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EXPERIMENTAL BUTCHERY WITH STONE TOOLS: A PRELIMINARY REPORT

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BACKGROUND AND RATIONALE

It has long been recognized that use of stone or metal tools in butchery may leave traces of distinctively different form on bone surfaces (von den Driesch & Boessneck 1975; Binford 1981). Cut marks on animal bones may thus serve as a useful index of the replacement of stone by metal tools, at least in butchery, and as such provide a valuable complement to reliance on surviving metal artefacts with their attendant problems of survival and of distinguishing between symbolic and practical uses of metal (e.g., Greenfield 1999; Isaakidou 2004; Halstead *in press*). While discrimination is relatively straightforward between marks inflicted by modern steel and flint knives, experiments suggest that use of (relatively soft) copper and (exceptionally sharp) obsidian knives poses greater problems of diagnosis (Collins 1987). These problems are particularly acute for the *transition* from stone- to metal-knife butchery, given the likelihood that the earliest metal knives retained an “edge” less well than their modern counterparts, and in regions, such as Crete, where obsidian seems to have been the principal raw material for chipped stone tools through the Neolithic (Conolly 2008) and Bronze Age (D’Annibale 2008; Carter 1998).

A useful approach to resolving potential ambiguities in cut mark morphology is to combine such observations with detailed analysis of cut mark placement: while differences in cut mark morphology reflect the contrasting nature of the cutting edge of stone and metal tools, cut mark placement reflects differences in handling that are in turn products of differences in the size and hafting of the two types of tool (Isaakidou 2004; *in prep.*). Although these suggested differences in cut mark placement can be tested

experimentally in the kitchen, it is arguably particularly important that observations on tool handling, as opposed to cut mark morphology, should be based on experimental use by someone experienced in butchery with a small knife. In addition, previous experiments had encountered significant problems with the accumulation of fat on obsidian edges (Collins 1987) during butchery of shoulders of lamb that had previously been hung in refrigerated conditions. Given that prolonged hanging of fresh carcasses would have been impracticable for much or all of the year in the distant past, it was also considered desirable to conduct experiments with a freshly slaughtered carcass. Butchery with small knives of freshly slaughtered carcasses is commonly practised, *inter alia*, by herders of sheep and goats in Greece. Accordingly, we decided to conduct experimental butchery with stone tools in Greece.

MATERIALS AND METHODS

The support of the John Wymer Bursary helped greatly in purchasing raw materials required for the production of flint and obsidian blades along with two hafted stone axes for the butchery experiment. The flint tools were made from a fine nodular flint from a quarry in Ingham, Suffolk and consisted of five blades and four flakes prepared by Ben Chan and a partially polished hafted axe prepared by John Lord. The obsidian tools were made from Rainbow Obsidian from Oregon, United States and consisted of 11 blades and a flake prepared by Hugo Lamdin-Whymark. A partially polished hafted axe made from Langdale volcanic tuff, prepared by John Lord, was also used. All of the flakes and blades were used unhafted, but – in the interest of safety – were backed prior to use. In the case of flint this was probably unnecessary, but

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the use of unbacked obsidian that involved downward pressure with the palm or fingers against the lateral margin of the blade would probably — given the sharpness of this material — have led to lacerations. The relative scarcity of backing on obsidian blades in the later Neolithic/ Early Bronze Age in the Aegean thus raises intriguing questions about what tasks obsidian tools were used for and how they were gripped during use.

Two young sheep were butchered: a fat lamb 2–3 months old (“Lamb B”), that we purchased, and a second 4–5 months old (“Lamb A”), in poorer condition because of a broken leg, that the owner kindly donated. For reasons of animal welfare, slaughter was carried out with modern knives. The owner of the sheep, Giorgos Kalfoutzos, kindly volunteered to act as butcher and, to make optimum use of his time between attending to his flock, we opted to have the carcasses skinned and gutted in advance (processes in which hands are anyway used more than cutting tools).

Both carcasses were disarticulated by Kalfoutzos and then subjected to more detailed filleting by Gkotsinas, Isaakidou and Tzevelekidi. The process was recorded with still photographs and video, while notes were taken on the sequence of butchery, on which tools were used and by whom, and on Kalfoutzos’ running commentary on the performance of the tools used relative to each other and to modern steel tools. The carcasses were dismembered and filleted principally with chipped stone tools, but both the flint and tuff axes were also used for chopping tasks in the case of Lamb A. To avoid any risk of confusing cut marks from the two types of chipped stone, obsidian only was used in the case of Lamb A and flint only in the case of Lamb B. Thus obsidian was used with the leaner of the two lambs, effectively minimizing the risk of obstructive accumulation of fat on the working edge of obsidian; with the benefit of hindsight, it would have been better to use obsidian on the younger lamb (see below).

Following butchery, the stripped bones of each animal were simmered to facilitate manual removal of adhering soft tissue and were then buried in mesh, inside a walled garden protected from scavengers, to complete the

process of cleaning. This skeletal material has not yet been exhumed or examined for cut marks. The stone tools used at various stages in the experiments were numbered and bagged separately for examination of the degree of edge wear suffered.



Figure 1. Giorgos Kalfoutzos separating ribs from vertebrae using the volcanic tuff ground stone axe.

PRELIMINARY RESULTS

Chipped stone tools of both obsidian and flint were successfully used to cut through muscle in the course of freeing up joints for dismemberment and of filleting meat from the bone. Kalfoutzos commented that the obsidian cut the fresh (“wobbly”) carcass more easily than would a modern steel knife. He found the chipped flint tools less sharp than obsidian, with a tendency for the flint edge to drag slightly at the meat like a finely serrated blade, so that it cut muscle less cleanly (a distinction of probably minimal significance for rustic cuisine!). On the other hand, flint was more resistant than obsidian to contact with bone (he could feel the obsidian edge getting blunt when it touched bone) and was strong enough to cut through cartilage on the sternum. He also found the coarse-grained flint easier to grip than the smooth surface of the obsidian, so that butchery seemed faster with flint, despite the greater sharpness of obsidian. In filleting the

dismembered joints, the obsidian tools rapidly displayed sufficient signs of edge damage that we discarded this meat as potentially unsafe for human consumption (despite the considerable academic importance of testing our concerns!).

The hafted stone axes were used to chop cleanly through the sternum and vertebrae, and to separate the ribs from the vertebrae, of Lamb A. Kalfoutzos commented that the flint axe was the more effective chopping tool, because it was thinner in cross-section, but that both compared favourably with a modern steel cleaver on a fresh carcass. This difference in performance was thus connected primarily with the morphology of the individual axes, rather than with the flint and tuff raw materials *per se*. Attempts to cut through the shaft of the tibia with both axes shattered the bones, though Kalfoutzos believed that a cleaner chop might have been achieved on a cold carcass.

Detailed analysis of cut mark placement must await study of the cleaned skeletal material, but preliminary observations made during butchery suggest that it is difficult to dismember the elbow joint (distal humerus – proximal radius – proximal ulna) with hand-held chipped tools of obsidian and flint, particularly without stripping surrounding muscle. This is consistent with previous suggestions concerning the use of cut mark placement as an aid to discriminating between butchery with stone and metal knives. It also follows that the distinction between dismembering and filleting cuts, reported by Binford from Nunamiut butchery of caribou with steel knives, may be less clear in the case of butchery with chipped stone tools. The obstructive build-up of fat on the edge of obsidian tools, observed in previous experimental butchery of hung carcasses, was *not* encountered in this case with a fresh lean carcass. Although it would have been interesting to examine fat accumulation on obsidian in butchering the younger Lamb A, the generally gracile nature of prehistoric sheep suggests that the leaner animal may have been the more appropriate analogue.

Finally, macroscopic examination of the chipped stone tools used in these experiments with a 10x hand lens offers some information on the degree of edge wear inflicted on obsidian and flint at different stages of

butchery. Initial examination of the edge wear indicates visible edge damage in the form of micro-flakescars along all utilized margins on the obsidian blades. As expected, edge damage is more prevalent on tools used to cut through cartilage than through muscle or where the edge had come into contact with bone, but all tasks, including filleting, produced visible edge damage. In comparison to obsidian, the flint tools exhibited less visible and more discontinuous edge-damage, although all cutting activities did leave some macroscopic trace. There was also less difference between edge-damage caused during filleting and that from cutting through cartilage.

Future analysis will concentrate on the extent and type of edge damage on the utilized tools and the location and characteristics of the cut marks on the two sheep skeletons. It is also planned to replicate these experiments with simple copper and bronze knives.

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EXPERIMENTAL INVESTIGATIONS INTO FLUVIAL MODIFICATION PROCESSES OF THE EARLIER PALAEOLITHIC RECORD

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Re-worked lithic assemblages in open-air settings represent a significant component of the earlier Palaeolithic record. However their derivation creates interpretative difficulties through the loss of primary spatial and environmental associations. Furthermore, preservation of lithic assemblages can vary significantly from one site to another (e.g. contrast the locally re-worked artefacts of the Clacton golf course and the heavily abraded bifaces of the Solent River's terrace assemblages: Singer *et al.* 1973; Ashton & Hosfield 2010). While recent studies have nonetheless emphasized the value of such data (Ashton & Lewis 2002; Ashton & Hosfield 2010), the recognition of post-depositional alteration and its effect on a lithic assemblage is still an important aspect of prehistoric research, especially in the Palaeolithic.

To identify archaeologically detectable variables influencing artefact modification, this project initiated the construction of an electric motor driven 100 litre plastic tumbling barrel with funds from the 2010 John Wymer Bursary (Figure 1). Tumbling barrels are an experimental apparatus commonly used by earth scientists (Lewin & Brewer 2002) to simulate fluvial clast-clast processes rotating a charge of clasts in water, abrading them as they move. While tumbling barrel experiments have been used by archaeologists to explore rates of abrasion before, they have focused on localized contexts (e.g. Grosman *et al.* in press; Gaudzinski *et al.* 2010) of individual assemblages in specific geological contexts while others have focused on the appearance of

singular characteristics such as *arête* width (e.g. Shackley 1975; Hosfield 2001).



Figure 1. The tumbling barrel constructed with funds from the John Wymer Bursary.

The goal of these experiments has been to develop data sets for broader applications by testing the effects of a wider range of variables in detail. Experiments are currently underway on a number of experimentally manufactured core and flake assemblages and handaxe sets. Preliminary results have confirmed a number of typical breakage patterns, scar removals and edge retouch (see Figure 2) seen in other tumbling barrel experiments (Grosman *et al.* in press) and mimicked a number of other characteristics such as scratching and surface sheen seen in archaeological assemblages, such as at Barnham (Ashton 1998) and Caours (pers. obs.). Still, many of these characteristics developed differently dependent on initial artifact dimensions (a, b, c-axis and weight), tumbling time and sediment calibre in non-linear association (Chu in press.).

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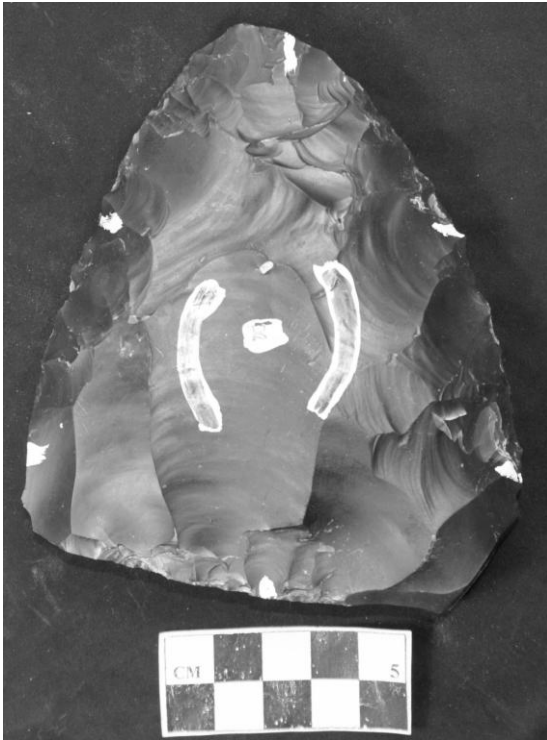


Figure 2. An experimentally manufactured handaxe.

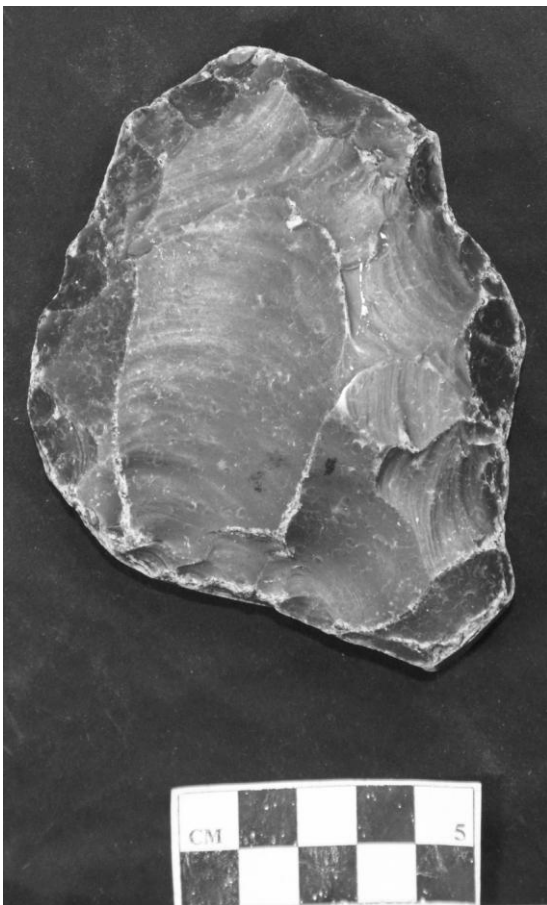


Figure 3. The same handaxe (figure 2) after four hours of tumbling.

More information will be gained as experiments continue and further investigations will consider factors such as flow velocity (barrel speed) and raw material type, as it is likely that they will also influence the type of modifications seen on artefacts. The key goal to these tumbling barrel studies is the application of these data sets to Palaeolithic collections.

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