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Howiesons Poort lithic raw material procurement patterns and the evolution of modern human behavior: A response to Minichillo (2006)

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Models of social and territorial organization such as those proposed for the Middle Stone Age (MSA) of southern Africa are often predicated on assumptions about the use of local versus non-local or exotic sources of stone tool raw materials (Deacon, 1989; Ambrose and Lorenz, 1990; Deacon and Wurz, 1996). Inferences about human behavior drawn from stone tool raw material source use patterns are predicated on accurate knowledge of the locations of lithic sources actually used. Higher levels of behavioral inferences, such as home range size, mobility patterns, and the evolution of regional interaction networks, reciprocal intergroup materials, and information exchange and cooperation for risk reduction, are drawn from data on lithic site-to-source distances (Ambrose and Lorenz, 1990; Deacon and Wurz, 1996).

Minichillo (2006) has effectively problematized the ways in which lithic site-to-source distances have been characterized. He notes the existence of several competing definitions of local and non-local, that consensus over definitions may never be achieved, and that explicit definitions should be articulated in each case where such evidence is used. Indeed, when definitions of local versus distant source uses are considered within the framework of foraging theory (Ambrose and Lorenz, 1990; Minichillo, 2006), it is unlikely that one definition can be applied to all settings. What may be considered non-local for foraging groups living in small, closed territories in stable, productive environments may well be considered a local resource within the larger home range of a group living in an unproductive and unstable environment. Gamble (1993) proposed a site-source distance of >40 km for non-local lithic procurement based on ethnographic evidence from Australian hunter-gatherers in desert environments. This is consistent with the results of Gould and Saggers (1985), who documented distances to flaked stone quarries among central Australian groups. I have adopted this distance for defining local versus non-local lithic sources for late Quaternary MSA and LSA sites in East Africa (Ambrose, 2001, 2002). A distance of >40 km may set the bar too high for hunter-gatherers living in smaller territories in more productive environments and may lead to an underestimate of the amounts of non-local lithic materials, but it is likely to be appropriate for populations during the last glacial era, when primary productivity was low and resources were scarce and unpredictable.

The focus of Minichillo's (2006) critique is the interpretation of lithic raw material source use patterns in the Howeisons Poort (HP) MSA lithic industry at Klasies River Mouth (KRM) and its implications for the interpretation of the evolution of modern human behavior by Ambrose and Lorenz (1990). Fine-grained lithic raw materials such as silcrete, as well as quartz, constitute a significantly higher proportion of the artifacts in the HP than in earlier and later MSA horizons within stratified archaeological sites in southern Africa. At coastal sites such as KRM, the excavators characterized these lithic raw materials as "exotic" and "non-local" (Singer and Wymer, 1982; Deacon and Wurz, 1996). Minichillo challenges this characterization of lithic sources by summarizing geological evidence and observations that such materials are

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relatively abundant, and can be easily procured locally in alluvial gravels and beach cobble deposits near the site. Much of this evidence for lithic raw material distributions remains to be adequately documented. For example Malan (1991), cited by Minichillo (2006) in a way that implies such documentation, does not mention silcrete in his detailed description of raw materials in the southern Cape coastal gravel formations. Minichillo has nonetheless made a compelling case for the importance of accurate determination of lithic source distributions for testing models of human behavior.

Coastal and near-coastal sites of the major silcrete-bearing regions of southern Africa are not the only places where long distance movement of lithic raw materials has been inferred for the Howiesons Poort. For example, at Border Cave, a chalcedony whose source was reported to be 40 km away makes up 6% of the raw materials in the MSA 2 levels and 46% of the HP levels (Beaumont, 1973). However, Beaumont (1978) has revised the site-source distance for Border Cave to 15 km (Minichillo, personal communication). At Diepkloof, located near Elands Bay on the western Cape coast, non-local lithic raw materials such as hornfels are abundant (Rigaud, personal communication), but source distributions in this region remain to be fully documented.

Although Minichillo (2006) focuses on the characterization of local versus ''exotic'' lithics along the southern Cape coast, the pattern of fine-grained lithic raw material use extends throughout the known distribution of the Howiesons Poort, including southern Zimbabwe and southern Namibia (Deacon and Deacon, 1999; Volman, 1984). This systematic pattern in the HP across southern Africa requires explanation. Ambrose and Lorenz (1990) proposed an ecological model of both increased home range size and mobility, *and* long-range intergroup interaction in the Howiesons Poort in response to an Early Last Glacial Maximum (ELGM = marine oxygen isotope stage 4) environment of lower primary productivity and increased resource variability in space and time (for a comprehensive review of the climatic evidence, see Deacon and Lancaster, 1988). This model is explicitly grounded in Dyson-Hudson and Smith's (1978) powerful foraging optimization framework for explaining variability in hunter-gatherer social and territorial organization.

The pattern of change in raw materials through time at KRM suggested changes in resource exploitation in response to environmental change. The frequency of fine-grained (''exotic'') lithics at KRM increased in the MSA 2 immediately *before* the beginning of the HP, declined toward the end of the HP, and was higher in the earliest levels of the MSA 3 immediately *after* the HP (when quartz and silcrete frequencies declined to levels slightly higher than in the MSA 2). We concluded that this difference in lithic source use reflected fundamental changes in behavior in response to environmental changes that were unlike any seen in response to similar environmental changes over the previous eight glacial-interglacial cycles of the last million years (Ambrose and Lorenz, 1990). We noted that this shift to high frequencies of fine-grained lithics resembled but did not rise to frequencies as high as those in the LSA Robberg Industry during the Late Last Glacial Maximum (LLGM = marine isotope stage 2). The maximum frequencies of fine-grained lithics at KRM was ~35%, but reached ~70% in the Robberg at Nelson Bay Cave. The primary behavioral responses to environmental change that we postulated for the HP (and Robberg) were (1) increased foraging range in response to a decline in resource abundance and predictability, which permitted embedded procurement (sensu Binford, 1979) of a wider range of fine-grained lithic raw materials, and (2) the adoption of a strategy of information and material exchanges, which also included lithic raw materials between groups (Ambrose and Lorenz, 1990).

Minichillo (2006) oversimplifies our discussion of the meaning of the behavioral responses to environmental change in the MSA during the ELGM vs. the Later Stone Age (LSA) during the LLGM as simply ''not modern,'' and attributes to Deacon and Wurz (1996) what I consider our most important conclusion about human behavior during the HP. We stated: ''If our hypothesis is correct, then the Howieson's Poort marks the first time in human history when there was a significant change in human territorial organization'' (Ambrose and Lorenz, 1990: 27). However, we contested the conclusion of Deacon (1989) that the HP represented *fully* modern behavior, because proportions of lithic raw materials in the HP resembled those in the middle Holocene LSA Wilton Industry rather than in the LLGM Robberg Industry. We argued that comparisons of behavior should be made with control over environmental variables, so it is more appropriate to compare lithic and faunal resource exploitation patterns between the HP in the ELGM with the LSA Robberg in the LLGM.

A fundamental component of our conclusion of ''not fully modern'' also rested on Klein's (1975) interpretation of the faunal assemblage from KRM as reflecting a non-modern pattern of prey selection and procurement. Klein and others (Klein et al., 1999, 2004; Klein and Cruz-Uribe, 1996, 2000; Halkett et al., 2003; Outram, 2001) have compiled a substantial body of evidence that demonstrates less effective predation in the MSA than in the LSA (contra Bartram and Marean, 1999). We gave equal or greater weight to differences in faunal resource exploitation in arguing that, in comparison to the behavior of anatomically modern humans in the most similar ecological context, HP behavior was not fully modern (Ambrose and Lorenz, 1990). We noted that the differences in lithic and faunal exploitation between the ELGM HP and LLGM Robberg LSA do not necessarily reflect differences in *capacities* for modern behavior. Rather, the differences in resource exploitation may reflect a smaller repertoire of technological innovations on which to draw. For example, MSA hominids may have lacked both poisons for projectiles and the bow and arrow in the HP (Klein and Cruz-Uribe, 1996; Ambrose, 2002), which may have limited their predation on prime-aged adults of several prey species.

Minichillo (2006) also approaches the problem of lithic resource exploitation within a general framework of foraging theory. He proposes that the increase in abundance of fine-grained lithics reflects a process of intensification of lithic resource procurement in a risky ELGM environment. The reasons why intensification of procurement might have occurred