CHAPTER FOUR

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Published in 2005:
South African Archaeological Bulletin 60: 115-120
(page numbers below reflect publication page numbers)

A METHOD FOR IDENTIFYING STONE AGE HUNTING TOOLS

Field and Technical Report

A METHOD FOR IDENTIFYING STONE AGE HUNTING TOOLS

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(Received July 2005. Accepted September 2005)

INTRODUCTION

Archaeological stone tools are often broken. Most such pieces are only counted for the record, but seldom contribute to the interpretation of Stone Age assemblages or hunter-gatherer behaviour. Yet, these tool fragments may provide interesting new data. Many fractures no doubt resulted accidentally, because they were walked on by Stone Age people, broken during knapping or excavation, or even trampled by animals, but some fractures are the result of use (Barton & Bergman 1982; Bergman & Newcomer 1983; Fisher *et al.* 1984). The identification of fracture types can be used to establish the possible hunting function of hafted stone tools. Breaks resulting from impact-use often present certain traits that distinguish them from fractures caused under other circumstances (Fisher *et al.* 1984; Geneste & Plisson 1993). Fisher *et al.* (1984) performed experiments to isolate and define fracture types that could be considered diagnostic for impact-use. Such diagnostic impact fractures could not have occurred in any other way than through forceful longitudinal collisions with other objects.

MACRO-FRACTURE ANALYSIS

In the Fisher *et al.* (1984) experiments, replicated arrows were shot with a bow into animal carcasses, and replicated spears were thrown at similar targets. Two quite different types of points with a wide range of edge shapes, varying from sharply pointed to transverse, were used. The morphology of the points did not seem to affect the fracture types. Diagnostic impact fractures were found on 40% of the arrowheads and 55% of the points that were used as tips for throwing spears. A large number of prehistoric flint points from different sites, and of different age, size and shape also displayed diagnostic impact fractures, thereby suggesting that the defined characteristics of impact function are universal for points of flint and related raw materials – irrespective of tool morphology and hafting methods. Odell & Cowan (1986) obtained similar results on chert, whereas Shea (1988) identified impact wear on Levallois blades, triangular flakes and pointed blades, confirming that morphology does not influence fracture types. Experiments conducted with local (South African) raw materials demonstrated that stones of various grain sizes such as hornfels, quartzite, chert and mudstone, also develop diagnostic impact fractures when used for hunting purposes (Lombard *et al.* 2004).

During macro-fracture analysis, consideration should be given to the morphology of the pieces, and whether the tools could have been used for other impact functions such as chopping (Fisher *et al.* 1984). It should also be noted that in the moment of detachment, flakes manufactured using the bipolar technique are exposed to forces very similar to those that the tips of hunting tools are exposed to. This may cause difficulty in the functional interpretation of such artefacts. Odell & Cowan (1986) addressed this problem, and established the major differences between use-impact fractures and accidental bipolar knapping fractures. The most important being that the location of bipolar damage coincides with other knapping characteristics, indicating the location of primary removal forces. Normally these traces are not located along the distal ends of the piece, and are not in association with a usable sharp tip or edge that could conceivably have functioned as the business end of a hunting tool.

Although other fracture types such as snap fractures or feather terminating fractures are common on experimental impact tools, I suggest using only diagnostic impact fractures as analytical criteria following Fisher *et al.* (1984). To further narrow down the margin of error, diagnostic impact fractures occurring in close association with knapping characteristics such as striking platforms, ripples and bulbs of percussion should preferably not be included in the data. This stringent approach provides the minimum number of artefacts that were used as impact tools in the sample.

The following definitions are used to identify the four diagnostic impact fracture types:

Step terminating bending fracture (Fig. 1a): a bending initiation fracture which before meeting the opposite surface of the specimen runs parallel to this surface, and which thereafter makes a sharp 90° step to meet the surface at a right angle (Fisher *et al.* 1984).

Spin-off fracture >6 mm (Fig. 1b): cone or other fracture types that initiates from a bending fracture, such as a snap fracture, and which removes parts longer than 6 mm of the original surface of the specimen (Fisher *et al.* 1984; Lombard *et al.* 2004). Although Fisher *et al.* (1984) indicate that for small transverse points spin-off fractures of only 1 mm in length may be diagnostic, I use 6 mm so as to be sure that the fracture could not have happened by any other means such as trampling (see McBrearty *et al.* 1998).

Bifacial spin-off fractures (Fig. 1d): cone or other fracture types that initiate from the same bending fracture removing parts of both surfaces irrespective of the dimensions of the spin-off fractures (Fisher *et al.* 1984; Lombard *et al.* 2004).

Impact burination (Fig. 1c): fracture resembling a burin blow occurring along either one of the lateral edges, lacking the negative bulb of percussion common to deliberate burination (Barton & Bergman 1982; Bergman & Newcomer 1983; Lombard *et al.* 2004).

For further definitions of fracture termination types the reader is referred to the report of the Ho-Ho Committee presented at the Vancouver Use-wear Conference (1979), and to Fisher *et al.* (1984) for more illustrations and discussions of diagnostic impact fractures.

The basic methodology of macro-fracture analysis is relatively uncomplicated, cost- and time-effective, and thus suitable for the processing of large samples and the development of student projects. A hand lens can be used to identify very small fractures, and although access to a low-power microscope with camera attachment or a scanning electron microscope facilitates photographic recording, these are not essential

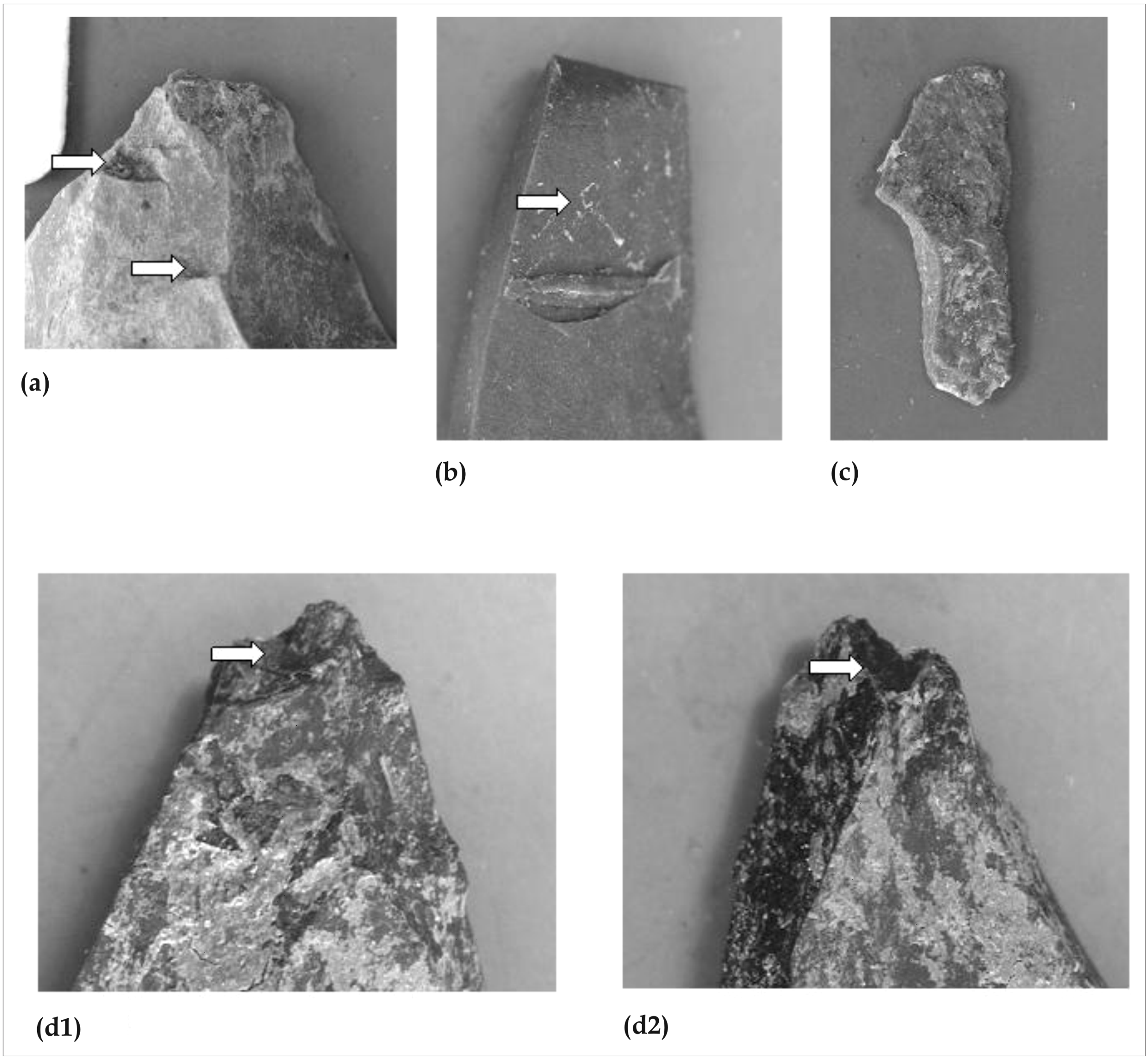

FIG. 1. *Some diagnostic impact fractures on stone points used in hunting experiments.* (**a**) *The arrows indicate two step terminating fractures;* (**b**) *the arrow indicates the surface of a large spin off fracture,* (**c**) *the proximal fragment of an impact burination;* (**d1** *and* **d2**) *the ventral and dorsal sides of the same point with small spin off fractures.*

for analysis. More experimental projects – also ideal for students – are needed to address specific variables such as raw material, the effect of velocity and force, potential differences in spear versus bow-and-arrow hunting and the distribution patterns of fracture types in greater detail. The approach is fitting for the analysis of existing archaeological stone tool samples as no special handling or curational processes are required. The derived data can be used as an indicator of the possible hunting function of stone tools. However, it should be noted that no single approach is conclusive, and where possible, additional strands of evidence should be investigated to strengthen arguments. For instance, stimulating advances have been made towards multi-analytical approaches in functional studies, incorporating usewear and residue analyses, resulting in more detailed functional information, and thus escalating the validity of technological and behavioural inferences (Kay 1996; Hardy & Garufi 1998; Shea *et at.* 2001; Hardy 2004; Lombard 2004; Rots & Williamson 2004; Lombard 2005).

AN EXAMPLE AND INITIAL COMPARISONS

Although I want to emphasize the value of this method for both LSA and MSA research, I use as an example the results obtained from a macro-fracture analysis performed on Howiesons Poort backed tools from Klasies River Cave 2. Based on the resemblance between Howiesons Poort (about 70 000–60 000 ago) backed artefacts and more recent mid-Holocene and ethnographic hunter-gatherer backed tools, Howiesons Poort geometrics are often assumed to have the same function as LSA tools, i.e. to arm hunting weapons (Deacon 1989; Mitchell 2002). Examples of such more recent hunting weapons are represented by a bone point with multiple backed tools inserted along its laterals from the Mesolithic in Denmark (Chard 1969), Mesolithic arrows from Sweden (Clark 1967), Egyptian Pre-dynastic or Early Dynastic arrows (Clark *et al.* 1974), and Bushman arrowheads from South Africa (Clark 1959, 1977).

Far-reaching behavioural hypotheses concerning the origins of human modernity (Deacon 1989; Deacon & Shuurman

TABLE 1. *Comparative data with European data adapted from Fisher et al. (1984).*

Site	No. of analysed tools	No. of tools with diagnostic impact fractures	% of tools with diagnostic impact fractures
South African sites			
Klasies River Cave 2	85	18	21%
Sibudu Cave	50	21	42%
European sites			
Ommelshoved	110	22	10%
Bromme	65	3	5%
Stellmoor, upper level	45	19	42%
Velbro, level 8	24	5	21%
Velbro, level 9	42	2	5%
Praestelyng	57	8	14%
Muldbejerg	30	9	30%

1992; Wurz 1999), symbolic behaviour (Wurz 1999), the *hxaro* delayed gift-giving partnership (Deacon 1992, 1995; Deacon & Wurz 1996), San languages (Deacon 2001) and, controversially, the origins of spirituality (Lewis-Williams & Pearce 2004) have been modelled on the assumption that some backed tools from the Howiesons Poort were hafted as arrow- or spearheads. But, archaeological and ethnographic backed tools were not only used as inserts for hunting tools. There are also instances where they were found hafted as blade components in cutting tools such as flint sickles used by early farmers (Chard 1969), and Australian *taap* knives (Oakley 1958). Wadley & Binneman (1995) reported that some LSA segments from Jubilee Shelter were probably used for the cutting or whittling of vegetal material. The function of backed tools can therefore not be assumed, but needs to be adequately researched. As an initial step towards investigating the use of Howiesons Poort backed tools, macro-fracture analysis was performed on a sample from Klasies River Cave 2.

The analysis conducted on all the backed tools (n = 85) from this site showed that 21% display diagnostic impact fractures. [Detailed results are published elsewhere (Wurz & Lombard, in press)]. The diagnostic impact fractures are mostly in the form of step terminating fractures, but all the other diagnostic impact fractures are also represented (Fig. 2). In keeping with the applied methodology, this percentage can be interpreted as the minimum number of backed tools in the assemblage that functioned as impact or hunting tools. Conceivably only the pieces used as weapon tips would show diagnostic impact fractures, whereas pieces used in other hafting positions, such as barbs, or for other functions, such as cutting blades, may not show such fracturing.

The results obtained for Klasies River Cave 2 compare favourably to other, younger samples from Eurasia such as Velbro level 8, Praestelyng and Muldbejerg that were analysed by Fisher *et al.* (1984) using the same or similar criteria (see Table 1).

These results may indicate that some of the Klasies River tools were possibly used for hunting activities. Most of the comparative data were obtained from European Upper Palaeolithic sites, and the samples all consist of points or transverse artefacts, known to have been used as arrowheads (Fisher *et al.* 1984). Only one similar study has been conducted on post-Howiesons Poort MSA points from Sibudu Cave, KwaZulu-Natal, South Africa. These tools were interpreted to have functioned as spearheads (Lombard *et al.* 2004; Lombard 2005).

The frequency of diagnostic impact fractures is relatively high for the Stellmoor upper level (42%) and Sibudu Cave (42%) samples (Table 1) when compared to the other samples (between 5% and 30%). All discovered points at Stellmoor show non-diagnostic fractures that may well have arisen from their use as projectile tips. Fisher *et al.* (1984) interpret this as the possibility that all the points from the upper layer at the site represent used arrowheads. This interpretation gains credibility if the frequencies of diagnostic impact fractures are compared to the experimental work where all analysed pieces were used as hunting tools. Fisher *et al.* (1984) obtained 40% for arrows delivered with bows and 55% for spears thrown from a short distance. Lombard *et al.* (2004) obtained 57% for spears thrust and thrown into carcass portions. It is thus possible that diagnostic impact fractures develop more frequently on hand delivered spearheads than on arrowheads, explaining the high frequency of points from Sibudu Cave with diagnostic impact fractures. However, no distinction could yet be made between macro-fracture types that resulted on stone tools from being used as spearheads or those documented on tools used as arrowheads (Fisher *et al.* 1984; Lombard *et al.* 2004). Therefore, macro-fracture studies can at present not be used to infer such differences.

The relatively low frequencies of archaeological artefacts – other than those from Stellmoor and Sibudu Cave – with diagnostic impact fractures in comparison with experimental results guided Fisher *et al.* (1984) to the conclusion that a considerable portion of points found at the European sites were possibly not used for hunting. It therefore seems more likely that many of the finished and apparently usable pieces in the examined inventories were never used at all. Arrow or spearheads can be made within a few minutes, while the production of an arrow shaft demands much more time. An obvious explanation may thus be that Stone Age knappers produced a series of appropriate pieces to ensure that they always had some in stock from which weapon tips most suited for the shafts at hand could be made (Fisher *et al.* 1984). This could also have been the case for the Klasies River backed tools. Alternatively some backed tools could have been used for purposes other than tipping hunting weapons, such as barbs or cutting blades in composite knives. Microwear and residue studies may further elucidate these possibilities.

The macro-fracture results for Klasies River Cave 2 can now be incorporated into the behavioural hypotheses based on Howiesons Poort backed tools from this site. Primarily they indicate that the tools were used for mundane subsistence purposes. Thus, if symbolic interpretations are hypothesized additional strands of evidence are needed to support such inferences.

SOME APPLICATIONS FOR LATER STONE AGE AND FUTURE RESEARCH

Ultimately, it will be useful to have macro-fracture data available on LSA material representing most of the industries and regions for comparative purposes. This may inform on changes in hunting, subsistence and related behaviour over time and space during the Holocene and late Pleistocene. Such research has the ability to contribute to most of the key areas highlighted by Mitchell (2005) including:

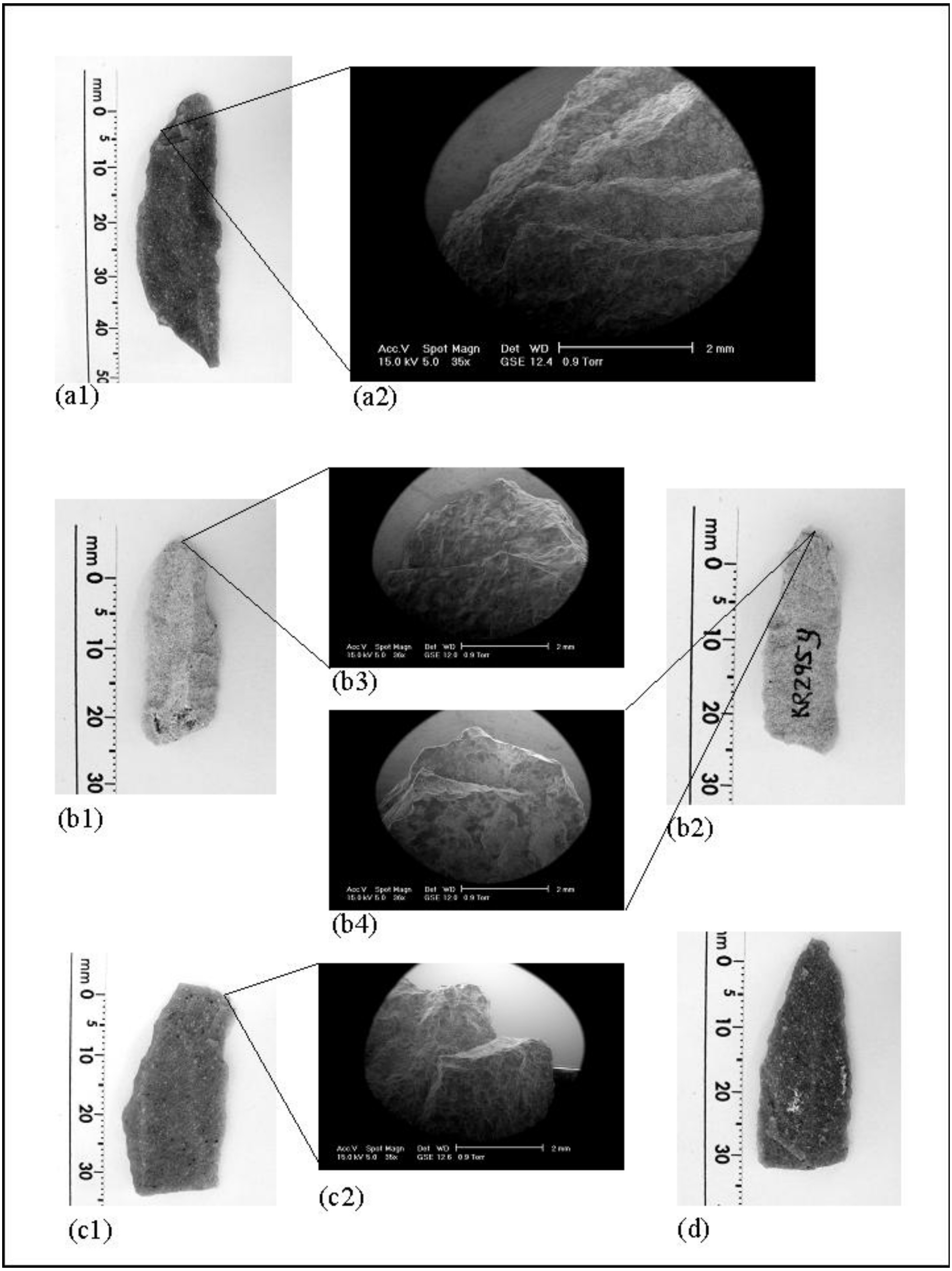

FIG. 2. *Diagnostic impact fractures on backed geometric artefacts from Klasies River×2.* (**a1**) *Artefact with a cluster of step terminating fractures;* (**a2**) *cluster of step terminating fractures at 35× enlargement;* (**b1 & 2**) *artefact with small bifacial spin off fractures;* (**b3**) *step terminating spin off fracture on the dorsal side of the artefact at 36× enlargement;* (**b4**) *step terminating spin off fracture on the ventral side of the artefact at 36× enlargement;* (**c1**) *artefact with small impact burination;* (**c2**) *impact burination fracture at 35× enlargement;* (**d**) *artefact with large unifacial spin off fracture. (Electron scanning micrographs taken with equipment supplied by the Centre of Electron Microscopy, University of KwaZulu-Natal.)*

- The expansion of our anthropological knowledge of recent hunter-gatherer groups, and to situate that knowledge in a broader historical perspective based on archaeological data about hunting behaviour.
- The study of interaction, differences and similarities between hunter-gatherer groups and other socio-economies such as so-called hunter-herders or herders. The first macro-fracture analysis focussing on the function of LSA blades and bladelets is currently being conducted by Isabelle Parsons and myself. This project aims to compare macro-fracture results from two Northern Cape LSA assemblages – Jagt Pan 7, where the tools are thought to have been manufactured by prehistoric hunter-gatherers, and Melkboom 1, an assemblage generally considered to have been manufactured by people owning domestic stock (see Beaumont *et al.* 1995 for a discussion of the Northern Cape Swartkop and Doornfontein Industries).
- The comparison of pan-southern hemisphere hunter-gatherer histories and the uses of material culture in structuring social life and adaptations to environmental variation from an archaeological perspective.
- Closing the 'gulf' that has opened up between the aspirations of LSA (and MSA) archaeologists to discuss and model the social behaviour of the people they study, and their capacity to substantiate or warrant many of those arguments by using the 'excavatable' and 'analysable' record.

Other advanced research questions that may benefit from functional studies include: the process of microlithization and its role in the development of hunting technologies and change in subsistence strategies (e.g. Ambrose 2002; Close 2002; Belfer-Cohen & Goring-Morris 2002; Kuhn 2002; Neeley 2002), or the origins of human hunting and hafting behaviour and its cognitive and evolutionary implications (e.g. Shea 1988; Stringer & Gamble 1993; Crompton 1997; Boëda *et al.* 1999; Klein 2000; McBrearty & Brooks 2000; Ambrose 2001; Barham 2002; Plug 2004; Lombard 2005). The approach also answers Mitchell's (2005) appeal to deliver LSA data with spatio-temporal resolution, and can produce usable data from relatively small sites and samples. And last, but not least, in order to understand the MSA and its behavioural complications we may be advised to return to the LSA archaeological record – especially its earlier industries such as the Robberg – and the functional data that can be derived from those industries. This will enable researchers to build a more secure bridge for functional interpretation, and the associated behavioural hypotheses, than the one currently based almost exclusively on recent San ethnography that is expected to span a 70 000 year gap. Southern Africa, with its continuous Stone Age record, provides the ideal place to conduct such research. Thus, although seemingly able to contribute only in a modest way, functional studies should not be neglected or underestimated in our endeavour to pursue more advanced research questions.

ACKNOWLEDGEMENTS

I want to thank Dr Sarah Wurz for allowing the use of Klasies River Cave 2 results in this article, and Isabelle Parsons and Bronwen van Doornum for comments on an early draft. Environmental Scanning Electron Microscope facilities and technical support for the micrographs were kindly provided by the Centre of Electron Microscopy of the University of KwaZulu-Natal. My research is funded by the Palaeo-Anthropology Scientific Trust and supported by the Natal Museum. Opinions expressed and conclusions arrived at herein are my own and do not necessarily represent the views of the Trust or the Museum.

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