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LATE HOLOCENE AND HISTORICAL BONE MIDDEN DENSITY IN ROCK SHELTERS OF THE UPPER SEACOW RIVER VALLEY*

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ABSTRACT

Many different taxa are represented in the faunal remains from upper Karoo rock shelters. However, meaningful frequency changes in individual species cannot be detected. An alternative approach is to measure changes in bulk faunal mass per unit volume of deposit. When the faunal contents of nine shelter fills were processed in this way it was found that at least two densely packed layers of mammal remains occurred at the same levels in all shelters. The lower midden, dating to ca 800 BP is usually the smaller of the two. It may be compressed with an even earlier midden of ca 1100 BP in a few shelters. The uppermost midden is better defined, with peak densities at ca 400 BP. As the three midden dates coincide with marked increases in grass over scrub pollen in local hyrax dung accumulations, and with small temperature fluctuations in the Cango speleothems these events may reflect increased Bushman hunting activity during spells of greater carrying capacity. Historical levels coincide with a sharp drop in faunal density in all but one shelter.

INTRODUCTION

None of the several Late Holocene faunal assemblages from Upper Karoo rock shelters (Sampson 1967:58-60, 1970:67; Deacon 1976:230; Klein 1979:42-3) show significant species fluctuations through time. Although some assemblages are quite large, the range of species present is considerable and few taxa are represented by more than a dozen specimens per sample. Some are represented only by solitary specimens. When an assemblage is divided into stratified or (in most shelters) arbitrary spit-based subunits, numbers of even relatively well represented taxa are reduced to a few specimens per layer. Typically, tables of percentages contain many columns of taxa, each filled with very low values. Visible fluctuations in frequencies of taxa through the layers (or spits) are rendered trivial or meaningless on account of low sample sizes. Consequently it is impossible to determine whether or not there were fluctuations in the procurement patterns of non-domestic mammals by upper Karoo hunter-gatherers.

Here, we present a promising alternative approach designed to bypass the problem posed by small sample totals. It also overcomes the effects of excavating by arbitrary spits in deposits without visible stratigraphy. The methods of recovery and analysis are briefly described, and the results from a cluster of nine rock shelters in the upper Seacow River valley (Fig. 1) are compared. Finally the shared patterns of fluctuating bone midden density are compared with palynological data from the same area, and with paleotemperatures estimates from the more distant Cango speleothem record.

METHODS

Our recovery and recording methods are a compromise between the expense and slowness of point-plotting and the faster, cheaper procedure of removal in metre squares

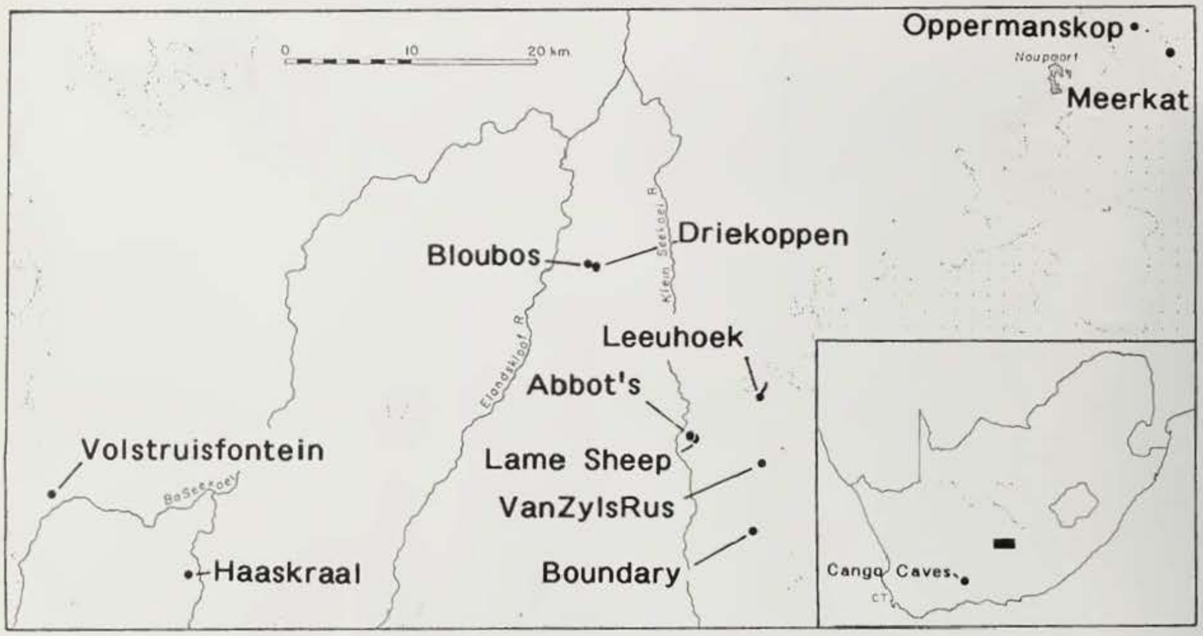

Fig. 1. Location of sites in the upper Seacow River valley, showing tributary channels and mountains (stippled). Inset: Location of the study area in relation to Cango Caves.

with no recording control of horizontal provenience within the the square. We divide the square into 16 blocks, each removed and bagged separately. Where no micro-stratigraphy is visible for depth control, the thickness of the removed block is kept between 25-30 mm (Sampson *et al.* 1989:7). The block's volume is ca 1,6-1,8 litres, between a third and a half of an average bucket. Although not precisely standardised as a unit volume of deposit, it has proved adequate for our purposes. Where the deposit contains abundant roof spalls, rock removal forces the depth of the unit to increase, although the volume of sediment is about the same.

As the dimensions of each block is recorded, 250 mm wide slices through the shelter fill can be reconstructed from superimposed blocks, resembling the stone masonry in a wall. As an example, two contiguous slices through Abbot's cave (Fig. 2 top) are illustrated (Fig. 2 center), showing a rocky roof fall zone where block thickness are greater.

When the number of non-domestic mammal fragments is plotted for each block in each slice, the density and packing of bone is found to be highly variable. Next, in order to remove the clutter in these data, blocks containing >100 fragments are plotted alone to isolate patches that can be reasonably termed bone middens. In the example shown here, a lower patch is clearly separated from an upper sheet. (Fig. 2 bottom).

Further synthesis was achieved by projecting blocks with >300 fragments on to composite sections comprising the back eight slices (Fig. 3 top) and the front eight slices (Fig. 3 bottom). Also on to these were projected the positions of blocks with 200-299 fragments and 100-199 fragments. The resulting plots were smoothed to form isopleth lines that reveal density variations within midden seen to comprise different areas and phases of faunal dumping. Without visible interfaces in the deposit, it was impossible to excavate these as discrete units.

The positions of chronological markers can also be projected on to the composite section to assist in estimating the dating range of individual middens. Again using Abbot's cave as the example (Fig. 4), the faint outlines and dense centers of the bone middens are plotted in relation to: the deepest and therefore earliest European artifacts (Saitowitz & Sampson 1992; Crass & Sampson 1993a & b; Moir & Sampson 1993; Sampson in press; Westbury & Sampson 1993); to the earliest European livestock (Plug *et al.* in press; Voigt *et al.* in prep.); to available radiocarbon dates; to the earliest ceramics (Hart 1989:225; Sampson *et al.* 1989); and to sherds with decorations known to have very narrow dating ranges (Vogel & Sampson in prep.).

Although the mammal remains are quite fragmented throughout, there are no significant differences in the median size of bone fragments (ca 18-20 mm) from densely packed lenses or from bone-poor horizons. This holds for al the sites in this study. From this we assume that changes in midden density reflect changes in accumulation rate rather than changes in bone particle size.

THE BONE MIDDENS

Abbot's cave

A small midden accumulated in the front half of the cave and must have reached peak density at ca 800 BP, given the associated radiocarbon date (Sampson & Vogel 1989:1). There is a small patch of high density bone below this, but above the line of earliest sherds that mark the ca 1100 BP horizon (Fig. 4 bottom).

The large, dense upper midden is separated from the

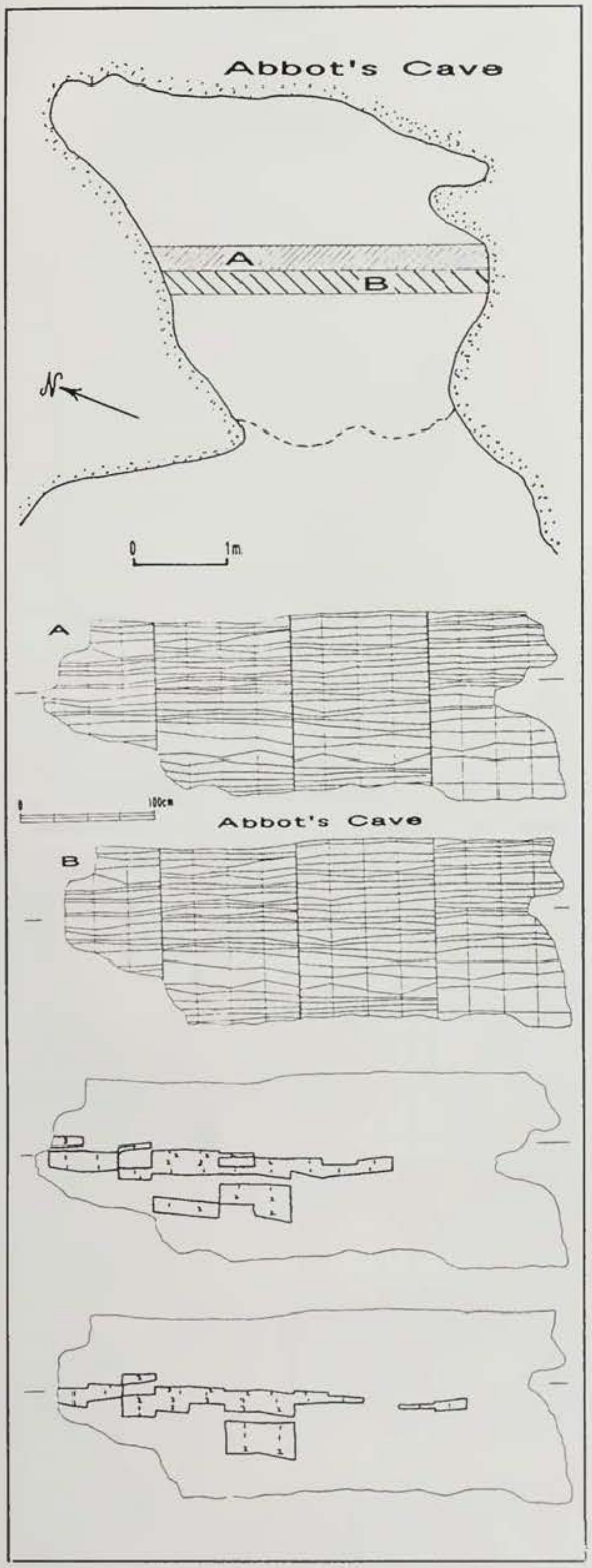

Fig. 2. (Top) Plan of Abbot's cave showing positions of two adjacent slices A and B; (center) side views of the two slices A and B, showing dimensions of excavated blocks; (bottom) slices A and B showing blocks containing >100 mammal fragments. Handwritten numbers in blocks are x100 fragments.

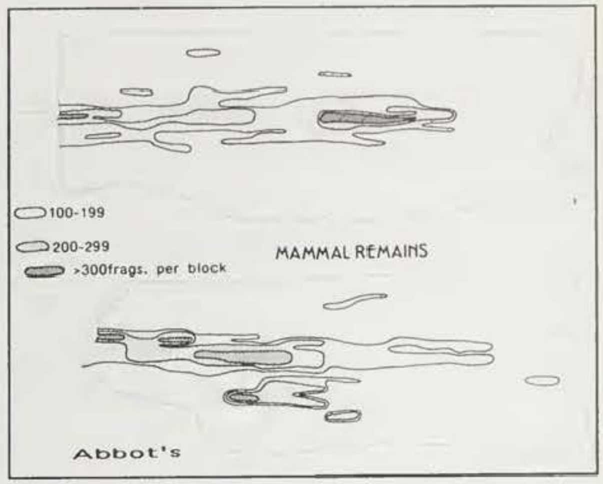

Fig. 3. Abbot's cave composite sections of (top) eight slices through the back half of the fill, and (bottom) eight slices through the front half.

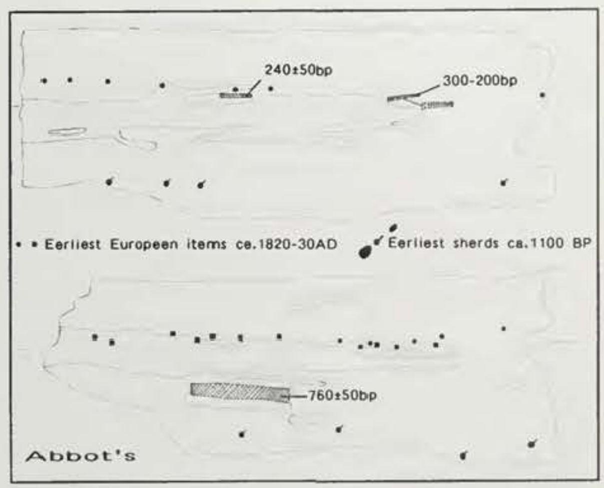

Fig. 4. Abott's Cave composite sections with chronological markers superimposed. European items include artifacts (circles) and livestock remains (squares. The conjoined blocks labelled 300-200 bp contain sherds with a decorative motif of that dating range.

lower by a bone-poor zone. There are hints of density fluctuations in the lower part at the upper midden, particularly at the back of the cave, and the two main concentrations within its core may be of different ages. The range of species present is given in Plug (1993). Four charcoal samples through the rear sequence have been submitted to obtain a refined chronology, and a date of ca 400 BP can be expected for its center. The line of deepest European artifacts in the front (Fig. 4 bottom) includes items not made before the 1820s, but some have been thrust down from above. Livestock were being stolen by local Bushmen after 1870 and were being given to them soon after 1800 (Voigt *et al.* in prep.). The radiocarbon date of 240 $\pm$ 50 BP (Pta-5183) from the back raises the possibility that midden density may have begun to diminish even before European contact.

Lame Sheep Shelter

Increases in bone fragments per block could be the result of increases in bone smashing and fragmentation rather than increases in game input to the midden. The most efficient way to demonstrate that bone fragmentation rates are not a contributing factor is to weigh (rather than count) the limb bone shaft and other splinters as well as fragments of tooth enamel and other undiagnostic pieces. This has been done for the adjacent Lame Sheep Shelter.

Lame Sheep is not really another site, but an extension of Abbot's Cave, with its rear exit linked to Abbot's through a short, low tunnel that joins the two deposits. The occupation history of Lame Sheep was quite different, however. The first sherds to appear are soon followed by a large dense bone midden well represented at the back (Fig. 5 top) nearest Abbot's, and also at the front (Fig. 5 bottom). Block depths in this very stony deposit were too deep to allow finer stratigraphic subdivisions of the lower midden, but it may be the equivalent of Abbot's lowermost two patches compressed into one. Associated charcoal has been submitted for dating. The large upper midden in Abbot's is reduced to a vestigial trace at the back of Lame Sheep closest to the link tunnel. Evidently the shelter roof disintegrated, making Abbot's the more attractive cavity for occupation. The dense patches in the post-Contact levels of Lame Sheep include some livestock remains, so they are not comparable with the Abbot's record where all livestock had been removed before analysis. Plug (1993) lists the frequency of wild species present.

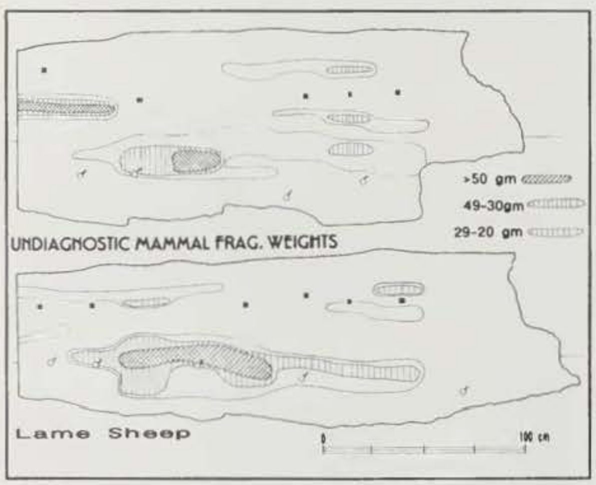

Fig. 5. Lame Sheep composite sections of (top) eight slices through the oack half of the fill, and (bottom) eight slices through the front half. Key to marker items in Fig. 4.

Volstruisfontein Shelter

Unsorted bulk fauna weights can also be used to discriminate between middens. In this case, the micromammal, fish, bird, reptile, and amphibian remains have not been removed from the sample before weighing, nor were the diagnostic articular ends and dentition

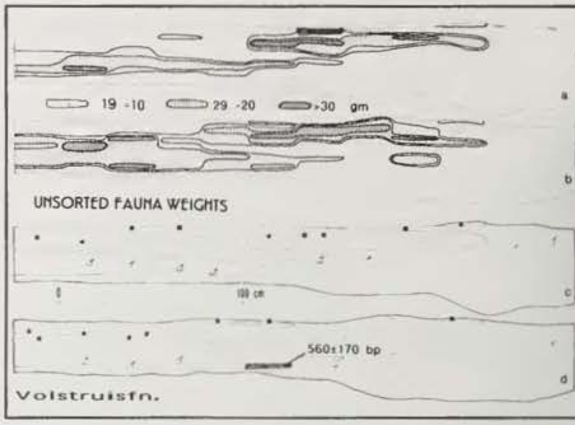

Fig. 6. Volstruisfontein (a, b) adjacent composite sections of two slices each through the fill. Rear shelter wall is to the right; (c, d) same, with chronological markers. Key to marker items in Fig. 4.

excluded. Again, an upper and a lower midden is clearly visible in two composite sections (Fig. 6a & b). The position in Fig 6d. of the radiocarbon date (Hart 1989:161) suggests that the whole sequence is equivalent to the Abbot's upper midden. However, there are hints (fresh micromammal remains) that the charcoal came from a disturbed area, so the lower ceramic line (ca 1100 BP). may be the better marker here. More charcoal dates will be obtained to resolve the question. The European items within the bone midden on the left of Fig. 6d have been thrust downward by churning and are not *in situ*. The top of the bone midden is inflated in a few places into the post-Contact levels because livestock remains are included in the weights.

Haaskraal Shelter

These samples were treated in identical manner to Volstruisfontein, and more charcoal dates are available (Hart 1989:156). Although overall faunal density is much higher at Haaskraal, two middens emerge if the density isopleth values are raised (Fig. 7). Faunal density is clearly very low before 1200 BP. The core of the lower lens of the lower midden dates to ca 1100 BP. and a

Fig. 7. Haaskraal composite sections of four slices through part of the shelter fill. Rear shelter wall is to the right. Key to marker items in Fig. 4.

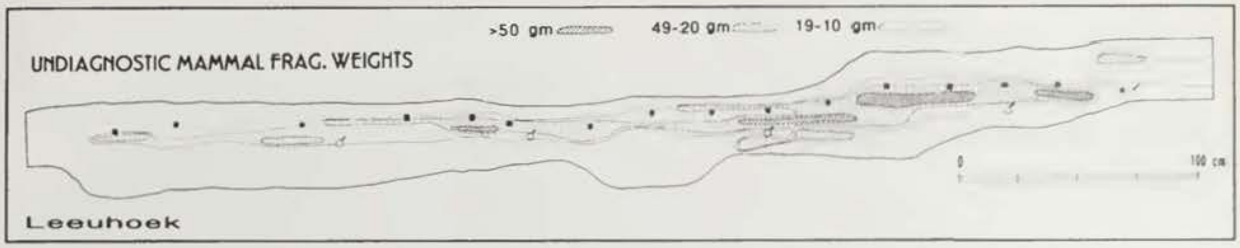

Fig. 8. Leeuhoek composite section of all eight slices through the fill. Key to marker items in Fig. 4.

younger lens of ca 500 BP. has been compressed into it in places. As the layering is not perfectly horizontal, the projected elevations of some dates appear misplaced. The top part of the upper bone midden is inflated by numerous livestock remains, including cattle (Plug *et al.* in press).

Leeuhoek Shelter

This very shallow, compressed fill yielded a rich fauna, but the separation between the upper and lower middens cannot be clearly resolved (Fig. 8). Leeuhoek has exceptionally well defined upper and lower marker horizons. There is a small high density patch in the preceramic level, of uncertain date.

Van Zyls Rus Shelter

The Late Holocene midden is on a visible disconformity separating it from Lower Holocene deposits in which very little fauna has survived (Fig. 9). Here, total non-domestic mammal fragment counts were used to construct the composite section. Like Leeuhoek, the bone midden is too compressed between the two marker horizons to show subdivisions. There is a dense patch of game remains above the earliest European markers.

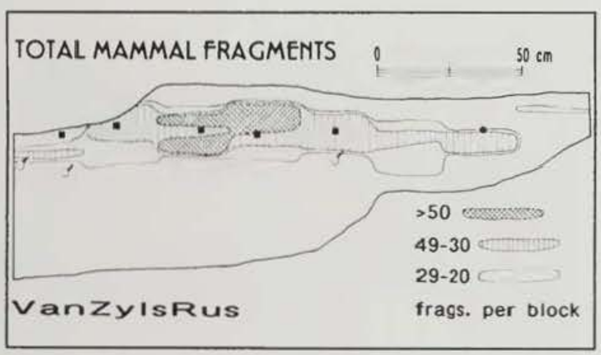

Fig. 9. Van Zyls Rus composite sections of all 12 slices through the fill. Rear shelter wall is to the right. Key to marker items in Fig. 4.

Boundary Shelter

Small patches of high density fauna rest on the Lower Holocene deposits but the patches are capped by the deepest sherds and could be preceramic in age (Fig. 10). Until associated charcoal dates are obtained it remains uncertain whether they represent the ca 1100 BP. midden seen at Haaskraal. In spite of the paucity of fauna and the highly compressed sequence between the two marker horizons, there is a well defined separation between the

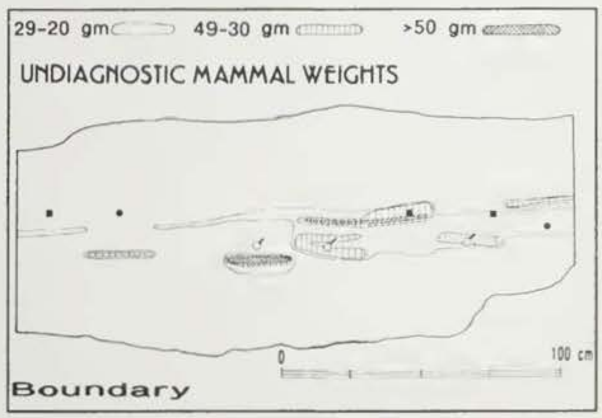

Fig. 10. Boundary composite section of twelve slices through main part of the fill. Rear shelter wall is to the right. Key to marker items in Fig. 4.

small, patchy lower midden and the more extensive upper midden.

Driekoppen Shelter

Very low faunal densities and poor records (the faunal contents from blocks in the same spit and square were combined) make this site difficult to present. Even though block values must be averaged, the analysis indicates that Driekoppen is unlike any of the others (Fig. 11). Only one concentration is evident between the two marker horizons, and the densest layer is near the surface in the post-Contact horizon.

Fig. 11. Driekoppen composite section of four slices through central part of the fill. Rear shelter wall is to the right. Key to marker items in Fig. 4.

Bloubos Overhang.

Only ca 100 m along the same slope as Driekoppen, the Bloubos sequence conforms not with its large neighbour but with the rest of the shelters in the upper valley. Although only a 1 x 1 m test pit (Fig. 12), the

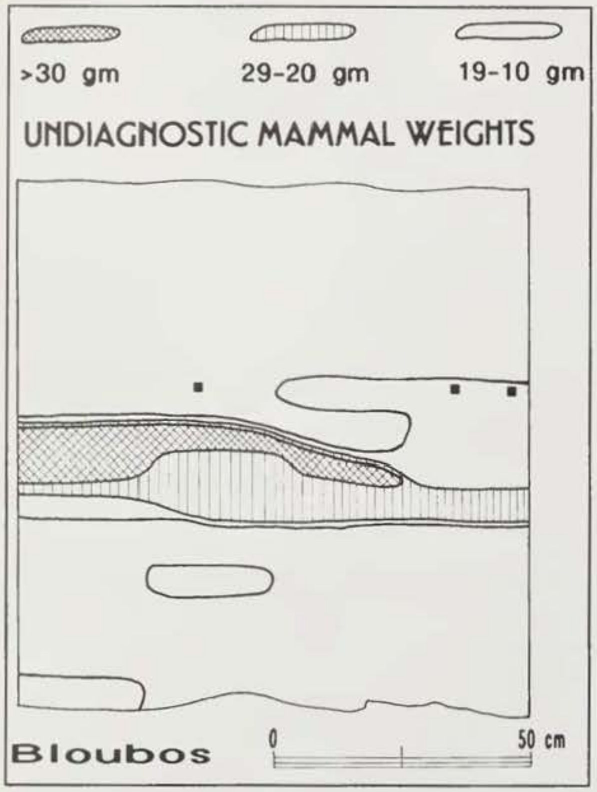

Fig. 12. Bloubos composite section of four slices. Key to marker items in Fig. 4.

results show a high-density patch on bedrock. It is followed by a second patch, followed by a low density zone then a very dense midden underneath the deepest European marker horizon. Although the sample is too small to allow us to see the deepest ceramic marker horizon, lithic analyses show beyond reasonable doubt (Pease 1993) that this is the same sequence seen elsewhere.

DISCUSSION

The first question to be settled is the accumulating agent responsible for these middens. The frequency of punctate tooth marks and porcupine gnawing is so small (Plug 1993) that the contribution of scavenging animals may be safely dismissed as trivial (Plug & Sampson in prep). By contrast the large samples of hornfels artifacts (Pease 1993), ceramics (Sampson *et al.* 1989), ostrich egg shell fragments (Sampson in press), and charcoal hearths directly associated with the bone accumulations can leave no room for doubt that they are mainly human discard. No attempt is made here to exclude the the small sample damaged by carnivores or porcupines from the analysis.

The next question is not so easily settled, namely the anomalous Driekoppen sequence. This may be connected to several other differences already noted at the site (van der Merwe 1990; Crass & Sampson 1993b) which hint that it may have been a major ritual centre. If, as suggested, its floor was a platform frequently used for trance dancing during post-Contact times, then aeolian lagging (the site is fully exposed to prevailing northwesterlies) and fragmentation underfoot may have combined to cause the post-Contact accumulation. The unprotected aspect of this site and its porous doleritic fill probably account for the paucity of older fauna.

The case for accelerating rates of mammal bone accumulation in all other shelters over a period centered on ca 400 BP is well supported. Implied in this statement is the untested assumption that rates of sediment deposition and roof fall remained constant before, during and after the midden forming event. It also assumes that the rate of sediment removal by wind scouring remained constant over the same period. Competing hypotheses are that bone accumulation rates remained constant while pseudo-middens formed because of lowered sedimentation rates and/or wind lagging of fauna. Independent cross-checks are needed from other sources to refute the rival hypotheses.

Although some 700 km to the southwest of the upper Seacow (Fig. 1 inset), the outstanding speleothem record from Cango Caves (Talma & Vogel 1992) is of particular value. The later part of their radiocarbon dated $\delta^{18}O$ record suggests relatively brief warmer episodes centered on ca 1150 BP, 850 BP, 450 BP and 50 BP (Fig. 13) with intervening colder episodes, particularly those centered on ca 1350 BP and 750 BP. Although the temperature fluctuations are relatively small, they reflect changes in deep cavern air temperature, several km from the cave system entrance. This implies a far wider range of ground surface changes. It would seem, on the basis of available evidence, that bone accumulations rates in the Upper Seacow River Valley shelters accelerated during warmer episodes. However, such episodes could promote slower roof spalling without any increase in carrying capacity. Spalling is very marked in the levels of the lower middens, but not in the upper ones, so other lines of evidence should be considered.

The radiocarbon dated pollen sequences from hyrax dung latrines at Oppermanskop and Meerkat shelter on the east rim of the upper Seacow (Fig. 1) are also useful as an independent check on potential processes that cause the middens to form. The ratio of grass to Karoo scrub pollen in hyrax dung appears to be a reflection of the local rainfall regime (Hubbard & Sampson 1993). The pollen diagrams from both sites show complementary fluctuations in grass and scrub pollen (Scott & Bousman 1990) over the last 1300 years or so. The Oppermanskop sequence gives adequate coverage for the earlier half of the sequence, but sampling intervals are too broad in the upper part of the compressed dung to be of much use. However the later portion is covered in excellent detail by the Meerkat latrine which overlaps with the top of Oppermanskop. Bousman (1990) has derived mean annual rainfall estimates from these data, based on comparisons between modern grass/Composite ratios from different parts of the Karoo. His reconstructed rainfall estimates are plotted in Figure 14, together with a summary curve of the Cango Cave temperature estimates.

The warm episodes centered on 1150 BP, 850 BP and especially 400 BP. appear to coincide with increases in

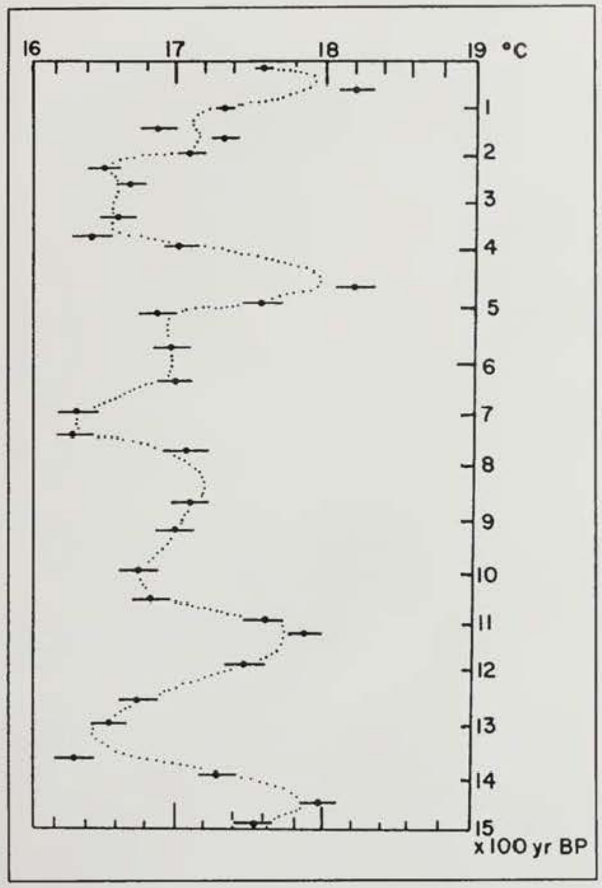

Fig. 13. Temperature estimates based on Cango Caves speleothem $\delta^{18}O$ data for the last 1500 years, after Talma and Vogel (1992:208).

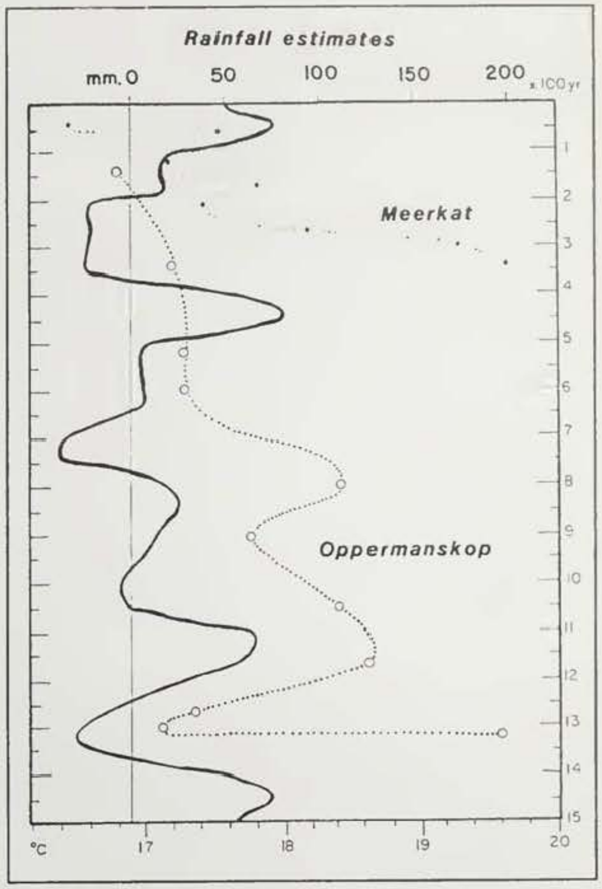

Fig. 14. Cango Caves temperature estimates (solid line) compared with rainfall estimates of Bousman (1990) derived from pollen diagrams at Oppermanskop and Meerkat hyrax latrines (see Fig. 1).

effective moisture, as reflected by increases in grass pollen output. Both the timing and the scale of these events suggest a link between climate, grass cover and bone midden accumulation.

The very marked decline in grass pollen output after ca 100 BP breaks the formerly cyclic association. This is reasonably interpreted as a reflection of the overgrazing by European stock farmers after ca AD 1850, rather than an extreme decline in rainfall. By this time most bone midden accumulation had already ceased abruptly after the systematic game slaughter by Europeans, briefly reviewed by Skead (1987), was under way. In shelters where game remains continued to accumulate rapidly in the post-Contact levels, there are also signs that the occupants possessed muskets (Westbury and Sampson 1993), suggesting that they too had joined in the general extermination.

In other shelters, there are hints that the decline in bone accumulation may have begun some time before the European arrival, but it is impossible to be more precise about dating. The rapid increase in ostrich egg intake by the surviving Bushmen during this period (Sampson 1993) also seems to have begun before the appearance of the first European livestock and artifacts. Precise timing again eludes us.

CONCLUSIONS

Driekoppen aside, a shadowy case can be made for two periods centered roughly on ca 1100 BP and ca 800 BP when the rate of mammal bone accumulation increased in upper Seacow valley shelters used by forebears of the Bushmen. A strongly supported case exists for a very marked increase in bone accumulation in all shelters for a period centered on ca 400 BP. Accumulations rates decline sharply at about the time of European Contact, with hints in some shelters that the decline started slightly earlier. There is a reasonably good fit, both in timing and scale, between these results and the temperature estimates from the Cango Cave speleothems and between both data sets and the rainfall estimates from Oppermanskop and Meerkat pollen diagrams. Bone middens formed during warm-wet episodes and stopped accumulating during cool-dry episodes. The European onslaught disrupted the whole pattern of associations by killing off the game and overgrazing the veld.

These results lend support to a simple climate-driven model in which carrying capacity fluctuates in response to modest, medium-range changes in rainfall and temperature. When carrying capacity reaches a critical level, the frequency of game animals taken by ancestral Bushmen hunters also increases. When they decline, so the frequency of kills decline. The model lends itself to further testing along several avenues of archaeological, archaeozoological and isotopic enquiry.

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