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14

FUSING FRAGMENTS

Repaired objects, refitted parts and upcycled pieces in the Late Bronze Age metalwork of Southern Scandinavia

Karin Ojala and Anna Sörman

Introduction

The metalwork from the Bronze Age has fascinated archaeologists since the birth of the discipline. Objects of bronze have been extensively collected, compiled and depicted. However, the presentation of the objects, especially in older literature, does not always correspond to what you find when you see them in real life. Behind the well-arranged typological series, reconstructions and well-preserved highlighted examples, there are also objects that are broken, fragmented, repaired or modified in different ways. Now increasingly recognised, bronze artefacts of the Nordic Bronze Age (NBA) with traces of repairs, modifications and reuse occur in museum collections (Oldeberg 1933; Madsen 2009; Skinner 2009; Thrane 2013; Hornstrup 2018; Horn & Karck 2019). There is a large variation in how these objects were mended. Some of the repairs were highly visible and changed the appearance of the objects, while others were more discreet. Sometimes, fragments or parts of objects have been used either to create new objects or to mend old artefacts. Such objects are therefore an important window into the life of fragments 'after the break', in a period when large quantities of broken metalwork were in circulation.

The topic of mended and modified NBA metalwork is not particularly well studied. Previous observations, primarily by Andreas Oldeberg in the first half of the 20th century (e.g. Oldeberg 1927, 1933, 1934, 1943), were entirely focused on the technical aspects of repairs. However, modifications probably also affected how items were regarded, used and valued. As shown by various archaeological, historical and ethnographic examples, alterations are not always only made due to functional necessity. This material evidence

stimulates wider reflection on fragmentable, ‘partible’ and composite objects and the ways in which different fragments invite reuse.

In this chapter, we explore some aspects of modified and mended metalwork in Late Bronze Age Scandinavia (c. 1100–500 BCE). We primarily study how fragments and pieces were added and reused in processes of repair and modification. We mainly include Swedish finds, although the discussion will also bring up examples from other parts of the NBA, an area covering southern Scandinavia and northernmost Germany, characterised by similarities in bronze metalwork (e.g. Baudou 1960; Sørensen 1987; Jantzen 2008).

Questions addressed are: What types of bronze objects have been mended or modified, and in what contexts have they been found? How were different objects repaired, modified, reassembled and repurposed? What ideas and values may have been connected to these modified items, and what can they reveal about the attitude towards and reuse of fragmented bronzes?

The archaeology of repairs

Archaeologists from modern western consumer cultures have often approached the broken and fragmented with ethnocentric expectations about the universal preference for the complete and intact (Chapman & Gaydarska 2007; Chittock 2020). The incomplete and repaired might instead carry meaning, be an act of veneration and be integral to the objects’ biography (Chapman 2000; Chapman & Gaydarska 2007; Caple 2010:308; Chittock 2021:109). Over the last decades, interest in mended and modified objects has grown, not only regarding technical and functional aspects but also in view of their cultural implications (e.g. Willmott 2001; Jervis & Kyle 2012; Swift 2012; Verger 2019; Chittock 2020; Dumont 2022). Repairs to a treasured object might imply an *addition* rather than a diminution in value (see Chittock 2020). Mended, modified and reused bronze metalwork testifies to the choice of keeping it instead of simply re-melting and casting it into new objects.

Repairs constitute significant events in the object’s cultural biography and often embody shifts in its function, value and meaning (e.g. Dooijes & Nieuwenhuys 2007; Swift 2012). Helen Chittock (2020, 2021) has observed that reused pieces from various dismantled objects were intentionally reassembled in Iron Age metalwork in northern England (see also Chittock this volume). Composing wagons, shields and swords out of decorated pieces of various ages, styles and degrees of use-wear was a way to materialise, commemorate and facilitate oral histories about these objects (Chittock 2021:99–100). Other examples of modifications with meaning beyond the purely functional are the European LBA full-hilted swords, where the addition of locally made hilts onto exotic blades functioned as a visual and material process of acculturation (Dumont 2022).

This shows that we should approach these objects as *modified*, a definition that does not give preference to just one of the many reasons (the functional) that a broken object might be manipulated or reused post-manufacture (e.g. Martin 2012:62). An emphasis on manipulation rather than repair also acknowledges that integrating old parts onto other items might create enchainments that reinforce relations (Chapman 2000; Chapman & Gaydarska 2007; Chittock 2020). Thinking about what fragments or parts were brought with them into a reassembled or repaired item has the potential to reveal the deeper complexity behind how and why objects and fragments were used (e.g. Chittock 2020). This is one of the avenues for exploring the itineraries for some fragments ‘after the break’ (see Chapman & Gaydarska 2007). We would like to contribute to this reflection: what fragments add to practices of remaking and reuse; the accumulations of histories and relationships that might be involved; and more generally, approaches to fragmented materials at various times.

Bronze objects in Late Bronze Age southern Scandinavia

In the LBA, copper alloys and bronze casting technology had been known in southern Scandinavia for hundreds of years. Traces of bronze casting, in the form of fragmented crucibles and moulds and occasionally also small pieces of metallic residue, are known from many different sites, both from long-house environments as well as burial and cult sites, indicating that bronze casting was a widespread practice throughout LBA southern Scandinavia (Levy 1991; Jantzen 2008; Sörman 2018).

Bronze objects were used in many spheres of society: as tools, body ornaments, dress attributes, drinking vessels, weapons, razors, ritual paraphernalia and more. The period had a very elaborate use of bronze; the metal dressed and accompanied many people, practices and ceremonies but was also used to mark and sacrifice to the spirited landscape through depositions. In the region, bronzes from the LBA are primarily found deposited in various wet or dry locations (Levy 1982:fig. 3-1; Rundkvist 2015:44–46). Nordic LBA hoard depositions are traditionally classed as ‘scrap hoards’, ‘sacrificial hoards’ or ‘single finds’ (e.g. Levy 1982). However, these functional divisions have been criticised as the material proves to be much more complex (e.g. Bradley 1990; Brück 2016; Fontijn 2019). Bronze objects are also occasionally found in burials, but only represent some of the object types in circulation. More rarely, objects or fragments are also found at settlements.

The archaeological sources and source criticism

Collecting information about modified objects in the literature and museum catalogues is challenging. Many publications focus on whole, undamaged

objects and not broken, fragmented or repaired artefacts, which mirrors the traditional preference for pristine objects in typo-chronological studies (e.g. Montelius 1917; Baudou 1960). In addition, catalogues and secondary literature sometimes completely fail to mention if objects were mended. Many repairs or modifications have probably never been noticed, and still remain undetected today. Some of the ‘cast-on’ repairs (see *Fill-ups* further below) are hard to detect without X-radiography (Skinner 2009:31). Moreover, there are examples of LBA metalwork with repairs dating from the 19th or 20th century, both from museum contexts (e.g. Skinner 2009) and private collections (e.g. Swedish History Museum (SHM) 2549). Nevertheless, modern modifications and prehistoric repairs can often be distinguished due to differences in techniques and patina (Skinner 2009). Some bronze objects were mended with other materials in the LBA, as, for example, a crack on a hanging vessel that had been filled up with resin (Oldeberg 1934:9). This kind of repair work is not included in this study.

The archaeological source material presented in this study was collected through a search in museum catalogues (notably the SHM) and in archaeological literature. It was compiled (Table 14.1) and classified according to the type of manipulation (see the following section, Figure 14.1). Although not representing a full overview, this source material is large enough to reveal interesting tendencies in the handling of fragments in practices of repair and modification.

Repair work, manipulations and reuse of metalwork in Late Bronze Age Sweden

Repaired objects occur both in the Early and LBAs (e.g. Oldeberg 1933, 1943; Kristiansen 1974; Thrane 2004, 2013; Melheim 2008; Skinner 2009; Nørgaard 2018:113). The LBA Nordic finds collected here, primarily from present-day Sweden, include four different types of repairs, manipulations and reuse: *fill-ups*, *fusing*, *patching* and *upcycling* (Figure 14.1), a classification based on the ways in which fragments or parts were used to modify the object.

Fill-ups

Fill-ups are repairs where metal has been added to fill a hole or damage. It seems that small holes appeared during casting rather frequently when the liquid alloy did not successfully fill out the full cavity of the mould. A study of Danish period IV–V (1100–700 BCE) hoard finds found that this ‘casting defect’ was rather common (Kristiansen 2016 [1974]:131). Some visible holes were left unaltered and the object went on to be used anyway; this can be seen on tools such as axes (Nilsson 2008:29–33), but also on larger

TABLE 14.1 The table shows some of the repaired LBA objects found in Sweden. Many of the hoards were discovered in the 19th century, and it is likely that fragments were sometimes neglected. SHM = Statens historiska museum; SLM = Södermanlands museum; UMF = Museum Gustavianum; KLM = Kalmar läns museum; VLM = Västmanland läns museum; OM = Östergötlands museum.

<i>No</i>	<i>Object type</i>	<i>Site, parish, province</i>	<i>Type of modification</i>	<i>Hoard</i>	<i>Reference</i>
1	Horse bit	Eskelhem, Eskelhems prästgård, Gotland	Fusing (new part)	In a mixed hoard with no/few fragmented objects	SHM 7994
2	Belt buckle	Öllöv, Grevie, Skåne	Fill-up	In a mixed hoard with no/few fragmented objects	SHM 12937
3	Belt buckle	Domta, Österunda, Uppland	Fill-up	In a mixed hoard with no/few fragmented objects	UMF 5690; Arwidsson 1939
4	Belt buckle	Slättäng, Vårkumla, Västergötland	Fill-up	In a mixed hoard with no/few fragmented objects	SHM 5316; Oldeberg 1943:214
5	Belt buckle	Vegestorp, Kareby, Bohuslän	Fusing	In a mixed hoard with no/few fragmented objects	SHM 845; Oldeberg 1943: 214; Baudou 1960:180, 260
6	Belt buckle	Nya Åsle, Åsle, Västergötland	Fill-up	In a mixed hoard with many fragmented objects	SHM 19748 (SHM 4127); Oldeberg 1934:11
7	Hanging vessel	Nya Åsle, Åsle, Västergötland	Fill-up (two reparies)	In a mixed hoard with many fragmented objects	SHM 4127; Oldeberg 1934:33–35
8	Cauldron	Hasse, Glanshammar, Närke	Patching (several mendings)	In a mixed hoard with no/few fragmented objects	SHM 21513; Gustawsson & Waldén 1937:66–70
9	Neck ring	Rud, By, Värmland	Fusing (hole)	In a mixed hoard with no/few fragmented objects	SHM 1056
10	Two neck rings	Svartarps gård, Åsle, Västergötland	Fusing (twisted)	In a mixed hoard with many fragmented objects	SHM 22470; Oldeberg 1934
11	Neck ring	?, ?, Bohuslän	Fusing (cast-on)	?	SHM 1270:455
12	Neck ring	Fageråkra, Veddige, Halland	Fusing	In a single type hoard with no/few fragmented objects	SHM 4228; Montelius 1917; no 1295
13	Neck ring/diadem	Långbro, Vårdinge, Södermanland	Patching (rivets and bronze sheet)	In a mixed hoard with no/few fragmented objects	SHM 2674

14	Neck ring	Spelviks Kyrka, Spelvik, Södermanland	Fusing	In a mixed hoard with no/few fragmented objects	SHM 813
15	Neck ring (<i>wendelring</i>)	Around Falköping, ?, Västergötland	Fusing	?	SHM 7591:15
16	Neck ring (<i>wendelring</i>)	Hökensåsén, Hubbo, Västmanland	Fusing (hole)	In a mixed hoard with no/few fragmented objects	VLM 3174; Arbman 1938:91
17	Neck ring (<i>wendelring</i>)	Altuna, Börje, Uppland	Fusing (cast-on)	In a mixed hoard with no/few fragmented objects	SHM 16018; Ekholm 1921:katalog period VI.
18	Two neckrings (<i>wendelring</i>)	?, Hårdshammar, Östergötland	Fusing (hole)	?	OM.C.000635; Nordén 1926:35
19	Neck ring (<i>wendelring</i>)	Samsvik, Gladhammar, Småland	Fusing (cast-on)	?	Heynowski 2000:43, 315
20	Neck ring (<i>wendelring</i>)	Hjälmarred, Allingsås, Västergötland	Fusing (hole)	In a mixed hoard with many fragmented objects	Hellgren & Lega 2021:21
21	Arm/foot ring (<i>wulstring</i>)	Hjälmarred, Allingsås, Västergötland	Fusing (hole)	In a mixed hoard with many fragmented objects	Hellgren & Lega 2021:19
22	Ornamental disc	?, Hulterstad, Öland	Fusing (new part)	In a mixed hoard with no/few fragmented objects	SHM 9321; Hjärthner-Holdar 1993:137
23	Pin	Vallby, Veddige, Halland	Patching/Fusing (iron rivets and bronze sheet (now lost))	In a mixed hoard with no/few fragmented objects	SHM 6523
24	Spearhead	Hvarsta, Fröslunda, Uppland	Fill-up	?	Ekholm 1921:katalog period VI.
25	Spectacle fibula	Härnevi prästgård, Härnevi, Uppland	Fusing (two repairs)	In a mixed hoard with many fragmented objects	SHM 11635; Oldeberg 1933:180

(Continued)

TABLE 14.1 (Continued)

No	Object type	Site, parish, province	Type of modification	Hoard	Reference
26	Spectacle fibula	Hjärpetan, Grava, Värmland	Fusing	In a mixed hoard with many fragmented objects	SHM 17093; Oldeberg 1928
27	Spectacle fibula	?, Skeby, Västergötland	Fusing	?	SHM 6753; Oldeberg 1936:164
28	Spectacle fibula	Senåte, Otterstad, Västergötland	Fusing	In a mixed hoard with no/few fragmented objects	SHM 1580; Oldeberg 1936:166
29	Spectacle fibula	Gunnarsmåla, Ålem, Småland	Fusing	?	KLM 000043; Oldeberg 1936:146, 169
30	Spectacle fibula	?, Västerlösa, Östergötland	Fusing	?	SHM 12799; Oldeberg 1936:172
31	Spectacle fibula	?, Kinda hd, Östergötland	Fusing	?	Oldeberg 1933:152, Montelius 1917:89; Norden 1926:33
32	Sword (antenna sword)	Kräknäs, Svärta, Södermanland	Fusing	?	SLM 18011; Oldeberg 1942:80, 82-83; Hjärthner-Holdar 1993:151
33	Shields	Fröslunda, Sunnersberg, Västergötland	Patching	With several other shields	Klockhoff 1995
34	Fragment of bronze vessel	Eskelhem, Eskelhem prästgård, Gotland	Patching	In a mixed hoard with no/few fragmented objects	SHM 7994



FIGURE 14.1 Examples of the four types of modifications detected in Late Bronze Age metalwork from Sweden and Denmark. Fill-up: a belt dome from Grevie, Skåne (SHM 12937; Photo from The Swedish History Museum (SHM), CC-BY 2.5 SE). Fusing: a spectacle fibula from Senäte, Västergötland (SHM 1580; Photo by Stina Svantesson, Västergötlands Museum). Patching: a neck ring from Långbo, Södermanland (SHM 2674; Photo from The SHM, CC BY 2.5 SE). Upcycling: a razor from Ebberup Mark Denmark (from Madsen 1872; see also Thrane 2013). The modifications are marked with arrows.

display items such as spectacle fibulas, spearheads and large belt ornaments (e.g. Oldeberg 1928, 1943:214; Arwidsson 1939).

Fill-ups were normally accomplished through ‘cast on’ (Ger. *überfangguss*; a method also used in other types of repairs; Drescher 1958). A new mould part was then modelled on or around the existing object to fill out the incomplete area (Skinner 2009; Nørgaard 2018:113). Fill-ups of rifts and small holes were probably often made directly in connection with production. A belt buckle with incised decoration on the mended area (SHM 5316) clearly shows a case where the fill-up was linked to the production process, between the stages of casting and decorating.

Fusing

These are modifications where components or parts – from the same or different objects – were joined to (re)create a complete object. Fusing includes

repairs where specific components have been replaced, such as the horse bit of iron probably replacing an original bronze bit on a bronze harness from Eskelhem (SHM 7994; Hjärthner-Holdar 1993:138). It is a rather common type of repair and occurs on many different objects, such as spectacle fibulas, swords and neck rings.

Fusing is frequently seen on large brooches known as spectacle fibulas, especially where the two plates have been rejoined after a break. Sometimes, this appears to have been done immediately after casting (Oldeberg 1928, 1933). One fibula shows traces of being mended on two different occasions (KLM 000043; Oldeberg 1933:140, 168). There are also fibulas that have been modified by fusing plates originally belonging to two different objects (SHM 1580; Oldeberg 1933:141, 166–167; Melheim 2008:543; Figure 14.2).

There is fusing on swords where either the tang or the hilt have been removed from the blade and later re-attached. An example is seen on a sword of central European origin (SLM 18011), where the hilt and the blade have differing amounts and placements of rivet holes, suggesting they did not originally belong together (Oldeberg 1942:80, 82f; Hjärthner-Holdar 1993:151; see also Dumont 2022).

Another type of object where fusing is common are neck rings, and sometimes also arm rings and ankle rings. Rings have been modified by joining two broken halves together either by drilling small holes to attach some form of a string (e.g. Nordén 1926:35; Arbman 1938:91; Hellgren & Lega 2021:19, 21; for example, OM.C.000635; VLM 3174) or through ‘cast-on’ (e.g. Oldeberg 1943:215; Heynowski 2000:43; SHM 16018). Neck rings have also been ‘fused’ by twisting two ring halves together (Oldeberg 1943:112; Heynowski 2000:41; SHM 22470; Figure 14.2). Most of these modifications are highly visible and change the appearance of the ornament. Whether the parts were originally from the same or different rings cannot always be determined without more detailed, and possibly scientific, examinations. It might be that two broken rings were reassembled to contain half of each.

Several LBA *wendelrings* have been fused by joining parts through drilled or pierced holes (Nordén 1926:35; Arbman 1938:91; Heynowski 2000:41; Hellgren & Lega 2021:21; see Table 14.1). The holes indicate that the parts were, at least at some point in time, joined together with a string or a metal wire. As such repairs occur on several *wendelrings* distributed over a large area, this was evidently a common way of mending or re-attaching parts of broken rings of this type (Heynowski 2000:40–45; see also Jennings 2014:170). However, more discreet types of mending also figure in the material from Sweden, such as *wendelrings* mended through a ‘cast on’ (Oldeberg 1943:215; Heynowski 2000:43–45; SHM 16018). This type of repair can be difficult to detect and much more discreet than the examples with holes and joining strings (Figure 14.2).

Patching

Patching is when small pieces or fragments have been added with rivets or ‘cast on’ to repair a broken object. This modification can be seen on pins and neck rings, but also on other objects, notably imported sheet bronze. As mentioned in the previous section, small fragments or patches have also been used in the fill-ups.

A conspicuous example of patching is seen on a bronze pin where two parts have been joined by drilling small holes and adding a patch (SHM 6523). As evident from rust marks on the object, this patch, now lost, was possibly joined on with iron rivets (Hjärthner-Holdar 1993:126–127).



FIGURE 14.2 Three types of fused neck rings, with holes: Hårdshammar, Östergötland (OM. C 000635); cast-on: Altuna, Uppland (SHM 16018); and two fused by twisting two halves together: Svartarps gård, Åsle, Västergötland (SHM 22470; Photos from The SHM, CC-BY 2.5 SE; and Östergötlands Museum, CC-BY SA 4.0). The modifications are marked with arrows.

Patching can also be seen in some of the sheet bronze metalwork brought to Scandinavia from the Continent. It is unclear if these patches were added before or after the objects reached Scandinavia. Such repairs are, for example, visible on the rim of several of the Herzsprung-type shields found at Fröslunda (Klockhoff 1995:52). Patching where an added fragment covers a rift on the front upper rim can also be seen on a sheet bronze neck ring or ‘diadem’ (SHM 2674; see Figure 14.1).

Another clear example is the South European cauldron, with seven different repairs found and containing several other objects in the so-called Hassle hoard (SHM 21513). The bronze fragments used to patch the vessel vary in shape and thickness, thus probably being successively added over time. Patching is very common on cauldrons across Western and Central Europe; they were fragile and needed to be able to keep liquids and food (Gerloff 2010; Joy 2014). The repair work was clearly visible on these prestige objects and might also have added to their sense of age and patina.

Upcycling

Upcycled items are fragments of old objects that have been repurposed and turned into something new and different. This practice has also been named *conversion* (Jennings 2014) and recycling (to differentiate from reuse, where the object’s shape is largely retained) (Caple 2010). However, in the context of bronze metalwork, recycling is mainly associated with remelting to cast new objects. We therefore choose to use the word upcycling, also known as creative reuse, a term that has gained popularity with environmentalism, circular economics and increasing interest in sustainable waste management and which signifies the practice of making new things out of used things or waste (e.g. Paras & Curteza 2018; for applied use in historical context, see Rous 2020). In the context of metalwork, upcycling, as conversion, can be defined as “the direct conversion of one object into another through cutting and reshaping” (Jennings 2014:163). Upcycled objects are often difficult to identify unless they have ornamentation or other morphological traces from their previous form.

Upcycling bits of old bronze objects into, for instance, arm rings, lancets, pins or awls was not unusual during the LBA (Baudou 1960:63; Thrane 2004; 2013; Kristiansen 2016 [1974]:145; Hornstrup 2018). There are several accounts of LBA arm rings made from larger neck rings (Baudou 1960:63). There are also cases where parts of arm or neck rings were reused to make very small arm rings with a diameter of around 3–4 cm, possibly designed for children (Kristiansen 2016 [1974]:144–145; see also examples in Thrane 2004).

LBA razors were sometimes made from fragments of other objects such as neck rings, hanging bowls and arm rings (Thrane 2013:445; Hornstrup

2018). There are also about 12 examples from LBA Scandinavia known so far where fragments of ‘imported’ bronze vessels have been upcycled into razors (Thrane 2013; Figure 14.1). The number is probably higher, since the origin of such fragments is only recognisable if they have ornamentation or include parts of the vessel rim. Sometimes the vessel decoration has been kept and respected/integrated into the razor, but this is not always the case (Thrane 2013). Henrik Thrane, who discussed this phenomenon in a 2013 paper, even identified three such fragment razors – from burials in northern Germany and on Danish Funen – that might originate from the same, decorated bronze vessel (Thrane 2013:449).

Summary of findings

There are various ways in which LBA bronze objects were mended or modified by means of joining or adding parts to an ‘incomplete’ object. Some objects were probably mended just after being cast, while others were repaired at a later time after being accidentally or intentionally broken. There are also pieces that have been upcycled, meaning that a fragment was reworked into a new, different object. Modifications where parts or new materials were added occur on a wide range of objects, including more exclusive social valuables. These include *wendelrings*, shields, bronze vessels, spectacle fibulas, swords, belt buckles and large dress pins – object types presumably linked to prestige, social hierarchies and ritual display. The nature of the modifications on these display items indicates that the mending was rarely carried out with the intention of being discreet. Since this study is not exhaustive, more mended objects and types of modifications certainly remain undiscovered in assemblages of finds. For example, upcycled metalwork is likely to exist also in Sweden but awaits similar studies as those of Danish and German archaeological material (Thrane 2013; Hornstrup 2018).

Discussion: Manipulated objects – manipulated meanings

These observations suggest that the attitude towards intact surfaces and the completeness of bronze metalwork was very different in the Scandinavian LBA than it is today. People who crafted and used these objects were less concerned about a smooth appearance. Some of the repairs are discreet, but many of the examples above are highly visible, and it often seems like little was done to hide them (see also Melheim 2008). Casting defects and mended items were evidently accepted or even appreciated, and the origin of upcycled cauldron pieces used as razors was sometimes evident from the remaining ornamentation or rims.

Visible repairs and alterations did not prevent the objects’ continued use or disqualify them from inclusion in depositions. Mended objects are

found in mixed hoards from dry-land contexts as well as in depositions in wet environments (Table 14.1) and were thus still considered appropriate for sacrificial offerings. Many of the repaired or modified objects, like spectacle fibulas and neck rings (particularly *wendelrings*), were probably objects of prestige worn very visibly (Kristiansen 1998:69; Melheim 2008:545). Here, modifications would have been apparent when worn, handled and seen. Some of the repairs show signs of wear, indicating that the objects remained in use after a modification (Nordén 1926:35). In addition, we find some items, such as the Hassle cauldron and the spectacle fibula from Ålem Parish, Småland, that have been mended more than once (KLM 000043; Oldeberg 1933). Little concern for visibility is also indicated by cases where metals with diverging colour nuances were used in repairs on LBA bronzes, such as iron rivets (Hjärthner-Holdar 1993; Sörman & Ojala 2022) or fill-ups with lead (Madsen 2009:85).

The visibility of the modifications could signal that repaired objects were considered ‘good enough’, for example, when objects were left with casting holes or were repaired with fill-ups immediately after casting. It also indicates that the value of LBA metalwork laid in other qualities than the visual impact of a perfect surface. One explanation for the tendency to keep imperfect casts and repaired objects in circulation could be that great importance was placed on the performance of the casting itself. LBA bronze casting was carried out at a variety of places and settings, including exposed locations within cult sites and large burial grounds interpreted as assembly sites, possibly meaning that the crafting of objects could take on the form of public events (Sörman 2018; see also Melheim 2015). LBA bronze castings as public rituals are further supported by the performative character of LBA casting in open hearths. The mythological dimensions indicated by finds of horse-shaped nozzles for bellows are one example; another is the nature of the products themselves, often markers of social and political status and presumably made in connection to important passage rituals (Sörman 2018). The significance of the process, timing and staging of the casting could explain why finished objects that turned out ‘flawed’ were kept and mended rather than remelted in a new try.

It has previously been suggested that visible repairs could indicate that the craftsperson responsible for the mending lacked the skills necessary to make an unobtrusive mending or to make a new object (Melheim 2008:545). Although this might sometimes be the case, most of the repairs from this period would still require some level of skill, and the object could have been melted and cast into something else. There are traces of widespread, non-centralised bronze artefact production during the LBA, including quite complicated objects cast locally in central Sweden (e.g. Oldeberg 1960; Sörman 2018), indicating that the availability of skill should not have been a problem. The origin of the metal recycled in new castings can also carry a meaning, and even when objects are melted down, their history can become part

of the new object (Caple 2010; see also Sörman this volume). This practice cannot be excluded for LBA Scandinavia, but this topic lies beyond the scope of this paper.

Although some of the repair work and modifications, such as patching up a leaking bronze cauldron, can be seen as repairs aiming to maintain the object's functionality, the mending can also be more than just a practical solution. While difficult to prove, examples of the fusing of parts from different objects, such as the spectacle brooches assembled from the discs of two different fibulas (Oldeberg 1933:141, 166–167; Melheim 2008:543), hint at a more complex reuse of fragments and parts than simple repairs and replacements. Fragments of bronze objects have been used to create new objects, not only by recasting but also by upcycling and by assembling parts of different objects. These repairs and modifications can be seen as part of the objects' cultural biography and indicate that objects chosen for manipulation were sometimes motivated by their special significance and use histories (Melheim 2008; Hornstrup 2018; Sörman this volume).

Some object types appear to have been manipulated more often than others, such as spectacle fibulas and *wendelrings*. This might simply reflect that certain object types are more fragile than others. Indeed, they are often broken in the place where the discs or rings are most easily broken off, partly due to weak points in their construction (Oldeberg 1933; Heynowski 2000:41). On the other hand, another reason behind the many repaired spectacle fibulas and neck rings might also be that these objects carried special meanings and values and therefore became subjected to manipulation more often. Anne Lene Melheim has pointed out the intentional asymmetry of many Nordic spectacle fibulas, suggesting that both the discs' initial design and various modifications, including fusing discs back together, could relate to a left-right symbolism in LBA cosmology (Melheim 2008). Breaking and recombining these symbols, reattaching separated halves, or taking parts representing different owners, generations, or meanings, could then have been a way to reinforce alliances between different people (Melheim 2008) or more generally to manipulate their 'power'.

The frequency of the fusions of neck ring halves, spectacle fibula discs and the blades and handles of swords hints at the specific *fragmentation quality* of various objects. We believe that it is reasonable to suggest that practices of fragmentation, dismantling and reassembly may develop differently for 'partible' and 'composite' pieces of metalwork (see also Chittock this volume). This can be illustrated by looking at swords and spectacle fibulas on the one hand and neck rings on the other. Most swords are constructed as composite objects, where the handle and blade are made separately (possibly also in different materials) and then joined. There are numerous European examples of Bronze Age swords and daggers where blade and handle have been treated differently, for example, in separate depositions (e.g. Knight 2022:143–144)

or components of different origins joined together in new combinations (e.g. Kristiansen 2002; Dumont 2022). The same fragmentation quality can be seen in the way Nordic LBA spectacle fibulas were constructed, joined and rejoined, consisting of two readily breakable halves.

Neck rings, on the other hand, are made in one piece, and breaking them in two creates a distinct separation of a whole lacking obvious components. Manipulating and rejoining pieces of fragmented neck rings could therefore, we argue, implicate something else. Composite versus fragmented objects implicate different possibilities of enchainments as an outcome of repairs and additions (see also Chittock this volume). Composite objects allow for parts to be replaced and for different people to contribute to the object's completion (Chapman 2000:40, 222). It also creates the opportunity to enchain various people and histories into one object during repair work (Chapman 2000; Verger 2019; Chittock 2020). For 'partible' but non-composite objects, on the other hand, the repairs or modifications may stand out even more clearly, as one could argue that a 'solid' object is more obviously or drastically broken than a composite object. This quality offers a striking way of creating material and visual effects that add extra dimensions to the object, such as two neck ring parts visibly linked together by a string. We can imagine that the histories, values and powers attached to these objects could be accumulated and combined into new physical forms.

Further questions

In this chapter, we have focused on the 'second life' of metalwork fragments as they become reintegrated into a repaired object or upcycled into new forms. The material demonstrates various forms of LBA manipulation and hints at the value placed on modifications, as indicated by their visibility and frequency. Other types of modifications are probably still hidden, undiscovered, in the LBA metalwork. The archaeological material demonstrates the different ways in which LBA bronze objects were 'partible' and could be reassembled in different constellations, of which only some have been discussed here. Future studies should develop methods for distinguishing between deliberate and accidental breaks and look further into the sets and levels of skill needed in order to carry out these modifications. Another avenue for future research lies in the identification of pieces from the same objects ending up in different places, such as when investigating the origins of upcycled razors from similar vessel types or examining halves of fused neck rings to see if they originally belonged to the same or different rings. By scratching the surface of the 'perfect' metalwork shown in corpus works and reconstruction drawings, post-production manipulations and the reuse of broken pieces will continue to be a rich source for understanding how these bronze objects were approached, valued and used in LBA society.

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