Florisbad—New Investigations at a Middle Stone Age Hominid Site in South Africa

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First results of renewed excavations at the Middle Stone Age spring site of Florisbad are reported. Seven meters of deposits dating possibly from the later mid-Pleistocene to the mid-Holocene contain several cultural phases and record alternating periods of increased spring flow *versus* more stabilized conditions. The archaic *Homo sapiens* cranium discovered in 1932 and the Florisian Land Mammal Age fauna retrieved from the springs are argued to derive from the earliest deposits, estimated to be ca. 100,000–200,000 years old. In an Upper Pleistocene layer beyond the range of Carbon-14 dating, a Middle Stone Age occupation floor has been excavated. This we interpret as a multiple-occupation kill, butchery, or scavenging site. The presence of a hearth, of chipping debris under 10 mm in size, and the limited displacement of artifacts which have been refitted as conjoining pieces demonstrate a minimally disturbed, primary context site.

INTRODUCTION

Although it has not been well-published or well-understood, the site of Florisbad has been known for most of this century for its archaeological and paleontological importance. The site is located in the high grassland interior of South Africa, 45 km north–northwest of Bloemfontein in the Orange Free State (28°46′S, 26°04′E, see Figure 1). This is a sweet grassveld area subject to frosts, which receives only about 380–500 mm of rainfall a year (van Zinderen Bakker, 1957; Acocks, 1975). Geologically, the site is the by-product of a cluster of springs which come to the surface due to fissures formed by a dolerite intrusion in the shale bedrock. The springs are saline, with a temperature of ca. 29°C and with more than 70% methane and 10% hydrogen gases present (Rindl, 1915). The water pH is 7.8, as measured by van Zinderen Bakker (1957) and by McLachlan and Lazar Ltd. in a private analysis in 1974.

The mineral waters were first discovered in 1835 by an early settler and in 1840 the Venter family settled there. While enlarging a bath at one of the spring eyes in 1912, Floris Venter unearthed large numbers of fossils and stone tools which his wife, Martha, collected. Robert Broom (1913) described some of this fauna. Then between 1917 and 1928, various collections were made from the baths (Dreyer and Lyle, 1931). It was during large-scale excavations in 1932 that Dreyer and Willeboer Venter discovered the fragments of a calotte and face of an archaic *Homo sapiens* in one of the spring eyes in the western half of the site (Dreyer, 1938). Figure 2 shows in plan view the location of the cranium, which lay in the easternmost eye of the cluster of springs called the Great Western Eye. Dreyer later joined the cranial fragments and so reconstructed his conception of the "Florisbad Man." These were found in the middle of a cone of spring gravel in a small extinct eye capped by white spring sand. Figure 3 is Dreyer's original profile of this spring eye and the position of the cranium within it. This illustration was included in a manuscript by Dreyer in the National Museum collections in Bloemfontein and it has never before been published.

The complex spring stratigraphy, the pick and shovel excavation methods, and the total lack of good records on provenance for the early finds have created much confusion over the stratigraphic position of the Florisbad cranium and fauna. A.C. Hoffman and A.J. Meiring of the National Museum conducted further excavations during 1952–53 along

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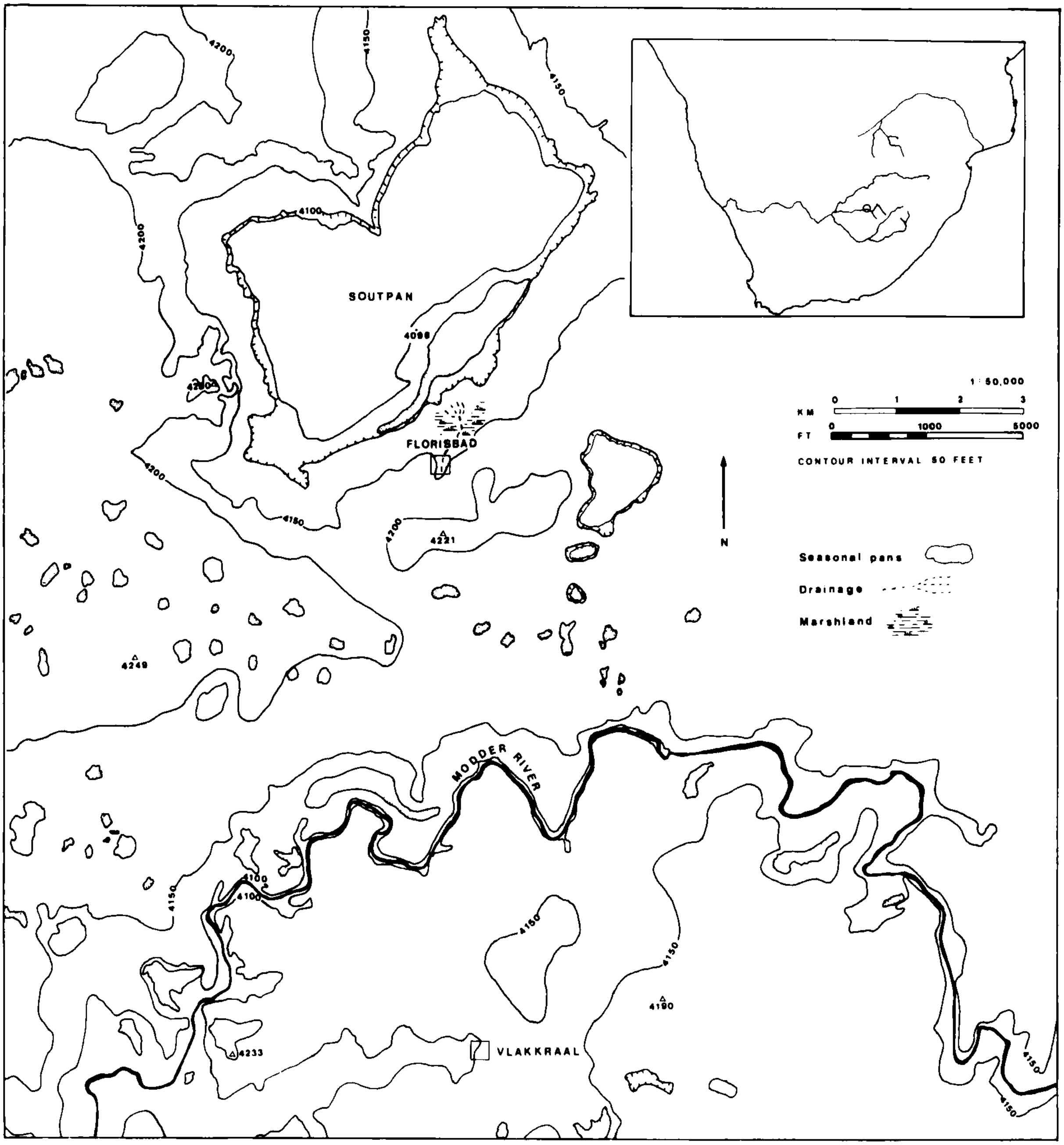


Figure 1. Map of the position of Florisbad in relation to Soutpan, the Modder River, and Vlakkraal. Small pans dot the area.

with Dreyer (Meiring, 1956), but the methods employed and records on provenance of the later finds were still inadequate. Despite these problems, the abundant fossils found at Florisbad provided many type species used to define the fauna of the Middle Stone Age in southern Africa. By the 1960s, the Florisbad fauna, together with that of Vlakkraal (or Prinsloo's site), a nearby spring site of similar origins (Wells et al., 1942), had become the type assemblage for Middle Stone Age fauna in southern Africa. The Florisbad–Vlakkraal "faunal span" or "stage" became widely accepted (Wells 1962, 1967; Cooke 1963, 1967). More recently, Hendey and Klein have both considered the status of these collections sufficiently well accepted to establish the "Florisian Land Mammal Age" (Hendey, 1974a, b; Klein, 1984). This period formally includes the still poorly dated faunas of the later Mid-

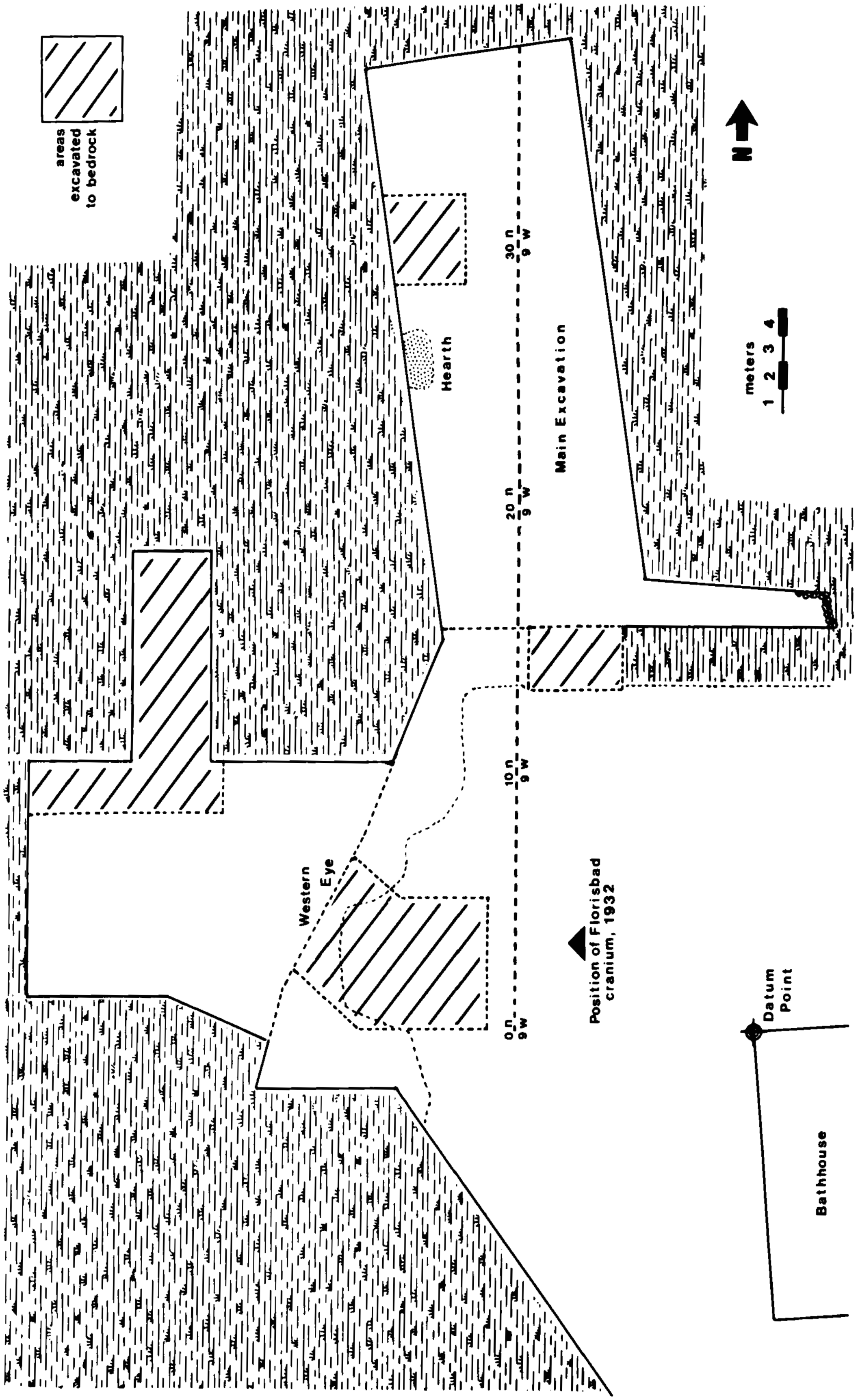


Figure 2. Plan of excavations, 1981–84. The area surrounding the position of the hominid cranium up to the irregular dotted line was removed by the earlier excavators.

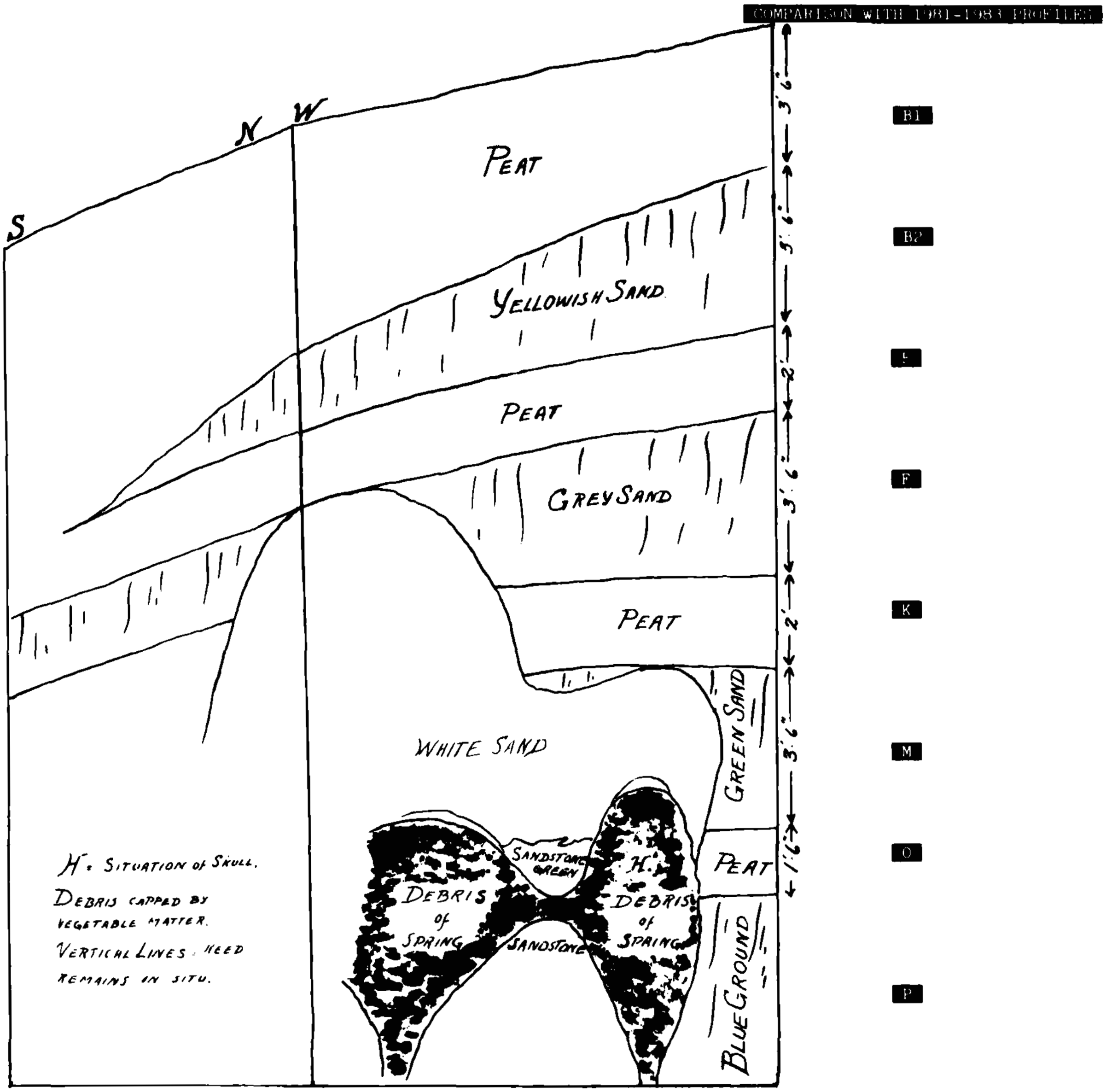


Figure 3. A section drawn by Dreyer ca. 1932, of the stratigraphy of the small spring eye in which the hominid cranium was found, located in the general area of the black triangle in Figure 2. Peat I is at base and Peat IV is at top. The cranium "H" was found at the level of Peat I in the spring gravel. A cap of pure quartz sand overlies the gravel and is sealed by Peat III. To the right of the profile, equivalent strata from the new excavations are listed.

dle Pleistocene (older than 128,000 years but younger than Cornelian faunas) and the Upper Pleistocene up to 10,000–12,000 years.

In 1980, J. Oberholzer took the opportunity to negotiate the purchase of Florisbad on behalf of the National Museum so that research on the many unanswered questions on the site could be re-initiated. From February 1981 to January 1984, R.J. Clarke directed the new excavations and organized new palaeoenvironmental investigations. K. Kuman served as archaeologist.

ENVIRONMENTAL SETTING

The northern and eastern Free State plateau of sweet and mixed grassveld has an altitude of ca. 1200 m above sea level in the west, rising to 1800 m in the east (van Zinderen Bakker, 1957). The area surrounding Florisbad in the northwestern sweetveld sector has only minor differences in elevation, but the site itself lies on the crest of a gentle rise relative to the depressed pan topography to the northwest (see Figure 1). Surface elevation of the site is 1272.74 m above sea level (Fourie, 1970), and our 1981–84 datum line lies at 1270.74 m. The Florisbad mound rises just north of the site to 1276.2 m before beginning to decline in the direction of the Soutpan basin.

The sediments which form the spring mound are predominantly of small particle size, with silts forming a major component. As dense vegetation was able to grow at the springs in this dry region, it may have served as a trap for accumulating sediments which were mobilized in the area by strong winds and redistributed by flooding. Even today, fierce dust storms are common at Florisbad during certain times of the year, and sediment deflation and deposition occur rapidly. In this way, the spring mound must have grown over thousands of years. Deflation from Soutpan to the northwest during dry periods probably made a very significant contribution to the sediment load in the immediate region.

Soutpan is the largest pan in the area and has at least one terrace at a higher level than the current shoreline. An extensive seasonal marsh runs south–southeast from Soutpan to the base of the Florisbad mound. Boreholes showed the marsh to have fewer organic layers and more clays, which indicates a more deeply flooded terrain and less vegetation than at the springs. At Florisbad itself, an extensive swamp or lake existed periodically. Boreholes showed that the spring deposits become thicker, with organic layers more common immediately west and northwest of the site. It is possible that when the springs were highly active, drainage from the Florisbad mound helped to feed the Soutpan paleolake. A volcanic intrusion of dolerite through shale has produced fissures along which water rises to the surface through clusters of small springs which run in a west–northwest line. Figure 2 shows two spring loci, one at the bathhouse and another at the Western Eye. Immediately northeast and east of the bathhouse is a third locus called the Eastern Eye, where Dreyer also recovered both fossils and artifacts. An outdoor swimming pool was later built over these springs. According to several local witnesses to the construction (Mrs. T. Klotz, Mr. S. Sowden, and Mr. J.A. Maree), many fossils were removed from these pools before the concrete floor slabs were laid and many more fossils still remain in those springs.

The reasons for such spring cycles, which are recorded in the repeated alternation of sands and silts with organic deposits at Florisbad, are poorly understood and controversial. We know that tectonics can activate spring eyes. In 1912, an earthquake at Fauresmith, some 130 km to the southwest, caused one spring eye at Florisbad to increase its discharge considerably. One guess was that its output rose from ca. 90,840 to over 380,000 liters per day (Hoffman, 1955). But can the springs also respond to climatic fluctuations? Any response of the spring flow to long-term rainfall fluctuations would be related to the source and age of the water, which are presently unknown. We hope that dating of the water may be possible in future. It is Butzer's opinion (1984a: 29) that the sodium chloride content of the water and the steady release of gas lend support to an origin for the water in the Carbonaceous Ecca Shale, rather than the Pre-Cambrian basement rocks. These shales are only a few hundred meters thick in the region. He also considers that there are certain parallels with the local alluvial sequences. His conclusion is that the springs behave more like a regional aquifer than as thermal springs of volcanic origin (Butzer, 1984a, b). While the link between climatic shifts and spring cycles here may not be fully understood, pollen and phytolith studies on past vegetation should provide much important environmental information.

STRATIGRAPHY AND DATING

During 1981–82, the South African Geological Survey assisted R.J. Clarke with the drilling of 31 boreholes around the 85.4 hectare Florisbad farm. The results clearly showed that the deposits of greatest archaeological and paleontological promise lay in the mound surrounding the springs. Up to 12 m of deposit occur near the site, while the deepest profile in our excavation is 7.5 m thick. Over the course of our work, 52 m length of detailed stratigraphic profiles have been drawn which reveal interesting microenvironmental differences across the site. Figures 4 and 5 are actual (rather than schematic) sections selected from these profiles, which contrast the stratigraphy at one of the springs (Figure 4) to an area 24 m further north in undisturbed ground in the main excavation that borders the spring deposits (Figure 5).

The alternating sequence of sands and silts with organic deposits records repeated shifts in the intensity of spring discharge and the amount of stabilizing vegetation and soil formation able to develop at different times. M. Inbar's preliminary study of a sediment suite from the main excavation indicates that depositional energy was predominantly low and uniform. Dating of the sequence has only been successful for the Holocene deposits. All dates, except where otherwise noted, have been provided by J.C. Vogel of the Council for Scientific and Industrial Research in Pretoria. Dr. Vogel collected the 1973 samples and we are grateful to him for permitting us to reference these unpublished dates and for his suggestions on interpretation. The authors provided the 1981–83 material. We will provide a general discussion of both stratigraphic profiles together. The numbering of paragraphs is for

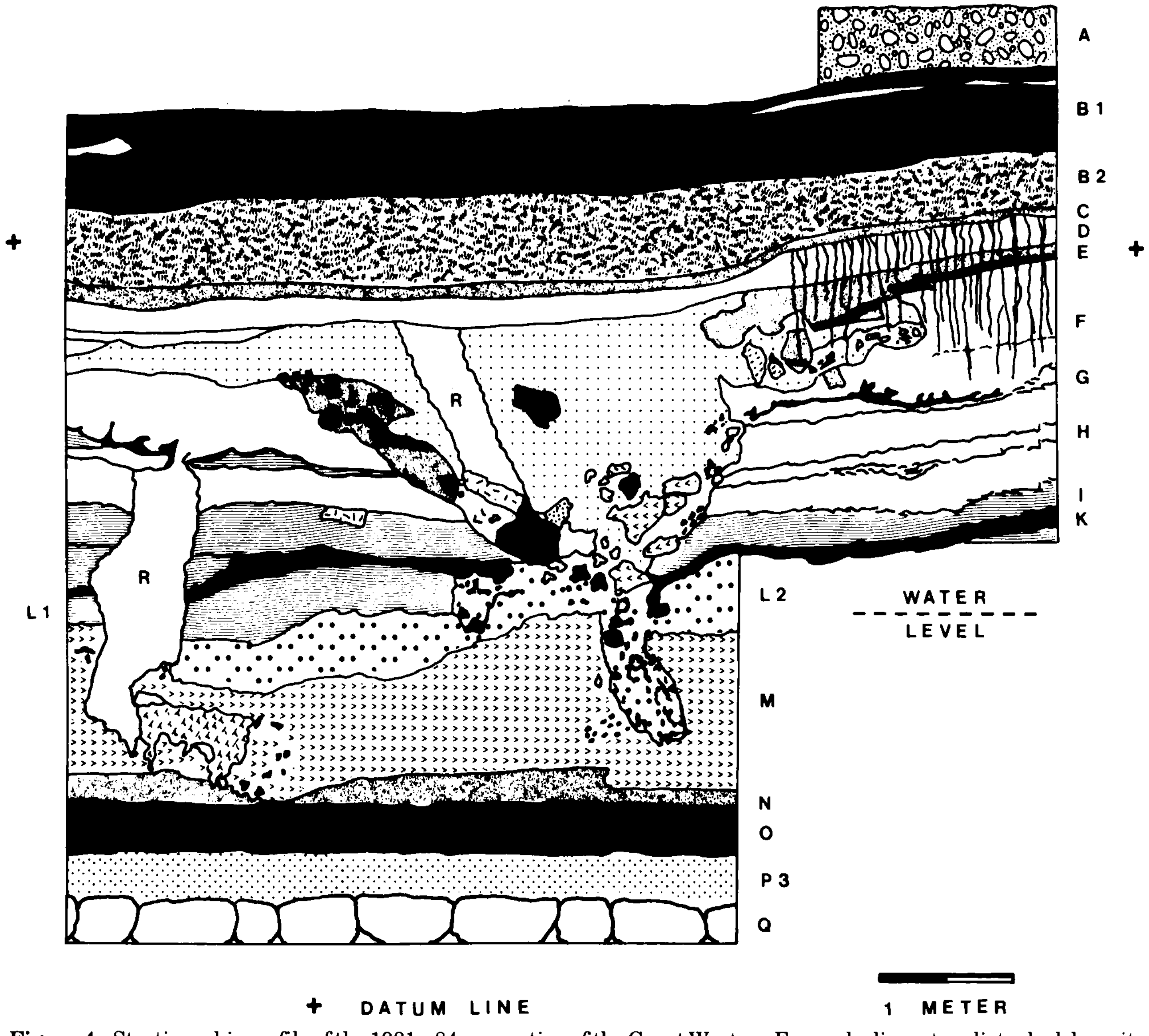


Figure 4. Stratigraphic profile of the 1981–84 excavation of the Great Western Eye and adjacent undisturbed deposits. This section is taken along the wall labeled "Western Eye" in Figure 2.

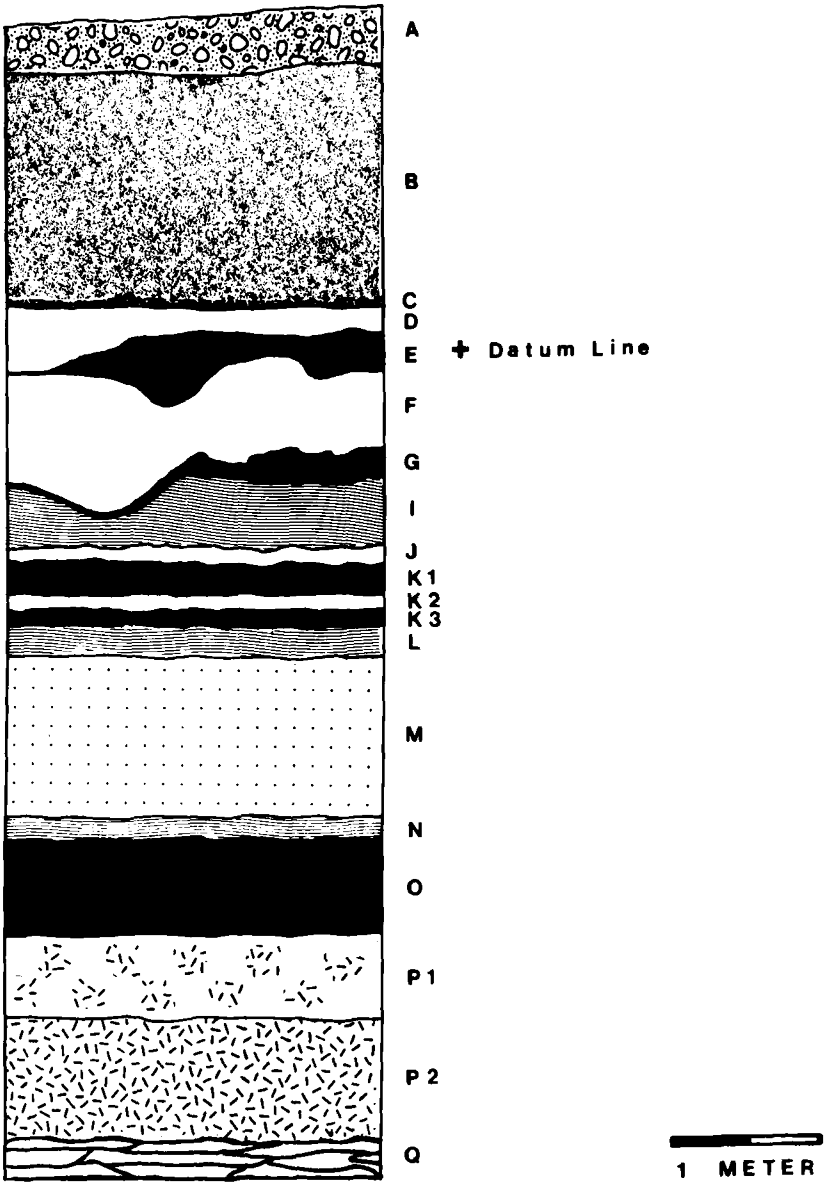


Figure 5. Stratigraphic profile from the Main Excavation, 1981–84. This section is taken along the western wall at ca. 30 m north—the hatched area to the right of the hearth in Figure 2.

ease in reading and not intended as final unit designations. Sediment descriptions have been generalized from M. Inbar's preliminary report and apply only to the Main Excavation suite. Informal descriptions of the deposits at the spring eye were assigned by R.J. Clarke during sample collection in the field.

A) Road Rubble. A modern surface deposit.

B) "Peat IV." B1 (Figure 4) is a black, sandy organic deposit (25–85 cm) at the Western Eye with occasional lenses of white sand. Its highly organic nature led Dreyer to refer to it and the other black, organic deposits as peats. This "peat" increases in thickness towards the center of the Western Eye springs, where Dreyer recorded it as 105 cm thick (Figure 3). It lenses out completely 7 m south of the Western Eye. Plant matter from this deposit has produced differing mid-Holocene dates:

1981–83	Pta-3617	Insoluble fraction: 3550 ± 60 ($\delta^{13}C = -25.5‰$)
	Pta-3631	Soluble fraction: 3580 ± 60 ($\delta^{13}C = -25.3‰$)

1973 Pta-1128 Insoluble fraction: 5530 ± 80 ($\delta^{13}C$ = −21.9‰)

Both the 1981−83 and the 1973 samples come from the base of B1 but are separated by approximately 8 m horizontal distance. The 2000 year spread in these dates, if not due to contamination, would seem to indicate different times when vegetation grew at the springs.

B2 is a brown sandy organic deposit (20−75 cm). It is lighter in color than B1 and has the distinct appearance of matted vegetation. This deposit also increased in thickness eastwards to 105 cm in Dreyer's section (Figure 3). Note that for Dreyer, Peat IV corresponds to our upper Peat IV (B1), while our lower Peat IV (B2) is for him a Yellowish Sand. There are no dates currently available for B2, but see the discussion on the dating of C, a paleosol at the base of B2.

Proceeding north from the Western Eye, both B1 and B2 become less organic and grade into B (Figure 5). In this main excavation area, B is stratigraphically complex and for now we have generalized the profile. In reality, however, B consists of 8 layers of weakly developed yellowish to light grey deposits. Each is composed of varying percentages of silts and sands, while 3 levels also have a very small clay fraction. B corresponds to the margin of the swamp or spring pool and it bears traces of human occupation. Fauna and hornfels artifacts have been recovered throughout B, but the vast majority of finds derive from the lower half of the deposit, which corresponds generally to B2. Only scattered finds occur in the upper half. C.G. Sampson (personal communication, 1985) considers that the artifact assemblage in B resembles the Lockshoek Industry of the Oakhurst Industrial Complex. This is a nonmicrolithic Late Stone Age industry with diagnostic large convex scrapers. No Lockshoek Industry has so far been dated, but dates for other Oakhurst assemblages in South Africa place this Complex in the terminal Pleistocene to early Holocene period, between ca. 8,000−12,000 B.P. (Sampson, 1974: 275−276; Deacon, 1984: 241−244). The dates from C, at the base of B, fit this chronology, as explained below.

C) C is a paleosol (5−30 cm) which appears as a dark, organic-stained horizon across the entire site (Figures 4 and 5). It consists of more than 70% sand and the remainder is silt. Three dates on plant matter are available:

1983−84 Pta-3609 Insoluble fraction: 8790 ± 70 ($\delta^{13}C$ = −28.5‰)
Pta-3643 Soluble fraction: 11,700 ± 110 ($\delta^{13}C$ = −27.7‰) both on roots from C but penetrating deposits below.

1973 Pta-1127 Insoluble fraction: 4370 ± 70 ($\delta^{13}C$ = −20.4‰) on stems? from within C.

1973 Pta-1125 Insoluble fraction: 10,000 ± 100 ($\delta^{13}C$ = −20.2‰) on ?roots below C which we interpret as growing from C.

We have interpreted this series of dates in the following manner. The three dates in the early Holocene date the land surface C and the ?roots which grew from that horizon and penetrate deposits below. The anomalous date of 4370 was run on material collected by Dr. Vogel which, according to his records, we believe must come from the C horizon. This young date may be due either to contamination by mid-Holocene vegetation growing in B or to its penetration to the level of C. The nature of the profile would suggest that the matted vegetation of B2 could be the above-surface foliage belonging to the roots descending into C. If this is so, then the age of B2 should also be in the 8,000−12,000 B.P. range as with C, and this would be consistent with the dates of the Oakhurst Complex in other parts of South Africa.

D) D (5−40 cm) consists of approximately 75% sand and 25% silt in the Main Excavation. At the Western Eye, it appears to seal the last eruption which had broken through Peat III. At or above the D level there is either a lengthy hiatus in deposition or the erosion of strata representing the late Upper Pleistocene (oxygen isotope stage 2). This conclusion is based on the estimated age of Unit E below.

E) "Peat III" (5−50 cm) is a sandy organic horizon. It is well-represented in *Figure 5*, where it consists of 95% sand and 5% silt, and in *Figure 4* it is present but has been broken by the Western Eye eruption. In other areas, however, it is difficult to distinguish due to variations in the amount of organic matter across the site. The only date presently available for Peat III was run in 1954 at Columbia University's Lamont laboratory and it must be considered a minimum age:

1954 L1271D: 19,530 ± 650

It would appear that Unit E is in the range of 30,000 years old or more as this level contains an assemblage of artifacts with elements diagnostic of the Middle Stone Age. Analysis is complicated by the fact that almost all the 116 pieces are of hornfels and are in a highly decayed condition, light grey and chalky. Despite this, there are at least three triangular flakes with facetted striking platforms and convergent dorsal scars which are characteristic of the Middle Stone Age and absent in Later Stone Age assemblages. Two of these are retouched. In addition, facetted platforms are distinguishable on seven other artifacts.

We believe the assemblage has decayed while *in situ* and that this is in some way due to the conditions responsible for the depositional hiatus or erosion which occurred in the late Upper Pleistocene. If this is correct, then a large temporal gap exists near the D level, covering the earlier Later Stone Age of the late Pleistocene. The sequence is only reestablished with the changing environmental conditions in the terminal Pleistocene or early Holocene, represented in Unit B by the Lockshoek industry.

F) F (25–85 cm) consists of more than 90% sand, mottled white in color, with some limited areas of cross-bedding. This deposit should be considered in two parts: 1) The upper portion, to a depth of 45 cm below the datum line, contains artifacts in the same highly decayed state as those from Unit E. 2) The lower portion, from a depth of 45 cm below the datum line to the base of the deposit at G, shows dramatically different conditions of preservation. Artifacts are patinated but mint in sharpness. Bone is moderately preserved. In this lower half of F, a rich Middle Stone Age occupation was discovered in 1982 and excavated throughout the extent of the Main Excavation seen in Figure 2. Scattered fragments of charcoal from 45 to 80 cm depth produced an infinite Carbon 14 determination:

1981 Pta-3465: Greater than 43,700 ($\delta^{13}C = -24.5‰$)

In 1983, we uncovered a hearth at a slightly lower level (84 cm), which Figure 2 shows in plan view. We have interpreted these levels as primary context occupations for several reasons: the undisturbed hearth, the association of artifacts with over 600 faunal specimens, the fresh condition of the artifacts, and the presence of several concentrations of chipping debris, with abundant small and delicate flakes. In addition, a number of artifacts have been refitted as conjoining flakes, showing that tool manufacturing was carried out *in situ*. The assemblage of more than 1250 artifacts contains only two burins and eleven minimally retouched or heavily utilized pieces. Six of the latter are illustrated in Figure 6 (Numbers 1–3 and 6–8). Further discussion of the Middle Stone Age occupation is provided in the section on archaeology. Dreyer's equivalent layer is the Grey Sand (Figure 3), 105 cm thick, which was sterile of finds, probably due to its proximity to the spring eyes.

G) G (5–35 cm) is an organic, 'flame'-structured horizon at the base of F which consists of more than 75% sand and the remainder mostly silt. It varies from a dry, fibrous, peaty crust in portions of the western half of the Main Excavation, to an irregular, organic-stained sand difficult to distinguish from F in other areas. It is particularly clear as dark, well-defined structures close to the Western Eye. G is useful as a marker horizon across the entire excavated area. Figure 7 shows G (the black areas) as sections in plan view. The white sands are pockets of F. Organic matter from G produced the following Carbon 14 determinations:

1981–83 Pta-3623 Insoluble fraction: Greater than 47,200 ($\delta^{13}C = -26.0‰$)

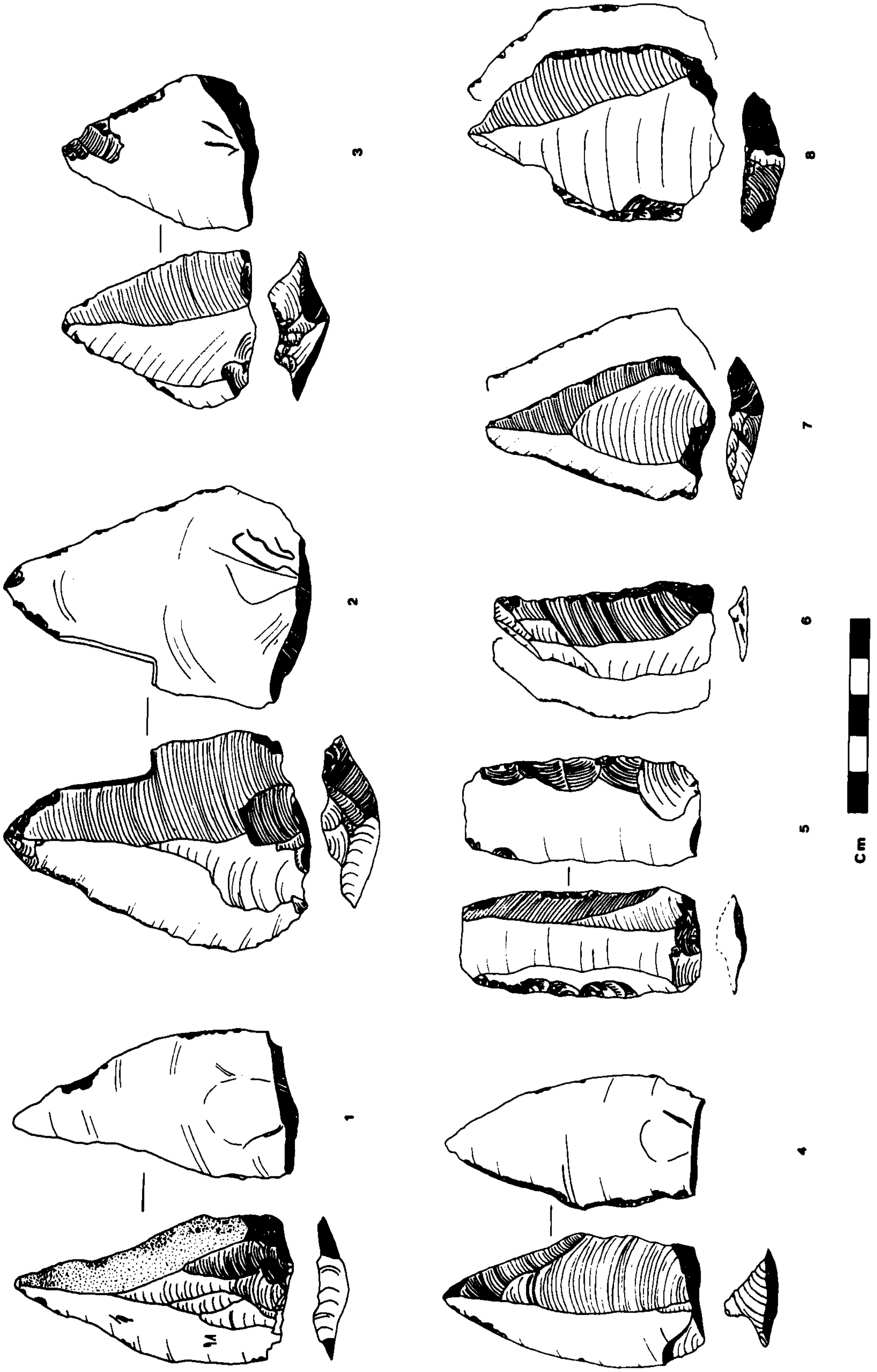


Figure 6. Middle Stone Age retouched or heavily utilized artifacts from the recent excavation at Florisbad. Numbers 1–3 and 6–8 are from the occupation horizons in Unit F. Number 4 is from Unit H, and Number 5 from Unit M.

Figure 7. Part of the Main Excavation, looking east, showing the dark organic layer of Unit G sectioned in plan view. Part of G can also be seen in profile along the base of the back wall. White sand pockets and channels of Unit F fill hollows in G. Bones and hippo tusk are pedestalled in the white sand (Dark vertical streaks on back wall are recent rain erosion).

Pta-3611 Soluble fraction: Greater than 44,600 ($\delta^{13}C = -25.7‰$)

We did not continue the Main Excavation seen in Figure 2 below the G level, but we did extend five trenches to bedrock in different parts of the site. These are the hatched areas in Figure 2.

H) H is a unit consisting of two to four layers of white sands (30–75cm) in Figure 4 only, which are distinguished by subtle color and grain size differences. Fifty-five artifacts were recovered from these levels in the areas south of the Main Excavation. Two retouched flakes are present, a scraper and the backed flake illustrated in Figure 6 (No. 4). A small amount of fauna was recovered, most notably two hippo teeth and a juvenile hippo radius.

I) I is a grey organic deposit (10–65 cm), composed of 60% sand and 40% silt, which directly underlies G in Figure 5. We believe that I in Figure 4 is the equivalent layer, but as the area connecting these two profiles has not been fully exposed we cannot be certain. I yielded 59 artifacts and a small amount of fauna, particularly more than 20 whole or fragmentary teeth, mostly of bovid but several of hippo.

J) J is a thin layer (ca. 10 cm), occurring only in the Main Excavation (Figure 5), of approximately 50% sand and 50% silt, with no finds.

K) "Peat II" is a highly organic, sandy unit. In Figure 4, it is one layer (5–35 cm), but in Figure 5 it is more complex. K1 (20 cm) and K3 (10 cm) both consist of 60% sand and 40% silt. They are separated by a non-organic layer, K2 (10 cm), which is 45% sand, 50% silt, and 5% clay. Peat II was not present in our two trenches to the west of the profiles presented here, but it was well represented eastward, where Dreyer recorded it as 60 cm thick over the hominid spring. Sixty-six artifacts and a small amount of bone and tooth derived from K. Dreyer reported only one triangular flake in Peat II.

Attempts to date Peat II by the Uranium–Thorium disequilibrium method have proven unsuccessful. J. Bischoff of the U.S. Geological Survey in California tried the method on both peat and bone from various levels as well as the spring eyes. He found all samples badly contaminated with Th-230 of extraneous origin. In 1973, J. Vogel obtained an infinite Carbon 14 determination on Peat II:

1973 Pta-1108: Greater than 42,600 ($\delta^{13}C = -28.2‰$)

L) L is an organic unit at the base of Peat II. Two layers occur at the springs (Figure 4), where L1 (15–50 cm) is a grey deposit underlain by L2 (25–55 cm), a deposit which varies from brown to black to grey. In the Main Excavation (Figure 5), this unit (20 cm) consists of grey sand (50%) and silt (50%). Fifty-four artifacts came from these sands, including one retouched triangular flake, and a small amount of bone and tooth.

M) M is a greenish layer (75–115 cm) in Figure 4. In an equivalent layer in the westernmost deep trench, a portion of a *Megalotragus* mandible was recovered, and just beneath it were three fragments of bone, a rib fragment, and a metapodial. In Figure 5, this unit is a yellow deposit with root markings (105 cm), consisting of 60% sand and 40% silt. It produced more than 35 fragments of bone or tooth and 120 artifacts, including two cores and four retouched pieces. One tool (Figure 6, No. 5) is a blade with invasive bifacial retouch which has rejuvenated the piece, as the unretouched portion shows a more developed patina. Dreyer's equivalent layer is his Green Sand (105 cm), from which he reported a few triangular flakes and "quite a number of" brown crumbly bones.

During 1952–53, the National Museum (Bloemfontein) Director, A.C. Hoffman, conducted new excavations with Dreyer and Meiring in both undisturbed deposits and in the hominid spring. The northern and western limit of their excavation are indicated in Figure 2 by the irregular dotted line. In a single level a few inches below the base of Peat II, they reported finding an *in situ* assemblage of highly retouched Middle Stone Age artifacts. These differ markedly with our occupation assemblage in F because of the large number of extensively retouched pieces. We have been able to locate no documentation for these finds in the museum records, but an oral account of their exact provenance was given to Sampson (1972: 102–103, and 1974: 203). The stratigraphic position was described as a discrete level within a Blue-Green Clay and Loam, which would be equivalent to Dreyer's Green Sand and our unit M (see Figure 3). As this collection of artifacts was the first sealed, unselected assemblage of its type in the region, Sampson (1974: 202–205) termed it the "Florisbad Industry" and has used it for comparison with other Free State sites (Sampson, 1985: 46–48). Sampson (1972: 103–104) also compared this excavated sample with the collections of other retouched material made over the years from the spring eyes, and he concluded they were similar enough to be regarded as one population. The collections do appear to be very uniform, but they show six or seven different kinds of patination, which reflect their mixed origin.

N) N is a grey organic layer (15 cm) in Figure 5, which is 80% sand and 20% silt. In Figure 4, it is 10–30 cm thick and black in color.

O) "Peat I" is a highly organic unit (60 cm) in Figure 5, which is approximately 60% sand and 40% silt. In Figure 4 it is 35 cm thick. Both are black in color. Over the years, statements entered the literature that the hominid cranium probably derived from Peat I (e.g., Hoffman, 1955; 166, Oakley, 1954: 85 and 1957: 77–78; Sampson, 1972: 163 and 1974: 178). Although Dreyer (1938) clearly stated in print that the hominid came from the center of the debris heap H (Figure 3), he is recorded in unpublished museum papers as saying that this heap was "roughly synchronous with the oldest Peat Layer" (i.e., Peat I). He believed this because the hominid was found at the level of Peat I, because the debris heap contained flakes of dolerite, a stone which does not occur in any layers above Peat I, and because there were no "long" hornfels flakes, which he associated only with the layers above Peat I. Dreyer also gave the erroneous impression that the hominid spring was sealed by the Green Sand above Peat I (M), but Figure 3 clearly shows that the spring is double-vented and that the entire structure is sealed by Peat III (E).

Because of the influence of Dreyer and Hoffman, statements also entered the literature that the bulk of the spring fauna derived from Peat I as well (Cooke, 1963: 96; Butzer, 1984a: 29). Our excavations did uncover a quantity of faunal material in Peat I, but most of the approximately 100 catalogued specimens were badly fragmented bone and tooth. The most complete specimens were 19 whole or broken teeth, including one of a warthog. This brown, crumbly material differs from the large, white, well-mineralized bones from the spring sands. Such fragmented material indicates that Peat I is unlikely to have been the source for the spring fauna. There is no substantiation for the claim that the fauna derived from Peat I. What we can say is that the fauna, including the hominid, was excavated from white spring sand and gravel. The bones from the spring eyes are generally white in color and many are filled with white sand and encrusted with calcium carbonate. These conditions of preservation are consistent with the bones having come from the intrusive white sands and debris cone illustrated by Dreyer. Although theoretically the fauna could have derived from any of the deposits that the explosive spring vents disrupted, we believe that this is unlikely as no bones showing a similar taphonomic history have been found in any of the undisturbed upper deposits adjacent to the springs. It is more probable that the bones were mineralized in sandy pools, perhaps at the level of Unit P.

Our excavations of Peat I from undisturbed areas also produced 22 artifacts, including two retouched scrapers. Of particular importance, however, is Meiring's report (1956) of finding large tools composed of dolerite wherever Peat I was broken up for removal. This material is discussed in Unit P. Uranium series dating of Peat I by J. Bischoff was attempted but proved unsuccessful due to contamination with extraneous uranium.

P) In Figure 5, P1 is a grey-green layer with root markings (55 cm), which is 60% silt and 40% sand. P2 (80 cm) is a green silt with roots (almost 90% silt, with the remainder sand). The equivalent unit in Figure 4 to these two layers is P3, a pale brown deposit (30 cm). In P1, we found ten unretouched flakes, one core, and two tooth fragments. P3 yielded one bone fragment, two hyaena coprolites, and four flakes, two of which are retouched. Dreyer's equivalent unit is his Blue Ground, which appears to have had a sandier top portion, underlain by a "boulder-rich clay" (Dreyer, 1938: 70). In the top portion, Dreyer discovered some teeth of *Equus* sp., in a brown crumbly condition. In the clay beneath, both Dreyer and later Meiring discovered more large artifacts similar to those from Peat I.

This assemblage from Peat I and the boulder clay was described by Meiring (1956) as his "Macrolithic Culture." It was said to be predominantly dolerite, but in fact it consists of a variety of lavas and some other rock types. The collection is small and not all of the pieces are true artifacts, but those which are differ in several ways from all other artifacts above Peat I, which are made almost exclusively of hornfels. A number have highly polished surfaces but this glaze can vary in intensity on a single piece. Large, heavy cores and thick flakes are most common and small elements are absent. The artifacts are not rolled, as edges have not been rounded. Rather, we attribute this polish to abrasion by sand in water. The artifacts were probably resting on a sandy base in a spring pool where multiple natural spring vents emerged, as they do today in the Florisbad swimming pools. The rising water would have driven the sand particles against the stones, resulting in mechanical polish and perhaps a degree of silica deposition. Many of the bones from the spring collections also show a parallel mechanical abrasion. Unfortunately, our excavations did not uncover any polished lava artifacts. Beaumont (Beaumont et al., 1978) considers that this industry has Early Stone Age affinities, but it is Clark's opinion (1974: 44–45) that the stone balls and dimple-scarred grindstones suggest some form of Middle Stone Age industry. The assemblage may well belong to an early phase of the Middle Stone Age, which could explain why it differs from the other artifacts at the site.

Q) Bedrock in Figure 4 consists of dolerite at 4.8 m below the datum line. In Figure 5, it is shale at 5.15 m below datum.

R) R refers to pipes of spring sands in Figure 4. The disturbance caused by spring eruptions is localized and distinct, and columns of sand accumulated in the resulting fissures. The violent nature of a spring eruption is clearly seen in Figure 4 where once horizontal deposits have been broken up and dispersed as blocks of peat, sand, and silt. Such disturbance shows how bones and artifacts could be displaced vertically and horizontally in the spring area. In our profile, Peat III has been broken by the last eruption, but note that the three lowest layers have not been disturbed, despite the fact that the springs emerge from bedrock. This is because the eyes are localized occurrences and the force of eruption and direction of disturbance will vary across the site. In this section, an eruption slightly to the east spread in this direction but disrupted only the levels above N.

Dreyer (1938) recorded the provenance of the hominid cranium as the third most easterly vent of the group of springs called the Great Western Eye ("H" in Figure 3). Found in the middle of a cone of spring gravel of this small extinct eye, it was firmly lodged beneath the horncores of two bovids, *Connochaetes gnou* and *Pelorovis antiquus*. Dreyer described the eye as having a typical spring structure of heavier debris or gravel at the base, capped by pure quartz sands.

PALEONTOLOGY AND TAPHONOMY

Broom (1913) and Dreyer and Lyle (1931) provided the first discussions of the fossil fauna from Florisbad. Cooke (1963, 1967) listed the species present and gave comparisons to other sites. Hoffman (1953) wrote about the *Megalotragus* remains. Ewer (1957, 1962) described the pigs and the otter and Hooijer (1958) the hippos.

The old collections from the spring eyes include the following extinct forms:

Megalotragus priscus, a giant hartebeest
Pelorovis antiquus, the giant long-horned buffalo
Damaliscus niro, a blesbok
Antidorcas bondi, a springbok
Equus capensis, a giant zebra
Sivatherium maurusium, the giant short-necked giraffe
cf. *Metridiochoerus* sp., a pig

The extant species represented are:

Connochaetes gnou, a wildebeest
Kobus leche, the lechwe
Taurotragus oryx, the eland
Damaliscus cf. *albifrons*, a blesbok
cf. *Antidorcas marsupialis*, a springbok
cf. *Sylvicapra grimmia*, the grey duiker
Equus burchelli, a zebra
Equus quagga, a recently extinct zebra
Giraffa camelopardalis, the giraffe
Diceros bicornis, the black rhino
Hippopotamus amphibius, the hippo
Phacochoerus aethiopicus, the warthog
Hyaena brunnea, the brown hyaena
Aonyx capensis, the clawless otter
Herpestes sanguineus, the slender mongoose
Atilax paludinosis, the water-mongoose

In addition, the following micromammals have been identified by D.M. Avery from the old collections:

Pedetes sp.
Tatera sp.
Otomys, two or three species
Parotomys sp.
?Cryptomys sp.

Cooke (1963) also listed the following as originally in the collection:

Xerus capensis (= *X. inauris*)

The above fauna is representative of the Florisian Land Mammal Age (see Klein, 1984). Although the Florisian origins appear to be in the Middle Pleistocene, this fauna characterizes the Upper Pleistocene, with two exceptions. *Sivatherium maurusium* belongs to the Middle Pleistocene and *Metridiochoerus* sp. "may" be of Middle Pleistocene age, as both are found in the preceding Cornelian Land Mammal Age assemblages (Klein, 1980: 268, and 1984: 131). The few teeth of *Sivatherium* sp. were unfortunately lost from the museum collections when they were sent overseas for study, and the identification of *Metridiochoerus* sp. was made only tentatively, by Cooke in the 1960s.

The fauna from the spring eyes is indicative of a predominantly open environment, grassland or open woodland, but the lechwe, water-mongoose, clawless otter, and hippopotamus also show the proximity of a large body of water, at least periodically. The two types of giraffe would also indicate the presence of some trees in the vicinity, but they are rare finds. The other fauna is dominated by grazers of open country. It is important to note that Broom (1913) mentions great quantities of wood from the spring deposits. He said that "some of the logs are of large size and show that there must have been much larger trees growing in the district than is now the case." Unfortunately, we did not find these in the old collections, although some small fragments of wood are preserved.

The only other major collection of fauna from Florisbad was recovered during our 1981–84 excavations of the Middle Stone Age occupation in the F Unit. J.S. Brink is currently studying this fauna, together with the spring collections. Although the faunal list is subject to revision on completion of his study, Mr. Brink (pers. comm., 1986) made the following identifications:

Extinct forms:
Damaliscus niro
Antidorcas bondi

Extant forms:
Damaliscus dorcas
Connochaetes gnou
Kobus leche
Equus cf. *burchelli*
Hippopotamus amphibius
Lepus sp.
Canis cf. *mesomelas*

Environmental indications are similar to those of the spring fauna. Again, grassland grazing bovids are the most common finds. The lechwe and the hippo are water-dependent species.

The state of preservation of this occupation assemblage in Unit F differs dramatically from that of the spring fauna in that the bones are highly fragmented, soft or fragile, and brown in color. There is also a notable rarity of large bones and horn cores in the occupation layer. In contrast, the spring fauna is well preserved, white in color, and consists of more complete bones, including many large specimens and horn cores. We believe that these differences cannot be due to micro-environmental variations at the site. The two assemblages have very different taphonomic histories, as follows:

A) The Spring Fauna:

1) These bones show indications of resulting from natural death and predation and scavenging by carnivores. Many bones, including the hominid cranium, show a pattern of damage characteristic of hyaena gnawing observed frequently by R.J. Clarke on hyaena-gnawed bones in East Africa. The carnivore damage to the hominid is described by Clarke (1985).

2) Many bones show signs of being weathered and sun-cracked on the surface before becoming fossilized. Numerous horn cores are riddled by grooves made by the larvae of the horn-moth, family Tineidae (Figure 8). These moths lay their eggs under the horn-sheath of dead bovids that lie exposed for a period of time on the surface.

3) At some time subsequent to the weathering and larval damage, the bones become mineralized. Bone canals accumulated deposits of calcium carbonate.

4) At a later stage, portions of the surfaces of many bones became eroded and polished.

Pits and grooves were gouged into the bones (Figure 9), and the calcium carbonate infill of bone canals was often left standing proud of the surrounding bone, which was eroded away. Many bones also show a glazed, polished surface, parallel to that on the "Macrolithic" tools from the base of the site. We believe that mechanical abrasion by sand under water was responsible for this erosion, as discussed under Unit P in the section on Stratigraphy.

B) The Occupation Fauna from Unit F:

1) There are no readily apparent signs of damage to the bones by carnivores. The material is smashed and fragmented in a manner characteristic of marrow extraction by man.

2) The bones show no signs of having weathered on the surface.

3) The bones are not mineralized with calcium carbonate. They are soft and fragile.

4) None of the bones have been pitted, grooved, or eroded.

The association of the Unit F fauna with a large Middle Stone Age industry is discussed in the next section. Our conclusion is that the occupation horizon fauna was hunted or scavenged by man, whereas man had little or no role in the accumulation of the spring fauna. Although we cannot disprove that the spring fauna was derived from various strata at the site, we believe that the taphonomic uniformity of the collection suggests that most of the bones do date to one time horizon, which is probably equivalent to that of the polished "Macrolithic" artifacts found in O and P, as no similarly altered bones and stones have been found in higher levels. The state of preserva-

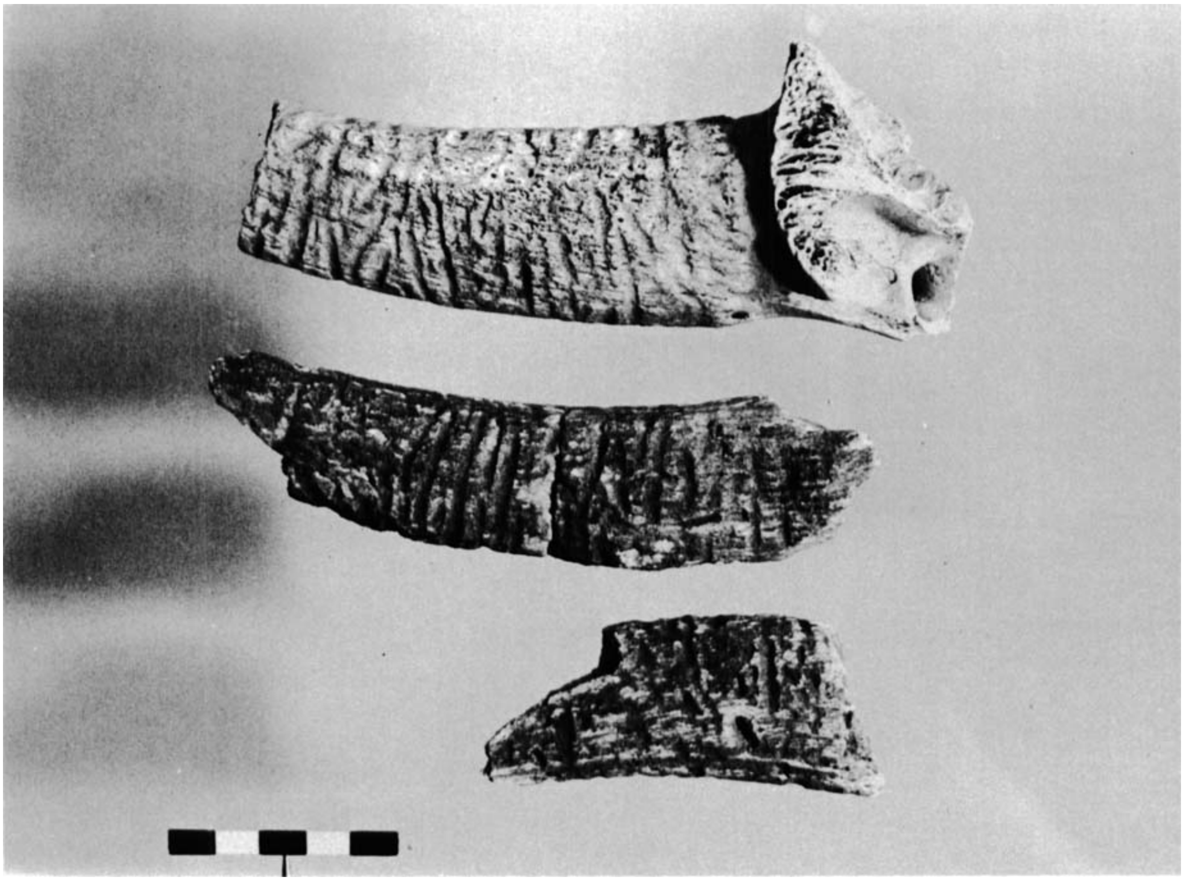


Figure 8. Portions of *Damaliscus* sp. horn cores from the spring fauna, showing grooves made by larvae of the horn moth (Tineidae). Scale in centimeters.

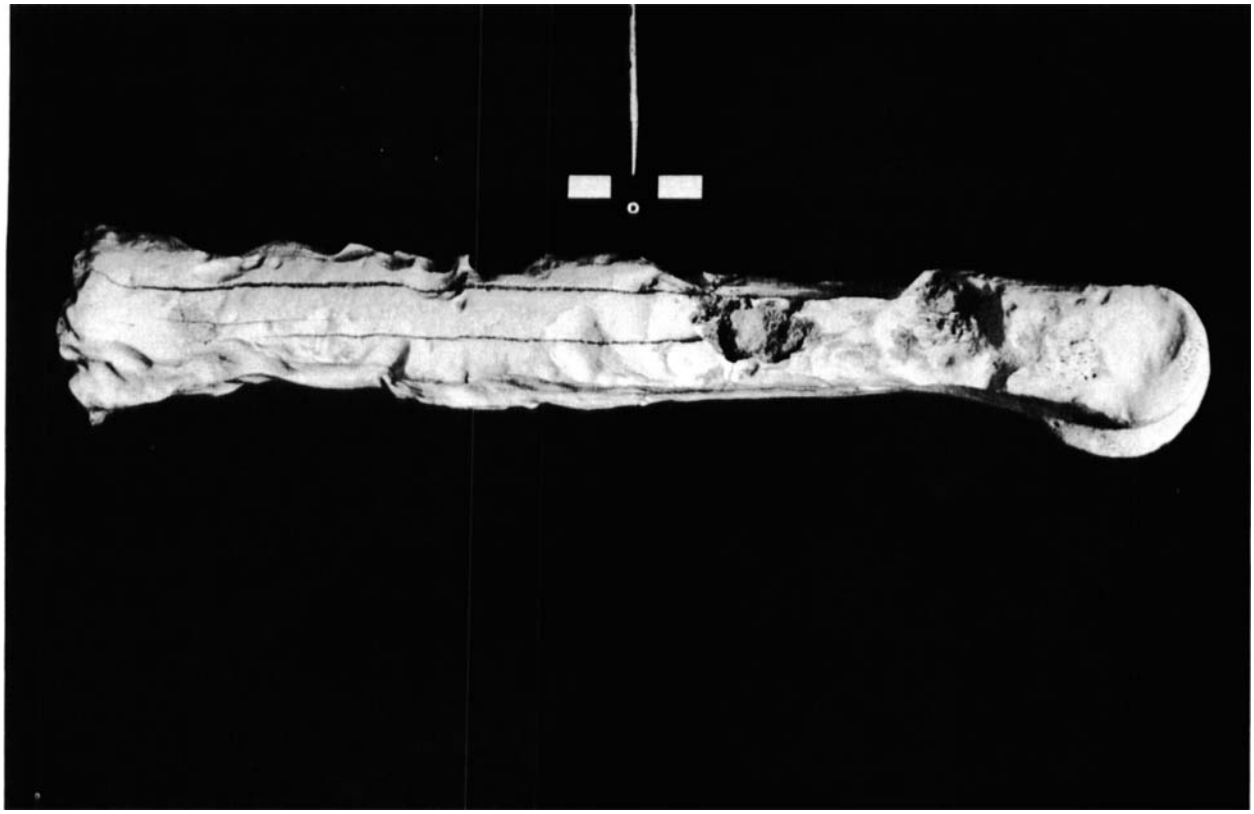
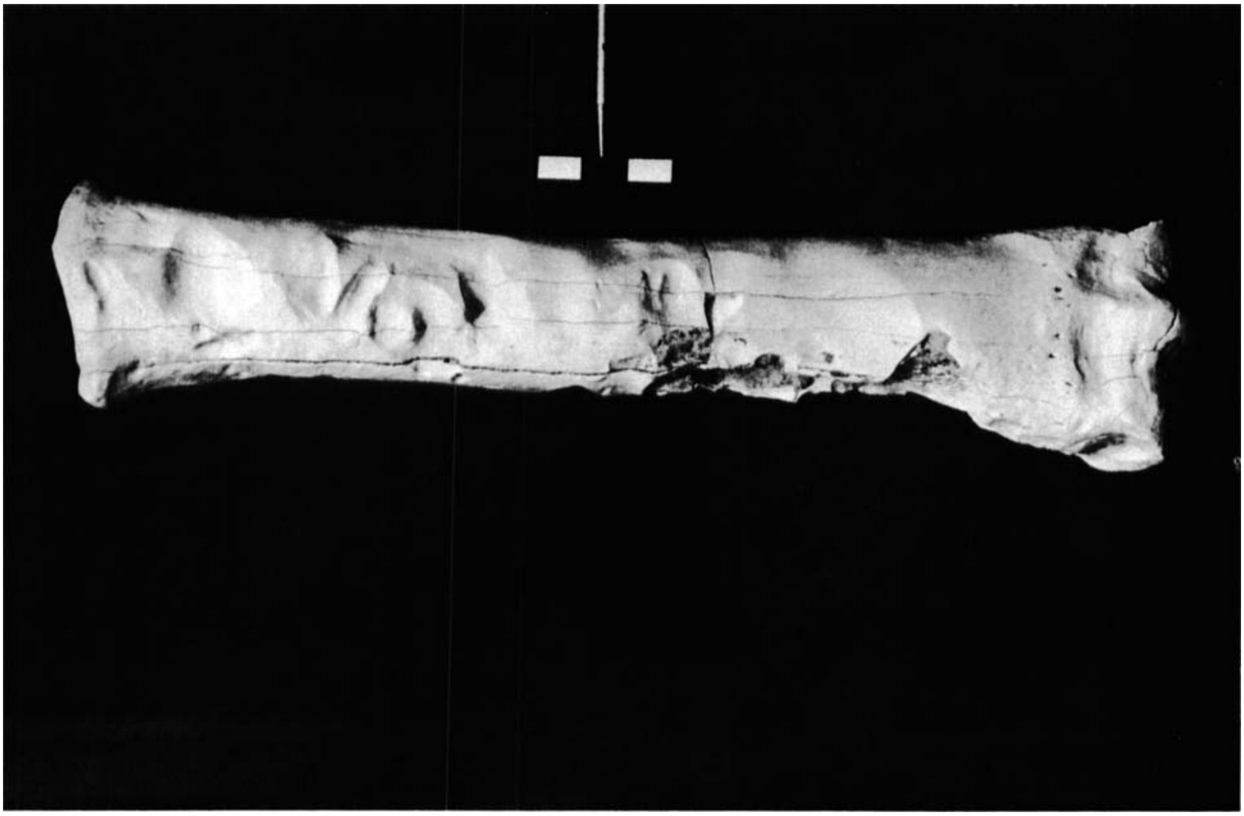


Figure 9. A and B: Two views of an equid metapodial from the spring fauna showing sun-cracking, polished pits, and grooves resulting from abrasion by sand under water. Scale in centimeters.



tion of the bones indicates that they did not derive from a peat, but rather, that they were mineralized in sandy pools. Such pools would have been a much frequented source of water for animals in the region.

ARCHAEOLOGY

There are many factors which demonstrate that the bone assemblage in Unit F is part of a human occupation site. We have already mentioned that a large percentage of the bones are smashed and fragmented. Many of these are fragments of long bones. Although vertebrae, ribs, and pelves are present, the great majority of remains are cranial and limb bones. This is one criterion which distinguishes human occupation sites from natural death sites (Potts, 1984: 146). Another factor is the limited number of species represented. Such low taxonomic diversity is more characteristic of human sites and contrasts sharply with the spring fauna, where a greater diversity of species, including carnivores, is present. All the species of the occupation horizon are edible game but for one jackal. With the exception of one partial hippo skeleton, the faunal remains consist of isolated bones and fragments scattered across the site. Natural death sites, on the other hand, tend to be characterized more by clusters of bones from single carcasses (Potts, 1984: 145).

The strongest argument for the bones in Unit F having been accumulated by man is their association with a hearth and numerous artifacts. A well-defined hearth at the western side of the occupation has been partially excavated and the remainder of this hearth continues into the unexcavated western wall. It contains a few fragments of burnt bone and stone, while other bone fragments and stone tools are in the vicinity. There are also clusters of charcoal fragments scattered across the occupation. The ratio of artifacts to bone is very high: more than 1250 artifacts have thus far been counted, *vs.* over 600 bones, teeth, or bone fragments. This high stone ratio is largely due to the presence of quantities of artifact manufacturing debris. Many of the smaller flakes and chips occur in dense concentrations characteristic of artifact chipping.

There are several indications that the occupation horizons were buried quickly and experienced minimal disturbance. Fifteen sets of artifacts have been fitted together as conjoining flakes or core with flakes. Of these, no individual set of refitted pieces has been found to be more than 12 cm apart in vertical spread. Secondly, the presence of large numbers of chipping debris under 10 mm in size is a further indication of the pristine nature of the site. Orientation and dip have been recorded for all artifacts and will be analyzed to determine if there are non-random alignments, but there is currently no reason to suspect that water has disturbed the occupation significantly. Finally, the good condition of the hearth also suggests that there was minimal disturbance to the site.

In the large assemblage of artifacts, there are only eleven retouched or heavily utilized tools and two burins (Figure 6, Nos. 1–3, 6–8). All pieces are made of hornfels and characteristic Middle Stone Age pointed flakes and blades with facetted striking platforms and convergent dorsal scars are present. Among the larger pieces, blade-dimensions are common but the dorsal scars follow a sub-parallel, convergent, or other non-parallel pattern. The eight cores in the assemblage are small and highly reduced, and three of these are prepared triangular flake cores. Naturally backed knives are not present, and it may be that the larger, sharp-edged flakes and blades were used as cutting tools. The nature of this industry and the small size of the hearth strongly suggest that the site was used for short-term, specialized activities, rather than for a longer-term occupation. It is likely that multiple short-term occupations took place, and analysis of vertical distribution plots should indicate whether discrete occupation horizons are present.

In sum, we have interpreted the Middle Stone Age occupation in F as a site at the margin of a swamp or pool where people hunted or scavenged game over a period of time. Temporary camps may have been made to butcher, cook, or consume the animals. The extent of the excavated area is about 125 m^2 and has not reached the limits of the occupation. Unfortunately, there are too few formal tools in this industry—as well as an absence of stratified sites with similar material in the Free State—to allow for accurate typological and chronological comparison of the Florisbad material. At this point, we do not know if this is an industry lacking in formal tools or whether their absence is due only to the specialized nature of the site.

Concerning the industrial sequence for the entire stratigraphic record at Florisbad, it is difficult to draw any firm conclusions. 1) The small assemblage of "Macrolithic" artifacts reported from Units O and P at the base of the site may belong to the later Early Stone Age, or more likely, to the early Middle Stone Age, but the artifacts are undiagnostic. 2) Of all the highly retouched material collected from the site, only one *in situ* sample was excavated. This "Florisbad Industry" material was reported to come from near the top of Unit M. Although occasional retouched tools came from our excavation of other layers in the bottom half of the strata, their numbers are too small to provide any further information. 3) Although the assemblage from the Middle Stone Age occupation in Unit F is large, it contains few formal tools and may be a specialized industry resulting from artifact manufacture, primarily for the butchering of game. 4) A Late Stone Age Lockshoek Industry was found in Unit B and is probably associated with the early Holocene dates from the base of this unit.

AFFINITIES AND PROBABLE AGE OF THE HOMINID

In 1984, R.J. Clarke completed a new reconstruction of the hominid cranium pictured in Figure 10 (Clarke, 1985). Dreyer's original reconstruction was incorrect in that he had joined frontal, nasal, and palatal portions when there were no contacts remaining between these fragments. He had also rotated the lateral margin of the zygomatic bone anteriorly in an incorrect manner. These errors gave the false impression of a small and modern face, which led Dreyer (1947) to claim the Florisbad hominid as a Bushman ancestor. The new reconstruction is considerably more accurate, but since the actual joins are not preserved, it is based on certain anatomical judgments. It shows that the cranium is an archaic *Homo sapiens* with close affinity to two older and even more archaic *Homo sapiens* or late *Homo erectus/Homo sapiens* transitional fossils from southern Africa: The Saldanha skullcap from Elandsfontein (South Africa), and the Rhodesian Man or Broken Hill cranium from Kabwe (Zambia). The Florisbad specimen is more modern than either of these not so anatomically modern as suggested by Dreyer (1947) and Wells (1969). Singer (1958) and Rightmire (1978) both studied the cranium prior to the new reconstruction and concluded that it had affinities with Broken Hill and Saldanha. These latter hominids are undated but have been assigned on faunal grounds to the earliest Upper Pleistocene or, more likely, to the Middle Pleistocene, as the faunas belong to the "Vaal-Cornelia span" (Klein, 1973, 1978), i.e., to the Cornelian Land Mammal Age which precedes Florisian. The Middle/Upper Pleistocene boundary is commonly accepted at ca. 128,000 B.P., at the boundary between oxygen-isotope stages 6 and 5 (substage 5e). A time range of 200,000–400,000 years for the Broken Hill and Saldanha fossils would, however, be more likely. More recently, Klein (1984) has noted that dates are still unresolved but the Cornelian–Florisian boundary could be as old as 400,000 years.

The Florisbad cranium compares most closely with two other African hominids which have been tentatively dated. It is extremely similar to the Ngaloba cranium from Laetoli, Tanzania, which is associated with Middle Stone Age artifacts. This hominid derives from the Ngaloba Beds, which are tentatively correlated with a marker tuff in the Ndutu Beds, estimated to be about 120,000 ± 30,000 years old (Day et al., 1980; Magori and Day, 1983). There is also strong similarity with the Omo II calvaria from Ethiopia (Day, 1969), which has a provisional Thorium-Uranium date on shell of ca. 130,000 years

Figure 10. Facial view (above) and right lateral view (below) of the new reconstruction of the Florisbad cranium. Scale in centimeters.

(Butzer et al., 1969). Two other specimens from the Upper Pleistocene appear to be more anatomically modern than Florisbad. From a Middle Stone Age level at Klasies River Mouth in the South African Cape (Layer 16, containing Wymer's MSA II), a fragment of hominid frontal bone was excavated. Butzer suggests a date for this layer based on geological considerations of ca. 115,000 B.P., while Shackleton believes the oxygen-isotope ratios found in shell could place it either at ca. 80,000 or 100,000 B.P. (Singer and Wymer, 1982). Finally, from Border Cave in KwaZulu near the Swaziland border come several anatomically modern specimens—a cranium, two mandibles, and a possible infant burial. A date of 90,000–110,000 B.P. has been suggested on geological and sedimentological arguments (Beaumont, 1980; Butzer et al., 1978). The certain association of these fossils with Middle Stone Age layers at this site is complicated by the fact that only one mandible and the infant were recovered from controlled excavations. It is also possible that all the human remains were burials introduced from higher levels, with only the infant likely to have derived from a Middle Stone Age level. The age of these modern-looking remains from Border Cave is likely to remain controversial until the time when a technique to date the fossils themselves has been developed (see Volman, 1981 for discussion). Nevertheless, they are, along with the Klasies River Mouth remains, considered to be very early examples of anatomically modern *Homo sapiens*.

The assessment of the estimated dates of all the above specimens suggests a pattern of hominid development to which the Florisbad cranium can be compared. The late *Homo erectus*/archaic *Homo sapiens* forms from Broken Hill and Saldanha date some time in the mid-Pleistocene, probably prior to 200,000 B.P. They are then followed by a more modern-looking archaic *Homo sapiens*, represented by the Ngaloba and Omo fossils from East Africa, estimated approximately to 120,000–130,000 years, close to the Middle to Upper Pleistocene boundary. Dates for the next phase represented by the anatomically modern *Homo sapiens* fossils from Klasies River Mouth and Border Cave are controversial, but these do fall within the Upper Pleistocene, in the general range of 80,000–115,000 years. On the grounds of anatomical comparison, the Florisbad specimen should fall in the broad time range of 100,000–200,000 years. A later mid-Pleistocene age of greater than 128,000 B.P. would certainly be reasonable for the basal deposits at the site.

SUMMARY AND CONCLUSIONS

The first results of three years' work at the Middle Stone Age hominid site of Florisbad have been discussed here. This site provides a long record of environmental changes from perhaps the later mid-Pleistocene to the mid-Holocene. Two representative stratigraphic profiles are presented, with tentative interpretation by the archaeologists. The alternating sequence of sands and silts with organic layers correlates with changing cycles of spring activity. No dating methods have yet proved successful on the Pleistocene deposits beneath Peat III.

A new reconstruction of the hominid cranium shows it to be an archaic *Homo sapiens*, more anatomically modern than the related Saldanha and Broken Hill fossils but not as anatomically modern as the Klasies River Mouth and Border Cave hominids. The Florisbad hominid compares most closely with the Ngaloba and Omo crania from East Africa. Based on anatomical comparison, we estimate the age of the Florisbad cranium to be in the range of 100,000–200,000 years. Such an age for the hominid is consistent with the supposed age of the Florisian fauna, which is thought to originate in the later mid-Pleistocene (Klein, 1984:120). A small assemblage of early Middle Stone Age or possibly late Early Stone Age artifacts may be contemporary with the Florisian fauna and hominid. Taphonomic study of the spring fauna shows many of the bones to have been broken and gnawed by carnivores and exposed for a period of time to surface weathering, then mineralized, probably at the level of Unit P, and finally eroded, pitted, and polished by sand and water.

Highly retouched artifacts, termed the Florisbad Industry, were also collected from spring sands, but one assemblage was reported to have been excavated *in situ* from a deposit just below the base of Peat II. Our excavations produced a large industry of mostly unretouched Middle Stone Age artifacts from an occupation within a white sand between Peats II and III. These artifacts, a hearth, and numerous broken up bones occur through a half meter of deposit and probably represent multiple occupations. Charcoal from these levels is of infinite Carbon-14 age. The limited vertical displacement of conjoined artifacts and abundant small flakes indicate the pristine condition of this site, which we have interpreted as a specialized occupation related to the butchering, hunting, or scavenging of game.

Finally, a Late Stone Age Lockshoek Industry was excavated from a deposit contemporary with lower Peat IV. The base of this layer has several dates, which range from 8700 to 11,700 B.P., while the base of upper Peat IV has produced three mid-Holocene dates ranging from 3550 to 5530 B.P.

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