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Settling the argument: The contribution of use-wear studies to understanding artefact scatters in Neolithic Britain

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ABSTRACT

Our understanding of the Neolithic of southern Britain has been largely based on the interpretation of monumental landscapes such as those around Stonehenge and Avebury. The remains of domestic structures dating to the Neolithic are rare, and when found, are often associated with small assemblages of material culture. The most common forms of settlement evidence are unstratified artefact scatters, which have little evidence of associated structural remains. As a result, our understanding of Neolithic settlement is poor. We have limited knowledge of what craft and subsistence activities were associated with them, and we do not know how quotidian practices were organised at a settlement or landscape level.

Taking the West Kennet Avenue Occupation Site as an example, this paper will show how use-wear analysis can be combined with a detailed technological analysis to reveal details of the character and temporality of a Neolithic settlement. The use-wear analysis will focus on the assemblage of microdenticulates from the site. It further explores the character and potential contact material related to Polish 23, the distinctive use-polish that occurs on these tools, and shows how the combination of spatial analysis and use-wear analysis can separate different episodes of occupation in a scatter of unstratified artefacts. The results provide crucial insight into the history of settlement in the Avebury landscape and shed further light on the character of use of microdenticulates, supporting the argument that they were used for processing plant fibres for the production of textiles.

1. Introduction

The character of Neolithic settlement remains in Britain varies geographically. In the north of Britain, in Scotland, and particularly in the Orkney archipelago, there are significant numbers of excavated Neolithic houses and settlements, some of which are stone-built and have outstanding levels of preservation (e.g. Childe, 1931; Ritchie, 1983; Richards, 2005; Richards and Jones, 2016). In the south of Britain, the remains of Neolithic houses are much less common, and being made out of timber, wattle and daub, their remains are often ephemeral, as shown by examples of Neolithic houses at Whitehorse Stone, Kent (Booth et al., 2011), Kingsmead Quarry, Berkshire (Chaffey et al., 2016), and Yarnton, Oxfordshire (Hey et al., 2016). In many cases, truncation by the plough means that all we are left with are clusters of pits, post-holes, and stake-holes, which have been hard to interpret, leading to disagreements amongst archaeologists about the role of houses in the Neolithic of southern Britain (Darvill 1996; Thomas 1996; Smyth 2014, 1-10).

Whilst the remains of domestic architecture have been hard to locate, evidence of prehistoric settlement is widespread across southern Britain in the form of artefact scatters that have been brought up by the plough, or lie undisturbed and buried by processes such as alluviation and colluviation (Richards, 1990; Schofield, 1991; Woodward, 1991). These scatters are often palimpsests of material derived from activity spread over millennia. As such, they are difficult sources of data to work with and the analysis of these scatters has proved hard for archaeologists to interpret or to synthesise into broader accounts of the period (Chan, 2003). In recent years, the lack of impact that the analysis of artefact scatters has had on archaeological narratives lies in stark contrast to the manner in which Bayesian modelling of radiocarbon dates, isotope analyses, and aDNA analysis have driven forward our understandings of chronology and human mobility at ever finer scales of resolution (e.g. Olalde 2018; Whittle et al., 2011; Parker Pearson et al., 2019).

Despite the transformational knowledge produced by advanced

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analytical techniques, they all rely on material excavated from well-stratified archaeological deposits, and thus they generate an understanding of the Neolithic drawn from a highly restricted range of contexts, such as pits and burials. We expend a great deal of resources on the analysis of material from these contexts whilst marginalising other forms of evidence. Yet, taking recent excavation in the Stonehenge landscape as an example, the amount of worked flint in the ploughsoil is generally comparable, or greater than, the amount of flint found in the archaeological features found beneath it (Mitcham, 2022, Table 8.1; Chan, 2022, 9.4). Therefore, it remains important to continue to analyse unstratified artefact scatters, and to develop methodologies to improve that analysis. This paper seeks to do this by exploring the potential for use-wear analysis to understand the character and spatial organisation of craft activities across an artefact scatter known as the West Kennet Avenue occupation site (WKAOS).

The analysis will focus on microdenticulates, a type of tool with highly characteristic wear traces. Identifying the activity associated with these traces has been an enduring conundrum in use-wear studies for many years (Hurcombe, 2007; Juel Jensen, 1994; Van Gijn, 1990). The intention here is not to finally solve the riddle, but to approach the question from a different angle. In most previous cases, the analytical focus has been on the analysis individual tools removed from their archaeological context (c.f. Högberg, 2016). The approach here is to analyse an assemblage of microdenticulates from a single site to see if their spatial distribution provides any insight into how the objects were used on the site. Analysing an entire assemblage of these tools also provides an opportunity for the detailed study of the character of formation of their distinctive polish. It is hoped that these two elements of analysis will bring us closer to identifying the process that the tools were used for and the materials that were involved in it.

2. The West Kennet Avenue occupation site and its assemblage

2.1. Avebury, the West Kennet Avenue and the West Kennet Avenue occupation site

The Avebury landscape provides the setting for one of the most impressive complexes of Neolithic and Early Bronze Age monuments in Europe (Gillings et al., 2008). At its heart lies the henge of Avebury, the main phase of which dates to around 2500 cal BC (ibid., 203; 2019, 361; Pollard and Cleal, 2004; c.f. Pitts and Whittle, 1992) in the later part of the Late Neolithic (2900–2400 cal BC). The monument is one of the largest henges in Britain and encloses the world's largest stone circle (Gillings et al., 2019, 359). Running south from Avebury, is the West Kennet Avenue (Smith, 1965), which was originally a 2.3 km long avenue of paired standing sarsen stones leading to a timber circle known as The Sanctuary (Fig. 1: Cunnington, 1931; Pollard, 1992; Pitts, 2001). The monument complex stands alongside Stonehenge as one of the defining features of Late Neolithic Wessex.

In 1934, Alexander Keiller set out to trace the line of the stones in the West Kennet Avenue's northern third, which at that point in time had mostly been removed or had fallen over. In the process of the excavation Keiller's team came across an abundant scatter of pottery and flint, including over 1000 tools (Smith 1965, 236-242), which lay in a distinct horizon roughly 0.3 m below the turf. The scatter, which was named the West Kennet Avenue occupation site was spread along a 140 m stretch of the avenue and was associated with two Neolithic pits and 10 pits or possible post-holes (ibid., 210–216), a relatively small number of features given the size of the scatter. The artefacts that made up the scatter included small amounts of Early, Late Neolithic and Beaker pottery and worked flint, but the majority dates to the Middle Neolithic (3400–2900

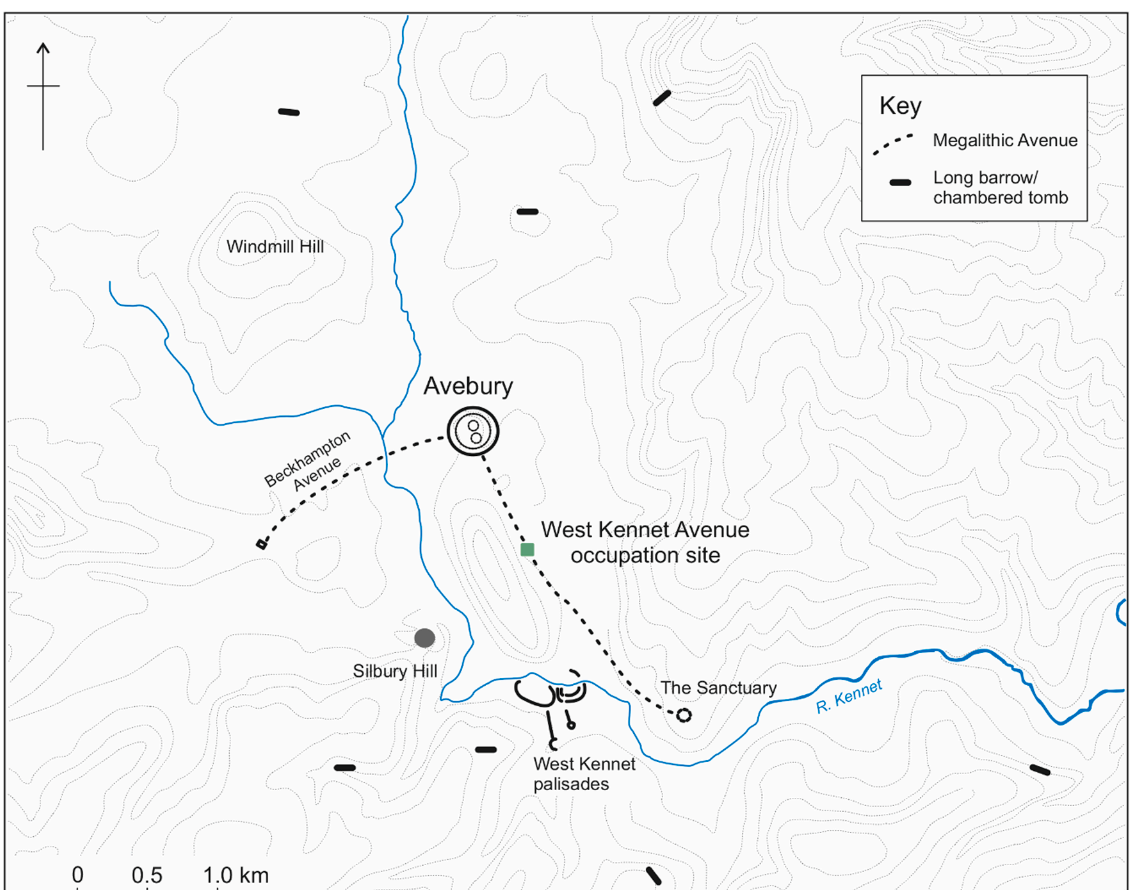

Fig. 1. Plan of the Avebury monuments and the location of the West Kennet Avenue occupation site.

cal BC), therefore indicating that the main occupation of the site predated the mid 3rd millennium BC construction of the West Kennet Avenue.

From 2013 to 2015 Joshua Pollard and Mark Gillings conducted a series of excavations on the site to further explore the context of what was understood to be an outstanding artefact scatter (Fig. 2; Pollard et al. in prep). In keeping with the results of the previous excavation of the site, they revealed an extensive artefact scatter associated with a series of pits and stake-holes. One pit, F.55, produced a radiocarbon date of 3086–2905 cal. BC (SUERC-70788; Pollard et al. forthcoming).

Crucially, the Pollard and Gillings excavation was conducted on a grid of 1x1m squares, with all material being dry sieved through a 10 mm mesh, giving good confidence in both the level and consistency of artefact retrieval, and allowing for the spatial analysis of artefact distributions. One of the principal aims of the excavation was to understand the practices and processes that had affected the formation of the scatter, which was notable for the outstanding condition of its artefacts.

Details of the excavation and its results will be published elsewhere (Pollard et al. in prep), but in summary, it showed the high analytical potential of the WKAOS scatter based upon the following factors:

1. The area had rarely been ploughed, and then only superficially, meaning that the scatter was relatively undisturbed and, despite being worm-sorted down through the topsoil, had maintained its two dimensional spatial integrity.
2. The scatter is multi-period, but material from different periods occurs in spatially distinct areas, rather than on top of one another.
3. The artefacts are in excellent condition, and due to localised decalcification of the soil, the flint artefacts exhibit little patination, a rare occurrence on chalkland sites. The lack of patination greatly enhances the potential for the use-wear analysis of the assemblage.

Mainly due to the systematic spatial recovery of the artefacts, it is the Pollard and Gillings assemblage that will form the basis of the current analysis.

2.2. The West Kennet Avenue occupation site assemblage

The Pollard and Gillings WKAOS assemblage consists of 16,399 pieces of worked flint. The assemblage is dominated by debitage products, as well as tools such as scrapers, awls, chisel arrowheads, and

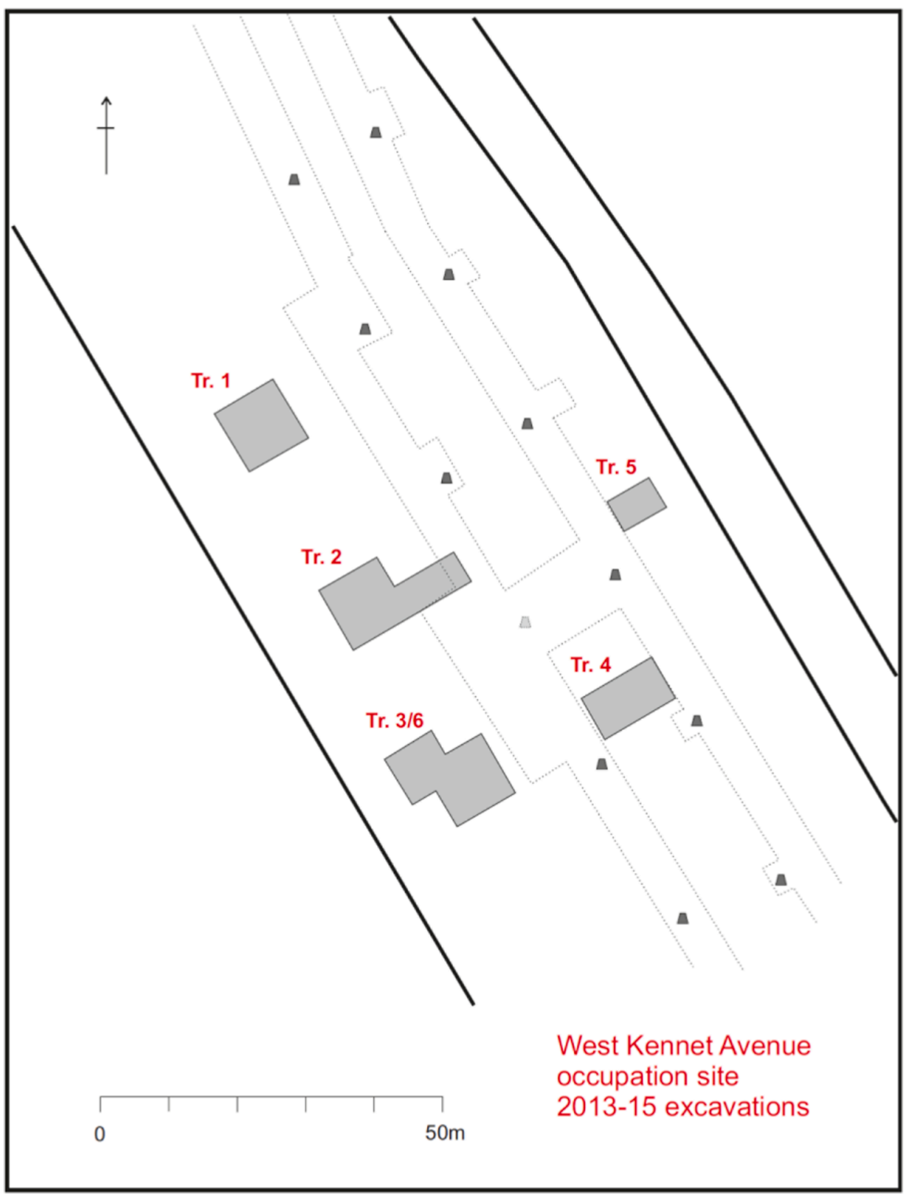

Fig. 2. The layout of the 2013–2015 WKAOS excavation trenches.

microdenticulates. Chronologically, the material is mixed, with Mesolithic, Early Neolithic, Middle Neolithic, Late Neolithic and Beaker/ Early Bronze Age artefacts all being present. As with Keiller's assemblage, the majority of diagnostic artefacts are Middle Neolithic in date. This material not only includes diagnostic tools, such as chisel arrowheads, but also cores and debitage products from the production of Levallois flakes, which were used as blanks for producing chisel arrowheads and scrapers on the site.

A detailed techno-typological and spatial analysis of the flint assemblage has been conducted by the author and will be reported in detail in Pollard et al. (in prep). This paper details a further stage of analysis involving the application of use-wear analysis to the microdenticulates in the assemblage.

2.3. Microdenticulates, use-wear analysis and polish 23

Microdenticulates, also known in Britain as serrated flakes, are usually made on blades or blade-like flakes, with the denticulations normally being formed on one and sometimes both lateral margins (Fig. 3). The denticulated lateral margins are most often straight, or slightly concave. The tool is characterised by the small size of their denticulations, with 10 or more occurring every 10 mm along the denticulated edge of the tool (Fig. 4). Geographically, microdenticulates occur on Neolithic sites across NW Europe into Scandinavia, occurring in Britain, France, Denmark and Sweden (Bocquet, 1980; Juel Jensen 1994, 50-68; Hurcombe, 2007; Högberg, 2016).

In southern Britain, microdenticulates are one of the tools that characterise Early Neolithic assemblages, particularly those from causewayed enclosures such as Etton (Pryor, 1998) and Windmill Hill (Smith, 1965, 91), and pit sites such as Hurst Fen (Clark 1960) and Kilverston (Garrow et al., 2006). Their use continues through the Middle Neolithic and into the earlier part of the Late Neolithic, occurring in Grooved Ware pits such as the Woodlands (Stone, 1949; Stone and Young, 1948) and Ratfyn (Stone, 1935) pits in Wiltshire.

Across their geographic distribution, the tools are strikingly homogenous morphologically, and appear to be even more homogenous in terms of their wear traces. These traces have been described in detail in Juel Jensen's (1994) seminal study of microdenticulates from Denmark, with the similarities in their wear traces apparent in all the countries in which they occur (e.g. Hurcombe, 2007; Högberg, 2016), and indeed in the current assemblage (see below). Moreover, as Juel Jensen (1994, 65-67) noted, a polish with the same characteristics is also found on quartiers d'oranges and débitage en frites tools on Linearbandkeramik sites (Caspar, 1988; Keeley, 1977; Van Gijn, 1990).

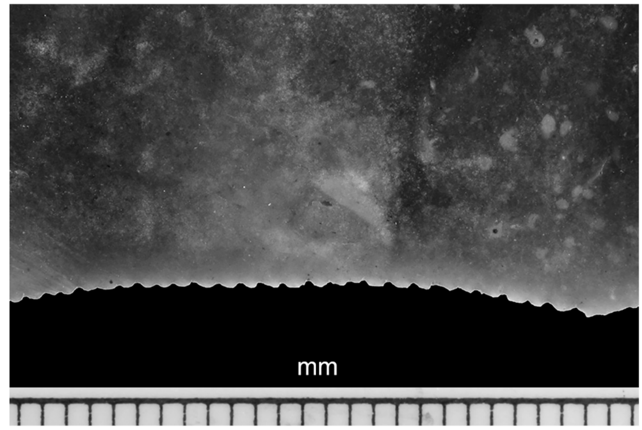

Fig. 4. Close up of the ventral surface of the denticulate edge of Object 17.

Acknowledging that the contact material on quartiers d'orange had yet to be identified, Van Gijn (ibid.) referred to the traces simply as Polish 23. Van Gijn (1990, 85) defined this polish as having a smooth, "snowfield"-like, highly reflective polish on one side of the tool, and a rough, matt and heavily striated polish on the other. She also stated that the spatial correlation of these two distinct sets of traces, combined with the short length of the traces along the edge of the tool, indicated that they were caused by a single activity, most likely the working of the stem of a plant.

Juel Jensen (1994, 65) notes that the traces on microdenticulates and quartiers d'orange are the same, but does not go on to refer to the former traces as Polish 23, nor does Hurcombe (2007) or Högberg (2016). Nevertheless, Juel Jensen clearly felt that the polish on both types of tools was one and the same, and that position is also adopted here. So, for the purposes of brevity in the description of these traces, in this paper the polish that commonly occurs on microdenticulates will be referred to as Polish 23. A detailed description of this polish as it occurs in the WKAOS assemblage is presented in the results section below.

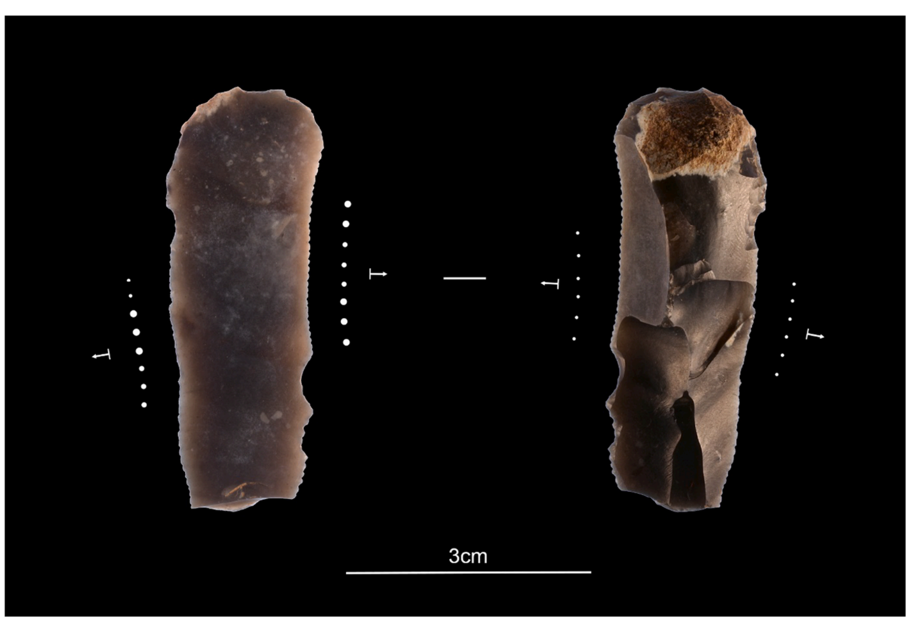

Fig. 3. A microdenticulate (Object 17).

3. Methodology

The assemblage of microdenticulates from the WKAOS consisted of 93 tools, of which 68 were subjected to use-wear analysis. The remainder were deemed unsuitable for use-wear analysis, primarily because of their fragmentary state. Analysing small fragments of the tools was a particular issue because wear traces on this type of tool most often only occur on a short section of the working edge. Therefore, in

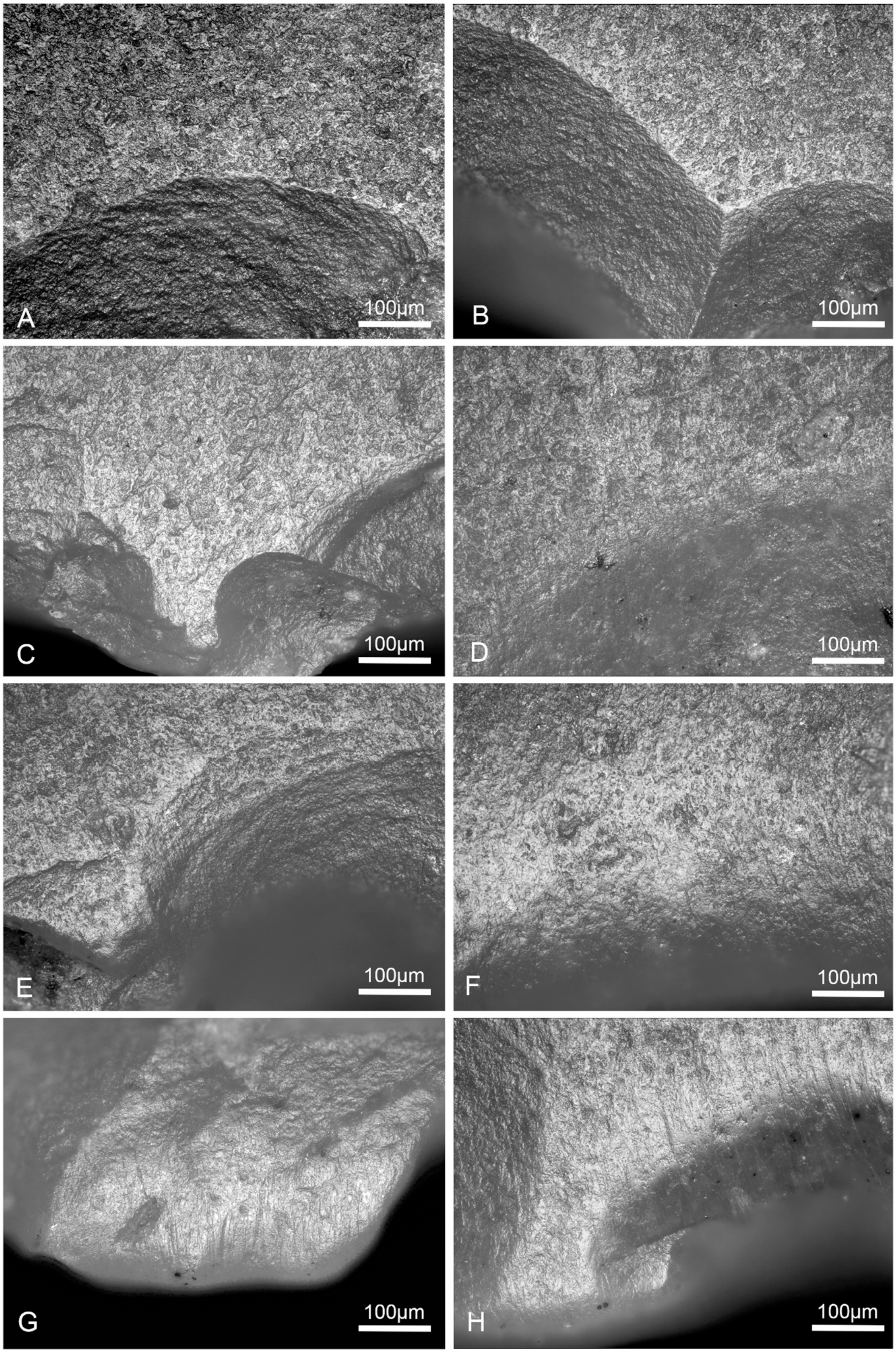

Fig. 5. The stages of development of A-side Polish 23 in sequence from A to H at 200x magnification (scale bars are 100 μm). (A = Object 37, B = Object 7, C = Object 42, D = Object 6, E = Object 11, F = 9, G = Object 29, H = Object 17).

cases where no traces were identified on a small tool fragment, it was not possible to confidently determine whether the tool was used or unused, rendering observations from such objects invalid for the current analysis.

The tools were washed with warm water and detergent prior to analysis and were spot cleaned using isopropyl alcohol during the analysis. All surfaces of all tools were inspected for wear traces using a stereo microscope (Leica M80), followed by high power incident light microscopy (Leica DM1750). Micrographs were taken using a GXCAM-U3PRO 20MP camera and were stacked using Helicon Focus 8.

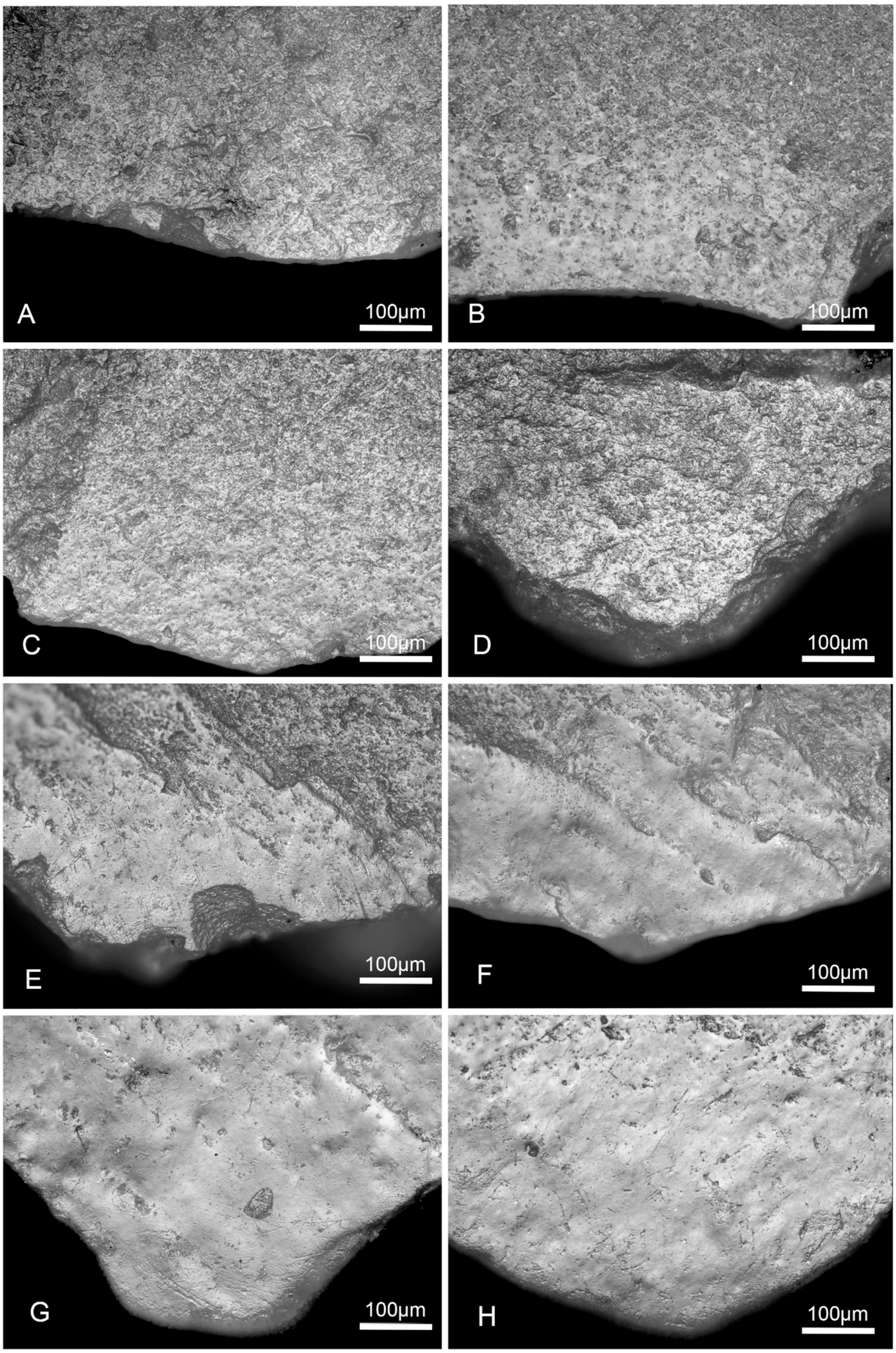

Fig. 6. The stages of development of B-side Polish 23 in sequence from A to H at 200x magnification (scale bars are 100 μm). (A = Object 37, B = Object 14, C = Object 7, D = Object 42, E = Object 14, F = Object 11, G = Object 4, H = Object 2).

4. Results

4.1. Use-wear analysis results

4.1.1. The microdenticulates

In the WKAOS assemblage 48 % (n = 45) of microdenticulates have denticulations formed on the left lateral margin, 43 % (n = 40) on the right lateral margin, and 9 % (n = 8) on both lateral margins. The average number of denticulations on the edges of the tool varies from 10 to 15 per 10 mm, with the average being 11 denticulations per 10 mm. The denticulations are nearly always struck from the ventral surface of the blank, so morphologically the teeth of the tool typically have a flat ventral surface, and a topographically varied dorsal surface formed by the negative facets of the denticulation removals. The working edge of the tools is normally straight or slightly concave in plan, with an average edge angle of 30°, which reflects the selection of thin blade or blade-like blanks.

A catalogue of the objects included in the analysis is presented as Supplementary Information.

4.1.2. Use-wear traces

In terms of wear traces, 62 % of the 68 analysed microdenticulates exhibit traces of use. Of the tools with traces, 76 % (n = 32) exhibited traces on both the dorsal and ventral surfaces of their use-edges. Those with traces on only one surface tended to be tools with only minimal signs of use where polish had not yet fully formed. The presence of tools that had been discarded at different stages of use provided the opportunity to catalogue the development of Polish 23 (Figs. 5 & 6). As with all polishes, this shows the difficulty in determining polish type during their early stages of its development. Confidence in the identification of the less developed examples included in Figs. 5 & 6 came mainly from the fact that the reverse side of the use-area had more identifiable traces on them (e.g. an identifiable B-side polish on one side can be linked to a barely developing A-side polish on the reverse side), as well as the fact that the traces on the tools are remarkably consistent.

4.1.2.1. Use-polish – Development and character. The character of the use-polish was extremely consistent across the tools with Polish 23 being present on 93 % (n = 39) of all used microdenticulates. In addition to Polish 23, in 5 % (n = 2) of cases traces were not well developed, and so could only be more broadly identified as being a plant contact material, and in 2 % (n = 1) of cases the contact material could only be identified as being soft.

The polish on microdenticulates has been previously described by Juel Jensen (1994), but it is worth describing again here in relation to the current assemblage. The polish has an A- and a B-side, which are distinctly different to one another. The A-side polish, the side that is in primary contact with the worked material, has a rough texture and a diffuse distribution where it extends into the interior of the object (Fig. 5). The polish develops first on higher topography, but will ultimately penetrate high and low topography and, when developed, will cover both the teeth of the denticulated edge and the interstices between them. The polish is normally associated with edge rounding and a strong transverse directionality that develops relatively early on in the polish formation. It is reminiscent of dry hide polish, but when fully developed the polish is brighter and smoother than hide polish, with the appearance of a plant polish. Comparison with Juel Jensen (1994, Plate 45) suggests that the most developed A-side polish within the current assemblage is actually the mid-stage in the development of the polish with further use eventually leading to a smooth metallic polish with strong directionality.

The B-side polish has a completely different character to the A-side polish. It occurs almost solely on the teeth of the denticulations and not the interstices between them (Fig. 7). When fully developed it covers both high and low topography and the whole area of the individual teeth. The polish itself is well-linked, reflective, metallic, and bright with a distinct undulating "snowfield" texture and is associated with numerous striations orientated in multiple directions. The striations do not appear to always be associated with a particular direction of tool motion, and the polish itself only exhibits directionality when most strongly developed (Fig. 6). The polish is typically associated with some degree of edge rounding.

The polish on the edge of the microdenticulates in the assemblage typically extends over an area of 10–20 mm on the edge of the tool, with the location of the A- and B-side polishes correlating closely to one another in all cases. In several cases where Polish 23 was only weakly

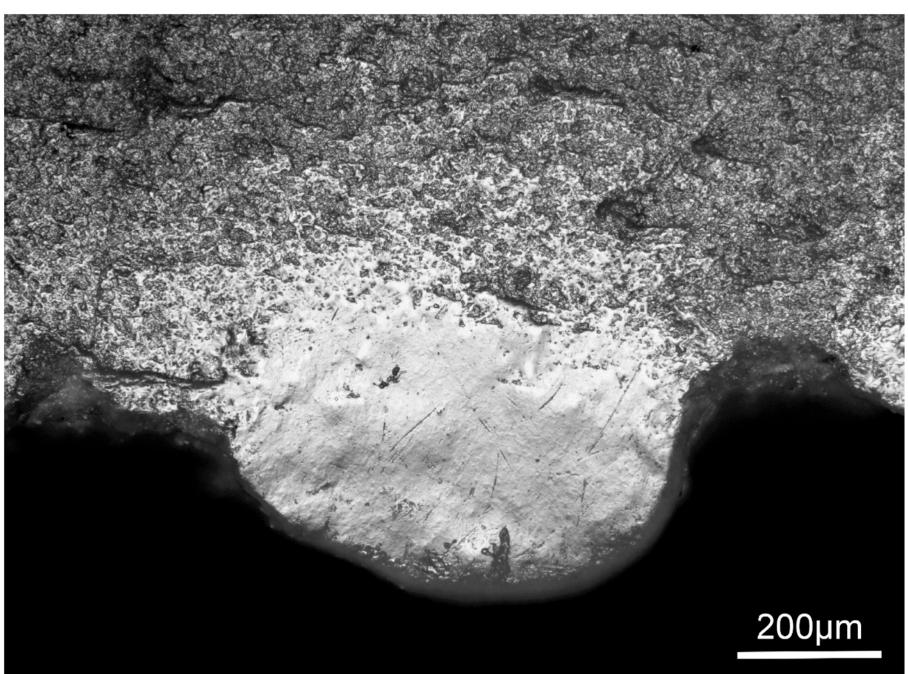

Fig. 7. The distribution of B-side polish on the teeth of Object 17 at 100x magnification (scale bar is 200 μm).

developed, it was clear that the B-side polish formed faster than the A-side polish (e.g. Object 13, 23 & 24; Fig. 8). This is slightly counterintuitive given that the A-side is the contact side of the tool and thus presumably subject to greater forces between the tool and the contact material. The presence of distinct A- and B-side polishes, however, indicates that during use, the material that was driven up over the upper edge of the tool was different to that which passed under the lower edge of the tool. For example, the remnants of the woody part of the stem may have been driven up over the top of the tool, whilst the fibres were drawn over the lower part of the tool. The difference in the speed of polish development between the two surfaces indicates that the part of the material that contacted the B-side was prone to developing polish faster than that which contacted the A-side. This may have not only been due to the part of the plant that the two sides were in contact with (the woody part vs. fibres), but also due to any additives that were involved in the treatment of the plant before fibre processing, and to some extent the angle that the tool was being used at.

4.1.2.2. Directionality. On tools where use-polish was identified, the direction of use was transverse in 76 % (n = 32) of cases, longitudinal in 5 % (n = 2) of cases, transverse and longitudinal in 5 % (n = 2) of cases, and unidentifiable in 14 % (n = 6) of cases. It is therefore clear, as in other examples of this type of tool, that the tool was used transversely, most likely with plant stems or fibres being drawn over the edge of the tool.

Given the predominance of transverse tool use on microdenticulates, it is worth examining more closely the tools that differ from this typical use. Of the four tools that exhibit some kind of longitudinal directionality, two (Object 4 and Object 20) have heavy post-depositional surface modification and the traces associated with the longitudinal directionality are weak and difficult to identify to a contact material. Object 14 shows a sequence of denticulating retouch, longitudinal use, and then typical Polish 23 transverse use. The longitudinal directionality is associated with a polish that is moderately well-developed and is a moderately bright well-linked plant polish with some pitting (Fig. 9). This polish does not penetrate the lower topography of the edge and is interpreted as being from the cutting of a ligneous plant. This is the only example of the serrated edge of a microdenticulate in the assemblage being used to cut or saw something.

The remaining example of a microdenticulate with longitudinal directionality is Object 65. This object has a lightly-developed polish with clear longitudinal directionality, but in this case it occurs on the opposite lateral margin from the denticulated edge, which itself has no sign of use (Fig. 10). The polish stretches along the length of the left lateral margin and is diffuse, extending approximately 1 mm into the interior of the flint. The polish is patchy, but where most-developed it is moderately bright, has volume, penetrates into the lower topography of the surface, and is associated with edge rounding. The edge associated with the polish has fine edge removals from utilisation all along its edge, all of which have been “struck” from the ventral surface and were formed during or before polish development. The polish on the dorsal surface is weaker, indicating that the flake was used in a cutting motion whilst downward pressure was being applied from its dorsal surface. The contact material is unclear due to the limited extent of polish development, but is interpreted as being a soft plant material, with the texture being somewhat reminiscent of the early part of the hide-like stage of Polish 23. It is therefore possible that its use was related to the same processing activity.

4.1.2.3. Duration of use. The use-area for the WKAOS microdenticulates is typically 10–20 mm in length, which is even shorter than the 15–35 mm average that Juel Jensen (1994, 59) describes on Danish microdenticulates. The short length of the use-area is one of the main factors that has been used to argue that the material that was being processed was plant fibres (ibid., 66; Van Gijn, 1990, 85). I take the short length of the use-area, combined with the fact that most examples have only one use-area that at most takes up one half of the denticulated edge, to indicate that the WKAOS tools have been used in a single episode of use. Defining what the length of that single episode of use was will always be difficult, but the different levels of polish development indicates that this varied between tools. Therefore, the period may have been an hour or two, or a day’s work. In this regard, it is worth noting that Hurcombe (2007, 60), after a series of microdenticulate replication studies, found that polish was still not fully formed after six hours of use, although we might expect that polish development would occur faster if the tool was in the hands of someone with lifelong experience of the task.

Regardless of the exact duration, the single-use hypothesis is based upon the fact that it seems unlikely that if a tool was picked up to be reused, the user would each time continue working on exactly the same part of the tools’ edge. Some insight into this can be given by those few tools that differ from the norm and exhibit more complex use-lives. Four microdenticulates (Objects 14, 17, 27 & 59) have denticulations and Polish 23 on both lateral margins and therefore have been used on two edges (Fig. 3), although the duration of time between the use of each edge is not known.

Although it has only one working edge, Object 29 (Fig. 11) exhibits a more complex use-life than these other tools. It has denticulations worked along the length of one concave lateral margin, but unusually the denticulations are struck from the ventral surface on the distal half of the lateral margin, and from the dorsal surface on the proximal half of the lateral margin. The wear traces indicate that the tool was used with the contact side of the tool being the ventral surface on some occasions, and the dorsal surface on others. The B-side polish can be seen dipping into retouch facets on both the ventral and dorsal surfaces, indicating

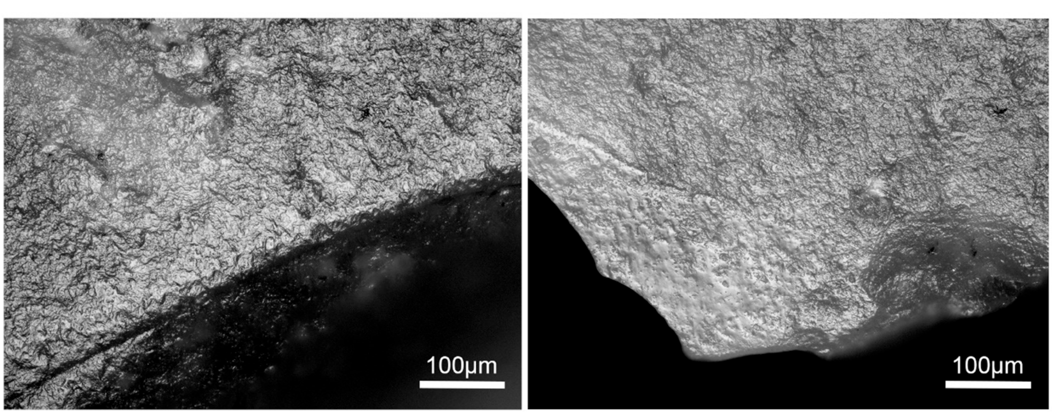

Fig. 8. The differential rate of development of the dorsal A-side (left) and ventral B-side (right) polish in the same spot of the edge of Object 24 at 200x magnification (scale bars are 100 μm).

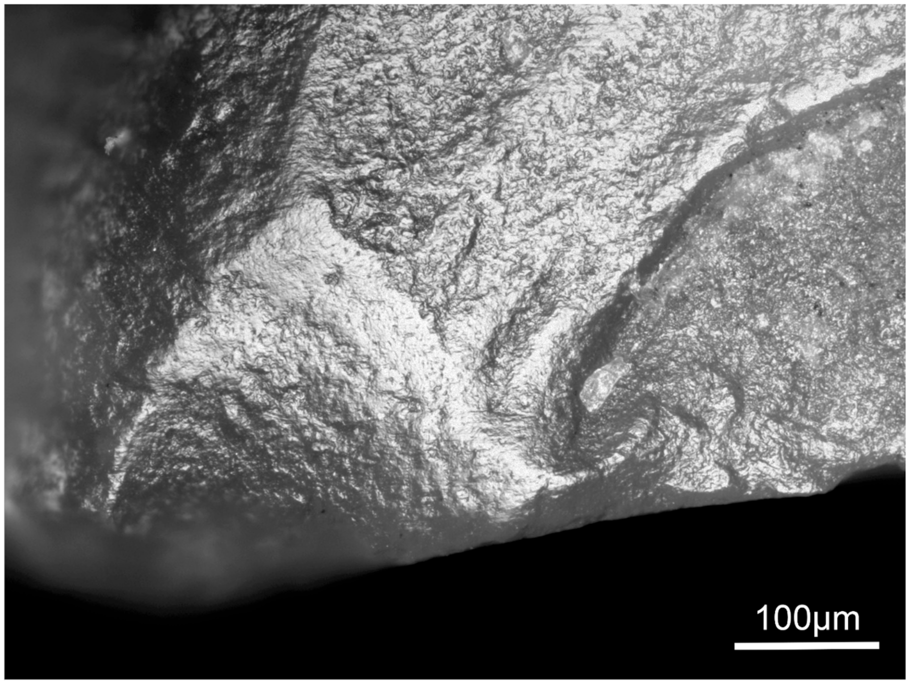

Fig. 9. Longitudinal polish on the edge of Object 14 at 200x magnification (scale bar is 100 μm).

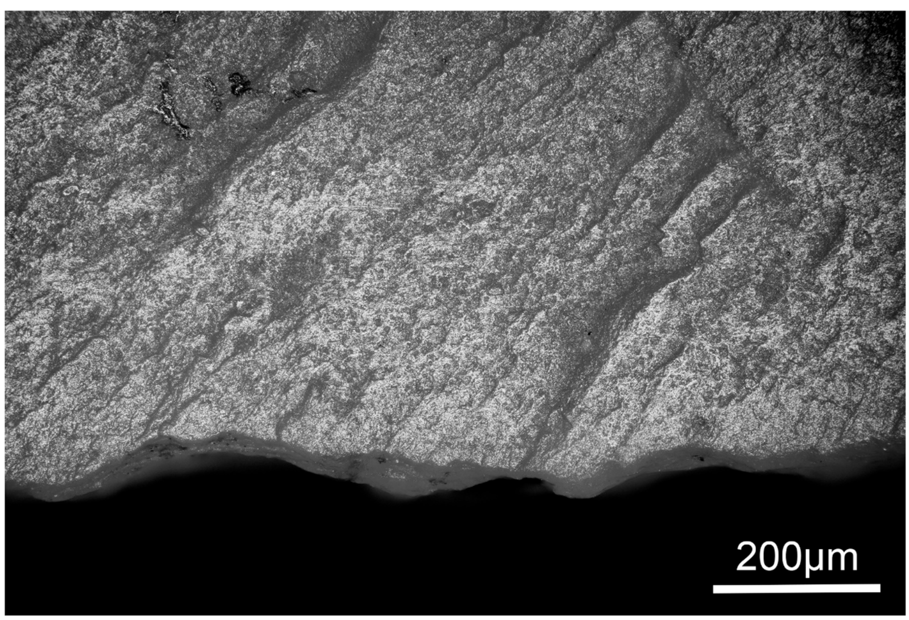

Fig. 10. Longitudinal polish on the edge of Object 65 at 100x magnification (scale bar is 200 μm).

that the lateral margin had been denticulated from both the ventral and dorsal surfaces prior to the main episodes of tool use. In addition to this, and in keeping with these observations, the tool is also unusual in having two distinct use-areas on one edge, both of which are longer than the average use-areas of microdenticulates on the site. The evidence, therefore, strongly suggests that this was a tool that had been used for an extended period, most probably spanning several episodes of working and involving flipping the tool over multiple times. The fact that the traces on Object 29 are distinctly different to most other tools in the assemblage, indicates that normally this was not the case.

The short use-life of many of these tools is also backed up by those examples that have only weakly developed polish on their edges, and furthermore, judging by micrographs in Juel Jensen (1994, Plate 45) it seems that in no cases the WKAOS microdenticulates were used to the extent that the A-side polish became fully developed.

4.2. Spatial analysis results

Having looked at the possible uses of the microdenticulates in the WKAOS, it remains to investigate their spatial distribution. Worked flint is spread across all trenches, but with considerable variation in density, varying from 1 to 299 flints per m^2, with an average of 33 flints per m2 (Fig. 12). The highest density of worked flint occurs in Trench 4 where Middle Neolithic cores, debitage products and tools are also

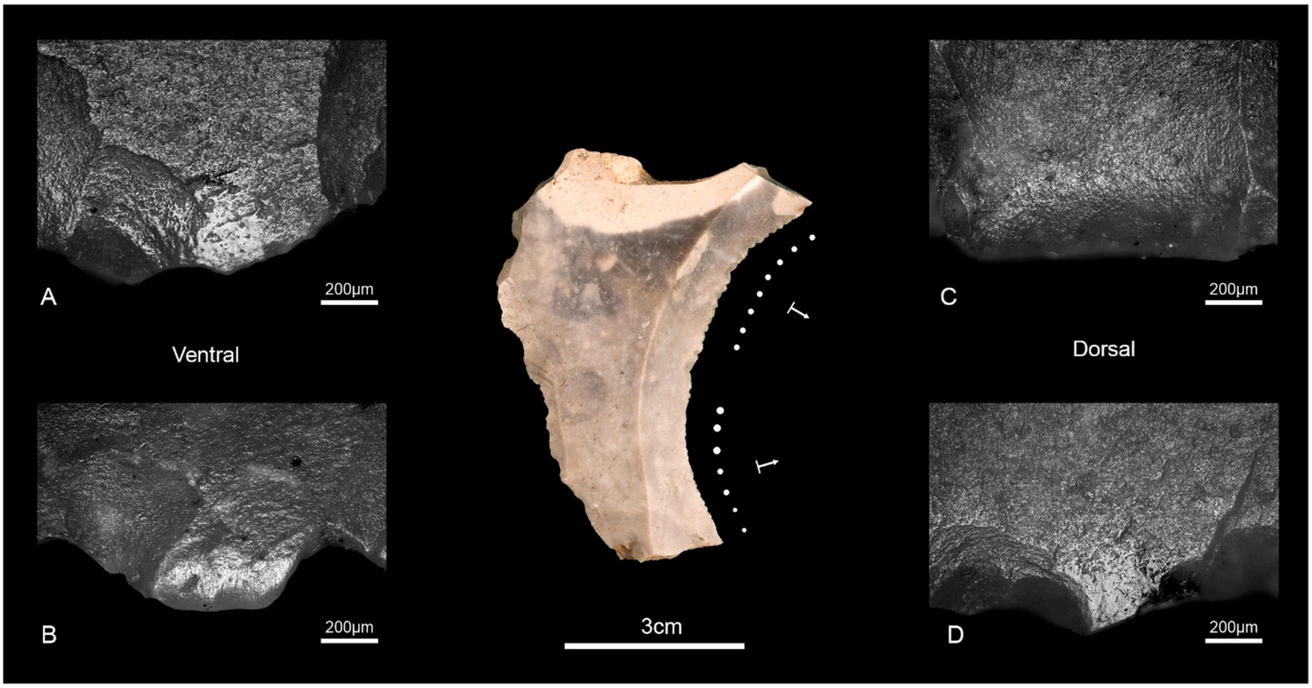

Fig. 11. Object 29 showing the wear on B-side polish (photo A) and A-side polish (photo B) on its ventral surface, and A-side (photo C) and B-Side (photo D) on its dorsal surface. A,B,C & D are at 100x magnification (scale bars are 200 μm).

concentrated, spreading to the southwest into Trenches 3 where densities in the 1 m^2 plot are artificially lower because of differences in artefact recovery strategies. The distribution of microdenticulates appears to be correlated with the spread of Middle Neolithic artefacts with the majority spread evenly across Trenches 3, 4 & 6, and with a second distribution spread across the northern part of Trench 2. A different pattern emerges when the degree of wear on microdenticulates is added to the distribution, however, with used microdenticulates occurring in a distinct curvilinear distribution across the southern part of the site (Fig. 13).

5. Discussion

5.1. Polish 23 and the use of microdenticulates

The traces on the microdenticulates are consistent with those reported elsewhere (Hurcombe, 2007, Högberg, 2016), and indeed on LBK quartiers d'orange tools (Keeley, 1977; Van Gijn, 1990), in terms of their polish formation, A- and B-side polish character, edge rounding, topographic distribution and the short length of the use-area. The repeated correlation between the location of the A- and B-side polishes has been argued by Juel Jensen (1994, 66) and Van Gijn (1990, 85) to indicate that they were generated simultaneously as part of a single process, and this conclusion is further supported by the WKAOS assemblage.

Past difficulties in replicating Polish 23, combined with the difference between the A- and B-side polish, point to the process being complex in terms of the pre-treatment of the plant by something like retting (Hurcombe, 2007). Juel Jensen (1994, 67) suggests that the wear traces indicate the use of additives, such as ash, in the treatment process, and that this type of complex multi-stage processing of plant fibres indicates that the goal was to produce finer softer fibres for textiles, rather than cordage for basketry or rope.

Hurcombe (2007; 2008a) conducted extensive experiments using microdenticulates to work bast from a range of plants. She found that the best match for the distribution of polish on microdenticulates, where the B-side polish is limited to the teeth and not the interstices between them, was to use the tool at a shallow angle to remove fibres from the woody part of stems that were still relatively intact (Hurcombe, 2007, 62). This would suggest that the process in question was somewhere between scutching and hackling, which are techniques for removing the stem and bark, and to separate out the fibres of a plant respectively, and are widely recorded in ethnographic and historical accounts of flax (Linum usitatissinum) and hemp (Cannabis sativa) fibre processing (Anderson Strand 2012, 26–27; MacFadyen, 2009).

The ability to tease out fibres without damaging them is one of the main advantages of the denticulations on the edges of the tools. Using these tools effectively upside down, with the dorsal surface and the negative facets of the denticulations as the primary contact surface, further helps to prevent the tool from damaging the fibres of the plant by presenting an edge with varied microtopography with concavities formed by the denticulation removals. This allows the contact surface to glide over fibres, whilst the flatter B-side of the tool catches and removes dirt and the woody remnants of their stems from them.

Although there is some consensus on the type of activity that the tools were used for, and that the contact material was probably a siliceous plant, there is less agreement on the exact plant in question. Given the difficulty in replicating the exact type of plant that was involved, it is worth looking at other evidence for plant use in prehistoric craft activities in NW Europe. In this respect, due to the preservation conditions needed for plant fibres to survive, the main issue is the rarity of examples (but see Good, 2001; Hurcombe 2008b). Hurcombe (2007,49) lists a range of worked plant materials found in British Neolithic contexts, which include grass rope, and nettle bindings on a leaf-shaped arrowhead from the Somerset Levels (Coles et al., 1973), and flax string from Etton causewayed enclosure (Pryor, 1998).

If evidence of cordage is rare in British Neolithic contexts, the evidence for textiles is even rarer. The situation for the Bronze Age is slightly better, however, with most preserved Early to Middle Bronze Age woven fibres being of flax (Linum usitatissinum) or nettles (*Urtica diocia*) (Harris, 2020, 162). Due to the outstanding preservation conditions at Must Farm, Cambridgeshire (Knight et al., 2019), we have some insight into the degree of reliance on plant fibres for making yarns and woven textiles in the Late Bronze Age. Amongst the collapsed structures on the site were numerous plant fibres stored for use in the form of

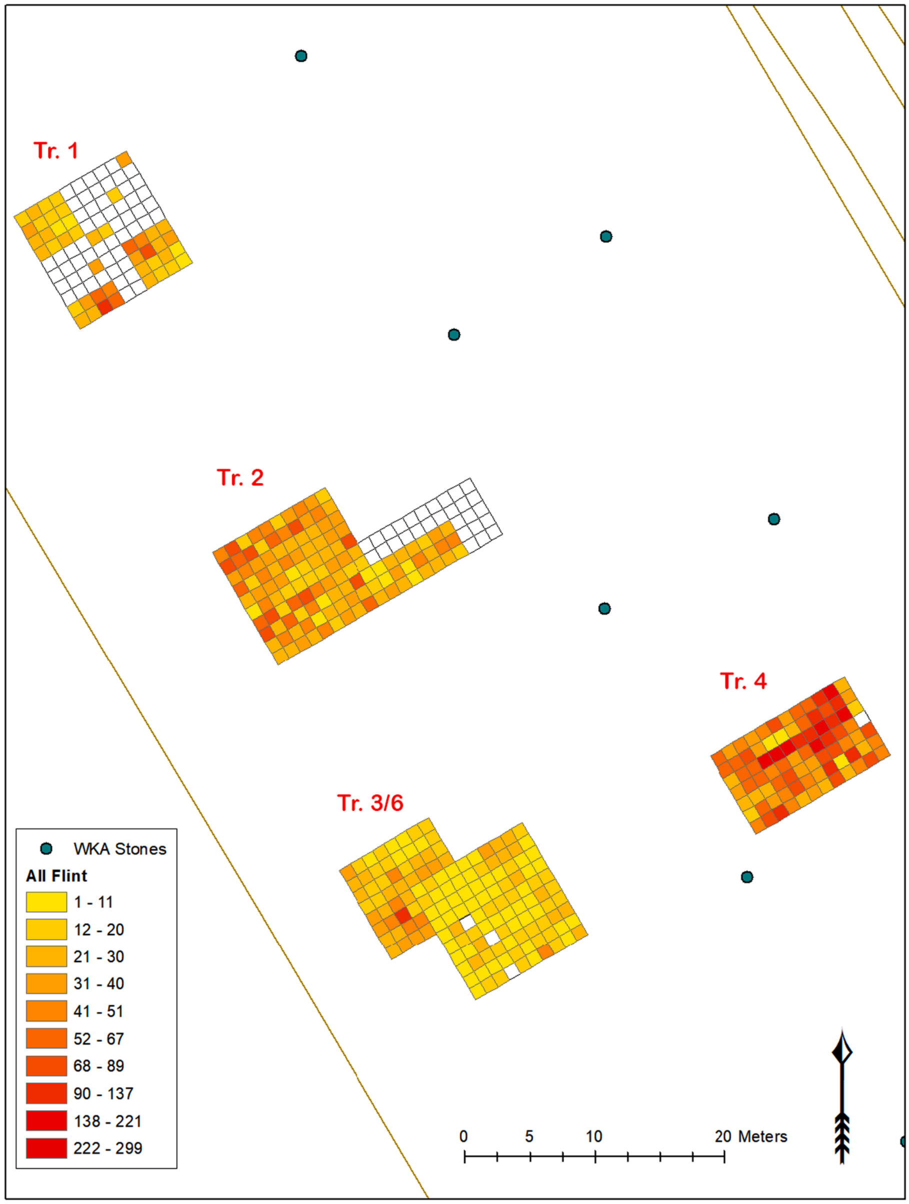

Fig. 12. The density of worked flint across the 2013–2015 excavation trenches.

carefully prepared bundles of flax fibres, and thin threads (<1mm diameter) wound around wooden dowels. The remains of finely woven textiles of flax were also found (Harris and Gleba forthcoming).

Further afield, the Late Bronze Age Lusehøj textile from Denmark (Bergfjord et al., 2012) made from woven threads of nettle, shows the continued use of wild resources for making textiles. Van Gijn (2010, 85-88) also suggests that flax and nettles were the most likely plant fibres used for textiles in the context of the Dutch Neolithic and Bronze Age.

Therefore, if it is accepted that microdenticulates were being used to process plant fibres for textiles, the most likely plants in question are, and in truth have always been considered to be, nettles and flax. This remains the case despite the difficulties in replicating Polish 23 using these plants. Although the traces, particularly the B-side polish, has not been fully replicated, Van Gijn (2010, 105-106) found that the closest match in her replication studies on quartiers d'orange tools was scraping flax and nettle stems, and Hurcombe (2007, 60-1) found that the closest match in her microdenticulate replication studies was scraping nettle stems.

5.2. Microdenticulates and the West Kennet Avenue occupation site

It is most likely that the majority of artefacts that make up the WKAOS artefact scatter were originally deposited onto the land surface as an accumulation of midden material, as is the case at the better preserved, though somewhat exceptional, Neolithic settlement site of Durrington Walls (Chan, 2009; Parker Pearson et al., In prep). The fact that the distribution of used microdenticulates on the site shows such a marked contrast with the overall density of the rest of the flint assemblage is a strong indication that their use relates to a different phase of activity than the major episodes of middening. This in itself is significant as, without the addition of use-wear analysis, separating out different phases of activity in what is essential a scatter of unstratified artefacts, would be impossible.

Although we are not sure what plant microdenticulates were being used to work, flax and nettle are good contenders. Depending on the processing techniques used to remove fibres and the quality of fibre that was sought after, flax has been historically harvested between mid-summer and late autumn (Andersson Strand 2012, 25; Harris and

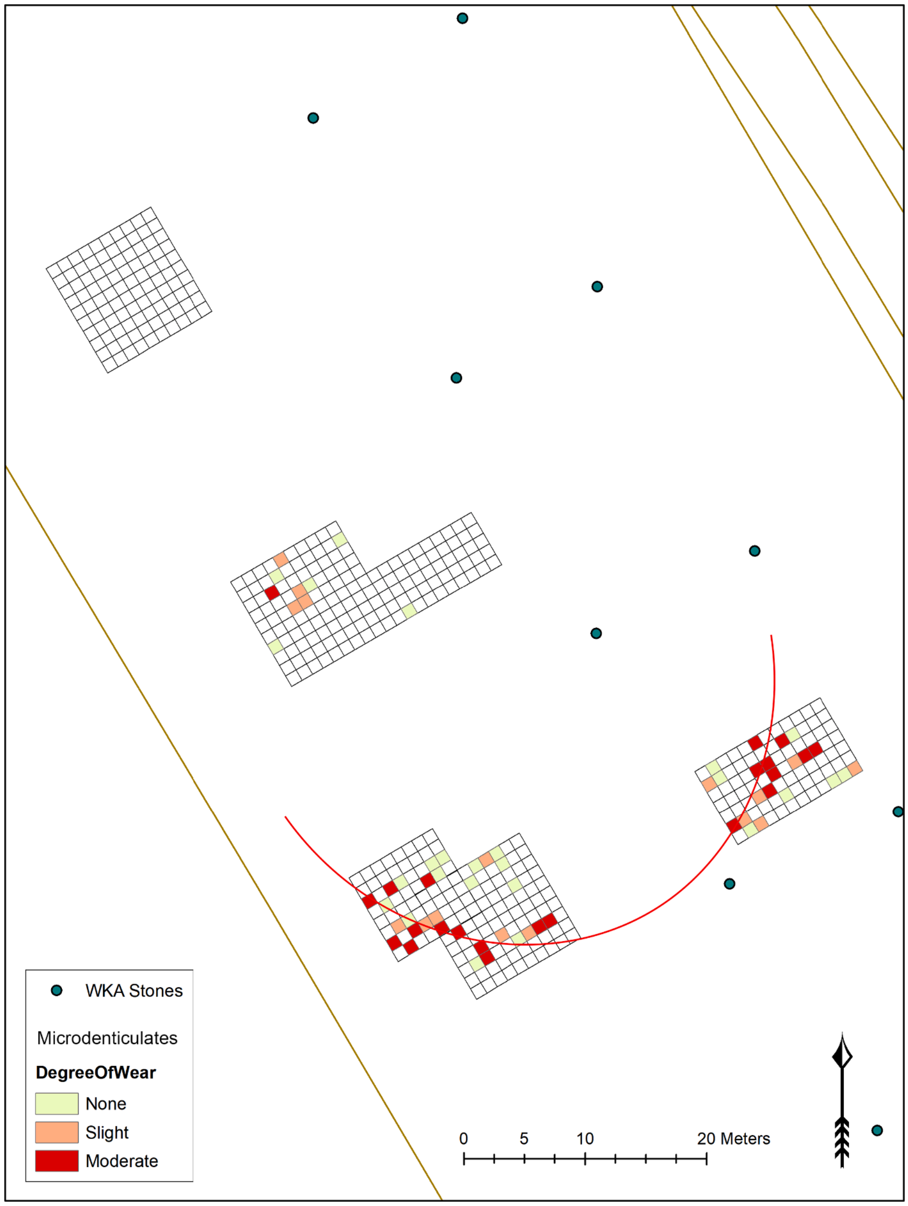

Fig. 13. The distribution of microdenticulates excavation trenches according to their degree of wear.

Gleber forthcoming, 519; MacFadyen, 2009), and Hurcombe (2007, 50) suggests that nettles may have been harvested similarly. This provides a relatively broad seasonal range for when people may have been working plant fibres at the WKAOS. Given the current lack of alternative seasonality data, this provides useful information about the occupation of the site.

Anthropogenic soils, such as middens, are typically enriched in nitrogen and phosphates (Eidt, 1985; Kolb, 2017; Wells et al., 2000), conditions which many plants, and especially nettles, thrive in (Hurcombe, 2014, 5). Abandoned areas of settlement, and particularly middens, therefore, would have attracted stands of nettles that are likely to have grown taller than those in the surrounding area. Given the often ephemeral nature of the structural components of Neolithic houses in southern Britain, it is possible that the location of abandoned settlements were more visible from the growth of plants like nettles, than they would have been from their structural remains, particularly if at the end of their life houses were decommissioned and partly or wholly deconstructed as they had been at Durrington Walls (Parker Pearson et al., In prep).

The Neolithic practice of ploughing middens *in situ* and cultivating them, is evidenced at Tofts Ness, Orkney (Guttman 2005; Guttman et al. 2005), and similar suggestions have been made for the Knap of Howar (Ritchie, 1983) and the Links of Noltland (Clarke et al., 1978) in Orkney, and for Hazleton North, Gloucestershire (Macphail, 1990). Neolithic communities were therefore familiar with the beneficial growing properties of middens, and if, as seems likely, nettles were a valued source of fibres for cordage and/or textiles, the affordances for their growth offered by an abandoned midden, would have certainly been appreciated. This is particularly the case given that taller nettles producing longer fibres would have been highly beneficial in the production of cordage or textiles. Good nettle stands, therefore, would have been valued and perhaps managed (Van Gijn, 2010, 89).

Bearing this in mind, it is worth returning to the distribution of the used microdenticulates at the WKAOS. The distribution appears to show that at some point people were working plant materials in an arc, or potentially a broad circle. If the material they were working was nettles, one possibility is that they were working in this arrangement because they were working around the fringes of an abandoned or temporarily abandoned settlement upon which stands of nettles had grown. This could either be seen as the managed or opportunistic use of a valued resource, part of a process of commemorating or even reopening a settlement, or a mixture of the three.

Future analysis will examine the use-wear of other elements of the assemblage to see if the spatial patterning of other used tools reflects the distribution of used microdenticulates, the bulk of the assemblage, or perhaps a different pattern and phase of occupation entirely. In the case of microdenticulates, if we accept that their use on the site is not contemporary with the main phase of Middle Neolithic occupation, it is necessary to consider when their use occurred. The tools themselves do not help as they have a broad date range, making it difficult to assess what date their use might relate to. However, on the balance of probability, it seems likely that they date to after the abandonment of the settlement. It is more difficult to say whether the period after its abandonment was a few years, decades or more. It is even possible that the clearance of vegetation was part of the early marking of the routeway that would eventually become the West Kennet Avenue.

6. Conclusions

The objectives of this analysis were twofold. Firstly, the goal was to investigate the use of microdenticulates and the activity that generated Polish 23. Secondly, the aim was to explore the potential for use-wear analysis to investigate an artefact scatter. The objectives were interlinked, with the examination of microdenticulate tool use relying on the spatial analysis of the objects within the scatter, and the understanding of the spatial patterning of artefacts relying on the results of the use-wear analysis.

Although the exact task involved in generating Polish 23 remains unknown, and will do until the traces have been successfully replicated, the analysis provides further insight into the character of polish formation and the potential duration of use of the tools, as well as developing an argument for the material that was being worked to have been nettle fibres. Even if it is not yet clear whether nettle is the contact material, the argument for use of microdenticulates and quartiers d'orange for the processing of fibres for textiles is persuasive. If this is accepted, it elevates these humble tools, as it links them inextricably with the production of material culture that would have been central to the expression cultural identity of Neolithic communities. Whilst the end product of the process may have been the most visible aspect of that expression, choices made at every step of the chaîne opératoire would have been deeply ingrained in material traditions which were also culturally specific. In this respect, the similarities in the tool form and use of microdenticulates across large swathes of Neolithic Europe is another revealing aspect in the study of the spread of Neolithic practices and ideas.

In terms of understanding the WKAOS, the analysis raises the possibility that use-wear analysis can be used to differentiate phases of activity within an unstratified artefact scatter. Furthermore, it suggests that the locale of the settlement site remained a significant place after its abandonment. It is possible that it retained its significance, not only because it was a useful source of plant fibres, but because those fibres were connected to the memory of the settlement itself. This is particularly significant given that the working of vegetation that grew up over the settlement site may have been one of that ways in which it remained in folk memory until it was incorporated into the route of the West Kennet Avenue some four to six centuries later.

CRediT authorship contribution statement

Ben Chan: Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The author declares that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jasrep.2024.104686.

References

Andersson, S.E., 2012. The textile *chaîne opératoire*: Using a multidisciplinary approach to textile archaeology with a focus on the Ancient Near East. Paléorient 38 1(2), 21–40. https://doi.org/10.3406/paleo.2012.5456.

Bergfjord, C., Mannering, U., Frei, K.M., Gleba, M., Scharff, A.B., Skals, I., Heinemeier, J., Nosch, M.L., Holst, B., 2012. Nettle as a distinct Bronze Age textile plant. Sci. Rep. 2, 664. https://doi.org/10.1038/srep00664.

Bocquet, A., 1980. Le microdenticulé, un outil mal connu. Bulletin De La Société Préhistorique Francaise 3, 76–85.

Booth, P., Champion, T., Foreman, S., Garwood, P., Glass, H., Munby, J., Reynolds, A., 2011. On Track: The archaeology of High Speed I Section I in Kent. Oxford Wessex Archaeology. Monogr. No 4.

Caspar, J.-P., 1988. Contribution a la traceologie de f industrie lithique du Néolithique Ancien dans l'Europe Nord-Occidentale. Université Catholique de Louvain. PhD thesis.

Chaffey, G., Barclay, A. and Pelling, R. 2016. *Horton, Kingsmead Quarry Volume 1*. Wessex Archaeology.

Chan, B., 2003. Understanding the Inhabitation of the Stonehenge Environs: the Interpretative Potential of Ploughsoil Assemblages. University of Sheffield. Unpublished PhD thesis.

Chan, B., 2009. Life amongst the rubbish: middening and conspicuous consumption at Durrington Walls. Internet Archaeol. 26. http://intarch.ac.uk/journal/issue26/chan_index.html.

Chan, B., 2022. Investigating traditions of stone-working and inhabitation in the Stonehenge landscape: the lithic assemblages of the Stonehenge Riverside Project. In: Parker Pearson, M., Pollard, J., Richards, C., Thomas, J., Tilley, C., Welham, K. (Eds.), *Stonehenge for the ancestors Part 2: Synthesis*. Sidestone Press, Leiden, pp. 243–271.

Childe, V.G., 1931. Skara Brae: a 'Stone Age' Village in Orkney. Antiquity 5 (17), 47–59. https://doi.org/10.1017/S0003598X00005597.

Clark, J.G.D., Higgs, E.S., Longworth, I.H., 1960. Excavations at the Neolithic Site at Hurst Fen, Mildenhall, Suffolk 1954, 1957 and 1958. Proc. Prehist. Soc 26, 202–245. https://doi.org/10.1017/S0079497X00016315.

Clarke, D.V., Hope, R., Wickham-Jones, C., 1978. The Links of Noltland. Curr. Archaeol. 6 (2), 44–46.

Coles, J., Hibbert, F.A., Orme, B.J., 1973. Prehistoric roads and tracks in Somerset, England: 3. The Sweet Track. Proc. Prehist. Soc 39, 256–293. https://doi.org/10.1017/S0079497X00011683.

Cunnington, M.E., 1931. The Sanctuary on Overton Hill near Avebury. Wiltshire Archaeol. Nat. History Magazine 45, 300–335.

Darvill, T., 1996. Neolithic buildings in England, Wales and the Isle of Man. In: Darvill, T., Thomas, J. (Eds.), *Neolithic Houses in Northwest Europe and beyond*, Neolithic Studies Group Seminar Papers Vol, 1. Oxbow Books, Oxford, pp. 77–112. https://doi.org/10.2307/j.ctvh1dw5t.12.

Eidt, R.C., 1985. Theoretical and practical considerations in the analysis of anthrosols. In: George Jr., R., Gifford, J.A. (Eds.), Archaeological Geology. Yale University Press, New Haven, CT, pp. 155–190.

Garrow, D., Lucy, S. and Gibson, D. 2006 *Excavations at Kilverston, Norfolk: an episodic landscape history.* Cambridge: East Anglian Archaeology Report No. 113.

Gillings, M., Pollard, J., Wheatley, D.W., Peterson, R., 2008. Landscape of the megaliths: excavation and fieldwork on the Avebury monuments, 1997–2003. Oxbow, Oxford.

Gillings, M., Pollard, J., Strutt, K., 2019. The origins of Avebury. Antiquity 93 (368), 359–377. https://doi.org/10.15184/aqy.2019.37.

Good, I., 2001. Archaeological Textiles: A Review of Current Research. Ann. Rev. Anthropol. 30, 209–226. http://www.jstor.org/stable/3069215.

Guttmann, E.B.A., 2005. Midden Cultivation in Prehistoric Britain: Arable Crops in Gardens. World Archaeol. 37 (2), 224–239. http://www.jstor.org/stable/40024231.

Guttmann, E., Dockrill, S., Simpson, I., 2005. Arable agriculture in prehistory. Proceedings of the Society of Antiquaries of Scotland 134, 53–64. https://doi.org/10.9750/PSAS.134.53.6.

Harris, S., 2020. The challenge of textiles in Early Bronze Age burials: Fragments of magnificence. In: Sabatini, S., Bergerbrant, S. (Eds.), The Textile Revolution in Bronze Age Europe; Production, Specialisation, Consumption. Cambridge University Press, Cambridge, pp. 154–196.

Harris, S. and Glebber, M. Forthcoming. Fibres and Fabrics, in M. Knight, R. Ballantyne, A. Copper, D. Gibson and I. Robinson Zeki (eds.) *Must Farm pile-dwelling settlement Volume 2: Specialist reports*. Cambridge: McDonald Institute Monographs.

Hey, G., Bell, C., Dennis, C., Robinson, M., 2016. Yarnton: Neolithic and Bronze Age Settlement and Landscape. Thames Valley Landscape monograph, Oxford Archaeology, p. 39.

Högberg, A., 2016. Microdenticulates of the funnel beaker culture: lithic attribute analysis, use-wear analysis, and contextual analysis. Acta Archaeologica 87, 11–32. https://doi.org/10.1111/j.1600-0390.2016.12164.x.

Hurcombe, L. 2007. Plant processing for cordage and textiles using serrated flint edges: new chaînes opératoires suggested by combining ethnographic, archaeological and experimental evidence for bast fibre processing. In, V. Beugnier and P. Crombé (eds.) *Plant processing from a prehistoric and ethnographic perspective*. Oxford: British Archaeological Reports International Series 1718.pp 41-66.

Hurcombe, L. 2008a Looking for prehistoric basketry and cordage using inorganic remains: the evidence from stone tools, In, L. Longo and N. Skakun (eds.) *"Prehistoric Technology" 40 years later: Functional Studies and the Russian Legacy – Proceedings of the International Congress Verona (Italy) 20-23 April 2005*, BAR International Series 1783, Oxford: Archaeopress 205-16.

Hurcombe, L., 2008b. Organics from Inorganics: Using Experimental Archaeology as a Research Tool for Studying Perishable Material Culture. World Archaeol. 40 (1), 83–115. http://www.jstor.org/stable/40025315.

Hurcombe, L., 2014. Perishable Material Culture in Prehistory: Investigating the missing majority. Routledge, London.

Juel Jensen, H. 1994 *Flint tools and plant working. Hidden traces of Stone Age technology*, Aarhus: Aarhus University Press.

Keeley, L.H., 1977. Beobachtungen über Micro-Abnutzungsspuren an l4 Klingen von Hienheim. In: P.J.R. Modderman: Die Neolithische Besiedlung bei Hienheim. Ldkr. Kelheim. Analecta Praehistorica Leidensia 10, 71–72.

Knight, M., Ballantyne, R., Robinson Zeki, I., Gibson, D., 2019. The Must Farm pile-dwelling settlement. Antiquity 93 (369), 645–663. https://doi.org/10.15184/aqy.2019.38.

Kolb, M.F. (2017). Analysis of Carbon, Nitrogen, pH, Phosphorus, and Carbonates as Tools in Geoarchaeological Research. In: Gilbert, A.S. (eds) *Encyclopedia of Geoarchaeology*. Encyclopedia of Earth Sciences Series. Dordrecht: Springer, Dordrecht. doi: 10.1007/978-1-4020-4409-0_11.

MacFadyen, J.D., 2009. Fashioning Flax: industry, region and work in North American firbe and linseed oil, 1850–1930. University of Guelph. Unpublished PhD thesis,.

Macphail, R. I. 1990. The soils. In Hazleton North, Gloucestershire, 1979–82: The Excavation of a Neolithic Long Cairn of the Cotswold-Severn Group (ed. A. Saville). London: HBMCE Archaeological Report 13, pp. 223–6.

Mitcham, D., 2022. Lithic scatters from the ploughsoil in the Stonehenge landscape. In: Parker Pearson, M., Pollard, J., Richards, C., Thomas, J., Tilley, C., Welham, K. (Eds.), *Stonehenge for the ancestors Part 2: Synthesis*. Sidestone Press, Leiden, pp. 205–242.

Olalde, I., Brace, S., Allentoft, M., et al., 2018. The Beaker phenomenon and the genomic transformation of northwest Europe. Nature 555, 190–196. https://doi.org/10.1038/nature25738.

Parker Pearson, M., Sheridan, A., Jay, M., Chamberlain, A., Richards, M.P., Evans, J. (Eds.), 2019. The Beaker People: isotopes, mobility and diet in Prehistoric Britain. Oxbow, Prehistoric Society Research Paper 7, Oxford.

Pitts, M.W., 2001. Excavating the Sanctuary: new investigations on Overton Hill, Avebury. Wiltshire Archaeol. Nat. History Magazine 94, 1–23.

Pitts, M., Whittle, A., 1992. The Development and Date of Avebury. Proc. Prehist. Soc 58 (1), 203–212. https://doi.org/10.1017/S0079497X00004151.

Parker Pearson, M., Pollard, J., Richards, C., Thomas, J., Tilley C. & Welham K (eds.) In prep. Durrington Walls and Woodhenge: A place for the living. Leiden: Sidestone press.

Pollard, J., Cleal, R., 2004. Dating Avebury. In: Pollard, J., Cleal, R. (Eds.), Monuments and material culture. East Knoyle, Hobnob, pp. 120–129.

Pollard, J., Chan, B., Cleal, R., Snashall, N. and Gillings, M. In prep. *The West Kennet Avenue occupation site, and the Middle Neolithic of the Avebury Region and Beyond*.

Pollard, J., 1992. The Sanctuary, Overton Hill, Wiltshire: a re-examination. Proceedings of the Prehistoric Society 58 (1), 213–226.

Pryor, F., 1998. Etton: Excavations at a Neolithic causewayed enclosure near Maxey Cambridgeshire, 1982–7. English Heritage Archaeological Report 18, London.

Richards, C., 2005. Dwelling among the monuments: the Neolithic village of Barnhouse, Maeshowe passage grave and surrounding monuments at Stenness, Orkney. Cambridge University Press, Cambridge.

Richards, C., Jones, R., 2016. The Development of Neolithic House Societies in Orkney: Investigations in the Bay of Firth, Mainland, Orkney (1994–2014). Windgather Press, Oxford.

Richards, J., 1990. The Stonehenge Environs Project. English Heritage Archaeological Report No.16, London.

Ritchie, A., 1983. Excavation of a Neolithic farmstead at Knap of Howar, Papa Westray, Orkney. Proceedings of the Society of Antiquaries of Scotland. 113, 40–121.

Schofield, A.J. (Ed.), 1991. Interpreting Artefact Scatters: Contributions to Ploughzone Archaeology. Oxford, Oxbow Monograph no. 4.

Smith, I., 1965. Windmill Hill and Avebury: Excavations by Alexander Keiller 1925–1939. Clarendon, Oxford.

Smyth, J., 2014. Settlement in the Irish Neolithic: New discoveries at the edge of Europe. Oxbow Books, Prehistoric Society Research Paper, Oxford, p. 6.

Stone, J.F.S., 1935. Some discoveries at Ratfyn, Amesbury and their bearing on the date of Woodhenge. Wiltshire Archaeol. Natural History Magazine 47, 55–67.

Stone, J.F.S., 1949. Some Grooved Ware pottery from the Woodhenge area. Proc. Prehist. Soc 15, 122–127.

Stone, J.F.S., Young, W.E.V., 1948. Two pits of Grooved Ware date near Woodhenge. Wiltshire Archaeol. Nat. History Magazine 52, 287–306.

Thomas, J., 1996. Neolithic houses in mainland Britain and Ireland – A sceptical view. In: Studies Group Seminar Papers Vol, 1, pp. 1–12. https://doi.org/10.2307/j.ctvh1dw5t.7.

Van Gijn, A.L., 1990. The wear and tear of flint. Principles of functional analysis applied to Dutch Neolithic assemblages. Analecta Praehistorica Leidensia 22.

Van Gijn, A.L., 2010. Flint in Focus: Lithic biographies in the Neolithic and Bronze Age. Sidestone Press, Leiden.

Wells, E.C., Terry, R.E., Parnell, J.J., Hardin, P.J., Jackson, M.W., Houston, S.D., 2000. Chemical analyses of ancient anthrosols in residential areas at Piedras Negras, Guatemala. J. Archaeol. Sci. 27, 449–462.

Whittle, A., Healy, F., Bayliss, A., 2011. Gathering time: dating the early Neolithic enclosures of southern Britain and Ireland. Oxbow Books, Oxford.

Woodward, P.J., 1991. The South Dorset Ridgeway: Survey and excavation 1977–84. Dorchester: Dorset Natural History and Archaeological Society Monograph Series No.8.