible fragments	Neck rings, socketed axeheads, tutuli, belt ornament, dress pin?, spectacle fibula?, hanging vessel?, sword/dagger?	Longhouse milieu	EBA-LBA	Ullén ed. 2003	
3	Bredåker	Sweden	Ceramic mould fragments, crucible fragments, bronze melts	Neck rings, dress pins with disc-shaped head, socketed axehead?	Longhouse milieu	LBA	Göthberg & Schutz eds 2006; Frölund & Schutz eds 2007	
4	Broby	Sweden	Ceramic mould fragments, crucible fragments	Neck rings	Cult-house milieu	LBA?	Schönbäck 1952, 1959; Ojala 2026: app.1	
5	Darsgärde	Sweden	Ceramic mould fragments	Neck ring	Cult-house milieu?	LBA?	Ambrosiani 1958; 1959	Possible/uncertain
6	Fansta	Sweden	Ceramic mould fragments		Longhouse milieu?	LBA?	Åberg 2013	Possible/uncertain
7	Fullerö	Sweden	Crucible fragment		Cult-house milieu?	LBA	Björck & Appelgren 2006	
8	Håga by	Sweden	Ceramic mould fragments, crucible fragments		Cult-house milieu	LBA	Forsberg & Hjärthner-Holmér 1985; Victor 2007: chapter 7	
9	Hällby	Sweden	Crucible fragments		?	LBA?	Hjärthner-Holmér 1993:80	
10	Kalvshälla	Sweden	Ceramic mould fragments		Cult-house milieu?	LBA	Andersson et al. 2009	
11	Kyrsta	Sweden	Ceramic mould fragments/crucible fragments?		Longhouse milieu	LBA?	Onsten-Molander & Wikborg 2006	Possible/uncertain
12	Kälvesta	Sweden	Ceramic mould fragments, crucible fragments, 1 intact crucible	Neck ring	Cult-house milieu?		Johansson et al. 2011	Possible/uncertain
13	Lilla Härnevi	Sweden	Ceramic mould fragments	Neck ring/hanging vessel?	Longhouse milieu	LBA	Karlenby 1998	
14	Lunda, Lovö	Sweden	Crucible fragments		Cult-house milieu?	LBA?	Petré 1982, 1984b	
15	Molnby	Sweden	Ceramic mould fragments, crucible fragments	Neck ring, spectacle fibula	Cult-house milieu and Longhouse milieu	LBA?	Hed Jakobsson et al. 2021	
16	Nibble	Sweden	Ceramic mould fragments, crucible fragments	Neck ring	Cult-house milieu	LBA	Artusson et al. 2011	
17	Nyvla	Sweden	Crucible fragment?		Cult-house milieu?	LBA	Fagerlund 2012	Possible/uncertain
18	Plaisieren/Vinsta	Sweden	Crucible fragments		Cult-house milieu?	LBA?	Laurén 1969	
19	Rydgårdet	Sweden	Ceramic mould fragments, crucible fragments, bronze melts		Cult-house milieu and Longhouse milieu	MBA-LBA?	Eriksson & Östling 2005; Hjärthner-Holmér et al. eds 2008	
20	Skeke	Sweden	Ceramic mould fragments, crucible fragments	Neck rings, dress pin?	Cult-house milieu	LBA	Larsson ed. 2014	
21	Skuttunge kyrka	Sweden	Ceramic mould fragments	Spectacle fibula?	Longhouse milieu	LBA	Seiler & Östling 2008	
22	Skälby	Sweden	Ceramic mould fragments, crucible fragments	Neck rings, dress pins with disc-shaped heads, belt ornaments, hanging vessels, spectacle fibulas, dagger, sword/dagger?, spearhead?, socketed	Longhouse milieu?	LBA	Oldeberg 1960	

Table 1 – Excavated sites in southern Scandinavia included in this study (see also figure 6). The sites feature clear or possible remains of bronze casting from the Bronze Age. The table summarizes their character, general dating, and object types cast according to mould imprints. For complete references, detailed information about each site and the casting remains recovered, see Sörman, 2018 (appendix 2).

23	Skämsta	Sweden	Crucible fragments			Longhouse milieu?	LBA	Frölund & Larsson 2002	Possible/ uncertain
24	Skölstä	Sweden	Crucible fragments			Longhouse milieu?	LBA?	Lucas & Lucas 2020	Possible/ uncertain
25	Sommaränge skog	Sweden	Crucible fragment			Cult-house milieu	EBA-LBA?	Forsman & Victor 2007	Possible/ uncertain
26	Stenvreten	Sweden	Crucible fragments			?	LBA?	Fagerlund 1994; Fagerlund & Hamilton 1995	Possible/ uncertain
27	Trekanten	Sweden	Ceramic mould fragments			Longhouse milieu	LBA?	Onsten-Molander & Wikborg 2006	Possible/ uncertain
28	Trollbo	Sweden	Ceramic mould fragments			Longhouse milieu	LBA	Åstrand 1998	
29	Vrå	Sweden	Ceramic mould fragments, crucible fragment?	Neck ring/dress pin		Longhouse milieu	LBA	Karlenby ed. 1997; Göthberg et al. eds. 2002	
30	Ärby	Sweden	Ceramic mould fragment?			?	LBA?	Göthberg 1998	Possible/ uncertain
31	Erikslund	Sweden	Crucible fragment			?	LBA?	Hjärthner-Holdar 1993:77	
32	Valby/ Trumslagarbacken	Sweden	Crucible, ceramic mould fragments	EBA tutulus?		Cult-house milieu?	EBA-LBA?	Simonsson 1959; 1966; Oldeberg 1974:241	
33	Bornsön	Sweden	Ceramic mould fragments and one core	Neck ring? Socketed object		Longhouse milieu?	LBA?	Elfstrand 1981; Eklöf 1999	
34	Galtbacken	Sweden	Crucible fragments, ceramic mould fragments?			Cult-house milieu	LBA?	Dunér & Evanni 2003	
35	Hallunda	Sweden	Ceramic mould fragments, core fragments, crucible fragments	Neck rings, socketed axeheads, spearheads, swords, sword/dagger, razor/sickle, double-button		Cult-house milieu	LBA	Vahne 1974; Jaanusson & Vahne 1975; Bennett 1975; Jaanusson et al. 1978; Jaanusson 1981; Riksantikvarieämbetet 1998	
36	Hästhagen/Igelsta	Sweden	Crucible fragment, bronze melt			Cult-house milieu?	LBA?	Elfstrand 1986	
37	Karleby/Gärtuna	Sweden	Crucible fragments, ceramic mould fragments, core fragment			Cult-house milieu?	LBA?	Bennett 1985	
38	Värberg	Sweden	Crucible			Cult-house milieu?	LBA?	Ferenius et al. 2011	Possible/ uncertain
39	Äbruna	Sweden	Crucible fragment, crucible, tuyère?			Cult-house milieu	LBA	Strucke & Holback 2006	
40	Äkra Grindstugan	Sweden	Ceramic mould fragment			Cult-house milieu?	LBA?	Tesch 1975	
Eastern Sweden (except the Mälars valley area)									
41	Västra Bökestad	Sweden	Crucible, ceramic mould	Neck rings. Gold (residue in crucible).		Cult-house milieu	LBA	Helander & Zetterlund 1997	
42	Tallboda	Sweden	Crucible, ceramic mould	Spectacle fibula		Longhouse milieu (but also on adjacent burial ground/cult-house milieu)	LBA (period V)	Äijä, Lindborg & Schönback 1996	
43	Prysgården	Sweden	Ceramic mould, tuyère (see Thrane 2006)			Longhouse milieu	LBA	Borna-Ahlkvist, Lindgren-Hertz & Stålbom 1998	
44	Rambodal	Sweden	Soapstone mould fragment, copper melt	Socketed axehead		Longhouse milieu	LBA (period V-VI)	Nyberg & Nilsson 2012	

Table 1 (continued)

45	Bruatorp	Sweden	Bronze melt			Longhouse milieu	EBA (period II-III)	Dutra Leivas 2001	Possible/uncertain
46	Kölbygårde	Sweden	Crucible fragments			Cult-house milieu	LBA	Ring et al. 2001	
Western Sweden and Norway									
47	Forsandmoen	Norway	Ceramic mould fragments, crucible fragments, soapstone mould	Socketed axehead		Longhouse milieu	LBA	Løken 1986; 1987; 1998; Weiler 1994:120	
48	Gumarstorp	Norway	Ceramic mould fragments, crucible fragments			Cult-house milieu	BA	Wangen 2009	
49	Hunn	Norway	Ceramic mould fragments, crucible fragments, tuyère fragments	Neck rings, spearheads, sword, sword/dagger, belt ornament?, hanging vessel?		Cult-house milieu	BA	Resi 1986; Skre 1998; Melheim 2012:189; chapter 4.1.3.; Melheim et al. 2016	
50	Humlekärr/Lyse	Sweden	Ceramic mould fragments, crucible fragments, intact crucible	Neck ring/dress pin		Cult-house milieu	BA	Särivik et al. 1977	
51	Bokenäs gamla kyrka	Sweden	Crucible fragments, 2 intact crucibles	Large object		Cult-house milieu?	BA	Niklasson 1948	
52	Hjälms	Sweden	Ceramic mould fragments, crucible fragments	Double button, dress pin with disc-shaped head		Cult-house milieu	LBA	Jonsäter 1979	
53	Jorlanda	Sweden	Crucible fragments			Longhouse milieu?	BA	Johansson 1995	
54	Tängen	Sweden	Crucible fragment			Longhouse milieu?	BA	Knutsson 1978; Andersson 2005:124	
55	Kärä	Sweden	Crucible fragments			?	BA	Andersson 2005:124; Ragnesten 2001	
56	Hjälpesten/Kville	Sweden	Crucible fragments			?	BA	Toreld 2018	
57	Röra/Önnered	Sweden	Crucible fragments			?	BA	Andersson 1970; Andersson 2005:118ff	
58	Bratthammar	Sweden	Crucible fragments			Cult-house milieu?	BA	Andersson 1975; Andersson 2005:123	
59	Tanumshede	Sweden	Crucible fragments			Cult-house milieu	LBA	Öbrink 2015:90, 180	
60	Linnomstien	Norway	Crucible fragments			Cult-house milieu?	BA	Engelbretsen 2009; Melheim 2012:225ff	
Southern Sweden and Denmark									
61	Store Tyrrestrup	Denmark	Ceramic mould fragments			Longhouse milieu	EBA	Nilsson 1996, 1997; Jensen 2002:115	
62	Skydstrup	Denmark	Crucible fragments			Longhouse milieu	EBA	Ethelberg 1995, 2000; Jensen 2002:117	
63	Lundbro II	Denmark	Crucible fragments	Sword/dagger		Longhouse milieu	EBA	Kristensen 2015	
64	Vrksund	Denmark	Crucible fragments			Longhouse milieu	EBA	Kristensen 2015	
65	Rosgårde	Denmark	Ceramic mould fragments	Sickle		Longhouse milieu	EBA	Kristensen 2015	
66	Kluborg	Denmark	Crucible fragments			Longhouse milieu	EBA	Kristensen 2015	
67	Elinelund	Sweden	Crucible fragment			Longhouse milieu	EBA	Sarnäs & Nord Paulsson 2001	

Table 1 (continued)

68	Broåsen/Grimeton	Sweden	Ceramic mould fragments, crucible fragments	Neck ring, neck ring/arm ring, spearhead, sword, sword/dagger, tutulus?	Cult-house milieu?	EBA-LBA	Saraau & Alin 1923; Svensson 1940	
69	Fosie IV	Sweden	Ceramic mould fragments, crucible fragments, tuyère fragments		Longhouse milieu	LBA	Björhem & Säfvestad 1993	
70	Brogård	Sweden	Ceramic mould fragments, crucible fragments		Longhouse milieu	BA	Carlie 1992	
71	Årup	Sweden	Crucible fragments		Longhouse milieu	LBA	Hanlon 2003	
72	Yngsjö	Sweden	Crucible fragments, ceramic mould fragments, soapstone mould fragments, bronze melts	Socketed axeheads, dress pin?	Longhouse milieu	LBA	Linderoth 2014	
73	Vä	Sweden	Crucible fragments, ceramic mould fragments, bronze melts	Sword/dagger	Longhouse milieu	EBA-LBA	Helgesson 2012	
74	Degeberga	Sweden	Intact ceramic mould	Socketed chisel	Longhouse milieu	LBA	Björk & Wickberg 2012	
75	Vrangelso	Sweden	Ceramic mould fragments, crucible fragments		Cult-house milieu	EBA-LBA	Ångeby & Lindman 2017	
76	Södra Kristineberg	Sweden	Ceramic mould fragments, crucible fragments	Sword, sword/dagger/spearhead, arm ring/neck ring. Gold (remains in crucible).	?	BA	Höberg ed. 2011	
77	Vindblæs	Denmark	Ceramic mould fragments, crucible fragments	Spearheads			Vestergaard Nielsen 1956	
78	Mølgård, Håg	Denmark	Ceramic mould fragments, crucible fragments	Sword, sword/dagger, spearhead, double-button			Neergaard 1908	
79	Jyderup skov	Denmark	Ceramic mould fragments, crucible fragments				Thrane 1971	
80	Kirkebjerg, Voldtofte	Denmark	Ceramic mould fragments, core fragments, crucible fragments	Bronze lure, sword, spearheads, arm ring, hanging vessel, belt ornament?	?		Jensen 1967; Berglund 1982; Thrane 1975; 1993; Jantzen 2008:391-392	
81	Fragtrup	Denmark	Ceramic mould fragments, crucible fragments, bronze melts	Armring	Longhouse milieu	LBA	Draiby 1985	
82	Brobakken	Denmark	Ceramic mould fragments, crucible fragments, bronze melts	Spearheads, swords, swords/daggers, arm ring, spectacle fibula?	Cult-house milieu	LBA	Mikkelsen 2015	
83	Løgstrup SØ	Denmark	Ceramic mould fragments, crucible fragments		Cult-house milieu	LBA	Larsen et al. 2015	
84	Sandagergård	Denmark	Ceramic mould fragments, crucible fragments		Cult-house milieu	LBA	Kaul 1987	

Table 1 (end)

THE ROLE OF BRONZE CASTING IN LATE BRONZE AGE SOCIETY

The casting at settlements versus cultic sites does not correspond to a functional division between production of domestic objects versus prestige/ritual objects, which has sometimes been proposed (see Levy, 1991; Kristensen, 2015). The picture that emerges is that of a spatial organisation which falls outside of the traditional models, such as centralised workshops versus domestic production in the households. Metalworking in Late Bronze Age southern Scandinavia was practised in two main arenas—long-house contexts and cult-house contexts respectively. The production in these arenas included a variety of objects, where casting of prestigious items is for example evident from both contexts. In the following discussion, I suggest that this production was structured in relation to the clients (i.e. the future owners of the produced objects), and that bronze casting was used as an important strategy in reinforcing the social structure.

The main argument developed throughout this discussion is threefold: 1) in the Late Bronze Age, casting developed into an elaborate, display-like practice, often performed as public rituals; 2) castings were staged and organised differently depending on the meaning and intended user of the manufactured object; 3) many bronzes were attributes of special social identities—primarily within the elite collective. Consequently, the casting of a new object was often motivated by, and linked to, initiations of persons into new roles. Hence, the act of casting not only materialized the physical object, but also shaped the identities, power relations and values which it embodied, and this manufacturing was adapted to various clients rather than redistributed from a centralised workshop. I therefore argue that we need to look beyond hierarchy and also consider heterarchy in craft production.

The arenas of bronze casting and the production as public ritual

Bronze casting was set up in a variety of indoor and outdoor settings; between graves, by cult-houses, in long-houses, at farmyards, or in other communal areas. The archaeological material from southern Scandinavia reveals no efforts to seclude, enclose or physically distance the areas where bronzes were cast, as has sometimes been suggested either for practical reasons of fire-hazard (e.g. Thrane, 2015, p. 124) or due to social and ritual taboos (Goldhahn, 2007). Instead, metalworking often appears in arenas which were visibly accessible, centrally located, or even spectacular. Bronze casting at larger grave- and settlement complexes often appears in central and conspicuous settings, suggesting that production was integrated and visible in the settled arena. We have seen the casting at yards, in houses and at open places in longhouse milieus, in particular from the well-preserved stratigraphy of Apalle. We have seen the plateaus and terraces in front of cult-houses, such as

Hallunda, Åbrunna (fig. 18), Hunn and Ryssgårdet, where casting would have been exposed to the dwelling below. I therefore suggest that casting – the most dramatic event in the bronze-crafting sequence – could be performed as public or semi-public rituals.

Public rituals, performances, spectacles or ceremonies refer to memorable, manifest and strongly formalised rituals which to some extents are performed in front of an audience (DeMarrais, 2014, p. 157, 161). Such events are often important tools in the maintenance and negotiation of social order, by displaying, commenting, exaggerating and objectifying it (DeMarrais, 2014, p. 156; see also Geertz, 1980, p. 104). I suggest that Bronze Age bronze casting correspond to several of the traits that characterise public rituals (La Fontaine, 1986, p. 181–183; Bell 2009 [1997], p. 159–161; Inomata and Corben, 2006; DeMarrais, 2014, p. 161), such as: 1) performed in contexts which permitted, and even guided an audience; 2) evoked powerful sensual experiences that contrasted with everyday life—like the rhythmic sound of bellows, the intense heat and light and the perception of liquid metal; 3) demonstrated impressive and exclusive skills and techniques, which were difficult to reproduce without guided and repeated practice. Bronze Age casting technique thus has properties which readily lend themselves to dramatic displays (see also Molloy and Mödinger, 2020, p. 207). It was thus particularly appropriate for spectacular rites of passage. Anne Maria Dobres has demonstrated that technological gestures are often witnessed by others, and thereby exploited to express or manipulate identities and interests (Dobres, 2000). This seems to have been the case with bronze casting, at least during the Late Bronze Age.

This interpretation calls for an update to the archaeological view on Bronze Age bronze crafting—both regarding visual representations and terminology. More open concepts, such as casting places or casting loci, are better suited to the embedded craft organisation which can be observed through the evidence. In contrast to traditional concepts of (male) specialists working at designated craft areas or workshops, often located in the edge of settlements, I suggest we should envision carefully staged events in settlements and ritual places. These probably featured audiences and onlookers taking part in the event from various distances (fig. 19).

Social projects and the motifs behind various casting events

The highly visible and varied organisation seen in the making of bronze objects can be explained by the social projects and motifs behind different castings. We might begin to observe where production of different bronzes was located and staged, based on identified object types in the recovered moulds (table 1; fig. 20). It should be emphasised that this builds on a very slim material, as only a minority of the casting moulds used in Bronze Age metalwork have survived to our days, and the proportion of those which has readable imprints/negatives are

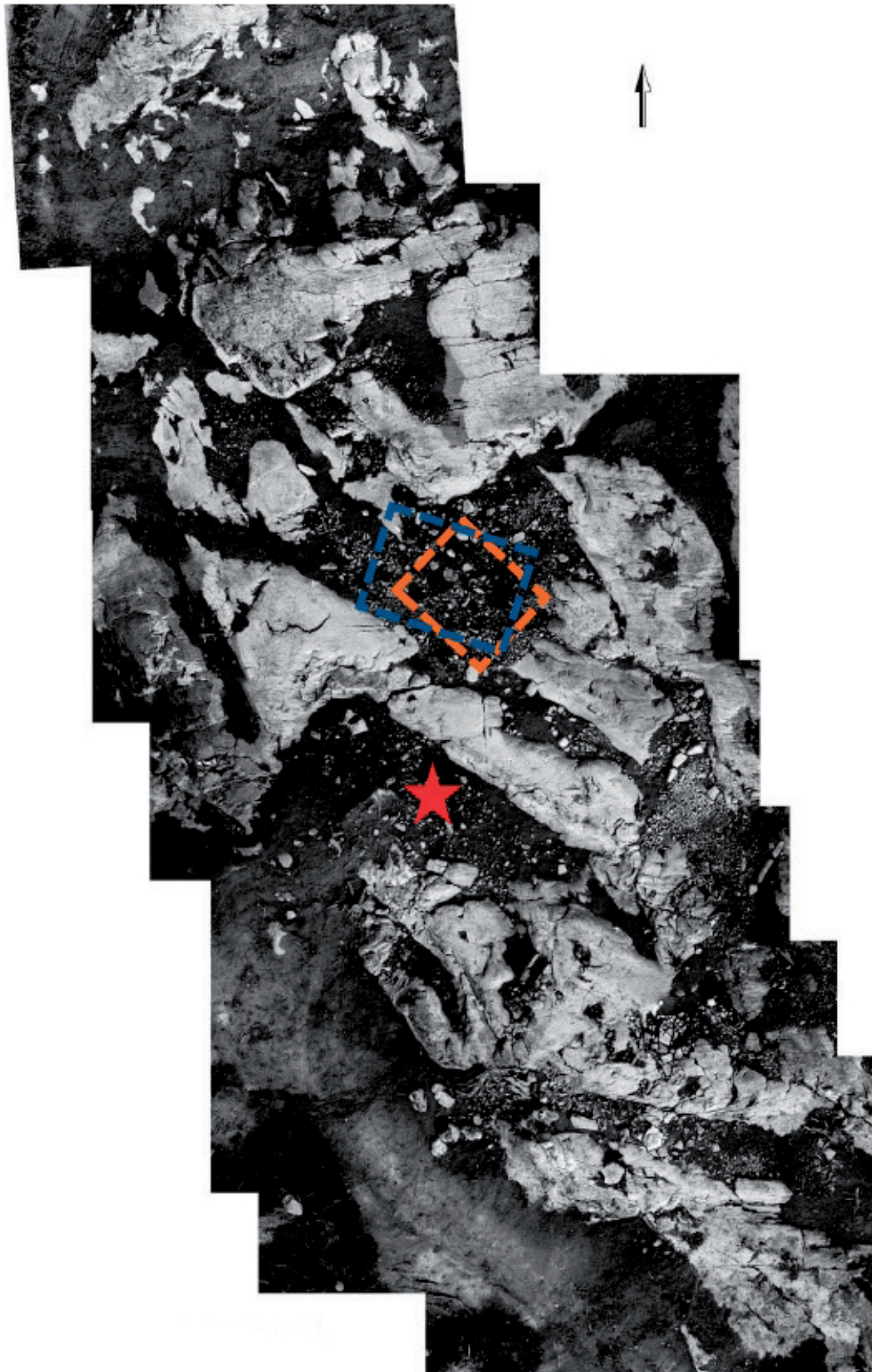


Fig. 18 – Overview of parts of the Åbrunna settlement in Södermanland, eastern Sweden. At this part of the settlement complex the remains of a succession of two small cult-houses (orange and blue rectangles on the photo) were found at the summit of a low rocky moraine hill. The red star marks the finds of casting debris and a possible melting hearth, at a terrace like platform just in front of the house, exposing towards the settlement below (photo: Kjell Olausson. Montage: Ulf Strucke; reworked after U. Strucke and T. Holback, 2006, fig. 28).



Fig. 19 – Interpretative drawing of a bronze casting event at the Late Bronze Age settlement at Pryssgården, Östergötland in eastern Sweden. Interpretation presented by Katarina Botwid, 2017 (drawing: Henning Cedmar-Brandstedt).

even fewer. Nevertheless, they can provide glimpses of object types cast in specific sites (but inversely, absence can never be used as negative evidence). Even though the material is meagre, these finds allow for the formulation of a tentative hypothesis which can be tested against future finds. The available evidence does not cover all known object types; the discussion therefore focuses on socketed tools and personal prestige objects.

The first category—socketed tools—were evidently produced at a wide range of sites and social contexts. The varied production contexts for axes and chisels fit well with the idea that these types of objects were involved in a wide range of social projects, and used by persons of varying social status in the community (Larsson, 1986). Axe production was sometimes staged at the longhouse—perhaps as an important event linked to the establishment of a new household (see Apalle; Ullén ed. 2003, and Yngsjö; Linderöth, 2014). Sometimes axes were produced at cult-houses in the same arenas where the production of weapons has also been testified (see Hallunda; Vahlne, 1974 and Brobakken; Mikkelsen, 2015). These axes were perhaps intended as combined tools-weapons to be carried as an individual possession by warriors or other persons, as known from rock art and other finds. Finally, socketed axes and chisels were sometimes produced at single farms, as demonstrated by finds at Degeberga and Rambodal (Björk and Wickberg, 2011; Nyberg and Nilsson, 2012). I suggest that these castings were performed by specialist crafters from larger settlements, who came to satellite farms to provide a new tool for these farms. This was most likely an important event for the household. Such a production event probably—like the axe itself—also manifested the household’s kinship identity, power relations and political dependency.

The production of prestige goods was also staged in several arenas (table 1). The prestige objects will here be divided into two loosely separated groups: prestige objects as personal attributes (the more common: dress pins, neck- and arm-rings, knives, razors or ‘razor sets’) and prestige objects as symbols of power (the more exclusive: spectacle-shaped fibulas, large belt elements for female ceremonial costume, large weapons). The evidence suggests that large belt elements and possibly dress pins were primarily manufactured within the longhouse arena (table 1). Well-identified moulds for spectacle fibulas are known from both longhouse and cult-house milieus, as shown by examples such as Tallboda; Äijä, et al. 1996, and Brobakken; Mikkelsen, 2015 (fig. 20; table 1). Weapons and possibly tools for ‘razor kits’, however, were more commonly (but not exclusively) cast in cult-house contexts (see e.g. Ryssgårdet; Hjärthner-Holtdar et al. eds, 2008, Hallunda; Vahlne, 1974 and Brobakken; Mikkelsen, 2015). Neck-rings and socketed axes were cast in both arenas (table 1). Considering the roles of these objects in male and female elite costumes and equipment, as demonstrated through the Early Bronze Age burial record where notably full-length swords and large belt ornaments are mutually exclusive (e.g. Bergerbrant, 2007, p. 8), this suggests a gender-based division for parts of the production. This tendency concerns the most prestigious objects—those acting as symbols of power, and having strong continuity in form and function throughout the Early to the Late Bronze Age. Following the argument about the public display-like character of the casting events presented above, I suggest that this pattern could mirror a practice whereby leaders and specialists within various elite domains/social institutions, sometimes also linked to female and male roles, received their insignia under different circumstances.

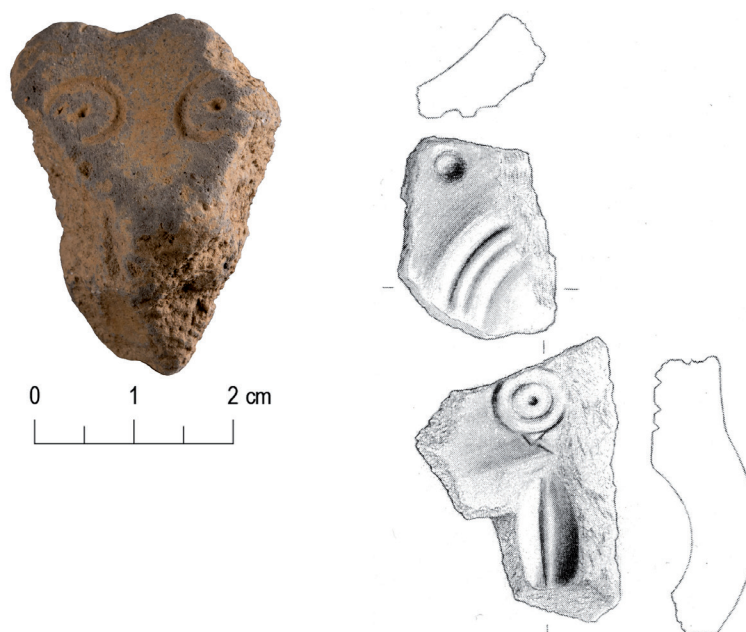


Fig. 20 – Mould fragments with identifiable imprints for spectacle fibulas. To the left: a fragment found in the vicinity of a stone-foundation type cult-house at the grave and settlement complex at Molnby, Uppland, Sweden (Hed Jakobsson et al., 2021; photo: Stefan Gustafsson, Arkeologikonsult AB); to the right: fragments found in a pit at the yard of a longhouse in grave and settlement complex at Tallboda, Östergötland, Sweden (Äijä, et al. 1996, here: fig. 13; drawing: Anders Eide).

The use of bronzes in costumes, and as symbolic personal attributes, implies that they had an important role in constructing various gendered power identities. The grand size and spectacular design of these attributes also indicate that such identities were often communicative and public in nature (Sørensen, 1997). This role as public markers of status and gender thus also seems to have structured their production. Castings of such objects were probably performed at a public scale, as indicated by the location of casting debris in these large settlement contexts. As suggested by Anne Lene Melheim and colleagues (2016), large cultic sites and associated settlements were probably used for assemblies for funerary ceremonies, but also trade and crafting. I suggest that some of these crafting events formed part of passage rituals where individuals within the elite collective entered into new roles, in ceremonies witnessed by the community. Examples of crafting taking place as part of communal ceremonies of this type are known from ethnographic literature, for example in the historical chiefdoms of BoCongo, where the chiefly insignia, in the form of highly symbolic iron bracelets, were produced as part of the inauguration rituals (e.g. Herbert, 1984, chapter 10 and 1993, p. 132; Blakely, 2006, p. 163, 166–167). From a contemporary Western horizon, it could be compared to a situation where wedding rings were to be cast during marriage ceremonies.

Hierarchy and heterarchy in the organisation of metalworking

The interpretation presented here implies that castings should probably be understood as an effective form of

political ritual, wherein power relations and claims were manifested and physically transformed. Gatherings, feasts and political rituals that surrounded such passage rites seem to have taken place at the larger grave and settlement complexes of local leading households—in the cult and funerary arenas or longhouse milieus. Thus, no production was carried out in spheres outside of the households, at special assembly sites or regional centres such as hill-forts or in centralised workshops (see also Levy, 1991). These results are in line with recent interpretations of metalworking in Late Bronze Age northern Europe as ‘embedded in the life of regular settlements’ (Molloy and Mödler, 2020, p. 221–222). However, the Scandinavian data also underlines the variation in how craft was staged within settlements, illustrated for example by the fact that Nordic Late Bronze Age settlements may also include important ritual arenas. Taken together, this craft production has greater similarities with the ceremonial production in communal rituals of small-scale societies (e.g. Spielmann, 1998 and 2002; Carter, 2007; Nikolaidou, 2007), than with centralized workshop production in chiefdoms, palace economies or early states.

Inspiration for this diversified craft production in Nordic Bronze Age households can be drawn from the concept of heterarchical societal structure, signifying a society characterised by several, parallel arenas for exerting power and multiple sources for social prestige (Crumley, 1979; Levy, 1995). Specialised craft in heterarchical societies is, as pointed out by Elizabeth DeMarrais, generally organised on a household basis, and tied to several different clients rather than centralised production for a united elite (DeMarrais, 2013). The variation in the craft organisation

in Late Bronze Age southern Scandinavia and its adaptation to future owners of the produced objects has here been interpreted as a production oriented towards the clients. Rather than special workshop areas organised around the metalworker, the metalworkers seem to have arranged their craft around their clients—clients did not seek out the workshop of the smith; the smith came to them. The heterarchical structure would fit well with such a model.

How did this heterarchical production for a varied group of social elites relate to the small-scale production of tools at smaller, single-farms? In what sense was production also politically hierarchical in the Late Bronze Age? I agree with the position that small-scale production at smaller farms was probably dependent on skilled craftworkers from the larger settlements (e.g. Björhem and Magnusson Staaf, 2006, p. 166), rather than independently carried out by ‘amateur’ casters (e.g. Nilsson, 2011; Earle et al., 2022). There are three important arguments that support this view. Firstly, regardless of how ‘simple’ objects were to be cast, investment in specialised equipment such as moulds, crucibles, bellows and tools would still be needed. Even in cases where the axe was cast in a ‘ready-made’ stone mould, like the small farm in Rambodal, this would require a ceramic core with casting channels, which is technically challenging. Secondly, casting is dependent on experience and practical skill, which seems difficult to sustain based on such a small-scale and irregular production of tools for household needs. Thirdly, the ritualised forms of casting prestige objects speak against a parallel amateur production: if bronze casting was exploited as an important public ritual for manifesting the positions of important social institutions, it is difficult to envision this being compatible with bronze casting carried out anywhere by anyone. If these castings, as I argue, were made by specialist crafters who came to smaller satellite farms to provide a new tool, this was probably an important occasion where the production event probably—like the axe itself—manifested the household’s kinship identity, power relations and political dependency.

The picture that emerges is that of a craft organised for and by the users, either by metalworkers visiting their households, or by setting up production in the grave and settlement complexes where they lived. Another indication that speaks for a joint craft collective, rather than several different levels of smiths, is the homogenous quality and similar methods in casting technology and technical ceramics over the Nordic Bronze Age area (Jantzen, 2008; Melheim, 2012; see also Sahlén, 2011). We can thereby talk of a hierarchical organisation, which to some degree confirms previous models of a more widespread production of tools in smaller households. At the same time, the material from these Scandinavian sites have also opened new windows into this production, suggesting a heterarchical organisation for important social institutions in society. The proposed organisation is visualised below in a diagram (fig. 21). This model can hopefully provide a useful hypothesis against which new casting sites can be tested in future excavations and research work.

CONCLUSIONS AND FINAL REFLECTIONS

The bronze crafting tradition in southern Scandinavia began as advanced but small-scale production in the Early Bronze Age. Known evidence from period I–II is so far limited to Denmark and southern Sweden. In this early phase, casting was performed in longhouses in settlements. Casting often appears in exceptionally large longhouses. Whether the connection to certain houses reflects monopolization by elite households, or crafting in shared, public buildings, is not yet clear, but a high degree of elite control seems plausible. Since casting was performed indoors it probably involved a rather limited number of people, such as an extended family or selected inhabitants and guests, rather than large audiences. This production thus seems to have been an affair concerning the household and its allies. The data from the earlier periods are less well-known, and this picture might change in the future.

From period III onwards and during the Late Bronze Age, bronze-working became more widespread and covered a much wider range of object types. Weapons, ritual paraphernalia, personal ornaments and dress attributes were now produced at grave and settlement complexes within all regions of southern Scandinavia. However, there are no signs of specialized production centres or centralised workshops. Rather than spatial and political monopolization by a centralized elite group, all production can, I argue, be considered household production. In larger households it was practised in two main arenas – longhouse contexts and cult-house contexts respectively. In the Late Bronze Age, the manufacturing of bronze objects occurred in households at various levels (hierarchy) and in various spheres within these households (heterarchy). This range seems to cover production in households with ritual or clan leaders, production in competing or collaborating households with various roles in the elite, and small-scale production in single households dependent on expert crafters from kin or allies.

The results of this study clarify the position of metalworking in physical and social space, which was previously hypothesized from finished objects and (neo-evolutionist) anthropological notions of specialized crafting in chiefdoms. The study demonstrates that bronze casting played an active and communicative role in social reproduction during the Late Bronze Age. This elaborate, socially meaningful and ritualised organisation of crafting contrasts with the specialised craft production in the form of workshops or attached specialists traditionally emphasized in Bronze Age research. The inconspicuous traces from the casting provide windows onto a different way of making and perceiving objects in small-scale communities.

Finally, some points of wider interest for craft studies can perhaps also be drawn from the Scandinavian data. The first point concerns approaching sites with metalworking, where there has been a tendency to categorise sites as ‘production units’ with either high or low status/

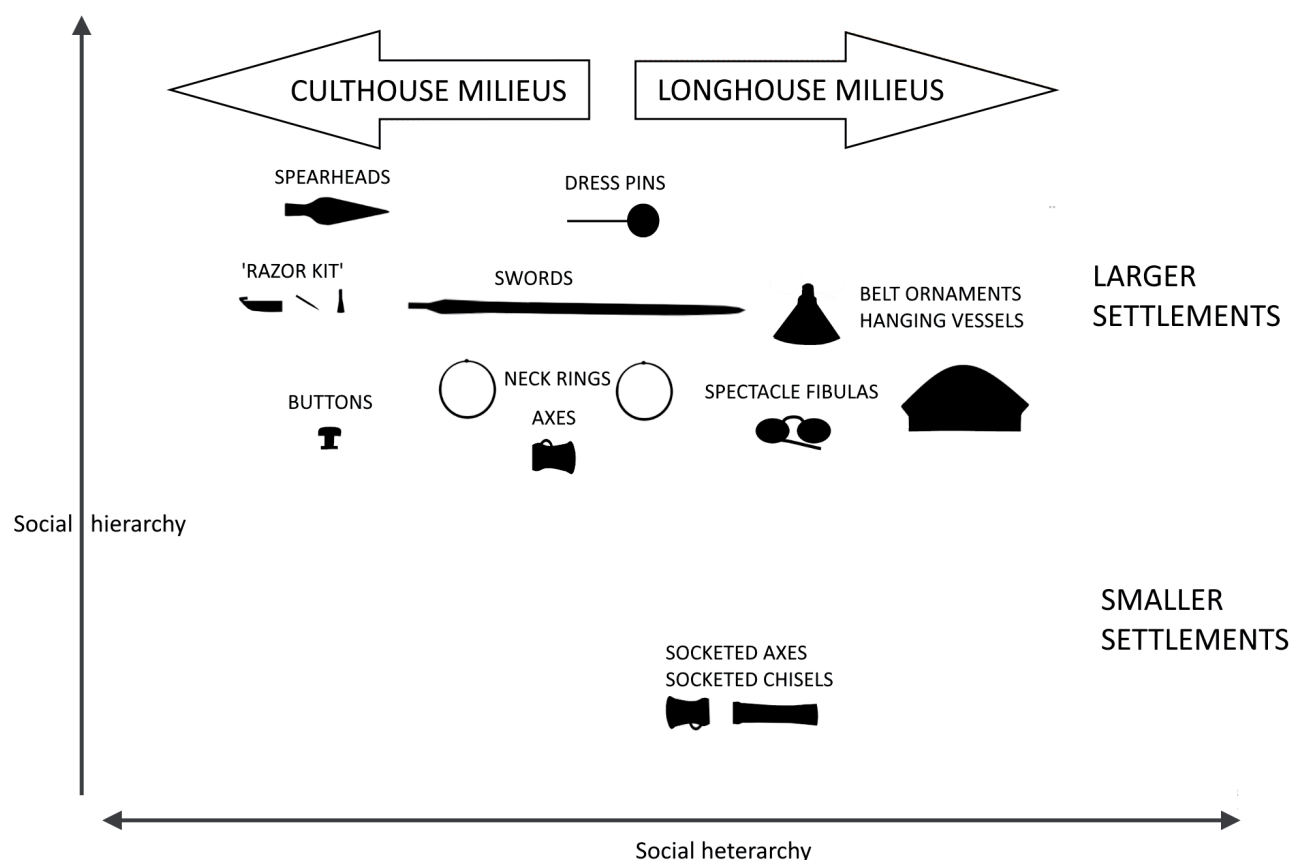


Fig. 21 – Model for the spatial and social organisation of casting bronze objects in the Late Bronze Age of southern Scandinavia. The tendencies of spatial and social differentiation (heterarchy) is shown on the X axis. The tendencies of differentiation in power is shown on the Y axis (hierarchy). The illustrated object types hint at a production where important items were produced in different places and under different circumstances, but it should be emphasised that it builds on very few surviving imprints of cast objects in mould fragments from excavated sites, and presents a more speculative aspect of this model – to be tested and adjusted as new finds emerge in the future (illustration by the author).

capacity, while the inner dynamic at these sites may remain obscure. The Scandinavian examples underline that spatial arrangements within sites holds great potential to inform about the social position of the craft. As Barry Molloy and Marianne Mödler recently stated: “Find contexts are a good indicator of the degree to which metalworking was integral to, and, we may argue, visible within societies” (Molloy and Mödler, 2020, p. 193). The second point concerns terminology, notably the notion of workshops when examining the organisation of specialised craft. This is a figure of thought that tend to bring about certain expectations (permanency, seclusion, one place hosting the full *chaîne opératoire*), that might hinder the observation of other forms of organising craft production in small-scale societies (Sörman, 2017; Costin, 2020). The specialised craft, even in chiefdoms, might not look as we have expected, and the terminology we employ should be open enough to allow for the data to surprise us.

Acknowledgements: This paper is based on my PhD research, carried out at Stockholm University 2012–2018.

It was made possible first and foremost thanks to a public-funded employment, then followed by a number of scholarships for which I am very grateful; from the Torsten Söderberg Foundation, the Johan & Jakob Söderberg Foundation, the Olle Engkvist Byggmästare Foundation, Lenart J. Hägglund Foundation for Archaeological Research and Education, the Helge Ax:son Jonson foundation and the Research Council of the Societas Archaeologica Upsalien-sis. I want to thank my supervisors for assisting me during various phases of this PhD project; Anders Andrén, Johan Ling and Alison Klevnäs. I would also like to extend my gratitude to the organisers of the DEWA meeting for the invitation to participate at this stimulating conference and for the chance to present my research, and a special thanks to Marilou Nordez for her encouragement. This gave me the opportunity to finally accomplish the task, long overdue, of publishing the results of this study in English.

Supplementary material: The full data-set included in the study underlying this article was published in my thesis (Sörman, 2018) in Swedish.

BIBLIOGRAPHICAL REFERENCES

- ÄNGEBY G., LINDMAN G. (2017) – *De synliga skeppsgravarna vid Vrangelsro: gravfält från bronsålder och boplatslämnningar från sten-, brons- och järnålder. Hallands län, Halland, Halmstads kommun, Övraby socken, Vrangelsro 5:5, Övraby 87. Mölndal, Arkeologerna, SHM (Rapport 2017:141), 244 p.*
- ARTURSSON M. (2009) – *Bebyggelse och samhällsstruktur: södra och mellersta Skandinavien under senneolitikum och bronsålder 2300-500 f. Kr.*, Göteborg, Göteborgs universitet, 245 p.
- ARTURSSON M., KARLENBY L., LARSSON F., eds. (2011) – *Nibble: en bronsåldersmiljö i Uppland. Särskild undersökning, 2007: E18 sträckan Sagån-Enköping: Uppland, Tillinge socken, Tillinge-Nibble 1:9 & Tillinge-Mälby 5:1.* [Sverige], Riksantikvarieämbetet (UV Rapport 2011:111.), 599 p.
- ÄIJÄ K., LINDBORG H., SCHÖNBÄCK M. (1996) – *Tallboda: RAÄ 16, 18, 258, 269, 270: Rystad socken, Östergötland, Linköping, Riksantikvarieämbetet (UV Linköping Rapportserie, 1996:46), 201 p.*
- BAUDOU E. (1960) – *Die regionale und chronologische Einteilung der jüngeren Bronzezeit im Nordischen Kreis*, Stockholm, Almqvist & Wiksell (Studies in North-European archaeology, 1), 338 p.
- BELL C. (2009 [1997]) – *Ritual: perspectives and dimensions*, Oxford, Oxford University Press, 351 p.
- BERGERBRANT S. (2007) – *Bronze Age identities: costume, conflict and contact in Northern Europe 1600-1300 BC*, Lindome, Bricoleur Press (Stockholm Studies in Archaeology, 43), 232 p.
- BJÖRHEM N., MAGNUSSON STAAF B. (2006) – *Långhuslandskapet: en studie av bebyggelse och samhälle från stenålder till järnålder*, Malmö, Malmö kulturmiljö (Malmöfynd; 8), 318 p.
- BJÖRHEM N., SÄFVESTAD U. (1993) – *Fosie IV. Bebyggelsen under brons- och järnålder*, Malmö, Malmö Museer (Malmöfynd, 6), 408 p.
- BJÖRK T. (2007) – Kring förfädernas bopålar: om bronsålderns och den äldre järnålderns bosättningar i Västland, in M. Artursson (ed.), *Vägar till Västland: en bronsåldersbygd i nordöstra Skåne 2300-500 f. Kr.*, Stockholm, Riksantikvarieämbetet p. 25-61.
- BJÖRK T., WICKBERG Y. (2011) – *Degeberga 26:3, Degeberga sn. Arkeologisk undersökning 2011*, Kristianstad, Sydsvensk arkeologi (Rapport 2012:20), 54 p.
- BLAKELY S. (2006) – *Myth, Ritual, and Metallurgy in Ancient Greece and Recent Africa*, Cambridge, Cambridge University Press, 328 p.
- BODDUM S., MIKKELSEN M., TERKILDSEN N., eds. (2012) – *Bebyggelsen i yngre bronsålders lokale kulturlandskab: Seminarrapport fra seminaret „Bebyggelsen i yngre bronsålders lokale kulturlandskab“ afholdt i Holstebro, 10. marts 2011*, Viborg, Viborg Museum and Holstebro, Holstebro Museum (Yngre bronsålders kulturlandskab, 2), 160 p.
- BODDUM S., MIKKELSEN M., TERKILDSEN N., eds. (2015) – *Bronzestøbning i yngre bronsålders lokale kulturlandskab: seminarrapport fra seminaret „Bronzestøbning i yngre bronsålders lokale kulturlandskab“ afholdt i Viborg, 6. marts 2014*, Viborg, Viborg Museum and Holstebro, Holstebro Museum (Yngre bronsålders kulturlandskab, 5), 140 p.
- BOTWID K. (2017) – *Understanding Bronze Age Life: Pryssgården (LBA) in Sweden from an Artisanal Perspective*, Lund, Lunds universitet, (Report series / Institute of Archaeology, 102), 161 p.
- BORSSON T., ERIKSSON T. (2011) – Keramik – krukor och serviser, in M. Artursson, L. Karlenby and F. Larsson (eds.), *Nibble: en bronsåldersmiljö i Uppland*, [Sweden], Riksantikvarieämbetet (UV Rapport 2011:111.), p. 427-444.
- BRÜCK J. (2001) – Body Metaphors and Technologies: Transformation in the English Middle and Late Bronze Age, in J. Brück (ed.), *Bronze Age landscapes: tradition and transformation*, Oxford, Oxbow, p. 149-160.
- BUDD P., TAYLOR T. (1995) – The Farie Smith Meets the Bronze Industry: Magic versus Science in the Interpretation of Prehistoric Metal-making, *World Archaeology*, 27, 1, p. 133-143.
- CARLIE A. (2004) – *Forntida byggnadskult: tradition och regionalitet i södra Skandinavien*, Stockholm, Riksantikvarieämbetet (RAÄ Arkeologiska undersökningar, Skrifter 57), 366 p.
- CARTER T. (2007) – The Theatrics of Technology: Consuming Obsidian in the Early Cycladic Burial Arena, *Archaeological papers of the American Anthropological Association*, 17, 1, p. 88-107.
- COLES J., HARDING A. (1979) – *The Bronze Age in Europe: An Introduction to the Prehistory of Europe c. 2000-700 BC*. London, Methuen & Co Ltd., 581 p.
- COSTIN C. L. (2001) – Craft Production Systems, in G. M. Feinman and D. T. Price (eds.) *Archaeology at the Millennium: A Sourcebook*, New York, Kluwer Academic/Plenum Publishers, p. 273-327.
- COSTIN C. L. (2020) – What is a Workshop?, in A. K. Hodgkinson and C. Lelek Tvetmarken (eds.), *Approaches to the Analysis of Production Activity at Archaeological Sites*, Oxford, Archaeopress, p. 177-197.
- CRUMLEY C. L. (1979) – Three location models: an epistemological assessment for anthropology and archaeology, in M. Schiffer (ed.), *Advances in Archaeological Method and Theory*, New York, Academic Press, , vol 2, p. 141-173.
- DEMARRAIS E. (2013) – Understanding Heterarchy: Crafting and Social Projects in Pre-Hispanic Northwest Argentina, *Cambridge Archaeological Journal*, 23, 3, p. 345-362.
- DEMARRAIS E. (2014) – Introduction: The archaeology of performance, *World Archaeology*, 46, 2, p. 155-163.
- DOBRES A.M. (2000) – *Technology and social agency: outlining a practice framework for archaeology*, Oxford, Blackwell, 300 p.
- DRAIBY B. (1985) – Fragtrup – en boplads fra yngre bronsalder i Vesthimmerland, *Aarbøger for Nordisk Oldkyndighed og Historie*, 1984, p. 127-216.

- DUTRA LEIVAS I. (2001) – *Bruatorp: ett långhus från äldre bronsålder, Söderåkra socken, Småland*, Kalmar, Kalmar länsmuseum (E22-projektet/Arkeologiska rapporter 2001:3), 128 p.
- EARLE T. K. (1981) – Comment on P. Rice, Evolution of specialized pottery production: a trial model, *Current Anthropology*, 22, p. 230–231.
- EARLE T. K. (1997) – *How Chiefs Come to Power: The Political Economy in Prehistory*, Stanford, Stanford University Press, 250 p.
- EARLE T. K., KRISTIANSEN K., eds. (2010) – *Organizing Bronze age societies: the Mediterranean, Central Europe, and Scandinavia compared*, Cambridge, Cambridge University Press, 303 p.
- EARLE T. K., HAACK OLSEN A.-L., VALENTIN ERIKSEN B., STEEN HENRIKSEN P., KJÆR KRISTENSEN I. (2022) – Everyday Life at Bjerre Site 7, a Late Bronze Age House in Thy, Denmark, *European Journal of Archaeology*, 25, 3, p. 372–395.
- ERIKSSON T. (2003) – Gjuterifyndet i Apalle, in I. Ullén (ed.), *Arkeologi på väg: undersökningar för E18. Bronsåldersboplatsen vid Apalle i Uppland: Uppland, Övergrans socken, Apalle RAÄ 260*, Stockholm, Riksantikvarieämbetet (UV Uppsala Rapport 1997:64), p. 129–146.
- ERIKSSON T. (2008) – Krukor och serviser, in E. Hjärthner-Holdar, T. Eriksson & A. Östling (eds) *Mellan himmel och jord. Ryssgärdet, en guldskimrande bronsåldersmiljö i centrala Uppland*, Uppsala, Riksantikvarieämbetet (Arkeologi E4 Uppland – studier, 5), p. 273–308.
- ERIKSSON T., GRANDIN L. (2008) – Brons – den gyllene metallen, in E. Hjärthner-Holdar, T. Eriksson and A. Östling (eds.), *Mellan himmel och jord. Ryssgärdet, en guldskimrande bronsåldersmiljö i centrala Uppland*, Uppsala, Riksantikvarieämbetet (Arkeologi E4 Uppland – studier, 5), p. 325–369.
- ERIKSSON T., ÖSTLING A. (2005) – *Ryssgärdet i Onslunda: ett fornlämningskomplex från senneolitikum till och med 1700-talet med tyngdpunkt i bronsålder: väg E4, sträckan Uppsala-Mehedeby: Uppland, Tensta socken, Onslunda 5:1 och 3:1, RAÄ 435: arkeologisk undersökning*, Uppsala, Riksantikvarieämbetet, 134 p.
- ETHELBERG P. (1995) – Den fjerde kæmpehal, *Skalk*, 1995, 3, p. 11–15.
- ETHELBERG P. (2000) – Højhuset ved Skydstrup, in S. Hvass (ed.), *Vor skjulte kulturarv: arkæologien under overfladen: til Hendes Majestæt Dronning Margrethe II 16 april 2000*, København, Det konglige nordiske oldskriftselskab and Jysk arkæologisk selskab. p. 70–71.
- FRÖLUND P., SCHÜTZ B., eds. (2007) – *Bebyggelse och bronsgjutare i Bredåker och Gamla Uppsala: arkeologisk undersökning, fornlämning 134, 596 & 599, Uppsala socken, Uppland*, Uppsala, Upplandsmuseet, 362 p.
- GEERTZ C. (1980) – *Negara: The Theatre State in Nineteenth Century Bali*, New Jersey, Princeton University Press, 295 p.
- GELL A. (1998) – *Art and Agency: An Anthropological Theory*, Oxford, Clarendon Press, 271 p.
- GOLDHAHN J. (2007) – Dödens hand – en essä om brons- och hållsmed, in J. Goldhahn and T. Østgård (eds.), *Rituelle specialister i brons- og jernalderen*, Göteborg, Göteborgs universitet (GOTARC Serie C Arkeologiska Skrifter, 65), 373 p.
- GOLDHAHN J. (2013) – Rethinking Bronze Age Cosmology: A North European Perspective, in H. Fokkens & A. Harding (eds), *The Oxford Handbook of the European Bronze Age*, Oxford, Oxford University Press, p. 248–266.
- HAYDEN B. (1998) – Practical and Prestige Technologies: The Evolution of Material Systems, *Journal of Archaeological Method and Theory*, 5, 1, p. 1–55.
- HED JAKOBSSON A., HJULSTRÖM B., LAGERSTEDT A. (2021) – *Molnby i Vallentunas utkant: bosättare, stenröjare och torpare: arkeologisk undersökning av lämningar från äldre bronsålder till 1800-talet inom fastigheten Molnby 1:5, Vallentuna socken och kommun, Stockholms län* [vol. 2], Upplands Väsby, Arkeologikonsult AB (Rapporter från Arkeologikonsult, 2021:2996), 988 p.
- HELMS M. (1993) – *Craft and the Kingly Ideal: Art, Trade, and Power*, Austin, University of Texas Press, 287 p.
- HERBERT E. W. (1984) – *Red Gold of Africa: Copper in Precolonial History and Culture*, Madison & London, The University of Wisconsin Press, 413 p.
- HERBERT E. W. (1993) – *Iron, Gender, and Power: Rituals of Transformation in African Societies*, Bloomington and Indianapolis, Indiana University Press, 277 p.
- HERNER E. (1987) – *Profession med tradition: teknisk-kvalitativ analys av den äldre bronsålderns spiralornamentik, dess central- och lokalproduktion*, Stockholm, Almqvist & Wiksell International, 271 p.
- HJÄRTHNER-HOLDAR E. (1993) – *Järnets och järnmetallurgins introduktion i Sverige*, Uppsala, Uppsala universitet (Aun, 16), 206 p.
- HJÄRTHNER-HOLDAR E., ERIKSSON T., ÖSTLING A. (eds) (2008) – *Mellan himmel och jord: Ryssgärdet, en guldskimrande bronsåldersmiljö i centrala Uppland*, Uppsala, Riksantikvarieämbetet (Arkeologi E4 Uppland – studier, 5), 555 p.
- INOMATA T., CORBEN L. S. (2006) – *Archaeology of Performance: Theaters of Power, Community and Politics*, Lanham, AltaMira Press, 339 p.
- JAANUSSON H. (1981) – *Hallunda: A Study of Pottery from a Late Bronze Age Settlement in Central Sweden*, Stockholm, Statens Historiska Museum, 140 p.
- JAANUSSON H., VAHLNE G. (1975) – *Arkeologisk undersökning 1969-71: Hallunda, Botkyrka sn, Södermanland, del II: fornlämning 13, boplats*, Stockholm, Riksantikvarieämbetet, 200 p.
- JANTZEN D. (2008) – *Quellen zur Metallverarbeitung im Nordischen Kreis der Bronzezeit*, Stuttgart, Steiner (Prähistorische Bronzefunde Abteilung XIX, 2), 466 p.
- JENSEN B. (1956) – *En bronzestøbers værkstadsplads: et beretning om undersøgelse af et bronzealders kulturlag*, Løgstør, Løgstør Bogtrykkeri, 27 p.
- JENSEN J. (1997) – *Fra bronze- til jernalder: en kronologisk undersøgelse*, København: Det Kongelige Nordiske Oldskriftselskab, 423 p.
- JENSEN J. (2002) – *Danmarks oldtid [Vol. 2] Bronzealder 2000-500 f. Kr.*, København, Gyldendal, 611 p.

- KARLENBY L. (2008a) – Senneolitikum och äldre bronsålder i Skandinavien – eller? Arkeologisk periodindelning och förhistorisk verklighet, in E. Hjärthner-Holdar, T. Eriksson and A. Östling (eds.), *Mellan himmel och jord: Ryssgårdet, en guldskimrande bronsåldersmiljö i centrala Uppland*, Uppsala, Riksantikvarieämbetet (Arkeologi E4 Uppland – studier, 5), p. 63–71.
- KARLENBY L. (2008b) – Hus och hem. Bebyggelsen på Ryssgårdet, in E. Hjärthner-Holdar, T. Eriksson and A. Östling (eds.), *Mellan himmel och jord: Ryssgårdet, en guldskimrande bronsåldersmiljö i centrala Uppland*, Uppsala, Riksantikvarieämbetet (Arkeologi E4 Uppland – studier, 5), p. 73–130.
- KARLENBY L. (2011) – *Stenbärarna: kult och rituell praktik i skandinavisk bronsålder*, Uppsala, Uppsala universitet (Occasional papers in archaeology; 55), 308 p.
- KAUL F. (1987) – Sandagergård. A Late Bronze Age Cultic Building with Rock Engravings and Menhirs from Northern Zealand, Denmark, *Acta Archaeologica* 56, p. 31–54.
- KAUL F. (1998) – *Ships on Bronzes: A Study in Bronze Age Religion and Iconography*, Copenhagen, National Museum, 295 + 168 p.
- KAUL F. (2006) – Kulthuset ved Sandagergård og andre kulthuse – betydning og tolkning, in M. Anglert, M. Artursson and F. Svanberg (eds.), *Kulthus & dødshus: det ritualiserade rummets teori och praktik*, Stockholm, Riksantikvarieämbetet, p. 99–112.
- KRISTENSEN I. K. (2015) – Spor efter bronzehåndværk i Salling og Fjends, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds.), *Bronzestøbning i yngre bronzealders lokale kulturlandskab: seminarrapport fra seminaret "Bronzestøbning i yngre bronzealders lokale kulturlandskab" afholdt i Viborg, 6. Marts 2014*, Viborg, Viborg Museum and Holstebro, Holstebro Museum, p. 107–119.
- KRISTIANSEN K. (1987) – From Stone to Bronze - The Evolution of Social Complexity in Northern Europe, 2300-1200 BC, in E.M. Brumfiel & T.K. Earle (eds), *Specialization, exchange, and complex societies*, Cambridge, Cambridge University Press, p. 30-51.
- KRISTIANSEN K. (1998) – *Europe Before History*, Cambridge, Cambridge University Press (New studies in archaeology, 7), 505 p.
- KRISTIANSEN K., LARSSON T. B. (2005) – *The Rise of Bronze Age Society: Travels, Transmissions and Transformations*, Cambridge, Cambridge University Press, 449 p.
- KUIJPERS M. H. G. (2008) – *Bronze Age Metalworking in the Netherlands (c. 2000-800 BC). A Search into the Preservation of Metallurgy Related Artefacts and the Social Position of the Smith*, Leiden, Sidestone Press, 171 p.
- KUIJPERS M. H. G. (2013) – The Sound of Fire, the Taste of Copper, Feel of Bronze, and Colors of the Cast: Sensory Aspects of Metalworking Technology, in M.L.S. Sørensen & K. Rebay-Salisbury (eds), *Embodied Knowledge: Historical Perspectives on Belief and Technology*, [e-book], Oxbow, p. 137-150.
- LA FONTAINE J. S. (1986) – *Initiation*, Manchester, Manchester University Press (Themes in Social Anthropology), 208 p.
- LARSSON T. B. (1986) – *The Bronze Age Metalwork in southern Sweden: Aspects of Social and Spatial Organization 1800-500 B.C.* Umeå, Umeå universitet, 200 p.
- LEVY J. E. (1982) – *Social and Religious Organization in Bronze Age Denmark: An Analysis of Ritual Hoard Finds*, Oxford, BAR (International series, 124), 171 p.
- LEVY J. E. (1991) – Metalworking Technology and Craft Specialization in Bronze Age Denmark, *Archaeomaterials*, 5, 1, p. 55-74.
- LEVY J. E. (1995) – Heterarchy in Bronze Age Denmark: Settlement Pattern, Gender, and Ritual, *Archaeological Papers of the American Anthropological Association*, 6, 1, p. 41–53.
- LINDEROTH T. (2014) – *Yngsjö 219:351: fornlämnning 166 och 167 Åhus socken, Kristianstad kommun, Skåne län*, Kristianstad, Sydsvensk arkeologi AB (Rapport 2014:18), 160 p.
- LING J., HJÄRTHNER-HOLDAR E., GRANDIN L., BILLSTRÖM K., PERSSON P.-O. (2013) – Moving metals or indigenous mining? Provenancing Scandinavian Bronze Age artefacts by lead isotopes and trace elements, *Journal of Archaeological Science*, 40, January 2013, p. 291–304.
- LING J., STOS-GALE Z., GRANDIN L., BILLSTRÖM K., HJÄRTHNER-HOLDAR E., PERSSON P.-O. (2014) – Moving Metals II: Provenancing Scandinavian Bronze Age Artefacts by Lead Isotope and Elemental Analyses, *Journal of Archaeological Science*, 41, January 2014, p. 106–132.
- MATTES J. (2008) – *Frühe Kultbauten - Fakt oder Fiktion? Studien zur Arkäologie sakraler Plätze in Südsandinavien*, Uppsala, Uppsala universitet (Aun; 38), 511 p.
- MELHEIM A. L. (2012) – *Recycling Ideas: Bronze Age Metal Production in Southern Norway*, doctoral thesis, University of Oslo, 484 p.
- MELHEIM A. L., PRESCOTT C., ANFINSET N. (2016) – Bronze Casting and Cultural Connections: Bronze Age Workshops at Hunn, Norway, *Præhistorische Zeitschrift*, 91, 1, p. 42–67.
- MELHEIM A. L., GRANDIN L., PERSSON P.-O., BILLSTRÖM K., STOS-GALE Z., LING J., WILLIAMS A., ANGELINI I., CANOVARO C., HJÄRTHNER-HOLDAR E., KRISTIANSEN K. (2018) – Moving Metals III: Possible Origins for Copper in Bronze Age Denmark Based on Lead Isotopes and Geochemistry, *Journal of Archaeological Science*, 96, August 2018, p. 85–105.
- MIKKELSEN M. (2015) – Brobakken – en lokalitet, der rejser væsentlige spørgsmål til vores forståelse af bronzestøbning i yngre bronzealder, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds), *Bronzestøbning i yngre bronzealders lokale kulturlandskab: seminarrapport fra seminaret "Bronzestøbning i yngre bronzealders lokale kulturlandskab" afholdt i Viborg, 6. Marts 2014*, Viborg, Viborg Museum and Holstebro, Holstebro Museum, p. 71-93.
- MOLLOY B., MÖDLINGER M. (2020) – The Organisation and Practice of Metal Smithing in Later Bronze Age Europe, *Journal of World Prehistory*, 33, p. 169-232.
- MONTELIUS O. (1885) – *Om tidsbestämning inom bronsåldern med särskildt afseende på Skandinavien*, Stockholm, Kongl. Vitterhets-, historie- och antikvitetsakademien (KVHAA handlingar; 10), 336 p.
- NEERGAARD C. (1908) – Haag-fundet. En affaldsdyngge fra en metallstøberhytte fra den yngre bronzealder, *Aarbøger for Nordisk Oldkyndighed og Historie*, p. 273-352.

- NIKOLAIDOU M. (2007) – Ritualized Technologies in the Aegean Neolithic? The Crafts of Adornment, in E. Kyriakidis (ed.), *The Archaeology of Ritual*, Los Angeles, University of California, p. 183–208.
- NILSSON A. (2011) – Making a Simple Tool: Bronze Casting for Personal Use in the Latter part of the Scandinavian Bronze Age, *Lund Archaeological Review*, 17, p. 85–90.
- NILSSON P., SÖRMAN A. (2015) – En gjutform av täljsten från den yngre bronsåldern: spår av bronsantverk vid Rambodal i Norrköping, *Fornvännen*, 110, 2, p. 84–96.
- NILSSON T. (1996) – Store Tyrrestrup. En vendsysselsk storgård med bronzedepot fra ældre bronzealder, *KUML*, 1993–94, p. 147–154.
- NILSSON T. (1997) – Bronzestøberens hus, *Skalk*, 1997, 3, p. 11–14.
- NORDEZ M. (2019) – *La parure en métal de l'âge du Bronze moyen atlantique*, Paris, Société préhistorique française (Mémoires de la Société préhistorique française, 65), 404 p.
- NØRGAARD H. W. (2015) – Metalcraft within the Nordic Bronze Age: Combined Metallographic and Superficial Imaging Reveals the Technical Repertoire in Crafting Bronze Ornaments, *Journal of Archaeological Science*, 64, December 2015, p. 110–128.
- NØRGAARD H. W. (2018) – *Bronze Age Metalwork: Techniques and Traditions in the Nordic Bronze Age 1500–1100 BC*, [e-book], Archaeopress, 500 p.
- NØRGAARD H. W., PERNICKA E., VANDKILDE H. (2021) – Shifting Networks and Mixing Metals: Changing Metal Trade Routes to Scandinavia Correlate with Neolithic and Bronze Age Transformations, *PLoS ONE*, 16, 6, e0252376.
- NYBERG P., NILSSON P. (2012) – *En bronsåldersgård och gåtfulla medeltida gravar: RAÄ 151, Rambodal 1:3 mfl, Styrstad socken, Norrköpings kommun, Östergötlands län. Särskild arkeologisk undersökning*, Linköping, Östergötlands museum (Avd. för arkeologi och byggnadsvård Rapport 2012:26), 285 p.
- OLDEBERG A. (1933) – *Det nordiska bronsåldersspännets historia: med särskild hänsyn till dess gjuttekniska utformning i Sverige*, Stockholm, Kungliga vitterhets-, historie-, och antikvitetsakademien (KVHAA handlingar, 38:3), 276 p.
- OLDEBERG A. (1942) – *Metallteknik under förhistorisk tid D. 1*, Lund, Håkan Ohlssons boktryckeri, 243 p.
- OLDEBERG A. (1960) – *Skälbyfyndet: en boplatslämning från den yngre bronsåldern*, Stockholm, Almqvist & Wiksell, 56 p.
- PETRÉ R. (1959) – En bronsåldersby i Bromölla, *Skånes hembygdsförbunds årsbok*, 1959, p. 47–55.
- PRESCOTT C. (2000) – Symbolic Metallurgy – Assessing Early Metallurgical Process in a Periphery, in D. Olausson and H. Vandkilde (eds.), *Form, Function and Context: Material Culture Studies in Scandinavian Archaeology*, Stockholm, Almqvist & Wiksell International, p. 213–225.
- RØNNE P. (1987) – Stilvariationer i ældre bronzealder: undersøgelser over lokalforskelle i brug af ornamenter og oldsager i ældre bronzealderens anden periode, *Aarbøger for Nordisk Oldkyndighed og Historie*, 1986, p. 72–124.
- SAHLÉN D. (2011) – *Ceramic Technology and Technological Traditions: The Manufacture of Metalworking Ceramics in Late Prehistoric Scotland*, doctoral thesis, University of Glasgow, 407 p.
- SARAUW G., ALIN J. (1923) – *Götaälvsområdets fornminnen*, Göteborg, (Skrifter utgivna till Göteborgs stads trehundraårsjubileum genom jubileumsutställningens publikationskommitté, 3), 370 p.
- SARNÄS P., NORD PAULSSON J. (2001) – *Rapport över arkeologisk slutundersökning: Öresundsförbindelsen: skjutbanorna 1B & Elinelund 2A-B*, Malmö, Malmö kulturmiljö (Rapport no. 9), 198 p.
- SCHÜTZ B. (2007) – Ett bronsgjuteri från yngre bronsålder, in P. Frölund & B. Schütz (eds), *Bebyggelse och bronsgjutare i Bredåker och Gamla Uppsala: arkeologisk undersökning, fornlämnning 134, 596 & 599, Uppsala socken, Uppland*, Uppsala, Upplandsmuseet (Rapport 2007:3), p. 239–247.
- SÖDERBERG A. (2002) – Metalliska spår efter gjuteriverksamhet – en skiss till en arkeologisk fältmetod, *Fornvännen*, 97, 4, p. 255–264.
- SØRENSEN M. L. S. (1989) – Period VI Reconsidered: Continuity and Change at the Transition from Bronze to Iron Age in Scandinavia, in M. L. S. Sørensen and R. Thomas (eds.), *The Bronze Age – Iron Age Transition in Europe. Aspects of Continuity and Change in European Societies c.1200 to 500 BC*, Oxford, British Archaeological Reports (BAR International Series; 483-2), p. 457–492.
- SØRENSEN M. L. S. (1997) – Reading Dress: The Construction of Social Categories and Identities in Bronze Age Europe, *Journal of European Archaeology*, 5, 1, p. 93–114.
- SØRENSEN M. L. S. (2015) – Forankring af metallproduktion – betydningen af bopladsfundene, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds.), *Bronzestøbning i yngre bronzealderens lokale kulturlandskab. Seminarrapport fra seminaret "Bronzestøbning i yngre bronzealderens lokale kulturlandskab" afholdt i Viborg, 6. marts 2014*, Viborg, Viborg museum and Holstebro, Holstebro museum (Yngre bronzealderens kulturlandskab; vol. 5.), p. 9–14.
- SÖRMAN A. (2017) – A Place for Crafting? Late Bronze Age Metalworking in Southern Scandinavia and the Issue of Workshops, in A. Brysbaert and A. Gorgues (eds.), *Artisans versus nobility? Multiple Identities of Elites and 'Commoners' Viewed through the Lens of Crafting from the Chalcolithic to the Iron Ages in Europe and the Mediterranean*, Leiden, Sidestone Press, p. 53–78.
- SÖRMAN A. (2018) – *Gjutningens arenor: metallhantverkets rumsliga, sociala och politiska organisation i södra Skandinavien under bronsåldern*, Stockholm, Stockholms universitet (Stockholm Studies in Archaeology, 75), 299 p.
- SÖRMAN A. (2019) – Casting in the Longhouse: The Organization of Metalworking at Late Bronze Age Settlements in South-eastern Sweden, *Current Swedish Archaeology*, 27, p. 143–189.
- SPIELMANN K. A. (1998) – Ritual Craft Specialists in Middle Range Societies, *Archaeological Papers of the American Anthropological Association*, 8, 1, p. 153–159.
- SPIELMANN K. A. (2002) – Feasting, Craft Specialization, and the Ritual Mode of Production in Small-scale Societies, *American Anthropologist*, 104, 1, p. 195–207.

- STRUCKE U., HOLBACK T. J. (2006) – *Järn och brons - metallhantverk och boende vid Åbrunna: väg 73, sträckan Jordbro-Fors: Södermanland, Österhaninge socken, Åbrunna 1:1, RAÄ 201: arkeologisk undersökning*, Stockholm, Riksantikvarieämbetet (UV Mitt Rapport 2006:9), 91 p.
- SVANBERG F. (2006) – I de mystiska kulthusens mörka inre, in M. Anglert, M. Artursson and F. Svanberg (eds.), *Kulthus & dödshus: det ritualiserade rummets teori och praktik*, Stockholm, Riksantikvarieämbetet, p. 123–128.
- SVENSSON B. (1940) – En gjuteriverkstad från bronsåldern, *Göteborgs och Bohuslans fornminnesförenings tidskrift*, 1940, p. 96–110.
- THRANE H. (2013) – Scandinavia, in H. Fokkens and A. Harding (eds.), *The Oxford handbook of the European Bronze Age*, Oxford, Oxford University Press, p. 746–766.
- THRANE H. (2015) – Kirkebjergbopladsens støbeaktiviteter, in S. Boddum, M. Mikkelsen and N. Terkildsen (eds.), *Bronzestøbning i yngre bronzealders lokale kulturlandskab. Seminarrapport fra seminaret "Bronzestøbning i yngre bronzealders lokale kulturlandskab" afholdt i Viborg, 6. Marts 2014*, Viborg, Viborg museum and Holstebro, Holstebro museum, p. 121–130.
- ULLÉN I., ed. (2003) – *Arkeologi på väg: undersökningar för E18. Bronsåldersboplatsen vid Apalle i Uppland: Uppland, Övergrans socken, Apalle, RAÄ 260*, Stockholm, Riksantikvarieämbetet, 329 p.
- VAHLNE G. (1974) – *Gjutfynden från Hallunda med särskild tonvikt lagd på tolkning av gjutformarna*, bachelor thesis, Stockholms universitet, 50 p.
- VAHLNE G. (1989) – The Workshop at Hallunda – A Presentation, in B. Ambrosiani (ed.), *Die Bronzezeit im Ostsegebiet*, Stockholm, Kungl. Vitterhets-, historie- och antikvitetsakademien, p. 107–113.
- VANDKILDE H. (2016) – “Bronzization”: The Bronze Age as pre-Modern Globalization, *Prähistorische Zeitschrift*, 91, 1, p. 103–223.
- VANDKILDE H. (2017) – *The Metal Hoard from Pile in Scania, Sweden: Place, Things, Time, Metals, and Worlds around 2000 BCE*, Århus, Aarhus University Press & The Swedish History Museum, 233 p.
- VESTERGAARD NIELSEN S. (1956) – Vindblæs-fundet: En vesthimmerlandsk bronzestøberplads, *KUML*, p. 41–49.
- VICTOR H. (2002) – *Med graven som granne: om bronsålderns kulthus*, Uppsala, Uppsala universitet (Aun, 30), 207 p.
- VICTOR H. (2006) – Bronsålderns kulthus – ett dateringsproblem i en komplex miljö, in M. Anglert, M. Artursson & F. Svanberg (eds.), *Kulthus & dödshus: det ritualiserade rummets teori och praktik*, Stockholm, Riksantikvarieämbetet, p. 113–122.
- WEILER E. (1994) – *Innovationsmiljöer i bronsålderns samhälle och idévärld: kring ny teknologi och begravningsritual i Västergötland*, Umeå, Umeå Universitet (Studia archaeologica Universitatis Umensis, 5), 203 p.
- WORSAAE J. J. A. (1843) – *Danmarks oldtid oplyst ved gravhøie og oldsager*, København, Selskabet for Trykkfrihedens rette Brug, 123 p.

Anna SÖRMAN

Dept. of Archaeology and Classical Studies,
Stockholm University, Wallenberglaboratoriet,
106 91 Stockholm, Sweden.
anna.sorman@ark.su.se