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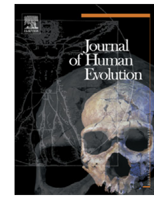

# Coalescence and fragmentation in the late Pleistocene archaeology of southernmost Africa

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ABSTRACT

The later Pleistocene archaeological record of southernmost Africa encompasses several Middle Stone Age industries and the transition to the Later Stone Age. Through this period various signs of complex human behaviour appear episodically, including elaborate lithic technologies, osseous technologies, ornaments, motifs and abstract designs. Here we explore the regional archaeological record using different components of lithic technological systems to track the transmission of cultural information and the extent of population interaction within and between different climatic regions. The data suggest a complex set of coalescent and fragmented relationships between populations in different climate regions through the late Pleistocene, with maximum interaction (coalescence) during MIS 4 and MIS 2, and fragmentation during MIS 5 and MIS 3. Coalescent phases correlate with increases in the frequency of ornaments and other forms of symbolic expression, leading us to suggest that population interaction was a significant driver in their appearance.



## Introduction

The archaeological record of southernmost Africa during the late Pleistocene exhibits a number of atypically early signs of cultural complexity, giving rise to claims that it is one potential point of origin for the emergence of modern human behaviour (Parkington, 2003, 2010; Marean, 2010; though note; Bouzouggar et al., 2007; Bar-Yosef Mayer et al., 2009). Elements of this complexity include the early production of ornaments, motifs and abstract designs, the use of osseous technology, and the manufacture of lithic technologies that later become common in many other parts of the world (Henshilwood and Sealy, 1997; Henshilwood et al., 2001a, 2002, 2004; d'Errico et al., 2005; d'Errico and Henshilwood, 2007; Backwell et al., 2008; d'Errico et al., 2008; Jacobs et al., 2008a; Mackay and Welz, 2008; Henshilwood et al., 2009; Lombard et al., 2010; Mourre et al., 2010; Texier et al., 2010; Henshilwood et al., 2011; d'Errico et al., 2012a; Texier et al., 2013; Vanhaeren et al., 2013). The temporal distribution of many of these markers is variable and apparently non-directional, leading to speculation about the causes of their appearance and disappearance (Jacobs and Roberts, 2009; Powell et al., 2009; Villa et al., 2010; d'Errico and Stringer, 2011; Henshilwood and Dubreuil, 2011; Lombard and Parsons, 2011).

Much of the discussion of late Pleistocene lithic technologies has focused on methods of tool manufacture and the definition of culture-historic units (Volman, 1980; Thackeray, 1989; Wadley and Harper, 1989; Wadley, 1995, 2005; Wurz, 2002; Soriano et al., 2007; Wadley, 2007; Brown et al., 2009; Villa et al., 2009; Mourre et al., 2010; Villa et al., 2010; Brown et al., 2012; Wurz, 2012; Porraz et al., 2013a). Less explicit consideration has been given to the mechanisms underlying lithic technological change across the subcontinent, and more specifically to the causes of patterns of similarity and difference between spatially dispersed sites (Deacon, 1984a; Mitchell, 1988; Ambrose and Lorenz, 1990; Deacon and Wurz, 1996; Ambrose, 2002; McCall, 2007; Jacobs et al., 2008a; Mackay, 2008a; McCall and Thomas, 2012; Faith, 2013; Porraz et al., 2013b). Causes of technological change that have been inferred (either implicitly or in brief discussion) include adaptations to changes in the subsistence environment (Mackay, 2009; Villa et al., 2010; Hiscock et al., 2011; Lombard and Parsons, 2011; Mackay, 2011; Mackay and Marwick, 2011; McCall and Thomas, 2012; Ziegler et al., 2013) and responses to changing social

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stimuli that are adaptively neutral with respect to environmental variation (sometimes called 'fashions') (Volman, 1980; Thackeray, 1989, 2000; Jacobs et al., 2008a). Viewed in extremis these two positions are equally unlikely. The frequent occurrence of similar technologies over large areas with diverse local environments is difficult to reconcile with optimally-adapted systems (Jacobs et al., 2008a); on the other hand, given that lithic technology was a component of human subsistence behaviour for more than two million years, it is unlikely that technological systems were always selectively neutral or maladaptive (though note Boyd and Richerson, 1985). We thus suggest that there were always some socially-mediated dimensions to environmental-mediated technologies and vice versa.

In this paper, we pursue a more nuanced understanding of technological change in late Pleistocene southernmost Africa. The objective is to understand the degree of fit between lithic technological systems and environmental variation through the period from 130 to 12 ka (thousands of years ago), and the extent to which transfer of information between interacting populations influenced the form of technological systems at different times. Changes in the extent of interaction between populations have implications not just for the forms of lithic systems, but also for the appearance of technological complexity, ornaments and other forms of social display. Large, interconnected populations may retain more complex variation in information, and are more likely to pursue signs of social identity through social symbolling than isolated or fragmented populations (Henrich, 2001, 2004; Shennan, 2001; Stiner and Kuhn, 2006; Kuhn and Stiner, 2007; Powell et al., 2009; Henrich, 2010; Sterelny, 2011; Kuhn, 2012; Collard et al., 2013; Derex et al., 2013; Stiner, 2014). Consequently, variation in population interconnectedness through time may help to explain the temporally patchy distribution of behavioural markers (Jacobs and Roberts, 2009).

In this paper we pose the following questions:

1. To what extent are late Pleistocene technological changes in southernmost Africa consistent with the spatio-temporal structure of environmental variation?
2. Is there evidence for the transmission of technological systems between populations?
3. Is the extent of population interconnection variable through the late Pleistocene?

In order to answer these questions, we synthesise data from the archaeological record of southernmost Africa through the period from 130 ka to 12 ka, focussing on patterns of occupation and technological systems in the region's different climatic zones. Before this, however, we introduce the elements of technological variation relevant to the study and present methods for their analysis in terms of technological organisation and information transmission.

## Components of technological variability and information transfer

Numerous schemes exist that divide the late Pleistocene archaeological record of southernmost Africa into a series of sequential units, variously termed cultures, industries or technocomplexes (Goodwin and van Riet Lowe, 1929; Sampson, 1974; Volman, 1980; Deacon, 1984b; Thackeray, 1989; Wadley, 1993; Wurz, 2002; Minichillo, 2005; Lombard et al., 2012). Currently prevalent schemes differentiate nine units in the study period: MSA[1] 2a (Klasies River unit), MSA 2b (Mossel Bay unit), Still Bay, Howiesons Poort, post-Howiesons Poort, late MSA, final MSA, early LSA[2] and Robberg. A range of characteristics are used to distinguish these units, the most common being material selection (the types of rocks chosen for tools), flaking systems (the ways in which those rocks are flaked) and implement types (also referred to as 'tools' where these are defined as morphologically-regular retouched flakes). We examine each of these factors separately, with the addition of a fourth factor, provisioning systems, and suggest that they have different potential for information transfer relative to resource structure, allowing us to differentiate the processes underlying technological change. We also give consideration to the processes underlying the transfer of information between individuals and how these may reflect variability in population interconnectedness.

### *Components of technological variability*

Provisioning systems Rock types do not necessarily occur when and where they are needed to perform tasks. For that reason, stone tool users deployed systems to ensure that adequate tools were always on hand when needed (Kelly, 1988). These are referred to as provisioning systems, and following Kuhn (1995) we differentiate two forms: place provisioning and individual provisioning. Place provisioning involves the transportation of stone to a selected point in space for the manufacture of artefacts (Parry and Kelly, 1987). Place provisioning is a viable system only where extended occupancy of a location can be anticipated, and is thus necessarily tied to resource predictability (Kuhn, 1995). This approach to technological organisation can be identified archaeologically by the accumulation of large assemblages of artefacts through the on-site reduction of transported stone blocks (commonly as cores) and the on-site production of implements (Riel-Salvatore and Barton, 2004).

Individual provisioning, on the other hand, involves the ongoing transport and maintenance of tools that are used to undertake many of the tasks foragers encounter. Heavy reliance on transported tools heightens the risk of tool failure, a risk that can be offset by expedient manufacture and use of implements often from locally-available rocks (Binford, 1979; Kuhn, 1995; Mackay, 2005). Individual provisioning is expected to be emphasised where the spatial and temporal distribution of resources is difficult to predict (Clarkson, 2004). Design constraints on transported tools emphasise portability and maintainability, constraints that are less relevant when place provisioning (Kelly, 1988; Nelson, 1991; Kuhn, 1994). Archaeologically, diminished assemblage size may result from individual provisioning, given a principal focus on implement maintenance and repair (Riel-Salvatore and Barton, 2004). Because the efficacy of different provisioning systems is strongly tied to the spatial and temporal configuration of subsistence resources, these systems cannot readily be transferred between populations in areas without underlying environmental similarities. That is, provisioning systems are always expected to be adaptive responses to local environmental conditions.

Material selection Material selection involves making choices about what rocks to use when making stone artefacts. Different rocks have different flaking characteristics, and thus not all rocks are equivalent with respect either to the kinds of artefacts that can easily be made (Eren et al., 2011a), or the extent to which (and economy with which) they can be used and reduced (Goodyear, 1989; Mackay, 2008a; Braun et al., 2009). Furthermore, different rocks have different distributions, with implications for acquisition costs. In many regions, fine-grained rocks are

[1] MSA = Middle Stone Age.

[2] LSA = Later Stone Age.