Journal of Archaeological Science 54 (2015) 294–299

Contents lists available at ScienceDirect

Journal of Archaeological Science

journal homepage: http://www.elsevier.com/locate/jas

Focus article

Kathu Pan 1 points and the assemblage-scale, probabilistic approach: a response to Rots and Plisson, “Projectiles and the abuse of the use-wear method in a search for impact”

Jayne Wilkins [a,*], Benjamin J. Schoville [a], Kyle S. Brown [b], Michael Chazan [c]

[a] Institute of Human Origins, School of Human Evolution and Social Change, PO Box 872402, Arizona State University, Tempe, AZ 85287-4101, USA
[b] Department of Archaeology, University of Cape Town, Rondebosch 7701, South Africa
[c] Department of Anthropology, University of Toronto, 19 Russell Street, Toronto, Ontario M5S 2S2, Canada

ARTICLE INFO

Article history:
Received 24 September 2014
Received in revised form
2 December 2014
Accepted 4 December 2014
Available online 13 December 2014

Keywords:
Use-wear
Functional analysis
Lithic analysis
Middle Stone Age
Hunting technology
Spears
Points
Diagnostic impact fractures
Edge damage distribution
Hafting

ABSTRACT

Rots and Plisson (2014) question our conclusion that 500,000-year-old points from Kathu Pan 1, South Africa were used as spear tips (Wilkins et al., 2012). However, their reinterpretation of the fractures we identify as diagnostic impact fractures are incorrect. Despite the assertion, knapping processes alone do not explain the basal modifications on the KP1 points. Although Rots and Plisson are critical of the edge damage distribution method, it provides objective, quantitative and statistical comparisons of experimental and archaeological datasets. The data we present stand as reliable evidence for early hafted hunting technology. We suggest that the disagreement stems from a differing perspective on how lithic functional studies should deal with equifinality and the challenge of confidently assessing stone tool function.

1. Introduction

In a recent article published in the Journal of Archaeological Science, Rots and Plisson (2014) criticize several studies that have applied principles from use-wear analysis for the purpose of addressing significant questions about tool function. Our recent study (Wilkins et al., 2012) received the brunt of the criticism. In that study we used multiple methods to assess the hypothesis that 500-thousand-year-old stone points from Kathu Pan 1 (KP1), South Africa were used as spear tips. All methods, including those independent of use-wear, supported the hypothesis. Rots and Plisson disagree with our findings, using our paper as a straw-man example of ‘the abuse of use-wear’. Here we focus on the specific details about the KP1 points that Rots and Plisson misrepresent or dismiss. Further deficiencies in their logic and arguments with respect to use-wear analysis have been highlighted elsewhere (Lazuén, 2014).

Rots and Plisson's (2014) main point is that lithic analysts should not rely on macrofractures to identify weapon tips; specialized microwear analyses and extensive experimental experience on behalf of the analyst are required to confidently assess stone tool function. Rots and Plisson's (2014) critique of our work is two-fold, resulting from conflicting interpretations about individual macrowear features, as well as conflicting perspectives on methodology. These two critiques are tightly integrated, because methodology necessarily influences interpretation. From the perspective of Rots and Plisson, use-wear analysis is based on analogical reasoning – a use-wear analyst makes functional interpretations of stone tools based on similarities they share with tools in an experimental reference collection. The scale of analysis in their approach is one individual artifact, the life history of which can be complex, and sometimes involve multiple functions. Many of the informative use-traces are microscopic, requiring specialized equipment and

* Corresponding author.
E-mail address: jayne.wilkins@asu.edu (J. Wilkins).

http://dx.doi.org/10.1016/j.jas.2014.12.003
0305-4403/

training to observe. A number of factors influence the presence, shape, size, and distribution of use-wear feature characteristics and not all features are functionally discriminative, so the reliability of the interpretation using this approach depends on multiple factors. These factors include, but are not limited to, the number of wear features on an individual tool that corroborate the same functional interpretation, the size and extensiveness of the reference collection for comparison, and the experience of the analyst.

The approach we applied to the KP1 points is also based on analogical reasoning and comparisons between archaeological and experimental observations, but differs from the approach advocated by Rots and Plisson (2014) in key ways. First, the scale of analysis is an assemblage of stone tools, rather than an individual stone tool. Second, it includes a quantitative consideration of how macroscopic wear features are distributed across the tool (i.e., edge damage distribution). Third, it is probabilistic, in the sense that it makes statistical statements about variation in wear feature characteristics between experimental and archaeological stone tools. Both approaches have their strengths and weaknesses. One strength of the assemblage-scale, probabilistic approach that we applied to the KP1 points is that it permitted us to address the question of function, despite the fact that the relatively coarse-grained, patinated surfaces of the majority of the KP1 points obscured microscopic use features. Furthermore, the approach is grounded in empirically-based research and the methods can be replicated by other researchers.

Specifically, Rots and Plisson (2014) make the following assertions about our functional analysis of the KP1 points: (1) we misidentify "diagnostic impact fractures" (DIFs), (2) DIFs can result from multiple processes, (3) because most of the KP1 points with DIFs only exhibit a single DIF, they were not spear tips, (4) the edge damage distribution method for testing tool function hypotheses is unreliable, (5) knapping processes can create scars on the ventral surface similar to the ones we identify as proximal modifications on the KP1 points, and that (6) an archaeological assemblage with an inferred cutting function is an inappropriate comparative model for our edge damage distribution method. Each of these statements is addressed below within the context of our conflicting interpretations and methodologies.

2. Identification of DIFs

DIFs are features seen in experiments where weapon tips impact animal targets (e.g. Fischer et al., 1984) and their presence is used by archaeologists to identify stone weapon tips (e.g., Barton and Bergman, 1982; Lazuén, 2012; Lombard, 2005a, b, 2007; Villa et al., 2005, Villa et al., 2009a, Villa, et al., 2009b, Villa, et al., 2010). Similar-appearing fractures can result from post-depositional processes, but the frequency within an assemblage is low (Pargeter, 2011a; Sano, 2009). There are four main types of DIFs; step-terminating bending fractures, unifacial spin-offs > 6 mm, bifacial spin-offs, and impact burinations. DIFs are defined based on a combination of their initiation and termination characteristics as established by the Ho Ho Committee (1979), their size, and their location relative to the lateral edge of the tool (i.e., burinations) and other fracture types (i.e., spin-offs). We identified fractures on the KP1 points with these features. Rots and Plisson (2014) argue that we misidentify DIFs based on their assessment of the initiation characteristics visible in our published images and on unpublished assertions about DIF definitions.

The reinterpretations by Rots and Plisson (2014) of the initiation characteristics of the DIFs shown in Wilkins et al. (2012) are incorrect. The fractures in Fig. 2A and B in Wilkins et al. (2012) *do* have bending initiations. There are no negative bulbs of percussion. The tiny snap fracture in 2A and the 'ridge' on 2B that Rots and Plisson (2014) refer to do not obscure the bending initiations. To highlight the features of step-terminating bending fractures, additional examples not published before are presented here in Fig. 1. Despite Rots assertion to the contrary, the burinations depicted in Fig. 2C and D in Wilkins et al. (2012) *do* initiate at the distal point, based on the orientation of undulations and hackles.

Rots and Plisson's (2014) assertion that impact burinations must have step terminations to be considered DIFs is not widely accepted, nor based on published results. The definition employed by Lombard (2005b) states that impact burinations must lack a negative bulb of percussion, but does not refer to a specific kind of termination. Other researchers present examples of hinge-terminating, rather than step-terminating, impact burinations (Barton and Bergman, 1982).

The criticism put forth by Rots and Plisson (2014) demonstrate the limitations of relying on single wear features to interpret stone tool function and to attributing causation to a single scar type. This is a point they themselves make and we are in agreement. That is why DIF presence is merely one method of inquiry we used to assess the function of the KP1 points.

3. DIF causation

We agree with Rots and Plisson (2014) that multiple processes result in fractures that fit the definition of a DIF. In fact, we

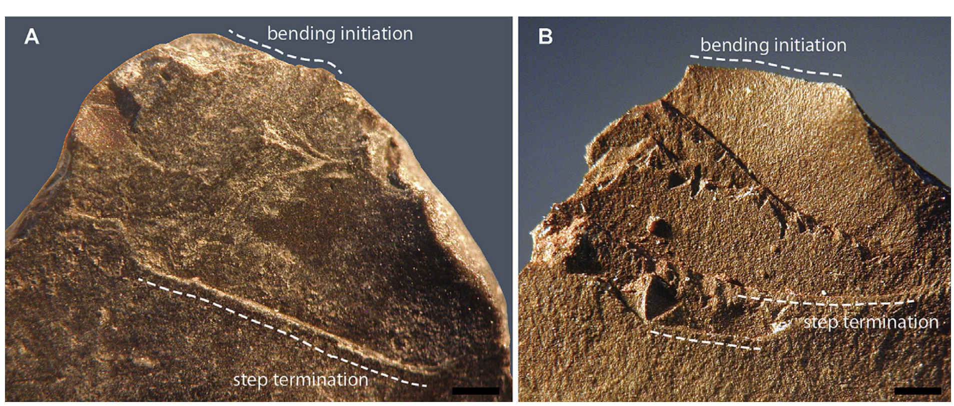

Fig. 1. Examples of DIFs at 12× magnification. (A) DIF at tip of 500 thousand-year-old chert point from KP1 with bending initiation (no negative bulb of percussion) and step termination. (B) Tip of experimental banded ironstone point used in spearing experiment with bending initiation (no negative bulb of percussion) and step termination. Scale bar = 1 mm. Step-terminating bending fractures are one type of diagnostic impact fracture (DIF). DIFs result from multiple processes including taphonomic ones, but develop more frequently on tools used as weapons tips. The KP1 points exhibit a significantly higher DIF frequency than expected if taphonomic processes alone explain their presence.