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Making marks meaningful: new materialism and the microwear assemblage

Christina Tsoraki[a], Huw Barton[b], Rachel J. Crellin[c] and Oliver J. T. Harris[c]

[a]Post-Doctoral Research Associate, University of Leicester, Leicester, UK; [b]Bioarchaeology, University of Leicester, Leicester, UK; [c]Archaeology, University of Leicester, Leicester, UK

ABSTRACT

In this paper we explore how positioning microwear analysis within new materialism and assemblage theory allows us to develop new ways of thinking about meaning in the past. By mapping the detailed histories of an object's making and use, we suggest that we can open up an understanding of marks as forms of material meanings. These material meanings operate as intensive events that fold together present and absent materials, as well as a range of ongoing processes. By studying marks on an archaeological object made of stone from one of the most famous Bronze Age barrows in Britain, within what we term a microwear assemblage, we will explore how a relational, more-than-representational, version of material meanings emerges.

Introduction

Take a single archaeological object, a stone battle axe with a shaft hole perforation, carefully pecked and ground 4000 years ago (Figures 1 and 2), and later deposited in an Early Bronze Age grave in southern Britain. This single object has been associated with all sorts of meanings; declared to be symbolic of 'high status', its location in a burial context marks it as a grave good *representing* the identity of the person it accompanied. No common object, the meanings archaeologists have associated with this artefact emerge from how it seemingly tells us about the beliefs, associations and social world of the people who made it, used it, and were buried with it. The object appears to offer a bridge to a lost world of ideas, signified by its context and the amount of work invested in its production. Yet need this be the case? What would happen if we thought about meaning differently? What would happen if we started not by trying to wonder what the object stands for, or symbolizes, or whether it indicates the presence of a metalworker or a powerful shaman (all actual interpretations of this artefact)? What would happen if we started with the object itself and learned to ask *it* about what it remembers, about the meanings it carries with it, about the relationships through which it emerged and which have endured intensively in its body for thousands of years? What if we turned away from traditional approaches to meaning towards ones that embrace the vibrancy of matter? What if we started with what we now call new materialism?

New materialism, both in archaeology and more widely, is accused of a lot of things: abandoning social justice (Van Dyke 2015), turning attention away from the human (Whittle 2018), and ignoring issues of power and responsibility (Ribeiro 2016). One might also suggest that new materialism, in its

reaction against post-processualism, has rejected discussions of meaning and symbolism (cf. Crossland and Bauer 2017). Symbolism was critical to many post-processual approaches; material culture, famously, was meaningfully constituted (Hodder 1982, 13). Archaeological materials were a kind of text that could be read and their meanings interpreted. The consequences of this reduction of material culture to language and symbolism were indeed part of the motivation for a range of archaeologists, from different perspectives, to turn to things once again (e.g. Jones 2012; Olsen 2003). In so doing, new concerns with material properties, the historical role of non-humans, and themes like ontology – what the past actually is – have come to the fore. Meanwhile, symbolism, identity, power and other critical post-processual concerns have faded from popularity in this dimension of archaeological theory (Harris and Cipolla 2017).

Here it is important to make a critical distinction; whilst with notable exceptions (e.g. Harris 2016; Normark 2012) meaning and identity, for example, have not dominated discussion within new materialism, this is a very different claim from suggesting that new materialism *cannot* address issues of meaning. One of the key concepts that comes from new materialism, and perhaps the one that has had the most influence on archaeology, is that of assemblage (Jervis 2018; see also Hamilakis and Jones 2017 and papers therein). A critical aspect of assemblages is that they make room for meaning, they contain, as Deleuze (2007, 177) puts it 'whole regimes of signs'. This means that assemblages not only include the material elements of the world that descriptions of them so often foreground (e.g. Harris 2014) but also the symbolic and the linguistic. The choice by archaeologists to emphasize the material aspects of assemblages, and to thereby effectively ignore the meaningful character of existence, is in part a product of how new theories emerge. They frequently emerge in apparent (though often not actual (see Crellin 2020)) opposition to earlier theoretical approaches – as new theorists try to demonstrate the difference that new theories make; ignoring meaning was part of a reaction against post-processualism and not a part of assemblage theory *per se*. The explicit rejection of meaning is also more central to some elements of the recent material turn, such as the symmetrical archaeology advocated by Olsen and others (e.g. Olsen et al. 2012), in a way that has never been the case for the readings of new materialism derived from Deleuzian and feminist philosophy (cf. Crellin et al. 2021; Garcia-Rovira 2015). As we will see below, new materialism overlaps in interesting and productive ways with other approaches to meaning being developed in archaeology, especially those drawing on Peircean semiotics.

Rather than a rejection of meaning, per se, the critical move by new materialism is to shift away from an emphasis on *representation* (cf. McFadyen and Hicks 2020, 3). Representation captures the dominant Western ontology, that human beings are separated from the world, and have to 'represent' it in their minds. From Plato's cave via Descartes dualisms to Kant's phenomena and noumena, a gap has been posited between the world 'as it is' and the world that human beings represent to themselves. Key here, in particular, are language and symbolism, where one element of the world comes to stand for another, or to represent it. This particular and specific mode of engagement is taken, within dominant Enlightenment accounts, to be primary and generative of our engagement with the world. This world of dualisms has been roundly critiqued by new materialism for only capturing part of how human beings and the world relate, and for privileging a specifically human form of engagement above any other. In contrast, the flat ontology favoured by many new materialists does not elevate any one aspect of the world above others – at least ontologically. Thus rather than presuming that symbolism and language, particular forms of representation, are the primary ways in which we access the world, a new materialist approach sees these elements as secondary to, or emergent from, a primary world of materials. Here the emphasis on representation is displaced into an approach that might be referred to as non-

representational, or perhaps better, more-than-representational (Anderson and Harrison 2010; Harris 2018).

In this paper we will explore how new materialism can be brought to bear on issues of more-than-representational meaning and how this can shift the discussion of these topics in new directions. Specifically, we draw on the language of assemblage theory to develop what we term wear-analysis assemblages. These place the human analyst, the materials under consideration and the multiple non-humans involved in analysis on the same ontological footing in order to consider different kinds of marks that were made in the past. Some of these will include marks that archaeologists have traditionally seen as decorative and thus deliberate and representational. Others will be marks less readily recognized as symbolic or meaningful: those made through processes of production and use. Microwear analysis, as a process, works with past materials, to disclose a form of material meaning, emergent in the marks themselves. It attends to the material vibrancy of past objects and the roles that materials themselves play in the production of meaning. Specifically, we will suggest that the forms of meaning disclosed through microwear assemblages can profitably be thought of as a form of *material memory* (cf. Harris in press). We will apply these concepts to the single battle axe with which we began this article. By exploring new ways of engaging with matter and meaning we are shifting the focus away from 'decoration' towards other marks on archaeological objects. These marks could be perceived as 'mundane' and have attracted less interest but, as we will show, are nevertheless meaningful parts of past worlds, once we embrace a more-than-representational approach to meaning.

Assemblages and meaning

We begin by fleshing out our theoretical framework more clearly. The concept of assemblage, critical to our work here, emerges primarily from the work of Deleuze and Guattari (2004). They offer assemblages as a way of rethinking the basic structures of the world. Rather than focusing on bounded entities they instead explore how the world emerges through intertwining relationships that are always in the processes of change and transformation. The world they envisage is never static but always changing at different speeds. Humans are not the sole protagonists of events; instead they can only act in collaboration and conjunction with non-humans. Assemblages therefore always consist of heterogeneous gatherings of components, and exist at multiple scales (Harris 2017).

Deleuze and Guattari ask us to focus on what things *do* in the world. This is not just a call to focus on what things are doing *at any given moment* but also a demand that we focus on what they *can* do. To allow us to explore this effectively, a key component of assemblages is that they are both virtual and actual (Deleuze 2004). The term virtual here in no way refers to the modern world of the internet. Instead Deleuze developed the concept of the virtual and the actual to discuss how assemblages have both empirical properties that are measurable and concrete, and capacities that, whilst equally real, are not currently in play (cf. Harris 2020, in press). Take for example, a trowel. The trowel has actual properties of weight and length and, in this example, is being used to dig a hole. The trowel could also be used to slice a cake, or to weed a garden but at present that is not what it is doing – these capacities are virtual. These virtual capacities are equally real but not currently realized. These two concepts work together to allow us to think about change and becoming as we can consider both what is actually happening right now, and what could have happened in the past, or could happen in the future.

Thinking about these processes of change draws us into discussion of another key concept: tetravalency. Assemblages are fourfold or 'tetravalent', that is to say they come together out of four different processes operating across two axes (Deleuze and Guattari 2004, 556). Most commonly

archaeologists tend to talk about the processes of territorialization and deterritorialization. Territorialization refers to how assemblages come together and deterritorialization refers to how they might come apart; these are two of the processes that act along one axis. These concepts have been utilized to talk about how new objects or practices might join assemblages and processes of making (e.g. Harris 2018). The second axis reveals that all assemblages are both machinic (they include material elements) and also enunciative (they include expressive and symbolic elements). These aspects of assemblages have been explored less often, to date, by archaeologists (but see discussions in Crellin 2020, 167; Hamilakis 2017, 172–3; Harris 2018, 89–90): this has resulted in the critique that new materialism and assemblage theory do not address issues of meaning and symbolism in particular.

This final point should emphasize our remarks from the introduction: there is nothing within a Deleuzian version of new materialism to stop us discussing meaning. However, we also need to consider critically what it is that we *mean* by meaning in this context. In this paper we suggest that taking a new materialist approach broadens the range of things we might consider capable of producing meaning. The version of meaning popularized by post-processual archaeology emerged from a representational understanding of the world and was primarily symbolic. This perspective argued that meaning relates to the ability of human beings to communicate with each other, and rests on the distinction between mind and body and signified and signifier. Meaning is created in the mind as a way of representing the world outside (cf. Harris 2018). This approach to meaning is inevitably anthropocentric, and emphasizes linguistic and symbolic understandings. It grows, as Crossland and Bauer (2017) stress, from a reliance on structuralist approaches to the world. This focus on representation, language and straightforward symbolism has even been explored as part of what could define a 'human revolution' argued to have occurred at the transition from the Middle to the Upper Palaeolithic (Mellars 1991; Mellars and Stringer 1989).[1] In this approach some things mean more than others and those who produce meaning are exclusively human.

This is not the only way to approach meaning. The work of Charles Sanders Peirce shows that an anthropocentric understanding of meaning is both incomplete and impoverished. Peirce's pragmatist philosophy has become increasingly influential in archaeology, particularly in North America (e.g. Cipolla 2013; Crossland and Bauer 2017; Preucel 2006). Peirce famously defined three types of sign: indexes, where the link between the sign and signified is direct, such as where the wind blows a weather vane; icons, where visual connections form a link, such as when a photograph forms a link; and symbols where the connection emerges from historical rather than visual or physical connection, such as a cross standing for Christianity. His version of sign relations follows this triadic structure involving both sign and signifier as per the classic representational model, but with the added critical role of the interpretant. As Crossland and Bauer (2017, 8–9) have shown, there is no need for this interpretant to be a human. In a critical, if somewhat morbid example, they set out how a human corpse offers a very different set of sign relations for a human interpretant than it does for a blowfly. For the human, the corpse can be a horrifying sight, a symbol of our own mortality and a disturbing icon of the person now deceased. For the blowfly, the corpse and the signs it emits (an odour of rotting flesh) are directly indexical of a suitable place to lay its eggs. In turn the blowfly's eggs offer forensic interpreters the opportunity to assess for how long someone has been dead, another indexical sign (Crossland and Bauer 2017, 9).

Although Peirce's work has not yet been incorporated within new materialism in archaeology (but see Cipolla forthcoming), many elements of his work offer important contributions and connections with this parallel tradition of thought. Peirce is a fundamentally relational thinker and

his work, as the fly example above demonstrates, is not necessarily anthropocentric. Furthermore, Peirce was a source of inspiration for Deleuze, particularly in his works on Cinema (e.g. Deleuze 1986, 1989), but also in thinking about how to describe different forms of relation in his work with Guattari (Deleuze and Guattari 2004, 586).

The precise interaction between different elements of Deleuze and Peirce offers archaeology a rich and promising resource for the future. Here, however, we want to emphasize how the most commonly employed aspects of Peirce's approach in archaeology can add to our ability to conceptualize meaning within new materialism and beyond representation and anthropocentrism. Deleuze and Guattari reposition Peirce's sign types of icon, index and symbol, which we introduced above, as ways of talking about different forms of relationship, and different degrees of territorialization and deterritorialization. If we start with indexes, in Deleuze and Guattari's (2004, 157) terms, these are 'territorialized' signs meaning they are a relation that cannot be separated, they are always tied together. Icons, for Deleuze and Guattari (2004, 157), are signs of 'reterritorialization' where visual or other connections link one entity to another. Finally, symbols for Deleuze and Guattari (2004), are deterritorialized signs, where the links are the product of conventional histories rather than physical connection or visual similarity.

Developing these accounts of relationships allow us to consider meaning as existing without relying primarily on symbolism and an ontology of representation. Meaning emerges as much in the fly's engagement with the corpse as it does in humans' engagement with a photograph, a cross, or a weathervane. Meaning no longer derives primarily from representation, therefore. We should be clear here that this does not mean that we reject representation entirely. It is not that things *never* symbolize something else, or that metaphor and simile are not important components of worlds involving human beings. However, it is to recognize that these meanings are not all that things are, or all that things do, and representation does not exhaust meaning. Here we see the importance of taking a more-than-representational approach, where we recognize that we can make space for representation as the outcome of relations formed through assemblages, and not as the primary mode in which the world operates (Harris 2018). We refer to *material meanings* here to capture how meaning does not rely necessarily on human engagement, in the way that symbolism and representation traditionally do.

Marks and meaning

In this paper we address these material meanings. In relation to material things, discussions of meaning are often limited to the interpretation of what we might refer to as art or decorated objects. We interpret a rock art panel, or consider the symbolism involved in the decoration on the surface of a pot. These kinds of marks are imbued with meaning, meaning that comes from the deliberate masterful work of an 'artist'. In the artist's work they represent the world that they know – sometimes this takes the form of iconographic marks, but it also takes the form of abstract art where the artist might represent a feeling, a place, or a concept in a manner that is not directly figurative. Here the artist or the maker imposes a mark onto the world intentionally with purpose and design. This mode of making and creating is often referred to as a hylomorphic approach (Ingold 2013). These kinds of marks have meaning because that is what the artist intended.

An ontological hierarchy of mark meaning is in operation here (and one that has anthropocentrism at its core). Decorative marks are ontologically elevated above other kinds of marks that exist. The marks on the blade of a Bronze Age axe produced in the chopping of wood or bone do not matter from an artistic, representational, perspective. They are not the work of the creative genius of an artist representing the world, rather they are the product of functional, utilitarian action of *just*

getting along in the world. Our ontological hierarchy relegates marks produced by non-humans even further. The etchings on a blade caused in reaction with soil, or the footprints left by an animal moving through a forest, or the eroded parts of a rock created by rainfall are all material marks left by non-humans. These carry no meaning, they are, apparently, simply natural.

From the perspective of this paper though the situation is quite different. We develop an account of mark making that revels in the emergent meaning of marks that are mundane and everyday, as well as those marks more readily recognized as symbolic. Practice theory (e.g. Barrett 1994; Pauketat 2001) has long reminded us of the importance of unthinking routine action, the unintended consequences of Giddens (1984), or the habitus of Bourdieu (1990). New materialism pushes these important moves further by expanding the engagement with routine quotidian action that practice theory develops to include the actions and engagements of a host of non-humans. By remaining resolutely relational, and refusing even a mutually constituting duality, new materialism offers a far less anthropocentric account of the emergence of daily life in the past. Below we explore the multiple meaningful emergence of marks, as materials, humans, non-humans, practices, processes and more come together in the ongoing becoming of the world.

Here we draw upon critical work by Jones and Díaz-Guardamino (2019) who have explored how marks emerge across a range of Neolithic artefacts from Britain and Ireland. Their work looks at deliberate examples of decoration, but goes beyond this to capture both what we might call the explicitly artistic marks and other lines made through production. Their work, utilizing digital imaging techniques including Reflectance Transformation Imaging (RTI) reveals marks that are often invisible to the naked eye but are nevertheless revealing of how these objects have been made and used. Jones' (2011) work on rock art develops many similar themes, examining how, beyond unhelpful dichotomies of nature and culture, these productions bring together a host of different productive forces, not limited to human beings, in the process of mark making. Whilst this work focuses on a form of 'art', traditionally the domain of the artist, he considers the role that the landscape itself plays in its production by thinking about how cracks and fissures in rock forms were enhanced and utilized to become a part of the 'canvas'. Our own work also engages with the detailed mapping of different wear traces[2] but utilizing the method of microwear analysis. Microwear studies allow us to consider a wide range of macroscopic and microscopic marks – often different to the ones revealed by RTI – and to delve into questions about the nature of the material that created these marks (contact material), the motion used when the different materials came into contact, and the interactions between multiple *chaînes opératoire* thus revealing 'hidden technological choices' (Van Gijn 2008, 217). By building on Jones and Díaz-Guardamino's approach to decorated artefacts, by shifting our theoretical framework surrounding meaning, and by employing different empirical techniques, we aim to show how we can open up new ways of thinking about meaning making materials.

The wear-analysis assemblage

If assemblage theory offers us our theoretical starting point, microwear gives us our methodology. Wear-analysis is of course a well-established analytical technique that entails the identification of microscopic wear traces that develop on the surface of objects during manufacture, use, handling, and post-depositional processes (Keeley 1980; Vaughan 1985; Van Gijn 1990, 2010; Dubreuil et al. 2015). By considering the microstratigraphic relations and the spatial extent of wear traces, we are able to explore different events in the history of an object and to start mapping relations between

materials, motions, things, and people. It is from these maps that our new categories of meaning can emerge.

As a technique wear-analysis is frequently employed as a method to contribute to the narrating of *châines opératoire* and object biographies (e.g. Van Gijn 2010; Guzzo Falci et al. 2020). The *châine opératoire* (Leroi-Gourhan 1964) focuses on identifying the technical stages involved in the production of objects (see Conneller 2006; Dobres 2000). The object biography, first developed by Igor Kopytoff (1986) and widely adopted in archaeology (see Gosden and Marshall 1999; Hoskins 1998; Joy 2009), considers how objects move through production, exchange, and consumption processes and how these changes shift their relationships with and meanings for people. Both the *châine opératoire* and the object biography can also be combined with the concept of taskscape (Ingold 1993) to explore how processes of making and using objects might be distributed across space (see for example Conneller, Little, and Birchenall 2018). All three concepts are interested in the mapping of processes and change. They are also examples of what we might term theory-method, in that they offer both a conceptual and a methodological approach to the study of materials (see Conneller 2017). Method and theory are always entangled for new materialists and so building on the approaches discussed above we introduce our key theoretical tool: the wear-analysis assemblage. Wear-analysis can be thought of as an assemblage because it has two key features, first it emerges from a heterogenous mixture of humans and non-humans, from the objects understudy themselves through to the microscopes employed to visualize them, the gloves that protect the objects from human hands, and the cameras used to capture images. Wear analysis can also be thought of as an assemblage because it is always a process. Wear-analysis is not a technique where we can simply reveal how an object has been used, rather it is a process of material engagement that provides evidence through which interpretations emerge. Objects from the past have a host of virtual capacities, including to tell us about how they have been used. Microwear analysis forms a means of attending to these capacities, to actualize them, to bring them into the present. Here we can develop the types of meaning that our microwear assemblages reveal.

Specifically, this approach engages with the form of memories present in materials. We suggest that objects are replete with material memories, a virtual past folded into their material present (Deleuze 1991); our use-wear analysis reveals these. Memory of course has been a much-discussed topic in archaeology (e.g. Borić 2010; Bradley 2002; Van Dyke and Alcock 2003), but the emphasis here has been on human recall. Again we seek to escape these anthropocentric clutches and rethink memory as a relationally emergent phenomena. Building on Jones (2007, 225) recognition that objects can act as 'physical memories' we explore how matter and memory are always entwined (Bergson 1991). Memory and matter here interweave in ongoing duration, and this duration speaks to the ongoing movements that are productive of, and revealed in, the marks that microwear analysis studies. In their study of archaeological photography, Knight and McFadyen (2020, 70) discuss how traces are always emergent from time and movement together. In both the images they present, and in the photos of objects we show here, traces must be thought of as continually emergent, not simply as vestiges of a bygone moment.

Meaning in the wear-analysis assemblage also always involves humans. Wear-analysts appreciate that they are very much a part of the process of interpreting the objects that they study (e.g. Van Gijn 2014). Interpretation usually emerges from comparisons that the analyst makes between different objects that they have studied and experimental reference collections that they are familiar with. In the terms of the new materialist physicist philosopher Karen Barad (2007), the analyst is a key part of the process by which data emerges. The investigator, the object of study, the equipment and techniques involved form a phenomenon emergent in their intra-action.

Wear-analysis is a classic example of this Baradian process, an engagement through which meaning emerges in the dialogue between multiple entities. The wear-analysis assemblage is one that learns to attend to materials in precisely the manner for which new materialist philosophy calls (cf. Harris 2014).

Meaningful materials in the Bronze Age

We draw on wear-analysis to study material signs to map the multiple relations through which meaning emerges; meanings which are not limited to human beings. Through this we will concentrate on how materials render specific kinds of meaning possible via their historically located capacities and properties and through their individual histories. Meaning here emerges as unfolding relations through time, a form of meaning and memory that goes beyond the human and beyond representation. To do this in detail in this paper we will focus on a single artefact: the stone battle axe from an Early Bronze Age burial in Britain which we began the article with (dating to c.2250--1500 cal BC) analysed through detailed macroscopic and microwear analysis.[3] The axe has gone through a process of transformation, a process which materialized as the object came into contact with a series of other materials, human actions, and taphonomic conditions. It is in these histories, we suggest, that new forms of meaning can be detected.

Upton Lovell G2a burial and battle axe

Excavated by William Cunnington in 1802, the Early Bronze Age burial Upton Lovell G2a, Wiltshire, is one of the more famous of the 'Wessex Culture' burials of southern England (Piggott 1938; Shell 2000). The grave contained two successive inhumations and a series of mainly flint, stone, and bone objects which were interpreted by Stuart Piggott as evidence that the burial belonged to a 'shaman/metalworker' (Piggott 1962). Among these objects were two definite battle axes: shaft-hole stone implements with a central perforation on their bodies. One of these two battle axes, placed by the feet of the lower male inhumation, was broken into two pieces and forms the subject of this paper.[4] While the term 'battle axe' carries specific connotations suggesting a specialized use in combat, there is no substantive evidence to support such an interpretation (Roy 2020; Wentink 2020). The axe is dark greenish grey in colour and made from a medium-grained quartz dolerite (Group XVIII) (Evens et al. 1962, 248; Evens, Smith, and Wallis 1972, 257; Roe 1966, 245) with a polished surface. It has a slightly expanded cutting edge and a rounded/slightly angular shaped butt. A shallow double groove has been incised along the margins of the axe and polished internally (Figures 1 and 2).

How can we interpret the marks on this object as both meaningful and material, but in a way that does not impose a hierarchy between these two elements and presumes that *human* meaning is the only one that counts? We can begin with the most obviously 'meaningful' mark, at least in our traditional assumptions: the grooves incised around the body of the axe. This line serves no 'functional' purpose, it instead demonstrates aesthetic concerns and transforms the axe from the category of tool, to art-object, building on the hard-work of polishing the axe. The careful creation of the grooves shows the skill of a craftsperson (or persons) as they worked the surface of the axe beyond what was necessary, taking the shape, form and texture of the axe into account as they transformed its surface. In the terms we have discussed above this line creates a connection between different elements of the world: it potentially symbolizes something. The connections today, in the present, escape our understanding. We do not know if the line might symbolize a river, a life, or a wind. These connections are deterritorialized in the present. Their absence indicated by

the groove itself. Here then we encounter a paradox. The apparently most meaningful element of the axe, the mark which is clearly artistic, aesthetic and potentially symbolic, is in fact very difficult for us to interpret in the present. This does not mean we cannot create connections in the present, to postulate, for example, a connection between axes and water that would make the line represent a river, but these remain necessarily speculative.

The incised groove is not the only line we can follow here. Alongside the potentially symbolic a second level of marks remain, lodged as what we term material memories. Similar to other British battle axes (Fenton 1984) the Upton Lovell battle axe was originally shaped by pecking with a hammerstone (pecking traces are more visible on the margins and around the perforation) and then ground and polished all over, although the surface was never polished to a high degree. The polishing was produced by contact with a hard mineral material as indicated by specific material signs: localized patches of a reflective micro-polish with flat morphology that develops on the higher elevations of the surface microtopography and is associated with fine micro-striations. The polishing extends to the butt area where the directionality of the polishing is perpendicular to the long axis of the object (Figure 3(a)). The pecking, polish and striations across the surface of the axe are indexes of past movements, movements of hands and of hammerstones and abrading tools crossing the material again and again. Each mark here is a relationship made manifest in the material; more-than-representational, the marks create meaning in the manner in which they generate a sequence of habit, a way of synthesizing time itself (Deleuze 2004, 101), through the production and reproduction of marks co-authored by multiple materials and humans. Observing the marks reveals a multitude of relations as we can begin to see how the maker(s) attended to the material properties of the stone and used their body(ies) to work with them *and* how the stone responded to the actions and movements of the maker(s) and their tools: from these relations the battle axe emerged.

The pecking marks, striations and polish from the axe's production capture the memories of making, a form of meaning that manifests itself away from language. Other memories persist as well. The different episodes of use of the axe have resulted in a worn-out cutting edge that exhibits the material signs of heavy edge damage and intense rounding (Figure 4(a)). Observations with the stereomicroscope reveal rounding of grains accompanied with grain extraction from use in a percussive activity. Under high magnification a reflective micro-polish with localized distribution that follows the grain topography can be detected. The micro-polish has a smooth texture, pitted appearance and a sinuous morphology and in places is characterized by troughs and fine striations (Figure 4(b)). This type of micro-polish and associated features are consistent with contact with a medium hard material such as wood or bone – on balance bone seems the most likely. Here we see absence made present in the meanings manifested in the axe. No bone survives against which we can say this axe was used. Yet here it is, part of the assemblage whilst not physically manifest; bone survives in the indexical links between past and present, between the bone that was worked and the stone that survives. Here a relational connection, which marks this axe as one for bone working, re-emerges through the process of microwear analysis, the microwear analyst, the experimental connections, the microscope, and more. These meanings are not representational, but they are meaningful, and memorable, nonetheless. Following this episode of use, the battle axe was used for a different activity, the traces of which are best seen on the flattened tips of the expanded ends of the cutting edge that exhibit heavy edge damage (Figure 1). This re-use has blunted the cutting edge of the axe rendering it ineffectual to act in its original form.

Matter remembers more than it seems on the surface. The rock comes from the Whin Sill in Northumberland in the northeast of England (Group XVIII) (Evens et al. 1962, 248; Evens, Smith, and Wallis 1972, 257; Roe 1966, 245), more than 300 miles from its eventual deposition in Wiltshire (but

Figure 1. The battle axe from the Early Bronze Age burial Upton Lovell G2a, Wiltshire (DZSWS:STHEAD.4a): upper body and cutting edge (photo taken courtesy of Wiltshire Museum, Devizes).

see Williams-Thorpe, Webb, and Jones 2003 for the identification of glacial erratics from the Whin Sill in southern Britain). The material carries the memories of its origin in its colour, its texture, and its chemical composition. It is both indexical and iconic. We cannot know if this meaning manifested itself for humans in the Bronze Age, although we know that many stone tools traced their origins to specific places in the landscape that were worked again and again (Woodward et al. 2006, 2011). Regardless of human understanding, however, and even during the long years separating deposition and recovery, the axe remembered. Here memory is virtual, a past located in the object but not actualized (Deleuze 1991), until, that is, part of the axe was cut away during modern analysis and examined petrologically to reveal its origins. The 'pure' past, as Bergson (1991) called it, here becomes actual, a memory contracted and revealed in the phenomena of analyst, microscope, sample, and source. In Baradian terms the meaning emerges from the relationship of the analyst with the object and a host of other non-humans (Barad 2007). The material body of the axe indexes this process of analysis itself in the form of a layer of gravel sediment that was used as filling material following the thin section sampling of the object for petrographic analysis (Figure 4(c)).

If meaningful memory permeated the virtual elements of the assemblage of the axe, this was coupled with the deterritorialization of connections as well. At times this happened without the intervention of people, such as in the separation of meaning from the axe's symbolic grooves as

Figure 2. The battle-axe from the Early Bronze Age burial Upton Lovell G2a, Wiltshire (DZSWS:STHEAD.4a): lower body and butt area (photo taken courtesy of Wiltshire Museum, Devizes).

seen above. At other times though the removal of meaning and history was more deliberate. The interior of the biconically-drilled perforation is polished along the long axis of the shaft hole – the microtopography of this surface and the presence of micro-polish are material signs that this was produced by contact with a hard mineral material (Figure 5(a)). The polishing obscures the concentric striations that resulted from the drilling process, which presumably entailed the use of a solid or hollow drill along with an abrasive material (e.g. sand) and a lubricant (e.g. water). While we have only a partial understanding of wear development in the interior of the perforation, no wear traces associated with hafting are visible. Considering that the cutting edge of the battle axe shows evidence of intense use, we can presume that the battle axe was once hafted. Yet, it is possible that the regular polishing of the interior of the perforation (Figure 5(b)) may reflect an intentional attempt to smooth the perforation and to remove the drilling traces. Here histories of relations were deliberately obscured. The marks left on the blade of the axe allow memories of working bone to be expressed, actualized from the virtual. The deliberate obscuring of the marks that were made in the production of the shaft hole do the reverse. They deny the history of the axe's emergence, they obscure the connections between different materials. Matter here is made to forget, the virtual is reworked in the erasure of marks in a process Deleuze (2015, 155) calls counter-actualization. Meaning here is not some permanent addition to the object, but a contingent and emergent expression of relations.
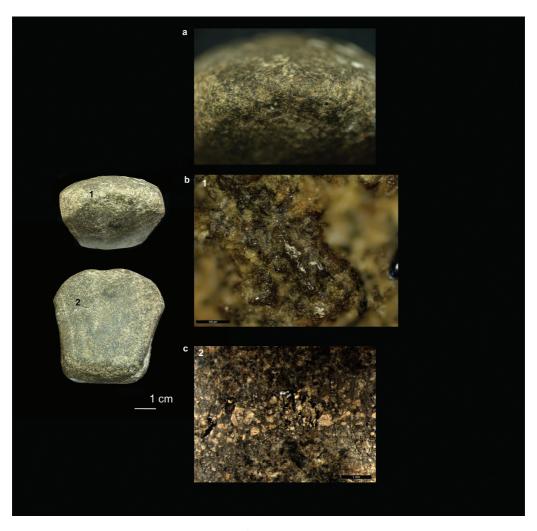
The axe is broken into two fragments – this was probably one of the most striking things about the axe when it was first discovered – unlike finds of ceramics, say, these are objects which are usually found whole. The two pieces of the once-whole axe attest to a moment of radical transition when the axe was broken. In assemblage terms this was a moment of dramatic change we can refer to as a phase transition – it breaks the history of the axe itself into two parts: before and after the breakage (cf. Deleuze 2004, 112; for archaeological application see Crellin 2017, 2020; Harris 2014). Analysis shows something quite remarkable though – although these two pieces of broken axe were placed back

Figure 3. Microwear traces on the butt area of the battle axe: (a) flat, reflective micro-polish, 200x; (b) percussive traces along the circumference of the butt end (photo taken courtesy of Wiltshire Museum, Devizes).

together in the grave, they actually had different use histories from the moment of breakage onwards. The end of the upper body piece (where the perforation would have been originally) was intentionally re-shaped by pecking and grinding following the breakage (Figure 1). This re-shaping transformed the fragment of the battle axe into a hammerstone: a change from a hafted to a non-hafted tool. By removing all traces of the central perforation the piece may have lost its original association with other shaft-hole implements along with other potential connotations the form and use of battle-axes may have entailed. The transformed object was used differently, engaged with bodies differently and had different properties and potentials. It had different meanings for both people and the materials with which it interacted.

The second fragment of the battle axe does not appear to have undergone a similar transformation; in this case weathering processes have partly transformed the surface of the fragment as seen in the rounding of the topography of the fractured edges around the surviving perforation (Figure 5(c)). Percussive traces of consistent appearance are present along the circumference of the butt end (Figure 3(b)). The resulting pits show occasional rounding, but in places interrupt the surface. While these traces could potentially relate to a subsequent re-use of the piece for percussive activities (i.e. as a hammer), based on the uniformity in their appearance (consistent depth, lack of flake removals and of sharp angular fractures, regular distribution across the circumference of the butt), it is also possible that they might relate to an attempt to reshape this area of the object.

Figure 4. Microwear traces on the cutting edge of the battle axe: (a) worn-out cutting edge exhibiting edge damage and intense rounding; (b) micro-polish with smooth texture, pitted appearance and a sinuous morphology, 200x; (c) layer of gravel sediment used as filling material following the thin section sampling of the object (scale bar 1 mm) (photo taken courtesy of Wiltshire Museum, Devizes).

The two fragments of the battle axe were brought back together to be placed in the grave. These two fragments both share a history but also have divergent pathways marked upon their surfaces, meanings that both overlap and interweave in their ongoing becoming. We cannot tell for how long the fragments became different objects or whether they were separated spatially during this time – but we can know that their relationship to each other was clearly remembered and retained by the people who chose to reunite them in the burial context. The two fragments are similar enough that at first glance it is clear they are parts of the same broken object. Yet, when we bring together the fragments, analysts, and non-humans into a microwear assemblage these differing histories are actualized in the present, allowing us to perhaps share in the same knowledge of the meanings and histories of these objects that prompted
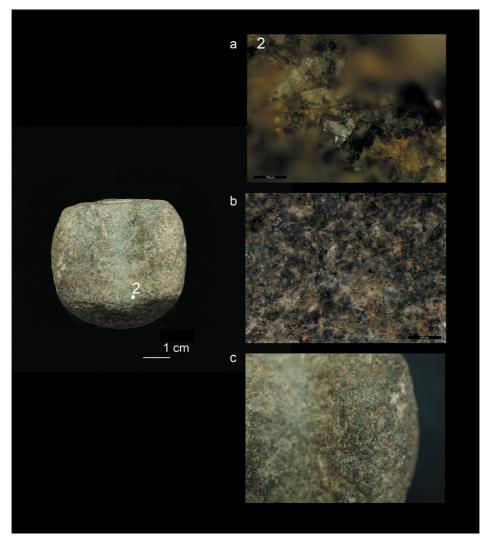
Figure 5. Microwear traces on the perforation of the battle axe: (a) flat, reflective micro-polish, 200x; (b) detailed view of the polished perforation interior showing levelling of grains (scale bar 500 μm); (c) rounding of the topography of the fractured edges of the perforation (photo taken courtesy of Wiltshire Museum, Devizes).

Bronze Age people to bring them together in the grave. There is much further work to be done here, especially expanding beyond a single artefact like this to examine the multiple relationships manifested across the grave assemblage. However, such an emphasis on emergent and complex histories and revealing what objects actually did in the past may open up new ways of configuring our understanding of the category of 'grave goods' beyond what they represent about human beings, or even the human relations they entail. Whilst humans are essential to the meanings that emerge from any use-wear assemblage so too are the non-humans, the object under study, the microscope, and the reference collections.

Conclusion

Meaning, as it is traditionally understood, is the province of human understanding alone, human engagement and human representation. This conception operates in a world where attempts are made explicitly to bridge a gap between mind and body, between humans and environment and between people and things. Turning to new materialism asks us to step away from these kinds of dualisms, and to explore meaning as a much more multifarious, complex and emergent form of relationship. It asks us to think about how memory and meaning are virtual as well as actual, territorialized in ways that allow them to be expressed in new ways, and in new relational conjunctions. Meaning here is more-than-human, it is more-than-representational and it is more-than-linguistic. One way of rethinking this is to consider meanings in materials as a form of material memory. Our objects remember, they carry material memories in their marks, both those we consider artistic and those that we dismiss as simply the residue of past actions. These memories remain virtual until they can be actualized by the microwear assemblage. They are therefore relationally emergent in the complex interweaving of human and non-human that make up such an assemblage. Meaning here is not written on stone, like the Rosetta Stone, a language awaiting a reader, instead it is an emergent relationship of which the object itself is a co-author. Microwear analysis, combined with new materialism, opens up the possibility for us to work with our objects to allow those memories to emerge once more.

In this paper we have focused on marks left on the surface of objects that express earlier processes. In some cases, those traces come from the actions of humans making and using the objects, in other cases they come from the actions of non-humans such as the geological processes of rock formation. Wear-analysis, as a process which brings together an assemblage of humans and non-humans, allows the interpretation of these material signs to reveal the histories of archaeological objects. The sceptical reader might ask if we are really exploring meaning here? We would argue that the Upton Lovell battle axe reveals to us multiple examples of all three kinds of Peirce's signs. The marks from polishing are indexical signs of a particular type of action, the colour and texture of its surface are iconic of its origins in the Whin Sill, and the decorative marks are symbols though we cannot tell what they represent any more. The interpretation of meaning has traditionally been limited to the human, but a wider engagement is necessary. Situated within the wear-analysis assemblage material meanings emerge as a form of memory, contracted in the body of the object and expressed in the complex relationships of humans and non-humans. From the deliberately anthropogenic, like the carved decoration, to the taphonomic and geological, such an approach democratizes meaning from an imposition of a human, past or present, to an emergent quality of a more-than-human multiplicity, of an assemblage in other words.

Notes

1. Of course this position is no longer adhered to by the majority of Palaeolithic archaeologists as they recognize that Neanderthals, at least, employed art and symbolism. Nonetheless, this merely extends the boundary of who gets to make meaning, rather than rethinking it entirely.
2. In this paper we use mark and trace interchangeably, the latter in particular drawing on its technical roots in microwear analysis. There is, however, an interesting theoretical analysis of these terms to be done, building on critical engagements with the term trace in particular that have emerged both within archaeology (e.g. McFadyen and Hicks 2020, 9) and outside of archaeology (e.g. Deleuze and Guattari 2004, 13).
3. Microscopic observations were conducted at both low (10–60x) and high magnifications (at 100x and 200x) using a Leica M80 stereomicroscope with an external, oblique light source, a Leica DM1750M incident light (metallographic) microscope with a vertical light source equipped with a Leica MC120 HD

digital camera and a stereomicroscope with a coaxial illumination unit (Leica M80 LED5000 CXI, magnifications up to 230x). Recorded wear patterns included micro-polish features, texture and development, micro-striations, grain edge rounding, levelling, micro-fractures, and the presence of residues (Dubreuil et al. 2015; Hayes, Pardoe, and Fullagar 2018).

4. One piece includes the cutting edge and part of the upper body of the battle axe (dimensions: 53.34 x 40.04 x 41.65 mm) and a second piece (48.80 x 45.96 x 46.59 mm) forms the lower part of the body and the butt end and retains part of the central perforation. The two pieces weigh 171 g and 175 g respectively. According to Roe's typological scheme (1966, No.231) this battle axe is attributed to Stage III D or to the Intermediate form in her subsequent simplified scheme (Roe 1979). The battle axe is on display at the Wiltshire Museum in Devizes, England (museum accession number: DZSWS:STHEAD.4a).

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Notes on contributors

Christina Tsoraki is a Postdoctoral Research Associate at the University of Leicester working on the *Beyond the Three Age System* project. She specializes in prehistoric archaeology focusing on microwear analysis, stone technology, cross-craft interactions and depositional practices. Between 2012 and 2018 she was the Head of the Ground Stone Team for the Çatalhöyük Research Project, Turkey.

Huw Barton is Reader in Bioarchaeology in the School of Archaeology and Ancient History, University of Leicester, UK. He is a specialist in the analysis of ancient starch residues and has expertise in the usewear and organic residue analysis of stone tools.

Rachel J. Crellin is Lecturer in Archaeology at the University of Leicester. Her research interests' centre on archaeological theory, especially new materialist and posthumanist approaches rooted in feminism. She is also a specialist in the Neolithic and Bronze Age of Britain, Ireland, and the Isle of Man, and a metalwork wear-analyst. She is the author of *Change and Archaeology* (Routledge) and a co-author of *Archaeological Theory in Dialogue* (Routledge).

Oliver J. T. Harris is Associate Professor at the University of Leicester. His research interests' focus on the Neolithic and Bronze Age of Britain, new materialism and Deleuzian philosophy. He is the author of *Assembling Past Worlds,* and a co-author of *Archaeological Theory in Dialogue* and *Archaeological Theory in the New Millennium* (all Routledge).

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