TWO LATE PLEISTOCENE-HOLOCENE ARCHAEOLOGICAL DEPOSITORIES FROM THE SOUTHERN CAPE, SOUTH AFRICA*

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ABSTRACT

This paper reviews research at two sites in the southern Cape, South Africa that together span the last 125 ka: Boomplaas and Klasies River main site. Environmental and cultural changes are discussed. The contrasts between the Late Pleistocene and Holocene and between the earlier and later Holocene environments are detailed. Climates have been similar to the present and more favourable for human settlement in the last 5 ka than at any time since the Last Interglacial. The Middle-Later Stone Age interface predates 21 ka in the Boomplaas sequence. The Howieson's Poort at the base of the Boomplaas sequence is a horizon marker that is also found in the top of the Klasies River main site. Human remains from Klasies River are dated to 90 ka and 120 ka. It is argued that these sites were occupied by morphologically and cognitively modern humans.

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Introduction

The dream of a 'magazine', published by a group of subscribers locally and overseas and serving South African archaeology, took 40 years to come to fruition. It was the youthful dream of the founder of the South African Archaeological Society and the first editor of the journal, rather than magazine, the *South African Archaeological Bulletin*, A.J.H. Goodwin (1958). Now, 50 years and as many volumes of the *Bulletin* later, the Society can look back on a proud record of achievement. Knowledge of the archaeology of this and other parts of Africa has been made accessible to world scholarship. It is a privilege to contribute a paper to this celebratory issue of the *Bulletin*.

This paper reviews some of the results of a research programme that started in 1972 and has continued to the present. In the last 25 years, the field of archaeology has made considerable advances in methodology and methods which can be used to advantage and it has been a stimulating learning experience to be involved in a long-term research project. The core of the programme has been the investigation of two long-sequence sites, archaeological depositories or archives that together span the Late Pleistocene (125-10 ka) and the Holocene (10-0 ka): Boomplaas Cave and Klasies River main site.

Initially a search was made for a site with specific characteristics. These were: continuous deposition to give good stratigraphic resolution, preservation of features such as hearths and organic remains and a temporal range extending to the earlier part of the Late Pleistocene. A two year search led to the limestone area of the Cango Valley and Boomplaas Cave. The investigation of Boomplaas took 10 years. The base of the Boomplaas sequence dates to about 80 ka and to extend this record to the beginning of the Late Pleistocene at 125 ka, the investigation of a second site, Klasies River main site, was started in 1984 and has continued since (Deacon 1989).

This time range is of interest because it includes the Later-Middle Stone Age stage boundary. In the 1970s learning about the differences between the Later and Middle Stone Ages was a particular challenge and remains one. Starting out with the idea that these Stone Age stages represented very different archaeological units, my thinking has changed significantly and this paper highlights continuities rather than differences between the stages. The interest within the programme in environmental data stems from a belief that environmental, or more properly habitat, changes were a determinant of the distribution and densities of people in the landscape. In many sequences in the sub-continent there are discontinuities in deposition, representing many millennia of low archaeological visibility of people, like that which often separates Middle and Later Stone Age occurrences. There is good reason to suppose that such discontinuities represent periods in the last glacial-interglacial cycle when there were lower population densities because of unfavourable habitat conditions due to aridity. Part of the research design, therefore, was the collection of high resolution environmental data that would demonstrate the nature of such conditions.

Boomplaas Cave

The Grobbelaars River drains the Cango Valley in the foothills of the Swartberg, the inner range of the Cape fold mountain belt, north of the town of Oudtshoorn. An upfaulted Precambrian rock sequence, the Cango Group, includes limestones in its lithology. The Cango Caves, a deep tourist cave, are in the main limestone formation. In the entrance and extending into the twilight zone of the Cango Caves are archaeological deposits (Goodwin 1930) yet to be studied in detail. Boomplaas Cave, some four kilometres to the west, is the entrance of a much smaller cavern system in an upper, thinner limestone bed at the same elevation above the valley floor. The Late Pleistocene and Holocene fills in these caverns are the most recent phase of deposition.

Limestone weathers at a higher rate than the quartzose rocks that make up most of the Cape mountains but deposition is still slow in the Boomplaas depository, of the order of 50 mm per thousand years. The radiocarbon chronology shows a near linear increase with depth and on the time depth curve the base of the some five metre deep sequence is estimated at 80 ka (Deacon 1979). Amino acid, uranium equilibrium and thermoluminescence dating projects to date the lower half of the sequence are in progress.

The contents of the deposit divide between the inorganic weathering products and in-washed sands and silts, wholly natural in origin, the faunal remains introduced by owls and carnivores that used the cave and those materials brought in by people. An attempt was made to resolve and follow the detail of the natural stratigraphy and sample all the contents. Thicker stratigraphic beds were called members (named by an acronym of the field description) and within these, units and sub-units were distinguished. In the human occupation horizons features such as pits and hearths were recorded.

The Holocene occupation at Boomplaas Cave

The topmost member, CBM, is a massive white porous layer formed from the burning of sheep dung when the cave was used as a sheep byre or kraal in historic times. Thinner multiple white layers in the underlying DGL member show more intermittent use of the site as a kraal in precolonial times. Large stone-packed hearth features, up to one metre in diameter, on level compact dung floors indicate that herders lived in the cave with their stock. Calibration of dates puts this herder occupation at between 396 and 437 AD. The only recorded older herder occupation at the Cape (Sealy & Yates 1994) is in Namaqualand.

There are relatively few bones of wild animals in the faunal sample from this level (Von den Driesch & Deacon 1985). The occupants of the cave were small stock farmers, not hunters and only sheep can be identified on the diagnostic skeletal elements of domestic fauna preserved. A significant pattern to emerge from the age distribution of the domestic fauna is that there is a high proportion (80%) of young animals under 6 months. In modern market-orientated sheep farming, flock management requires the culling of three quarters of the lambs before they reach reproductive age. These data can be used to argue that the occupants were engaged in intensive small stock farming at this early date. The cave served as an early Khoekhoe stock post in the Cango Valley.

The youngest hunter-gatherer occupation at Boomplaas is dated to 2 ka and is noteworthy for the more than 45 lined seed storage pits in the BLD member. The linings of amaryllid leaves and grass are preserved. While most pits had been emptied of their contents, some still contained the oil rich fruits of *Pappea capensis*, known to have been used as a cosmetic (Watt & Breyer-Brandwijk 1962). The fruits can be collected only in mid-summer and were cached in the cave for later use. Pit storage of fruits is not unique to Boomplaas; the same fruits and linings are recorded at Melkhoutboom (Deacon 1976), for example, but is not recorded on a similar scale elsewhere. Edible plants were not stored in pits. The only remains of edible plants recovered were some *Hypoxis* corms that, by chance, had been scuffed into disused pits. This is a good illustration of how deliberate burial in the case of *Pappea* fruits increases the chances of preservation.

The Holocene lithic industries have been detailed elsewhere (Deacon 1984a). Notable finds in the Wilton layers were a number of painted cobbles. The Boomplaas examples are dated to 2 ka with one from a pit that may be associated with an older layer. Appropriate to the Little Karoo is an ostrich depiction on one stone, which came from a pit. The painting, on the lower surface, was not visible when the stone was uncovered. There were paint stains on the sediment on which it rested, suggesting it was placed in this position when the paint was still wet and that the painting was not meant to be viewed. Painting on large cobbles and slabs is a region-wide tradition developed in the Holocene in the southern Cape (Rudner 1971). There is also the region-wide use of rock shelters as cemeteries. Both practices may have had to do with investing places with power and people with rights of domicile.

Another significant find from the Holocene levels at Boomplaas was a mounted scraper (Deacon & Deacon 1980). Although small convex scrapers are the most common formal tools in the Wilton industry, this is the only example found still completely encased in mastic. From this find it is possible to establish that the small convex scrapers were replaceable bits, held in place by flaps of mastic and side-mounted on pencil-like holders. As the working edges of these scrapers are usually about 15 mm wide, they were designed for light duty work. The morphology of the working edge and use-wear traces (Binneman 1982) show they were leather-working tools.

Scrapers are less common in the Albany industry at the beginning of the Holocene (BRL member) and these examples are very much larger, with a working edge twice the width. It is tempting to equate differences in scraper size and frequency in the Holocene with changes in dress styles. As archaeological finds of worked leather are off-cuts rather than complete garments, changes in dress styles are difficult to document. Small convex scrapers may have been more suited to preparing the thin supple leather of small antelopes, used in body fitting garments like the 6000 year old man's pull-through recovered from Melkhoutboom (Deacon 1976). The high frequency of small convex scrapers would then reflect the continuing need to repair such garments. The low relative frequency of the larger Albany scrapers suggests a different emphasis in skin working and perhaps skin underclothing was not worn. Earlier in time, stone artefacts that conform to even a loose typological definition of scrapers are rare and if skin clothing was worn, the skins were not scraped in the same way. A repetitive task, like the making and repair of clothing, leaves a very visible archaeological trace.

In the Holocene, when conditions for preservation are optimal, there is the opportunity to observe how hafting constrains the size and form of stone inserts. Small convex scrapers are design types, standardised in form by retouch to fit a haft. There are no examples of hafted tools from the Late Pleistocene known from southern Africa and conditions of preservation mitigate against finding such rare items. There are, however, tool designs (the Howieson's Poort segments and trapezes are an example discussed below) that show similar constraints of size and form and can be assumed to have been hafted.

Hearths are the most common features encountered in the Boomplaas sequence and the placement of hearths is seen as significant in partitioning living space. The standard domestic hearth is a shallow, ash-filled depression 300 mm in diameter. As stressed in this paper, these take the same form in Later and Middle Stone Age contexts. The stone hearths of the herder occupation are a departure from this standard and the only other unusual hearths were mapped in the mid-Holocene BLA member. These were two oval two by one metre beds of charcoal laid in the central part of the cave. There are no associated finds to indicate their special function and none would be expected if they were used to dry meat or similar foodstuffs. Domestic hearths also occur in BLA. Because they depart from the standard type of hearth the two examples cited here are noteworthy.

Holocene environments in the Cango valley

BRL5, near the base of the lowest Holocene member, is a culturally sterile wash of red soil and a useful marker. The large mammal fauna (Klein 1978) in the Holocene layers above this marker is dominated by small territorial antelope and ground game. This contrasts with the underlying Late Pleistocene levels in which larger game is more common. There are roosts for barn owls in the cave and pellets of regurgitated bone accumulate on the surface. The deposit is rich in small mammal bones from this source. The Holocene levels are dominated by rodents, with *Otomys irroratus* as the indicator species (Avery 1982). Again, this contrasts with the Late Pleistocene levels in which shrews, and in particular *Myosorex varius*, are more important. The large and small mammals reflect a gross change in the vegetation cover. In the Holocene, the vegetation was dominated by woody perennials that provided good ground cover for browsers but poor graze. In the Late Pleistocene, with annual grasses more prominent in the vegetation succession, there was grazing for large bovids, more litter to attract insects and shrews but poor cover for small antelopes and rodents.

Two other studies, one of charcoals from hearths in the cave and the other of stable isotopes in a stalagmite from the Cango Caves, provide more information on Holocene environments in the valley. These show the earlier and later Holocene environments to have been significantly different. Initiated in collaboration with D.L. Daitz, the charcoal study (Deacon *et al.* 1983) showed that the sources of firewood collected by the inhabitants in the early Holocene were species of a dry shrub vegetation, but in the later Holocene *Acacia karroo* was dominant. *A. karroo* is an excellent fuel and would have been used had it been available in the early Holocene. From this it is inferred that *A. karroo*, a sub-tropical pioneer species, was a late Holocene invasive. It was possible to confirm the same pattern in the Holocene sequence at Buffelskloof (Opperman 1978), near Calitzdorp, so the range expansion of this species was a regional phenomenon.

Stable isotopes in the Cango stalagmite (Talma & Vogel 1992) show that other vegetation changes took place at the same time. The deeper sections of the Cango Caves serve as a natural, constant temperature laboratory and a successful search was made for a stalagmite that had deposited calcium carbonate in equilibrium with the cave environment and was suitable for carbon and oxygen isotope analyses. The upper section of the stalagmite grew continuously over the last 5 ka and records a marked increase in $\delta^{13}C$ values with a peak at 2-3 ka. Talma & Vogel (1992) interpret this result as reflecting an increase in C_4 grasses in the valley as a consequence of higher summer temperatures. Even given that seasonal temperature differences were more marked in the later than in the earlier Holocene, mean annual temperatures would have been below those of the mid-Holocene optimum. This suggests that a further factor, the season and amount of precipitation, is relevant to explaining the vegetation change. The dominant C_4 grass in the vegetation in the valley is *Themeda triandra* which, like *A. karroo*, is a sub-tropical pioneer. An increase in the component of summer precipitation makes it possible for a C_4 pioneer like *T. triandra* to compete successfully with and invade the domain of C_3 grasses adapted to dry summer climates and a winter growing period. Other evidence from the region (Scholtz 1986; Deacon & Lancaster 1988) is consistent with an increase in precipitation in the later Holocene with the maximum, like the $\delta^{13}C$ values in the stalagmite, dated to 2-3 ka. The response of *A. karroo* mirrored that of *T. triandra*.

Not only did the climates of the Holocene differ from those of the Late Pleistocene, but those of the earlier Holocene were different from the climates of the later Holocene. Although the data are from one valley they have wider relevance. In particular, the shift in seasonal precipitation and the increase in effective precipitation in the later Holocene reflects the strengthening of anti-cyclonic circulation that is a pervasive control on climates in the latitudes of South Africa. It is in this period, as recently as 5 ka, that the present-day synoptic patterns of climate in South Africa had their inception. The connection between the reliability of summer precipitation and the strength of the anti-cyclonic circulation posited here on the evidence from the Cango Valley explains why, in the Later Holocene, archaeological sites become more widespread in the sub-continent and archaeologists record greater intensity of occupation and increasingly complex social dynamics in their sites. The climates of earlier times, as far back as 80 ka on the Boomplaas evidence, were unlike those of the present and not as favourable for human settlement.

Late Pleistocene Later Stone Age occupation at Boomplaas

The best developed trace of human occupation in the Boomplaas archive is in the 0,25 m thick CL (carbonised loam) member, dated to between 15 ka and 12 ka. The carbonisation is the product of the burning of litter from food plants in the central activity area of the cave. Carbonisation precludes specific identification of the plant residues but the fibrous texture of the plant residues is recognisable.

The artefacts are ascribed to the Robberg (Deacon 1984a), an industry of relatively large irregular flakes with the notable exception of the production of micro-bladelets. These bladelets, less than 20 mm in length, were struck from small pyramidal cores. Few Robberg bladelets are retouched and they were used as such as inserts in a haft. In the local industries, blade technology is encountered again only in the production of the larger Howieson's Poort blades. The similarity of the attributes of the striking platforms of the blades in these two industries is impressive and in both cases a flexible, presumably wooden, punch was used. Blade technology can be considered part of the repertoire of Middle and Later Stone Age artificers, rather than a discrete technology that was reinvented at different times.

The sample of artefacts from the CL member includes ostrich eggshell beads and decorated water containers. Worked eggshell is not found lower in the sequence except for an unfinished and a complete bead in the older OLP member (42 ka). These older finds require independent dating before their provenance can be accepted. There are some marine shell fragments in the top of the CL member but no worked pieces. The lowest stratigraphic occurrence of marine shell beads is the overlying BRL member. This is explained by sea levels having been lower and the cave more distant from the coast prior to 12 ka. There are bone beads, bone points, and a tortoise shell bowl from CL. All these items are impressive evidence for continuity in material culture because similar items are still manufactured by the Kalahari Saan.

The large mammal fauna is relatively abundant and diverse in CL. It is a fauna dominated by animals of large body size (Klein 1978) with two zebrine species, black wildebeest and possibly an extinct wildebeest-like grazer (Brink pers. comm.), buffalo and eland. The contrast with the Holocene fauna characterised by browsers has been noted. It has been suggested elsewhere (Deacon 1972, 1976), on the evidence of a quantum increase in faunal remains per unit volume of deposit in the Late Pleistocene levels of sites, that the shift from hunting large migratory herd animals to hunting small territorial antelope implied different forms of social organisation. It was reasoned that searching for and following herds of large animals required low territoriality and large group sizes, whereas trapping small antelope in and around patches where plant foods were concentrated would have required defined territorial ranges and small group sizes. I now consider this model of social group dynamics in the Later Stone Age to be too simplistic.

One reason is that Opperman (1987) has been able to show that, at the site of Bonawe, late Holocene hunters were able to hunt large animals like wildebeest resident in patches of sweet grass in kloofs in the foothills of the Drakensberg, without having to follow the herds. The presence of the remains of grazers in a faunal assemblage cannot be assumed to imply the following of herds. In the example of the Cango Valley in the Late Pleistocene, the dominant C_3 grasses would have provided year-round grazing and herd migration is an unlikely scenario. Added to this, the Late Pleistocene fauna from Boomplaas is not a typical grassland plains fauna. The zebrines and probably the wildebeest-like grazer that, together with eland, make up the bulk of the fauna are territorial rather than migratory. These animals would have been hunted in the valley. As a rule, following herd animals may not have been a proposition for any Stone Age foragers as African bovids have notoriously low fat levels (Speth 1987, 1989). Migrating herds may have been culled for supplies of biltong at hunting camps on migration routes, although this has yet to be documented in any Stone Age occurrence in South Africa.

The quantities of carbonised plants and the near exclusive use of local raw materials suggests occupation of the cave was by small groups of patch-bound foragers, as in the Holocene. They had access to larger prey and, as the quantities of faunal remains suggest, meat was a significant supplement to plant foods in the diet. In my view, the faunal data inform on diet quality rather than on the social dynamics of foragers in the Late Pleistocene and the Holocene.

There is Later Stone Age occupation of Boomplaas at the Last Glacial Maximum in the GWA-HCA member that dates to almost 18 ka (Pta-3283 17 830 ± 180 BP). This overlies LP, a roof rock clast-rich member that is largely a natural accumulation. The earliest discrete Later Stone Age Robberg occupation is in the underlying LPC member that is dated to 21 ka (Pta-1810 21 200 ± 200 BP, UW-300 21 110 ± 420). The Later Stone Age-Middle Stone Age transition, discussed below, is represented in the wash that accumulated in a pool deposit, the YOL member.

The Last Glacial Maximum in the Cango valley

The CL member falls in the period that can be described as the lead down from the Last Glacial Maximum (LGM) at 18 ka to the beginning of the Present Interglacial or Holocene. Apart from the large mammal fauna, the small mammals and charcoals are sources of information on palaeoenvironmental changes in the Cango Valley. The most significant conclusion from the small mammals (Avery 1982) is that amelioration of the extreme harsh, cold and dry conditions at the LGM had begun by 14 ka. This is consistent with the general pattern of evidence that the amelioration in the southern hemisphere was several thousand years in advance of that in the northern hemisphere (Deacon & Lancaster 1988). Under those still cool but moist conditions *Olea* woodland, relicts of which remain in sheltered side-kloofs of the Cango Valley (Moffett & Deacon 1977), provided wood for fires. The amelioration brought trees back to the valley.

There is a hiatus in the growth of the Cango stalagmite (Talma & Vogel 1992) between 14 and 5 ka. However, the stalagmite provides a record of oxygen and carbon isotope changes reflecting the temperatures and vegetation at the LGM and earlier. The depression of mean annual temperature at the LGM was of the order of 4-7°C. Carbon isotopes show a dominance of C_3 grasses with increases in the C_4 grass signal at 21 ka and 32 ka, marking interstadials which can be associated with increases in summer rainfall as in the late Holocene.

At the time of the LGM, charcoal data (Scholtz 1986) suggest the Cango Valley was a treeless heathland. The occupation horizon GWA-HCA shows some habitation in the valley even under the most extreme conditions at this time. If this was a time of stress, it may be indicated in the preference for non-local silcrete for making bladelets, suggesting more mobility or wider social networks. As a rule, the probability of occupation being recorded in any sequence at the LGM would be low relative to an interstadial period.

The Later-Middle Stone Age interface at Boomplaas

The dating of the LPC member (21 ka) gives a well-attested minimum age for the interface, but the youngest dated Middle Stone Age layer is the BP member (32 ka) and that underlies YOL. In the YOL member (Deacon 1984a, b) there is the earliest occurrence of the tip of a bone point and a backed microlith, but in this wash there are also Middle Stone Age artefacts. The youngest well-dated Middle Stone Age materials elsewhere are those from Strathalan (Opperman & Heydenrych 1990), Apollo 11 (Wendt 1972, 1976) and Rose Cottage Cave (Wadley 1993). In conjunction with the data from Boomplaas, these suggest the best estimate of the dating of the interface is 23 ± 1 ka. The only conflicting evidence from southern Africa is the much older dating at Border Cave (Beaumont 1978, 1980), an anomaly which is unexplained.

The Middle and Later Stone Ages were defined on differences in technology and the differences are in the production and size of flake blanks. There is a high degree of standardisation of Middle Stone Age flake blanks. Mason (1962) referred to this as 'dorsal preparation', meaning that the core was developed to produce a blank of predetermined form. In the Later Stone Age there is not the same emphasis on control of the form of flake blanks.

An equivalent interface between what is known as the 'Late' rather than 'Later' Stone Age occurs elsewhere in sub-Saharan Africa at virtually the same time. An example is the dating of the Lemutta industry in Tanzania (Mehlman 1989). North of the Sahara and in the Levant the equivalent of the Later Stone Age is called the late Upper Palaeolithic or epi-Palaeolithic and has similar antiquity (Gilead 1991). The penecontemporaneous, continent-wide replacement of Middle Stone Age technology suggests that the technological change may be explained by the adoption of a significant innovation. There is evidence from Boomplaas that this innovation was bow and arrow hunting.

In addition to the bone point tip from YOL, there are two more complete bone points from the immediately overlying LPC (21 ka). Typologically the latter are arrow armatures (Deacon 1984b). There are further examples in the younger layers associated with the Robberg industry. The only complete bone point from a Middle Stone Age context is from Klasies River (Singer & Wymer 1982), but is discounted as a sport in the absence of direct dating.

There is no evidence from Boomplaas or other South African sites that there was replacement of archaic by modern populations at this interface. The skeletal remains from Later Stone Age burials (Rightmire 1978; Bräuer & Rösing 1989) are 12 ka or younger and are relatively recent. There are few well dated Middle Stone Age human remains but, for example, those from Border Cave (Beaumont 1978, 1980; Rightmire 1979) are morphologically modern even if the relationship to any living ethnic population is a matter of debate.

Boomplaas cave: the Middle Stone Age

A small area, seven square metres, was excavated through the Middle Stone Age occupation layers to bedrock. The succession of members below YOL is BP, OLP, BOL, OCH and LOH. The 32 ka interstadial in BP correlates with oxygen isotope stage 2-3 boundary and an amelioration at this time was global. The underlying OLP (42 ka) includes layers composed of the bones of thousands of small mammals per square metre, predominantly shrews. The interstadial in the top of BOL, indicated by the small mammal data (Avery 1982), can be equated with the oxygen isotope 3-4 boundary and the three quarter glacial, stage 4, is registered within this member. OCH/LOH (Pta-2464 >49 ka), at the base of the sequence, correlates with stage 5a, the end of the Last Interglacial *sensu lato*, again on the evidence of the micromammals (Avery 1982).

Although BP is a relatively thick multiple occupation horizon, there is only a thin discrete occupation event in OLP and few artefacts in BOL. This indicates low intensity use of the site in the mid-Late Pleistocene, but a continued presence of people in the region. It is over this period that few occupation deposits are recorded anywhere in southern Africa and the densities of people appear to have fallen near or below the limits of archaeological visibility. A mid-Late Pleistocene population bottleneck is indicated, with low environmental productivity the likely cause.

In OCH, there is a marked increase in the use of silcrete as a raw material and a single example of a characteristic large Howieson's Poort segment. The occurrence of this industry in the base of the Boomplaas sequence, with its good biostratigraphic and chronological controls, gives confidence in estimates of its dating to circa 70 ka. It occupies the same chronological position in the Boomplaas and Klasies River main site sequences.

Klasies River sites

The Klasies River sites are in a group of cave and associated deposits on the Tsitsikama coast between Plettenberg Bay and Cape St Francis. They were the focus of extensive excavations in the 1960s (Singer & Wymer 1982) and since 1984 further excavations have been carried out with the dual purpose of improving the conservation status of the sites and extending the archival record from Boomplaas back in time to the beginning of the Late Pleistocene at 125 ka.

The key location is the main site, 0,5 km from the river mouth. It is formed by a re-entrant of the cliff overlooking the sea. There are caves and shelters cut into the cliff face, but these are not the primary reason for the thick occupation layers that have built up at this location. Rather, shelter is provided from the dominant north-west storm weather in the lee of the cliff face. Cormorants still seek shelter on the cliff face in bad weather and they regurgitate pellets of fish bones that fall on the deposits below. The bones of small inshore fishes from these pellets in the deposits testify to the timelessness of this behaviour.

Sea levels are now almost as high as they were at the beginning of the Late Pleistocene and in the intervening period sea levels were some tens of metres lower. It is presumed that under conditions of lower sea level during the Late Pleistocene there was a back-of-the-beach dune protecting the location on the seaward side. In front of the other Klasies River sites that are set further back from the coast there are analogous barrier dunes stabilised by milkwood forest. The barrier dune, probably a series of dunes, would have been destroyed as the sea level rose in the Holocene. The rise in sea level not only removed the dune but also undercut the cone of deposits, causing slumping and the loss of perhaps two thirds of the accumulation at main site. A flowstone layer that formed on the original ground surface before this event has been radiocarbon dated to some 6 ka (J.C. Vogel pers. comm.). This is a time when sea levels rose slightly above those of the present. The impressive 20 m sequence of layers exposed in cuttings and cemented to the cliff face is a remnant.

The 1967-8 investigation (Singer & Wymer 1982) established the outlines of the depositional history, the cultural stratigraphy, and subsistence base of the inhabitants. It also yielded a sample of fragmentary human remains. What has remained to be done is to provide better dating, improve the information on the context of the finds through higher resolution sampling and to add to the interpretation of the significance of the site.

Main site stratigraphy and dating

The sediment pile formed initially in front of and within the lowest cave openings, caves 1 and 1B. As the pile grew against the cliff face, cave 1 became blocked off and eventually even the high level cave 2 at 18 m above sea level became filled. Accumulation of sediments started as sea levels dropped from the Last Interglacial high sea level and these sediments were sands with grading characteristics similar to the modern beach in the nearby cove. Artefacts, hearths and bone and shell food remains are found in the oldest levels, called the LBS (light brown sand) member. Two fragments of maxilla, from different individuals, found in the same shell-rich midden heap within a metre of each other in the LBS are the oldest human remains from the site (Rightmire & Deacon 1991).

An original study by Shackleton (1982) indicated a Last Interglacial isotopic signal for shell from the LBS member, implying a date of 125 ka. This finds support in a later study by Talma (Deacon *et al.* 1988). A uranium disequilibrium date measured by Vogel for a stalagmite that grew on the top of the LBS member (Deacon *et al.* 1988) gave an age of 110 ka. These dates are consistent with the accumulation of the LBS as the coast retreated from the position of the cliff face and the barrier dune was established.

The source of sediments (Deacon & Geleijnse 1988) for the main site depository became the calcarenite dune perched on the cliff top as the sea receded. This was the main contributor of sands as the cone of sediments accumulated against the cliff over the next some 60 ka. Interleaved in these sands are shell middens and carbonised partings surrounding hearths that mark multiple discrete episodes of occupation. The SAS, the thickest member, overlies the LBS, and facies of this member are recognised in different parts of the depository. The top of a stalagmite in the back of cave 1, dated by Vogel, is 100 ka and as this grew in free space, the onset of the SAS sediment pulse is more recent. Amino acid (Bada & Deems 1975) and ESR (Grün *et al.* 1990) datings provide estimates of the order of 90 ka. These dates refer to the age of all the human remains excavated by Singer & Wymer (1982) from caves 1 and 1B and to the ulna (Rightmire & Deacon 1991) recovered in the subsequent excavations. The SAS is associated with the culture stratigraphic unit, the MSA II, of Singer & Wymer (1982).

Collapse of pendant blocks of dripstone formed by waters percolating from the calcarenite dune and depositing carbonates on the cliff face marks the end of the SAS deposition. Designated the RF (Rock Fall) member and equivalent to Layer 22 of Singer & Wymer (1982), the deposits are red brown sands up to a metre thick. The sands are culturally sterile with the exception of isolated carbonised partings marking occupation events. Overlying these sands is the Upper member, the lower half of which includes the Howieson's Poort artefact occurrence and the upper half, the MSA III of Singer & Wymer (1982). The Upper member correlates with the bottom of the Boomplaas sequence. The age of the RF and Upper members is beyond the range of conventional radiocarbon dating and any finite results (Singer & Wymer 1982) can be discounted as minimum ages (J.C. Vogel pers. comm.). The dating of the Upper member and the Howieson's Poort centred on 70 ka has been argued recently (Deacon *et al.* 1988, Deacon 1992). The informally-termed Klasies River regression, equated with isotope stage 4, is registered in the Upper member and correlates with BOL at Boomplaas. There are ongoing studies to increase the precision of the age estimates.

The Upper member represents the youngest Pleistocene occupation at main site. The overlying scree or slope wash preserves no occupation deposits. Abandonment of the site because the depository had filled to the extent that it no longer provided shelter is a possibility but, as noted, the mid-Late Pleistocene is a period of general low archaeological visibility. In the situation of the Klasies River sites it is improbable that populations simply moved closer to the then position of the coast because the off-shore profile (Van Andel 1989) is stepped and steep. The shore would have been less than 10 km distant and still within the range of movements of local groups of hunter gatherers.

Subsistence evidence at main site

The large mammal fauna and the shellfish are the most obvious food remains. It is also evident from the carbonised materials that plant food gathering was an important activity.

Available to the Middle Stone Age hunters were small territorial antelope like grysbok but also a range of medium and large bovids including eland, buffalo and *Pelorovis*, the extinct giant buffalo (Klein 1976, 1989). In addition seal remains are common and they are likely to have been washed up on the coast from rookeries off-shore.

The bovid body part proportions that have been debated in the literature (Binford 1984) are more a reflection of preservation biases and excavation procedures than procurement strategies. Preservation of bone is variable even within the same part of the site and in the same layer. The larger bovid shaft bones have invariably been broken open to extract the marrow, thereby making these skeletal elements more susceptible to disintegration through chemical attack. The friable condition makes the bone difficult to recover and the full range of skeletal elements tends to be under-represented, especially in selected samples. By contrast, the micromammalian fauna (Avery 1987) is more complete and consistently well preserved. These small animals were the food of owls and genet cats and not processed by people.

Shellfish were collected in quantity and shell midden dumps built up. Much of the shell throughout the sequence is *Perna perna*, the brown mussel. This species does not have a robust shell and, due to diagenesis and the mass of overburden, *P. perna*-rich middens tend to collapse. As a result the original bulk of the shell accumulation is less obvious. This is the only explanation that can be offered for the observation of Singer & Wymer (1982) that the shell accumulations are different from those of the Later Stone Age. There is a good example of a midden in front of cave 1C, SAS SM5, that can be traced for a linear distance of more than five metres. It is as extensive as any Later Stone Age midden. This is important, not only because it refutes any suggestion of occasional rather than regular shellfish collecting (Binford 1984), but because it shows patterned disposal of food refuse in localised heaps. This is a point that will be returned to later in the discussion.

Main site is an early archaeological record of the use of sea foods. These resources comprise not only shellfish, but extend to seals and penguins. The fish remains can be accounted for by the activities of cormorants and gulls. The Middle Stone Age occupants did not engage in fishing and they may have lacked the necessary technology for line fishing. They cannot have been ignorant of fish as food as flocks of gulls scavenge dead fish along the beach. In the hierarchy of food resources available in the earlier Late Pleistocene it is possible that fish were not ranked highly. Shellfish, on the other hand, are a source of fat (Fox 1966) and, importantly in this environment, minerals and therefore shellfish may have been an essential if less substantial item of diet.

The situation of main site points to its having been a base for procuring sea foods, but a noteworthy feature is the occurrence of carbonised material in the surrounds of domestic hearths. By analogy with better preserved Holocene sites (Deacon 1993) the carbonised material represents plant food residues. Although none of the material has potential for specific identification the local endemic flora is rich in geophytes; corms, bulbs and rhizomes. It is the discarded bulbar leaves and corm tunics from the processing of plant foods that accumulated in domestic space around hearths, became burnt and formed the distinctive black partings that are common features at the site. Where this material was not burnt the only trace may be brown colouring due to humification of the residues. The numerous hearths show an ability to make fire at will and, given the obvious response of geophytes to fire, I have argued for a high antiquity for the farming of geophytes with fire. The point is that geophytes regenerate slowly and require management to be a viable resource.

Cultural remains

Stone artefacts occur in considerable densities at the site. Density is, firstly, a measure of the intensity of occupation and, secondly, a product of the degree of diagenesis of materials other than stone. The main exposures are also those at the back of the cone of deposition where the rate of accumulation was slower and interbeds separating episodes of occupation are thinner. The diagenesis of shell, carbonisation of organics and thin interbeds result in considerable overprinting of one horizon on another, making distinction of discrete occupation events difficult in the field. However, even if the densities of artefacts reflect post-depositional processes, the impressive numbers of artefacts show this to have been a well-used location. The extent of the deposit before truncation can be mapped from cemented relicts on the cliff face and the total volume of deposit was very considerable. The size of the site and the quantities of cultural remains are consistent with it having been an important and perhaps ritually powerful place.

The 1967-68 excavations generated a large assemblage of artefacts, so many that they were selectively sampled. The artefacts from the more limited recent excavations provide some control on selection. The typology of the artefact sample is well described in Singer & Wymer (1982), as is recognised in subsequent re-assessments and studies (Volman 1981, 1984; Thackeray 1989, 1992). The materials are mainly hard high quality quartzite that produced robust edges not in need of strengthening by retouch. Reduction sequences are not a feature and use damage rather than retouch is the primary form of edge modification on flake blanks.

The low incidence of retouched tools in the Middle Stone Age makes the backed tools in the Howieson's Poort assemblage in the Upper member noteworthy. Similar assemblages occur throughout southern Africa (Deacon 1992). In the Klasies main site sequence, as at Border Cave (Beaumont 1980), the popularity of these backed tools has a limited stratigraphic and therefore temporal range. The Howieson's Poort segments and trapezes are modal forms of the same tool type, have the same form as the Later Stone Age Wilton segments, but are one third larger. The difference in size is explicable in functional terms if it is accepted that both size classes were designed to be mounted on projectiles; the larger Howieson's Poort examples on spears and the smaller Wilton examples on arrows. They would then have served as a cutting edge to ensure a sufficiently large entry wound for the shaft of the projectile. The test of these inferences lies in replication and use damage studies that will follow on the detailed typological and technological investigation currently being undertaken by S. Wurz. If backed tools are parts of hunting equipment then further inferences about behaviour can be drawn, as indicated in a following section.

Human remains

The human remains are not uniformly distributed through the deposit. The oldest come from a midden in the LBS member and thus date to approximately 120 ka. These are two maxillary fragments from the same horizon and they were found in close proximity. There is a younger episode of accumulation (Deacon & Schuurman 1992) to which all the Singer & Wymer (1982) finds from cave 1 and cave 1B relate. The dating is about 90 ka. A number of individuals are represented (Rightmire & Deacon 1991) and again the remains are fragmentary. There are isolated finds from higher in the sequence.

White (1987) has suggested that cannibalism explains how the human fossils got into the deposit. Apart from being fragmentary, there are impact and cut marks and many pieces are burnt. The context shows the fossils are not from conscious burials or reburials and the association is with heaps of discarded food waste. It is this association and the paucity of non-cranial skeletal elements that suggests processing the carcasses like those of other animals and may indicate dietary cannibalism. However, as there is a ritual component to all cannibalism, no clear distinction between dietary and ritual cannibalism may be possible. The practice is unlikely to have been restricted to one site and a record of the incidence at other Stone Age sites is needed to access the Klasies River evidence more fully. Regular prosecutions in the courts (Evans 1993) involving medicine murders show that a form of cannibalism is still practised in South Africa.

In the Late Pleistocene there was strong selection for gracility in large mammals, including humans. The Klasies River finds are at the beginning of this process of mosaic evolution. A single dimorphic population is sampled and this is more archaic and undoubtedly older than the more complete but less well provenanced and dated remains from Border Cave. Assessment of the Klasies River sample as morphologically modern (Singer & Wymer 1982, Rightmire & Deacon 1991, Bräuer *et al.* 1992) has not gone unchallenged (Smith 1992), but enjoys substantial support. The scarcity of well-dated human remains from the Late Pleistocene of southern Africa or even sub-Saharan Africa at present makes it impossible to detail the series of morphological changes that took place in the Late Pleistocene and demonstrate on morphological evidence any ancestor-descendant link with extant peoples. The case for population continuity and specifically for relationships with the Saan is argued on the grounds of behaviour, not morphology.

Questions of behaviour in the Middle Stone Age

The most explicit statements on the behaviour of human groups inhabiting main site have been made on the basis of faunal studies. An emphasis on scavenging has been cited by Binford (1984) to indicate a pre-modern human level of behaviour. Klein (1989, 1992) has consistently argued in favour of hunting, but at a grade less efficient than in the Later Stone Age because, for example, young and old individuals rather than prime adults of the large, more aggressive species were the prey of Middle Stone Age hunters. He has also pointed to food resources important to Later Stone Age people like fish and flying birds which were not exploited at all or, like shellfish, exploited less intensively during the Middle Stone Age. In addition, the absence from Middle Stone Age assemblages of other generally accepted markers for modern behaviour by reference to the Upper Palaeolithic such as art, personal ornaments and bone tools is part of his reasoning that the behaviour of Middle Stone Age people was not fully modern.

The high degree of fragmentation of skeletal elements in the fauna is a measure of the intensity of processing of the fauna. The excavation of a limited area in cave 1B as part of this programme (Henderson 1990) was designed to look at the spatial relationships between hearths, artefacts and faunal elements. Among other evidence, a partial skeleton of a medium bovid mapped in this area and identified by J.S. Brink provides evidence for carcasses having been returned to and butchered at the site. A recent study of bone damage signatures on the fauna from Klasies River cave 1 by Milo (1994) complements this observation and supports active predation on all size classes of bovids, a level of hunting skill that he rates as near-modern. The reason for his positing near-modern behaviour is cultural: the absence of bone technology and art. I would suggest the faunal data relate more to ecological changes over time, the ranking of foodstuffs and the availability of technology than to differences between Middle and Later Stone Age peoples in cognition in the economic sphere.

Comparisons with Later Stone Age and Saan hunter-gatherers as well as Earlier Stone Age Acheulian groups are relevant to a discussion of social cognition. In the southern Cape and the surrounds of both Boomplaas and Klasies River, Middle and Later Stone Age sites have the same distribution in the landscape. Sites are along the coast and in the mountains and there is frequent but not exclusive occupation of rock shelters. The only overlap with Earlier Stone Age Acheulian sites is at dunal wetland localities on the outer margin of the coastal platform, situations like the Geelhoutboom site of Laidler (1947). Acheulian groups had a narrow ecological focus, linked to water sources in a way that is more significant than simply the absence of containers for transporting water. Greater mobility in the landscape is evident for Middle and Later Stone Age groups who ranged from the coast to high in the mountains, often using the same rock shelters. This mobility implies not only the use of different, in particular plant, resources but social mechanisms for aggregation and dispersal. Because of the antiquity of Acheulian sites, considered to be upwards of half million years old, the contexts are variously disturbed and preservation is poor. However, the artefacts still mark the positioning of their makers in the landscape and from this it is inferred that Acheulian groups did not have the social mechanisms to disaggregate and disperse as did later peoples. The Acheulians are the non-modern outgroup in the assessment of social cognition.

What is impressive in the investigation of the Klasies River main site Middle Stone Age deposits is the extent to which they mirror Later Stone Age deposits in the features encountered. These features are interleaving occupation and non-occupation horizons denoting episodic occupations, discrete circular hearths set in carbonised partings or haloes of brown (humified organic) soil and discrete middens of bone and shell food waste. The deposits at main site are older and more degraded than at well known local Later Stone Age sites of Nelson Bay cave (Inskeep 1987) or Matjes River rock shelter, but the site formation processes are the same. This encourages the view that people were living by the same rules of use of space and cleanliness in the Middle and Later Stone Ages.

Comparisons can be extended to individual features. Hearths of the same form, as noted, occur in both Middle and Later Stone Age occupations at these sites. In the sequences they tend to be storeyed or in echelon, suggesting that they were laid in the same place over a series of visits. The function of the standard hearth was domestic, as the cooking-hob size suggests. At main site a direct association with food items like mussels can be shown (Henderson 1990, 1992). In modern traditional societies, whether hunter-gatherer or agriculturist, domestic hearths are the domain of women with reproductive rights and with the social obligations of child-rearing. In this sense hearths are women. In Middle and Later Stone Age contexts the presence of domestic hearths indicates not only the presence of women but, by extension, that the nuclear family was the basis of the social group. The argument is that for more than 100 ka the social dynamics of hunter-gatherer groups have been similar to the range observed among modern Saan hunter-gatherers.

Some researchers have been reluctant to see Middle Stone Age behaviour as modern because of the absence of bone technology. There may be significant technical reasons for the absence of bone working, but they may have little bearing on cognition. In the Later Stone Age wood and bone are interchangeable materials. The study of wood and bone artefacts from the well preserved Later Stone Age site of Melkhoutboom (Deacon 1976), for example, showed that the same artefacts were made in both materials and the materials were worked in similar ways. For smaller artefacts, like link shafts for arrows, a denser, less pliable bone may be superior to wood. The paucity of bone artefacts from Middle Stone Age contexts is understandable in relation to the items of equipment made rather than an inability to appreciate the properties of bone as a material. There are several considerations that make it inappropriate to contrast Upper Palaeolithic bone and antler working, in a non-African environment, with Middle Stone Age technology. One is the difference in the availability of materials like antler compared with hardwood. Another is the difference in the levels of investment in technology. The low investment in technology in the Middle and Later Stone Age reflects the diverse and dispersed resource base with productivity made unpredictable by episodes of drought. This is in strong contrast to populations living in the higher latitude zone of the westerlies where even under drier glacial conditions precipitation was not a limiting factor and investment in specialised technology was appropriate to harvest strongly seasonal abundances of resources.

Another accepted Upper Palaeolithic marker for modern behaviour is the presence of art in the form of personal ornaments, decoration on artefacts and rock art. There are few finds of personal ornaments from Middle Stone Age contexts that warrant serious consideration and all require independent dating. If less durable materials than shell and bone were used for ornaments, they will not be archaeologically visible. However, there is evidence for personal ornamentation in the Middle Stone Age in the occurrence of ochre. Red ochre, including triangular shaped ground ochre pencils from main site (Singer & Wymer 1982), indicates that a level of colour coded symbolic communication was practised. In traditional societies throughout southern Africa body painting is common and the use of pigments may be associated with rites of passage (Prins & Hall 1994:190). Rock art from a late Middle Stone Age context has been reported from Apollo 11 (Wendt 1972) but thus far not from any southern Cape sites. The use of symbols for social or religious reasons is universal among modern peoples but may take many forms.

Artefacts are a further potential source of information on behaviour. As formal design types that, it has been suggested, were hafted, it is possible to single out the Howieson's Poort backed artefacts. At main site there is an increase in the use of non-local material (Singer & Wymer 1982) in the manufacture of segments and trapezes; the non-local materials are mainly silcrete but also include hornfels, chalcedony and quartz crystal. Raw material selection is not functional because the larger proportion of these artefacts are made on local quartzites. The value added to the composite tools in which these stone inserts of non-local rock were hafted can be understood if the tools were traded in a system of exchange. Exchange implies rules of reciprocity which point to a modern level of social interaction. If segments and trapezes were parts of hunting equipment, as discussed above, an argument can be made that this equipment was used and exchanged by males. Reciprocal exchanges of equipment between Saan hunters (Wiessner 1983) reinforces inter-male bonds and it is suggested here that such exchanges were part of Middle Stone Age social dynamics. Apart from backed tools, pressure flaked bifacial points are among the finds that point to the importance of reciprocity in the Middle Stone Age.

Binford's (1984) characterisation of Middle Stone Age people as sub-human scavengers seeking a convenient shelter to consume food items too small to share has stimulated closer examination of evidence for the behaviour of the people who lived at main site. A set of arguments has been presented that Middle Stone Age people were modern in their cognitive abilities in the economic, technological and social spheres.

It is inappropriate to apply eurocentric criteria to archaeological discussions of what constitutes modern as opposed to non-modern behaviour in an African context. Neanderthals did not live in sub-Saharan Africa and were not the makers of Middle Stone Age artefacts. The Later Stone Age is not an African equivalent of the Upper

Palaeolithic. What, then, are the criteria that indicate modern behaviour in a southern African context? These should include a nuclear family basis to foraging groups with social mechanisms for aggregation and dispersal, individual domestic hearths, active hunting of all sizes of bovids, management of plant food resources, colour symbolism, and reciprocal exchange of artefacts. The outgroup would be Acheulian foragers living in the same landscape earlier in time, who arguably had base camps, practised food sharing but lacked the same social mechanisms for dispersal. It has yet to be shown that storeyed hearths occur in any of the South African Acheulian cave sites but showing that they are absent, if indeed they are, is important. Acheulian groups may have had control of fire but it is not known whether they could make fire at will, or used fire in the management of food sources. The presence of ochre as an exotic material at Acheulian sites has yet to be documented although there are claims that it occurs (Beaumont pers. comm.). Middle Pleistocene bifaces may show degrees of refinement but I am not aware of claims that they were items of exchange. This does not gainsay the evidence from technological studies that humans in Acheulian times had complex cognitive abilities (Belfer-Cohen & Goren-Inbar 1994) but it does suggest that those abilities were not of a modern grade.

Concluding comments

Although investigated from the same institutional base, by the same team and producing similar sets of data, the reports on the two sites given here are different in emphasis. The different emphasis shows the development of theoretical perspectives in the course of the programme. At Boomplaas a primary concern was the establishment of a culture stratigraphic and biostratigraphic sequence. With much research already done at the Klasies River sites (Singer & Wymer 1982) there has been the opportunity to focus on details of context and interpretation. Together these investigations provide a corpus of data and constraints for debating propositions about the environmental conditions of Late Pleistocene times and the behaviour of people.

The research in the Cango Valley, at Boomplaas and the Cango Caves (Talma & Vogel 1992), has produced a number of independent lines of evidence that the last 5 ka was the period of most favourable environmental conditions in many millennia. This is significant because it indicates that the primary explanation for greater archaeological visibility and for what goes under the archaeological concept of 'intensification' in the later Holocene is environmental. Causal primacy for changes in social dynamics may lie in the changing modes and relations of production but these are the consequence of population increase driven by environmental change.

The stage units have been useful in giving a time frame for South African archaeology when other dating evidence has been absent. They continue to be useful as broad time referents. The Middle and Later Stone Age stage terms, however, have significance only in technological terms and the technological change to which they refer has no social or demographic correlates. There is the same scale of technological change at a similar time throughout sub-Saharan Africa and this underscores a need to investigate this pattern of change on a continental scale. The miniaturisation of artefact piece size, one way to describe this technological change, and an explicit link to bow hunting is argued.

The debate over the emergence of anatomically modern people has done much to encourage a world view of archaeology. New research in the fields of genetics, palaeoanthropology and archaeology has been stimulated. Studies of the geographical distribution of gene frequencies (Cavalli-Sforza *et al.* 1994) and the use of new techniques to analyse entire human mitochondrial DNA sequences (Horai *et al.* 1995) are among recent advances providing strong evidence for the recent (100-200 ka) African origin of modern people, the RAO hypothesis. The Klasies River main site has had some prominence because if the human remains from the site are assessed as morphologically modern, as contended in this paper, they are further support to the RAO hypothesis. The fossils, dated to 120 and 90 ka, are fragmentary but indicate a dimorphic population that is more archaic and presumed to be older than the other important set of human fossils with a bearing on the RAO hypothesis from South Africa, those from Border Cave. Efforts to obtain a larger sample of well-dated human fossils from local and other African sites enjoys some priority in research but, ethically, archaeologists cannot mine deposits for human remains. The relevant deposits contain important information and materials relating to human behaviour.

Archaeological interest in the debate over modern humans is in the evidence for the emergence of modern behaviour. The conventional wisdom has been that the behaviour of Middle Stone Age people was different from that of Holocene Later Stone Age people and that Middle Stone Age people were not behaviourally modern. One of the main contributions of this investigation of the two depositories has been to provide a detailed and continuous archaeological record of the similarities and differences in behaviour over the duration of the Holocene and Late Pleistocene. Evaluation of this record has led to questioning the conventional wisdom and this paper argues for modern economic and social cognitive abilities in populations at the beginning of the Late Pleistocene, more than 100 000 years ago.

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