

CHAPTER 24

Osseous Technology

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Introduction

Clark's original excavations at Star Carr recovered extensive evidence for a rich and varied suite of osseous material culture. This included finished artefacts in the form of uniserial barbed points, modified red deer frontlets, elk antler mattocks, bone bodkins, aurochs bone scraping tools, worked red deer tines, a bird bone bead, an elk antler hammer, a spoon-like object made of elk antler and a possible red deer antler handle. In association with these finished forms, Clark also recovered a large quantity of red deer antler which had been worked to various extents: 'blank' splinters waiting to be worked into barbed points, the manufacturing waste from the production of the bone scraping tools and bodkins and fragments of elk antler left over after the production of mattocks. These finds were supplemented by a much smaller assemblage of worked red deer antler and a single barbed point during further excavation of the site in the 1985 and 1989 (Mellars and Dark 1998).

Our excavations have recovered evidence for bone and antler working from across the wetland areas of the site, with an overall assemblage which mirrors that of Clark in terms of the range of artefacts and debitage. This consists of modified red deer frontlets, barbed points, red deer antler debitage, bone working debitage, elk antler debitage, a bone bodkin, a bone scraping tool and an elk antler mattock. Finds were analysed, recorded and photographed at the University of York before being conserved by York Archaeological Trust. Selected artefacts were recorded using reflectance transformation imaging (RTI) prior to conservation.

Having outlined the methods used in analysis, this chapter will first deal with the working of bone at Star Carr and the production of aurochs bone scraping tools and bodkins, before moving on to discuss the working of red deer and elk antler, and the production of elk antler mattocks. A full description and analysis of the working of barbed points and red deer frontlets are provided within Chapters 25 and 26 respectively. These classes of artefact have been given their own chapters to allow for an independent discussion of their research history and their wider role within the European Early Mesolithic. However, discussion of the more general trends in osseous technological practice will draw from material across these three antler-based chapters, and involve various degrees of cross-referencing. A discussion of the significance of this assemblage within the wider context of Mesolithic Northern Europe will be provided within Chapter 27.

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Methods

The use of traceological analysis in the study of osseous tools from Mesolithic contexts has been pioneered by the work of David (2005). Her method of analysis comprises four major stages of recording for each piece of osseous material recovered from an archaeological site. These consist of a hand survey to record the maximum length, width, thickness and weight of the piece, as well as any anatomical measurements that it is possible to record. Secondly, a technical description of the piece is carried out, using the methodology outlined by Voruz (1984). This method of shorthand description allows the occurrence of markings, their character, their location and their relationship to other markings and surfaces to be recorded quickly and consistently. Thirdly, the pieces are photographed to give an impression of the overall character, but also to illustrate working marks were present through the manipulation of raking light. Finally, drawing was undertaken for some of the material from Star Carr. This element of the methodology is modified slightly from that used by David. In this study, only finished artefacts were drawn and annotated in the style outlined by David (2005, 468–472). This decision was taken based on the advances in digital photography technology that have taken place since David's original development of the methodology, which allow high-quality images to be taken and disseminated with relative ease and which can illustrate the markings present on osseous material without the need to produce drawings.

From this recording process, several assertions can be made regarding the individual pieces of material. Firstly, the biological properties of the piece can be described. Through comparisons with reference material (both modern and archaeological), the species and element and anatomical region of origin can be determined. This is primarily based on the morphological form of the piece, the character of any intact compactor tissue and the consistency of spongy material. Events and processes which occur in the course of the biological history of the material are also possible to identify, based on an understanding of animal behaviour. For instance, the occurrence of polish on the tips of antler tines can be linked to the fraying of antlers, when deer rub themselves against the ground or trees, and need not be directly linked to anthropological action (Jin and Shipman 2010).

Secondly, the taphonomic factors to which the piece has been subjected can be discussed. Through an examination of the character of the material, the condition of the anatomical surfaces, instances of discolouration and the nature and orientation of striations and incisions, it can be possible to broadly identify processes such as gnawing (by rodents, ungulates or molluscs), demineralisation, exposure to weather or the action of water. This can also be greatly aided by the study of contextual information from the excavation archive, although in some cases this is not always possible.

Thirdly, once the biological and taphonomic processes have been identified and accounted for, the markings associated with specific working actions can be discussed. The form of these working marks can be related to specific techniques and actions, based on comparisons to both archaeological and experimentally produced reference material. The relationship between these markings can also be studied to gain an understanding of the sequence in which these were carried out. In a similar way to the principles of stratigraphy that are used to establish sequential relationships between depositional events on a site level, working marks which overlie or 'cut' other episodes of working or taphonomic processes can be said to occur later than the original actions. In this way, a sequence of actions, or *chaîne opératoire*, can be built up for each individual piece within the assemblage.

Microwear of some of the osseous artefacts was carried out by AL (see Chapter 15 for methods). During this work a limitation became apparent, in that published microwear reports detailing analysis of similar objects is severely lacking. This is perhaps not surprising considering the historical focus on flint followed by other stone types in microwear studies. Only more recently are we seeing attention turn to a more diverse range of materials such as shell, pottery, bone and antler.

Analysis and interpretation

Bone technology and debitage

Only three bone artefacts were found on the site during the 2004–2015 excavations: one barbed point (see Chapter 25), one scraping tool and one elk bone bodkin. However, there is further evidence for bone working in the form of debitage. Working traces beyond butchery marks and the spiral fractures associated with marrow extraction were detected on 47 animal bones.

David's (2005) analysis of Clark's material identified a chaîne opératoire for the production of rectangular bone blanks from large mammal metapodia (Figure 24.1). This was interpreted by David as evidence for the production of bone notched points; although bone notched points are not documented within the Clark assemblage, her analysis of the technological sequence in bone working stands as a good point of departure for considering the new evidence for bone technology. Her analysis showed a process which involved the initial enlargement of the proximal foramen (Figure 24.1, a) through the dotted perforation technique (Figure 24.1, b), the application of wedge-splitter technique to further modify the shape of the proximal epiphysis (Figure 24.1, c), the removal of the distal epiphysis through a sawing-prepared break (Figure 24.1, d) and the subsequent application of the wedge-splitter technique to divide the remaining bone along the natural grooving (Figure 24.1, f).

Of the material uncovered in the 2004–2015 excavations, 13 fragments of red deer and two fragments of roe deer metapodia, along with five red deer long bone fragments unidentified to element, show signs of having been split via the wedge-splitter technique (see Figure 24.2). However, the evidence for bone working contradicts the patterns identified by David to a certain extent. There is very little evidence of the use of dotted perforation (see Figure 24.2) to enlarge the nutrient foramen at the proximal ends of the pieces (with a single exception, <116893>), nor the use of wedge-splitter technique to shape the outer surface of the proximal end (again, with the single exception of <116463>).

There is also a consistent combination of both spiral percussion breaks and wedge-splitter evidence on the same bone, suggesting that bones were broken for marrow initially, and then the fragments were further split for other purposes. Perhaps related to this, there are numerous instances of splitting which ignore the natural grooving of the metapodia (a natural characteristic which can aid the production of sub-rectangular blank fragments), suggesting again that this splitting was carried out somewhat as an afterthought to butchery and marrow extraction. Furthermore, this splitting is not confined to metapodia: femora, ulnae, radii and tibiae

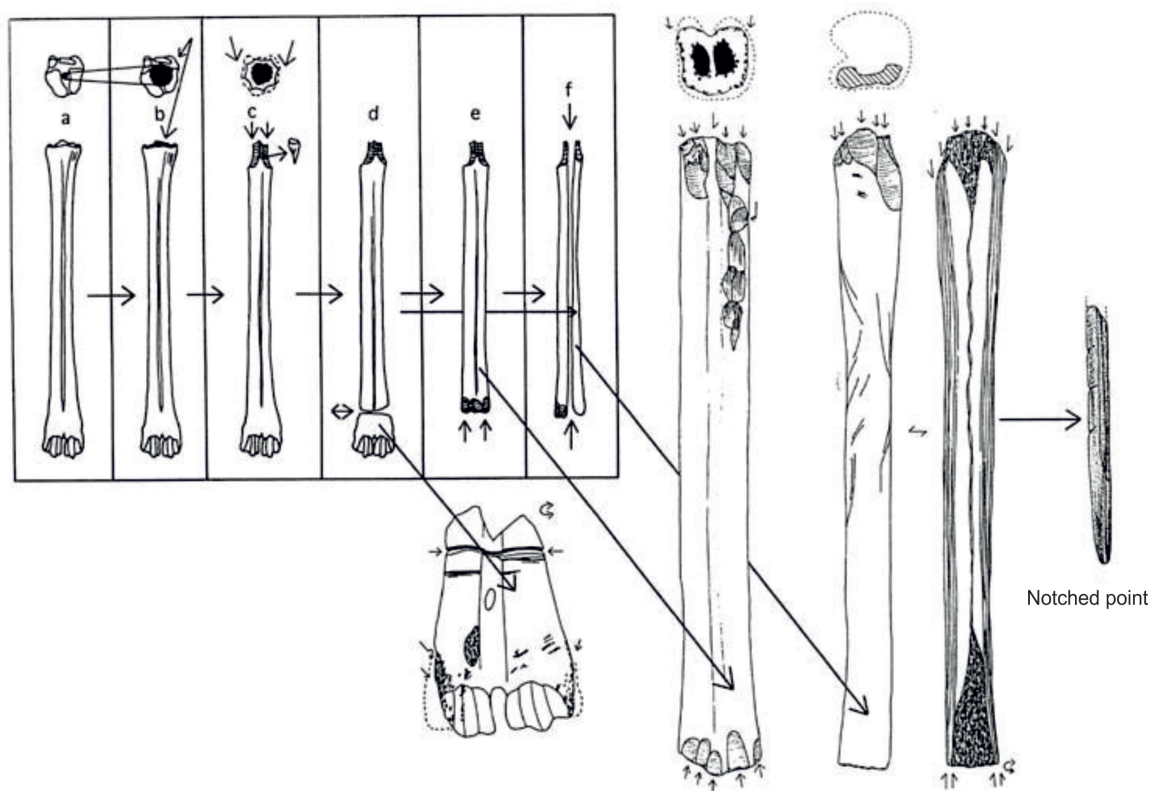


Figure 24.1: Chaîne opératoire for the production of bone notched points (David 2005, 326) (Copyright Eva David, CC BY-NC 4.0).

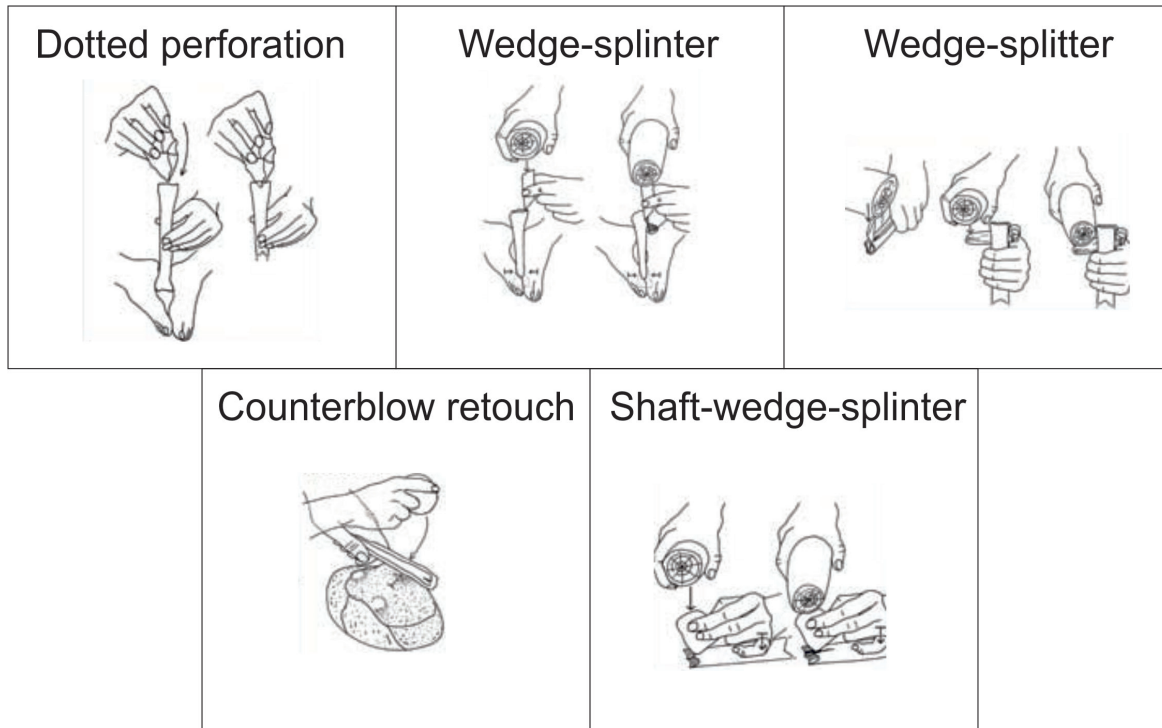


Figure 24.2: Distinct techniques used to work bone, as identified and defined by David (2007, 39) (Copyright Eva David, CC BY-NC 4.0).

have all been split using the wedge-splitter method. A single instance of the shaft-wedge-splinter technique was identified on a medium mammal rib bone. The bone material removed by this would have been too small to produce a barbed point, and so it must again be concluded that this technique was used to extract marrow from ribs.

As such, we have a complex combination of actions at play within this assemblage. On occasions, long bones are broken apart with no apparent concern for the form of the bone fragments left afterwards, producing spiral fractures. Given the disregard for the form of the bone fragments left, this was presumably undertaken for the extraction of marrow and grease, with long bones being particularly rich in both of these materials. In other instances, more controlled, wedge-splitter techniques are used to break bones apart, which help to produce regularly sized and dimensioned portions of metapodia; what would usually be considered as blanks for bone barbed point production. However, there are numerous instances which cloud this clear-cut distinction between bones fragmented to extract marrow and bones carefully split to make artefacts. These include fragments which have been carefully split via the wedge-splitter technique, but not in a way which produces blanks suitable for bone barbed point production, and fragments which have traces of both spiral fractures and wedge-splitting on them.

The intention here is unclear and may be a reflection of an occasional preference for the use of particular techniques in multiple tasks, even if they may not be the most efficient. Whilst many of the wedge-split bone would not be usable as material culture blanks due to their size and shape, the actions themselves may well have allowed marrow to be extracted. This suggests that the presence of the wedge-splitter technique in itself need not necessarily indicate an intention to produce material culture, and serves to highlight the complexity of the treatment of bone at the site.

However, these findings do demonstrate that, although not executed universally, cervid long bones were being occasionally split in a regularised manner to produce blanks which would be suitable for the manufacture of bone barbed points. The relatively small scale of these actions is notable in comparison to the abundant

evidence for the groove-and-splinter technique within red deer antler, and the almost total use of antler for the finished barbed points at the site (Chapter 25).

David's analysis also identified a distinct chaîne opératoire for the working of the more robust aurochs metapodia, specifically for the production of large scraping tools, (Figure 24.3), which involves the coin-éclat-fente (shaft-wedge-splinter) technique, alongside dotted perforation, wedge-splintering, and counter-blow retouch (Figure 24.3).

Two split aurochs metatarsals were recovered showing similar signs of working. One of these had been originally split using the wedge-splitter method, and showed signs of sawing and a prepared break at the distal end to remove the epiphysis. Following this, counter-blow retouch had been applied along one edge to further modify the shape of the piece. The second split metatarsal had been subject to the wedge-splitter technique and then abandoned. This appears to demonstrate the manufacture, use and deposition of a small number of these aurochs metatarsal scraping tools were being carried out at the site.

More unusual, aurochs bone working was apparent in the form of two phalanx fragments, which had been split longitudinally. Although the preservation of these pieces makes a full definition of their working methods problematic, the continuous and regular character of the split surfaces would suggest that this was achieved through wedge-splitting.

Aurochs bone tool

Clark's excavations at Star Carr recovered an assemblage of 11 finished aurochs bone scraping tools and nine pieces of debitage produced as by-products of their manufacture, made from metapodials, metacarpals and metatarsals. These were interpreted as hide-scraping tools through ethnoarchaeological analogies with Inuit groups in North America.

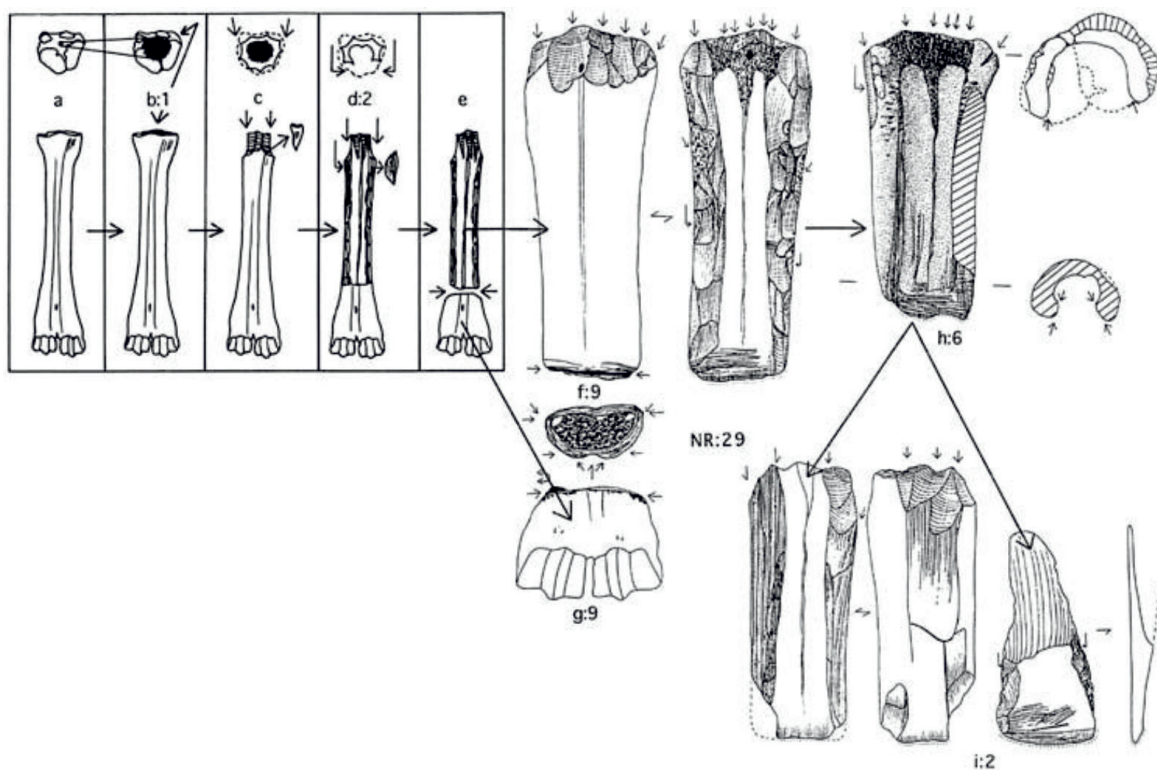


Figure 24.3: Chaîne opératoire for the production of aurochs bone scraping tools (David 2005, 331) (Copyright Eva David, CC BY-NC 4.0).

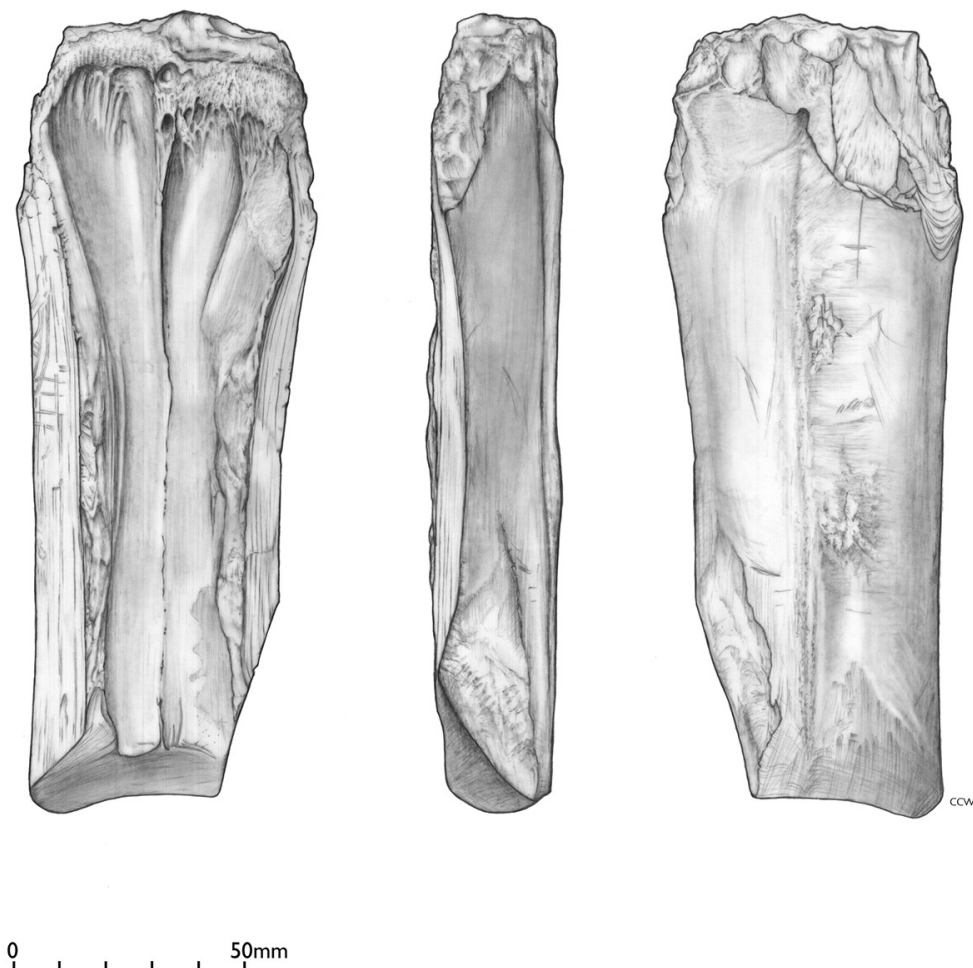


Figure 24.4: Aurochs bone chisel <117517> (Copyright Chloe Watson, CC BY-NC 4.0).

In 2015, a large, worked and utilised fragment of a split aurochs metatarsal midshaft <117517> was recovered from Clark's area of the site, within the reed peat (312) (Figure 24.4). The piece was well preserved and robust and there is the suggestion of a healed lesion on the cortical bone surface. The distal end has been modified through dotted perforation (opening up the medullary cavity) and then negative removal scars around the circumference of the bone suggest the use of the wedge-splinter technique to further shape the distal end.

The techniques used to achieve the splitting are unclear. Macroscopically, the highly lustrous and longitudinally striated edges suggest some form of secondary working or possible utilisation, whilst the angled, bulbous negatives on the inner aspects of the less-regular split edges suggests the shaft-wedge-splinter technique was employed. The angle of the proximal termination is consistent with those observed on spiral fractures throughout the Star Carr assemblage (Noe-Nygaard 1977), although it appears to be broken short to a certain extent. The surface of the proximal termination is highly lustrous and demonstrates multiple fine striations and has a similar character to that observed along the split edges.

The chisel was analysed for wear traces but none were identified. However, the lack of wear on the blade of the chisel may be a result of a later (post-use) rejuvenation of the edge, probably with a flint tool, which is visible macroscopically (Figure 24.5). It was possible to see that at high magnification this scraped area and an adjacent area which appears to have sheared off, possibly at the same time, lack the same shiny generic polish seen across the rest of the object, the cause of which is unclear. No use polish was identified on the ventral side of the chisel blade either. No hafting traces were identified. If this chisel was used and the wear traces were then removed through resharpening, it does not appear to have been used again after that resharpening event. The breakage that appears to have occurred at the same time may account for it not being re-used, although even with that damage, it remains a perfectly functional tool. The alternative possibility is that it was never used and may have been abandoned once the breakage occurred during the final stages of manufacture. In both scenarios, the question remains: why abandon a functional tool?



Figure 24.5: Close-up of the blade end of the chisel showing edge-sharpening traces, probably made with a flint blade (Photograph taken by Paul Shields. Copyright University of York, CC BY-NC 4.0).

Bone bodkin

Clark's excavations recovered a collection of eight elk lateral metacarpal bones which had been subtly modified to create tools, which he interpreted as bodkins (for making holes in leather) or fastening pins. These were shaped and either polished or worn smooth, with two displaying bands of fine, incised lines running perpendicular to the axis of the point. The 2004–2015 excavations recovered a further bodkin <116151> from Clark's area of the site, within context (312), made from a partial lateral metacarpal of an elk (Figure 24.6). The taphonomy of the piece limits the amount that can be said about the way in which has been made. However, it is formally consistent with the examples described and illustrated by Clark and as such adds to the scarce record for this particular type of artefact within Britain.

The distal epiphyseal end (see Figure 24.7) had broken away from the main body of the element post-deposition. The proximal end of the specimen has been humanly modified whilst maintaining the original shape of the bone. Identification of specific working marks is complicated by the post-depositional water-action, which has smoothed the surfaces of the artefact. However, some longitudinal striations are visible under raking light using RTI analysis. The very tip has broken off, possibly during use.

Use-wear analysis revealed a very bright shiny and smooth polish containing numerous micro-striations which was located towards the tip and in apparent association with the larger striations observed macroscopically. This polish is consistent with siliceous plant polish. On the ventral surface it has a very clear directionality, running perpendicular to the edge; whilst on the dorsal surface, the polish runs both longitudinally and perpendicular to the edge. Another occurrence of probable siliceous plant polish is associated with a second grouping of macroscopically visible striations located on the dorsal surface towards the epiphyseal distal end, which had broken off. Thus it appears that these striations are use related and have probably developed from regular contact with plant fibres. One possibility is that it was used in weaving (see Figure 24.8).

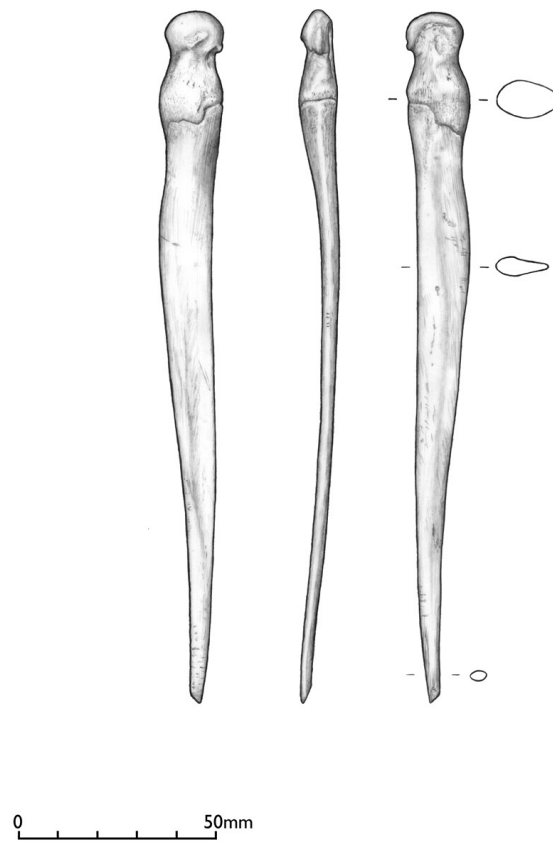


Figure 24.6: Elk bone bodkin <116151> (Copyright Chloe Watson, CC BY-NC 4.0).

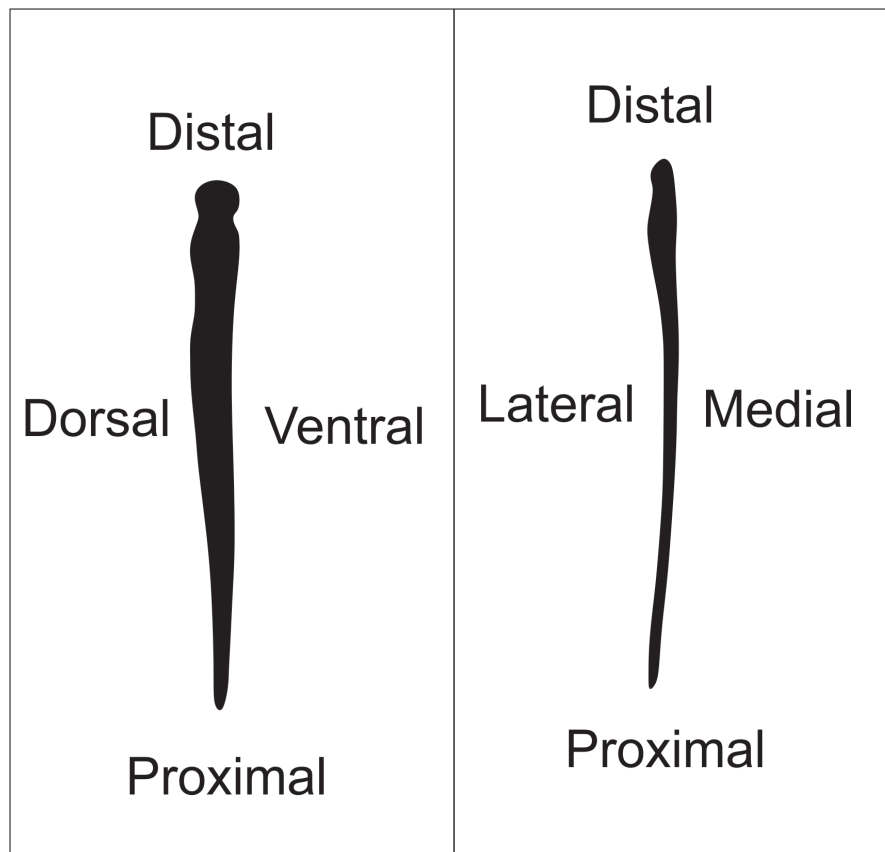


Figure 24.7: Schematic diagram of elk antler bodkin showing anatomical orientations (Copyright Ben Elliott, CC BY-NC 4.0).



Figure 24.8: Using a replica bone bodkin to make a coil basket (Copyright Aimée Little, CC BY-NC 4.0).

Antler technology

Elk antler technology and debitage

Six pieces of elk antler were recovered during the 2004–2015 excavations from a mixture of wetland and Clark's backfill contexts (Figure 24.9; Table 24.1). No elk antler was recovered from the dryland areas of the site, but given the small sample size and the reduced chances of survival for organic material within the dryland areas, it cannot be categorically argued that elk antler working was restricted to the wetlands. The assemblage includes a finished elk antler mattock, a possible mattock preform, two tines, a palmate portion and two unshed antlers attached to a skull. In terms of condition, this small assemblage is easily identifiable to species and region but lacks the preservation of fine surface detail to allow a more robust identification of working techniques. Whilst smaller than the original collection of elk antler finds recovered by Clark, these new finds confirm some of the patterns noted earlier at the site.

Elk antler mattock

Clark recovered six antler mattocks, which fell into two distinct types. Type 1 was made from the beam, pedicle and adhering frontal bones, whilst Type 2 was made using the beam and palmate portion of the elk antler. Further to this, Clark also recovered other types of elk antler artefact: a fragmented elk antler hammer and a spoon-like tool, as well as a small assemblage (n=13) of elk antler debitage.

<113836> is an intact, perforated elk antler mattock (Figures 24.10 and 24.11). Using Clark's typology, this is a Type 2 mattock utilising the distal portion of the beam (for the creation of the working edge) and the lower part of the palmate portion of the antler. The upper part of the palmate portion and tines have been removed,

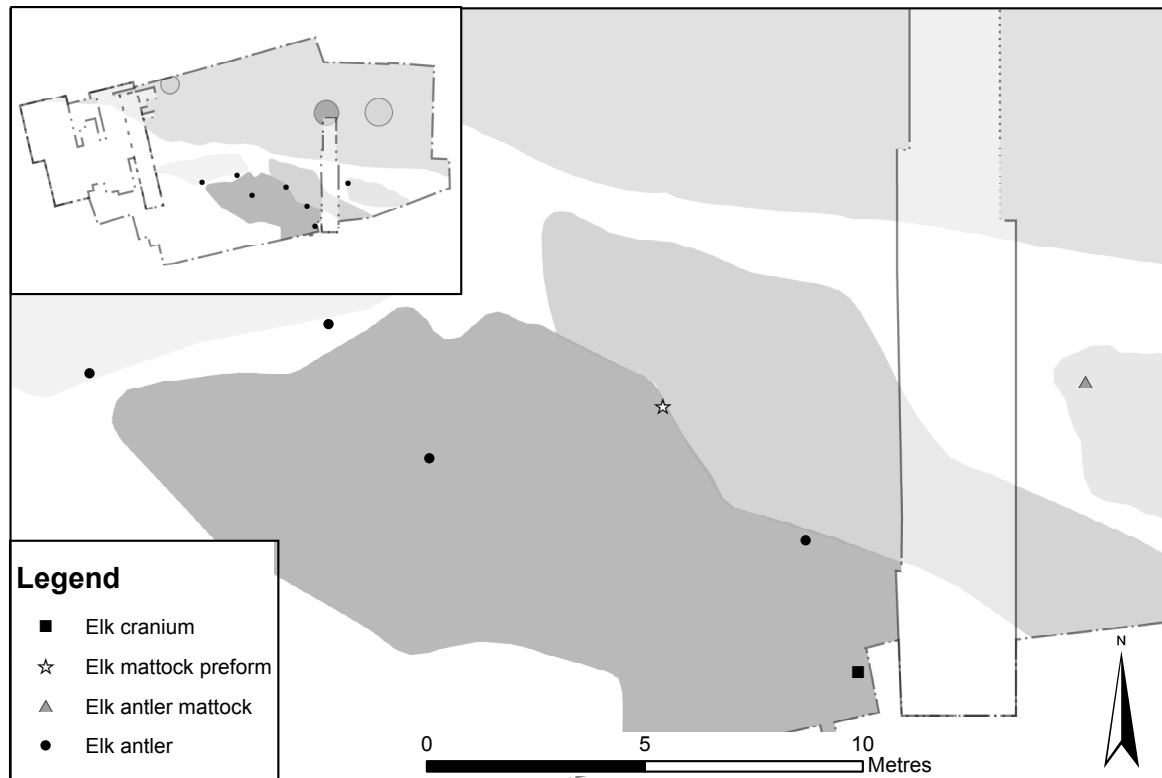


Figure 24.9: Distribution of elk antler across 2004–2015 excavations (Copyright Star Carr Project, CC BY-NC 4.0).

	Clark's backfill	Read peat (312)	Detrital mud (317)
Tine	1	1	0
Palmate portion	0	0	1
Skull with antler attached	0	0	1
Preform	0	1	0
Mattock	0	1	0
?Frontlet?	1	0	0

Table 24.1: Quantities, categories and contexts of elk antler from Star Carr 2004–2015.

although no indication of the methods used to achieve this survive due to localised demineralisation of the piece. The working marks associated with the creation of the working edge are also no longer intact. However, the angled break can be assumed to have been produced using a similar technique to that described by David et al. (2007, 40) for the creation of red deer antler axe and adze working edges. The perforation is larger on the internal aspect (ø32 mm) than on the external aspect (ø27 mm). It is set at an angle of c. 70 degrees to the axis of the piece and as such, when hafted, would have been set on a similar orientation to a modern day mattock (as opposed to an adze). No traces of a haft were found, despite meticulous excavation and the retention of all peat from within the perforation for post-excavation flotation.

In addition to the complete artefact, a possible antler mattock preform was also recovered. This represents a possible roughed out mattock, with the anatomical regions defined through primary working, but no further

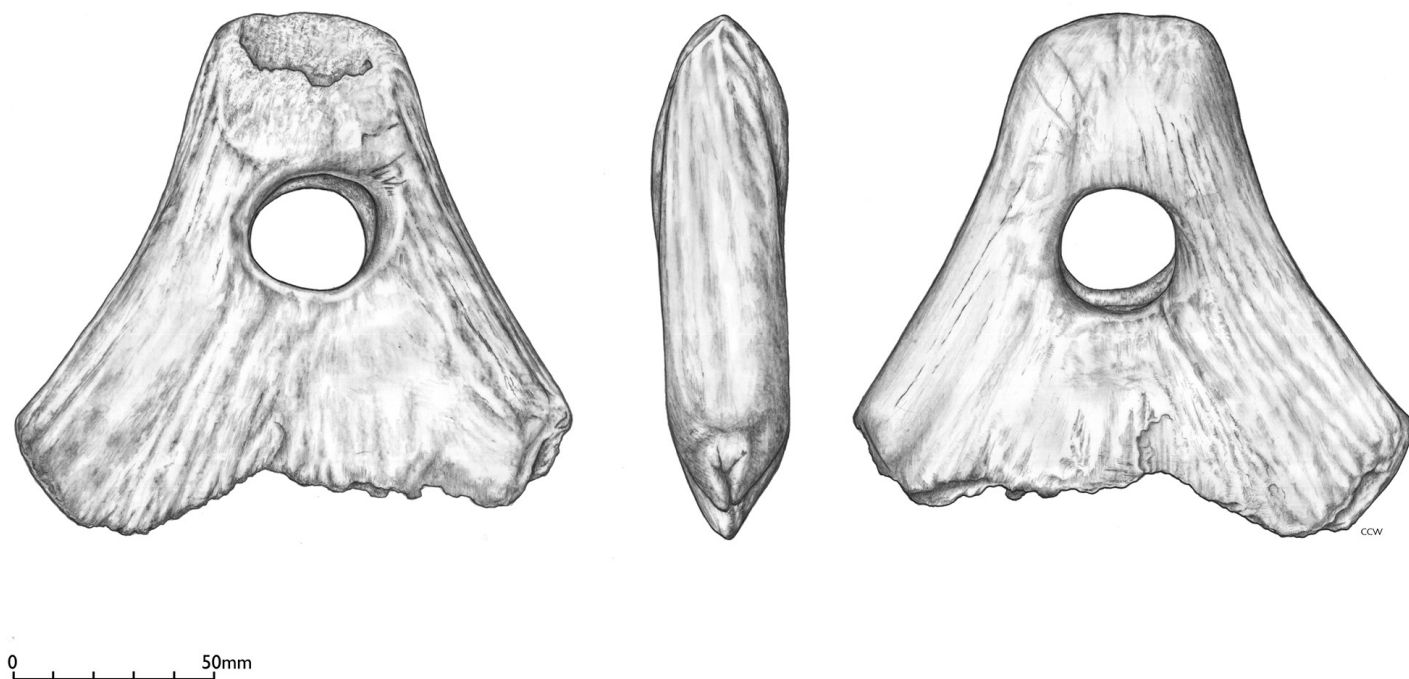


Figure 24.10: Elk antler mattock <113836> (Copyright Chloe Watson, CC BY-NC 4.0).



Figure 24.11: Elk antler mattock <113836> in situ within reed peat deposits (Copyright Star Carr Project, CC BY-NC 4.0).

traces of finishing. This consists of the palmate portion and beam of an elk antler, with the tines removed. There is no trace of a perforation, or an attempt to create one. The preservation conditions of this piece appear to be particularly complex, with white leaching and demineralisation severely affecting the proximal termination of the beam. This is particularly unfortunate as it prevents an assessment of any modification in this area. As such, this piece remains a potential antler mattock preform, having been worked to isolate the portion of elk antler classically used to create Clark's Type 2 mattocks. As to whether or not a working edge had been created before the manufacture was abandoned, and if so how this had been attempted, it is now impossible to say. Unfortunately the condition of the mattock did not permit use-wear analysis.

Interpretation

Clark's original interpretation of the elk antler mattocks was as digging or grubbing tools for the extraction of roots and tubers. He dismissed the idea of them as woodworking tools based on the angle of the perforation which would have placed the haft at an acute angle to the working edge. However, experimental work challenges this. A replica elk antler mattock was manufactured, hafted (without binding) and used successfully in a series of woodworking activities (Figure 24.12). In this instance, the haft was formed of a trimmed piece of birch roundwood. Given their spatial association with the large quantities of worked wood within the wetland areas of the site, their suitability for woodworking should be considered.

The majority of the elk antler mattocks at Star Carr form part of a larger group of artefacts which were deposited into the wetland areas of the site having first been dehafted. <113836> falls into this category, alongside five of Clark's mattocks, the barbed points from the site and a range of flint tools which were hafted and dehafted prior to deposition within the wetlands. The quantities of wood recovered from context 312 demonstrate that wood was capable of preserving in this area of the site, and as such the lack of haft requires a more complex explanation than that originally offered by Clark.

The exception to this pattern of dehafting and disassembly is Clark's EM6—a single example of an elk antler mattock with the carbonised stump of a haft inserted within the perforation. EM6 is worth some further consideration here, as a well-recorded exception to this general rule. Analysis of the original specimen has identified the haft as a piece of unmodified roundwood: this would have been functionally viable as a haft but would not have allowed optimal performance of the tool in woodworking activities (see Chapter 29). The evidence for in situ reed burning across the site means that this burning could have occurred either before deposition or after, whilst the haft was still attached to the mattock head. However, the antler component of the mattock head



shows no sign of burning, even around the perforation itself. This may suggest that whatever the purpose of this particular piece of wood, it was burnt and then inserted into the perforation prior to deposition.

Red deer antler technology and debitage

Clark's analysis of the red deer antler working waste products recovered from Star Carr focussed around an assemblage of 104 loose antlers (that is, either shed or detached from the majority of the frontal bones of the skull and distinct from the frontlet artefacts described in Chapter 26), 94 of which had been modified in some manner. The basic sequence of working identified by Clark involved the initial removal of the crown and tines from a red deer beam, and then the subsequent light scoring of parallel grooves along the length of the beam, aligned with the natural guttering of the antler (Figure 24.13). These grooves cut into the hard outer compactor tissue of the antler. During our experiments it was observed that snapped flint blades became very useful for grooving. Using these tools, grooves are then progressively deepened until the compactor is fully penetrated, the underlying spongy core is exposed, and the intervening strip (or splinter) of antler removed. This rectangular splinter is then further worked into a finished barbed point using the methods discussed above. Experimental work has established that the detached tines played a key role as wedges for the removal of the splinter from the beam (Elliott and Milner 2010). The relative scarcity of removed splinters at the site has been commented on by several authors (Jacobi 1978; Warren 2006; Chatterton 2003), and in lieu of more direct evidence Clark relied on measurements of the removal scars left on the worked antlers to estimate the initial widths and lengths of splinters prior to further working. He noted that these splinters appeared to be much longer than the finished barbed points, and he suggested that individual splinters may have been divided up and used to produce multiple barbed points. This key point renders much of the subsequent discussion of the precise quantities of barbed points produced at Star Carr obsolete (Clark 1954; Mellars and Dark 1998; Price 1982; Mellars 2009), as even a speculative estimate of the numbers of splinters removed at the site does not equate directly to the number of barbed points that may have been produced.

Clark noted that the extent to which individual antlers were worked, in terms of the number of splinters being removed, varied considerably across the assemblage and that this bore no relationship to the mixture of shed ($n=41$) and unshed ($n=65$) antlers.

The 2004–2015 excavations recovered an assemblage of 158 pieces of worked red deer antler (Figure 24.14; Table 24.2). This is distributed across the excavated areas, with organic material being inevitably more likely to survive within wetland areas but with the occasional fragments of dryland antler providing evidence for antlerworking. Stratigraphically, the evidence for antlerworking is distributed throughout the sequence at Star Carr, indicating that this practice persisted throughout the site's occupational history and in a range of environments.

The evidence for the working of red deer antler is extensive, with similar patterns of tine and crown removal being observed, and both beams and tines being grooved and splintered for the removal of blanks for barbed points (Table 24.3). A mixture of prepared breakage and simple percussive breakage appear to have been used to achieve these initial steps, and in a small number of instances individual tines remained attached to the beam when groove-and-splintering began. There is also evidence for the application of the groove-and-splinter technique to tines which have been removed from the parent beam.

The preservation conditions of the assemblage need to be carefully considered when making comparisons between the absolute measurements of finished barbed points, removed splinters and the removal scars on worked antlers. Due to the range of factors affecting the Star Carr assemblage, some pieces of material will have been affected in different ways, with individual finds subjected to flattening, shrinkage and warping to varying degrees. As such, making definitive statements or analyses of the dimensions of these characteristics is problematic. However, the data available from the 2004–2015 assemblage supports Clark's initial observations on a relative basis, with the small number of removed splinters that have been recovered being longer than the intact barbed points and shorter than the length of splinter scars.

Figure 24.12 (page 266): Experimentally reproduced elk antler mattock being used to work wood (Copyright Aimée Little, CC BY-NC 4.0).



Figure 24.13: Stages in the groove-and-splinter process (Photographs taken by Ben Elliott. Sourced from Elliott and Milner 2010. Copyright Cambridge University Press. Reprinted with permission).

Clark's original discussion of Star Carr identified worked tines as a distinct class of artefact. This group included nine red deer tines which had been intentionally detached and further signs of modification towards the tip. These were originally interpreted as hide working tools and soft hammers for knapping. Subsequent discussions of woodworking at the site have cited these artefacts as potential wedges for the splitting of large timbers within the platform structures (Mellars and Dark 1998) and more recently, experimental investigations

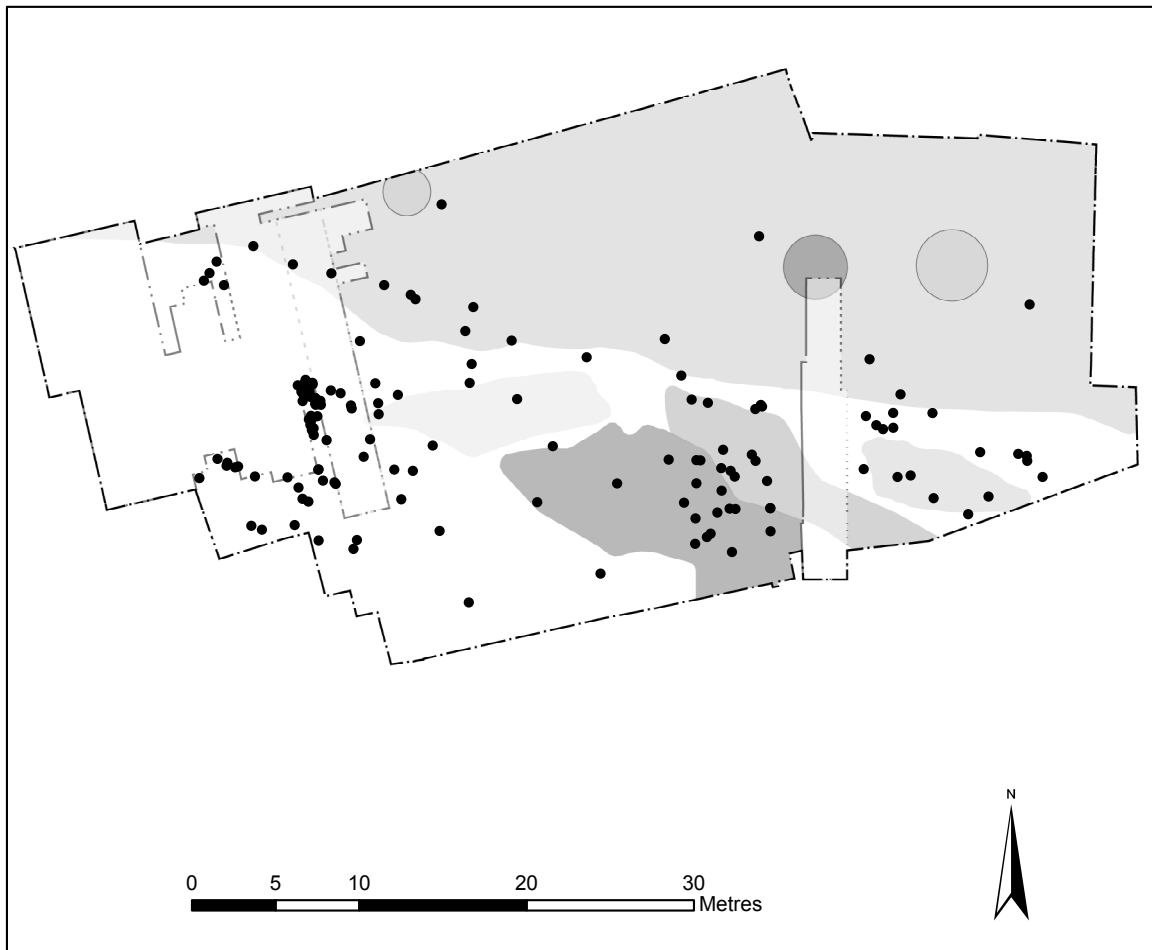


Figure 24.14: Distribution of red deer antler across 2004–2015 excavations (Copyright Star Carr Project, CC BY-NC 4.0).

have demonstrated the utility of removed tines for extracting splinters from a parent beam (Elliott and Milner 2010). As such, the current understanding of these objects is that they can be used in a range of tasks and are a simple but very flexible form of tool. However, Clark neglects to mention the 115 ‘broken-off tines’ which Fraser and King describe within the faunal report. These have been intentionally modified, in their removal from the beam, and their natural form makes them perfectly suitable for use as soft hammers or wedges.

The 2004–2015 excavations recovered 46 removed red deer tines (Table 24.3). Some of these have been reduced via the groove-and-splinter technique ($n=8$), others show signs of modification at the tip in the form of longitudinal scraping ($n=6$, see Figure 24.15) and there are two instances of removed tines on which grooving has been attempted but not completed. Generally, tines were removed from the beams and then, if used, were not further modified. Only in a relatively small number of instances were the tips modified further, and the most substantial modifications were achieved through the original application of the groove-and-splinter technique (presumably whilst still attached to the parent beam), rather than scraping to achieve closer control over the final shape of the tip. Given the naturally high levels of variation which occur in the form of tines, this would tentatively suggest that they were involved in a range of different tasks rather than serving a single function throughout the site’s occupation. However, if these are to be taken as a type of tool, their abundance at the site should be noted, with Clark’s 124, Rowley-Conwy’s three and the 47 recovered from 2004–2010, giving a total of 174 from the site to date.

Context	Deposit	Basal portion	Beam	Crown	Tine	Removed splinter	Compactor	Unidentifiable
35	Reed peat	1	1	2			1	
48	Dryland				1			
83	Wood peat						1	
84	Reed peat				1			
93	Reed peat				1		1	
240	Reed peat		1					
302	Dryland				1		1	
308	Dryland	1			1		7	2
310	Wood peat	3	6		9		11	2
310/ 312	Interface			1				
312	Reed peat	3	21	1	20	3	7	1
317	Detrital mud		6		5		5	
319/320	Interface							
320	Blue sand and cobbles		1					
Backfill	Backfill		6		7	1	14	1

Table 24.2: Categories, quantities and context of antler recovered from Star Carr 2004–2015.

Type	Quantity	Shed	Unshed	Non-diagnostic	Groove-and-splintered
Basal portion	8	4	4	0	2
Beam	42	10	11	21	29
Crown	4	0	0	4	0
Tine	46	0	0	46	8
Removed splinter	4	0	0	4	4
Compactor	48	0	0	48	4
Unidentifiable	6	0	0	0	0

Table 24.3: Working of red deer antler from Star Carr 2004–2015.

Spatially, the debitage assemblage shows an interesting degree of patterning. Beams (69% of which have had splinters removed) are deposited around the wetland areas of the site, and 64% of all of the beams are deposited into contexts which would have been at least partially submerged at the time of occupation. This may suggest a link between beams and standing water, which the experimental work into the importance of soaking antler during the application of the groove-and-splinter would support (Elliott and Milner 2010). As such, this suggests that antler was soaked for working in the wetland areas and that in the case of the beams this may represent in situ working of antler within the wetlands. The particular association between a concentration of beams amongst the central timber platform and detrital wood scatter, and another smaller scatter around the eastern timber platform, may also suggest use of the platforms to access these wetland areas, within which antlerworking was taking place.



Figure 24.15: Longitudinal striations at tip of removed tines. A) <103643> B) <103648> (Photograph taken by Paul Shields. Copyright University of York, CC BY-NC 4.0).

The presence of compactor fragments within the dryland areas of the site, in particular within the wood peat, may be more attributable to preservation bias, with these deposits being notably drier and so antler more likely to deteriorate into fragments of poorly-preserved compactor. Chronologically, this suggests that antler was still worked in substantial quantities at Star Carr, even after the areas of open water had been succeeded by fen.

In contrast to this, the deposition of removed tines appears focussed around the areas of good preservation such as Clark's area. As discussed in Chapter 26, it seems unlikely that this was an area of in situ frontlet manufacture as the high concentration of bone, antler, flint and wood in this area shows no signs of trampling or other taphonomic processes associated with the movement of people across this area after the deposition of the material. Therefore caution needs to be exerted when interpreting the distribution of the tines, as their presence may be more indicative of more formal, multi-material depositional practices than in situ discard or loss whilst removing and using the tines within the wetland areas of the site.

Conclusions

The analysis presented here reveals some key new findings concerning the ways in which osseous technologies at Star Carr were structured and practised. It has been shown that these excavations have yielded some evidence for the production of bone barbed points at Star Carr, through the identification of blanks made from deer metapodia. However, it has also been noted that the working techniques (originally defined by David and illustrated in Figure 24.1) used to create these blanks were also used alongside much less controlled methods in the general fragmentation of the faunal assemblage, thus suggesting that identifying the presence of these techniques in themselves is not enough to support the assumption that bone artefacts are being produced at a site. The products of this working are also required to confirm a site of production.

This fragmentation of bone often involved material which could have otherwise been used to produce bone barbed point blanks, and this, combined with the comparatively large numbers of antler barbed points in relation to bone (see Chapter 25) and the much higher rate at which red deer antlers were worked via the groove-and-splinter technique, suggests that antler was by far the more preferred material for the production of barbed points at Star Carr. Further to this, the analysis has shown that there is more variation in the ways that individual bone artefacts (both bone barbed points and aurochs chisel tools) were made than has previously been suggested for Star Carr.

The microwear analysis carried out on the elk bone bodkin also marks a major advancement in our understanding of this particular artefact type. Conventionally, bodkins are assumed to have been used in sewing or fastening hide and fabric. However, the analysis presented here suggests that they may have been used to work plant material, possibly in the making or maintaining of baskets. Experimental work carried out as part of this project has also prompted new questions concerning the function of elk antler mattocks, and suggested that they may have been used in woodworking tasks (Chapter 28). Red deer antler axes have long been associated

with woodworking (Jensen 1991; Van Gijn 2007; Van Gijn and Pomstra 2013), but this link for typologically defined elk antler mattocks is novel (Elliott 2014).

In regards to the working of red deer, the spatial data associated with the assemblage allows us to demonstrate that antlerworking was carried out throughout the occupational history of Star Carr and formed an important part of life at the site over multiple centuries. The focussed deposition of worked red deer beams within wetland areas of the site may well be linked to the soaking of antler. The data and analysis presented here confirms the sequence of groove-and-splinter working originally identified by Clark (1954) and further developed by Elliott and Milner (2010), and draws attention to the red deer tines which were removed from the beam as part of this process. These may have been used in a range of different tasks, without requiring further physical modification, and when considered as a group represent the second most numerous organic artefact from Star Carr, behind the barbed points (Chapter 25).