APPENDIX II

A PROVISIONAL INTERPRETATION OF THE SEDIMENTARY SEQUENCE FROM MONTAGU CAVE (CAPE PROVINCE), SOUTH AFRICA

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Introduction.

Montagu Cave is located in the side of a small ravine cut through the Table Mountain Sandstone, near the town of Montagu. Facing ENE the cave seems to be developed near a structural contact in low-grade metamorphics, where shear and tension have favored greater friability and removal of cementing minerals in solution. Sediments with archeological materials are found in the larger and outer of 2 chambers, with a mouth width of c. 11 m, a maximum length of c. 17 m and a vault elevation of as much as 13 m. The site was first excavated in 1919, with a second excavation undertaken 1964-65 by Charles M. Keller (University of Illinois) (Keller, 1966). Since the site contains two major archeological levels and two quasi-sterile strata, all predating 50,000 B.P., Montagu Cave potentially spans the little-known transition of Middle to Upper Pleistocene in South Africa. For this reason the writer studied seven samples (see Table 1), collected by Keller in 1965, attempting a broader interpretation of the sediment sequence.

In addition to macroscopic examination of structure and consolidation, color (dry) was determined by the Munsell Soil Color Charts, texture by hydrometer and wet-sieve analyses, carbonate content by the Chittick method, and pH (electrometrically) in distilled water (see Butzer and Hansen, 1968, appendix A). Textural classes are given according to both the Wentworth and U.S.D.A. classifications. Subsequent microscopic scanning of sand-sized residues included a semi-quantitative estimate of quartz-grain frosting and rounding. Non-quartz aggregates in the sand fraction were found to be soluble in 20 percent hydroxide. These analyses were carried out in the Paleo-Ecology Laboratory (Anthropology Department) of the University of Chicago, with the assistance of Daniel C. Bowman.

Since the samples themselves were too limited in scope to allow an adequate description of the sedimentary strata, a good series of detailed color slides was studied, as explained and amplified by Dr. Keller, and supplemented by the descriptions earlier provided by Keller (1966). Although the overall results are not conclusive, they do show that the strata convey potential paleo-environmental data. The very fact that Montagu is situated within the Cape Folded Ranges, at the edge of the semi-desert Karroo, places it in a climatically sensitive transition.[1]

Bedrock.

The bedrock exposed in Montagu Cave is a white, coarse-grained sandstone that has been moderately metamorphosed. Although it does not deserve the designation "quartzite," the quartz grains have been sufficiently deformed and partially fused to merit the label of a "metamorphosed sandstone."

Grain-size is 50 percent in the 200-500 micron size-range, and the individual grains are quite angular. All the sand-sized quartz grains of the cave sediments fall within the shape and type of this local sandstone, and differences in degree of microscopic rounding are almost negligible. The primary quartz grains show a degree of atypical frosting, which is somewhat more prominent in the cave sediments, particularly in the lower beds. This micro-pitting is almost certainly due to chemical or biochemical agencies operating during and after sedimentation in the cave (see Butzer and Gladfelter, 1968), and offers no paleo-environmental clues. There is no cementing substance in the sandstone, so that the "rock" is quite friable, breaking down during even gentle sample pretreatment. However, the differences of sand size components among the cave sediments depend primarily on the degree of fractionation of these quartz grains—which can be attained by modest weathering or by prolonged stirring at high speed in a blender. Unfortunately, this property of weak cohesion precluded any systematic study of coarse,

[1] Montagu itself is at 223 m elevation, and has a mean annual precipitation of only 312 mm, concentrated in the transitional seasons. The Kõppen climatic classification is BSk (cool-steppe climate), that of Thornthwaite DB_2d (semiarid mesothermal, with little water surplus).

detrital components in the sediments. The bedrock is weathered, in that there is a small clay component of almost 5 percent (compared with 5-12 percent in the cave sediments) and that the rock matrix (presumably silica and sesquioxides) has been at least partly removed. Finally, the bedrock lacks organic components other than intrusive, carbonized roots.

Simple breakdown of the sandstone should provide approximately 90 percent sand-sized quartz, with a minor component of silt and clay. Consequently the quartz sand content of the successive cave strata provides a useful index to the extraneous "complications." On this basis, the limited number of samples suggests that materials introduced by man, animals, and inorganic agencies account for as little as 10 percent and as much as 60 percent of the different layers.

A last point of interest is the black, finely laminated precipitate found on parts of the cave wall and tentatively attributed to hyrax urine (Keller, personal communication). This precipitate has not been identified but contains at least some ferric components. Small grains of identical material (in the 0.6 to 6.0 mm grade) were found in 3 samples (1713, 1714, 1715), probably indicating that rockfalls had introduced it to accumulating floor sediments.

Levels 7 and 6.

The basal accumulations of the cave have been described by Keller (1966) as (a) unsorted sand, with rare artificial materials—level 6; and (b) fine-grained sandy clay, with decomposing fragments of bedrock, presumably a weathering residual—level 7. The basal horizon is about 5 cm thick, the succeeding accumulation varies from 15 to 60 cm. No samples were available for study.

Level 5.

The thickness of the Acheulian level 5 increases rapidly from about 30 cm near the front of the cave to some 150 cm farther inside. The lower boundary is smooth and abrupt, the upper wavy and abrupt; both clearly mark discontinuities in sedimentation. The internal bedding is very pronounced, with undulating, alternating bands of 5 to 12 cm dark, organic sands and white, clean sands. There also are occasional, short lenticles of clean sand. Rock debris, angular and ranging from 1 to 25 cm in diameter, is common and dispersed throughout the bed.

Two samples were analyzed. The "organic" facies represents a weakly structured reddish gray, sandy loam, with abundant diffuse humus and a trace of macroscopic organic matter. The reddish color comes from red silts introduced to the cave and now adhering in part to the autochthonous quartz sands. There are no extraneous quartz or silcrete grains, so that the source of the silt is obscure—man, fissure-wash, or eolian dust. Tool débitage (gray quartzite and white quartzitic "chert" with biotite veins) in the 2-5 mm grade accounts for 2 percent of the sample; there are traces of such biotite in samples 1710 and 1712.

The "inorganic" facies is a white loam with next to no organic matter, and slightly greater compaction (coarse, sub-angular blocky structure). Tool débitage is completely absent, supporting the inference of non-occupation. At least 4.0 percent of the material consists of sesquioxide-stained silcrete aggregates in the 25-500 micron size-grade. These aggregates are clearly extraneous, and are most probably of eolian origin. This explanation is compatible with the well-stratified or laminated, wedgelike character of the lenses in which such aggregates abound. It would also be a reasonable process during times of cave-abandonment. Nonetheless, even allowing that some of the finer quartz grains were blown in after short transport distance, eolian components constitute only a small part of the total sediment. Weathering or fissure-wash must have continued to supply silts and some clay.

Level 4.

The so-called sterile horizon, level 4, includes a lower, occupation zone—with many diagnostic properties of Level 5—and a massive, upper horizon, rather different in character.[2]

The lower level has a maximum thickness of 20 cm towards the cave interior, and consists of well-stratified lenses of undulating aspect, interspersed with crude rockfall debris. The material is a dark brown, loamy sand, weakly structured, with moderate concentrations of diffuse humus and a trace of macroscopic, organic matter. About 4.5 percent of the sediment consists of 2-5 mm tool débitage, although artifacts as such are very rare. Silcrete grains are absent, although extraneous red silt is indicated.

The upper level, separated by a clear, wavy contact, ranges from 75 to 90 cm in thickness. It is rather homogeneous and the stratification is horizontal and undisturbed, with limited amounts of relatively small, roof debris. No sample was available for study, but it is expected that the material lacks organic inclusions or appreciable weathering products. Eolian components are a probability.

Level 3.

The second major Acheulian deposit, Level 3, has the lowest sand content of the entire cave sequence; instead, there is unusually abundant silt (50-60 percent).

[2]Dr. Butzer has included the band that includes surface VIII in layer 4 rather than in layer 5 as I have done [C.M.K.]

The basal surface is smooth and abrupt, the upper contact wavy and abrupt, in part coinciding with a major rock collapse and suggesting disconformities. Thickness of the stratum varies from 30 to 60 cm, and internal bedding is undulating, as is also characteristic of Level 5. There are basal and intermediate "inorganic" horizons.

The normal, "organic" facies is a weakly structured, very dark brown, silt loam, with abundant diffuse humus, some macroscopic organic matter, and traces of silcrete aggregates. Micro-débitage (2-5 mm) accounts for about 1 percent of the sample. Probably a half of the extraneous material (including soil sediment) can be safely assigned to human activities, and at least a good part is fine mineral ash.

The "inorganic" bands consist of light gray silt loam with greater compaction (very coarse, subangular blocky structure), and with traces of both diffuse and macroscopic humus. Some micro-débitage and occasional artifacts further indicate that occupation was reduced in intensity but not entirely absent. Silcrete aggregates suggest eolian activity, but the general prominence of silt and soil sediment is nonetheless enigmatic.

Level 2.

The Middle Stone Age stratum, Level 2, has Groningen radiocarbon dates (from top to bottom) of 23,200, 19,600, greater than 50,800, and 45,900 B.P. (GrN 4726-4728), inferring a time-depth of almost 30,000 years. The nature of the deposits does not contradict this: the level has a thickness varying from 25 to 160 cm and, despite good stratification in detail, is disrupted by a number of major rockfalls. Given the careful pretreatment of GrN radiocarbon samples in general, and the unlikelihood of pure charcoal's ever being too old, it would seem imperative to explore all other possibilities before concluding that the C^{14} dates are substantially incorrect. The deposit, it goes without saying, is sufficiently complex to allow for a long period of successive accumulations.

The basic sediment is a weakly structured, very dark gray, sandy loam, with abundant diffuse and macroscopic humus. Silcrete aggregates are moderately prominent. Micro-débitage (1-5 mm) accounts for 2.2 percent. Possibly the abundance of large and small sandstone detritus contributes to the high overall sand content. Derived soil sediments are present.

Unlike the lower occupation strata, Level 2 includes seven distinct "surfaces" (i.e., horizontal concentrations of artifacts) with hearths (Keller, 1966); similarly, charcoal in different size grades is fairly abundant throughout. However, the undulating nature of the strata, building up from the cave entrance, indicates substantially the same mode of cultural deposition as for 5, 4 (lower), and 3. The only difference appears to be partial decomposition of the related organic material (e.g., matting, bedding, etc.) from the Acheulian levels.

Level 1.

The thin surface level, varying from 0 to 30 cm in thickness, had been partially removed by early guano hunters. It consisted of a "brown sand" littered with surface rubble, and containing artifacts and traces of hearths with LSA. A C^{14} date of 7100 B.P. (GrN-4725) was obtained. No sample was available for study.

General nature of the cave sediments.

Perhaps the most striking aspects of the cave sequence can be numerated as follows: (1) The extremely acid pH (3.0-3.5) exceeds any of the surface "Greyish-brown to dark brown soils" developed on Table Mountain Sandstone (see v. d. Merwe, 1963). The high acidity must be attributed in good part to prolonged and repeated cave occupance. (2) The high organic content —whether macroscopically visible or decomposed to amorphic humus—as well as the weak structure and rather dusty nature of the bulk of the sediments are rather apparent. This reflects on the lack of cohesive clays, the basic sandy grade of the autochthonous sediments, and the predominant silt size of all extraneous matter. (3) The strongly undulating and conspicuous nature of the stratification was noted by the writer in several LSA accumulations near Plettenberg Bay and appears to be peculiar to organic middens of the type associated with many LSA sites (see Deacon and Deacon, 1963; Wells, 1965; Deacon, 1969). In part, this may reflect differential compaction as organic components rot out, in part it bears upon the exceptional stratification caused by grass matting, etc. (4) The small yet conspicuous component of sesquioxide-stained silcrete grains in the 25-500 micron grade is noteworthy. It certainly appears to be eolian, yet it would be difficult to prove this point by rigorous criteria. (5) The variable silt component of the strata, associated with extraneous soil sediments of some sort, remains difficult to explain. The relative proportions introduced by man, by fissure-wash, and by eolian activity cannot be determined, and their identification would be crucial to a firm paleoenvironmental interpretation. Montagu Cave will require field examination and further sample collection by a Pleistocene geomorphologist, and pollen analyses should be rewarding, if not essential to a more detailed interpretation.

TABLE 1

Sediment Data from Montagu Cave

Sample Number	Color (dry)	Wentworth Textural Class	U.S.D.A. Textural Class	$CaCO_3$ (%)	pH	Silcrete Aggregate (%)	%Quartz over 60 microns
1 (No sample)							
2	1715 10 YR 3/1 (v. dark gray)	Silty Coarse Sand	Sandy loam	0.0	3.4	1.0	67.0
3 (Organic)	1714 10 YR 2/2 (v. dark brown)	Med.-sandy silt	Silt loam	0.0	3.0	0.5	36.0
3 (Inorganic)	1713 10 YR 7.5/2 (lt. gray)	Med.-sandy silt	Silt loam	0.0	3.5	2.5	30.0
4 (Upper) (no sample)							
4 (Lower)	1712 10 YR 4/2 (dk. brown)	Silty coarse sand	Loamy sand	0.0	3.2	0.0	76.5
5 (Organic)	1710 5 YR 5/2 (red. gray)	Silty coarse sand	Sandy loam	0.0	3.3	0.0	52.5
5 (Inorganic)	1711 7.5 YR 10/2 (white)	Silty coarse sand	Loam	0.0	3.3	4.0	62.0
6 (No sample)							
7 (No sample)							
Bedrock	1716 10 YR 8/1 (white)	Coarse sand	Sand	0.0	4.8	0.0	90.0

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