Available online at www.sciencedirect.com
SCIENCE DIRECT®
ELSEVIER
Journal of Human Evolution 50 (2006) 359–364
JHE

News and Views

Raw material use and behavioral modernity: Howiesons Poort lithic foraging strategies

Tom Minichillo*

Department of Anthropology, University of Washington, Box 353100 Seattle, WA 98195-3100, USA

Received 19 January 2005; accepted 7 August 2005

Keywords: Middle Stone Age; Lithic technology; Modern human origins

Introduction

In an important early attempt to apply behavioral ecological modeling to lithic resource use and the archaeological record, Ambrose and Lorenz (1990) investigated the problem of the Howiesons Poort sub-stage[1] (HP) in the southern African Middle Stone Age (MSA). In that paper, Ambrose and Lorenz compared general mobility patterns (based on lithic raw material occurrences) to the general environmental setting to reach the conclusion that MSA people behaved in a way that was different from any modern peoples, whether ethnographically or archaeologically characterized. At the time of its writing, this work was used to support the idea that MSA people, during the period of time prior to that which the HP represents, were not behaving in a fully modern fashion.

More recently, Ambrose (2002) revisited the use of raw materials in the HP. Although no longer positing ''non-modern'' behavior, this paper continued to try and explain a pattern of a marked increase of fine-grained raw material use in comparison to other MSA components at Klasies by invoking distant sources for these materials. As Ambrose and Lorenz (1990) is one of only two explicit published models (for the other, see Deacon and Wurz, 1996; Wurz, 1997, 1999, 2000; Deacon and Deacon, 1999) that attempts to explain the HP pattern, one of its basic underlying premises is examined further here.

The assertion that MSA peoples did not behave in ways analogous to modern peoples has special importance in the debate over modern human origins. Several models have been proposed for the timing and nature of this event (McBrearty and Brooks, 2000; Henshilwood and Marean, 2003). In only one of these proposed models, the later upper Pleistocene model (or the neural advance model; Klein, 1995, 1999), is it posited that modern behaviors arose after the HP, and Ambrose and Lorenz (1990) is one of the few empirically based studies that supports that model.

The Howiesons Poort sub-stage

As originally defined by Stapleton and Hewitt (1928, 1929) at the name-bearing site (the Howieson's Poort shelter near Grahamstown, South Africa; Fig. 1), the HP was a ''lithic industry'' of the MSA. Deacon (1995) provided a discussion of the history of excavation at that site and numerous artifact illustrations. Thackeray (1992) provided an overview of HP occurrences and their stratigraphic location within the MSA. She demonstrated that the HP occurs within the MSA sequence and is not a transitional entity between the MSA and the Later Stone Age (LSA), as was once thought (e.g., Binford, 1984). A major HP horizon was identified at the Klasies River cave sites by John Wymer in the 1960s, and it is that published assemblage (Singer and Wymer, 1982) that was utilized by Ambrose and Lorenz (1990) to explore raw material

* Tel.: +1 206 525 7404; fax: +1 206 543 3285.
E-mail address: tminichi@u.washington.edu

[1] I follow Wurz (2002) in the use of technologically defined and temporally discrete sub-stages for the southern African MSA. This causes some spelling oddities in this paper, as Howiesons Poort is given without an apostrophe in that nomenclature, but the site itself was always spelled with an apostrophe by the researchers working there (Stapleton and Hewitt, 1928, 1929; J. Deacon, 1995). I use both here, accepting the modern spelling (or substituting HP following Singer and Wymer, 1982) for the sub-stage but using Howieson's Poort shelter to refer specifically to the original site.

0047-2484/$ - see front matter
doi:10.1016/j.jhevol.2005.08.013

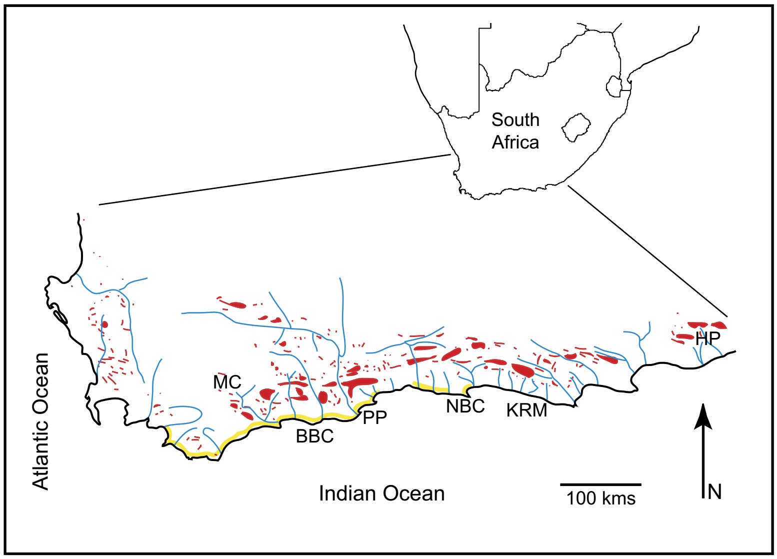

Fig. 1. Map of the southern Cape showing (1) sites discussed in this article: Montagu Cave (MC), Blombos Cave (BBC), Pinnacle Point (PP), Nelson Bay Cave (NBC), Klasies River main site (KRM), and Howieson's Poort shelter (HP); (2) locations of primary silcrete (red); (3) the coastal distribution of the Klein Brak Formation conglomerate-containing Bredasdorp Group (yellow); and (4) the major streams that dissect them (blue). Adapted from Malan (1991) and Roberts (2003).

patterning in this industry. The lithic assemblages from more recent excavations at the Klasies River main site by Hilary J. Deacon's team from Stellenbosch University have been presented by Wurz (1997, 1999, 2000, 2002; Wurz et al., 2003).

That the HP has been the focus of much research is not surprising. Technologically and typologically, the stone tools of the HP contain many elements that are rare or absent in preceding MSA assemblages. These include small blades that grade into bladelets and, most notably, backed pieces. These backed pieces are often larger than those of the LSA, but somewhat smaller than the typical flake and blade tools more common in the MSA (hence the original supposition that they were intermediate between the two). Howiesons Poort knappers had an obvious preference for fine-grained raw materials, such as quartz and silcrete, for manufacturing both the small blades and bladelets and the backed pieces typical of that industry, and it is this preference that provides the basis for Ambrose and Lorenz's increased mobility model. It should be noted that this preference was not exclusive at Klasies River, where the majority of tools continued to be made on quartzites during the HP (Singer and Wymer, 1982). This is also the case for the nearby large HP component at Nelson Bay Cave (Volman, 1981). Howiesons Poort sites also show an increase in the abundance and variety of ochres used for pigments, which is interpreted as increasingly complex symbolic behavior (Watts, 1997, 2002). Dates for the HP have consistently placed it at around 60,000 years ago (Feathers, 2002; Tribolo, 2003), or OIS4, a time of increased aridity and lowered sea levels in southern Africa.

Exotic, not nonlocal

Singer and Wymer (1982) used two terms to describe the fine-grained lithic raw materials that increased in frequency of use during the HP, "exotic" and "nonlocal." These terms were used interchangeably by both Singer and Wymer (1982) and then later by Ambrose and Lorenz (1990). In neither case were these terms explicitly defined and informal use of these terms is common in archaeology.[2] Nonlocal can mean that the raw material occurs naturally at some distance from the site, typically >25 or 50 km, and its presence is used to indicate foraging range, special procurement journeys, or long-distance trade. Exotic is an informal term that means the raw material is locally rare, may be from a great distance away, and its source may be unknown. Singer and Wymer did not know the sources for any of the raw materials that they termed "nonlocal," speculated that they may have had origins in nearby river valleys, and made only a "cursory" attempt at locating them in the vicinity of the caves (1982: 89). No formal raw material survey has been undertaken in the vicinity of the Klasies River sites. In this discussion, what becomes clear is that not knowing the sources of raw materials and then applying a term—"nonlocal"—that implied such knowledge would have unintended consequences when those data were examined later for mobility patterns.

Van Andel (1989) noted that the offshore bedrock geology in the Klasies vicinity could contain many of the fine-grained materials used for tool-making during the MSA and that these would have been exposed during lower sea stands, such as

[2] For example, Gould (1977) used "exotic" for raw material sources >40 km away, and Roth (2000) termed raw materials from >100 km "nonlocal." Kuhn (1995) noted that what archaeologists consider "local" is variable. "There is little consensus regarding the significance of the distances stone tools found in archaeological contexts were moved" (Kuhn, 1995: 27). Blades (1999) suggested that what is meant by "local" should be determined for each archaeological case and determined a distance of >25 km as "nonlocal" for his study. Other analysts forgo the use of these terms entirely and create "natural classes" for each site analyzed (Feblot-Augustins, 1990). Singer and Wymer recognized the inaccuracy of their use of the term "nonlocal" and stated such (1982: 75).

during the HP, and possibly weathered into beach cobbles (Fig. 2). In a very similar geologic setting on the Cape coast, at Pinnacle Point near Mossel Bay, an on-going archaeological program has begun to address these issues (Marean and Nilssen, 2001; Marean et al., 2004; Brown, n.d.). While still in a very early stage, a raw material survey in the vicinity of Pinnacle Point has identified quartzite cobbles and bedrock, quartz seams and cobbles, silcrete in primary geological context and as cobbles in streams and conglomerates, and various cobbles of hornfels, chert, and chalcedony within a 15 km radius of the MSA cave sites.

Silcrete cores from the HP component at Klasies were frequently clearly made on stream or beach cobbles, usually in the 8–12 cm size range (Wurz, personal communication; personal observation of the author). Noting that the "nonlocal" rock occurred in small cobble form, Singer and Wymer (1982: 90) observed that "the knapping of the pebbles of the finer-grained rock appears to have been done entirely on the living sites, as outer flakes of these rocks are commonly found." Silcrete cores from Blombos Cave, from the Still Bay layers, another silcrete-rich sub-stage of the MSA, are also frequently in the form of water-worn cobbles (Soressi and Henshilwood, 2004). At least one example from Blombos is encrusted with marine barnacles on the cortical surface, suggesting that it was recovered from a cobble beach during a sea-level retreat (Soressi, personal communication).

Roberts (2003) recently mapped the occurrence of silcrete in primary geologic context in the southern Cape. Silcretes occur in a near continuous belt along the Cape Fold Mountains, including inland from the Klasies River main site (Fig. 1). Anywhere that this belt is dissected by streams or rivers, the occurrence of silcrete in alluvial gravels is to be expected. Additionally, alluvial gravels containing whatever materials were locally present are incorporated into the Pleistocene-age Klein Brak Formation along much of the southern Cape (Fig. 1) (Malan, 1991). This conglomerate formation is believed to have been deposited during the OIS5e high stand, dating to about 125,000 years ago (Malan, 1991). Locally, the Klein Brak conglomerate is eroded into streams to again become alluvial gravel (Fig. 3). Quartz, the second most common material labeled as "nonlocal" by Ambrose and Lorenz (1990), occurs as seams and cobble inclusions within the Table Mountain Sandstone quartzite that is the parent material of the Klasies River caves (Fig. 4). The observations of all of the researchers working with these assemblages, including Singer and Wymer, are clear: the fine-grained raw materials originated as water-worn cobbles *and* they are being transported to the sites in cobble form. The latter part of this observation is of no small importance. The presence of cobble cortex and primary reduction of cores suggest minimal transport distances for these materials.

Further evidence to support the local nature of the fine-grained raw materials comes from the variability between HP assemblages. As I have noted, the main local sources of fine-grained raw materials in the vicinity of Klasies River and Nelson Bay Cave are in the form of secondary water-borne deposits. At these sites the percentages of HP tools made on fine-grained raw materials, while substantially higher than for other MSA sub-stages, still never exceeds half. In contrast, the HP tools at Montagu Cave, further west, are made almost exclusively on silcrete, which is locally abundant in primary geological formations (Keller, 1973; Volman, 1981). Roberts (2003) mapped especially abundant and dense surface occurrences of silcrete around Grahamstown, the location of the Howieson's Poort shelter, and the HP tools from that site are similarly made almost exclusively on silcrete (Stapleton and Hewitt, 1928, 1929; Deacon, 1995). While the early excavators of the Howieson's Poort shelter selected which artifacts to keep in a biased way, it is likely that any formally retouched tool was kept regardless of its raw material, making the use of those data valid in this context.

Resource and technological intensification

In order to extract more resources from the local environment (a process that archaeologists often refer to as intensification), foragers can expend additional energy in different

Fig. 2. Cobble beach typical of those along the Cape coast, Pinnacle Point, South Africa.

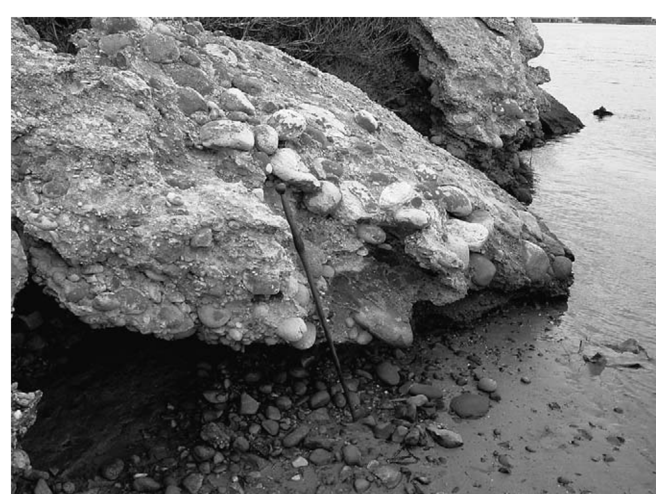

Fig. 3. Conglomerate of the Klein Brak Formation eroding back into alluvial gravel, Klein Brak River, South Africa. Walking stick is approximately one meter.

Fig. 4. Table Mountain Sandstone, the parent material of the Klasies River caves, with quartz cobbles as inclusions. White bar is 10 cm.

ways to accomplish similar goals. It is important to note that all forms of intensification are inherently inefficient—they have a higher unit cost in comparison to what they are an intensification of. Extracting additional prey from the local environment by expanding the regular diet to include increasingly small packages constitutes resource intensification. Another version of resource intensification is the increasingly inefficient extraction of calories from normal prey, such as smashing and boiling the bones of an antelope, increasing handling costs. Increasing the costs of tools in order to mitigate capture and/or handling costs has been referred to as technological intensification (Minichillo, 1999).

Technological intensification can involve increased costs in procuring raw materials for tools or in their manufacture. The HP appears to be an example of both, with increased costs for raw materials and the construction of the complex composite tools, of which the small blades and backed pieces are the preserved parts. In each case, intensification can be measured in travel distance, energy output, or time. I argue here that time is the best measure for technological intensification during the HP.

Time versus distance

The lithic portion of the archaeological record has several characteristics that make it well-suited to economic-based foraging models. These characteristics include: (1) static locations of resources; (2) gradual depletion of resources with no rebound over time (i.e., rocks do not ‘‘grow’’ back if left alone, although new exposures can appear); (3) physical characteristics that can be measured in the present and compared to make ordinal scale rankings; (4) in many cases, knowable sources for individual specimens; (5) near universal use by prehistoric peoples; and (6) in comparison to other artifact classes, much greater preservation in the archaeological record.

The positive aspects of these characteristics have long been recognized in archaeology and have been used to generate models of mobility and exchange [i.e., Binford's (1980) logistic foraging]. While most of these models do not rely on foraging theory formally, many of them have aspects of central place models, with decisions on when to process in the field and when to transport whole raw materials based on measures of distance to source. These types of models, however, can only be applied to lithic resources that occur as primary sources.

The aspects of the lithic record that are most problematic for modeling using foraging theory are threefold. First, there is no set currency for the ‘‘value’’ of a lithic resource. That is, unlike edible resources, there is no caloric or other fitness-enhancing measure that can be easily approximated in most cases. For example, the use of body size as a proxy for prey rank in faunal resources has wide application and a sound theoretical basis (Winterhalder, 1981; Stephens and Krebs, 1986; Broughton, 1994a,b; Grayson and Cannon, 1999). No formal proxy measure of value has been theoretically developed for lithic resources. Second, and closely related to the first point, there is little theoretical basis for linking changes in lithic resource use to changes in subsistence and, ultimately, fitness. An exception to this in foraging theory is found in diet choice models, which must take into account how changes in technology (including lithic technology) affect capture and processing rates, but this is done largely by attempting to hold technology constant (Winterhalder and Goland, 1997). Third, the aspect of the lithic record that I address most directly in this paper is the fact that the majority of the lithic record, in many settings, is produced from locally available or secondarily deposited raw materials. These types of materials are not subject to the sourcing methods applicable to primary source materials. In addition, transport costs are not likely to be significant in resource choice for locally available materials, so central place models tell us little about what costs are involved in the choices of different materials.

As I have noted above, primary lithic resources are often modeled as distance-dependent and have been used frequently to make arguments for foraging range (Binford, 1980), group mobility (Kelly, 1988; Ambrose and Lorenz, 1990; Tankersley, 1991), and long-distance trade. Another type of lithic resource distribution has a different set of characteristics that require a different type of modeling. This type of resource often occurs as a secondary deposit covering a wide area on a local or regional scale and is internally heterogeneous. Secondary resources are common in many ecological settings, occurring as stream and river cobbles, beach cobbles, and aggregate in glacial outwash and till. As these deposits are secondary, sourcing methods fail to pin-point the location from which they were collected. The internal heterogeneity of these resources can be in the form of a small percentage of cobbles of cherts or flints in a field of quartzite, or in some cobbles of the same general material class having a finer grain or other desirable characteristic than the rest of that class (for example some finer-grained quartzite cobbles in a field of quartzite cobbles). As the rate of occurrence of some of the classes of materials in this type of deposit may be very low, it would not be unusual for them to be labeled as ‘‘exotics’’ or even as "nonlocal" when analyzed in the lab by archaeologists. When the source of these materials is correctly identified as being from local deposits of this type, a common practice is to treat them as very low cost, due to a nearest distance determination. I argue that the nature of this type of resource makes them dependent on search-time rather than on distance-traveled measures, and therefore a different type of model from a central place one is required.

The diet breadth (or resource choice) model has many elements that make it attractive for use with local and secondary lithic resources. Rather than review all of the assumptions of this model, which have been well described elsewhere (see Winterhalder and Goland, 1997: 128–134), I focus on those aspects of this model that apply especially to lithic resources. (1) The resource choice model holds that there is a fine-grained random distribution of resources in the local environment (Winterhalder and Goland, 1997). This is true perhaps more so for piles of beach or stream cobble or rocks in glacial till than for any edible resource. (2) Encounter rates are held to be a product of resource density, with search time separate from processing and handling costs. For many lithic resources occurring as cobbles, handling and processing costs can be considered nearly equal, leaving search time as the main cost of capture.

Applying a diet breadth model to the lithic raw materials at Klasies River and other HP occurrences shows a reordering in the ranking applied to them, with the fine-grained materials, primarily silcrete, becoming very highly ranked and for the first time exceeding their local representation in the lithic assemblages. Rather than a by-product of increased foraging ranges, this can be explained fully in the local geological context as increased foraging times. Why this was done is not fully resolved, but in the context of foraging theory, a shift in technology can occur in order to keep the diet the same. There is some evidence to support this interpretation, as the HP is dated to a time of increased aridity and probably declining local prey productivity. Yet there is no evidence for a change in prey species abundance in the faunal record from this time (Klein, 1972, 1975). This interpretation has the added benefit of also explaining why the HP disappeared. When the local climatic conditions improved in the second half of OIS4, the costs of technologies based on increased foraging times outweighed their benefits and they were discontinued.

Conclusions

Time-dependent foraging is a better explanation of the presence of larger quantities of fine-grained raw materials during the HP than increased residential mobility. All of the fine-grained raw materials likely originated from secondary deposits in the local setting of the Klasies River main site. This means that the basic premise for the interpretation of mobility and setting used in Ambrose and Lorenz (1990) is in error. The interpretation of Ambrose and Lorenz (1990)—i.e., that the peoples of the HP employed a foraging strategy that involved a large range and high mobility, relative to prior and subsequent MSA sub-stages—is not supported and the null hypothesis that the purported mobility pattern is somehow "non-modern" can be rejected. Consequently, the patterns of raw material use during the Howiesons Poort sub-stage can no longer be used to support the later upper Pleistocene model for modern human origins.

However, change to a time-dependent model from a distance-dependent model has little or no effect on Deacon and Wurz's (1996) model of reciprocal exchange as a risk-reducing strategy. Increasing the value of artifacts by long-distance transport or by extended foraging times are both compatible with this model. As secondary deposits are, by definition, removed from easily knowable primary sources, the movement of finished HP pieces between groups in the Cape of southern Africa may be impossible to detect in the archaeological record by raw material alone. Additional technological or stylistic analyses may be required.

This does not mean that the movement of raw materials over long distances is unknown in the African MSA. The movement of well-sourced obsidians over >100 km in eastern Africa is well documented (Mehlman, 1977, 1979, 1989, 1991; McBrearty, 1981, 1986, 1988). This mosaic of approaches, of long distance travel and exchange and of local intensification, is the general pattern of at least the second half of the MSA. It is this *pattern*, not any one resource procurement strategy, that is fully modern.

Acknowledgments

I thank Eric A. Smith for discussions and comments on an earlier version of this paper and Kristen J. Gremillion for introducing me to foraging theory. I have benefited greatly from discussions on MSA lithic technology with Angela E. Close, C. Garth Sampson, Marie Soressi, Sarah Wurz, and Royden Yates, none of whom are to blame for anything said here. Two anonymous reviewers provided helpful comments. Access to artifact collections was generously granted by the Albany Museum, Iziko: South African Museum, and the University of Cape Town. My research is supported by the Wenner-Gren Foundation for Anthropological Research Dissertation Fieldwork Grant GR 6894, National Science Foundation Grant BCS-0130713 to Curtis W. Marean, and Student Technology Fee Grant 2004-49 to myself and Phoebe S. Anderson.

References

Ambrose, S.H., 2002. Early microlithic industries in sub-Saharan Africa. In: Elston, R.G., Kuhn, S.L. (Eds.), Thinking Small: Global Perspectives on Microlithization. Archeological Papers of the American Anthropological Association, Number 12. Arlington, Virginia, pp. 9–29.

Ambrose, S.H., Lorenz, K.G., 1990. Social and ecological models for the Middle Stone Age in southern Africa. In: Mellars, P.A. (Ed.), The Emergence of Modern Humans. Edinburgh University Press, Edinburgh, pp. 3–33.

Binford, L.R., 1980. Willow smoke and dogs' tails: hunter-gatherer settlement systems and archaeological site formation. Am. Antiq. 45, 4–20.

Binford, L.R., 1984. Faunal Remains from Klasies River Mouth. Academic Press, New York.

Blades, B.S., 1999. Aurignacian lithic economy and early modern human mobility: new perspectives from classic sites in the Vézère Valley of France. J. Hum. Evol. 37, 91–120.
Broughton, J.M., 1994a. Late Holocene resource intensification in the Sacramento Valley, California: the vertebrate evidence. J. Archaeol. Sci. 21, 501–514.
Broughton, J.M., 1994b. Declines in mammalian foraging efficiency during the late Holocene, San Francisco Bay, California. J. Archaeol. Sci. 13, 371–401.
Brown, K.S., n.d. Middle Stone Age lithics from the 2000 excavations at the Pinnacle Point cave complex, South Africa. Unpublished manuscript on file with the Mossel Bay Archaeology Project, Institute of Human Origins, Tempe.
Deacon, H.J., Deacon, J., 1999. Human Beginnings in South Africa. David Philip, Cape Town.
Deacon, H.J., Wurz, S., 1996. Klasies River main site, Cave 2: A Howiesons Poort occurrence. In: Pwiti, G., Soper, R. (Eds.), Aspects of African Archaeology. University of Zimbabwe Publications, Harare, pp. 213–218.
Deacon, J., 1995. The unsolved mystery at the Howieson's Poort name site. S. Afr. Archaeol. Bull. 162, 110–120.
Feblot-Augustins, J., 1990. Exploitation des matières premières dan l'Acheuléen d'Afrique: perspectives comportementales. Paléo 2, 27–42.
Feathers, J.K., 2002. Luminescence dating in less than ideal conditions: case studies from Klasies River main site and Duinefontein, South Africa. J. Archaeol. Sci. 29, 177–194.
Gould, R., 1977. Puntutjarpa Rockshelter and the Australian Desert Culture. Anthropological Papers, vol. 54. American Museum of Natural History, New York.
Grayson, D.K., Cannon, M.D., 1999. Human paleoecology and foraging theory in the Great Basin. In: Beck, C. (Ed.), Current Models in Great Basin Archaeology. University of Utah Press, Salt Lake City.
Henshilwood, C.S., Marean, C.W., 2003. The origin of modern human behavior: a review and critique of models and test implications. Curr. Anthropol. 44, 627–651.
Keller, C.M., 1973. Montagu Cave in prehistory: a descriptive analysis. University of California Anthropological Records 28, 1–98.
Kelly, R.L., 1988. The three sides of a biface. Am. Antiq. 53, 717–734.
Klein, R.G., 1972. The late Quaternary mammalian fauna of Nelson Bay Cave (Cape Province, South Africa): its implications for megafaunal extinctions and environmental and cultural change. Quat. Res. 2, 135–142.
Klein, R.G., 1975. The mammalian fauna of the Klasies River Mouth Sites, southern Cape Province, South Africa. S. Afr. Archaeol. Bull. 31, 74–98.
Klein, R.G., 1995. Anatomy, behavior, and modern human origins. J. World Prehist. 9, 167–198.
Klein, R.G., 1999. The Human Career: Human Biological and Cultural Origins, second ed. The University of Chicago Press, Chicago.
Kuhn, S.L., 1995. Mousterian Lithic Technology: An Ecological Perspective. Princeton University Press, Princeton.
Malan, J.A., 1991. Lithostratigraphy of the Klein Brak Formation (Bredasdorp group). Lithostratigraphic Series No. 13. South African Committee for Stratigraphy, Pretoria.
Marean, C.W., Nilssen, P.J., 2001. The Mossel Bay Archaeology Project (MAP): background and preliminary results from test excavations of Middle Stone Age sites at Pinnacle Point, Mossel Bay. Progress report prepared for the South African Heritage Resource Agency (SAHRA).
Marean, C.W., Nilssen, P.J., Brown, K., Jerardino, A., Stynder, D., 2004. Paleoanthropological investigations of Middle Stone Age sites at Pinnacle Point, Mossel Bay (South Africa): archaeology and hominid remains from the 2000 field season. Paleoanthropology 2, 14–83.
McBrearty, S., 1981. Songhor: a Middle Stone Age site in western Kenya. Quaternaria 23, 171–190.
McBrearty, S., 1986. The archaeology of the Muguruk Site, western Kenya. Ph.D. Dissertation, University of Illinois.
McBrearty, S., 1988. The Sangoan–Lupemban and Middle Stone Age sequence at the Muguruk site, western Kenya. World Archaeol. 19, 379–420.
McBrearty, S., Brooks, A.S., 2000. The revolution that wasn't: a new interpretation of the origin of modern human behavior. J. Hum. Evol. 39, 453–563.
Mehlman, M.J., 1977. Excavations at Nasera Rock, Tanzania. Azania 12, 111–118.
Mehlman, M.J., 1979. Mumba-Höhle revisited: the relevance of a forgotten excavation to some current issues in East African prehistory. World Archaeol. 11, 80–94.
Mehlman, M.J., 1989. Late Quaternary archaeological sequences in northern Tanzania. Ph.D. Dissertation, University of Illinois.
Mehlman, M.J., 1991. Context for the emergence of modern man in eastern Africa: some new Tanzanian evidence. In: Clark, J.D. (Ed.), Cultural Beginnings: Approaches to Understanding Early Hominid Lifeways in the African Savanna. Monographien 19. Forschunginstitut für Vor- und Frühgeschichte, Römisch-Germanisches Zentralmuseum, Bonn, pp. 177–196.
Minichillo, T., 1999. A hard rock is good to find: foraging strategies and lithic resource modeling. Paper presented at the 64th Annual Meeting of the Society for American Archaeology, Chicago.
Roberts, D.L., 2003. Age, Genesis and Significance of South African Coastal Belt Silcretes. Memoir 95, Council for Geoscience, Pretoria.
Roth, B.J., 2000. Obsidian source characterization and hunter-gatherer mobility: an example from the Tucson basin. J. Archaeol. Sci. 27, 305–314.
Singer, R., Wymer, J., 1982. The Middle Stone Age at Klasies River Mouth in South Africa. The University of Chicago Press, Chicago.
Soressi, M., Henshilwood, C.S., 2004. Middle Stone Age lithic technology at Blombos Cave, western Cape, South Africa. Paper presented at the Annual Meetings of the Paleoanthropology Society, Montréal.
Stapleton, P., Hewitt, J., 1927. Stone implements from a Rock-Shelter at Howieson's Poort near Grahamstown. S. Afr. J. Sci. 24, 574–587.
Stapleton, P., Hewitt, J., 1928. Stone implements from a Howieson's Poort, near Grahamstown. S. Afr. J. Sci. 25, 399–409.
Stephens, D.W., Krebs, J.R., 1986. Foraging Theory. Princeton University Press, Princeton.
Tankersley, K.B., 1991. A geoarchaeological investigation of the distribution and exchange in the raw material economies of Clovis groups in eastern North America. In: Montet-White, A., Holen, S. (Eds.), Raw Material Economies among Prehistoric Hunter-Gatherers. University of Kansas Press, Lawrence, pp. 285–306.
Thackeray, A.I., 1992. The Middle Stone Age south of the Limpopo River. J. World Prehist. 6, 385–481.
Tribolo, C., 2003. Apport des methodes de la luminescence a la chronologie des techno-facies du Middle Stone Age associes aux premiers hommes modernes du Sud de l'Afrique. Ph.D. Dissertation, l'Univesité Bordeaux I.
van Andel, T.H., 1989. Late Pleistocene sea levels and human exploitation of the shore and shelf of southern South Africa. J. Field Archaeol. 16, 133–155.
Volman, T.P., 1981. The Middle Stone Age in the southern Cape. Ph.D. Dissertation, University of Chicago.
Watts, I., 1997. The origins of symbolic culture: the southern African Middle Stone Age and Khoisan ethnography. Ph.D. Dissertation, University of London.
Watts, I., 2002. Ochre in the Middle Stone Age of southern Africa: ritualized display or hide preservative? S. Afr. Archaeol. Bull. 57, 64–74.
Winterhalder, B., 1981. Foraging strategies in the boreal forest: an analysis of Cree hunting and gathering. In: Winterhalder, B., Smith, E.A. (Eds.), Hunter-Gatherer Foraging Strategies. University of Chicago Press, Chicago, pp. 66–98.
Winterhalder, B., Goland, C., 1997. An evolutionary ecology perspective on diet choice, risk, and plant domestication. In: Gremillion, K.J. (Ed.), People, Plants, and Landscapes. The University of Alabama Press, Tuscaloosa, pp. 123–160.
Wurz, S., 1997. The Howiesons Poort at Klasies River: from artefacts to cognition. Master's Thesis, University of Stellenbosch.
Wurz, S., 1999. The Howiesons Poort at Klasies River—an argument for symbolic behavior. S. Afr. Archaeol. Bull. 54, 38–50.
Wurz, S., 2000. The Middle Stone Age at Klasies River. Ph.D. Dissertation, University of Stellenbosch.
Wurz, S., 2002. Variability in the Middle Stone Age lithic sequence, 115,000–60,000 years ago at Klasies River, South Africa. J. Archaeol. Sci. 29, 1001–1015.
Wurz, S., le Roux, N.J., Gardner, S., Deacon, H.J., 2003. Discriminating between the end products of the earlier Middle Stone Age sub-stages at Klasies River using biplot methodology. J. Archaeol. Sci. 30, 1107–1126.