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Life on the cutting edge: Interpreting patterns of wear on Scottish Early Bronze Age axes

by

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Life on the cutting edge: Interpreting patterns of wear on Scottish Early Bronze Age axes

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ABSTRACT

Traditional approaches to Bronze Age metalwork have very often been framed within a series of dichotomous relationships often concerning either an objects production or ultimate deposition. In contrast, this thesis utilises a 'biographical approach' to material culture to illuminate what happened to objects during their often varied lifetimes, and importantly how this may have related to their deposition. A physical re-examination of wear, damage and states of fragmentation exhibited by a number of Early Bronze Age axes from Scotland (c. 2,400 to c. 1,700 cal B.C) is undertaken against a concurrent a program of experimental work. It is suggested that the physical appearance and condition of these objects were held to be indicative of both the object and its owner’s biography. It is shown that axes deposited together in hoards show recurring patterns of use wear and damage relating to both the longevity and intensity of use seen during their individual lifetimes. Moreover, it is argued that decoration may have been carried out over extended periods of time rather than in one event, or even after an object was no longer useable.

FIGURES

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CONTENTS

1. INTRODUCTION

1.1 Outline

The arrival of the first metals in the archaeological record has long been seen as a key indicator of technical, social and economic developments in prehistoric society. However, traditional approaches to this rich body of material have primarily focussed in two distinct areas relating to either its production or ultimate deposition. Production issues have rarely ventured far from the well trodden path of typo-chronology, provenance, or the more technical aspects of manufacture. The voluminous discussions of deposition have long debated the rationale behind such acts to the extent that the social significance of metal has invariably been inferred from the ways in which it was discarded (Bradley 1998:83). While this situation has resulted from some inherent limitations of the data itself, such as its relative absence in dateable contexts (see Chapter 2 for discussion), it is also allied to the shifting paradigms of archaeological thought. These combined factors have served to sterilise approaches to metalwork, especially when the diversity of evidence suggests that a single explanation for all cases is unlikely.

The argument that I wish to put forward in this thesis is founded upon a critique of these historical positions, chiefly because of their failure in my view to adequately attend to what happens 'in between' - that is to say, after the object has been produced and before it was deposited. Equally, it is critical to consider how this period of an object's life may be implicated in its ultimate deposition. Our common understandings have tended to homogenise the lives of objects during this part of their existence by compressing each object life time. Moreover, there has been only limited discussion of how these object's lives may be related to those of people. What have often been overlooked are the complex uses and understandings of material culture by people, as well as the perhaps endless avenues of social meaning that may be contained in the data (Cooney & Grogan 1994:97). It is important to stress from the outset that my intention is not to suggest that issues of production and

deposition are not salient concerns, nor to debate whether acts of deposition were highly structured and socially significant. Rather, I want to consider how these nominal phases of making, using and discard may be interrelated.

1.2 Analytical framework

There is an essentially 'biographical' basis to my approach. The idea of a biography in this sense proposes that as both people and objects move through time and space, they continually accumulate histories of different meaning, understanding and consequence relevant to the specific contexts in which they have existed (Gosden & Marshall 1999). It is apparent from the great number of recent archaeological publications, conference sessions and journal articles that these ideas are now firmly established as an methodological tool (e.g. Gosden & Marshall 1999; Immonen 2002; Lima 2007; Moyler & Hoogsteyns 2004). At first glance therefore, utilising such ideas in relation to metal objects may seem a relatively straightforward affair, a simple case of "add theory and stir". Indeed, during the conception of this research, one university professor suggested that I might be better served with an alternative analytical framework, given that 'biographies' were both ubiquitous and by implication, distinctly 'old hat'. This opinion is unsurprising, because the whole notion of a biography is generally deemed to be understood, workable and unproblematic in all situations. On the contrary, amidst the recent wave of syntheses, there has been very little systematic critique of this type of approach, or any question of its pertinence to specific sets of archaeological data.

Rather than accepting the idea of a biography at face value therefore, I believe that there are in fact a number of questions which need to be addressed before it can be further developed in relation to metalwork. Firstly, there is a question of definition. Given the omnipresent nature of such terminology, one would reasonably assume that there was a clear distinction of what the concept actually comprises. However, I will show that the answer to this question is far from clear, and that its familiarity belies a distinct lack of clarity. In rather the same way that 'agency' became a

buzzword of contemporary archaeological theory (Dobres & Robb 2000), so the attribution of biographical status to a body of work has now become very much *'de rigueur'*. Consequently, the term itself has become a somewhat nebulous idiom, easily dropped into an archaeological text to bring it methodologically bang up to date. Furthermore, the theoretical foundation of such ideas has become blurred alongside the scales of analysis at which such schemes may operate.

Secondly, and notwithstanding this problem of definition, there are issues of application. While the root of the biography essentially lies in an ongoing anthropological discourse dealing with the exchange and circulation of objects in social networks (e.g. Strathern 1988), the ability to interpret these associations in past societies is clearly mediated by access to only one part of this association, namely objects. Archaeological applications have primarily used the biography as an interpretive tool that draws on a recurrent set of ethnographic examples to cross culturally identify that material evidence from the past may also have been seen in such ways. Objects are often held to be richly imbued with biographical significance under the intellectual camouflage provided by citations of (and possibly unread?) well thumbed ethnographic tomes (e.g. Kopytoff 1986). Although these are seen to be contemporary approaches, they are in essence not far removed from Graham Clark's (1965) suggestion for example, that the movement of Neolithic stone axes in Britain was analogous to the gift exchange of greenstone axes amongst indigenous Australian communities. These interpretations amount to little more than the direct imposition of one cultural system onto another, with both often far removed in space and time. Therefore, it is also necessary to question the suitability of the biographical framework for use in an archaeological context. Can such a premise ever be more than a metaphorical mechanism with which to highlight the multifarious relations between people and the material world? To answer this question fully, the epistemological basis of these ideas will be considered to determine whether the inherent flaws of biographical application are the result of either inadequate method or theoretical shortcomings.

1.3 Specifics

It is against these historical and theoretical backdrops that I wish to develop my discussion of Early Bronze Age (EBA) metalwork. Specifically, I will focus on copper and bronze flat axes in Scotland, broadly dated to the period c. 2,400 to c.1,700 cal B.C. (Needham 1996). In general terms, the EBA developmental sequence moves from the first copper axes, characterised by their broad thick butts and blades, to later more narrow, flat or slightly flanged examples in bronze, with lozengic profiles and narrow butts (Needham, *et al.* 1985, Classes 1-4). In Britain, axes are largely absent from grave contexts but numerically dominate both hoard assemblages and single finds. While they are the sole object form whose currency extends throughout the Bronze Age (Barber 2003:155), post-production and pre-depositional attention has invariably centred on the efficacy of these objects as woodworking tools. While axes will form the primary focus of my discussion, they do not exist in isolation, and therefore I will also refer to other contemporary objects, notably daggers.

However, rather than offering a passive conceptualisation of these objects in terms of functional utility during their 'use life' (Tringham 1994:175), I will situate various stages of an axe's 'life history' within the broader social scheme. Anne Woodward (2002) has noted how very few attempts have been made to reconstruct the specific object biographies and my argument will be that this state of affairs has emerged in part from a failure to examine some of the ways in which an objects history may be recognised from the physical evidence itself, let alone a consideration of how these object lives may have been connected to the personal histories of people. For metalwork, the relatively poor contextual information for any stage of an object's life has perhaps been seen as a further limit to the potency of the biographic framework. On the contrary, in place of focussing on contexts of production or deposition in isolation, an alternative stance is to consider the object itself as a context in its own right. I will develop this theme by taking a closer look at

states of wear, damage and fragmentation exhibited by the vast majority of these objects**.** While such approaches are readily used in the analysis of lithic material (e.g. Hurcombe 1992), they have only more recently begun to feature in the assessments of metal objects (e.g. Bridgford 1997; 2000).

1.4 Layout of this study

My underlying aim in this thesis therefore is to propose an alternative approach to metalwork that allows the fusion of what is a highly traditional body of evidence with some of the more recent ideas concerning the role of material culture in social relations (Gosden & Marshall 1999:169). Firstly, I outline the background to Bronze Age metalwork and critically analyse the way the evidence has been approached historically (Chapter 2). I will then review the idea of a biographical approach to material culture from both a theoretical and methodological standpoint and consider its applicability to Bronze Age metalwork (Chapter 3). It is against this backdrop that the methodology to be adopted will be described in Chapter 4, and the specific details of the EBA axe dataset will be given in Chapter 5. The results of my experimental and analytical work will be laid out in Chapter 6, before the implications of my findings will be drawn together and interpreted in Chapter 7.

2. APPROACHES TO BRONZE AGE METALWORK

2.1. Introduction

In this chapter, I would like to review the current state of knowledge regarding Early Bronze Age metallurgy. Firstly I will examine the physical evidence that exists for the metalworking process. Secondly, I will consider the way in which this rich body of evidence has been approached historically. I will argue that interpretation of this evidence has rarely ventured far beyond chronology, typology, provenance, and the technical aspects of production.

2.2 Bronze Age Metal

Metalwork has long been the focus of highly traditional subject of study, from the earliest antiquarian collectors through to the present. In Bronze Age studies in particular, the first copper and later bronze objects remain a central research theme set against a remarkable dataset, a rich body of evidence comprising literally thousands of objects. These earliest metal objects have long been associated with the emergence of Beaker pottery in the archaeological record, accounted for historically by the idea of a "Beaker Folk" migrating across Europe. While the wholesale movement of metallurgists in person has subsequently been overturned in favour of the movement of ideas between people, a strong association remains as shown by the presence of Beaker pottery fragments alongside the earliest evidence for copper mining at Ross Island, Co. Kerry (2,400 – 1,900 cal B.C. (O' Brien 1995; 2004)). The earliest metal objects are copper daggers and knives, such as those found alongside the so called "Amesbury Archer" (Fitzpatrick 2003), also a Beaker burial, as well as the earliest forms of copper axes (These will be discussed further in Chapter 5). These early forms are relatively soft in material terms and questions have been raised regarding their functional benefit over the stone tools they were to eventually replace. More recently, discussion has moved away from the obvious adoption of a supposedly superior technology, to concerns with the issues of technical innovation and incorporation into existing social norms and conventions of society (Sofaer

Derevenski & Sørenson 2002). Notwithstanding these assertions, there is dateable evidence for the early use of axes from tool marks left on timbers from the Corlea trackway, where dendrochronology has given dates of 2259±9 B.C. (O' Sullivan 1996). In Britain, there are a number of clear general patterns and changes that occur over time (summarised in Table 2.1).

Date	Mould	Metal/Alloy	Objects
End of Neolithic c.2,500B.C.–2,200 B.C	Open (Stone) Sand	Copper Copper Arsenic	Axes Daggers/Knives
Early Bronze Age 2,200 B.C.–1,500 B.C.	Open (Stone) 2 Piece (Stone)	Copper Arsenic Copper/Tin	Axes Dirks
Middle Bronze Age 1,500 B.C.–1,150 B.C.	2 Piece (Stone)	Copper /Tin/Lead	Palstave Axes Rapiers
Later Bronze Age 1,150 B.C. – c.750 B.C.	2 Piece (Stone) Lost Wax	Copper/Tin/Lead	Socketed Axes Socketed Spears Swords

Table 2.1 Metalwork Developmental Sequence

Firstly, there is an increase in the number of object types over time as well as an increase in the number of items in circulation. In simple terms, this trend is likely to map the slow though progressive uptake of metal objects in society as whole as well as the presumed availability of metal as a material in itself. Secondly, virtually all objects show a change in manufacturing techniques allied to parallel ‘developments’ in the technical process. Synchronic changes in mould technology for example are seen alongside differences in the composition of the material being used. While the earliest objects are of pure copper, they give way relatively quickly to the processes of alloying copper and tin to form bronze and later still the addition of lead to the mix (Tylecote 1986: 26). For the earliest copper metals, arsenic was either deliberately added to the mix or incorporated as a by product of using arsenic rich

ores as a preference. These compositional changes facilitated both easier casting and the production of stronger metal matrices. From around the mid third millennium B.C. the adoption of metallurgy was far later in the British Isles than in continental Europe where there is a distinct preceding Copper Age. However, by 2000 BC the technologies used were broadly similar (O' Brien 2004: 1).

2.4 Evidence of metalwork production

The large body of metal artefacts that have been recovered sits in stark contrast to the very limited evidence for their production in the British Isles. Notwithstanding this situation, the production of metalwork and the inherent metallurgical skills required have historically been one of the central themes in Bronze Age studies. The fragmentary evidential record of manufacturing has been underpinned by extensive metallurgical analysis (e.g. Junghans, *et al.* 1968) as well as detailed experimental programmes aimed at replicating the methodologies employed in antiquity. Most of what is known is therefore allied to modern day knowledge of the physical properties of metals and their production. Additionally informed through ethnographic comparison, these efforts have focused on both reproducing and refining the sequence of manufacturing actions, or 'chaîne opératoire', required to produce the various forms of extant objects. The flow chart in Appendix 1 presents a summary of these activities, which details the primary operations in the fabrication sequence and is split into several distinct areas. These divisions map a theoretical division of fabrication activity in that each operation, while being critical in the overall scheme, could be executed on a separate occasion and in a different location. In practice this may not be the case, where both smelting and casting operation may be carried out from a single furnace for example. It is not my intention at this point to discuss the social implications of these activities but to approach them from a technologically determinist perspective. This explanation of the chaîne opératoire is removed from both the socio-political relations of production and the dynamic social milieus in which these activities take place (Dobres 1999: 124). These issues have been highlighted in more recent anthropological texts (e.g. Dobres & Hoffman 1999; e.g.

Lemonnier 1993; Pffanberger 1992) and I will return to these matters in due course. As a conceptual tool, the chaîne opératoire allows an analysis of the technical sequence of production at an empirical level, but also a framework for the social re-contextualisation of these activities.

2.5 The supply of metal ores

The prospection for suitable ore sources clearly leaves no tangible physical evidence archaeologically. However, the ability to seek out specific material was not a phenomenon that emerged alongside the advent of metallurgy (Ottaway 2001). The deliberate and skilled seeking out of stone specific stones sources for Neolithic axes for example (Bradley & Edmonds 1993), or the seeking out of particular flint veins clearly demonstrates a long standing familiarity with both the landscape. In terms of metal, copper and later tin ores are not present in all parts of the British Isles, but major sources have been found in the South West of England, as well as at locations in Cumbria, Yorkshire, Cheshire and Staffordshire (Timberlake 1991). In relation to the relatively widespread distribution of copper ores, the presence of tin is far more restricted. In the British Isles, Cornwall held the largest concentrations of tin and is the only area with credible evidence for Bronze Age ore sourcing (Harding 2000: 201).

Once a suitable ore source had been selected, their extraction was carried out by three main methods; firstly the collection of surface rocks originating from natural outcrops; secondly by digging shallow pits into the ground to expose ore bearing layers (open cast mining); finally by underground mining that involved the excavation of shafts and passageways that follow the natural line of the ore bearing seams. Primary evidence comes from finds of stone hammers and antler picks used in the ore extraction process. Secondary evidence comes from the presence of tool markings as well as charcoal deposits from fire setting. This latter process involves the heating of rock faces by lighting fires alongside and subsequently inducing their

rapid cooling and shattering by pouring cold water over the hot surfaces. Some of the more noteworthy and discussed locations are Great Orme Head (Lewis 1998), Alderley Edge (Garner, *et al.* 1994), Mount Gabriel (O' Brien 1994) and Ross Island (O' Brien 1995; 2004) (Table 2.7). The dates clearly show activity from the Earlier Bronze Age onwards.

Location	Chronology	Dating Evidence
Ross Island	2,400- 1,900 cal B.C.	(O' Brien 1995; 2004)
Copa Hill	2,396- 2314 cal B.C.	Wooden Launder (Timberlake 1990)
Great Orme	1,880-600 cal B.C.	C14 dates on charcoal in spoil heaps (Timberlake 1990)
Mount Gabriel	1,700-1,400 cal B.C.	C14 dates on waterlogged wood & charcoal under spoil heaps (O' Brien 1994)

Table 2.2 Data from selected Copper Mines in British Isles

Various estimates have been made of the 'man' hours required to service these mines (e.g. Shennan 1995), but the question of whether smelting activity took place at mine locations remains unanswered, not least due to the fact that no slag has been found at any of these sites in Britain. However, mining evidence can only ever be incomplete owing to the ephemeral nature of small surface source which would have been readily accessible to the earliest metallurgists (Harding 2000: 197) as well as the destruction of other ore sources by later activity. For example, the photograph in Figure 2.1 shows the top area of exposed rock at the Great Orme mine in North Wales that is a product of the considerable amount of later mining that has taken place at this location. While there is clear evidence of Bronze Age workings, these

are further down in the rock strata beneath this later activity. Similarly, at Ross Ireland, mining activity continued into the Early Medieval period (O' Brien 2004).

Figure 2.1 Great Orme Mine head (Photo: Author)

2.6 The Furnace

Figure 2.1 shows the assumed simple firing arrangement used in the metalworking process which allowed the application of draft to the charcoal charge in order to lift temperatures to the required level for casting and smelting (see Appendix 1 for details). This proposes a clay lined pit sunk into the ground with air delivered into the seat of the fire via a set of bellows. Air would have flowed along a series of wooden ‘tubes’ that were separated from the heat and flame by a tuyère connection. In Britain however, there is no evidence for furnaces and no evidence of bellows have been found (presumably because they were made from organic material). On a more positive note, there is potentially one tuyère at Ewanrigg, Cumbria (Bewley, *et al.* 1992). Equally there are no clearly identifiable metalworking tools although there

are some finds of possible anvils in the Isleham Hoard, Cambridgeshire (Eluere & Mohen 1993) and from Lichfield (Needham 1993).

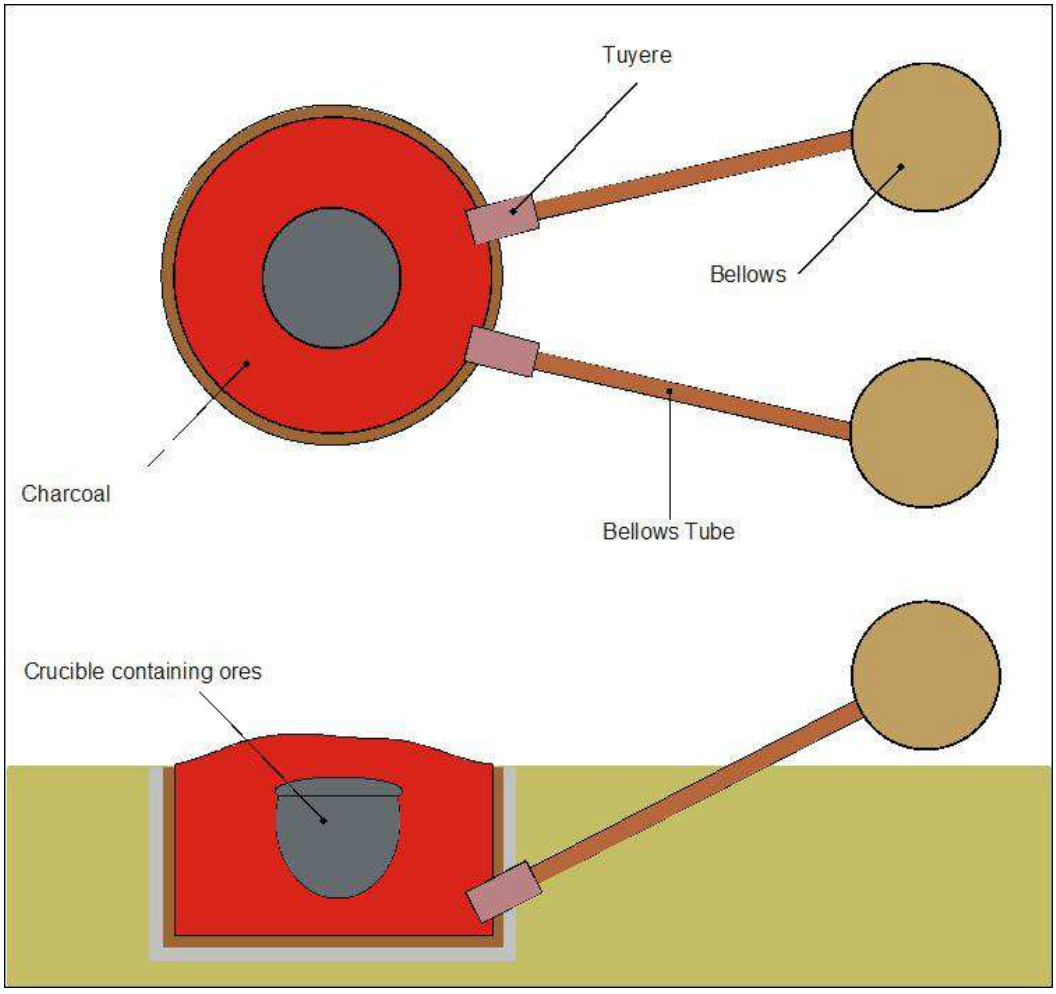


Figure 2.1 Schematic diagram of a Bronze Age furnace

Again, most of the evidence comes from continental European contexts. Equally, there are no deposits of metalwork that have explicit evidence that connects them to the actual process of metalworking (Needham 1988: 232), and it remains only one interpretation that they represent the stocks of metal smiths (see below).

2.7 Moulds

The main body of evidence for manufacture comes in the form of mould fragments and a number of examples of open moulds are known such as those at such as at Culbin Sands, Aberdeenshire (Callender 1903). However, only fragmentary evidence

of either two piece models or of clay moulds such as at Dainton, Devon (Needham 1980). In Scotland, other examples of open moulds have been found (e.g. Strathconan - Figure 2.2), all comprising single stone blocks with either single or multiple mould matrices cut into their faces.

Figure 2.2 Axe mould from Strathconan (Photo: Author)

They have predominantly been recovered in the North Eastern part of the country and none have been found in connection with any sites or other archaeological evidence. While Coles (1969) tentatively identifies 50 of his Type B axes with these moulds, none have the requisite matrices for earlier copper/thick butted forms (see Chapter 5).

2.8 The location of bronze working

In terms of the location of bronze metalworking activity however, continental Europe again has a more numerous examples such as at Fort Harrouard, France (Mohen &

Bailloud 1987), while in Britain, sporadic evidence comes from primarily Later Bronze Age settlement contexts such as at Mucking (Needham 1988) or Jarlshof (Curle 1932-3; Hamilton 1956). However, a functional interpretation is perhaps not always applicable. At Springfield Lyons (Buckley & Hedges 1987) for example, mould fragments were found deposited in the outer ditch terminals at either side of the entrance. There is however no evidence of metalworking at the site, and subsequent ritual connotations are often applied to such depositional activity. Moreover, the potentially magical, dangerous or even taboo qualities of metal production should not be overlooked (Budd & Taylor 1995), and how these may relate to the social perception of both the manufacturing process itself as well as those members of society who carried it out.

This speculation leads neatly into another area of speculation, namely the identity and social standing of those involved with or having the skill and knowledge of metallurgy. The main debate centres upon whether metal smiths were 'itinerant' (Childe 1930), travelling between communities to carry out their trades, or whether metal production was carried out by a particular individual or members of the community as part of the seasonal round of communal agricultural and productive activities. The former suggestion of transience is bolstered by the lack of evidence of centralised metalworking as well as the presence of so called 'Founders Hoards', which were deemed to be the stockpiles of material waiting to be realised (see below). These are largely a feature of the LBA. However, the somewhat romantic image of a wandering trader has been called into question primarily on account of the fact that similar individuals are not directly observable ethnographically (Rowlands 1971). Extant anthropological examples suggest that metalworking is practiced within the community as a whole, and those involved are often held in some esteem or even feared within society. Harding (2000: 237) suggests that from the Middle Bronze Age onwards, there is perhaps more evidence that could indicate the presence of some sort of centralised metalworking, such as the production of axe 'blanks'

ready for distribution or the fact that objects start to show greater degrees of similarity and standardisation.

2.9 Metallurgical analysis

A considerable amount of the literature relates to the metallurgical analysis of metal objects to ascertain the compositional analysis of each item. An initial wave of analysis after WWII was characterised by large scale programmes using Optical Emission Spectroscopy (OES). This methodology provides information in two key respects. Firstly, it has enabled the construction of the sequence of alloy composition over time. At a general level, this trend suggests the earliest objects were made from pure copper (Late Neolithic/EBA), to copper arsenic and copper tin alloys (EBA), and finally to a combination of copper, tin and lead (MBA/LBA) (Tylecote 1986: 26). Such observations have in part relied on the analysis of copper and bronze axes (e.g. Allen, *et al.* 1970; Coffey 1901; Coghlan & Case 1957). These changes in elemental additions have widely been held to increase the strength of metal itself as well as to refine the casting process. The addition of tin and lead for example both produces a harder metal and facilitates better pouring. However, since copper ores can be either relatively pure but also naturally contain traces of arsenic, debate remains as to whether the addition of arsenic was a deliberate or intended action. There are two convincing arguments that suggest a deliberate motive. Firstly, there appear to be relatively uniform levels of arsenic, which suggests some form of control either in terms of the amounts of arsenic added or the deliberate seeking out of particular arsenic bearing ores (Britton 1961). Secondly, these levels also show distinct patterns with higher levels occurring in metal items with a cutting edge, but less in ornaments and interestingly axes (Ottaway 1994).

The second area of investigation where elemental analysis has played a crucial role is the provenance of ores, and this has been carried out through a comparative analysis of the impurity patterns of both metal objects and the ores themselves. While this method was initially thought to be definitive, it has subsequently proved problematic in number of areas. Trace element analysis of extant ores sources have shown that

large elemental variations are contained within a single ore deposit, which means that an object from any source may contain a number of compositional overlaps. Secondly, additional elements not present in the initial ores used in experimental casting have been shown to end up in the final elemental make up of an object, finding their way into the mix from both previous casts or from the charcoal itself. Again, this situation further erodes the extent to which a definitive source of ore may be recognised from the elemental composition of an object alone. It should also be remembered that the mixing and recycling (see below) of metal from different sources practically erases all evidence of provenance (Pernicka 1998: 264)

Notwithstanding these caveats, various attempts have been made at defining distinctive metal types or groups. For the EBA in Britain, Northover (1980; 1982) has determined a series of impurity patterns and suggested that their spatial distribution shows clear circulation zones. Moreover, when these patterns are overlaid with chronological schemes, it seems that the earliest metals in Britain emanated from Irish sources before more localised ore resources in mainland Britain were exploited over time (Metal Types A,B and C). A similar pattern emerges for the EBA Scottish evidence as set out by Coles (1969: 56-68) who designated a number of distinct ‘metal clusters’ based on similarities in impurity patterning (Table 2.3). Coles suggested that these metal types correlated both typologically and chronologically with a number of objects. For example Cluster A & C were the most frequently represented sources in typologically early object forms, and the elemental composition was deemed comparable to the Group I metal advocated by Coghlan and Case (1957) and designated to be of Irish origin.

CLUSTER	A	B	C	D	E
Lead (Pb)	None/Trace	None	Low/ Med	None/Trace	None/Trace
Arsenic (As)	Med/High	Trace	High	Med/ High	Variable
Antimony (Sb)	Medium	Trace	Medium	Medium	Trace/Low
Silver (Ag)	Medium	Trace	Medium	Medium	Medium
Nickel (Ni)	None/Trace	None	None/Trace	Medium	None/Trace
Bismuth (Bi)	None	None	None/Trace	None	None/Trace
Iron (Fe)	None	None	None/Trace	None	None/Trace

Table 2.3 Metal clusters in Scotland and their elemental composition (after Coles 1969)

More recently, the application of Lead Isotope Analysis has come to the fore (see Needham & Rohl 1998 for example). Elements with a high atomic number demonstrate no measurable changes in their isotopic composition even after changes in chemical or physical state (smelting). When comparing the isotopic ratios of ore deposits with those from metal objects, a non match effectively rules out the ore source as a possible origin point for the object. The method is however unequivocal as different ore sources can have the same isotopic values, and therefore a direct match between object and ore do not absolutely prove point of origin.

2.10 Recycling

The fact that metal can be melted down and recast is often cited as one of the underlying functional reasons for the adoption of metal as a material and the

realisation of this potential sits in contrast to contemporary reductive lithic technology. Notwithstanding the fact that a theoretically perfect recycling economy would exhibit vary little metalwork evidence (Needham 2001) , it is widely held that metal was recycled. However, in the absence of any real tangible evidence, debate continues regarding where and when (if at all) such activities did recycling take place. One general observation to emerge from trace element analysis is that EBA groups show a more distinctive elemental record, and this has been interpreted as being an indication of relatively few ore sources at this time (Pernicka 1998: 259). This contrasts with the less distinctive patterns seen in the LBA, which has been seen as an indication of mass recycling of metals. If this is the case, the question remains as to how particular design mixes were achieved if metal from a number of sources and with a range of tin/lead/copper ratios were re-incorporated over time. The occurrence of so called 'Founders' hoards (see below) has been seen as an indication of recycling activity, albeit in a dormant form. The often implied assumption is that more recycling took in locations distant from readily available metal sources, especially at times of poor supply (Kristiansen 1978; 1984). Various other hypothetical models, based on the ebb and flow of an inherent metal stock in circulation have been proposed that attempt to account for various recycling regimes and how these may relate to the resultant levels of deposition retrieved archaeologically (Needham 1998; 2001).

2.11 Metalwork deposition

The vast proportion of the metalwork evidence recovered to date derives from either the deliberately deposited collections of material culture, commonly referred to as 'hoards', as single isolated objects, or as components of grave assemblages. At a general level, two patterns emerge throughout the Bronze Age as a whole, namely an increase in the amount of metalwork that appears to have been consigned to the ground, as well as a shift from dry to wet contexts of deposition (Bradley 1998). As well as an increase in the volume of objects deposited, there appears to be an underlying diachronic increase in the amount of broken or worn out material. At

slightly higher resolution, the correlation between object type and types of deposition in the Early Bronze Age reveals a number of non random patterns of deposition (Needham 1988: 230) (see Table 2.4). Axes rarely occur in graves in Britain, where there are only 13 definite axe grave associations, and it has also been suggested these axes are atypical in the broader typological schemes (Needham 1988).

Object	Context of Deposition
Axes	Almost always in hoards and as isolated finds and rarely in graves Number of isolated finds far outweighs the number of hoarded objects
Daggers	Predominantly found in graves or as isolated finds Some hoarded examples
Halberds	When associated they are rarely found with other objects Isolated finds outweigh number of hoarded examples
Spearheads	Primarily found in hoards or as isolated finds Isolated finds outweigh number of hoarded examples
Small Tools[1]	Predominantly found in funerary contexts Associated items far outnumber isolated examples
Ornaments[2]	Predominantly found in funerary contexts Gold Lunulae & gold discs both found in isolation from other metal

Table 2.4 Early Bronze Age Metalwork Deposition (after Needham 1988)

Hoard assemblages are a pan European phenomenon of Bronze Age archaeology, especially in later prehistory, it is perhaps testament to their enigmatic nature that they remain one of the least understood features despite being one of the most discussed bodies of material (Harding 2000:352). However, the fact that these

[1] Small Tools (Knives, Razors, Awls, Chisels)

[2] Ornaments (Beads, Bracelets, Sun Discs, Lunlulae, Neckrings, Hair Rings, Earrings, Pins, Button Covers)

collections have predominantly been found in isolation from other material or cultural correlates means that they have traditionally been viewed in quantitive rather than qualitive terms.

The definition of hoard in the Oxford English Dictionary is as follows:

> **Hoard** /h:ɔd/ 1. *n*. store (esp. of money or treasure), laid by.
> 2 *v*. amass, put away, store *up*.

By definition therefore, the term 'hoarding' encapsulates an implicit process heavily laden with ideas of deliberate storage and intended future use. As the term suggests, many interpretations have assumed this foundation in the construction of their reasoning. Moreover, there is an implied notion of a hoard being a collection of items consisting of more than a single artefact. These issues were implicit in Evans' (1881) categorisation of such assemblages as being either 'Personal', 'Founder's', Merchant' or 'Craftsman's' hoards, all representing caches of material awaiting retrieval. However, these divisions paid little attention to the large amount of metalwork found in seemingly irretrievable contexts such as the River Thames (Ehrenberg 1980). The majority of hoards are of solely metalwork and fall into the familiar Bronze Age categories of 'weaponry', 'tools' and 'ornaments'. These categories fit the general patterns of deposition but as Bradley points out, the only feature that they all have in common is that they have not been recovered until relatively recently (Bradley 1988:6). The waters are further muddied by the contemporary changes in burial practice observed in some regions. In Western Europe for example, it is as complex burials diminish that hoarding at 'wet locations' appears to increase. Burgess and Coombs (1979) further refined these categories into hoards that were deliberately concealed, hoards that have never been retrieved, votive deposits never to be retrieved and finally to instances of accidental loss. These ideas assume firstly that hoards were in some cases temporary depositions perhaps made during periods of social unrest and which were for some reason never

recovered; secondly they assume that the items that were deposited had an economic value. The interpretation of mistaken deposition also provided a suitable category into which single finds could be absorbed as well as explaining some material may have ended up in 'wet' contexts. Bradley (1984) suggests however that "metalwork which took along time to make can hardly have come to us through the incompetence of so many boatmen and the forgetfulness of so many smiths".

Many interpretations of the evidence concern themselves with the regulation of metal supply, the implication being that when too much bronze was available the only way to maintain its value would have been to remove items from circulation. It follows that as an anti inflationary measure, metalwork was hoarded. For example, O'Shea (1981:178) has proposed a 'social storage model', where at times of economic surplus, the community may invest in high status goods with which to trade or use as gifts in the future in order to maintain relations with other groups. Another suggestion has argued that the special character and social value of item is maintained by its removal (Meillasoux 1981:71). An increasing supply of items into society would increase the access of various levels of that society to goods normally associated with 'elites'. In this way, the status and social value of items would be reduced through wider ownership, and the deliberate hoarding of items would maintain the limited supply and hence the 'status' of an item. In terms of axe deposition in graves, Needham (1988) has proposed that the fact that many of the axes deposited in graves are of diminutive size is related to the regulation of metal stocks, in that the size of metal axes took less metal out of circulation. In all cases these interpretations are concerned with the reduction of metalwork from circulation. The nature of their economic approach results in the imposition of 'modern' concepts of value and 'supply and demand' to prehistoric society. Moreover, these ideas fail to account for the apparent irretrievability of some hoards from certain locations such as rivers. Nor do they account for who is controlling the deliberate reduction of metal.

2.12 The dichotomy of ritualised or utilitarian activity

Other interpretations have shifted away from both typological analysis and functional or economic motivations to promote ideas of symbolic behaviour and contextual variation (e.g. Bradley 1998; e.g. Burgess & Coombs 1979; Levy 1982). These representations have tended to conceptualise hoarding practices as being the result of either ritualised or secular action (Brück 1999). Levy has proposed a division of hoards into secular and votive assemblages (Levy 1982), and these ideas have been extended and discussed in terms of context by Bradley (1990). In making these distinctions, the composition of hoard assemblages are integrated with their depositional context. 'Ritual hoards' are deemed to be those found at 'special' locations such as rivers for example, and containing a restricted set of items. In many cases, the formal arrangement of the hoarded objects also suggest something more than a purely functional rationale behind their deposition. For example, the eleven axes hoarded at Carhan Co. Kerry (Schmidt 1978:319) were placed in a hollowed rock in a stream and arranged so as to encircle a pile of wood ash and deer bones with their blades facing outwards. The assumption behind these ritual deposits is that they were never meant to be retrieved and in accepting the votive nature of such activities, deposition has often been seen as representing 'gifts to the gods' (Bradley 1990; Needham & Burgess 1980). In contrast, non-ritual hoards are characteristically found in dry locations, close to settlements, and are utilitarian in nature. It is considered that these hoards were always intended for retrieval at some point in time. Needham (2001:279) identifies three underlying assumptions that are made in the designation of 'utilitarian' moniker. Firstly, retrieval is not difficult if desired, secondly that tools are mundane objects in contrast to fine weapons or ornaments, and finally that the physical act of scrapping bronze indicates an intention to capitalise on metal's continuing utility.

However, the ritual: secular dichotomy can be criticised on grounds that assemblages in both locations are markedly similar (Larsson 1986). Kristiansen (1984:93) has also proposed that votive offerings may represent a 'cheaper method' of consumption

than the giving of grave goods. The similarity between items found in rivers and bogs with those formerly found in graves, have strengthened arguments for the ritual deposition of items. Water deposits are perhaps a reflection of a new way of disposing of the dead with fine metalwork that is analogous with the grave goods found in mounds. Significantly patterns of water deposition occur when mound building declines. However as Levy (1982) has pointed out, some of the 'ritual' hoards in Scandinavia appear to comprise several sets of equipment rather than just the one that may be associated with grave goods. Bradley (1990) also highlights the fact that in Western Europe the distribution of votive deposits in the Later Bronze Age appears to increase suggesting an expansion of the consumption of metalwork. He has suggested that personal items were discarded to symbolically mark the end of a life cycle. This may have been the end of biological life or when the relationship between groups or individuals comes to an end (Bradley 1984:104).

2.13 Symbolic deposition and the consumption of wealth

The symbolic act of deposition has been seen as being equally as important as the make up of the deposits or indeed the contexts in which artefacts are ultimately found. Drawing on ethnographically attested notions of conspicuous consumption, specifically that of the Northwest Coast potlatch (Gregory 1982; Mauss 1925), interpretations have highlighted notions of 'competitive consumption' (Bradley 1982). In his study of Early Bronze Age axes from Scotland for instance, John Coles (1969:33) makes a direct potlatch analogy to account for a number of broken axes in hoards, the idea being that competition for status and power may have been played out through the act of public deposition or ability to 'afford'. Burgess and Coombs (1979:v) suggest that there is a relationship between acts of deposition and periods of instability, whereby the public act of deposition was a key part in creating and maintaining social status, ideas perhaps shown ethnographically by Geertz (1973) in his portrayal of the Balinese cockfight. Disputes between people are here mediated through the symbolic behaviour and the act of destruction, so eradicating the need for physical conflict. The cross cultural application of ethnographic models of gifting,

exchange and ritual consumption were deemed equally applicable to Bronze Age society that was similarly pre capitalist in nature. While many of these proposals have been applied to water deposits, where retrieval was unlikely, it is hard to reconcile the amount of dry land hoards and single finds that survive. The lack of evidence for the subsequent retrieval after initial deposition has lead to a dismissal of the idea that this activity may have happened (Needham 2001:277). It may be that hoarding fulfilled many functional and social requirements, and the complexity of its significance is demonstrated by the temporal and spatial variation in the material record.

2.14 Typological and chronological approaches

While some graves in the British Isles contain metal objects, notably daggers, the majority are found in isolation from other cultural features datable by radiocarbon and suffer from notoriously poor contextual information. This situation was highlighted over thirty years ago by ApSimon (1969: 57) in his assessment of the Bronze Age in Ireland, when he stated:

> *"Metalworking has been seen in terms of traditions and industries, which though often poorly defined, can be arranged in a succession of stages. Settlements and burials have been used to define cultures whose interrelations delimit periods and phases. But, because metal finds are so rare among grave goods and in settlements, it is practically impossible to combine bronzes and cultures in a single detailed chronological scheme"*

The availability of absolute dates for bronze has therefore been severely restricted, and has in part fuelled the focus on constructing relative chronological schemes based on the typological development of associated items. Into these structures, unassociated or 'single' finds have been allocated their appropriate typologically progressive position, and ultimately the entire relative proposal has then been assimilated into a broader absolute schemes derived from pan European dateable

contexts. The major areas of debate within such typologies and traditions have primarily been centred upon arguments concerning the date at which different researchers perceive changes in these aspects (e.g. Burgess 1980: 126; e.g. Harbison 1973). Consequently, approaches to the period as a whole have been from either a metalworking or a burial angle (Cooney & Grogan 1994: 96) with production of several ordered chronologies and traditions derived from quite separate bodies of data that have proved difficult to reconcile with each other.

The typological arrangement of finds also draws upon the idea that recording and classification are an essential part of an objective understanding of the past through the creation of a scientific body of data against which interpretations could subsequently be made. Ultimately, these notions of didactic objectivity emerged out of the shift from antiquarian collecting of 'objects of wonder' prior to the Renaissance, to a subsequent concern with the classification and the creation of scientifically proven knowledge that remains ever present today. The production of fantastically detailed and inclusive corpora of finds is perhaps one of the most tangible results of these notions (e.g. Burgess & Gerloff 1981). While these bodies of evidence were held to be incontrovertibly 'factual' documents, they remain problematic on account of the fact that typological arrangement and classification is at once a situated and subjective exercise. Interpretation was seen as being something that arose out of classification when in fact interpretation itself was a key tenet of the classification process (Barber 2003: 19). The original subjective classification system devised by C.J. Thomsen in 1816 into ages of stone, bronze and iron was subsequently adopted as the foundation of an apparently objective methodology with which to order the prehistoric archaeological remains of Europe.

However, such approaches have also grown out of the fact that metalwork is often regarded as the defining feature of a 'Bronze Age' (O' Brien 1995: 38), the central developmental phase of Thomsen's 'Three Age system'. Under this system, it is changes in form, material and technological procedures underwritten by ideas of

progress and development that provide the means of mapping the development of a society from ‘Age of Stone’ to an ‘Age of Iron’, via an ‘Age of Bronze’. The key element of such schemes is the location of a society’s relative superiority on the technologically defined scale of progress rooted in the Enlightenment paradigms of the eighteenth century. Moreover, metal, wealth and power are concepts that are easily combined to explain the evolution from simple societies to complex ones (Rovira 1995). Under the rubric of a cultural historic methodology particular artefact types were deemed suitably representative of distinctive cultural groups.

By mapping the geographical extents and movements of such characteristic styles and forms the distribution and movement of cultural groups could be determined. This promoted an idea of a Bronze Age society that was economically and technologically driven in relation to the production of objects, their accumulation and deposition (Needham 2001: 275). These ideas were reinforced by Childe (1930) who, in placing metal objects as the central currency of understanding the Bronze Age, saw the period as one defined by peoples access to these items be that in the shape of finished objects or their raw material prerequisites. Childe’s ideas were an extension of social and cultural progress issues, where technological changes were deemed to be representative of social and economic alteration. It is only more recently that the problematic nature of such a methodology has been subjected to critique. The fact that these divisions of time are essentially abstract arrangements often remains in the background, and the periods themselves are treated as though they were clearly identifiable, objective realities.

As such, the idea emerged that there would be a transitional period between each phase that should be detectable in the material evidence and distinct research programmes were created to identify the appropriate material transformations at the Neolithic/Bronze Age transition for example. Moreover, a closer examination of the evidence in the case of the British Isles, shows that there are perhaps more far reaching social and cultural changes attributable to the technologically defined

'Middle Bronze Age', such as new forms of burial practice or the emergence of field systems and settlements, in which the production and use of metal objects would appear to play only a subsidiary role (Barber 2003).

2.15 Outline of the problem

As shown by this review of the current state of knowledge regarding Bronze Age metalwork, academic attention has generally been centred on either production or depositional phases in an objects life and this situation is summarised in Figure 2.3. To reiterate, in terms of production, a focus on the manufacture, supply and movement of metal has been one of the central analytical areas, particularly in relation to the establishment and display of elite status. Such ideas are broadly conditioned by capitalist ideas of wealth, accumulation, supply and demand. Typological methodologies have also dominated, as part of the ongoing quest for more accurate chronological frameworks (Needham 1997: 55), to map the development of increasingly efficient items over time, and to plot the spatial distributions of various object styles in a broader European setting.

While these considerations have provided crucial information, they often remain at a relatively grand scale of analysis, where delineations of similar forms and styles are often taken to imply a convergence of meaning (Saunders 2000: 47). A relative lack of primary production evidence has evoked a considerable amount of experimental work, which has ascertained the fabrication sequence that lies behind the creation of the final object. In parallel, metallurgical analysis has attempted to chart both evolutionary changes in elemental composition and to question where particular ores originated, with a view to ascertaining distribution and trade patterns (Coles 1969: 54). The voluminous discussions on metalwork deposition have long debated the rationale behind such acts to the extent that the significance of metal has invariably inferred from the ways in which it was deposited (Bradley 1998: 83). The historical situation has served to sterilise approaches to this body of material, especially when the diverse nature of the evidence suggests a single explanation for all cases will

remain ever illusive.

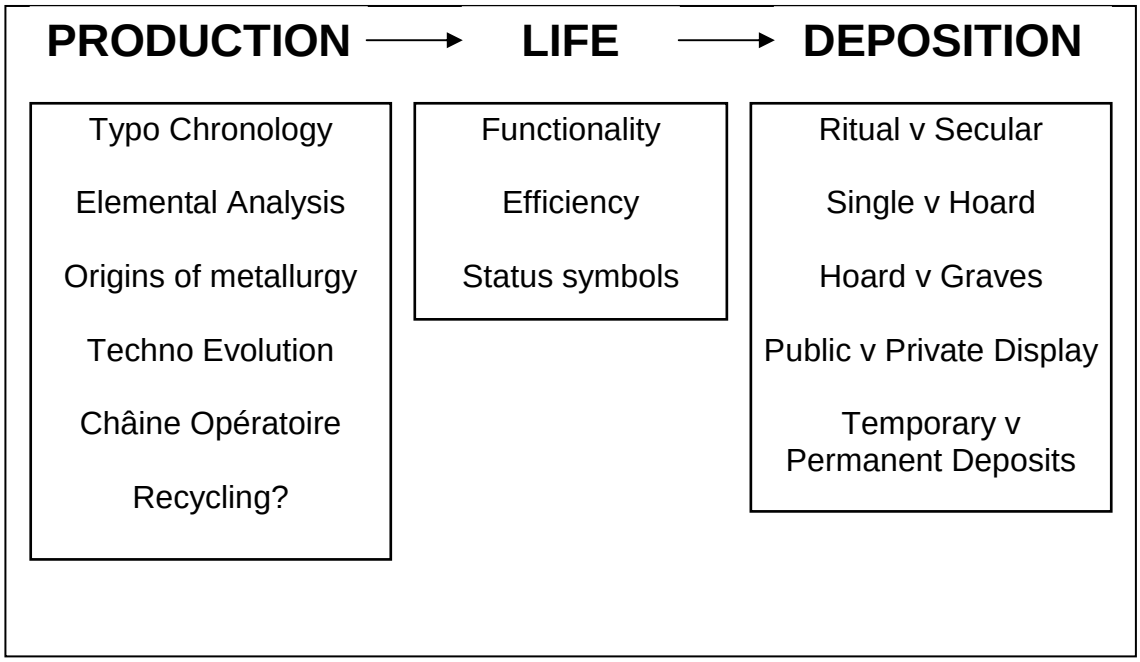


Figure 2.3 Approaches to metalwork and their relationship to the life of an object

Questions remain concerning the way in which metal objects were perceived in other than functional terms (Harding 2000:197). What have often been overlooked are the complex uses and understandings of material culture by people and the endless avenues of social meaning that may be contained in the data (Cooney & Grogan 1994: 97). What has emerged are a number of dichotomous categorisations that remain common discursive currencies today. For example assemblages have long been characterised as either single finds or hoards (or graves), and various secular or votive depositional motives have been proposed (see Bradley 1990 for detail and Figure 2.3).

My aim now is to move beyond these more familiar dichotomies and considerations to address a concern that the traditional mindset fails to adequately attend to what happens ‘in between’. By this I refer to what happened to objects during their ‘lives’ after their ‘production’ and before deposition. Our traditional approaches have tended to homogenise the lives of objects during this part of their existence by compressing each object life time. In many accounts, the reader could easily be

persuaded that objects were produced and deposited almost in the same action. At such big scales of analysis all swords are considered in the same way, as weapons of war, and possible status symbols for those who own procure or capture such items. Each one of these objects has however had a separate life that may very well fall within these grand schemes and norms, but nonetheless operates at the smaller scale of day to day action as an operand in social relations.

By emphasising the depositional phase of an object life, I contend that a somewhat retrograde assessment of the evidence has been offered that starts with the perceived context of an object's discard and subsequently works backwards through a limited number of interpretive dimensions. In contrast I want to advocate a perspective from the multi dimensional viewpoint afforded by the *a priori* position of those making, using and depositing objects (c.f. Van der Leeuw 1989). Rather than taking deposition or production as a starting point, I want to think about how these nominal phases of making using and discard may be interrelated with the lives of objects and people. As such, there is an essentially 'biographical' basis to my approach. Such methodologies have emerged amidst a wider concern for the role of material culture in social relations (Gosden & Marshall 1999: 169), and have become increasingly popular in the archaeological literature over recent years. Before I continue in this vein, it is necessary to consider the idea of an object biography and how it has been previously applied to archaeological evidence before assessing its suitability to the task in hand, namely an alternative approach to metalwork.

3. THEORETICAL FRAMEWORK FOR A BIOGRAPHICAL APPROACH TO BRONZE AGE METALWORK

3.1 Introduction

In this chapter, my intention is to set out the basis of a biographical approach that is applicable to Bronze Age metalwork. To do this, I firstly review the anthropological origins of this biographical concept as well as setting out the key theoretical tenets that underpin approaches of this nature. Secondly, I critically examine the way in which the idea of a biography has been applied to archaeological information. I will show that while it is now appears to be a very popular way of dealing with material evidence, there is still a separation between the objects themselves and the narrative that accompanies them. Finally, I set out a biographical framework that conceptualises the object as a context in itself, one that can materially reveal certain aspects of an object's life. It is this approach that I will adopt in my consideration of EBA axes in subsequent chapters.

3.2 The idea of biography

To begin my discussion, I would like to outline the concept of a biographical approach to material culture. It is aligned with the idea that as objects move through time, space and varying social settings, they continually accumulate histories of different meanings, understandings and consequence relevant to the specific contexts in which they have existed. The conceptual origin of this statement is to be found in an ongoing anthropological discourse that deals with the exchange and circulation of objects in social networks (e.g. Strathern 1988) and demonstrates how the boundaries between people and things can be dissolute and permeable. The fact that objects could have certain qualities akin to their human counterparts was initially highlighted by Kopytoff (1986), who drew attention to the fact that like people, things could not be fully understood at just one point in their existence but only as a product of their entire life history. His argument centred on the fact that if people could also become commodities as slaves and treated in the same way as material

things, then objects could also be seen to possess some of the essential qualities of being and be treated like people. If objects are to be conceptualised in the same way as people therefore, it follows that they too must be viewed in terms of their entire existence and framed around the passage of their birth, life and death (Holtdorf 2002; Jones 2002)

While the primary aim in making this distinction was to prioritise the active life cycle of an object itself and the way in which such items may be implicated in society, attention is also drawn to the fluid nature of the margins between people and things. Objects can take on some of the characteristics of a person and vice versa. In her work on Sumba for example, Janet Hoskins (1998) shows how material objects can be employed to both establish and embellish the particular standing of an individual in society as well as objects being used as a 'vehicle of selfhood' (ibid: 3). Such an approach marks a significant departure from a materialist perspective that centres on an objects finite use life in functional terms (c.f. the approaches to metalwork outlined in Chapter 2), and to address the ways in which objects are used to both define and recount personal narratives (Jones 2002: 84). In Hoskins' account, it is the Betel bag, a metaphorical container of aural stories that both represents the history and identity of its owner, Maru Daku and establishes his position as a revered storyteller in Kodi society. The symbolic passing down of this object confers the historical rights to tell the stories located within (Hoskins 1998:36). In this instance emphasis has moved away from the idea of an object having its own life history to one where the material world acts as a mechanism for the recounting of a persons' own life narrative as well as a vehicle for the display of social identity. We may draw a comparison here with Munn (1986) who has also highlighted how individual fame and renown in society may become established through access to and use of material objects, namely Kula shells.

3.3 People and objects

In further contrast to Western ideas of the bounded person, biographical perspectives also emphasise how objects are inherently related to the people who have made, circulated, owned and used them with objects taking on some of the essential qualities of being and the potential for each to be representative of each other. Drawing on the classic distinction between a gift based economy and one based around the exchange of commodities set out by Marcel Mauss (1925), Kopytoff (1986) also noted how the latter are removed from their context of production and given a value that is subsequently negotiated in a 'market' where it is the acquisition of an object itself that is the main aim of the transaction (Fontijn 2002: 25; Gregory 1982). Such a conceptualisation is symptomatic of Western ideas of object neutrality, where material items are 'alienable' and not related to the people who made them, the context in which they were produced, or with any reference to the way they have moved since their creation. By contrast, objects that circulate in a gift economy are closely related to their context of production and consumption where the purpose of gifting is to create and maintain social relations by building up varying levels of indebtedness. While the objects that are used, 'gifts' may have a concurrent monetary value, it is the movement of objects in reciprocal spheres that allows for the spatial extension of social links, indebtedness and relations (Gell 1998; Sahlins 1974; Strathern 1988).

The 'value' of a gift therefore is founded upon elements of its inherent history that emerge from important facts such as the identity of its creator, recipient or past owners. The notion of a gift therefore moves beyond the physical object itself to additionally entangle issues relating to its spatial, temporal and social significance. In her studies of Melanesian society, Marilyn Strathern (1988) looks at how the histories of people and objects can be interwoven and describes how each can be seen to move in a network of social relations where the identity of either is ever changing in relation to the position it takes up in this network. One of the key factors in Strathern's argument is that for Melanesian people, the boundaries between people

and objects are dissolved and divisible. Material items are thereby viewed as compendiums of human agency and as detached parts of people while people are seen as being 'made up' of the objects they have made and transacted - "social trails may lead up to and follow the use of physical objects which, insofar as they are sometimes associated with particular persons, extend that personhood beyond the individuals biological body" (Parkin 1999:303). Both objects and people therefore have a biographical history of interaction and meaning and these proposals demonstrate how, in our highly mechanised and commodity based society, we have tended to alienate objects from their contexts of production with a shift away from a conceptualisation of skilled practice to a demonstration of function and utility (Dant 1999:150).

3.4 Biographical Theory

There are several key theoretical tenets that set the biography apart from other approaches to material culture and it is worth highlighting them before proceeding to discuss their application archaeologically. Firstly, a biography suggests that an absolute or universal truth is not possible and belief in a totally objective interpretation of the past is dismissed in favour of hermeneutics and critical theory. As such, it also contends that there are no essential properties of the world or of people but rather a diversity of readings of any given situation or set of material – in short there is no one historical narrative to be proven but many interwoven histories to be interpreted. 'Meaning' can therefore never be fixed but remains in a constantly fluid state of recreation and negotiation. It is these meanings and the way in which they are configured that are combined to form the unique components of a history. In place of any claim to objectivity therefore, a biographical methodology is overtly subjective, and centred on two fundamental areas, specifically the way in which meanings are created through the interaction of people and objects and secondly how these meanings are both accumulated through time and space (Gosden & Marshall 1999b:170). Rather than investigating larger scale 'meta-narratives' (Lyotard 1984), the biographical framework is more concerned with the specific details of the human:

object association and as such is interested in smaller scales of analysis that localise material culture within the context of personal and interpersonal interaction (Spector 1993). In place of an analysis of change over vast spatial and temporal tracts, consideration is given to the role of material culture at the level of the human life course (e.g. Sofaer Derevenski 2000) or the life cycle of an object, framed within the biographical metaphors of birth, life and death.

3.5 Biography, material culture and prehistoric archaeologies

The 'biographical approach' has now become firmly established in shaping the methodologies employed in archaeological interpretation, and in recent years there has been a proliferation of published articles and books that set out to consider the cultural biography of various material items. However, with respect to archaeological evidence, our ability to interpret the relationship between people and objects in past societies is clearly mediated by access to only the material elements of these associations and archaeological perspectives therefore do not directly study humanity in an anthropological sense, but theorise the interaction between people and tangible objects (Lesick 1997: 36). The adoption of such an inductive research methodology that emphasises the specific details of object/human/environment relations recognises society as being far more complicated than previously suggested and sits in contrast to previous approaches to material culture in archaeology. Culture Historic archaeology emphasised both the material recognition and development of ‘cultures’, where objects were held to be the ‘mute products of internalised traditions’ (Thomas 2000:361) as the distinctive material signatures commensurate with definable cultural groupings. Material culture was thus seen to tell us about past people through various inferential and analogical approaches. The catalyst for change in an objects form, style or decoration was seen to have resulted from contact between people, be it related to trade and exchange or to the wholesale migration or invasion of sections of the population. In the context of Bronze Age studies, the classic example regularly cited to demonstrate these ideas is that of the ‘Beaker

Folk', identified in the material record by their eponymous ceramic vessels, crouched inhumations, and archery equipment.

In reaction to this situation, the development of positivist approaches to material culture, under the auspices of the New Archaeology, was united by an attempt to objectively separate elements of the human/object relationship and generally framed objects as passive mediums through which to infer the nature of humanity. In viewing the association between people and material culture as an empirical relationship, it followed that what could be discovered about anthropogenic activity in the past is both created and limited by 'observationally static facts' that inertly reflected a fossilised history (Binford 1977:6; Patrik 1985). Attempts were made to create a series of generalised laws at large scales of analyses that were deemed to be cross culturally applicable. It is in this way that the creation of scientifically proven objective knowledge was possible. The epistemological basis of these endeavours holds that absolute universal truth is possible and that certainty is achievable. Moreover, it is the truth that we should be aiming for. Frameworks were sought by which to quantify and compare social identity and status as well as adopting a 'Modern' day materialistic conceptualisation of objects. Such an approach views objects as the physical manifestation of human intent to achieve particular goals against the external forces of nature, and developing along an ever increasingly efficient linear technological trajectory as an 'extrasomatic means of adaptation' (Binford 1965:205). Objects were not seen as emanating from the internal mechanisms of society, but driven by the need to counteract and survive the pressures exerted from nature.

A division of human and object has in turn affected the way in which either side of this equation have been treated in terms of classification, description and interpretation (Shanks 1998:22). Objects in general have been subjected to studies that seek to reveal their functional capacity, their date of manufacture and use, and developments in form and style. A consideration of these issues over long periods of

time allowed for a comparative study of change in the material record and epistemologically. On these grounds, archaeological approaches sought to create a series of generalised laws at large scales of analysis that were cross culturally applicable and in this way the creation of scientifically proven objective knowledge was ultimately possible. At such large scales of analysis, attempts were made to identify universal patterns in the material record but failed to cater for the day-to-day lives of people and objects in the context of social action. As I have already shown in Chapter 2, approaches to Bronze metalwork are often characterised by large typological corpora of inventories such as the *Prähistorische Bronzefunde* series, which embody this state of affairs, where delineations of similar forms and styles are taken to imply a convergence of meaning (Saunders 2000:47). The situation served to sterilise approaches to this body of material especially when the diverse nature of the evidence, such suggests that no single set of explanations can be applied to all situations. Objects have been homogenised by type rather than considered on their own merits. The fact remains that objects all have different lives, and are part of networks of relations between people, even though they may fall within social convention.

3.6 Archaeological biographies and contexts

Given that the whole purpose of archaeology is arguably to write a story that revitalises material remains from the past (MacGregor 1999:260), it is perhaps unsurprising therefore that the biographical notion has proved to be so popular in archaeological circles during recent years. Owing to the fact that the objects themselves cannot tell their own stories, it is been put together for them by employing the metaphorical mechanism of biography (Dant 1999:143). In practice, biographic syntheses have tended to follow either a historical or metaphorical aspect. Historical biographies essentially sequence a number of events along a linear trajectory and provide and interpretive narrative to account for the changes in this progression (e.g. Hamilakis 1999). Very often these are “long biographies” (Holtdorf 2002). Alternatively, and particularly in relation to prehistoric evidence, a more

metaphorical approach is adopted where production, use and deposition are conceived under the headings of birth, life and death, and it is the human like qualities of objects that are very often at the centre of these approaches.

Archaeological biographies tend to start with the material residues of the past and work backwards through time to postulate the prior trajectory of an object to account for its final archaeological context. In these terms, archaeology itself is an essentially biographical mechanism. Studies normally start with a perceived transitional point in an object or person's life, such as the deposition of an item or the burial of an individual, and work backwards to create a narrative framework through which to account for the initially perceived situation. It is interesting to note that it was on this basis that Schiffer (1987) that attempted to create a series of laws to account for the passage of an object from its systemic to its archaeological context via a series of cultural or natural transforms based on inferences regarding the life history of things (Holtorf 2002). A critique of these proposals would centre upon the generalised nature of Schiffer's interpretation that is deemed to apply to all situations.

Many of the contributions to the *World Archaeology* volume dedicated to 'cultural biographies' (Gosden & Marshall 1999a) can also be seen against this backdrop. While these examples are based on the theoretical tenets outlined previously, such ass the active nature of objects and the need for a contextually specific interpretation, both their temporal and contextual scale of analysis remain at a relatively high level. Laura Peers' (1999) account of the life of the 'S. Black bag' for example, an item which has been variably seen as a loving gift, souvenir, curiosity and a museum artefact to name but a few of its connotations, demonstrates how radical changes in the objects context influences the way in which it is reconceptualised through time. While the object in this example has clearly accumulated a number of meanings that are directly related to the various places and times in which it has existed, the drastic changes in context have meant that previous understandings have been lost or fragmented to the extent that they are no longer implicated in the construction of

fresh ideas. Its 'long biography, (Holtdorf 2002) reveals that it is now far removed from both the life/context it was originally planned to have, and the social milieu in which it was originally intended to circulate A slightly different situation is demonstrated by Hamilakis' (1999) account of the cultural biography of the 'Parthenon Marbles', which reveals how this collection of objects has similarly gained its biography through the creation of new meanings and significance that are directly related to past understandings.

In other cases, it is the movement between essentially unrelated contexts that fuels the biography of an object, where initial meanings are lost and new ones created in a different unconnected time and place. Thomas' (1991:18) analysis of the way in which new relationships and understandings are fostered in a colonial contexts also builds on this premise by further diluting the commodity/gift dichotomy and draws attention to the way in which original meanings can be created and accumulated with regard to relative scales of contextual shift. In all these examples objects have physically moved in space and it is this tangible disposition that has inaugurated a shift in meaning. In the example of Kula exchange, it is a movement between related contexts within the broader sphere of Melanesian islands that is the prime mover in creating a biographical narrative and giving objects significance. The nature of these biographies reveals that these objects are far removed from both the life and context it which they were initially planned to operate, and the social milieu in which it was originally intended to circulate. The fact that I will be discussing a collection of archaeological evidence (EBA axes) later in this thesis also fits into their extended biography.

However, in practice, I would argue that the attractive idea of biography has been widely used as merely a descriptive tool that draws on a recurrent set of ethnographic examples (e.g. Kula exchange) to cross culturally identify that prehistoric material *could* also have been viewed in these ways. For example, Whitley (2002:221) highlights how many Neolithic specialists have been unable to make any significant

suggestion as to how the meaning of a particular object may have altered throughout its history, preferring to merely state how certain objects have 'rich biographies' (see also Joy 2007). While anthropological studies show clearly how objects and people are interrelated and often interchangeable, there has been a strong temptation to "cut and paste" ideas from present to past. In recognising that objects may have biographical significance to their owners and users, as well as demonstrating how artefacts have distinctive life histories that extend from their production, through use and deposition, only a small number of studies have mapped the specific biographical trajectories of certain objects throughout their lives (Woodward 2002).

It is crucial to consider both the socially structured decision making processes that lay behind these trajectories and the cultural milieu in which these paths open out. Therefore, in writing biographically, it is imperative to consider the trajectories of material items as situated and structured elements in social convention, and consider objects from the forward looking perspective of those who created, used and discarded items. Society is made up of both 'people' and 'things' (Riggens 1994:1) and while both sides of this association are quite separate and distinct spheres, they are linked by a dynamic interrelationship (Sørenson 2000:75). Objects, people and the environment share an inseparable bond and rather than being separable static phenomena which can be analysed in isolation, they are held to inform each other and to gain significance from their mutual association. Instead of simply encompassing the actions of the individual (Barrett 1994:5), human agency is the *knowledgeable* behaviour of people who make choices that affect the world in which they live and it is through these decisions that they have the capacity to shape their existence in any way number of ways. Concurrently, these judgments are bounded by a series of structures, norms and conventions that pervade the social fabric and shape the decision making process at varying levels of consciousness (Giddens 1984). On this basis, Bourdieu (1977) denotes how social practice shapes society by concentrating on the taken for granted routines of daily life, or 'habitus', in which

people create and become structured by social institutions and beliefs beyond their conscious awareness or control. From this perspective, a recursive relationship is seen to exist between social structure and agency, whereby human action is not random but both constrained and enabled by social conventions that are simultaneously created and maintained through both the conscious and subconscious agency of individuals. The duality of this situation can be understood to emerge from endless set of reproduced relations that manifest themselves as a series of repetitive social practices and it is through the ongoing performance of this agency/structure relationship that social constitution is continually reaffirmed.

The production and use of material culture is fundamentally situated in this arrangement, and is born out of the mutual dependency of both human agency and structure where objects are created through synchronic actions informed by the decisions and context of people. Objects provide a fundamental apparatus through which social relations are mediated (Brumfiel 2000:250; Dobres & Hoffman 1994:212), and have the ability to act as a bridge between the mental and physical worlds (Miller 1987:99). Since people have the ability to affect the social structure through their own actions they are able to reproduce it or change it and authority can be demonstrated by the ability to manipulate objects. As medium for social action, material culture is ‘meaningfully constituted’ and so derives its meaning from the roles that it plays in these contexts of practice and it follows therefore that a contextual interpretation of objects is needed to permit any understanding of social relations in the past (Hodder 1986:170). Under such a scheme, meaning is not attached to the object itself, but arises from the way it is used, or ‘read’ in a particular temporal or spatial context (Tilley 1991).

In the meantime, this perspective crucially highlights how both time and space are fundamental elements of social interaction. It is through time that norms are modified

and maintained and it is in space that these activities unfold. Since this is a fluid state of affairs that is never complete, it is inappropriate to "take a timeless snapshot of a social system as one can, say, take a real snapshot of the architecture of a building. For social systems exist as systems only in and through their functioning (reproduction) over time" (Giddens 1981:17). At each point in its life therefore, an object exists as an intrinsic variable acting in webs of social action whereby human beings live through the material things that surround them (Thomas 2000:362). Rather than reconstructing generalized laws, or retrospectively mapping the trajectories of objects and people 'after the event', we must recognise that the small scale and localised actions that were "deemed appropriate and effective and made sense according to some recognisable order and logic in the world which they addressed and to which they also contributed" (Barrett 1994:3). It is from these smaller scale assessments that we move to recreate the larger scale structures of life (Jones 2002:83).

Rather than solely thinking about objects as they move through linear time, we should also pay due cognisance to the fact that they are at once representative of time itself, as the physical manifestation of past, future and present. Sofaer Derevenski (2000) presents a useful example in which to frame these ideas through her interpretation of a series of Copper Age spiral arm rings at Tizapolgar Basatanya. She describes how these objects may have been employed to denote both different stages in the human life cycle as well as playing an important role in the expression of gendered identity. Since these items only occur in the graves of males aged between 5 – 25 years old, it is contended that it is thought the fitting, elongation and eventual removal of the arm rings that the gendered course of human life is tangibly represented. This I contend is a synthesis founded upon a biographical account of both objects and people that is also situated in the ***intended context of conventional action***, and encapsulates the idea of the 'short biography' put forward by Holtorf (2002).

3.7 Objects as contexts

The narrow declaration that objects must have had rich and varied biographies has emerged in part from a failure to examine some of the ways in which an object's history may be recognised from the physical evidence itself, let alone a consideration of how these object lives may have been connected to the personal histories of people. In many situations the material nature of the object is in fact deemed insignificant, or plays little role in the biographical narrative. More often, it is the relative position an object takes in a web of exchange that is seen as the critical issue, rather than reference to its material form or condition. Most object histories are based on movement in social contexts and between members of societies. Figure 3.1. sets out this situation. In terms of applying these ideas to Bronze Age metalwork therefore, one is left with what seems a sizeable problem of applicability. As I have already outlined in Chapter 1, the contextual information available for most metal items is extremely limited. Most metal objects have been recovered in non archaeological conditions and even the relatively rudimentary information such as location has been lost. Virtually no information is available regarding the spatial contexts in which these objects ultimately ended up, or where they resided and operated during their lifetimes.

Rather than focussing on a movement between spatial contexts therefore, an alternative stance is to consider the object itself as a context in its own right, as a physical record of its lifetime. Objects themselves are physical manifestations of their compound lives and affect the way in which they are perceived, valued and treated. As such, “the life of an artefact is accompanied by physical changes and processes. An artefact wears in its use and consumption. Marks upon it attest to events it has witnessed, things that have happened to it. It can deteriorate. The artefact ages” (Shanks 1998:17). The approach adopted here is to consider these features from the physical evidence itself and then to relate them to the social contexts in which these object existed. In some cases it is the physical appearance of the object that conditions our relationship to it. As an example, Shanks (ibid.) uses

the example of moon rock and the way it is treated to show how our perception to the fact it comes from another celestial body is completely different if we are then told that the rock is in fact from the earth for example.

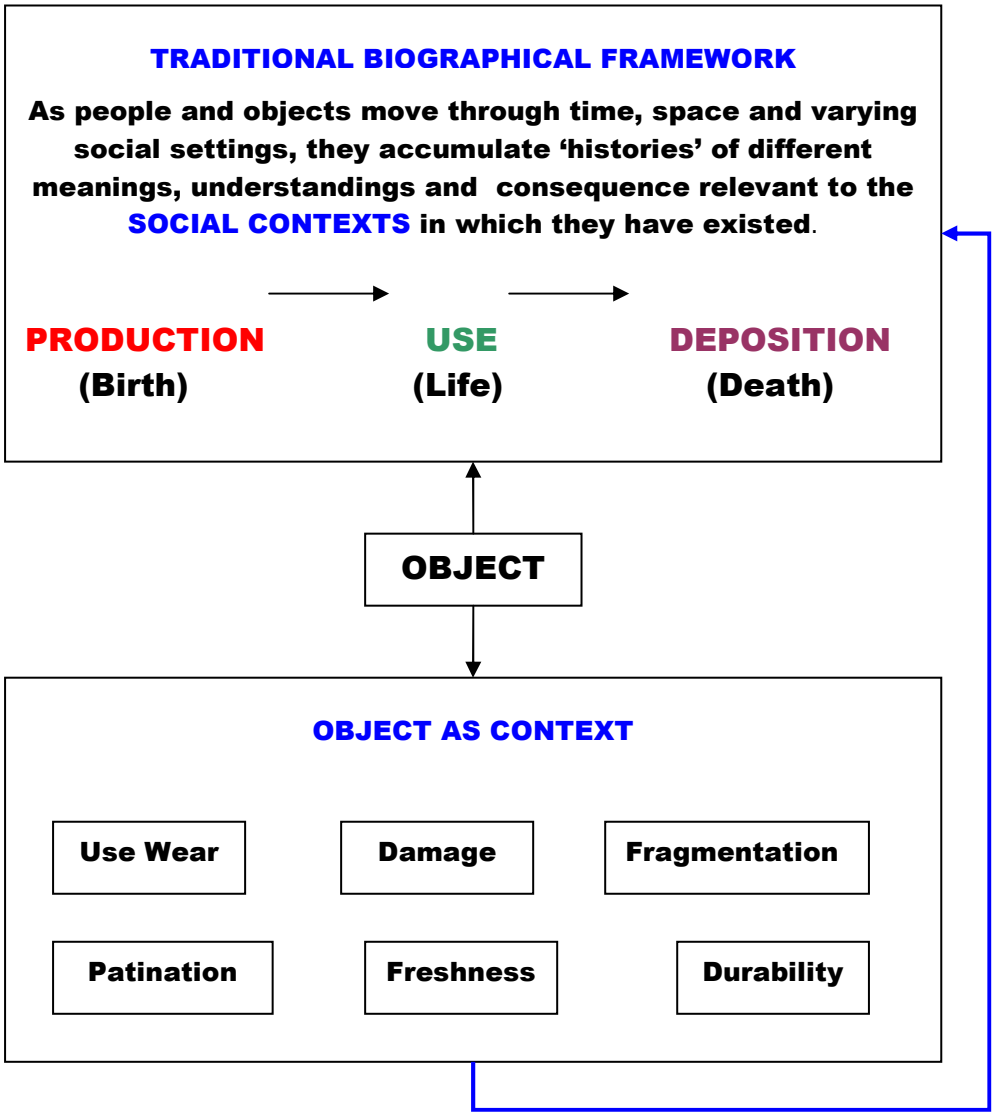


Figure 3.1 Objects as contexts

In this case there is an 'aura' that surrounds the object, a concept put forward by Walter Benjamin (1969) . Although Benjamin forwarded his concept idea in relation to 19th century artworks and the subsequent advent of photography, it is equally applicable to material culture in a wider sense. The conceptual basis of his

suggestion is that there is something elusive about an object that affects the way it is conceived, but that something is forever beyond our reach in a physical sense. This could merely be a history or story accompanying an object that leads us into a particular relationship with it. However, my argument here is that there are in fact many constituent parts that make up an 'aura', and an associated place of origin (in the case of moon rock) is just one facet. In this example, it is unlikely that the physicality of the moon rock was recognisable to most people. Another constituent part of an object's aura is its physical condition and appearance. For example, think of how we may relate to and treat something which we perceive to be old due to the wear it displays, such as a dusty old book in a library, or an illuminated manuscript in a museum. This physicality also extends to people. We relate to a person with a wrinkled face and grey hair in a completely different way to that which we may interact with someone which displaying the physical attributes of youth. As another facet of an aura, an object or person history is therefore tied up in their physical appearance. In the case of Bronze Age metal, I believe that this is presents a way to bridge the spatial and temporal contextual void. This approach can more closely relate the physical objects themselves and the narratives that we construct for them. It would be possible to imagine virtually any narrative within the theoretical limits of the biography concept outlined previously. Contrastingly in my opinion, it is crucial to pin a biography down and relate it to the objects themselves and in so doing construct a narrative that is more firmly grounded in the material itself. In this way, my intention is to release some of the hidden details contained within and attached to what are familiar objects to us. The blue connecting arrow in 3.1 represents this approach in that the physical attributes of the objects themselves are prioritised and related back into the more traditional approach the construction of an object biography.

3.8 Biography and Wear Analysis

One way in which we might begin to address this apparent lacuna therefore, is to take a closer look at states of wear, damage and fragmentation. Analysis of these features are readily used in the analysis of lithic material (e.g. Hurcombe 1992).

Analysis of gloss or ‘polish’ along the cutting edge of flint tools for example, can reveal the specific type of activities that a particular implement was employed in, differentiating for instance between either the cutting of plant materials (e.g. Edmonds 1995:42) or the processing and slicing of meat (e.g. Vaughn 1985). However, metalwork has until quite recently has received much less direct attention in this regard (see for example Bridgford 1997; Kienlin & Ottaway 1998; see for example Taylor 1993) perhaps due in part to a lack in confidence in the ability of such methodologies to reveal any useful information Indeed, David Fontijn (2002:32) has recently taken the pessimistic view that it is difficult to ascertain any archaeological correlates that identify anything about the way in which an object is used. While there has been extensive analytical and experimental work on the production of metal objects, as well as an increasingly voluminous literature that is concerned with their final deposition, studies that aim directly to analyse patterns of use wear on metal objects are relatively thin on the ground.

Notwithstanding these assertions, the physical state in which metal objects have been found has been implicated in their classification for some time and my review thus far has already borne out several instances where this is the case. For example, the typological categorisation of hoard assemblages by Evans (1881: 457-470) divided assemblages by function into distinct categories, but also on the condition of the objects contained therein. Under this scheme, so called ‘Founder’s Hoards’ were identified by the presence of worn out items, scrap metal and casting debris indicative of the manufacture of metalwork. Conversely ‘Merchant Hoards’ were distinguishable by the presence of a number of similar items in unused condition ready to be sold or exchanged. Even though the relatively simplistic and broad nature of these divisions has been criticised, they remain a common classificatory currency used in contemporary analyses. Allied to notions of competitive consumption, the breakage of items prior to deposition has been seen as a status enhancing public act of desecration that demonstrated individuals’ wealth and ability to destroy it (Bradley 1990). At Flag Fen in East Anglia (Pryor 1991), a large quantity of metalwork that

has seemingly been deliberately broken was recovered within throwing distance from the wooden trackway that extended out into the mere. Interpretation of these finds has centred on the ritualised actions of people in this regard and the deposition of high status items into the water. Elsewhere, studies of two Central European hoards from Zalkod and Vaja in North-eastern Hungary (Kristiansen 1999) have been interpreted as votive offerings made by the victorious side in combat on the basis that most of the swords in these hoards carry un-repaired 'combat damage' (Kristiansen 2002). The actual use life of an object is aligned with the characteristics of its final deposition and Kristiansen has also shown how sword hilts exhibit wear patterns attributable to clothing (Kristiansen 1978). On a contrastingly belligerent theme, Sue Bridgford (2000) was concerned with patterns of use on bronze swords, and through a series of experimental syntheses, she contends that arrangements of blade trauma are related to changes in conflict type.

An allied concern is the apparent freshness of wear and damage that is observable. While these considerations are difficult to quantify in a non subjective manner, material will be subjected to various types of attrition through time through either use itself or during periods of circulation. One only has to look at modern coinage as an analogy for the range of freshness displayed. It follows that over time the condition and freshness of items will decay as a direct function of its time in circulation. Coles and Taylor (1971:13) noted such factors in relation to gold items associated with the rich Wessex culture burials, where the very freshly executed ornamentation of some of the items was held to be indicative of a very short time in circulation after manufacture. In an alternative study of wear patterns on daggers also from Wessex, Julia Wall (1987: 115) alternatively suggests that items with a restricted currency or special symbolism may also have circulated for longer as significant social props. Similar ideas were eluded to by some of Kristiansen's earlier work (1977; 1978) that focused upon use wear patterns on hoarded items in Denmark. He suggested that in areas distant from sources of metal and in times of poor supply, items were used and circulated for longer and perhaps recycled. Equally, Bridgford's (1997) analysis of

use wear on swords dating to the Irish Bronze Age, contends that some of these objects, notably from ‘wet’ or ‘votive’ contexts displayed little use wear. Her thesis is that these ‘special’ swords may already have had special significance attached to them during their production which subsequently guided the way they were ‘cared for’ during their lives before succumbing to a predestined type of deposition. These conclusions echo Kristainsen’s (1984) identification of highly decorated swords found in complex grave groups in Denmark that show little signs of use, which sit in contrast a second group from simple burial reveals traces of combat damage and resharpening.

3.9 Fragmentation and Biography

The freshness of breakage also has ramifications for the way in which interpretations are made of object fragments. John Chapman (2001) has considered depositional practice through the lens of fragmented objects. His approach suggests that fragmentation allows the multiplication of one item into more numerous pieces and the creation of a social currency that permits a greater diversity alongside the association and juxtaposition of other items. Therefore, the individual parts of the whole may have been of equal significance as the complete object itself. In considering data from the prehistoric period in Eastern Europe, Chapman makes an important distinction between whole and parts of objects, and how these are deliberately organised when deposited. His suggestion is that through the breakage, collection and exchange of wholes and parts of objects, social relations are both forged and developed. Through the re-incorporation of a range of fragments into a ‘new’ object, perhaps through the recycling of metalwork or the use of grog temper in pots, these relations are both strengthened and negotiated. While Chapman’s assessments are essentially drawn from depositional arrangements of items, his ideas have clear ramifications for the circulation and accumulative histories of objects in different fragmentary states, and there is an essentially biographical element to these ideas. The notion of a life history is aligned with the idea that as both people and objects move through time, space and varying social settings, they continually

accumulate histories of different meanings, understandings and consequence relevant to the specific contexts in which they have existed. This approach recognises that objects are active in social relations and aims to illuminate how the interaction between people and things may figure in the production of meaning. As such it sits in contrast to the idea of an objects use life, where the sequential stages in an objects existence are recreated and recorded over time with particular attention being given to morphological changes or alterations to an objects functional prowess (Gosden & Marshall 1999b; Tringham 1994).

It follows that there is a direct relationship between elements of wear over time and the life history of an object. Although this connection has been made in relation to bronze metalwork, it has been more systematically realised in assessments of objects fabricated form other materials. In respect of composite jet necklaces for example, Shepherd (Shepherd 1985: 208-209) has interpreted differential wear patterns on individual beads as indicating that they had lead different lives of various durations prior to their joining together. Sheridan and Davis (2002: 822) also suggest that the majority of spacer plates show little signs of wear, suggesting that they were not worn much prior to deposition. Taking these observations a stage further Jo Brück (2004:313) has recently proposed that differential states of wear result from the amalgamation of different necklaces into new wholes, thus metaphorically representing relationships between the living and the deceased. A similar analytical basis is adopted by Skeates (1995) in his approach to the prehistoric ‘axe-amulets’ from the central Mediterranean. In this case the life histories of personal jadeite pendants from their original forms as larger ‘axes’ that are progressively fragmented and worn down through to their redrilling and reformation as bodily adornments. Axes are seen to circulate and accumulate prestige and histories until they are too small to function, at which time they move into a ceremonial sphere as personal ornaments.

3.9.1 Conclusion

In this chapter I have outlined the nature of biographical approaches to material culture in both anthropological and archaeological contexts. I have argued that archaeologically, constructing an object's biography is not simply a case of adding biographical theory and anthropological analogy to data and coming up with a simple narrative that accounts for the movement of things between contexts. Rather it is imperative to also to build a stronger biographical argument that builds on the nature of the physical evidence itself as well as considering the contextual and temporal situation. Given the contextual restrictions present for metalwork in the Bronze Age that I have already noted, I do not believe that a biography of metalwork in the anthropological sense is in fact possible in anything other than a purely theoretical sense. Alternatively, it is by revealing elements of these objects lives via information locked into their very physicality that we may be able to approach the biography of Bronze Age metalwork. Such an approach is essentially "biographic" within the terms of the theoretical tenets outlined in this chapter, and yet differs slightly from many of the biographical synthesis put forward before. By treating the objects as contexts, my intention is to tease out some of the ways in which these objects have been used, coveted, damaged fragmented or broken during their life times (to name but a few potentialities). I believe that this is an effective way of looking into the past and situating a discussion of an objects life. From this position, it is then possible to overlay some of the more established ideas concerning production deposition in order to try a tie together both traditional and more recent material culture viewpoints. Critically, my approach wishes to deal with these objects in their intended contexts rather than considering their more historical life stories. It is against this discussion that I will now outline my methodology for the assessment of wear and damage.

4. EXPERIMENTAL WORK AND METHODOLOGY

4.1. Introduction

In this chapter, I will outline the underlying basis of the methodology employed in this thesis which is set out into three distinct parts as set out below in Figure 4.1. Firstly, there is an experimental phase that involves the fabrication and use of a series of replica flat axes. The rationale behind this work is to simulate patterns of wear and damage against which to assess extant Bronze Age material. Secondly, there is an analytical phase where the examination of this material is described. The examination criteria were selected on the basis of the experimental woodworking activities as well as observations made elsewhere in the archaeological literature. Finally, there is an analytical phase whereby the results of this work are considered in light of the theoretical framework previously set out. The interpretation of my analysis will be dealt with in Chapter 7.

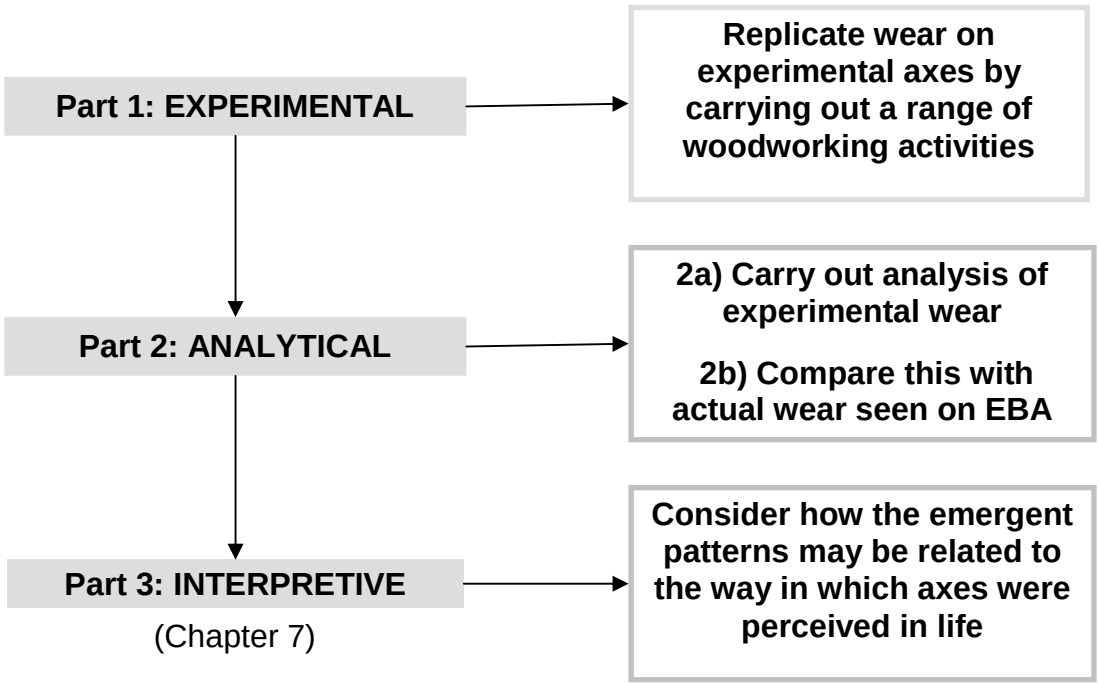


Figure 4.1 Methodology employed in this thesis

PART 1: EXPERIMENTAL WORK

4.2. Fabrication of Experimental Axes

Eight experimental axes were cast in total that replicated the forms and types present in the Early Bronze Age in Britain (see Table 2.1 (Chapter 2) and Chapter 5 for a detail of axe development). The axes were cast using the process detailed by the flow diagram in Appendix 1. While this flow diagram details the various stages in the fabrication of any bronze metal object, it has been amended to suit axe manufacture. The operations detailed below commence with Stage C 'Casting'. While my initial intention was to fabricate all the axes using only these surmised traditional methods, it became apparent that this added little in pursuit of the research questions other than to increase the time taken to produce the final objects. This was particularly the case with regard to traditional finishing methods which would require weeks of work to transform an 'as cast' axe to one in a 'finished state'. Equally, it was critical from both a cost and time perspective to ensure that a 'good' casting was achieved on each occasion. This is a factor that is not always achievable with authentic methods, and I have already noted how traditional methods were founded upon a level of experience specifically in relation to the ability to achieve and maintain furnace and crucible temperature. Ultimately, a set of finished axes were required that simulated the performance of the extant examples to be examined. It is against this background that several available short cuts and alternative methods were employed and adopted as follows:

- Use of modern refined materials of known impurity
- Use of modern ceramic material for moulds
- Propane gas burners and modern furnace
- Reference to an electronic temperature meter and stopwatch during casting
- Electronic grinder, metal files and Emery paper used for finishing

4.2.1 The Furnace

A small home-made furnace was used in the casting process and this comprised a steel refuse bin with a hole cut into the base (Figure 4.2). The interior of the bin was lined with heat blanket and a base fashioned out of heat bricks of the same materials used for the moulds (See 4.2.6). The materials were weighed out into the desired mixes and placed into the crucible. The crucible was then placed into the furnace and subsequently accessed through the top of the bin. Heat was then supplied via a propane fuelled gas burner through the cut away hole in the base of the bin. An electronic heat gauge was fitted to the furnace to allow the internal temperature to be measured. The furnace was heated up to 1200ºC to melt the crucible charge.

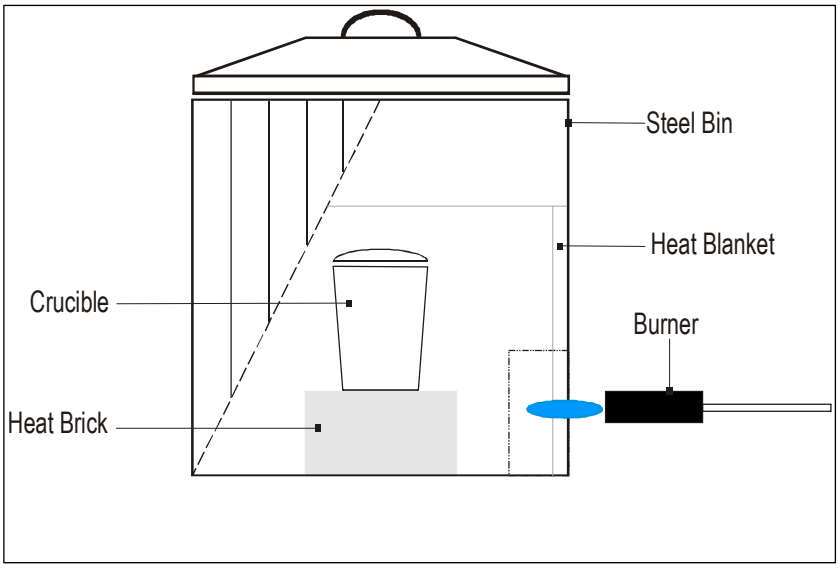


Figure 4.2 Schematic diagram of furnace used in fabrication of experimental axes

4.2.2 Material Mixes

I have already outlined the broad sequence of material composition in Chapter 2. It is against this background that a range of material mixes were selected to reflect the make up of known Bronze Age material. Using the data for the elemental composition of Scottish axes (Junghans, *et al.* 1968), an assessment was made regarding the primary material mixes from known examples. Information was

available for a total of 93 axes from Scotland. Figure 4.3 shows the distribution of arsenic content for 6 Scottish copper axes. Clearly, this is only a very small sample, but there is a clear pattern. Arsenic content appears to be either very little or around 6%. The addition of 1% arsenic makes a considerable difference to the potential hardness of the axe. As previously discussed, the debate continues as to whether the addition of arsenic was either a deliberate or accidental inclusion.

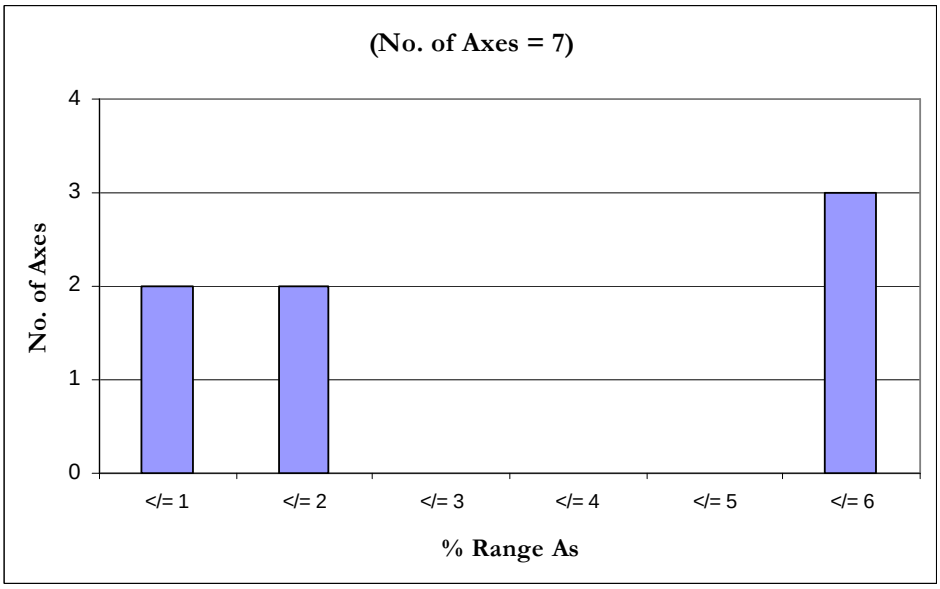


Figure 4.3 Frequency of copper axes by arsenic content

The chart in Figure 4.4 shows how out of 44 of 86 samples fall in the 9-10% tin content range, with a further 31 axes having greater than 10% tin. On the basis of this analysis, a series of material mixes were selected for the experimental axes. The various material mixes are set out in Table 4.1 later in this chapter. In general terms, two axes were made of a copper arsenic mix, while the remainder are an alloy of copper and tin (Bronze) with two levels of the latter element being used.

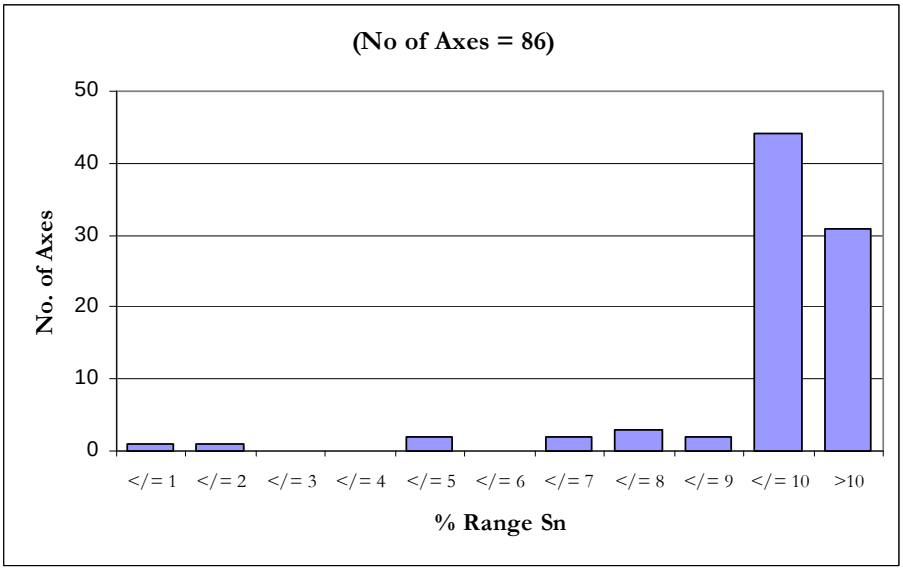


Figure 4.4 Frequency of bronze axes by tin content

4.2.3 Copper

The copper materials were sourced from a number of cables formerly used for electrical power distribution. The copper in these has been refined to extremely high levels of purity through electrolysis. While this method is used to copper plate items, it is also a means of purifying copper whereby a small cathode of pure copper is used with a larger anode of impure copper. As the electrolytic cell operates, pure copper is transferred to the cathode. The copper wire was cut up and carefully weighed out into the desired proportions.

4.2.4 Tin

The tin elements were sourced from local Cornish casserite procured by Carn Metals at Pendeen, Cornwall. The casserite was smelted to metal by reduction with carbon at a temperature in excess of 1200°C. Due the fact that casserite is hardly ever entirely free from other impurities such as iron, the initial smelt reduces many of these additional elements at the same time forming alloys with the tin. The tin was therefore refined a number of times to remove these unwanted elements. There are various ‘modern’ techniques used to refine tin. For example, copper is removed with the addition of sulphur and iron elements can be removed by passing steam through the molten metal. Arsenic and antimony content can be refined out via the addition of

aluminium alloy. The tin that was used in this work has undergone significant refining and exists in a very pure state.

4.2.6 Moulds

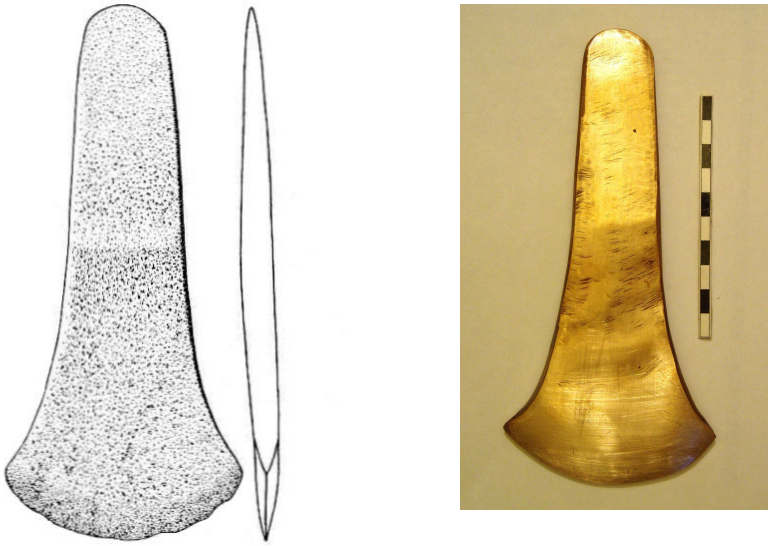
Two different 'two piece' moulds were fabricated and used for casting the experimental axes. The moulds were fashioned out of a modern thermal ceramic firebrick made by Morgan Thermal Ceramics Ltd (see Figure 4.5). These bricks are commonly used as linings for industrial furnaces and kilns, and this material was used for a number of reasons. Firstly, it provides a relatively cheap medium for mould creation. Secondly, the firebrick is essentially a lightweight insulation block that has low thermal conductivity and can be carved into any desired shape using only a craft knife. This makes it an easy material to use. Finally, the firebrick material proves to be much more stable under heat and will prevent any spiting and popping associated with more authentic methods (Neil Burridge pers.com). Once the matrices of the desired axe form had been carved into the material, the surfaces were painted with a carbonizing fluid that sealed the porous areas that would be in direct contact with the molten metal. While a two-piece method is more akin to Middle Bronze Age technology, it produces a more symmetrical casting and ultimately reduces the amount of finishing time required for each axe. Moreover, it has been frequently suggested that the earliest 'open' moulds would have had some form of lid or covering to reduce the amount of oxidisation that occurs when molten bronze is exposed to the atmosphere (see Tylecote 1962: 112 for example). The use of a two-piece mould has no perceptible implications for the way in which the axe will perform when used and therefore offered a significant time saving for my purposes.

4.2.7 Mould Matrices

Two different mould forms were fabricated in this way. **Mould A** was based upon the axe from Thornhill, Dumfrieshire (Coles 1965) (Figure 4.6). This is a developed form of flat axe that incorporates a median bevel and hammered up low flanges. Typologically, this example has been assigned to the Glenalla group (Schmidt & Burgess 1981) and also designated Class 4 (Needham, *et al.* 1985). **Mould B** was

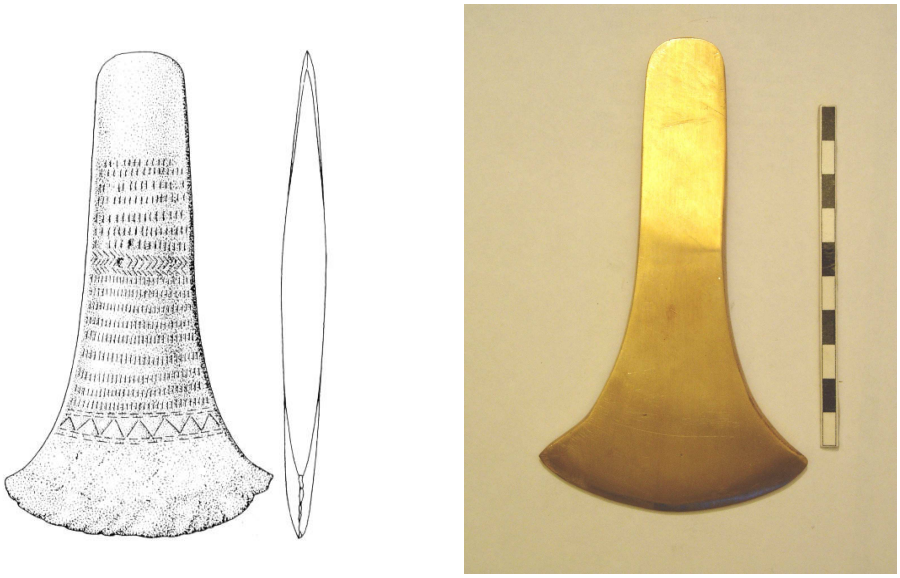
designed to replicate one of the axes from the Willerby Wold hoard. Typologically, this axe is designated to be of type ‘Falkland’ (Schmidt & Burgess 1981) or Class 4 (Needham, Lawson & Green 1985)(Figure 4.7) This form of axe is readily associated with continental material, and found notably in the classically Unetician assemblage of the Dieskau Hoard (von Brunn 1959) as well as beneath the dated ditch at the Mount Pleasant henge (Wainwright 1979) (See Chapter 5 for dating details).

Figure 4.5 Mould B opened after casting with axe 5 in situ



A **B**

Figure 4.6 A) Axe from Thornhill (after Schmidt & Burgess 1981)
B) Experimental Axe No. 4



A **B**

Figure 4.7 A) Willerby Wold Axe (after Schmidt & Burgess 1981)
B) Experimental Axe No 6

Figure 4.8 Axe 5 being cast in mould B

4.2.8 Casting & Mould Assembly

The mould was preheated in another furnace of the same construction and operation as in Figure 4.1. Preheating creates a better cast in that it reduces the rate at which the molten metal cools when coming into contact with the surface of the mould. Once the mould was preheated it was removed from the furnace and set using a 'G' clamp. The complete assemblage was then located ready to receive the molten metal, was subsequently poured directly into the mould (Figure 4.8). Three axes were cast, six using Mould A (Thornhill) and two using Mould B (Willerby Wold).

4.2.9 Finishing

Once the each axe had been cast, they were removed from the moulds and allowed to cool before finishing. All casting debris was removed by mechanical means, as were the oxidised surfaces. The axes were then subjected to a process of cold hardening and annealing. It should be noted that in the work by Roberts and Ottaway (2003: 124), none of the experimental axes were cold hardened in order to reduce the number of variable elements in the production process. This seems to me to be

unrepresentative of the known condition of the vast majority of known artefacts, which appear to have been cold work to some extent. On this basis all the experimental axe blades were cold worked and annealed. On completion of the cold working process, each axe was then subjected to a final finish. This involved firstly the filing down of all faces and edges in order to remove all surface undulations, before further process of polishing achieved with 1200 grade emery paper. Care was taken to ensure that all filing and smoothing strokes were made along the axis of each axe to ensure that all striations from these activities were in a uniform direction. This was done to create a 'Petri dish' where any evidence of use wear markings would be apparent in its divergence from this state. This was deemed to be particularly important when examining each example microscopically.

4.2.10 Decoration

A number of EBA axes are decorated, and while these have been assimilated into the typological schemes outlined in Chapter 5, they have also been categorised according to their decorative styles (see Harbison 1969; see Megaw & Hardy 1938; Needham 1983 for details). Aside from the style and form of the designs, a number of decorative techniques have been surmised. Specifically, designs were created through hammering, grinding, or the use of a 'tracer' or punches to incise the faces and edges of the axe. In many cases, a combination of these techniques was used to achieve the desired effect. There is only limited evidence of tools that were used to decorate metalwork in general (but c.f. Butler & van der Waals 1966). While iron tools were available in the LBA, an ongoing debate for EBA material is the ability to decorate bronze axes with bronze tools, where both are of the same strength. There have been various experimental projects that have concerned themselves with the decoration of bronze with iron tools (Lowery, *et al.* 1971), however very limited attention has been given to the use of bronze on bronze. Owing to the fact that bronze and copper work hardens when hammered, bronze tools significantly degrade as decoration progresses.

Notwithstanding this situation, three of the experimental axes were decorated using a bronze punch (Figure 4.9). Figures 4.10 and 4.11 show two of the decorated examples. These decorative schemes do not exactly replicate any known combination but were used to provide a range of forms. The reason for decorating these axes was to set up a situation where any wear over the decoration could be identified. This feature has been noted by Needham (1988: 245), especially in relation to his suggestion that some axes may have spent certain periods of time in an unhafted state. This hypothesis is further strengthened by the fact that axe decoration is commonly found all over both faces including areas which would have been invisible when the axe was attached to its haft.

Figure 4.9 Experimental punch used to decorate test axes. Length = 6cm (Photo: Author)

Figure 4.10 Experimental Axe 1

Figure 4.11 Experimental Axe 3

4.2.11 Hafting

Due to their organic nature, very few examples of axe hafts have been found. Some often cited EBA examples are known from Flag Fen (Pryor 1991; Taylor 1992), where oak was the preferred timber, or from the 'ice man' Oetzi (Spindler 1994), where ash was chosen. Both these axe hafts were fabricated from show adjoining section of branch and tree trunk, as were the experimental hafts used by Darrah (2004) in the reconstruction of the Dover Bronze Age boat. Based on the limited details of hafting techniques established to date, two replica hafts were constructed for use in this thesis. Both were fabricated in ash wood, as this appears to have been at least one of the favoured species employed in the prehistoric period. From a functional perspective, ash exhibits a suitable strength for use in this way, but also a subtle flexibility that is capable of absorbing the forces that run through it when in use as a haft. While the hafting procedure was kept to be as authentic as possible, various issues had to be incorporated. To allow the rapid and easier changing of blades for resharpening purposes as well as for recording, a suitable quick release mechanism had to be found that still allowed the blades to be suitably fixed into the haft. Jubilee clips emerged as suitable alternative to the historically postulated application of twine (Figure 4.12)

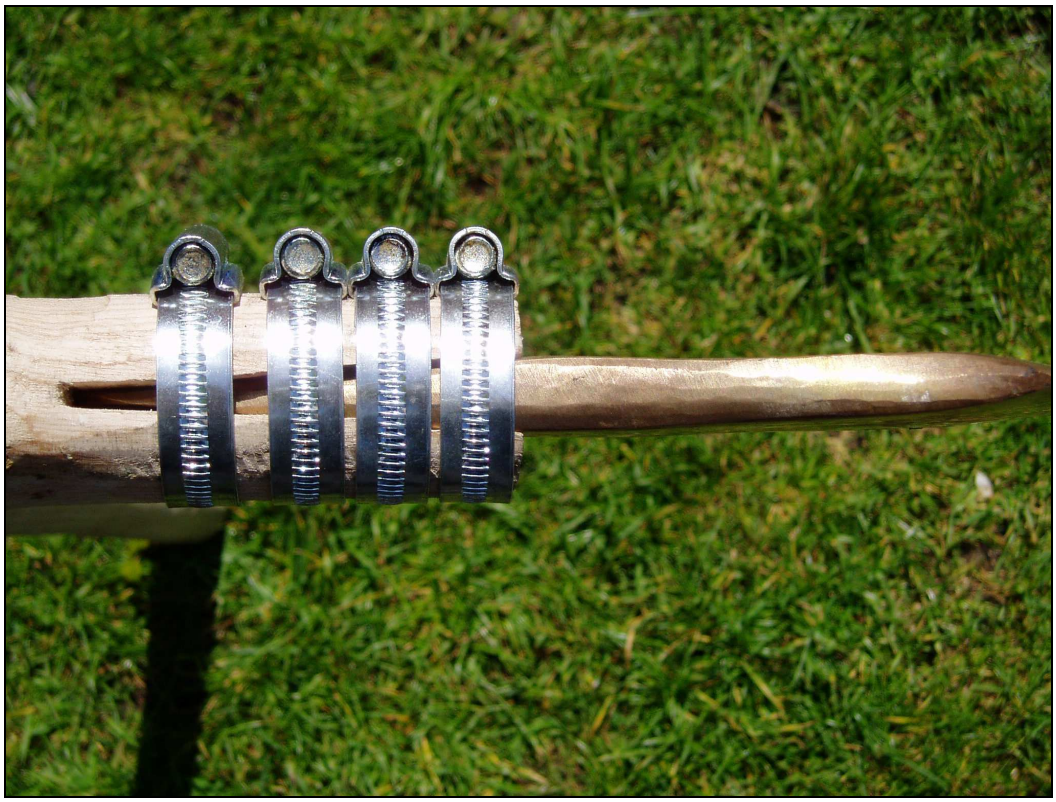


Figure 4.12 Jubilee Clips on haft A

As I have previously outlined, extant evidence for hafts assumes that they were made out of a section of timber that formed the connection point between tree trunk and branch. Previous researchers who have noted how deformation and blade use wear is often accumulated on one side of the blade (Roberts & Ottaway 2003: 126), suggesting that the angle between the axis of the axe head and the axis of the haft were less than 90º. Darrah (2004:129) notes similar findings in his work on the Bronze Age boat reconstruction where it became apparent that different lengths of haft handle create more effective and comfortable tools. On these grounds, a changeable jig was made in order to simulate the motion of the axe head and one of the test axes was used in a series of test swings to find a suitable angle at which to set the axe head (Figure 4.13). It was clear even from these small scale tests that there is a definite hafted angle that produces a more comfortable and effective blow from the axe blade.

A **B**

Figure 4.13 A) Experimental adjustable haft jig **B)** Completed experimental Haft A

4.2.12 Schedule

The following table sets out details of the experimental axes prior to their use.

Axe No	**Mould**	**L mm**	**W mm**	**% Cu**	**% Sn**	**% As**	**Decorated**
1	A	202	100	95	0	5	Y
2	A	198	99	95	0	5	N
3	A	199	102	92	8	0	Y
4	B	150	74	92	8	0	N
5	B	204	100	90	10	0	Y

Table 4.1 Schedule of experimental axes

4.3 Experimental Woodworking Activities

Kienlin & Ottaway (1998) have looked at the potential for identifying prehistoric use wear by comparison with experimental replication and use of flanged axes pertaining

to the northern Alpine region. Their work showed not only how signs of manufacturing and use could be visibly distinguished from each other, but that the patterns of blade damage that resulted from experimental woodworking were also present on the artefacts themselves. Allied to these findings, a second study by Roberts and Ottaway (2003) based on a similarly experimental methodology, considered patterns of use on Late Bronze Age socketed Axes from South East Scotland and East Yorkshire. It has shown that most of the axes in their data set had been used, a small number of which were categorically identified as having been employed in woodworking activity. Woodworking is generally seen as the major functional use of axes in prehistory, an assertion supported by a wealth of evidence of such activities. Examination of the timbers from 'Sea Henge' reveal the presence of tool facets on the lower less eroded sections of the timber circle. Fine grained analysis suggests that there was a tendency for larger axes to have been used for felling activities, with medium and small sized axes being used fro the trimming of timber ends. Many of the trees were worked with multiple axes, and indeed over 50 different tools have been identified from their material signature (Brennand & Taylor 2003). Similar marks have been found at Flag Fen (Taylor 1992) and on the remaining sections of the Dover Boat (Clark 2004). However, some suggestions have been made regarding the use of axes as weapons (Yates 1849) or alternatively as agricultural implements (Ashbee, *et al.* 1989; Harding 1976; Pitt-Rivers 1898). Against this background, the axes were used in a series of woodworking activities were designed in order to simulate axe usage. All work was carried out by a single operative (the author).

4.3.1 Felling

A programme of tree felling in the New Forest was carried out, arranged with the Forestry Commission and work has been undertaken as a part of their forest management programme. Sections of the forest are cleared of trees periodically, and in certain locations permission was granted to fell as many trees as required. This was a fantastic opportunity to utilise the replica axes on living trees. In all twenty

five trees were felled using the experimental axes and the axes were resharpened as and when required by using whetstones. In all cases modern felling techniques have been employed and there is some evidence that these techniques was also used in prehistory (Darrah 2004: 121). Each tree was cut down above roots by executing the following sequence of operations:

1. Form ‘sink cut’ into on side of the tree trunk (1/4 to 1/3 of stump diameter)
2. This sink faces the desired direction of fall
3. Make felling cut across trunk, from opposite side above level of the sink cut.
4. Progress felling cut into truck to leave hinge
5. Where necessary wooden wedges were used to support felling cut

The choice of timber was limited to areas designated by the Forestry Commission and was primarily comprised of Silver Birch and ash trees. The images below (Figure 4.14) are screen shots from some video footage taken during one of the felling operations and show the author using the replica axe head and haft.

Figure 4.14 Experimental Axes in use by the author

Figure 4.15 Birch tree felled with experimental axe

4.3.2 Shaping timbers

Axes were also used for shaping activities, whereby felled branches were tapered at one end. There is abundant evidence of this activity taking place in prehistory. Toolmarks on the timbers at Oakbank Crannog for example showed a detailed sequence of trimming and tapering the log piles sunk into Loch Tay (Sands 2004). Similar activity is in evidence at Flag Fen (Taylor 1992).

PART 2 a): ANALYSIS OF EXPERIMENTAL AXES

In this section, the condition of the experimental axes is considered in relation to the wear and damage that they demonstrated after having been used during the experimental work. This is split into a number of sections relating to specific types of wear. Where applicable the criteria for the examination of the extant axes themselves is outlined, along with the rationale and basis of these investigations

4.4 Recording of wear on experimental axes

The experimental axes were prepared so as to be in a pristine state prior to use, with highly polished surfaces and sharp blades. All were recorded in detail at this stage both macro and microscopically. Each of the axes was then examined after use and instances of wear recorded. Figure 4.14 shows diagrammatically the different types of attrition that were present on the axes after use. These will now be dealt with in

turn and developed into a series of observational criteria with which to examine extant axes themselves.

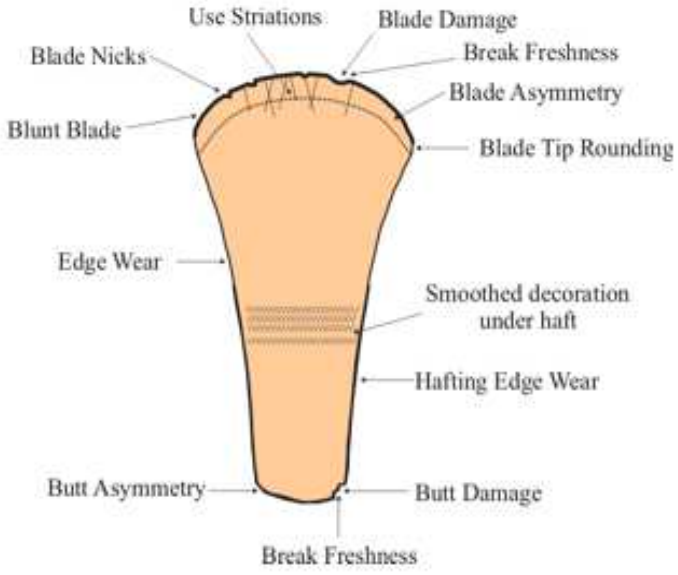


Figure 4.16 Patterns of use wear discussed in this chapter

4.4.1 Blade Sharpness

The primary type attrition present on the experimental axes is the sharpness of the blade. If the axe is being used as assumed then, the blade edge is first part of the axe that shows signs of attrition. The experimental axes showed that the 'perfect' state of sharpness that was initially present was removed relatively quickly once the axe had been used. It was initially intended to make some assessment of the rate at which the blade degrades with respect to the metal mix contained therein, in order to make some comparison of amount of use between the experimental and extant axes. However, it was decided during the experimental work to abandon this plan and there were a number of reasons for this course of action, primarily relating to the number of possible variables. Firstly, degradation was clearly affected by the type of wood being worked. Living trees blunted the blade far more quickly than seasoned wood, due to the increased resistance offered by the green fibres of the growing tree itself. A second variable is the tree species are hard of softwood. Thirdly, while

untested, it is likely that the strength and skill of the person using the axe would also have an effect on degree of wear exhibited by the blade. On account of these possible variations in degradation rate it was decided that any rates calculated would be relative and essentially meaningless as a comparative tool. For each axe examined, an assessment has been made regarding the relatives sharpness of the blade. The following images record the different states of blade sharpness shown on the experimental axes after use according to the analytical categories above.

Figure 4.17 Blunt blade on an experimental axe

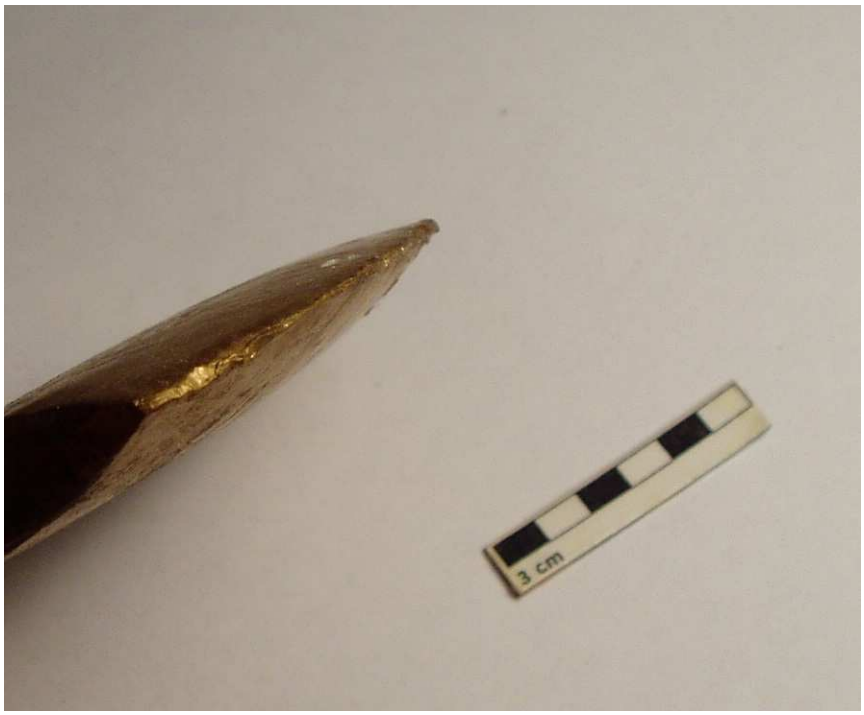


Figure 4.18 Used blade on an experimental axe

Figure 4.19 Sharp blade on an experimental axe

4.4.2 Blade Nicks

Along the edge of the blade, small notches appear as the axe is used (Figure 4.18). In previous work Roberts and Ottaway (2003) suggested the presence of nicks on the blade were related to possible combative activity, on account of the fact that none of their experimental axes replicated such damage from carpentry activities alone.

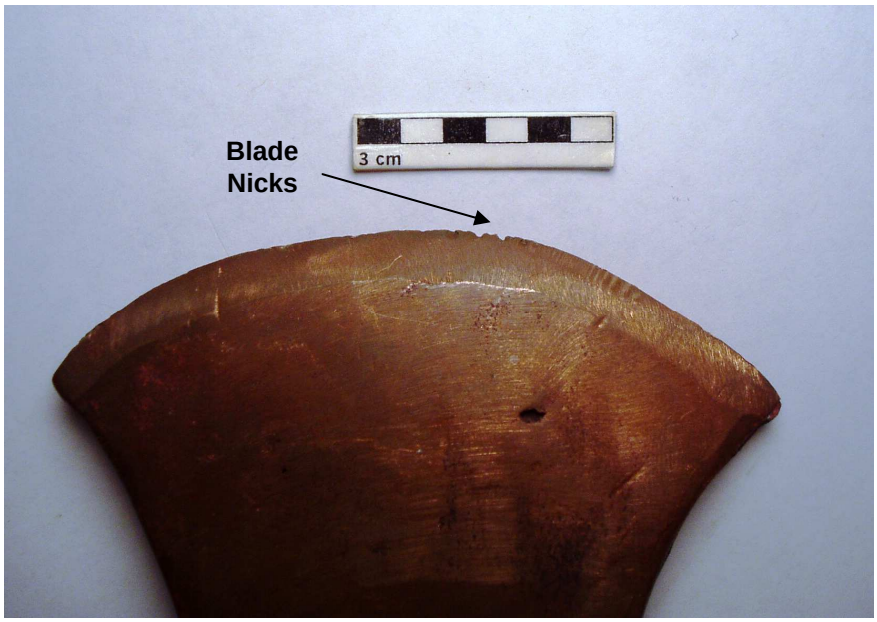


Figure 4.20 Blade Nicks on an experimental axe

However, blade nicks can also occur through woodworking activity and are caused when the axe strikes something harder than itself. For example Darrah (2004) notes their presence on the experimental axes used in the Dover boat reconstruction and suggests that they were the result of the blade coming into contact with knots in wood being cut. They occur both in concentrations (normally in association with the most worn half of the blade) but also randomly the on cutting edge.

4.4.3 Use Striations

Along the faces of the axe, a series of inclined scratches form through use, where the axe face comes into contact with the wood after the blade has cut through it. These are shown on the experimental axe in Figure 4.19. The angle of indentation s related to the angle at which the blade is mounted in the haft. Roberts and Ottaway (2003) have shown these marks experimentally and suggested that they extend from the blade up to around 20mm along the face of the axe, as well as its presence on prehistoric examples. The experimental work showed that the length of the striations is significantly increased when shaping work is carried out rather than felling in isolation. This was due to the angle at which the axe head itself comes into contact with the wood itself. Equally, the experimental axes also showed how symmetrical

striations occur at alternate equal and opposite angles when the axe is rehafted in the same haft.

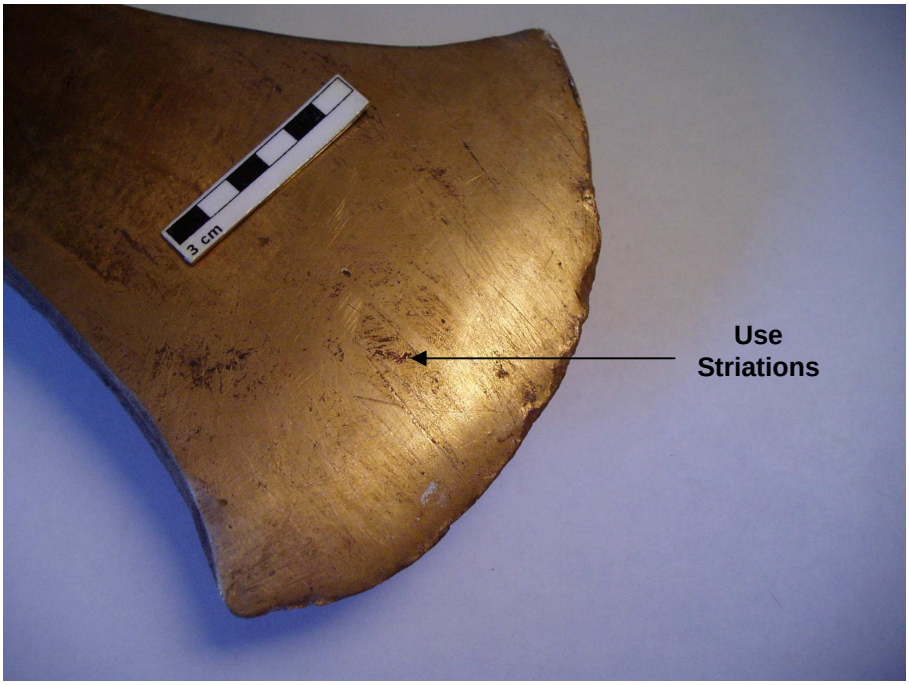


Figure 4.21 Use Striations

4.4.4 Blade Asymmetry

The experimental axes also showed signs of symmetry deterioration as illustrated in Figure 4.20, where you can see how curvature of the blade is distorted on the left hand side of the axe. The recognition of use wear on axes has been made primarily on assessments of blade trauma and its extant symmetry, material features that have also been noted swords (Bridgford 1997; Kristiansen 1999; Needham 1990; Savage 1979). Furthermore, previous research in this area has focussed on axe forms from the Middle and Later Bronze Age periods, specifically palstaves and socketed axes. For example in a hoard from Sompting, Sussex, Curwen (1948:162) identified different degrees of blade expansion due to hammering on two axes that putatively came from the same mould, suggesting that one had been subjected to greater use and had therefore been resharpened more frequently.

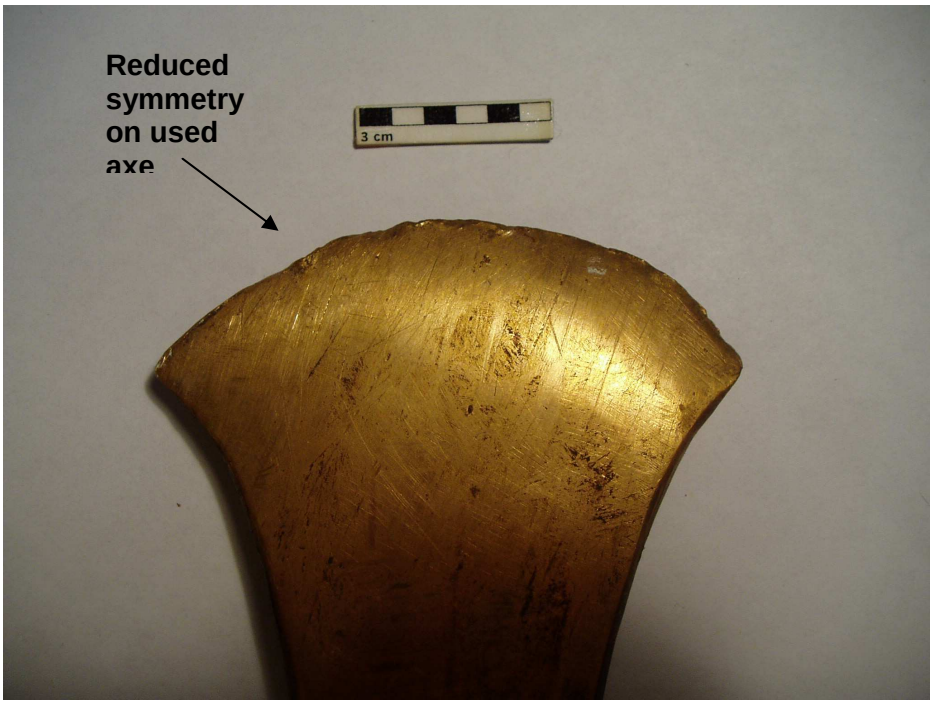


Figure 4.22 Asymmetry of blade on experimental axe after resharpening and use

In similar fashion, an assessment of Middle Bronze Age palstave production and use in Southern Britain (Rowlands 1976) proposed that the distinctive crescent blade edges were in fact the outcome of repetitive resharpening of the blade rather than a preconceived moulded feature. Coombs (Burgess & Coombs 1979) made similar conclusions in his analysis of the hoards at Figheldean and Watford where resharpening marks were identified on socketed axes, as has Farley (1979) in respect to hoard axes from Aylesbury Hoard. Outside of the British Isles, Larsson (1986) has made an assessment of use wear on Swedish Bronze Age axes and drew attention to the relationship between blade symmetry and episodes of resharpening. He noted how repeated resharpening of the blade resulted in the wearing away of the metal in certain areas. Although it is not expressly stated, it is assumed that the action being discussed in this instance is achieved through the grinding of the blade with a suitable lithic material (e.g. whetstone) rather than the alternative method of resharpening by hammering. In either case, the assumed proportionality of the blade 'as cast' is interfered with.

4.4.5 Resharpening

On the experimental axes, and in concurrence with Kielin & Ottaway (1998:275), the direction of polishing & grinding strokes becomes apparent, very often along the axis of the axe. Microscopic analysis of experimental axes has shown that the grinding and/or hammering of the blade produced fine scratches along the blade. My experimental work concurs with the findings of Kienlin & Ottaway (1998) in that these marks do not appear to result from any woodworking activity. However, it should be noted that the resharpening of the blade drastically reduces the visibility of previous wear, especially at the microscopic level.

4.5.6 Blade Damage

Over and above the small blade nicks and striations from usage, the blade of the experimental axes also exhibited larger scale damage. This was primarily due to sections of the blade breaking away, a feature that was very often preceded by the emergence of tiny hairline cracks at the blade edge. These cracks form once the axe has been used and a result of the metal itself becoming brittle as it is essentially cold worked through usage. If the axe is not reheated to allow the tension in the metal to dissipate, the cracks become larger and ultimately lead to severe blade trauma as shown in Figure 4.21. If the axe has been overworked during its production, the hairline cracks appear with very little use at all. Experimental Axe No. 1 was deliberately overworked and subsequently used to see how quickly these features would appear. Only two birch trees were felled before the cracks appeared relating to no more than twenty minutes of use.

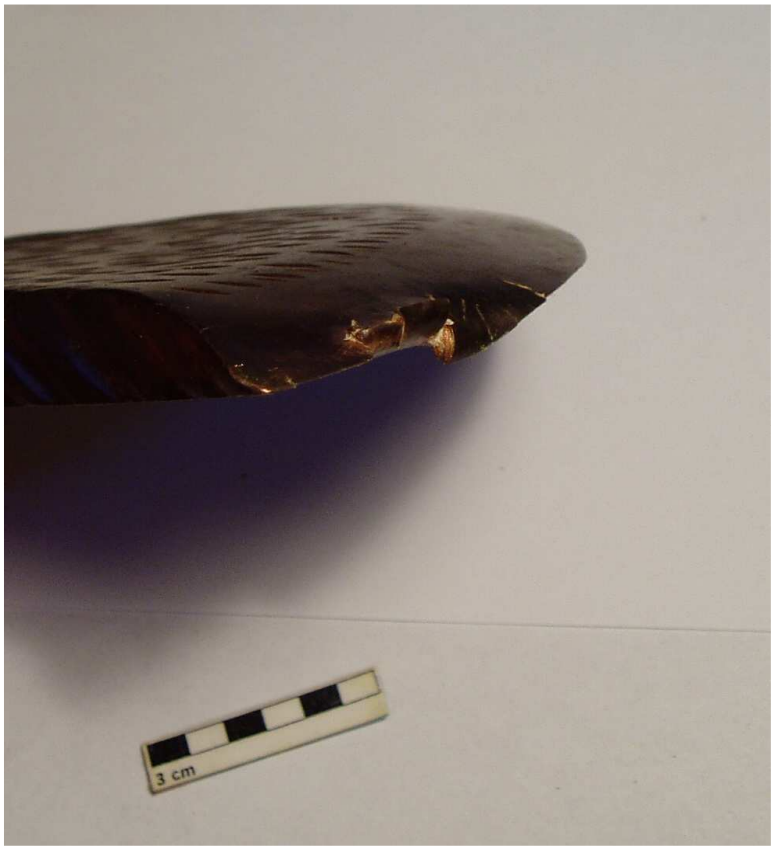


Figure 4.23 Blade damage on experimental axe

4.5.7 Blade Tips

A further wear signature to be noted on the blade is the degree of attrition of the blade tips. These are clearly prominent sections of the blade itself and degrade with use. In addition, the blade tips are damaged when the axe is handles, placed on the ground or leant up against other objects. Figure 4.22 compares the blade tips on two axes. The upper axe is unused and displays crisp pointed blade edges, while the second axe in the lower half of the picture has been used and demonstrates how the blade tip is now deformed and rounded. This wear starts to accumulate almost as soon as the axe is used.

Figure 4.24 Differential blade tip wear shown on unused and used axes

PART 2 b): ANALYSIS OF EBA AXES

Drawing on the experimental work and previous work in this area, a series of analysis points was drawn up against which to analyse existing EBA axes as follows.

4.6.1. BLADE SHARPNESS: For each axe examined, an assessment has been made regarding the relatives sharpness of the blade. One of three grades of sharpness were designated for each axe as follows: (A) BLUNT (Meaning that they were no longer functional) (B) USED (Not perfectly sharp, but still functional) and (C) SHARP. The presence and location of blade nicks was also recorded.

4.6.2. RESHARPENING: Each blade was examined microscopically for traces of resharpening. However, the degraded state of most of the axes means that these traces are often not visible. Coupled with deep patination and corrosion, this line of analysis has proved to be of limited empirical value. Moreover, modern cleaning with abrasive tools such as files or whetstones will result in a similar wear signature.

4.6.3. SECONDARY WEAR PATTERNS: A record has also been taken of wear and damage that does not appear to relate to primary function of the axe or have been replicated in the experimental work. Types of wear deemed to be non related to function are where the axe has been bent, hammered or broken.

4.6.4. SYMMETRY & BLADE WEAR: To do this, the assumption has been made that axes were symmetrical prior to being utilised, a contention supported by the regular shapes shown on known stone axe moulds (e.g. Callender 1903). A series of high resolution digital images have been taken directly above each object from which a digitised tracing has been made providing a highly accurate scaled image, showing the extant blade proportions. A second image of the blade has then been created and overlaid onto the first that replaces the assumed original symmetry of the blade. Where necessary, reference has been made to other axes of the same type in order to

achieve the correct blade shape. In Figure 4.23, the results of this process are shown for the axe from Auchnacree (DQ256). The original photograph of the axe is shown on the left, while the grey shaded part of the axe drawing on the left is the electronically drawn version. The missing sections of the blade and butt of the axe have been drawn back and these are shown as a dotted line.

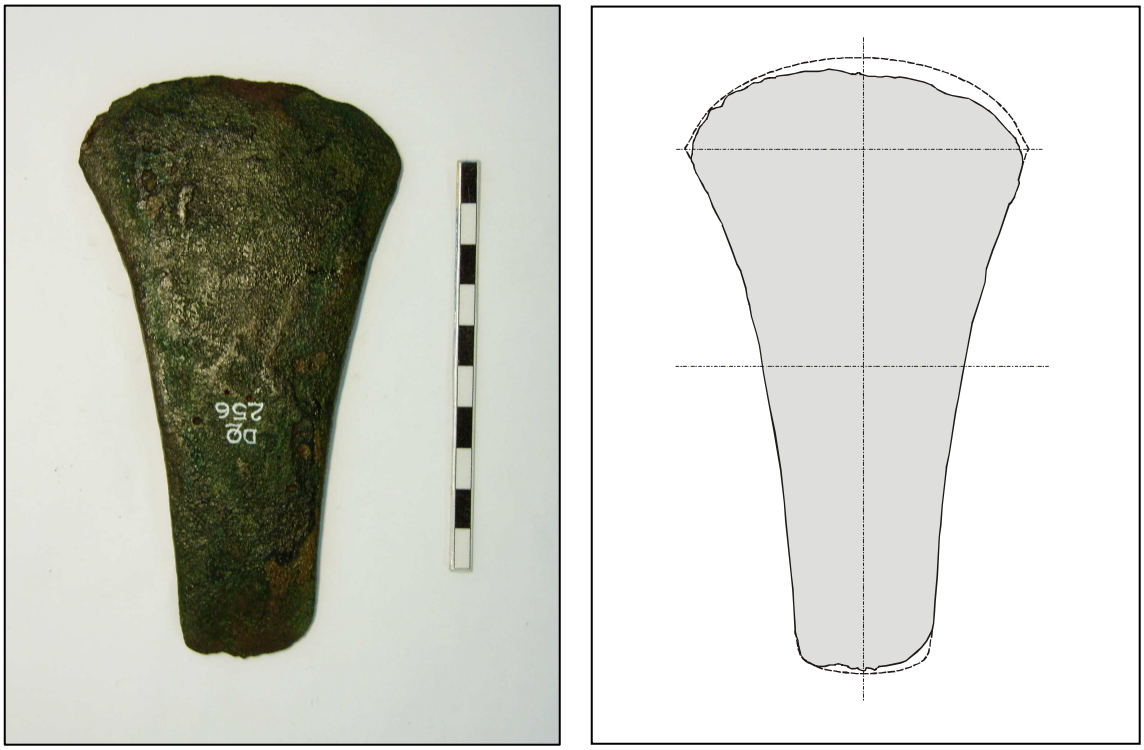


Figure 4.25 Images of the axe from Auchnacree showing redrawn sections of the missing blade and butt

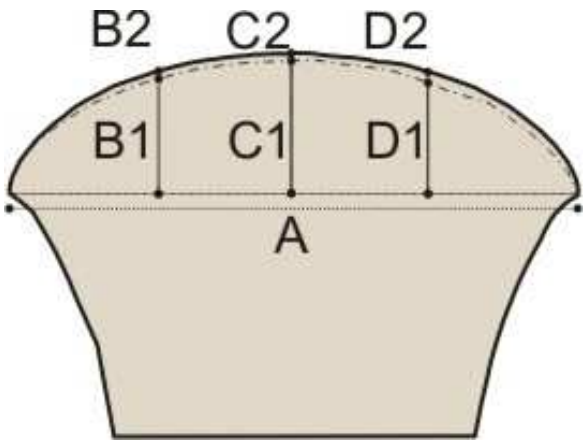


Figure 4.26 Measurements of blade used to calculate blade wear

A series of measurements of the blade ratio has then been taken as shown in Figure 4.24. Using the following formula, the reduction of the blade from its original to its current state has been estimated and expressed as a percentage.

$$\text{Original Blade Ratio} = \frac{B2 + C2 + D2}{A}$$

$$\text{Extant Blade Ratio} = \frac{B1 + C1 + D1}{A}$$

Amount of Blade Wear = Original Blade Ratio - Extant Blade Ratio

4.6.5. BLADE TIPS: The blade tips on each axe were categorised in terms of their wear. A simple tripartite system was employed that graded each tip as being either A) PERFECT B) ROUND C) FLATTENED or D) MISSING

4.6.6. USE STRIATIONS: Each axe was examined for the presence of use striations emanating from the blade. Where present their length along the axe face was also record

4.6.7. ANGLE OF USE STRIATIONS: Using the longditudinal centre line of each axe as a bench mark, the angle of striations (where present) was recorded. Where striations ran in opposing directions suggesting a rehafting of the axe, a comparison was made of the different angles or whether they were matching.

4.6.8. HAFTING WEAR: An assessment was made as to whether there were any notable differences in wear, degradation or attrition to the area of the axe that would theoretically have been covered by the presence of a haft. Particular attention was given to the butt of the axe as well as the relative freshness of the edges (See 8).

4.6.9. FRESHNESS: The condition of the object at deposition may give clues to the amount of time that an object was in circulation. I have already outlined in Chapter 2

the suggestion out forward by Coles and Taylor (1971) that the freshly executed ornamentation of some of the items contained in Wessex Graves was held to be indicative of a very short time in circulation. This idea has been extended here to consider three parts of each axe. Firstly, the edges of each axe have been examined along the section between the sides and face of the object. Secondly, freshness of any breaks has been considered. A broken object that shows little signs of abrasion or further damage along its broken section may be indicative of a shorter period of time in circulation prior to deposition than one where additional use wear and damage has been inflicted after breakage. Thirdly, the freshness of decoration has also been studied (Figure 4.25). While the experimental axes did not reveal any obvious traces of wear due to the haft, Needham (1988) has previously drawn attention to differential wear patterns on decorated haft ends suggesting that axes were both hafted and unhafted at various points in their lives. Against this backdrop, one of three grades of freshness was designated for each axe, namely A) CRISP B) WORN and C) ROUND. An analysis of the freshness of wear has therefore been noted for each axe and these observations have analysed at both a microscopic and macroscopic level.

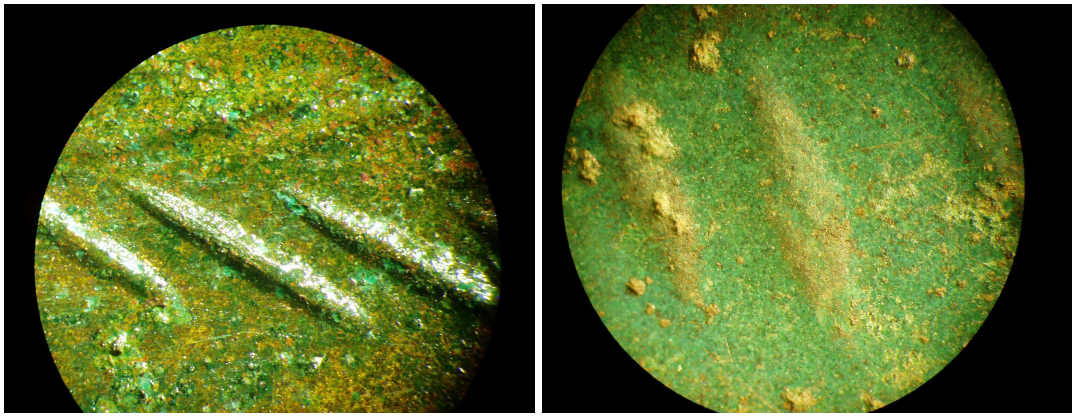


Figure 4.27 Comparative freshness of decoration on axes
from Nairn (Fresh Decoration) (left) and Llanbryd (Worn Decoration) (right)

4.6.10. POST DEPOSITIONAL WEAR AND DAMAGE: Clearly a primary distinction must be made when examining the original axes is a determination of what constitutes pre and post depositional wear. Vankilde (1996:32) notes the

difficulty in separating the two, however Kienlin and Ottaway (1998) point out that close inspection of the patina that has formed on the surface of most axes allows a distinction to be made. I have adopted the latter view in the examination process. A close inspection of the uniformity of the patina that has built up across the surface of the object shows that 'modern' scratches have no patination, or at the very least a different thickness and colour of patina if it has built up since the imposition of modern damage. The marks left by a steel file are equally obvious, primarily on account of the depth and uniformity of resultant cut marks.

4.6.11. FINAL DEPOSITION STATE: An assessment of the final condition of each axe at deposition has been also been made. Where necessary this approach makes allowance for any modern damage or post depositional degradation. Categorisation was made under the following headings:

- **Prepared/Not Used & Prepared/Used:** An axe s deemed to have been 'prepared' if it has been altered in any way from its 'As Cast' state. A 'used' is determined if the axe has been used in any functional capacity. Without grinding or any surface treatment the surface of the axe remains in a porous condition, with a 'sandy' granular finish.

- **Fragmentary State & State of Completeness:** Details have been recorded regarding the fragmentary nature of the axe. This deals with general issues such as whether or not the axe is broken. Note is also made of whether all component parts of the axe were deposited if it was in a broken state. In the event that only a portion of the axe was deposited, details are recorded regarding which part of the object was selected for discard. Careful attention has been given to a microscopic examination of the porosity of the broken sections within the axe to make a judgement as to whether the axe has broken at point in relation any flaw in the original casting (c.f. Bridgford 1997:297 who notes that many broken swords appear to have snapped at flaws in the metal structure of the blade).

4.7 Photographic Records

In all cases digital photographs were taken for the recording of both experimental and extant axes. This sits in contrast to previous approaches to the recording of wear, when moulds have been taken of used axes to create negative impressions of damage and wear (c.f. Roberts & Ottaway 2003:123). A photographic record was employed for several reasons. Firstly, the digital images were a cheap way of recording, with no real financial constraints on the number of images that could be taken, as well as being far more time efficient than the procedures required to prepare moulds of each sample. The number of axes being dealt with in the study also ruled out the preparation of moulds in each case. Moreover, by using photographic recording methods, the axes could be recorded at specific intervals for later comparison rather than from a mould at one fixed point in time. Secondly, the digital images could subsequently be manipulated during post fieldwork, both in terms of magnification of features as well as the embellishment of colours using various image processing software to make certain features stand out. All images were taken using a Canon E20 Digital camera at 3.2 mega pixel resolution. The camera was mounted on a tripod and set horizontally above each axe to eliminate any issues of parallax error. The camera was operated by remote control to stop any blurring at low light.

5. EARLY BRONZE AGE AXES FROM SCOTLAND

5.1 Introduction

In this chapter, I will outline the data set with which has been studied, namely Early Bronze Age axes from Scotland. I will detail the typological and chronological schemes within which they are situated, as well as reviewing the history of research into these objects. This is very much intended to be a companion to and an extension of the information discussed in Chapter 2 since axes have been have been subjected to the same investigative trends for Bronze Age metalwork in general. They too have been discussed primarily in terms of production and deposition, as well as forming the backbone of typochronological schemes.

Date	**Mould**	**Metal/Alloy**	**Axe Form**
End of Neolithic c.2,500 B.C. – 2,200 B.C	Open (Stone)	Copper Copper Arsenic	Flat Axe Broad Blade/Thick Butt
Early Bronze Age 2,200 B.C. – 1,500 B.C.	Open (Stone) 2 Piece (Stone)	Copper Arsenic Copper/Tin	Flat Axe Narrow Butt Flat Axe Narrow Butt Hammered Flanges
Middle Bronze Age 1,500 B.C. – 1,150 B.C.	2 Piece (Stone)	Copper /Tin/Lead	Cast Flanged Axe Palstave
Later Bronze Age 1,150 B.C. – c.750 B.C.	2 Piece (Stone) Lost Wax (Clay)	Copper/Tin/Lead	Socketed Axe

Table 5.1 Bronze Age axe developmental sequence

However, I will deal now with the more specific details of these objects themselves. Table 5.1 shows the broad pattern of axe development throughout the Bronze Age in Britain, and summarises the chronological changes in axe form, material components and mould technology. Axes are perhaps one of the most recognisable prehistoric artefacts that appear almost synonymous anthropomorphic activity from the earliest stone hand axes through to the present day. While the focus of the research presented here is upon the first and earliest periods of their incarnation as metal objects from

around 2, 500 B.C. in the British Isles, there is considerable continuity apparent from preceding periods. During the Neolithic, flaked flint axes and later highly polished examples were created, exchanged, used and deposited and were clearly a significant element of the material world. Indeed the first metal examples seem initially to mirror the form of their stone counterparts with their broad blades and thick butts.

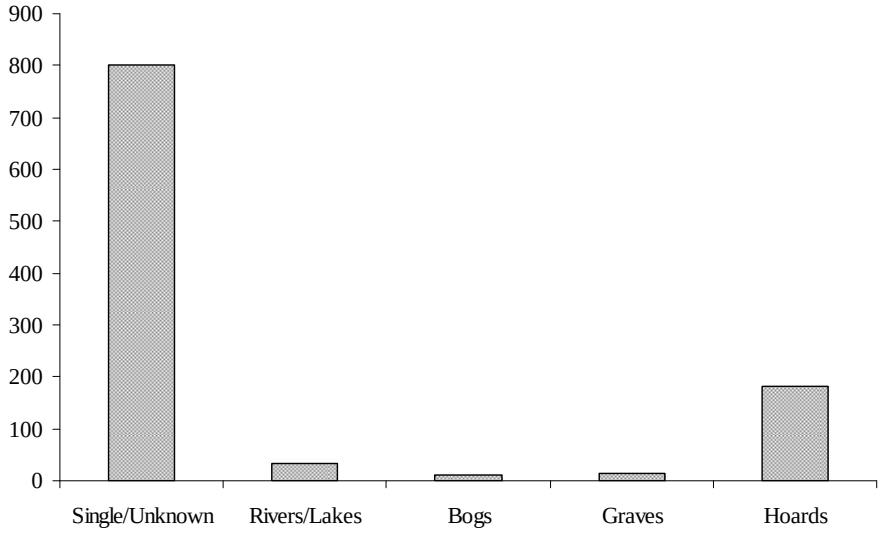


Figure 5.1 The context of EBA axe deposition in Britain (after Needham 1988)

From this point, axes are the sole object type to occur throughout the entire Bronze Age (Barber 2004:155) albeit with considerable changes in form, style and size. These features have made axes a particularly suitable quarry for the application of typological methodologies and the creation of detailed progressive schemes, framed within ideas of unilinear developments in style, artistic practice and the technological process. A typological approach has been further enhanced by the fact that so few examples are recovered from contexts dateable by radiocarbon. In Britain, around 1000 Early Bronze Age examples are known, occurring as either so called ‘single’ finds or forming the dominant object form in ‘hoard’ assemblages (See Figure 5.1). In contrast only 13 examples have been recovered from confirmed funerary contexts. While there is a number of axes that have been found in the vicinity of burial mounds and cairns, no direct relationship can be established contextually between these monuments and artefacts. However, even if these axes were to be deemed to have

been deposited in funerary contexts too, the total number would still be very small, and would confirm that metal axes appear to be non associated or deemed unsuitable for burial with the dead during this period.

5.2 Early Bronze Age axes: a history of research

The adoption of a classificatory approach can be seen as long ago as (after 1724 with additions), when William Stukeley first made a distinction between axes that were either flat or flanged in form and those that were 'socketed'. This differentiation was based primarily on the method in which each type was hafted, specifically the socketed form that received the haft and conversely those that were received by the haft (Flat & flanged). Such observations came at a time when debate remained among antiquarian scholars as to what these objects actually were. Stukeley himself, perhaps inevitably, suggested that they were druidic knives, while other suggestions understood them to be Roman tools (Lort 1779) or 'Celtic battle-axes' (Dow 1818). More regional studies began to emerge a few decades later. For example Wilde (1861) suggested a classificatory scheme for the large body of Irish material and Wilson (1863) made an early assessment of Scottish material noting both their antiquity and a range of types. While metal composition and chronology were a key feature of this latter analysis, Wilson delineated between flat, flanged and socketed forms as being elements in a sequence and so drew upon both Stukeley's type divisions as well as Du Noyer's (1847) earlier separation of flat and flanged forms. John Evans (1881) subsequently presented the most definitive and extensive survey of the British material up to that time and published a well illustrated though highly descriptive compendium that remains a significant source of reference today. In classifying axes as being of either flat, flanged, palstave or socketed varieties, the hafting methods evoked by Stukeley (1724) supported the notion of a developmental and evolutionary sequence that placed socketed versions as the most advanced forms in a relative scheme. Evans not only suggested a series of hoard categories related primarily to their function, but also noted the contemporary nature of metal objects through a cross analysis of these closed hoard assemblages. Attempts were also made

to assign absolute dates for the entire axe scheme and so for the Bronze Age itself, which was divided three periods (Early, Middle, and Late). An inception of circa 1,400 BC was suggested for this sequence, derived by working retrospectively from the date for the first iron swords in Britain, as defining the end of the Bronze Age, and then allowing 1000 years. However, Montelius (1908) significantly altered this assertion and proposed an earlier date of circa 2,500 BC based upon his own typological assessment of British metalwork in line with the wider continental European schemes for which he is now better known (Table 5.2). The chronology was founded upon a series of assumed timescales and one 'fixed' date of 1,700 B.C., the latter coming from a Scandinavian hoard at Fjälkinge which contained two axes decorated in a British style and a further Italian axe (Schmidt & Burgess 1981:3).

Similar typological and chronological schemes were promulgated with addition of new finds after the turn of the century with Crawford's (1920) Catalogue of English Flat Axes and the definitive British Museum Bronze Age Guide. However, Scottish evidence was again used as the basis for reassigning some of the division proposed by Montelius. Callender's (1922) study of Scottish hoards reassigned various object forms to different periods. For example flanged axes were assigned an earlier appearance in Period III rather than period IV.

Period	**Typo Chronology**
I	Copper Axes (Assumed 500 years from c. 2,500)
II	Thin Butted Flat Axes/Early Flanged Axes (assume 250 years)
III	Flanged Axes & Palstaves. Decoration (assumed 250 years)
IV	Socketed Axes (assumed 250 years)
V	Transition to Iron Age (assumed 300 years)

Table 5.2 Montelian Chronology (1908)

Type	Criteria	Details
I	**Form**	Flat axe. Broad cutting edge. No definite flanges or bevel. Concave sides and rounded butt. Size: c.150– 300mm
	Decoration	Mainly lozenged sides, no saltires, no cable
	Found	Highland Zone, Scandinavia, North Germany
II	**Form**	Straighter sides, low flanges, some cast. Size: c.150 – 300mm
	Decoration	No lozenge, frequent saltires of faces, both cable and Herringbone designs on sides
	Found	British Isles Only
III	**Form**	Straight sides, developed cast flanges. Crescent shaped cutting edge. Median Bevel present. Size: c.100 -150mm
	Decoration	All types of decoration present
	Found	Concentration in Southern England, Northern France. A few examples in Ireland.

Table 5.3 Typological Divisions (after Megaw & Hardy 1938)

Scottish axes also featured strongly in Megaw and Hardy's (1938) seminal paper, which adopted a different emphasis by concentrating upon the distribution of these artefacts and their relationship with continental examples. In an approach underpinned by ideas of mapping the diffusion of these artefacts across Europe, a simple tripartite typology was put forward based on axe form (Types I, II, & III) (Table 5.3). Based on the development of decorative styles and their presence or indeed absence on the various types, the conclusion was offered that saw the Type II axe as representing a hybrid form somewhere between the flat and flanged varieties perhaps in relation to continental influence. However, the typological division made between Types 1 & 2 has subsequently been criticised for its poor definition (Needham 1983:10) and also that the typological assessments made were in fact of secondary concern as the main part of paper was dedicated to axe decoration (Schmidt & Burgess 1981: 4). However, there is also an inherent problem regarding what is deemed to be 'decoration'. Megaw and Hardy included only hammered and punched decoration found on the sides and faces of the axes and developed a limited set of decoration types that did not include a number of so called 'tinned axes' whose high surface tin content creates a highly shined silver appearance. In contrast, Harbison's (1969) 1969 catalogue of Irish material extended this scheme to include a

wider range of ‘decorative’ techniques, including the hammered grooves or ‘fluting’ found on a number of axe faces. More recently, in his analysis of axes from Southern Britain, Needham (1983) extended this decorative range further to include any embellishment to the ‘as cast’ form of the axe such as the faceting of sides. Furthermore, Harbison’s catalogue was criticised on account of the fact that it gave no indication regarding the condition of the axes themselves, and that the attached drawings fail to show all relevant typological or decorative indicators (Needham 1983:13).

Coinciding with the publication of Megaw and Hardy’s work, Stuart Piggott (1938) also presented a seminal paper that was concerned with the Early Bronze Age in Wessex. More specifically Piggott studied the relationships between the rich grave sequences and hoarded metalwork as well as synchronising the British Material with Continental assemblages. In defining the ‘Wessex Culture’, Piggott highlighted the hoarded association of Arreton type flanged axes with the same grooved dagger form that was also found in the Wessex graves. Significantly for the chronology of these sequences, it was also noted that where axes did occur in graves they were essentially developmentally more primitive flat axes, found with triangular daggers (Piggott 1938:62). During the following twenty years, little amendment was made to the underlying developmental framework. Raferty (1951) established a classification of the large body of Irish material, while Coghlan & Case (1957) offered a combined classification of both British & Irish axes. However, the 1960’s saw the emergence of increasingly detailed typological frameworks with the publication of several key texts. Based solely on hoard rather than single finds, Britton (1963) concentrated on the scheme for Early Bronze Age Axes in his definition of a series of distinctive metalworking traditions. Significantly for this discussion, he attributed the production of broad butt flat copper axe forms alongside the tanged daggers associated with Beaker pottery to the last period of the Neolithic. The beginning of the Bronze Age was thereby defined by the emergence of the Migdale-Marnoch tradition, characterised by the bell shaped thin butted axes fabricated in bronze as

seen in the eponymous Scottish axe and mould forms. Furthermore, Britton identified the change from thick to narrow butted form to be allied to the shift from copper to bronze axes. Of equal importance was the definition of the Arreton type (Britton 1963:259), as being a fully flanged axe form that emerged from a later metalworking working tradition of the same name in Southern England. Developing the ideas out forward by Piggott (1938) previously, this later tradition was noted for its association with more developed metal forms such as riveted daggers and socketed spearheads seen in the Wessex grave sequence.

In the same year, J.J. Butler (1963) also presented a typological analysis of the entire Bronze Age axe sequence, formulating five typological types that were essentially related to their methods of construction. The Early Bronze Age examples were divided into developed flat axes, low hammered flanged types and finally axes with high cast flanges. Significantly, this latter fabrication method was attributed to continental influence. Overseas contact also was at the root of the assessment of Irish material by Case (1966) which provided the first detailed study of the links between British and continental European axe morphology, and proposed a tripartite typology. Type A axes were defined by broad blades and thick butts and were seen as being essentially indigenous forms, while Type B examples marked the evolution of thin butted forms and were held to have resulted from continental influence. A third group, designated Type AB were seen to be 'hybrid' types, which Case ultimately related to an 'Impact Phase' of migration from the Únětice culture. Different hafting methods were also recognised (1966:1966). An extended version of the scheme set out by Case was put forward by Coles (1969) who published a trio of articles that dealt with Early, Middle and Late Bronze Age metalwork in Scotland respectively. Coles similarly employed the Type A, B and AB system, but also splits type B into three sub categories (Ba, Bb, and Bc). This typological scheme relates directly to the Scottish material at the centre of this thesis, and its defining features are set out in Table 5.4.

Type	Details
A	Copper Axes Thick Butt, blade less than twice the thickness of the butt Straight edges or smooth concave Club Hafted Not associated with other material in Scotland
AB	Copper Axes (except one axe which has Tin) Form as per type A, with thin butt Comparable to Harbison (1969) type Balybeg
B	Blade is 2 –3 times width of thin butt Form associated with majority of Scottish stone moulds Majority of Type = Bronze Eastern European affinity suggested? ("Únětice Culture") Swan's neck haft
Ba	Thin square butt and widened blade Rarely comparable with Irish material unlike Type Bb/ Bc
Bb	Long & triangular form Comparable to Harbison (1969) types Killaha & Ballyvalley
Bc	Roughly parallel sides and abruptly widened blade Comparable to Harbison (1969) type Derryniggin 'Low flanged' (defined as being less than 2mm)

Table 5.4. Axe Typology for Scotland (after Schmidt & Burgess 1981)

The next major contribution and refinement of the typological scheme for axes was based primarily on the Scottish material an offered by Schmidt and Burgess (1981), who both reappraised Coles' scheme and included all axes found geographically north of a line drawn between the Humber and the Mersey. In respect of the Early Bronze Age, 14 types were identified, with considerable disagreement with Coles' Type B subdivisions. For my purposes here, I have again set out a summarised version of the typological scheme that was proposed in Table 2.5.

AXE TYPE	MATERIAL & MORPHOLOGICAL DETAILS
Castletown Roche/Pitlochry	Copper: Straight Sides/Thick Butt. Trapezoidal. No Scottish association.
Growtown/Milton	Copper: Straight Sides/Thin Butt
Lough Ravel/Minto	Copper : Curved Sides/Thick Butt. No Scottish Association
Ballybeg/Roseisle	Copper: Curved Sides/Thin Butt
Dunnotar	Bronze: Straight Edge/Broad butts. 1/3 of these types are tinned. No Associated material.
Migdale/ Migdale Decorated Variant	Bronze. Bell shaped. Thin Butt. No median bevel. Convex rounded sides some decorated.
Killaha (Irish)	Bronze. Large. Wide cutting edge. Irish Imports into Scotland
Biggar (Migdale Variant)	Bronze. Narrow butt. Square like in appearance. Cutting edge less rounded than Migdale. Some decoration.
Nairn	Same type features as Migdale, but large. Ceremonial (Burgess & Schmidt 1981:48)
Aylesford	Shows developed features. Median Bevel and/or raised edges. Only occurs with ‘simpler axes’.
Glenalla	Longer and narrower than Type Migdale with a rounded butt. Common in Ireland
Scrabo Hill	Like Type Glenalla but with straighter sides and a more rounded butt.
Falkland	Like Type Glenalla, but less elongated. Decoration present. Median Bevel & raised face edges Dieskau Hoard (Únětice). Mount Pleasant. Typologically A1/A2. RC Prior to 1900 cal BC
Bandon	Smaller than other developed axes. Straight, near parallel sides, splayed at blade. Crescent cutting edge. Straight butt, square corners. Raised edges. Median bevel. Decoration, especially to sides

Table 5.5 Scottish Axe typology (after Schmidt & Burgess 1981)

The last major revision of the British axe typology was based on an extensive first hand study of EBA axes in Southern England[3] by Needham (1983) who devised the typological framework set out in Table 2.6, and this has become almost the standardised terminology when referring to this body of material. No cross referencing of Needham's Class system has been applied to the Scottish material (although see Appendix 6). This axe typology sequence was also at the root of the subsequent Metalwork Assemblage framework (Needham, *et al.* 1985), where each grouping refers to groups of associated finds, mainly from hoard data and defined using a detailed axe typology.

Class	Group	Type	Blade	Butt	Profile	Bevel
1		Flat		Broad/ Thick		None
2		Flat		Broad/ Thick	Lenticular	None
3	A - E	Flat	Broad	Narrow	Lenticular	None
3	F-G	Flat/ Low Flange	Medium	Narrow	Lenticular	
4	A	Flat	Broad	Narrow	Lozengic	Stop Bevel
4	B	Flat/ Low Flange	Medium	Narrow	Lozengic	Stop Bevel
4	C - E	Low Flange	Narrow/ Expanded	Narrow	Lozengic	Stop Bevel

Table 5.6 Classification of Axes from Southern Britain (Needham 1983; Needham, Lawson & Green 1985)

5.3 Scottish Axe Chronology

The tabulated information in Appendix 6 presents the developmental sequence for EBA Scottish axes alongside the most up to date chronological information. In general terms, there are very few cases where C14 dates are available for objects found in association with axes. In addition to these few dates, absolute dates for sections of the relative developmental scheme are bolstered by firstly association

[3] Essentially this study dealt with axes below the Mersey/Humber line of Schmidt & Burgess (1981)

with the better dated dagger sequence, and secondly with the dating of the Wessex sequence. Additionally, there has long been an accepted association between material found in the Migdale Hoard with the Únětice culture. At a general comparative level graves containing axes and daggers together have been seen to reference similar continental European associations (Piggott 1973:359). Elsewhere, the Migdale axe butt found at the Mill of Laithers was found in association an armlet bearing comparable incised decoration to those seen on Early Únětice broad band armlets (Burgess 1980:76). The C14 dates for the wooden core bead in Migdale Hoard fits in with these ideas (Hedges, *et al.* 1993; 1995). However Needham (1988: 236) suggests that the Únětice link may not be required for axe grave deposits, preferring an interpretation that sees a continuation of flint axe deposition in Late Neolithic single graves. The Falkland type designated by Schmidt & Burgess (1981) has also been compared to an axe found at the Mount Pleasant henge (Britton 1979).

5.4 Current location of axes

The following table details the current location of Early Bronze Age axes from Scotland. This information was drawn up from museum archives themselves as well as literary sources (Coles 1969; Schmidt & Burgess 1981) The table also shows which axes were examined during this research. The table also indicates where recording was not possible, and this was due to the very poor state of preservation of the artefact itself which meant that no meaningful information was visible in relations to use wear and damage.

Location	Axes	N/A	Exam	Record
Blair Atholl Museum	1			
Brodick Castle Museum, Arran	2			
Campbeltown	1	1		
ChambersMuseum, Peebles	1			
Dunblane Museum	1		1	1
Dunrobin Castle Museum	1			
Edinburgh City Museum	3		3	3
Forres	8		8	8
Hull Archaeology Museum	1			
Inverness	38		38	18
Location Unknown	28	28		
Manchester Museum	1			
Marischal College	18		18	18
Museum of Antiquities, Newcastle	1			
National Museum of Wales	2			
NMS	147		147	141
Perth	16		16	16
In Private Ownership	16	16		
Selkirk Museum	2			
St Albans City Museum	1			
Stewartry Kirkcudbright	1			
The Ashmolean	7		7	7
The Banff Museum	2			
The British Museum	7		7	7
The Burgh Museum, Dumfries	6			
The Carnegie Museum, Inverurie	1			
The City Museum, Dundee	6			
The Elgin Society Museum	16		16	16
The Hunterian, Glasgow	6		6	6

Location	Axes	N/A	Exam	Record
The Kelvingrove, Glasgow	7	7		
The Museum, Montrose	3			
The Nicholson Museum, Sydney (Aus)	1	1		
The Paisley Museum & Art Gallery	1			
The Regional Museum, Aberdeen	7	3	4	4
The Stirling Museum	2			
The Stranraer District Museum	7		7	7
The Ulster Museum, Belfast	1			
The West Berkshire Museum, Newbury	1			
The West Highland Museum, Fort William	1			
The Yorkshire Museum, York	1			
Thurso Museum	1			
Totals	**374**	**56**	**278**	**252**

6. RESULTS OF ANALYSIS

6.1 Introduction

In this chapter, I will set out the results of my analysis of 278 Early Bronze Age axes from Scotland. A full record of my data is contained in Appendix 3. Nearly all of the axes examined display some sort of wear and damage that can be attributed to activity in antiquity. Some were deposited in almost pristine, such as the example from Darnaway (DA69), which has an excellent degree of blade symmetry, very crisp edges and blade tips, and a sharp cutting edge. At the other end of the scale some have been used extensively, such as the example from Fortrie of Balnoon (DA38) which has worn edges, rounded blade tips as well as reduced symmetry of 11.54%. Many of the axes also display signs of damage that has been inflicted relatively more recently, primarily since their recovery in the modern era. Some have been reused as axes or chisels since their recovery from the archaeological record, but there has also been a wide variety of treatments imposed on the axes in the name of conservation. These features naturally add to the objects life history and record different stages of each axe's biography. Crucially however, a large part of the physical analysis of the axes required the separation of the old from the relatively modern. The key factor in delineating one form the other is the presence of and thickness of the patina that builds up on the axe surface over time. The analysis presented here deals solely with wear and damage attributable to ancient use.

6.2 Doing away with dichotomies?

As I have already noted in Chapter 2, metalwork has often been discussed within a series of dichotomous relations. For example axes will be categorised as being 'decorated' or 'non decorated'. The major dichotomy that continues to be used as a categorisation tool is that of either 'Single Find' or 'Hoard'. Far greater attention has been placed on hoarded examples because of the greater opportunities for typological comparison as well as the scope they offer for interpretations of the reason for their

deposition. In the first part of this analysis, I will consider whether the way in which axes were employed in their life times has any correlation to these categories through the lens of wear and damage. It has been previously suggested that there is perhaps no difference between these assemblages, and their division is purely a product of modern thinking (Needham pers. com.). In line with the argument I am following throughout this thesis, the categorisation of the evidence in this way on the basis of solely the nature of its deposition, says very little about what happened during the axe's lifetime.

6.2.1 Blade Wear

Figure 6.1 shows the distribution of axes based on reduced blade wear alone by comparing original against extant symmetry.

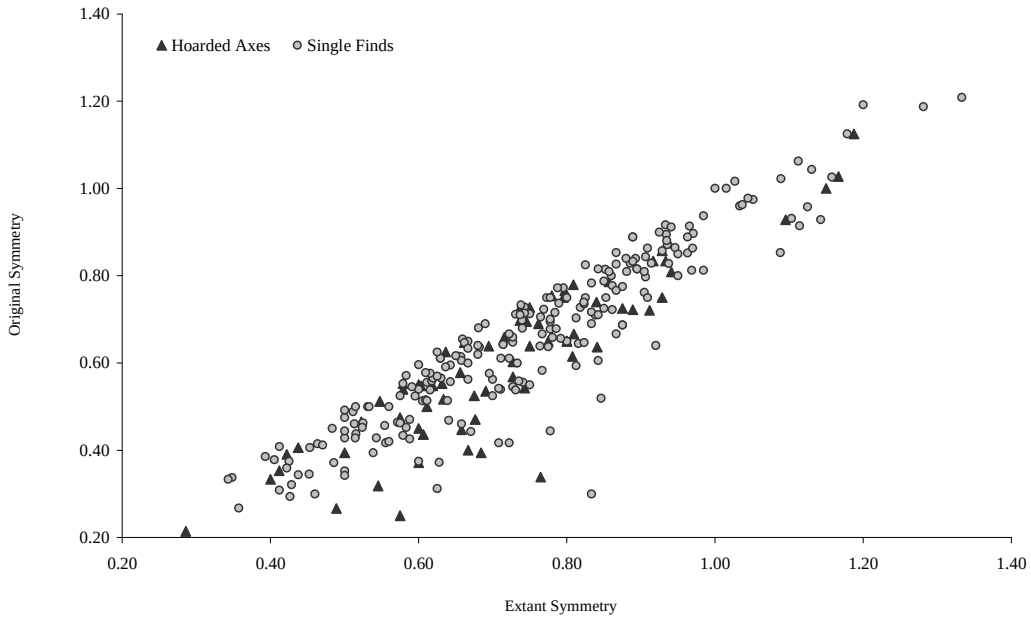


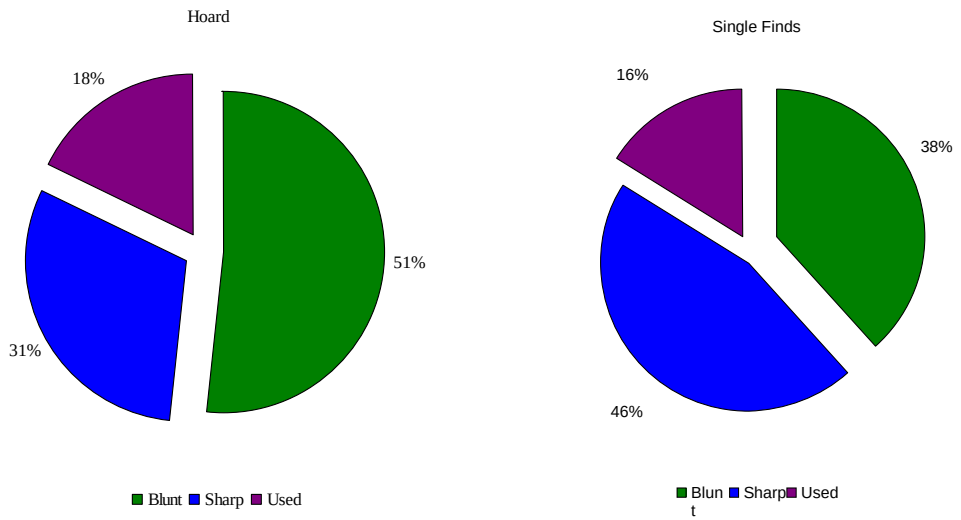
Figure 6.1 Distribution of hoarded and single finds by symmetry

It demonstrates how a wide range of different degrees of usage are represented within both categories of Hoard and Single Find. Axes of either category are found deposited in both pristine and worn states. As such it would appear that the degree of

wear and by extension in this case the amount of use is not necessarily a definitive factor in designating the way in which an axe was deposited.

6.2.2 Blade Sharpness

This contention is broadly supported by the charts in Figure 6.2 and associated chi squared tests, which again shows a broad correlation between the state of blade sharpness and deposition type.



x2 (2, n=256) = 6.23, p<0.5

Figure 6.2 Blade sharpness between single and hoarded finds

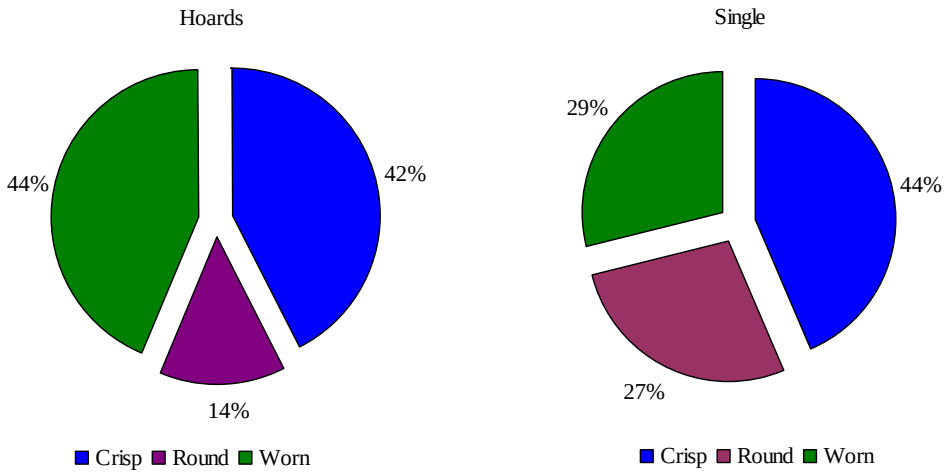
(256 axes in sample, Hoards n = 63 Single Finds n = 193)

However, 51% of hoarded axes have blunt blades compared to 38% of single finds perhaps reinforcing the idea that bluntness represents a point of finality in the axes life. It is also clear that nearly half of the single finds examined were deposited with sharp blades, in a perfectly functional state.

6.2.3 Freshness of edges

This observation is backed up further when the relative freshness of wear is analysed. Figure 6.3 compares the freshness of axe edges between single finds and hoards. Once again this split of axes into single finds and hoards would not appear to be

borne out in the wear displayed by the axes themselves. There is no stand out pattern of wear to indicate that an axe could be deemed a single find or hoard find based on these parameters alone.



x2 (2, n=256) = 7.53, p<0.5

Figure 6.3 Freshness of single finds and hoarded items

(256 axes in sample, Hoards n = 63 Single Finds n = 193)

6.2.4 Amount of use

So far, these criteria have viewed this material in just one dimension, namely reduced symmetry, blade wear, and edge freshness. However, these criteria are clearly related and do not occur in isolation and the overall condition of the axe may be viewed as a whole rather that just one particular trait. I have already discussed in Chapter 3 how there is a tension between the intensity at which an axe may be used, and the amount of time it is in circulation, whether it is being used or not. For example, an axe can be little used but be in circulation for many years. Equally a period of heavy use may occur over a relatively short period of time. Figure 6.3 reconsiders the split between hoard and single find from a multi dimensional perspective. In this case it has been assumed that the amount of use an axe has had during its life time is related directly to the degree of blade wear. Wear from 0 – 10% has been taken to be “Small Use”, a reduction of between 10 – 20% has been regarded as “Medium Use”, and blade wear

above 20% is considered to be “Heavy Use”. Alongside this information, the degree of edge freshness has been judged to be an indicator of the time an axe was in circulation. Crisp edges are thus taken to indicate a “Short Circulation” time, worn edges are judged to indicate a “Medium Circulation” time and finally fully round edges are seen to indicate a “Long Circulation time”.

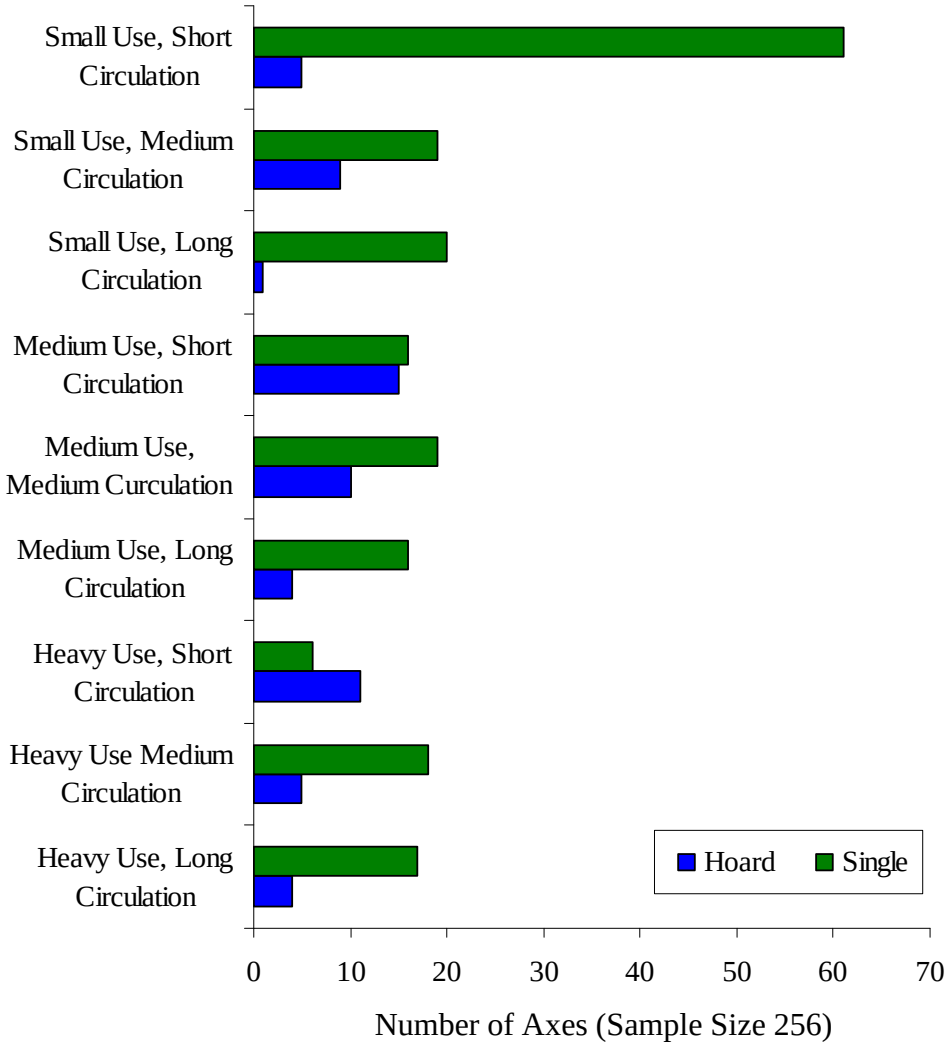


Figure 6.4. Use and circulation time of single and hoarded axes

It is clear from the chart that the dominant pattern for single finds is one where they have been little used and in circulation for a short period of time. This contrasts with hoarded items which show a broad distribution across all categories. However, a further pattern is visible for hoarded finds in that the number of axes decreases in number with increased circulation.

6.2.6 Typo chronology

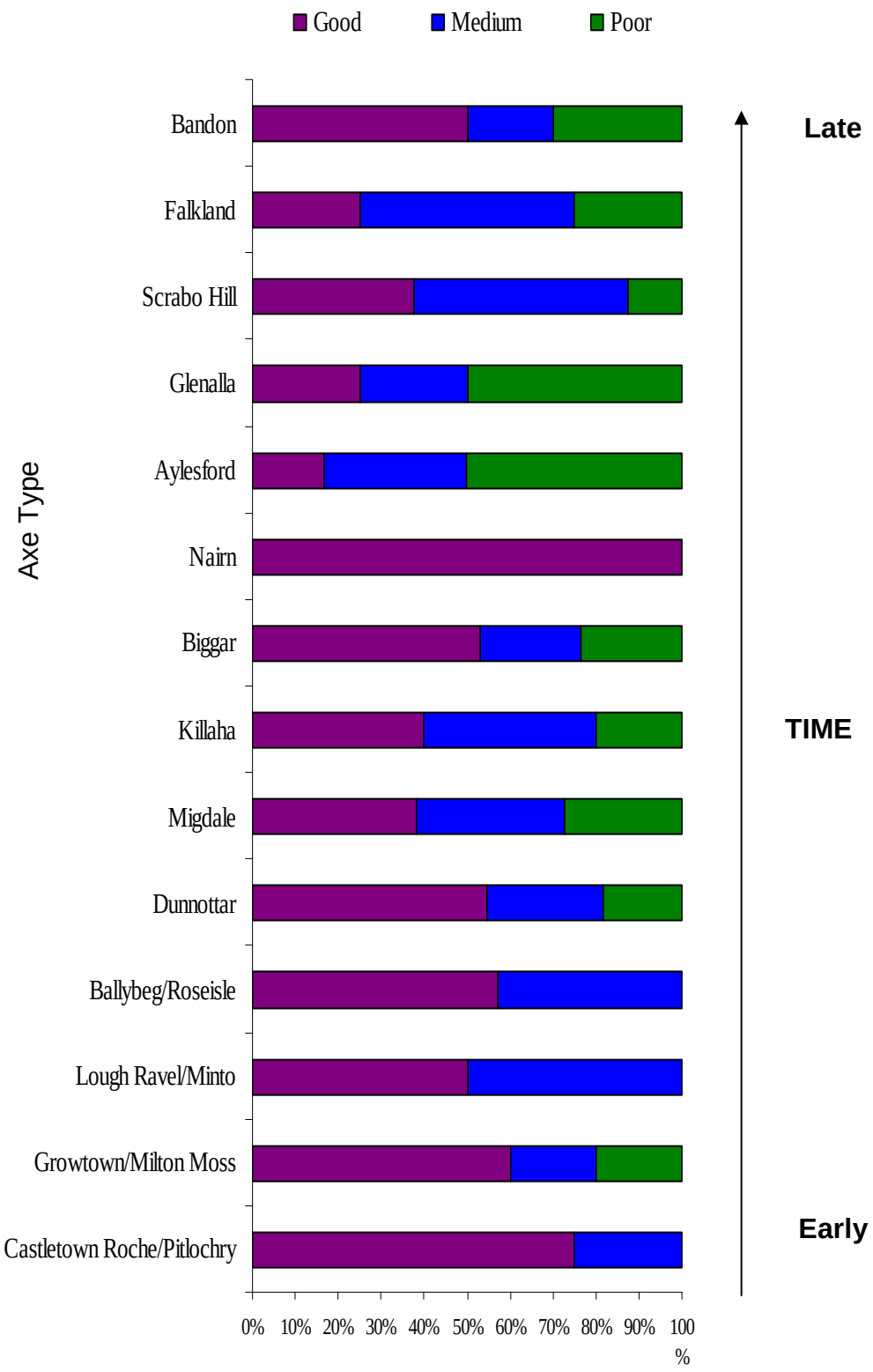


Figure 6.5 Symmetry of Blade

(Number of axes = 256)

Figure 6.4 shows the distribution of blade symmetry by typological group. The graph is plotted chronologically with the earliest types at the foot of the graph and progressing to the later types in the sequence at the top. In this instance, the degree of blade symmetry has been judged to be “Good”, “Medium” or “Poor”, based on a visual inspection of each axe. The overall pattern shows how the earliest axes in the sequence display more symmetry in the blade and that this factor decreases with time. The later axes have a reduced level of symmetry. The one exception to this pattern of decreased symmetry is the 2 Type Nairn axes, which may be anomalous due to their large size and the fact that they may not have been used in the same ways as other axe types. A plot of reduced blade symmetry for copper axes in Figure 6.5 further supports this pattern. The distribution shows how the earliest copper axe types have less blade wear than the later ones.

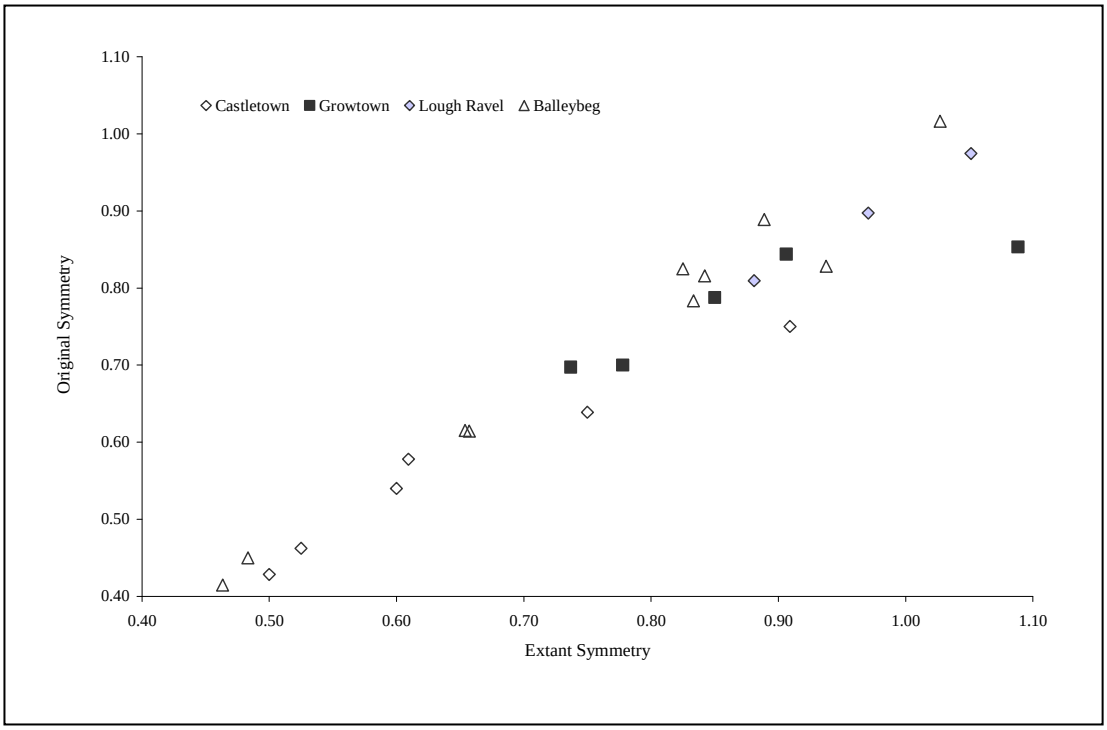


Figure 6.6 Distribution of copper axes by type & symmetry

This suggests that axes were either in circulation for longer periods of time or progressively used with increasing intensity (or both). The state of affairs brings to

mind Renfrew's (1978) assertion that the social context of object use is perhaps not always utilitarian (Renfrew 1978) and that there is a move over time from a 'special' status to more 'domestic'. Similar themes have been presented in relation changes in the nature of prehistoric pottery (Bradley 1984; Woodward 1998). While the terminology being used here clearly represents polarised positions (e.g. 'domesticated'), this does appear to be a generally recurring pattern. Julia Wall (1987) notes a similar pattern of increased wear for Wessex I and II daggers, and my own study of Bronze Age hoards in Ireland also suggested that typologically later objects were worn, damaged and fragmented with greater intensity than earlier metal objects (Moyler 2002)

6.3 Hoards

The analysis so far has been set a relative highly resolution, and dealt with methodological categories as a whole. The importance of hoards as closed assemblages has already been highlighted with regard to the invaluable information that they provide for the cross comparison of stylistic traits and their associated dates. A further consideration that can now be undertaken is that of cross comparing the different states of damage and wear afforded by individual items in a hoard. Notwithstanding the suggestions put forward by Needham (1998) regarding the retrieval and reburial of hoarded items on more than one occasion, for the moment these collections will be considered as one off depositions and the assumption made of the contemporaneous nature of the objects contained therein. For each hoard in the study area where comparison was possible, blade condition, reduced symmetry, freshness and use wear striations have been tabulated below, along with a discussion of results.

6.3.1. Abdie

ID	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DA 62	Axehead	Blunt	21.88	Crisp	Crisp	N/V
DA 61	Axehead	Sharp	18.75	Crisp	-	5˚

Commentary: Both these hoarded axes have been prepared and show signs of use. Similarly both axes also display a series of lateral indentations across their faces that are as a result of hammering. While these are not overtly decorative their similarity in both technique and form suggest further links between these axes in life prior to deposition. These marks are fresh and therefore imply that the axes had been in circulation for a shorter period after their creation. This fact is also supported by the crispness of the axe edges. Moreover, while DA62 is broken across the middle, the freshness of the break itself suggests a deposition relatively soon after this damage occurred. One of the axes is blunt and non functional whereas the other is sharp and functional.

Figure 6.7 The Abdie Hoard

6.3.2. Auchnacree

ID	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DQ 256	Axe	Blunt	14.06	Worn	Crisp	N/V
DQ 257	Axe	Sharp	18.75	Crisp	Crisp	30˚
DQ 258	A. Blade	Sharp	22.22	Crisp	Crisp	25˚
DQ259	Dagger	Sharp	Asym	Crisp	Crisp	
DQ 260	Dagger	Sharp		Crisp	Crisp	
DQ 261	Bracelet	-	-	Round	Crisp	-
DQ421	Axe	Sharp	19.23	Round	-	N/V
LOST	Bracelet					

Commentary:

A variety of wear and damage is displayed by the objects contained in this hoard. All items have been prepared and used. The outstanding feature of this assemblage is the relative freshness of the majority of items. The two sharp axes (DQ257 & DQ258) show differing striation angles suggesting that they had not been mounted in the same been haft. While axe DQ256 displays wear to its edges, it shows the least blade reduction which indicates a longer period of circulation but less intensive use. The fact that the other three axes in the assemblage are sharp but display greater blade reduction suggests that they have been resharpened, although there is no striation evidence visible on the blade to confirm this. The broken section of axe DQ258 contains porosity bubbles indicative of a poor casting and the lack of wear along the broken section suggests that this axe was deposited soon after this break occurred

Figure 6.8 The Auchnacree Hoard
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6.3.3 Barevan Kirk

ID	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DQ 265	Axe	Sharp	10.87	Crisp	-	N/V
DQ 264	Axe	Blunt	42.31	Crisp	-	N/V

Commentary:

Both axes in this hoard had relatively short lifetime as indicated by the freshness of their edges and the freshness of the hammered decoration on axe DQ264. However, axe DQ 265 was used far less intensively and remained sharp at deposition. In contrast, axe DQ264 has been used extensively and has an increased blade reduction and was blunt when deposited.

Figure 6.9 The Barevan Kirk Hoard

6.3.4. Boreland Farm, Inch

ID	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
1964-9	Axe	Sharp	9.21	Crisp		-
1964-8	Axe	Sharp	3.26	Crisp	Crisp	-

Commentary:

Both the axes in this hoard remained sharp at deposition and have very crisp edges suggesting a relatively short lifetime. Axe 1964-8 has some damage to its blade that is symptomatic of a blade that was over worked during manufacture and was subsequently too brittle. The fact that this axe has seen little use may indicate that once the cracks started to appear it was no longer used to restrict further damage.

Figure 6.10 The Boreland Farm Hoard

6.3.5. Burannoch

ID	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
1990.217.1	Axe 1	Sharp	3.92	Worn	Crisp	-
1990.217.2	Axe 2	Blunt	6.67	Crisp	Crisp	20˚
1990.217.3	Axe 3	Sharp	38.10	Worn	N/A	-
1990.217.4	Axe 4	Sharp	11.90	Worn	Worn	20˚

Commentary:

The axes contained in this hoard display a range of wear patterns. Axe 1 is sharp, has been little used but its worn edges suggest an increased period of circulation. The freshness of its breaks suggest that the breakage occurred later in its life due to the different amounts of wear between edges and break. In contrast Axe 2 is blunt and has been used more, but has crisp edges that indicate a shorter period of circulation. Axe three is the most used of the four axes, but was sharp at deposition meaning it must have been resharpened. Its worn edges suggest that this axe had been used intensively over an extended period. Finally Axe 4 is again sharp at deposition but has matching wear to both its edges and broken sections. The fact that these match indicates that the axe was circulated for a period after the break had occurred. Axe 2 & 4 have identical striation angles visible emanating from the blade that extend a similar distance along their faces perhaps indicating the use of the same haft for both at different times.

Figure 6.11 The Burannoch Hoard
© Perth Museum

6.3.6. Camptown

Object		*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DA 29	Axe	Sharp	3.64	Crisp	Crisp	-
DA 28	Axe	Used	5.36	Round	Worn	-
LOST	Ferrules					

Commentary:

The two axes in this hoard offer contrasting states of use and wear. Axe DA29 remains sharp, and has been little used. Its edges and broken section show little signs of wear as do its very crisp blade tips and this indicates a short lifetime. In contrast, Axe DA28 was used intensively more intensively over a longer period, and circulated for longer.

Figure 6.12 The Camptown Hoard

6.3.7. Colleonard

Object	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DA 19	Axe	Blunt	12.50	Used	Crisp	13
DA 20	Axe	Blunt	18.18	Fresh	-	-
DA 21	Axe	Blunt	21.05	Used	-	20
DA 22	Axe	Used	32.00	Used	-	30
DA 23	Axe	Used	26.92	Fresh	-	-
DA 24	Axe Frag	Used	4.69	Used	Crisp	20

Commentary: Again, the items in this hoard display a range of wear patterns. Axes DA 19, DA 20 and DA 21 are blunt but have experienced different amounts of use in their lifetime. Their edge wear suggests that they had been in circulation for differing lengths of time. DA23 for example, has been intensively used over a short space of time as shown by its sharp edges. This axe was still functional when deposited. DA20 is blunt with a reduced symmetry, but fresh edges suggest that this use occurred over a relatively short space of time. The broken axe fragment DA24 has a very crisp edge along its broken section which contrasts with the freshness of its edges. This pattern indicates that either the axe fragment was not in circulation for an extended period after this break occurred, or was at least looked after post break. Both DA 21 and DA24 have use striations that extend to similar lengths along the axe face and run at the same angle of 20˚ perhaps indicating their mounting in the same haft. Use striations are also present on axe DA19 and DA 22. However these are at different angles (13˚ and 30˚ respectively) and were therefore not used in the same hafts. At least three different axes are represented in this hoard.

Figure 6.13 The Collenard Hoard

6.3.8. Culbin Sands

Object	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DA 59	Axe	Sharp	1.79	Crisp	-	20˚ O/W
1951.212	Axe	Blunt	5.71	Round	-	-

Commentary: The two axes in this hoard show different circulations times. While both maintain highly symmetrical blades, indicative of little overall use, DA59 is still sharp while 1951 is blunt. DA59 has very crisp edges and was little used during a very short circulation time. In contrast, the edges of axe 1951 are worn round which suggest a longer circulation time. There is a small amount of blade damage to DA59 symptomatic of the formation of brittle sections through over working. The little use that this axe has had may mean that it was effectively retired once this damage started to occur.

Figure 6.14 The Culbin Hoard
Top image © The Trustees of the National Museums of Scotland
Bottom image © The Huntarian Museum

6.3.9. Durris

Object	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
l247.11	Axe	Blunt	6.82	Crisp	Crisp	-
DA 49	Axe	Blunt	24.32	Round	Crisp	20˚ - 45˚
LOST	4 Axes					

Commentary: As in the other hoards discussed so far, the two remaining axes from this hoard display contrasting patterns of wear. While both axes are blunt, 1247 shows significantly less use than DA49. Similarly, 1247 has very crisp edges and section where pieces of the axe blade have broken while DA49 has more rounded edges and smoothed broken sections. These patterns indicate in DA49 an axe that saw a short period of intensive use over a short period of time. In contrast, 1247 was an axe that saw more use but over an extended lifetime. Use striations are also present on axe DA49. However, the angle at which these occur varies from 20˚ - 45˚ and also extend at varying lengths along the axe face. This would suggest that this axe was use in association with at least 2 different hafts in its life time. The striations appear to only run in one direction meaning that the axe was always mounted the same way round.

Figure 6.15 The Durris Hoard
Top image © Marischal College
Bottom image © The Trustees of the National Museums of Scotland

6.3.10. Hill of Finglenny

Object	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DQ307	Axe	All Sharp	4.96	Crisp	-	30
DQ308	Axe	All Sharp	0.29	Worn	-	0
DQ309	Blade	All Sharp	6.06	Worn	Worn	10
DQ309	Butt	-	-	Worn	Sharp	-
DQ310	Blade	Part Sharp	6.17	Worn	Worn	12
DQ310	Butt	-	-	Worn	Sharp	-
DQ311	Blade	All Sharp	0.15	Worn	Sharp	28
DQ311	Butt	-	-	Worn	Sharp	-
DQ312		All Sharp	3.24	Crisp	-	5
DQ131		All Sharp	0.40	Worn	-	30

Commentary: The two axes (DQ309 & DQ310) with the highest degree of blade asymmetry maintained a cutting edge when deposited and had therefore been resharpened prior to their internment. Axe DQ311 retains nearly its original form with less than 1% deterioration and yet was completely blunt when deposited and perhaps had never been resharpened. All three show similar states of freshness along their edges. In contrast, while axe DQ307 shows around 5% reduction in symmetry, it retains a sharp blade but with crisp edges, suggesting a short period of intensive use rather than an extended period of circulation. Axe DQ308 displays very little asymmetry and no use wear striations on its face. However, on account of its rounded edges, it would appear to have been circulated for some time but little used.

A second point of note is that two of the broken axes from Finglenny (DQ309 & DQ310) show dissimilar wear patterns across their broken sections. In both cases the broken edges on the butt fragment remains in a much fresher state than the corresponding blade section. This suggests that these individual sections of the same axes were circulated for different periods post fracture.

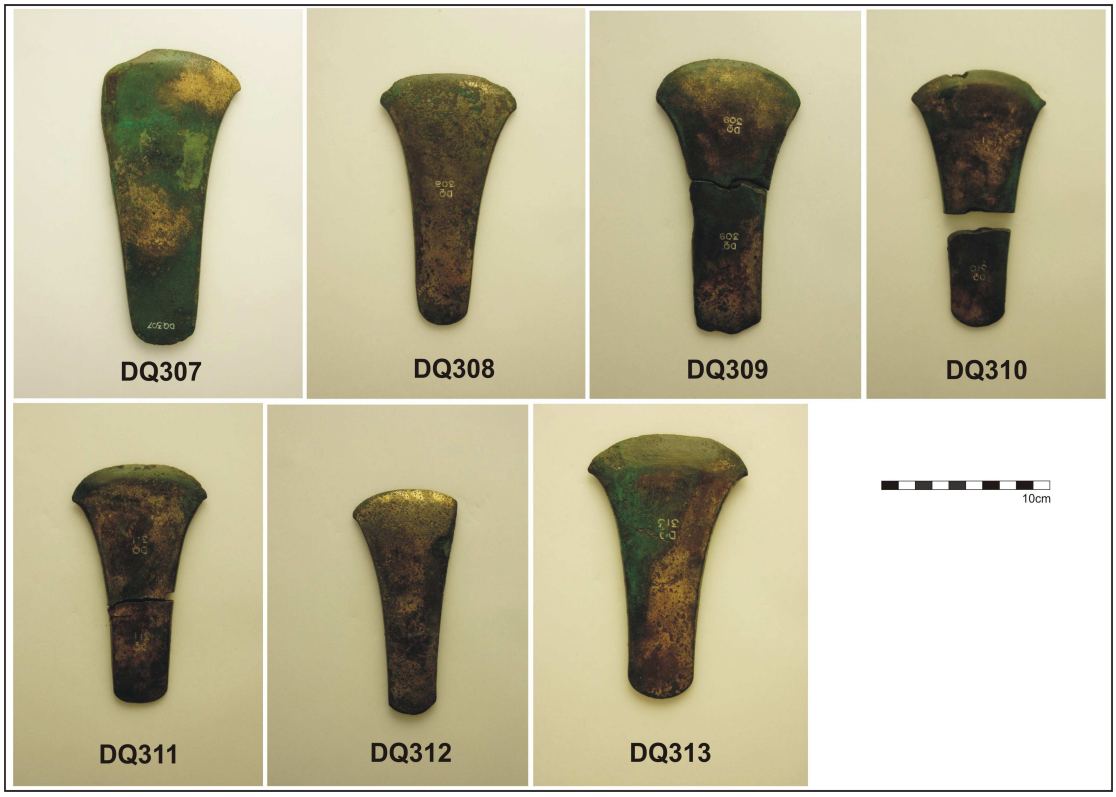


Figure 6.16 Axes from the Hill of Finglenny hoard

6.3.11. Ladyhill

Object	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
1868.1a	Axe	Sharp	2.22	Crisp	Crisp	N/V
1868.1b	Axe	Sharp	10.71	Worn	Worn	22
1868.1d	Axe	Blunt	20.97	Worn	Crisp	N/V
1868.1e	Axe	Blunt	40.00	Round	Round	N/V
1868.1c	Axe	Sharp	5.26	Worn	Crisp	N/V

Commentary: Once again a range of wear conditions are demonstrated by the axes contained within this hoard. Axe 1a is a very fresh example with very little use and crisp edges suggesting a short lifetime. At the other end of the scale, axe 1e is blunt, has a largely reduced symmetry with round edges and broken sections suggesting a long period of circulation and resharpening. Axes 1b, 1d and 1c also have worn edges meaning an extended lifetime with different degrees of blade wear and sharpness present.

NO IMAGES AVAILABLE

6.3.12. Low Glenstockdale

Object	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
1987.835	Axe	Sharp	3.03	Round	Fresh	-
1987.839	Axe	Used	14.81	Crisp		-

Commentary

These two axes represent a paradoxical picture in terms of wear. Firstly axe .835 remains in a sharp state with good overall symmetry despite some damage to its blade. However its edges are rounded suggesting a longer lifetime when it was used relatively little. However, the blade damage is fresh compared to the edges that suggest that the axe was not used for most of its life and was damaged later on relatively soon before it was deposited. Secondly, axe .839 has been used as indicated by its blade state and reduced symmetry. Its edges are crisp however indicating that this period of use occurred over a relatively short period of time. It should be noted that both axes have been extensively cleaned in the modern era.

Figure 6.17 The Low Glenstockdale Hoard

6.3.13. Sluie

ID	*Object*	*Blade Condition*	*% Reduced Symmetry*	*Freshness (Edges)*	*Freshness (Breaks)*	*Striation Angle*
DJ 4	Dagger	Sharp	-	Fresh	Clean	
DA 32	Axe	Blunt	6..33	Worn	-	15˚
DA 33	Axe	Sharp	12.00	Worn	-	15˚
LOST	Bracelet					

Commentary: Both the axes in this hoard have worn edges suggesting a long period of circulation. DA33 remains in a sharp condition but has a reduced symmetry which indicates that the axe must have been resharpened at some point in its life. In contrast, DA 32 has been used to a far lesser extent but is blunt. This suggests that this axe was used until blunt but never resharpened. Both objects have matching use wear striation angles of 15˚ that extend to similar lengths along the face of each axe. This may indicate that both axes were mounted in the same haft during their lifetime. In contrast to the axes, the associated dagger has very fresh edges and breaks suggesting a short life time and deposition soon after breakage.

Figure 6.18 The Sluie Hoard

6.3.14 Wear Patterns in Hoards

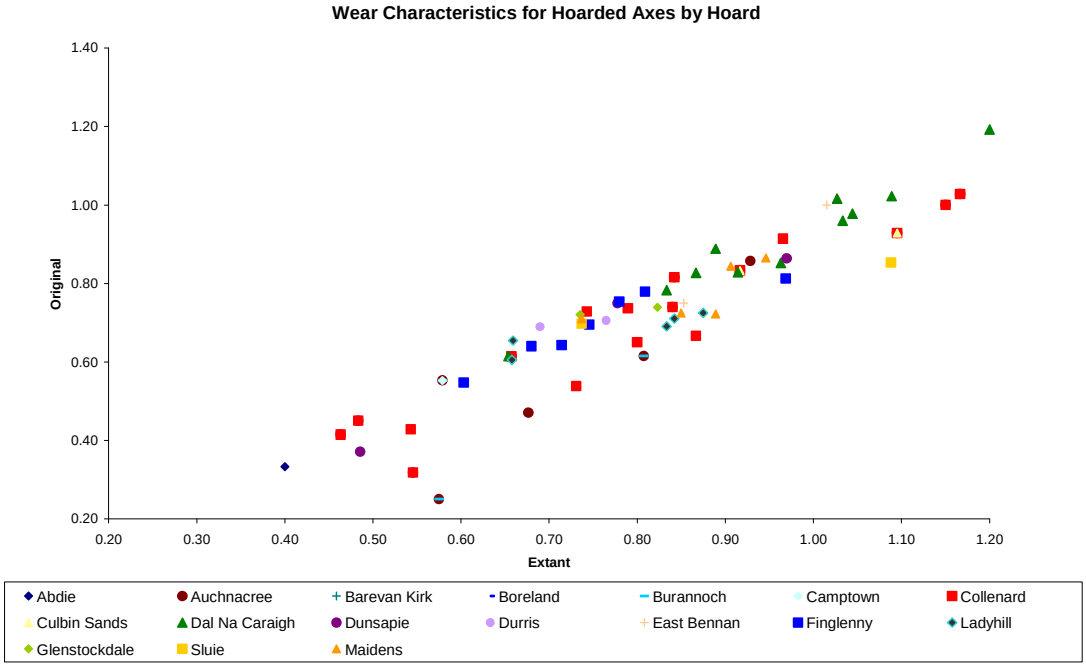


Figure 6.19 Distribution of hoarded axes by reduced symmetry

The examination of the hoards has revealed a recurring theme whereby different objects appear to have been selected on account of the different and contrasting patterns of wear that they display. The distribution graph in Figure 6.17 serves to emphasise these patterns. Based on blade wear alone it shows the range of use in evidence in each hoard. However, once again blade wear does not appear to be the sole factor governing what is included in each assemblage. In many cases there is also a contrasting range of circulation times in evidence. With this in mind, Table 6.1 shows the distribution of axes in each hoard according to the joint parameters of use and circulation time. As before Wear from 0 – 10% has been taken to be “Small Use”, a reduction of between 10 – 20% has been regarded as “Medium Use”, and blade wear above 20% is considered to be “Heavy Use”. Alongside this information, the degree of edge freshness has been judged to be an indicator of the time an axe was in circulation. Crisp edges are thus taken to indicate a “Short Circulation” time, worn edges are judged to indicate a “Medium Circulation” time and finally fully round edges are seen to indicate a “Long Circulation time”. It similarly shows how the axes contained in hoards offer a represent different circulation times and use.

	Heavy Use Long Circulation	Heavy Use Medium Circulation	Heavy Use Short Circulation	Medium Use Long Circulation	Medium Use Medium Circulation	Medium Use Short Circulation	Little Use Long Circulation	Little Use Medium Circulation	Little Use Short Circulation	Grand Total
Abdie			1			1				2
Auchnacree			1		1	1				3
Barevan Kirk						2				2
Boreland Farm, Inch					1				1	2
Burannoch					1			1	1	3
Camptown					1				1	2
Colleonard		1			2	2			1	6
Culbin Sands				1		1				2
Dail na Caraidh	2	2	2		1	2	1	1	1	12
Durris				1		1				2
Finglenny			1	1	2			3		7
Ladyhill	1				2			1	1	5
Low Glenstockdale				1					1	2
The Maidens, Port Murray		1				4				5
	3	4	5	4	11	14	1	6	7	55

Table 6.1 Distribution of axes by hoard according to use and circulation times

6.4 Wear and its relationship to decoration

The application of decoration to metal objects has traditionally been seen as being part of the production process, perhaps creating a different identity for the axe. However, in a number of cases closer analysis has revealed that some decoration appears to have been added after the axe has been used or at least circulated circulated. On several examples (e.g. Carnethy Hill, Figure 6.18) punched decoration appears to overlay visible use wear striations that occur on the axe face. Elsewhere (e.g. Kevans Figure 6.19), the decoration appears very fresh, while the edges of the axe appear to be worn suggesting again that the axe was decorated sometime after it had been circulated or used.

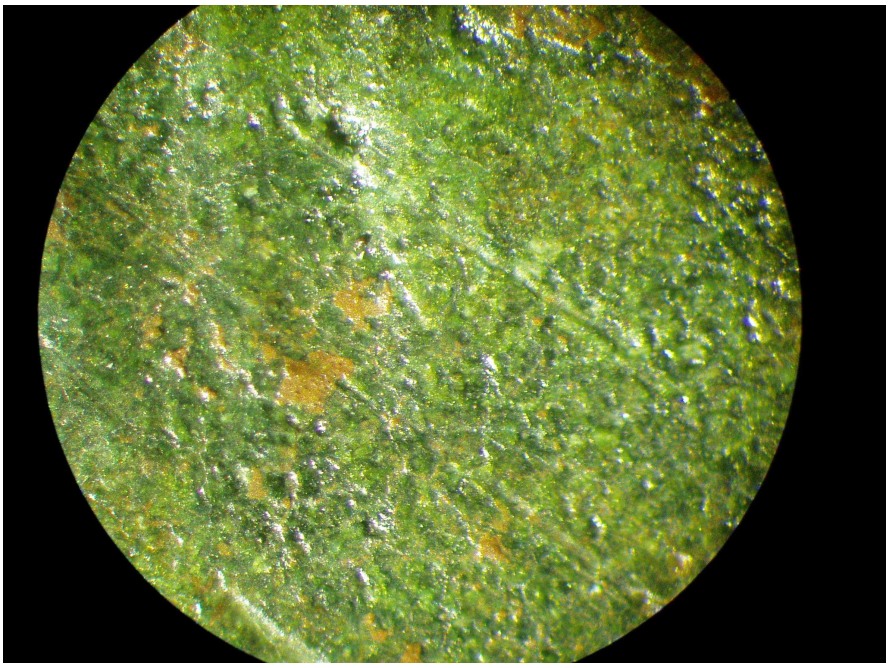


Figure 6.20 Axe from Carnethy Hill showing the Relationship between use wear and decoration

Another example, from Mainshead (Figure 6.20), shows where the decorative scheme has been applied or at least 'repaired' after a section of the axe face has broken away. The decoration on four axes from a hoard found at Burannoch, Perthshire appears that it was not all applied at the same time (Trevor Cowie pers.com).

Figure 6.21 Example from Kevans showing fresh decoration on worn axe

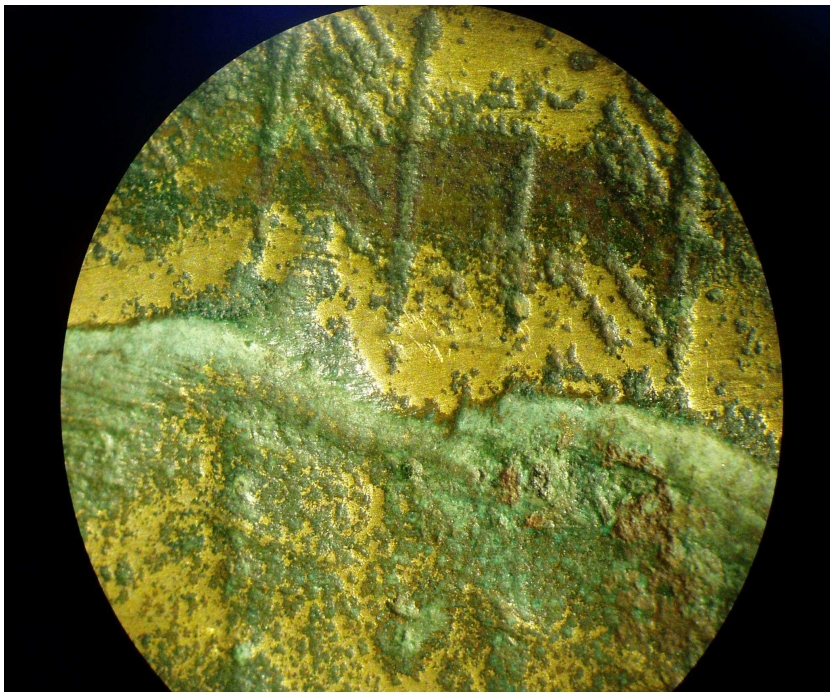


Figure 6.22 Axe from Mainshead showing decoration placed on top of a damaged/worn surface

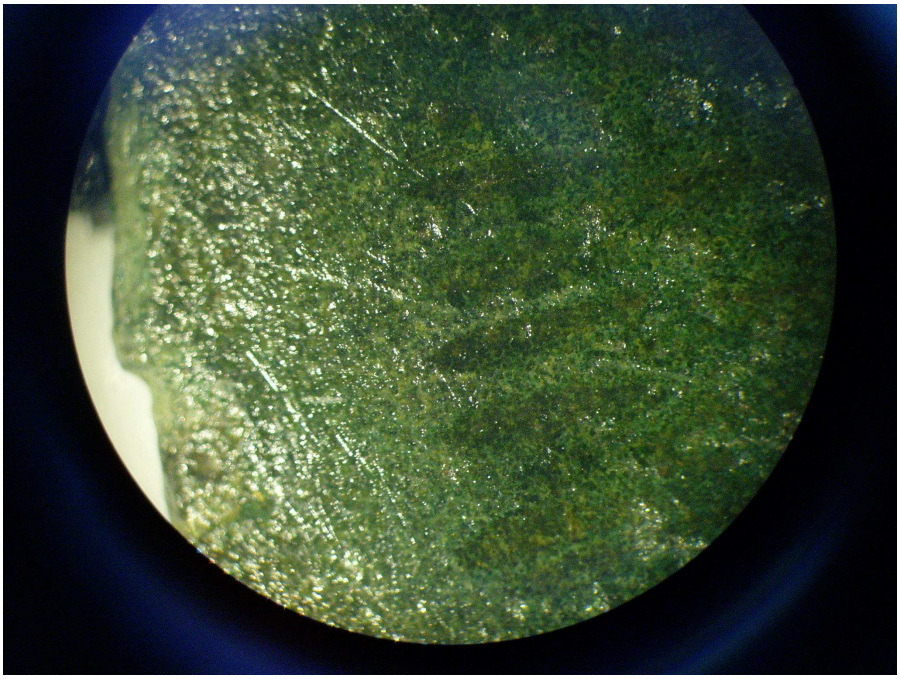


Figure 6.23 Collenard DA21 showing use striations cut by decoration

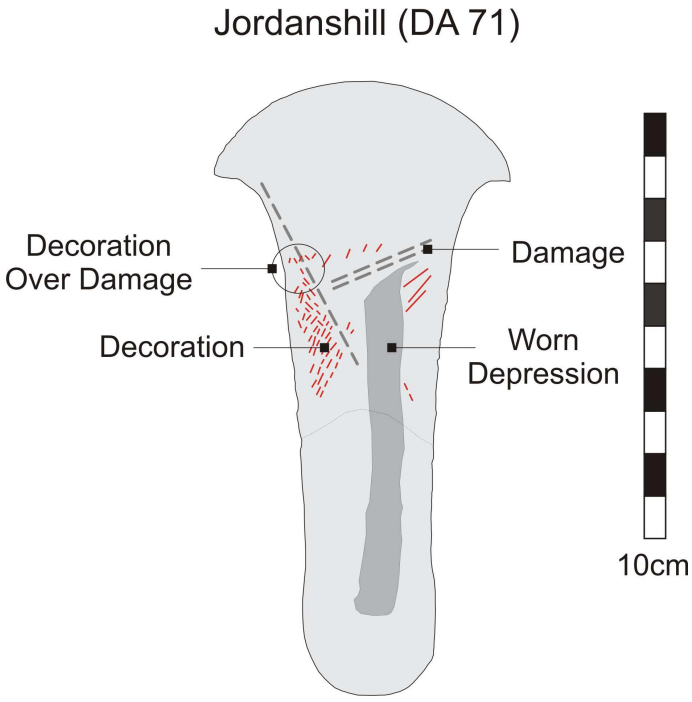


Figure 6.24 Schematic drawing of the axe from Jordanshill (DA71) showing the relationship between decoration and damage

Figure 6.22 depicts the axe from Jordanshill (DA71). The axe is damaged by a series of lateral indentations or cut marks running across the face. The axe also has a number of punched decorative indentations. However, the decoration physically overlays damage to the axe face in this case. Stratigraphically therefore, the application of the decoration must have come after the damage had occurred to the axe face. Moreover, the decoration appears to be framed by the damage, or certainly has influenced where the decoration was placed. This again overturns the notion that metal objects were decorated as part of the production process before they were used or circulated during their use life. These activities could clearly take place at any time, perhaps far removed from the production of the original object itself.

Other examples offer indirect direct evidence of the application of decoration at a later point in an axe's life. For example, the decoration on axe DA5 "Scotland" is decorated with a punched pattern on both sides. However, the punches show far greater degree of wear on one side of the axe which may indicate that this side was decorated for a longer period of time. Elsewhere, the herringbone decoration on the axe from Ashybank (DA10) appears incomplete as if it was still in the process of being embellished. On other examples the relative freshness of decoration also suggests that this process was not necessarily a one off operation carried out during the production phase of an axe's life. The decorated axe from the Barevan hoard (DQ264) has a fluted pattern running along the length of the blade and a series of punched marks running along the edges of the axe. However, the fluted decoration is very worn, with distinct attrition being seen along the crests of the decoration ridges. In contrast however, the punches are very fresh and relatively recent. This again suggests decoration being carried out at different points in an axes life. The contrasting evidence of decoration freshness is also seen on one of the axes (DNC 986.18.2) from the Dail Na Caraidh hoard (Figure 6.22). Here a fragmentary axe, showing signs of significant use and circulation has very fresh decoration that appears to have been applied to the axe when it was already in a worn state.

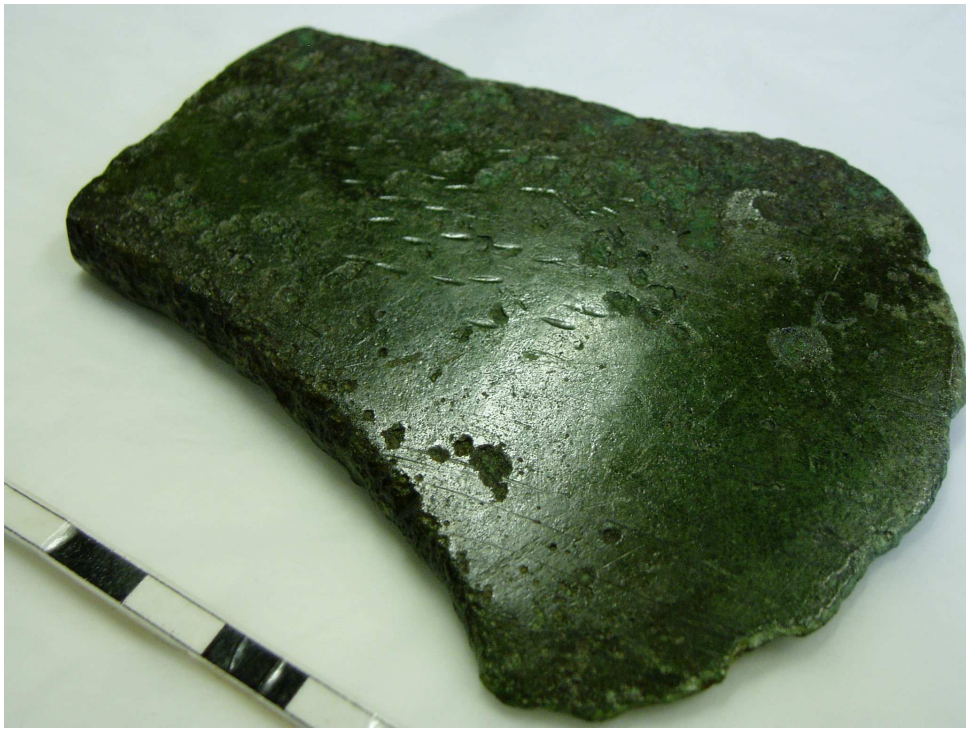


Figure 6.25 Fresh decoration on fragmentary axe
© Inverness Museum

Several other examples are indicative of an ongoing process of decoration during an axe's life. The axes from Falkland (1927.2715 & 1927.2716 both in the Ashmolean) have decoration on one side only and the examples from Rosskeen (1927.2720 also in the Ashmolean) has a different layout of herringbone pattern on each side.

7. TOWARDS A BIOGRAPHY OF AXES

7.1 Introduction

In this final chapter, my intention is to draw upon the theoretical and methodological arguments that I have put forward, and to fuse these with the tangible and empirical results of my analysis. My argument has been that analytical attention of Bronze Age metalwork has primarily been concerned with the production and deposition of objects rather than how the object may have operated when alive. There are undoubtedly limitations to the evidence which will always restrict the construction of a complete biography. There are no examples where sufficient information is available concerning all parts of an axe's life. It is not possible to trace an unbroken line from the extraction of ores, through the production process, the activities in which the object was involved and finally to its ultimate deposition. However, this should not restrict the ability to write biographically. By treating the objects as a context in their own right, a window is opened that allows us to recreate sections of the objects life and to consider how these section may theoretically be related to the areas where information is less forthcoming. With this in mind, I will focus in this chapter on two areas which I consider to be the most important findings to have emerged from this research as a whole. Firstly, I will consider the differential wear patterns that are displayed by hoarded items and consider the rationale behind these patterns. Secondly, I will consider the idea of deliberate damage at greater length. Finally I will discuss the implication of decoration being separated from the production process.

7.2. Differential patterns of wear in hoards

The evidence from Scotland shows that items hoarded together show varying degrees of wear, suggesting that they had each witnessed different lives prior to their interment. They each had different circulation times and had been used in varying degrees of intensity. These differential wear patterns displayed by the objects in hoards remind us of the individuality of objects and they all have a specific history

and are perceived in their own right. It follows that all axes were different with no two being exactly the same. This issue is often overlooked in by the disengaged categorisation of objects via typology. The wear patterns shown, and the variances they display, suggest that there was in fact no definitive point in an object's functional life when they are deemed to have become ‘ready’ to be deposited solely on account of their physical state and efficacy. Our categorisations of single or hoarded find do not consider these factors and are more concerned with the context of recovery and association of typologically similar material. However, when each item contained therein is treated as a context in its own right and viewed individually, it is apparent that there is a repeated pattern where varied wear signatures suggest that there was almost some form of predetermined recipe of old and new or fresh and worn objects that were required to be associated together. Needham (2004) suggests that the hoards from Dail Na Caraidh 1and Hill of Finglenny may represent material gathered over a few generations on account of their inclusion of chronologically variant types. This suggestion has more weight when set alongside the inclusion of items in hoards that have different circulation times as indicated by their different edge and break freshness. In this regard, it is also interesting that objects displaying recurring wear patterns have also been recorded in late Bronze Age Nordic ornament hoards (Kristiansen pers. com) as well as collections of Bronze Age thumbnail scrapers (Brück pers. com). It would appear therefore that the curation and reconfiguration of sets of material was more widespread. In these situations, different phases in the object's life appear to be intentionally represented. These features serve to highlight the point that axes like other objects lived out different existences after they had been created, and that these lives were an intrinsic part of the selection criteria for assembling groups of objects to be deposited together. In chapter 3, I outlined the approach put forward to the circulation of fragments put by Chapman (2001). The basis of his approach was the breaking of objects into smaller partible parts that then have the potential to be circulated, collected and reconfigured alongside other material indices. While Chapman is concerned with the actual breakage of objects, his ideas of accumulation clearly have resonance in this situation. Rather than being seen as

collections of fragments, where the possession of them is a socially significant fact, the hoarded axes are collections of items that conform to some sort of grammar or social convention.

By extension, a discussion concerning heirloom and relic status may also be applicable here. These ideas focus on the passage of items down through time, where objects serve “to objectify memories and histories, acting as mnemonics to remind the living of their link to a past” (Lillios 1999: 236). The recognition of an heirloom is inherently linked to an appreciation of the life histories of an object, especially where its time of manufacture significantly predates their period of disposal in an archaeological context (ibid. 1999: 238). However, states of wear and damage have also been a central mechanism by which to judge an object's heirloom status. For example, Anne Woodward (2002) offers an analysis of Beaker pottery and bead necklaces based on an assessment of abrasion levels. She draws the distinction between heirlooms and relics, where objects in the former category are related to specific individual histories while the latter as more generalised objects that are invested with significance owing to their antiquity or association with the past. One of her main objectives was to distinguish different types of object life cycle, and she notes how fragmentary remains can be incorporated into this scheme as significant items having been derived from complete objects. Two key emerge issues emerge from the discussion so far. Firstly, the intrinsic relationship between objects and people and secondly the way in which certain material features may be recognised

7.3 Recognising objects and people

While the objects contained in hoards have had different histories of their own as evidenced by their variations in wear and damage, they are by extension representations of the people who have own and used them. Therefore their biographies are intimately and inseparably interlinked with people to the extent that their identities become synonymous. An extension of this situation is that so called single finds were perhaps deposited by individuals whereas ‘hoards’ were deposited

by groups (c.f. "community deposits" Needham 1988), as a medium for the creation and mediation of social liaisons. The practice of hoarding may have been the end result of community activity whereby objects that were symbolic of different social relationships were accumulated together to reinforce communal relations en masse. Different parts of society perhaps defined by age, gender, or kin association may have been subject to differing rules and regulations governing the identity of objects they were required to submit. Perhaps a better term for these assemblages would be “event deposits” where different individuals are represented who have taken part in some form of communal activity, for example the felling of trees for the construction of a trackway.

In this light, the joint internment of items physically represents the day to day social relationships. This concept is particularly applicable to the roles axes may have played during their lives and shows how the boundary between object and person is likely to have been transgressed. The condition of an individual axe was perhaps a direct indicator of an individual, visible to all in society that extended the presence or agency of an individual. For example, in simple terms it is possible to hypothesise a range of status based on age were longer biographies of people’s social standing was intimately related and displayed through a parallel longer biography of an object. Axes had their own personalities and histories and I contend this was recognisable through the lens of their physicality. Here, the concept of Patina is useful and relevant. The term encompasses any wear, tear, chips or sheen that develops on the surface of an object during its life. It is these features that give vital clues towards recognising the age of an object and so the duration of its life. Mckraken (1997) demonstrates how these features were socially significant and related to a system of display and status in the high medieval period. An individual claim to status was materialised in ownership and condition of items such as cutlery and crockery. With the increasing wealth of individual families, these items were becoming more readily affordable by an increasing number of people. However, the key issue was that while such items were affordable and available for purchase by elites for use at social

gatherings, the patina that they displayed was an indicator of how long their owners had owned and used these objects. This was synonymous with their own biographies of status and denoted their longevity as a member of the elite class. This affirmation of an individual claim to status is therefore given a temporal aspect in rather the same way that archaeological evidence has been used to legitimise claims for national status. Critically, patina was not forgeable and could only be created over time. These issues are still prevalent in today's society. For example faded jeans replicate age and wear so rather than buy a 'new' pair of trousers; there is a demand for them to at least appear old. Clearly these issues are also tied into the changing fashions and the social identity of the owner. While the physicality of objects is often taken for granted, it is a key element of intended life of an object (Buchli 1995: 81-93) and related to its intended or required durability.

This concept is particularly relevant to the wear on axes. As a vehicle for transferring the status, age or identity of the owner, the wear and damage to an axe was perhaps a material expression. It was through the condition of material items in this way that an "aura" is created around both the object and its owner (Benjamin 1969; Shanks 1998). While most axes were deposited in a functional condition, the typologically later forms display greater levels of non symmetry and more overall signs of attrition. This suggests that circulation periods increased through time. Similar ideas have also been discussed in terms of pottery (Woodward 1998). These terms represent points at either end of continuum in rather the same way that issues of production and deposition underlie traditional approaches to metalwork. In contrast, I would like to argue that these recurring patterns of increased wear and attrition mirror the incorporation of metal objects into social use. Since objects are created through technological acts that are informed by the decisions and context of social actors, technology is a fundamental medium through which social relations are mediated (Dobres & Hoffman 1994: 212). It is useful to picture this relationship as a form of 'social equation' that exists in an ongoing and dynamic state of recalculation to encompass variations in its component parts facilitated by the action of people who articulate their social

relationships through an engagement with the physical world. Metallurgy represents the appearance of one such variable into this formula. The increased amount of hoards, the greater degrees of fragmentation, circulation times and wear, as well as the increased number of objects contained in Later Bronze Age assemblages may be the physical manifestation of both an increased number of liaisons as well as the increased use of metal as a medium for social exchange.

7.4 A biography of damage

A number of axes examined are incomplete and remain as only broken fragments. In these cases emphasis has traditionally been placed upon the most prominent form of use wear or damage visible. An axe that is found broken into two pieces would normally be categorised on account of this fact alone. It is here that the notion of deliberate damage has been liberally applied as part of broader interpretations of metalwork deposition being intrinsically linked to acts of wilful destruction, perhaps as ritual offerings or public display. A good example of this situation is shown by assessments of the broken axes in the Collenard hoard in Scotland, which are deemed to have been ritually broken prior to deposition (Cowie 1988; Jones 2002). The implication of this argument is that items were damaged at or just prior to deposition. The hypothesis that objects were either deliberately damaged prior to deposition or buried soon after they had been used would suggest that these features should remain relatively fresh when they are recovered archaeologically. However, by making these judgements solely on the ‘macro’ nature of the damage, no visibility is given to instances of microwear that they may display, how they may have been employed prior to deposition, or indeed for how long. While this fact has been previously identified (e.g. Jones 2002:101) relatively few attempts have been made to carry out any formal assessment of metal objects. Little attention has traditionally been placed on how long items may have been in circulation either prior to or after instances of damage, or more generally to the relative lengths of object life times. The analysis undertaken in this research has addressed the situation by looking comparatively at the freshness of edges and breaks and has shown that there is frequently a variance in

the degree to which they are worn. For example two of the broken axes from the Hill of Finglenny (DQ309 & DQ310) show dissimilar wear patterns across their broken sections. In both cases the broken edges on the butt fragment remains in a much fresher state than the corresponding blade section. This suggests that these individual sections of the same axes were circulated for different periods post fracture. Roberts & Ottaway have previously proposed that variations in wear indicate the presence of "active tools [that] became offerings to the land" (Roberts & Ottaway 2003). However, this example illustrates that fragments were also circulated in a non functional state prior to being finally reunited, in this instance at deposition. Elsewhere incomplete section are deposited adding further weight to the idea that the fragments have been separated and taken on a life of their own as objects in their own right. If this is in fact the case, then it is necessary to reconsider the idea of deliberate breakage as part of the act of deposition itself

Very often the attribution of the deliberate breakage tag is borne out of the fact that objects do not appear to have been used sufficiently to have been broken through normal usage. In their final discussion of the relationship between use and depositional context, the suggestion is made that distinct locations and times were chosen for the deposition of socketed axes (Roberts & Ottaway 2003:136). This assertion stems from the fact that firstly some of the axes examined were still in a useable state, which suggests that they were not deposited on account of being worn out. However, I would like to question the notion of *deliberate* breakage in its broadest sense, since it is very difficult to snap an axe in two without leaving some other forms of damage on the faces of the object itself. As part of the experimental work undertaken, I have tried to deliberately break some of the replica axes. Figure 7.1 shows one of the replica axes wedged between two blocks of stone. This axe was beaten, initially with large beach cobbles which induced the bend in its length. Three observations were immediately apparent. Firstly, it was impossible to break the axe clean in half. Having failed with the stone cobbles, a range of modern hammers were used and still failed to induce failure. Secondly, before the use of the hammers, the

axe face became pitted and damaged by the blows of the hammers (Figure 7.2). Finally, as the axe began to bend, the structure of the bronze started to form into hairline cracks (Figure 7.3)

Figure 7.1 Test axe after attempts to induce fracture

Figure 7.2 Test axe after attempts to induce fracture showing damage surface

Figure 7.3 Test axe after attempts to induce fracture showing hairline cracks in surface of the axe

It is therefore significant that all of the broken extant axes examined do not show any signs that they have been struck, bent or levered in any way to induce fracture. Figure 7.4 shows the clean break across the axe fragment from the Collenard Hoard. This shows no stress or trauma to suggest a deliberate breakage activity has taken place

Figure 7.4: Broken axe from Collenard (DA24) showing broken section

In short, none of the axes in the collection were broken by force. However, closer examination of the broken sections in almost every case reveals the presence of a range of casting flaws, such as cracks, hollows and air bubbles. For example, the axe from Auchnagarron (DA85) (figure 7.5) shows a casting flaw in the section. Elsewhere, examples such as that at Hill of Finglenny (DQ308) (Figure 7.6) show cracks forming across the centre of the axe.

Figure 7.5: Broken axe from Auchnagarron (DA85) showing casting flaw in section

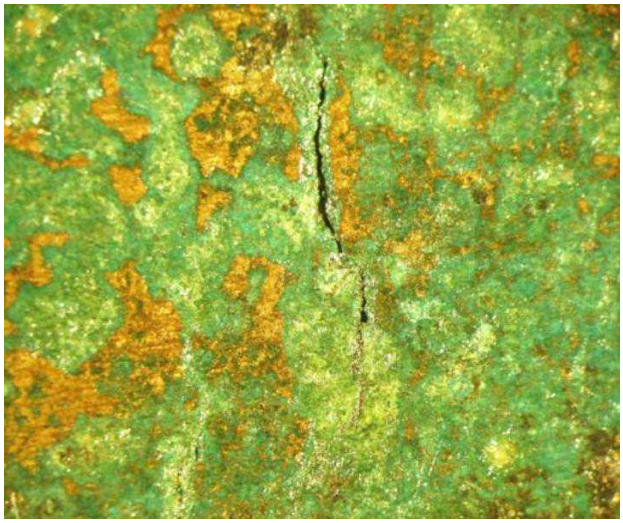


Figure 7.6: Axe from Hill of Finglenny (DQ308) showing crack across face

The presence of such features infers that these particular axes snapped while in use and that this breakage may in fact have been unavoidable. This does not mean to say that the breaking of these axes was not a significant event when it occurred. In some

cases, cracks in the matrix of the metal are visible on the surface of the axe (See Figure 7.7) and as

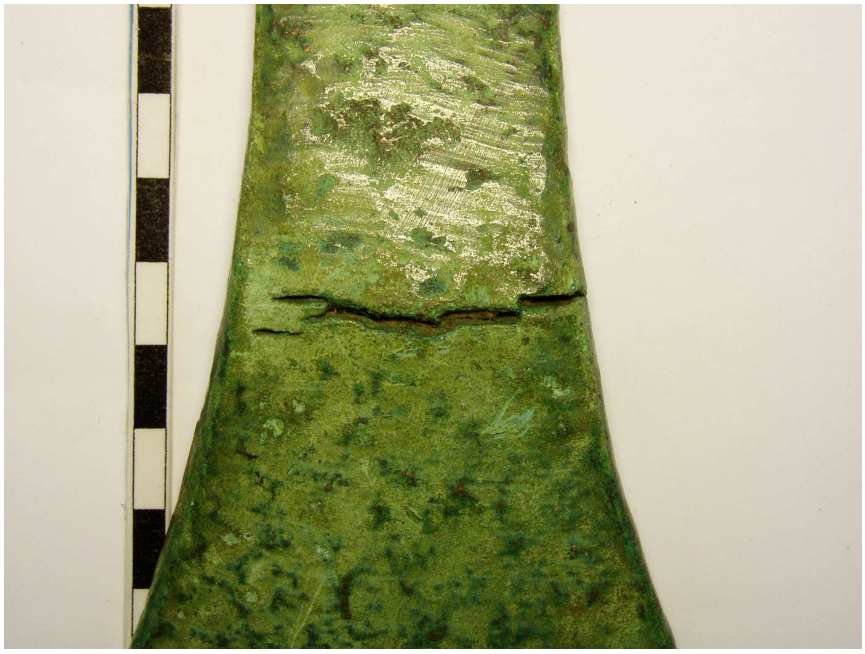


Figure 7.7: Axe from Abdie (DA62) showing crack across face

Figure 7.8 Bent axe from Dunino

It is tempting to suggest that as metal became more freely available to a greater number of people it took on more significance as a medium of embodying social relations. While axes were not broken in overtly deliberate ways, later forms of object such as swords may have allowed different forms of breakage. The modern day conceptualisation of the technological process sees it very much in utilitarian terms as finite process with a defined beginning and end. In the case of metallurgy, such a view may begin the technological sequence with the initial recognition and collection of the requisite ores followed by the various processes that transform these raw materials into metal, and perhaps end with the breaking of an object from its mould. In this light, the infliction of damage or the breakage of this created object into pieces seems to be counter-intuitive. However, we may consider such activities as an extension of the technological process, as an ongoing manipulation of the material world. Hoffman (1999) has noted how in order to break an item a degree of technical knowledge its material properties is necessary and informs the method of breakage. In this light, it may be that certain objects which displayed signs of poor casting were deliberately selected to be broken when in use, perhaps as part of the destructive performance. Figure 7.8 shows a bent axe from Dunino which is perhaps and example of a failed attempt. Building on Hoffman's ideas of the link between technical knowledge, I would like to propose that the later forms of artefact were easier to break. The effort and material knowledge required to break a small bronze axe for example is far different from the snapping of a sword blade across the knee. Moreover, there are more limited ways of damaging an axe, whereas a sword provides a larger amount of features to be damaged. These ideas connect to suggestion above that these items remained in circulation for a longer period of time, and the infliction of damage was increasingly used as a social mechanism and means of expression.

There are a series of issues that arise out of these previous approaches, and my initial concern is with the various terminologies that are employed. The terms 'use wear', 'damage', and 'fragmentation' appear ill defined, and take on nebulous qualities to the extent that they have become almost interchangeable. I contend that this issue

emerges from the inferred function of the objects in question. For example, the presence of trauma to the blade edge on a sword is a feature that is to be expected from such an item, arising out of its primary use as a weapon. This may equally be described as ‘use wear’ or ‘damage’. Conversely, if the sword is broken into pieces, analysts appear reticent to attribute anything but a premeditated motive, irrespective of the fact that these breaks may have occurred at weak points in the original casting and conceivably arose out of normally expected usage. Unsurprisingly, this situation would normally be ascribed ‘deliberately damaged’ status. While I believe many metal objects were indeed deliberately broken, I would contend that blanket assignation of ritualised status to this action presents far too narrow an assessment in all cases. Such opinions are rooted in a modern day conceptualisation of the technological process that sees it very much in utilitarian terms as a finite process with a defined beginning and end. In the case of metalwork, such a view may begin the technological sequence with the initial recognition and collection of the requisite ores followed by the various processes that transform these raw materials into metal, and perhaps end with the breaking of an object from its mould. In this light, the infliction of damage or the breakage of this created object into pieces seems to be counter-intuitive. If this fictitious example describes the polarised positions on either side of a deliberate: unintentional use wear dichotomy, a somewhat hazy situation arises where cutting edges are held to show signs of intentional damage (e.g. Needham 1989).

A related issue is the fact that we tend to separate objects once created from their physical inventory. The division of artefacts into categories assumes that these divisions were recognised in prehistory. However, these functional delineations may not have been recognised in the same way, where the meaning and value of an object may have been relatively less stable (Bradley 1990: 32). In terms of metalwork, once an axe has been cast and freed from its mould we tend only to concern ourselves with the shape of the axe and the way it is utilised, rather than a consideration of the material properties and technology it represents. How may these latter features be

related to the passage of its life? Once the technological process has finished the artefact is created and considered as the artefact alone and no longer in terms of the technical biography that goes behind it. It is overlooked that the object is representative of a series of fragmentary activities that have been combined into on whole. It incorporates a range of natural elements such as fire, water and ore. These elements would all be endorsed by the way in which they were understood within the social, cultural and natural world. For example, fire may be seen for its destructive qualities in certain contexts or for the warmth and protection that it provides in other situations. Its transformative power may have been both feared and resisted or revered and encouraged. It follows that the materials and processes that are joined together as a technology perhaps already have implications within the social fabric, and their combination would have both required and acquired a new set of significance.

7.5 Decoration in the life of objects

Decoration is traditionally assumed to be part of the production process and the implication is axes were decorated all in one go by one person immediately after they were finished (or at least as part of the finishing process). This in itself forms one of the boundaries between the different stages of the use life model based around phases of production, use and discard. This concept may be related to the evolutionary conceptualisation of axes in that decoration eventually becomes cast as opposed to manually formed. However, in several cases the examined axes have suggested that this order may not always be followed. There are several implications of these findings. Firstly, unlike ceramic technology, where all incised decoration is carried out before firing, the embellishment of metal objects is not always part of the production phase. In the course of this research, I can find no other literature that makes this assertion. Clearly the application of decoration changes the identity of the axe and perhaps its user and may be related to changes in a person's identity and status. Moreover, if decoration did not always occur when an axe was being made, further questions emerge. Firstly, what is the identity and status of those who subsequently carried it out? Secondly, at what point in time did these activities occur?

Thirdly where they took place? The fact that some metalwork may have been decorated over time rather than in one phase has clear ramifications for the way in which that object operated and was perceived throughout its life.

Decorated axes do not appear until later in the Early Bronze Age metal axe sequence, when schemes are employed that share a set of design conventions found on a variety of objects such as beakers, grooved ware pots and lunulae (Jones 2001). Traditional approaches to decoration have essentially concerned themselves with categorising the various designs themselves and identifying possible continental connections (Megaw & Hardy 1938; Harbison 1969; Needham 1983). Only a limited amount of work has been carried out on the techniques themselves (Lowery *et al.* 1971) over and above a simplistic determination of the methods used, such as 'hammer' or 'punched' decoration. In any event, their application is normally identified as part of the production process, creating an object that has a different identity perhaps linked to the status of its owner. However, while it is not a widespread phenomenon, I would like to suggest that some decorative schemes appear to have been added after the axe has been used or certainly after it had been in existence for some time.

There are several implications of these findings. The materiality of metal therefore allows ornamentation to be added at a later stage in an object's life, perhaps changing its identity and significance in relation to parallel transformations of its owner's social status. Moreover, it is not necessarily the maker of the axe who performs the ornamental procedure, and these techniques were perhaps subject to their own social convention and appreciation. Microscopic examination of the punch marks on nearly all the decorated examples recorded, shows distinct changes in morphology of the imprint, and it is tempting to suggest that some schemes were built up over time, perhaps marking events in the axe's life. The current problem with this argument is the fact that due to the cold hardening of the assumed bronze punches used to create these designs they would require periodic annealing to avoid their becoming brittle. Therefore, changes in the shape of the ornamental marks themselves may reflect both

the deterioration of the punch being used as well as its revised morphology after reworking. As part of the broader research project presented here, it is hoped that ongoing experimental work may reveal further information in this regard. Nonetheless, these findings also draw attention to the question of whether the decorative schemes were ever seen to be complete, or remained in a continual state of becoming. Some of the less well documented axes in the National Museum collection add weight to this argument. Rather than displaying fully symmetrical designs, they have 'incomplete' schemes such as the one on the Jordanshill discussed previously (Figure 6.22). Ultimately, the fact that some metalwork may have been decorated over time rather than in just one phase has clear ramifications for the way in which that object operated and was perceived.

7.6 Conclusion

In this thesis, I have brought together a traditional body of material, namely Bronze Age axes, with some of the more recent theories and approaches to material culture. The potential of wear analysis as a useful tool in the assessment of metalwork has also been developed. There are several key findings which have been apparent, and in conclusion I would like to summarise them here.

Firstly, I have attempted to advance the use of a so called biographical approach by relating its theoretical tenets with the physical evidence itself. I have shown how, whilst being widely accepted as profitable approach to objects, biographical applicability can be co dependant on a large slice of contextual information. AS we have seen , this is sadly lacking for most metal objects. However, the presence of use wear, damage and states of fragmentation in objects has been shown to provide a route to useable contextual information upon which to centre biographical enquiry.

Secondly, the experimental work that was carried out extended previous work in both its scope and extent. While my initial hope that a range of use wear rates could be established was not realised due to the large number of variables that became apparent, work on the cold hardening and decoration of axes has opened up new avenues of research. The speed at which an axe becomes cold hardened during its use, and the resultant brittleness of the metal, shows that for a metal axe to be used in a functional sense over any length of time, a sequence of reheating and cooling would have been necessary. This would have potentially require the axehead to be removed from the haft, and certainly the creation of a fire. Were these activities carried out by metalworkers or by the owners of axes? What social significance did these acts take on?

Thirdly, from the perspective of use wear analysis, the arguments put forward suggest that the traditional dichotomies employed in the categorisation of this body of archaeological material do not seem to be represented in patterns of wear. Our designated boundaries of items as either 'hoards' 'single' finds for example appear to be more blurred and ill defined. It is clear that these items all had individual lives post production, and were circulated for varying lengths of time. While these suggestions are not new, it is apparent from the results presented here that another variable in this argument can be removed from consideration.

My fourth point is an extension of this fact where I have shown that metal axes were subjected to different intensities of use in a functional sense, but were also circulated for different time periods prior to their deposition. The period of time after production

and before deposition may have been further divided into functional or symbolic periods, perhaps extending far beyond the individual human lifetime. In terms of their association with other axes in hoard deposits, I have suggested that a consideration of their individual life histories was an important criteria for their selection and juxtaposition. Their relative ages when deposited, identified by degrees of wear and attrition, may have been synonymous with both the individuals who owned and used them, as well as recounting the activities or events in which they had been involved. I have shown that interpretations of structured acts of deposition must also incorporate factors relating to the life of those objects prior to their final consignment, and move to consider how these salient issues were mutually entangled.

Fifthly, I have shown through my critique of more traditional approaches to metalwork, how objects have been homogenised by typology and as a result their object lifetimes have been compressed. While attention has previously been given to use wear, the extension and cross comparison of the freshness of edges and the sharpness of blades clearly indicates a range of lifetimes in evidence. Perhaps most significantly, the different freshness of broken edges across two parts of the same axe reinforce the concept that these objects could transform from a purely functional object, to a symbolic item that carried with it an individual history. Additionally, this fact also undermines the long held idea that items were broken or damaged at or very near to the time at which they were deposited.

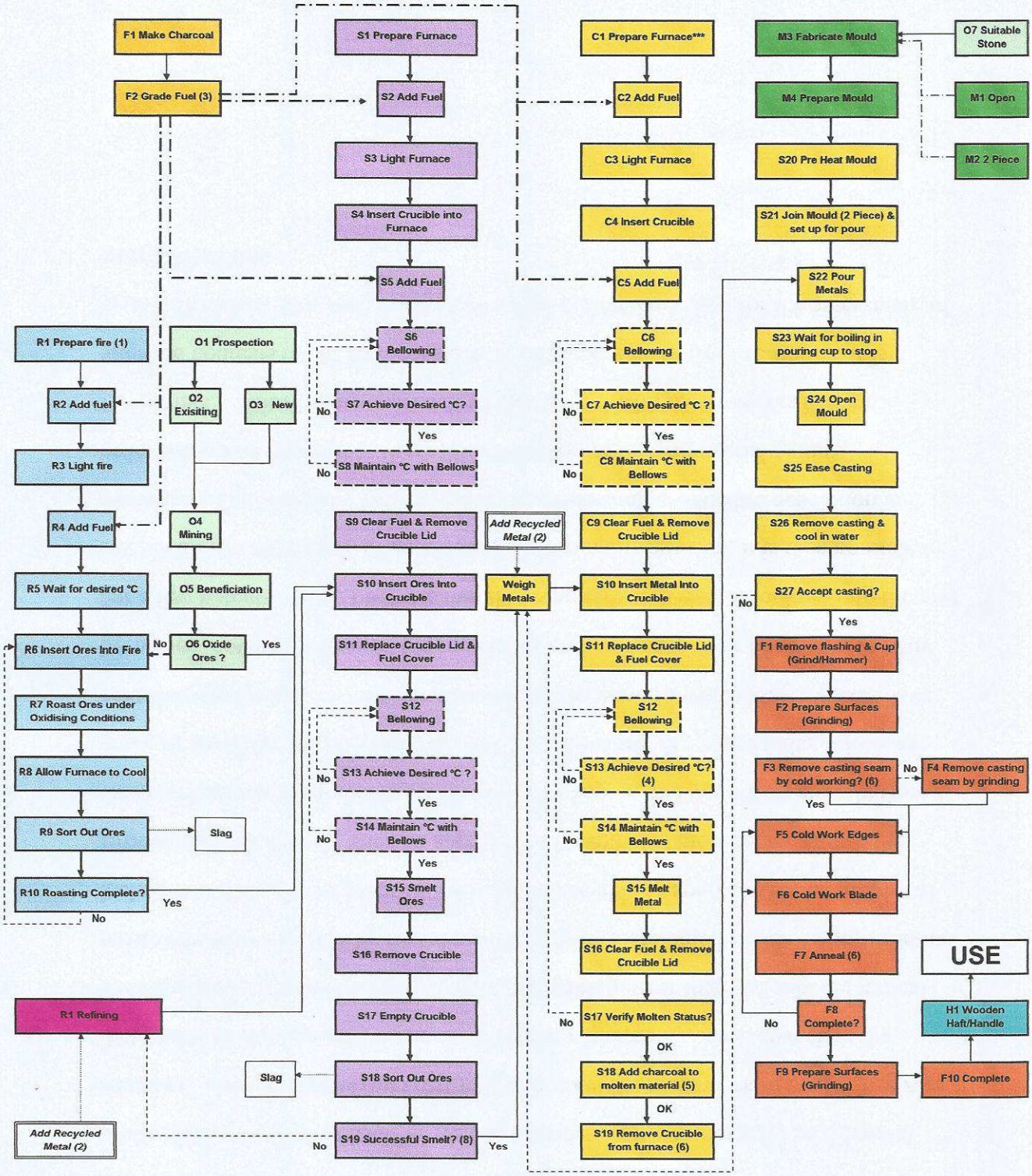
These facts are further enhanced if we consider the potential application of decoration over time rather than a facet of production. We can perhaps see, in certain decorated examples incomplete decorative schemes that are in the process of being fashioned. An immediate area for future discussion in these situations is why certain objects were not completed. Furthermore, what is the relationship between the individuality of the EBA decorative schemes carried out over time to those decorative

enhancements that are made during the casting process on similar types of item in later periods?

Finally, the work presented here has clearly involved only one class of object. The goal must now be to extend some of the key issues across not only the whole range of metal objects, but to other objects. It is clear that other types of object were also circulated over periods of time and the findings of this study would be significantly bolstered by similar approaches being applied.

APPENDIX ONE

Appendix 1: FLOWCHART DETAILING THE BRONZE PRODUCTION SEQUENCE



Processes & Codes	
F	Fuel Prepartion
R	Roasting Sulphide Ores
O	Supply of Ores
S	Smelting
R	Refining
M	Mould Preparation
C	Casting
F	Finishing
H	Hafting

Notes	
1	Could be achieved in stone lined pit or furnace. Fire option shown here.
2	It is assumed that this was a known mix
3	Grading Fuel allows quicker conversion of bellowed air into CO^2
4	Temperature Pure Copper: 1085°C; 12% Tin/Copper Mix: c.950°C. See Note (6)
5	Removes any remaining oxides from the mix
6	Temperature must be sufficient to maintain molten state during pour
7	Knowledge of when to stop hammering and anneal expwerience
8	Process repeated to this point for each metal type
***	Experimental casting process starts here (See Chapter 4)
	Experience Critical activities: Colour of charcoal?

Materials	
Tin	Chemical symbol Sn. Atomic number 50. Melting point 231.91 C
Copper	Chemical symbol Cu. Atomic number 29. Melting point 1084 C Brinell Hardness 40
Arsenic	1% addition: Brinnell Score 124 – 177 (Tylecote 1962:42)
Bronze	Brinell Hardness 120-160