

Chapter 2

Exploring the Relationship Between Climate Change and the Decline of the Howieson's Poort at Sibudu Cave (South Africa)

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Introduction

The Howieson's Poort (HP; ~65–60,000 years ago) is an enigmatic sub-stage of the southern African MSA which is notable for its technological innovations, including finely made bone points and backed stone tools (both of which may have served as arrow points; see Backwell et al. 2008; Wadley and Mohapi 2008; Lombard and Phillipson 2010) as well as for its evidence for symbolically mediated behavior (engraved ostrich eggshell; Parkington et al. 2005; Texier et al. 2010). One of the more perplexing aspects of the MSA record is the apparent disappearance of the innovative behaviors associated with the HP after ~60,000 years ago. Given the apparent chronological association between the HP and a glacial period—the phase falls within MIS 4, a glacial period, and disappears around the time of the transition to an interstadial (MIS 3, ~59 ka)—the innovations evidenced in the HP have long been modeled as an adaptation to a particular set of environmental conditions (e.g., Ambrose and Lorenz 1990; McCall 2007). In fact, it has been proposed that the appearance (and disappearance) of the HP simply reflects shifts in the adaptation of an indigenous population in response to climate change; some have even argued the episode stands as one of the earliest examples of a highly

dynamic (and “distinctly human”) response to changing environmental conditions (e.g., Ambrose and Lorenz 1990).

And yet, in comparing a suite of optically stimulated luminescence (OSL) dates from HP and post-HP MSA sites located across southern Africa to ice core data from Antarctica, Jacobs and colleagues (Jacobs et al. 2008; Jacobs and Roberts 2008) argued that the appearance of the HP correlates with a period of climatic amelioration, not decline, and that the ages for the post-HP MSA also line up with a period of warming. Furthermore, because HP sites cross-cut so many distinct ecozones, they argued that the phase cannot be associated with any particular climatic or resource zone. As such, they argued against climate as being a primary catalyst for the HP.

More recently, Chase (2010) has taken issue with Jacob et al.'s use of polar ice core data as a proxy for southern African paleoenvironments, arguing that the region has a distinct climatic regime that does not necessarily align with global trends identified using polar records. Using a variety of paleoclimatic proxies from the southern African subregion, Chase argues that the disappearance of the HP does appear to correlate with an abrupt termination of the MIS 4 humid phase, thus keeping alive the possibility of a link between climate change and the disappearance of the HP.

Others have suggested that the disappearance of the HP reflects a localized population extinction (Bar-Yosef 2002) or even the northward migration of HP populations, who would eventually move out of Africa (Mellars 2006). Given these competing hypotheses, it is clear that gaining a higher resolution picture of the transition from the HP to the post-HP MSA is relevant to larger questions about modern human origins and the adaptive capabilities and strategies of early modern humans. In this paper, I explore the relationship between climate change and the end of the HP using faunal data from the HP and post-HP MSA deposits at Sibudu Cave (KwaZulu-Natal, South Africa).

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Background

Located approximately 40 km north of Durban and 15 km inland from the Indian Ocean, Sibudu preserves an extensive MSA sequence that spans from the pre-Still Bay (>75 ka) through the final MSA (~39 ka; Fig. 2.1; Table 2.1; see Wadley and Jacobs 2006 for a detailed discussion of stratigraphy and excavation procedures). It is one of a few HP sites with good faunal preservation, and one of the only known sites to preserve the transition from the HP to the post-HP MSA. Current excavations at the site have been ongoing since 1998. More than 20 sq. m of MSA deposits have been excavated, although the deepest layers (including most of the post-HP MSA and everything below) have only been reached in a 6 sq. m unit. Deposits are excavated in 50 cm quadrants and screened through nested 2 and 1 mm sieves; materials from the 2 mm sieve are subject to initial sorting and processing on site.

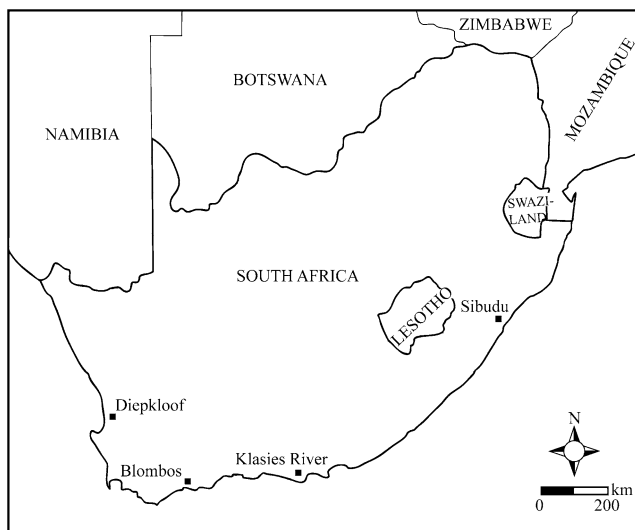


Fig. 2.1 Map showing the location of Sibudu and other MSA sites

Table 2.1 Optically stimulated luminescence dates from Sibudu (Wadley and Jacobs 2006; Jacobs et al. 2008)

Phase	OSL dates (ka)
final MSA	38.6 ± 1.9^a
late MSA	47.7 ± 1.4^a
post-HP MSA	58.5 ± 1.4^a
HP	61.7 ± 2.0
	63.8 ± 2.8
	64.7 ± 2.3
	70.5 ± 2.3
Still Bay	72.5 ± 2.5
pre-Still Bay	73.2 ± 2.7
	77.3 ± 2.7

^a Weighted mean ages

Figure 2.2 shows a profile drawing of the HP and post-HP MSA deposits at Sibudu. Note that while the post-HP MSA was initially defined as a single unit based on the OSL dates and other shared characteristics (including similarities in the lithic assemblage; Wadley and Jacobs 2006), it has since been divided into an upper and a lower unit, known as the post-HP MSA 1 and post-HP MSA 2, respectively. A number of lines of evidence support this division (see Clark and Plug 2008 for a detailed discussion); most notably, archaeomagnetic data indicated a dramatic shift in mineral magnetic properties during the course of the post-HP MSA, perhaps reflecting the transition from MIS 4, a glacial, to MIS 3, an interstadial (Herries 2006), and lithic data show a marked shift in raw material use at the same time.

A number of features distinguish the HP from the post-HP MSA. First are those related to the archaeological remains themselves. The lithic assemblage from the HP is comprised primarily of the geometric backed tools which define the industry, and typical MSA hunting technology—that is, stone points—are absent. Residue and microwear analyses by Lombard (2007, 2008) demonstrated that the backed tools were likely hafted in composite tools; the presence of impact damage suggests that at least some of these were used for hunting (Lombard and Pargeter 2008; Wurz and Lombard 2007). Metric studies of the backed segments recovered at Sibudu indicate that the dimensions of some of these tools fits within the known range of arrow points, leading Wadley and Mohapi (2008) to propose that bow and arrow technology may have been present in the HP (this argument has recently been expanded in Lombard and Phillipson 2010).

The HP at Sibudu also includes a worked bone industry; bone tools present in the HP layers include a finely made bone point which is virtually indistinguishable from pre-historic and ethnographically documented arrow points, leading Backwell and colleagues (2008) to argue that these tools may stand as an additional line of evidence for the presence of bow and arrow technology during this phase. In addition to these innovative technologies, Wadley and colleagues (Wadley 2006, 2010; Clark and Plug 2008) have proposed that remote capture technology such as snares, traps, or nets, may also have been employed during the HP. Given that there is no direct evidence for these technologies (which are generally made of perishable materials that would not survive to become part of the archaeological record), these arguments were based on the nature of the HP faunal assemblage; a more thorough exploration of this hypothesis is currently underway.

In contrast, the post-HP MSA deposits contain a more typical MSA lithic assemblage comprised primarily of unifacial points and scrapers (Cochrane 2006). Bone points (or other formal bone tools) are also absent. It would thus appear that a very different technological system,

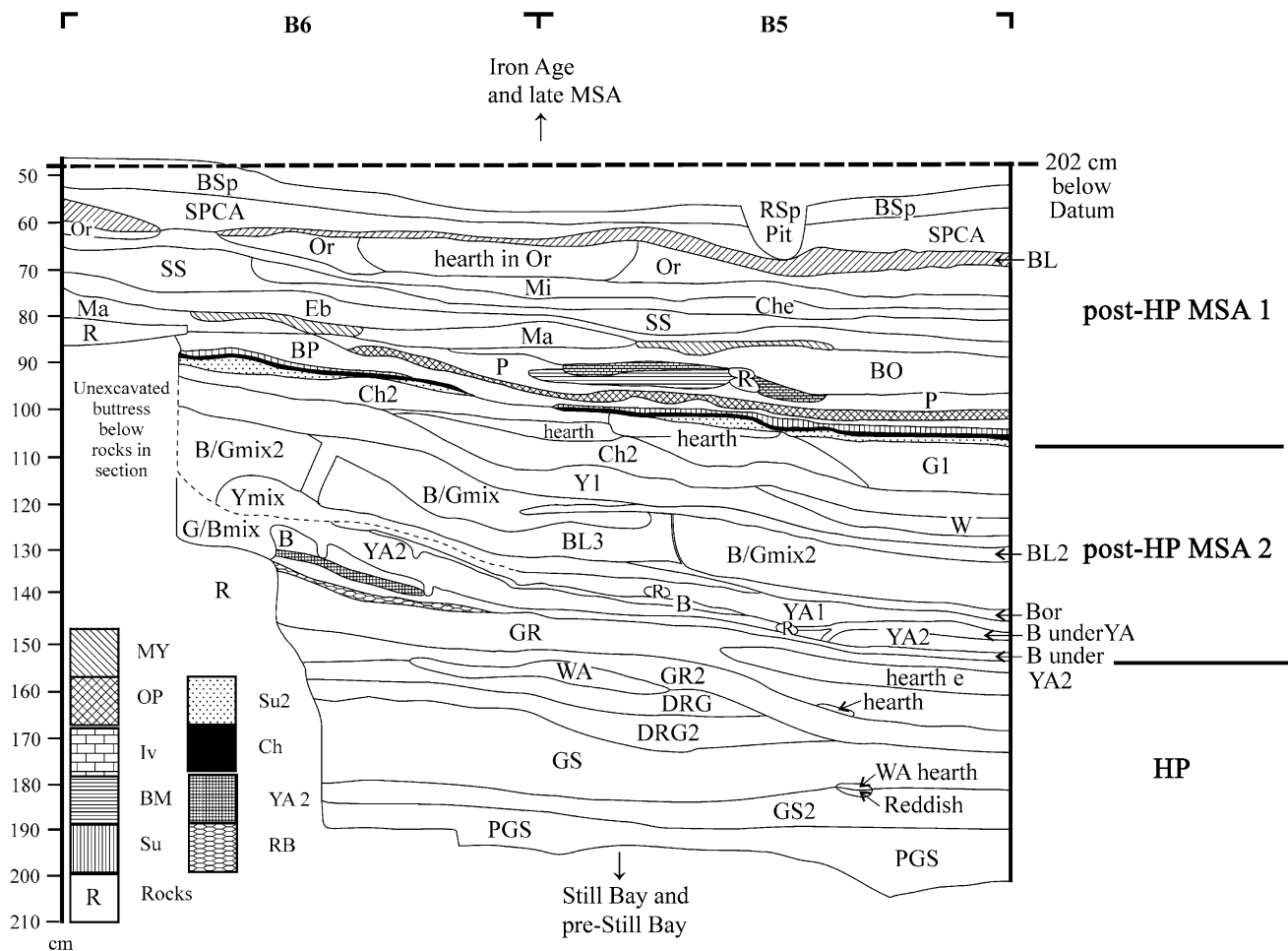


Fig. 2.2 Profile drawing of the HP and post-HP MSA at Sibudu

particularly as relating to hunting weaponry, was in place during the post-HP MSA.

In addition to the changes in material culture evidenced between the HP and the post-HP MSA, there are also a number of characteristics that distinguish the deposits themselves. The HP is comprised of thicker, monotonously colored deposits, while the post-HP MSA consists of thin, brightly colored deposits that contain palimpsests of inter-fingering combustion features (Pickering 2006; Wadley and Jacobs 2006; Goldberg et al. 2009). This distinction may be due in part to greater intermixture of deposits in the HP caused by more intensive trampling (Goldberg et al. 2009). The post-HP MSA is also more variable in sediment composition than is the HP, and gypsum inclusions, which occur frequently in the post-HP MSA, are largely absent in the HP (Schiegl and Conard 2006).

Furthermore, while Jacobs and colleagues argued that broadly similar conditions prevailed during the HP and post-HP MSA (Jacobs et al. 2008; Jacobs and Roberts 2008), the faunal and botanical data available from Sibudu suggest that the local environment underwent

significant changes during this period (Allott 2006; Wadley 2006; Clark and Plug 2008; Hall et al. 2008; Clark 2009, 2011). During the HP, the flora and fauna both indicate a strong evergreen forest component; the evergreen *Podocarpus* was the most frequently identified genus in the charcoal assemblage (Allott 2006), while forest dwelling species such as the blue duiker (*Philan-tomba monticola*) and bushpig (*Potamochoerus larvatus*) comprised the majority of the faunal remains that could be identified to genus or species (Clark and Plug 2008; Clark 2009, 2011). Several lines of evidence also indicated that conditions were relatively humid during this phase, including the presence of the Gambian giant rat (*Cricetomys gambianus*) and the horseshoe bat (*Rhinolo-phus clivosus*), both of which primarily occur in more humid environments, as well as the absence of gypsum (which is water soluble) in the HP deposits (Glenny 2006; Schiegl and Conard 2006).

The available data indicated that marked changes in the local environment had occurred by the end of the post-HP MSA, with data from the post-HP MSA 1 suggesting drier

conditions and a shift to more deciduous/open vegetation (Allot 2006; Hall et al. 2008). Botanical data indicated that the evergreen forest surrounding the site may have significantly declined in size during this period, with *Podocarpus* absent from the uppermost layers and open species such as *Acacia* becoming more common (Allott 2006). Wadley (2006) and Hall et al. (2008) proposed that by the end of the phase, the vegetation in the vicinity of the site may have been characterized by a small patch of evergreen forest close to the river and larger patches of well-grassed savanna on the neighboring hillsides. The fauna from this period were also distinctive from that in the HP—although sample sizes were relatively small, the majority of the remains identifiable to species came from taxa that preferentially inhabit more open environments, including equids and wildebeest (*Connochaetes taurinus*; Clark and Plug 2008; Clark 2009).

However, questions remained as to the precise nature of the timing and nature of the changes in the local environment—especially in comparison to the changes in technology and material culture—due to a lack of botanical data from the post-HP MSA 2 (charcoal from these layers remains to be fully analyzed/published), and because the initial faunal sample from these layers was quite small (Clark and Plug 2008; Clark 2009). Here I present new faunal data from the HP and post-HP MSA deposits at Sibudu, which allow for a higher resolution reconstruction of environmental change during the HP and post-HP MSA.

Materials and Methods

Table 2.2 provides summary data on the faunal remains analyzed through August 2010. While the site preserves large quantities of fauna, the assemblage is highly fragmentary, with the vast majority of the remains consisting of non-identifiable fragments less than 2 cm in maximum dimensions. Of the more than 800,000 fragments analyzed thus far, the number of identifiable specimens (NISP) is only ~5,600, meaning that less than 1 % of the assemblage was identifiable. Among the identified bones (which are limited to the macromammalian remains; analysis of the

remainder of the assemblage, including fish, birds, and microfauna, is not yet complete), the vast majority consisted of bovid remains that could only be identified to size class; Table 2.3 provides a breakdown of these size classes and representative species for each.

The analyses presented herein utilize NISP rather than MNI (minimum number of individuals); the reasons for this choice have been discussed in detail elsewhere (Clark and Plug 2008; Clark 2009). To briefly reiterate, NISP was chosen because NISP counts are straightforward to calculate (contra MNI; see Lyman 2008), and because the measure is not subject to the aggregation effects that plague minimum number counts (Grayson 1984). Furthermore, Marshall and Pilgram (1993) have demonstrated that minimum number counts can be more depressed (and less representative) than NISP when dealing with a highly fragmented assemblage like that at Sibudu. It is also worth noting that despite the issues involved in using MNI data at Sibudu, when the measure was calculated (Clark and Plug 2008; Clark 2009), the patterns evidenced using NISP were still intact, although the resulting sample sizes were quite small. That the same patterns were evidenced was not entirely unexpected, as Grayson (1984) and Grayson and Frey (2004) found that for any given fauna, minimum number values can generally be tightly predicted from NISP counts. Given these factors, NISP seems to be the most appropriate quantitative unit for the assemblage at hand.

A detailed discussion of the taphonomic history of the assemblage is beyond the scope of this paper (see Clark and Plug 2008; Clark 2009; Clark and Ligouis 2010); however, it is relevant to note that all of the available evidence indicates that humans were the primary contributor to the assemblage. More than 8,600 bones were examined under a microscope for signs of human activity, and while there was a low occurrence of surface damage (likely due to poor cortical preservation caused by high degrees of burning, see Clark and Ligouis 2010), signs of human involvement (in the form of cut marks and percussion damage) were always more common than carnivore or raptor damage (evidenced primarily by tooth scores/punctures and signs of digestion)—1.5 % of the assemblage showed evidence for surface damage associated with human activity and 0.05 % showed evidence for carnivore/raptor involvement.

Table 2.2 Faunal summary

Phase	Non-ID < 2 cm*	Non-ID > 2 cm	NISP	ID (%)
post-HP MSA 1	~290,337	28,938	905	0.28
post-HP MSA 2	~275,297	17,191	1,313	0.45
HP	~176,864	10,766	3,577	1.87
Total sample	~742,498	56,895	5,619	0.70

* Full counting of the <2 cm non-ID remains was undertaken in units B5 and B6 only. The full sample of small fraction non-IDs was counted for one quadrant per each level/unit for the rest of the material and this data used to estimate the total count of this material

Table 2.3 Bovid size classes with representative species

Size class	Live weight (kg)	Species (list not inclusive)
Bov I	<23	Blue duiker, common duiker, steenbok
Bov II	23–84	Mountain reedbuck, bushbuck, impala
Bov III	85–295	Red hartebeest, blue wildebeest, kudu
Bov IV	295–950	African buffalo, eland
Bov V	>950	Giant buffalo (extinct)

Furthermore, there was a very low representation of carnivores in the assemblage (less than 2.5 % of the total NISP), most of which were small carnivores such as the mongoose, which would not be contributing significantly to the ungulate assemblage. Finally, the fauna is highly burned and is associated with large quantities of stone artifacts and hearth structures. Taken in concert, all of these lines of evidence indicate that humans were primarily responsible for accumulating the faunal remains. Data also indicate that the relative degree of fragmentation was similar across the three units (Clark 2009), and thus variability in the degree of post-depositional destruction should not be skewing the results.

The faunal data were used to explore the timing and nature of changes in the local environment on two different scales. I first conducted an analysis of the habitat preference data, which is based on that fraction of the faunal remains which could be identified to genus and species, using NISP. The data were divided into three classes; animals that preferentially inhabit closed or semi-closed environments, those that primarily occupy open environments, and those which have no specific habitat requirements (see Table 2.4, which also includes NISP counts for each taxon). Data on habitat preferences were taken from Skinner and Chimimba (2005); “open” habitats include savanna and open woodland or woodland savanna, while “closed” or “semi-closed” habitats include forest (riverine or evergreen), thickets, and underbrush.

I also approached this issue by exploring variation in the ungulate size class data over time. This much larger dataset provides broader information about animal exploitation strategies, but can also serve as a proxy for environmental change over time, as the larger species represented in this assemblage also tend to be those which occupy more open environments. Given that this is predominantly a human produced assemblage, and because Sibudu’s inhabitants may not have been selecting prey in direct proportion to their presence on the landscape, this dataset may not provide a direct reflection of the local environment; however, as discussed above, the floral and faunal data do indicate the

same trends, indicating that the patterning evidenced in the faunal data is meaningful.

Because the goal for this study was to gain as high a resolution picture of the transition between the HP and post-HP MSA as possible, the three primary units of analysis (HP, post-HP MSA 2, post-HP MSA 1) were broken down as finely as sample sizes would allow. While the HP could be broken down into its three primary layers (Pinkish Grey Sand, Grey Sand, and Grey Rocky), sample sizes for the two post-HP MSA units were small enough that each could only be subdivided into an upper and lower unit (denoted in the figures as “pHP2 low” and “pHP2 upp” for the lower and upper halves of the post-HP MSA 2, etc.).

Results

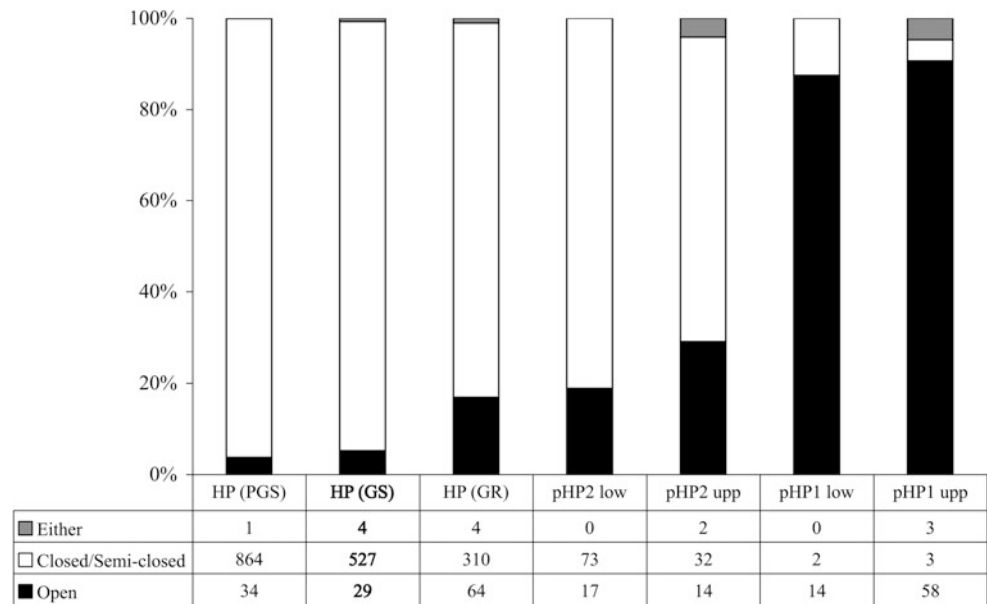
Figure 2.3 presents the habitat preference data. The patterning evidenced among the initial faunal sample remained intact (c.f. Clark and Plug 2008; Clark 2009, 2011), with a vast majority of the remains from all of the HP layers coming from species that preferentially inhabit closed (and particularly forested) environments. Interestingly, while the difference in the proportion of open versus closed dwelling species was significant between layers Grey Sand and Grey Rocky, both of which are within the HP, the difference between the uppermost-HP layer (Grey Rocky) and the lower post-HP MSA 2 was not (Table 2.5). As a whole, it appears there was a relatively gradual increase in open-dwelling species over time. It is intriguing that a marked increase in open-dwelling species occurs at the boundary between the post-HP MSA 1 and 2, particularly given Herries’ (2006) proposal that the transition between MIS 4 and 3 occurs at/around this boundary.

Before moving on, it is worth noting that the sample sizes for the HP are so much higher than those in the post-HP MSA in large part because of the species-level identification of the blue duiker, a small, forest dwelling bovid that is the most commonly identified taxon in the HP. To ensure that the broader pattern is not simply a reflection of changes in the presence of blue duiker across the sequence, the species was removed from the analysis; however, as indicated in Fig. 2.4, the pattern remained intact (see Table 2.5 for a further demonstration of the consistency of the results).

Turning now to the ungulate size class data (Fig. 2.5), which can serve as a rough proxy for environmental change, the data indicate a steady, stepwise decline in the relative proportion of small game that extends from the lowermost HP through the post-HP MSA. This trend continues right across the HP to post-HP MSA transition; once again, the greatest changes occur at the end of the post-HP MSA

Table 2.4 List of species present with habitat preferences (from Skinner and Chimimba 2005) and NISP counts for each species

Habitat preference	Taxa	HP (PGS)	HP (GS)	HP (GR)	post HP-MSA 2 (low)	post-HP MSA 2 (upp)	post-HP MSA 1 (low)	post-HP MSA 1 (upp)
Both	<i>Atilax paludinosus</i> , marsh mongoose	1	2	0	0	0	0	0
	<i>Hystrix africaeaustralis</i> , Cape porcupine	0	2	0	0	0	0	2
	<i>Kobus ellipsiprymnus</i> , waterbuck	0	0	4	0	0	0	1
	<i>Oreotragus oreotragus</i> , klipspringer	0	0	0	0	2	0	0
Total both		1	4	4	0	2	0	3
Closed or semi-closed	<i>Cephalophus natalensis</i> , red duiker	3	0	0	0	0	0	0
	<i>Cercopithecus albogularis</i> , Sykes' monkey	23	0	0	0	0	0	0
	<i>Chlorocebus pygerythrus</i> , vervet monkey	26	34	3	3	7	0	0
	<i>Cricetomys gambianus</i> , Gambian giant rat	29	16	5	0	1	0	0
	<i>Philantomba monticola</i> , blue duiker	662	358	234	23	18	0	2
	<i>Potamochoerus larvatus</i> , bushpig	117	114	68	45	6	2	0
	<i>Redunca fulvorufula</i> , mountain reedbuck	0	0	0	0	0	0	1
	<i>Sylvicapra grimmia</i> , common duiker	0	2	0	0	0	0	0
	<i>Tragelaphus scriptus</i> , bushbuck	4	3	0	2	0	0	0
Total closed/semi-closed		864	527	310	73	32	2	3
Open or open w/ shade	<i>Aepyceros melampus</i> , impala	0	2	5	0	1	0	0
	<i>Connochaetes taurinus</i> , blue wildebeest	0	0	2	0	0	2	4
	<i>Damaliscus pygargus</i> , blesbok	0	0	0	0	0	0	1
	<i>Equus quagga</i> , plains zebra	0	1	5	0	0	0	22
	<i>Equus sp.</i>	0	0	0	4	3	3	10
	<i>Galerella sanguinea</i> , slender mongoose	2	0	0	0	0	0	0
	<i>Hippotragus equinus</i> , roan antelope	0	4	1	0	0	0	0
	<i>Hippotragus sp.</i>	0	0	0	0	0	0	1
	<i>Orcyteropus afer</i> , aardvark	1	0	0	0	0	0	0
	<i>Papio hamadryas</i> , chacma baboon	10	4	1	0	0	0	0
	<i>Pelea capreolus</i> , grey rhebok	1	0	2	0	0	0	0
	<i>Phacochoerus africanus</i> , common warthog	0	0	5	6	4	4	3
	<i>Procavia capensis</i> , rock hyrax	9	8	11	4	2	1	2
	<i>Pronolagus crassicaudatus</i> , Natal red rock rabbit	0	2	0	2	0	0	0
	<i>Pronolagus sp.</i>	3	2	0	0	0	0	0
	<i>Raphicerus campestris</i> , steenbok	1	3	14	0	0	0	0
	<i>Syncerus caffer</i> , African buffalo	4	3	12	1	0	1	9
	<i>Thyromys swinderianus</i> , greater canerat	1	0	3	0	3	0	0
	<i>Tragelaphus oryx</i> , eland	2	0	3	0	1	1	0
	<i>Tragelaphus strepsiceros</i> , kudu	0	0	0	0	0	2	6
Total open		34	29	64	17	14	14	58

Fig. 2.3 Habitat preference data (NISP)**Table 2.5** Results of pair-wise statistical tests for habitat preference data presented in Figs. 2.3 and 2.4

	Full data set		Data set with blue duiker removed	
	χ^2 value	p value	χ^2 value	p value
HP (PGS) vs. HP (GS)	5.37	0.0682	2.36	0.3073
HP (GS) vs. HP (GR)	35.45	<0.0001	24.93	<0.0001
HP (GR) vs. pHP2 low	1.12	0.5712	4.59	0.1008
pHP2 low vs. pHP2 upp	6.08	0.0478	9.86	0.0072
pHP2 upp vs. pHP1 low	n/a ^a	0.0001	n/a ^a	0.0177
pHP1 low vs. pHP1 upp	n/a ^a	0.3381	n/a ^a	0.2678

Bolded p-values are significant at $\alpha = 0.05$

^a Sample sizes too small for appropriate use of chi-squared test; Fisher's Exact Test applied instead

(Table 2.6; each pair-wise comparison showed a statistically significant shift in the proportional data, but the highest chi-squared value is associated with the transition from the lower to the upper post-HP MSA 1.

A glance at the numbers reveals that much of this patterning is driven by the smallest ungulates falling out of the sequence; since blue duiker are included in that group, I again removed them from the analysis, but as was the case with the habitat preference data, the general trend remained (Fig. 2.6; Table 2.6).

Discussion

In thinking about the implications of these results, one cannot overlook two primary caveats: (1) they are based primarily on faunal data, and the incorporation of finer-grained botanical data and isotopic data (analyses in progress) will be critical for further demonstrating the validity

of the patterns presented here, and (2) data from other sites preserving the HP to post-HP MSA transition (such as Diepkloof) will be necessary for demonstrating the broader applicability of these findings. Notwithstanding these issues, I argue that these data have at least two important implications.

First, they suggest that the changes in material culture and technology at the end of the HP are perhaps *not* best modeled as an adaptive response to environmental change. This implies that we must seek alternative models for explaining the disappearance of the HP (as suggested by Jacobs and Roberts 2008). While recognizing that demographic and/or social models for behavioral change during the MSA will be much more difficult to test than ecological ones, it seems that the time is ripe for us to focus on fleshing out alternative models, particularly when it comes to developing testable implications for these models. While this is not the place for such an endeavor, it is worth noting that faunal data may also be useful for addressing the models which imply that the HP to post-HP MSA transition

Fig. 2.4 Habitat preference data (without blue duiker; NISP)

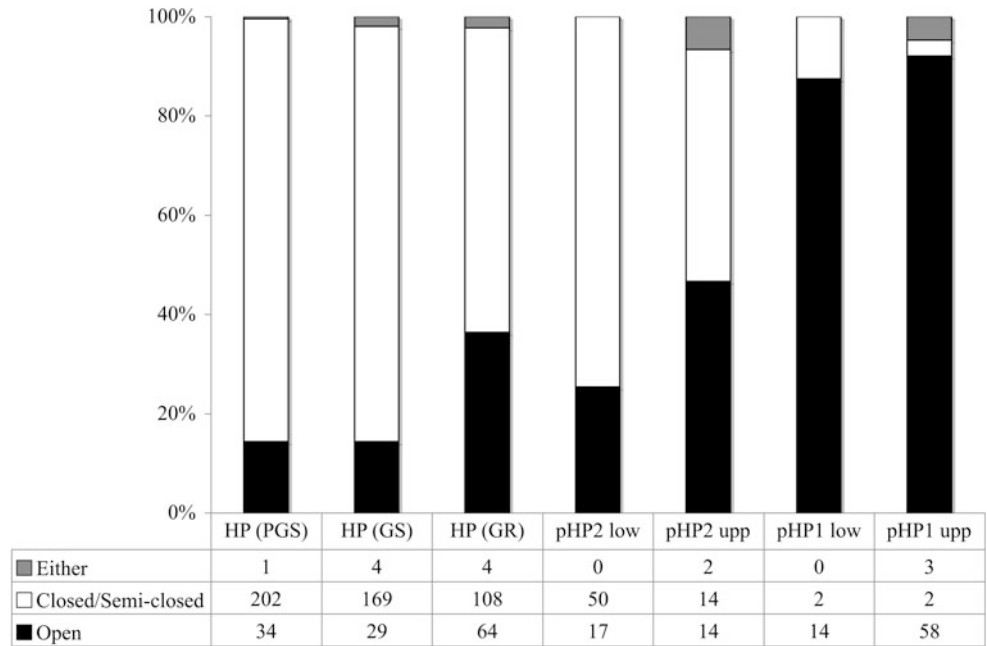


Fig. 2.5 Ungulate size class data (NISP)

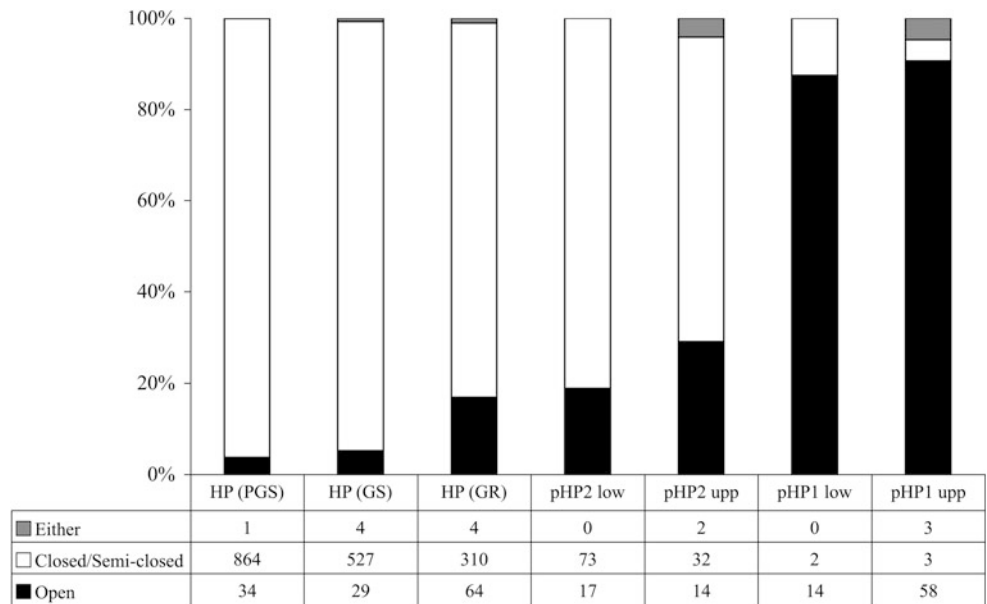
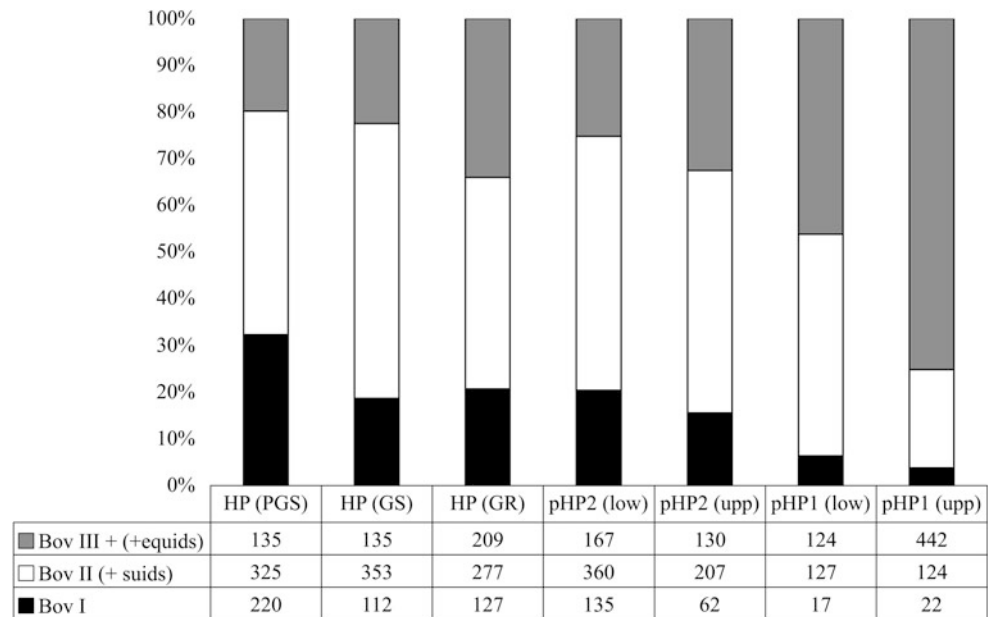


Table 2.6 Results of pair-wise statistical tests for ungulate size class presented in Figs. 2.5 and 2.6

	Full data set		Data set with blue duiker removed	
	χ^2 value	p value	χ^2 value	p value
HP (PGS) vs. HP (GS)	64.39	<0.0001	31.41	<0.0001
HP (GS) vs. HP (GR)	38.69	<0.0001	25.89	<0.0001
HP (GR) vs. pHP2 low	64.77	<0.0001	13.89	0.001
pHP2 low vs. pHP2 upp	6.68	0.0354	8.26	0.0161
pHP2 upp vs. pHP1 low	29.19	<0.0001	19.98	<0.0001
pHP1 low vs. pHP1 upp	68.73	<0.0001	69.42	<0.0001

Bolded p-values are significant at $\alpha = 0.05$

Fig. 2.6 Ungulate size class data (without blue duiker; NISP)



reflects population replacement (per Bar-Yosef 2002; Mellars 2006), as one might expect a different population using different technologies to also employ different animal exploitation strategies, not only in terms of what prey was captured, but also in terms of transport and processing strategies. And yet, as demonstrated by Adler and colleagues (Adler et al. 2006; Adler and Bar-Oz 2009), the exploitation strategies of late Middle Paleolithic and Early Upper Paleolithic populations (presumably representing Neanderthals and anatomically modern humans) were often times remarkably similar. There is no doubt that this is a thorny issue, but it is clearly important to our broader understanding of the adaptive capabilities and strategies of Late Pleistocene human populations.

The second implication also relates to the development and use of alternative models for technological change. Despite the seemingly major changes in hunting weaponry between the HP and the post-HP MSA—perhaps as dramatic as use of the bow and arrow and remote capture technology during the HP versus the use of hand-thrust or cast stone-tipped spears during the post-HP MSA—there do not appear to be any major changes in basic subsistence behavior across the transition between the phases. If the changes in hunting technology are not a function of different subsistence practices or needs, this implies that we may also need to focus more attention on social models for explaining technological change during the MSA.

Conclusions

Environmental change often serves as a default explanation for marked changes in the archaeological record during the Later Pleistocene. Given the apparent chronological association between the HP and a glacial period (MIS 4), the innovations evidenced during the HP have often been modeled as an adaptive response to a particular set of environmental conditions. However, high-resolution faunal data from HP and post-HP MSA deposits at Sibudu Cave indicate a marked disconnect in the timing and nature of changes in the local environment relative to the major changes in technology and material culture evidenced at the end of the HP. While not denying the important role that climate change can play in shaping human behavior, I argue that these data imply that we need to focus more attention on developing demographic and/or social explanations for behavioral change during the period—and particularly on deriving testable implications for these models.

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