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Keeping your edge: recent approaches to the organisation of stone artefact technology

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Keeping your edge: recent approaches to the organisation of stone artefact technology

Abstract

The past twenty five years has seen the development of interesting and productive new research avenues and the opening up of new ground in approaches to, and interpretations of, stone artefacts. Far beyond the description, listing and enumeration of artefact types, these developments have focused on the situational variables which structure stone artefact assemblages. Theory articulating stone artefacts with past behaviors has made possible new methods, new ways of seeing, and ultimately, new understandings of a field previously dominated by description. The aim of this volume is to present papers applying recent insights from the organization of technology to the interpretation of stone artefact assemblages from a range of archaeological contexts. Specific attention is paid to the techniques by which people acquired and maintained cutting edge technology, and the situational variables which encouraged them to employ those techniques. The unique strength of this collection is that while the studies are unified by a common goal of understanding prehistoric human behaviour through the organisation of stone artefact technology, they span a substantial geographical and chronological breadth. Given this strength, we hope that this collection of studies is one that can be drawn on for both generally for inspiration and more specifically for methods for the study of flaked stone assemblages from anywhere and anytime in prehistory. In this introductory chapter we highlight the common themes that unite the collection and summarise the key contributions of each chapter.

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KEEPING YOUR EDGE: RECENT APPROACHES TO THE ORGANISATION OF STONE ARTEFACT TECHNOLOGY

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INTRODUCTION

The past twenty five years has seen the development of interesting and productive new research avenues and the opening up of new ground in approaches to, and interpretations of, stone artefacts. Far beyond the description, listing and enumeration of artefact types, these developments have focused on the situational variables which structure stone artefact assemblages. Theory articulating stone artefacts with past behaviors has made possible new methods, new ways of seeing, and ultimately, new understandings of a field previously dominated by description.

The aim of this volume is to present papers applying recent insights from the organization of technology to the interpretation of stone artefact assemblages from a range of archaeological contexts. Specific attention is paid to the techniques by which people acquired and maintained cutting edge technology, and the situational variables which encouraged them to employ those techniques. The unique strength of this collection is that while the studies are unified by a common goal of understanding prehistoric human behaviour through the organisation of stone artefact technology, they span a substantial geographical and chronological breadth. Given this strength, we hope that this collection of studies is one that can be drawn on for both generally for inspiration and more specifically for methods for the study of flaked stone assemblages from anywhere and anytime in prehistory. In this introductory chapter we highlight the common themes that unite the collection and summarise the key contributions of each chapter.

EDGES

The overarching theme of the edge has two meanings for this collection. The first meaning concerns the margin of a stone artefact that is used to do work such as cutting, chopping or sawing. Quantitative analysis of this specific edge and how it was created and maintained is a key attribute that many of the papers in this volume have in common. The paper that is perhaps the best example of this focus on the artefact's working edge is that of Connell and Clarkson. They examined user-wear, residues and the retouched edge morphology of stone scrapers from two mid to late-Holocene sites in the eastern Victoria River Region of the Northern Territory,

Australia. Connell and Clarkson find a relationship between the intensity of reduction of an artefact and the function of the artefact. For example, artefacts with traces of bone working are typically more reduced than those used for plant processing. In this study, Connell and Clarkson contrast optimality in tool use with optimality in tool management – that is, whether people used tools in the most optimal way (eg., transporting multiple tools in various states of reduction), requiring transportation of multiple tools, or whether they managed tools in the most optimal way (eg., transporting fewer items), requiring some inefficiency in tool use. In the assemblages they examine they found that tool use is optimised, but they suggest these two models may operate as alternative strategies depending on the availability of tools, the transported supply, and the demand for fresh working edges and the type of work to be performed.

The second meaning of 'edge' refers to the forefront of research at which the papers collected here are situated. We believe that the stone artefact research collected in this volume is at the leading edge of research in the regions they cover. While all of the papers here are innovative, to highlight a selection of them we follow the Oxford English Dictionary in making a subtle distinction here between the 'cutting edge' and 'bleeding edge' in our introduction to the papers. Cutting edge refers to the latest or most advanced stage in the development of a scientific field while bleeding edge implies the forefront of innovation in a scientific field with an emphasis on its experimental and risky qualities and unproven viability.

We consider that the chapters by Reepmeyer *et al.* and Ferris and Andrefsky to be bleeding edge research. Reepmeyer *et al.* is a particularly good example of an experimental and unproven contribution. They use social network analysis methods to assess the degree of relation between settlements and hierarchicality of settlement structure for the Linear Bandkeramik (LBK) of western Germany. Social network analysis consists of a group of quantitative methods for identifying, describing and visualising relationships between social groups. This kind of analysis is in wide use in the social sciences, but has seen limited application in archaeology (Graham, 2007). For Reepmeyer *et al.* the inputs into the social network methods are counts of different categories of flaked stone artefacts at 13 LBK sites. They interpret the results in terms of how raw material exchange patterns shift over time, concluding that centres of influence have shifted in

ways that are not predicted by prevailing models of linear expansion of LBK settlement in this region. Reepmeyer *et al.* note that their findings are ‘highly speculative’, and this is one of the qualities of this paper, combined with its innovative and experimental combination of social network methods and flaked stone artefact data in their chapter, that qualify it as bleeding edge research in our opinion.

Ferris and Andrefsky’s experimental study on the effects of flake transport is perhaps a more obvious example of bleeding edge work with its use of experimentation as a tool for generating knowledge. They conducted experiments to determine differences between artefact edge damage caused by artefact contact during transport and edge damage caused by deliberate use of the tools for sawing and whittling. They found distinct differences in the size of the damage scars and the patterns of distribution on the flake’s edge. Ferris and Andrefsky then consider the data from Lake Paulina, central Oregon, USA to which material had been transported over distances of between 250 km and 10 km. They conclude that the archaeological flakes show edge damage patterns that are significantly different from both the experimentally transported and used flakes, suggesting instead that post-depositional processes may be responsible. The key implication of this work is that edge damage on artefacts can come from a variety of processes unrelated to use. Ferris and Andrefsky’s study emphasizes that careful work is required to be confident of inferences relating to artefact function.

Examples of cutting edge work in this volume include Hiscock and Attenbrow’s quantitative analysis of flake retouching at Capertee 3, western Sydney, Australia. Their main findings are that changes in stone artefact technology over the last 8000 years at this site are most robustly described by an analysis of macroscopic conchoidal scar form and superimposition on retouched flakes. Hiscock and Attenbrow contrast their approach and results with previously popular models of technological change in prehistoric Australia. These earlier models create typologies based on the overall shape and size of the artefact, describing typological changes over time as if they were a succession of broad homogenous stages and explaining these successions as a result of migration or diffusion. In our view it is clear that in this chapter Hiscock and Attenbrow have provided a well worked out and persuasive alternative to the culture-historical and typological approaches to studying prehistoric stone artefacts in Australia. In this sense, their work is cutting edge because it represents an advancement in the development of scientific methods for study of archaeology in the Australian region. Hiscock and Attenbrow have been active at this cutting edge for over a decade and have influenced numerous archaeologists in Australia and elsewhere with their approach. We expect that future work will fill in the details of the explanation of the causes of the complex and continuous changes in Australian stone artefact assemblages, which are alluded to by Hiscock and Attenbrow here as resulting from adaptation to risk.

Another example of cutting edge work is Nejman’s chapter on forager mobility at four sites in southern Moravia during the Middle-Upper Palaeolithic transition. He uses well-established and robust techniques to measure artifact retouch and interprets the data using conventional technological provisioning models. The innovation in this work comes from the challenge it presents to prevailing notions of a historical progression of lithic industries in central European archaeology. Instead, Nejman claims that the assemblages mostly likely reflect variations in mobility patterns and home range sizes. The implication of this is that modern humans and Neanderthals appear to have used similar strategies to exploit the landscape. Although further work on identifying the exact hominid affiliation and timing of the assemblages is necessary, Nejman’s work suggests that slight differences in mobility behaviours between the two species may be relevant in explaining the extinction of Neanderthals in central Europe.

RISKS

A second theme that is prominent in this collection is risk. Although this concept has received extensive treatment in archaeological literature and has a variety of definitions, most of the papers in this collection define risk as both the probability of a negative outcome occurring as well as the severity or magnitude of that outcome. Four of the papers in this collection engage with risk in a direct and substantial way.

Faulkner analyses Holocene-aged flaked stone artefacts from surface sites at Willandra Lakes in semi-arid western New South Wales to investigate risk reducing behaviours employed by prehistoric foragers. The region has a low density of stone suitable for flaking and scarce resources such as water, resulting in a relatively high risk of failure. A particularly interesting observation in these data is that risk minimising behaviours appear to have been concentrated on cores rather than flakes. Flakes were not retouched frequently or extensively. Cores, on the other hand, tended to be small, square-shaped and with little remaining cortex, suggesting they were worked to maximize flake production. Faulkner concludes that people were optimising tool-making (or edge-making) potential rather than the use-life of tools. This is a valuable insight because much of the literature on risk and stone artefacts tends to emphasise curation of retouched flaked. In Faulkner’s work we see that prehistoric risk management can also be identified on cores and the production of high numbers of usable and simple but standardised flakes.

Similarly, Cropper claims that the rise and decline of the distinctive naviform cores of the Neolithic Levant can be explained as part of a risk minimisation strategy. Naviform cores are a paradigmatic risk-reducing technology: they were mass produced from high-quality flint in workshops by specialists to improve standardisation, they were cached to insure against shortages and they were used to produce systematic flakes for sickles that were

later recycled into projectile points. Cropper claims that the prevalence of the naviform was a risk minimisation strategy adopted during a transitional period in the Neolithic economy. They became abundant as domesticated cereals became popular, and faded as domesticated animals and pastoralism were integrated into the subsistence economy, diminishing the importance of the harvest and the hunt. The rise of pastoralism can be considered another kind of risk reducing behaviour, such that the burden of subsistence risk management was transferred by Neolithic people from their stone artefact technology to their animal husbandry strategy.

While Faulkner and Cropper deal with risk at a general level of subsistence and technological organisation, Turner takes a finer-grained approach using experiments to investigating the risks of failure at specific stages in the manufacture of Maori stone adzes in prehistoric New Zealand. Turner's detailed description of her experiments provides insights into points of failure during adze making that help explain patterns in the archaeological record. For example, large adzes – used to make timber canoes crucial for hunting and travel – were mostly manufactured at quarries because of the high cost of transporting a large mass of stone and the unpredictable flaking properties of the raw material. Turner makes an interesting comparison between adzes from New Zealand and Pitcairn Island, noting that lower adze manufacturing costs but higher risks surrounding canoe technology might explain the dominance of adzes reworked into a specialised range of narrow-bladed gouges and chisels of various sizes and designs on Pitcairn compared to New Zealand where the larger types are more common.

MODELS

The final theme that we believe unifies this collection is that of using explicit models of the past as an explanation of the material traces of past behaviours. Models are explanatory narratives that include simple generalisations about how interactions between different parts of a system occur (Craver, 2006; Winterhalder, 2002). Choosing a method of explanation has received little attention in recent archaeological literature, with the exception of Foeglin (2007: 609) who notes that archaeologists 'employ inference to the best explanation almost constantly with little thought about the system of reasoning they are engaging.' Although inference to the best explanation has robust status in the pantheon of explanatory approaches curated by philosophers of science, recent work indicates that the weight of criticism that has accumulated has diminished its status and instead model-based explanation has become prominent (Craver, 2006; Giere, 2004).

One example of this approach is in the chapter by Doelman and Holdaway who analyse standardisation in the shape and size of tula adzes in surface sites at four locations in western New South Wales. They review ethnographic and archaeological data on the production of tula adzes and devise a model that predicts that adze

design is constrained by selection of flake blanks and functional requirements. Their empirical analysis finds their predictions to be reliable; design constraints are evident even on the highly retouched adzes. They state that less variation occurred in adze width and thickness than in platform dimensions. Doelman and Holdaway claim that this likely reflects constraints imposed by hafting and blank selection. The relatively high variability in platform dimensions suggests that core properties were less important in constraining adze discard size and shape. This study is a straightforward example of how a narrative of generalisations about the system, in this case a system of adze manufacture and use, has been compiled from previous work and tested on new data.

Perhaps the most explicit example of model-based explanation in this volume is found in Mackay and Marwick. They investigate technological costs and climate change at three late Pleistocene sites in southern Africa. Two aspects of the use of models in this study are noteworthy. First is that the relationship between time spent on stone artefact technology and foraging variables is modelled with a mathematical function in addition to a basic narrative. They find that the von Bertalanffy function is useful for modelling costs of hunter-gatherer technology under conditions of varying resource returns. The second interesting result is that when the predictions of the model are tested with data from three late Pleistocene sites in the Western Cape of South Africa, there is a relatively poor match between the predictions and the data. This leads to a modification of the model to incorporate a new idea that during conditions of extreme cold, foragers may have switched from optimising time spent foraging to optimising the number of encounters with prey. In this respect we echo Box and Draper's (1987: 424) observation that 'all models are wrong, but some are useful', since the predictive failures of this model lead to novel and unexpected insights.

CONCLUSION

This collection of papers represents a selection of novel and substantial work on stone artefact technology that spans a wide geographical and chronological range. Our hope is that the papers in this volume will inspire continued innovative research at the intersection of stone artefact technology, risk analysis and model building and evaluation. Our view is that these concepts are a productive source of tools for future research into prehistoric stone artefact technology.

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