

Hominid Molars From a Middle Stone Age Level at the Mumba Rock Shelter, Tanzania

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ABSTRACT Three hominid molars were recovered from a depth of 7.0–7.1 meters in the Mumba Shelter at Lake Eyasi, northern Tanzania. Geological context of the finds and archaeological data indicate that people with a Middle Stone Age technology were using the Mumba locality intermittently whenever retreat of lake waters allowed access to the site. Uranium series dates suggest an age on the order of 130,000 years bp for the teeth and stone tools. Based on morphological analyses, the dental remains probably belonged to one individual and appear to be the crowns of two upper permanent M²s and one lower permanent M₂. Crown areas are very small, even in comparison to the variation exhibited by recent African populations. Crown patterns have no archaic features. These teeth are smaller than any verifiable archaic *Homo sapiens* examples; thus, they may represent early anatomically modern *Homo sapiens*.

Mumba is situated at the northeastern end of Lake Eyasi in Tanzania. It lies 3.25 km east of the lakeshore locality which has provided archaic *Homo sapiens* cranial fragments (Reck and Kohl-Larsen, 1936). The site occurs in a low range of Precambrian residual hills partially buried by Quaternary volcanics and detritus from erosion in surrounding highland areas (Pickering, 1961, 1964). The shelter developed from a wave cut niche in quartzo-feldspathic gneiss (Lais and Schmid, 1952); lake level is currently about 28 m below modern site surface.

The sheltered area is 20 m long and up to 9 m wide. It was first excavated by the Kohl-Larsens (1943 IL:308–14) who distinguished six levels in 10 m of deposit. In layer III they recovered parts of 18 human skeletons which exhibit strong affinities to Negroids (Bräuer, 1980, 1983). These burials are associated with cultural remains ranging from Later Stone Age (LSA) to Iron Age; one burial dates to about 5000 years bp.

Towards reassessment of Kohl-Larsen data, excavations were resumed at Mumba in 1977 (Mehlman, 1979). During this work, on 24 November 1977, three isolated human mo-

lars, designated Mumba XXI, were found in a Middle Stone Age level.

PROVENIENCE AND AGE

The three XXI molars were recovered from a spit 7.0–7.1 m below datum (Fig. 1). At this depth (Kohl-Larsen's lower middle Bed VI) the deposit is a sandy gravel, brown (10YR 5/3) in color. The teeth were obtained from screening about 0.325 cubic meters of sediment from in situ. Matrix on the teeth matched that on all other items at the same level. Mineralization is consistent with the condition of other lower Bed VI teeth. Their derivation from higher in the section is also deemed improbable because in lower Bed V the precaution was taken of stepping back the excavation by 1 m; thus younger artifacts and bones were prevented from being included unwittingly in collections from older, subjacent strata.

Bed VI as originally described by Kohl-Larsen is divisible into two parts (Mehlman, 1987). Unit VI-A is dominated by features indicative of a shrinking lake—claystone pel-

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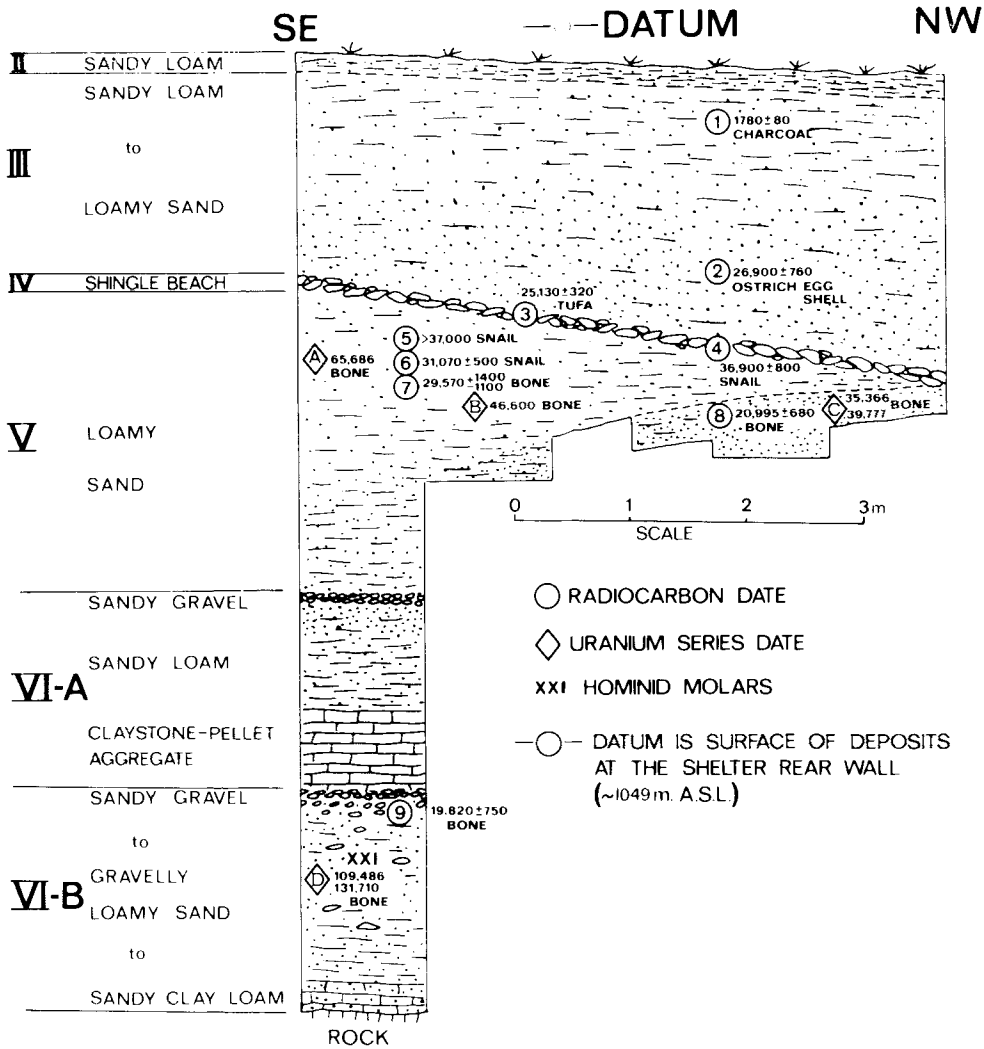


Fig. 1. Mumba stratigraphic section (southwestern face) showing dates and provenience of Mumba XXI.

lets and variable amounts of CaCO_3 ; basal VI-A is a considerably consolidated claystone-pellet aggregate. A distinct contact exists between VI-A and underlying gravels which cap unit VI-B. Sediments of the lower unit show marked evidence of water action—coarser grain size distributions, minimal CaCO_3 , and absence of clay pellets. The deposit is less gravelly at depth, grading down through the level in which the XXI teeth were found, until it is a brown gravelly sandy

clay loam on bedrock. Bed VI-B was 1.9 m thick in the 1977 section.

Bones and artifacts of VI-B vary from fresh to heavily rolled; unabraded material was most frequent between 6.8 and 7.4 m depth. The state of faunal and lithic remains agrees with sedimentary evidence suggesting that an initial lacustrine depositional phase (base of VI-B) was followed by a regime of fluctuating lake levels in which terrestrial deposits were reworked by water. The pebble gravel

capping Bed VI-B is full of rolled bone and artifacts.

Foregoing evidence suggests that Bed VI-B finds are not in primary archaeological context, but the context is not merely geological. Shelter situation in a rock outcrop surrounded by lower-lying land virtually precludes sheetwash and stream activity as debris-aggregating agents. Whereas stream action would have flushed artifacts out of the shelter, relatively low energy lacustrine incursions periodically reworked material in place during the time when Bed VI-B sediments were accumulating. Thus, the primary locus of deposition for the artifacts and faunal remains was actually at the rock shelter.

Besides the XXI molars, Bed VI-B contains stone artifacts of Middle Stone Age (MSA) type and technology (Mehlman, 1979, 1987). In contrast to overlying Bed VI assemblages, the industry at 7.0–7.4 meters has a low ratio of Levallois technique and of points/percoirs, combined with increased frequencies of side and notched/concave scrapers, bifacially modified pieces, heavy duty tools, and amorphous cores. This MSA lithic configuration seems relatively primitive in aspect.

Mineralized bone is abundant in Bed VI-B, but identifiable pieces, particularly teeth, occurred only between 7.0 and 7.7 m. Two *Phacochoerus* molars, of modern morphology but of larger-than-modern size (T.D. White, pers. comm.), were collected in 1977, as well as several bovid molars. The Kohl-Larsen collection contains 7 equid, 8 bovid, 1 suid, and a partial hippopotamus tooth. One tooth initially attributed to an extinct species (Lehmann, 1957) is probably *Connochates taurinus* (D.P. Gifford-Gonzalez, pers. comm.).

The only C-14 determination from Bed VI is spurious; bone from the pebble gravel at the top of VI-B registers $19,820 \pm 750$ years bp (GX-6623A). This date is inconsistent with seven other C-14 dates from lower Bed III through Bed V, all of which are older; the lowest lies stratigraphically three meters above the top of VI-B. Other dates aside, one of 20,000 years can be dismissed without reservation as an unreasonable correlate to any MSA assemblage.

A pair of uranium series determinations may have real bearing on the age of the deposit; these were processed on an unabraded bone fragment from 7.1–7.4 m deep, immediately below the Mumba XXI level. The Th-230 date is 131,710 (+ 6,924 and -6,026)

and Pa-231 measures to 109,486 (+44,404 and -23,020) years bp (collectively, USGS sample no. 82-19, courtesy of J.L. Bischoff). Concordance between independent decay pairs, U-238 to Th-230 and U-235 to Pa-231, confers the highest level of confidence the method allows (Bischoff and Rosenbauer, 1981). These dates are consistent with others on bone and shell from Beds III through V, although the set of Bed V dates is inverted according to their provenience (Mehlman, 1987).

TOOTH MORPHOLOGY

Crowns of the Mumba XXI molars are well preserved, and they are unlike those of first molars. Since cusp patterns on second and third molars are normally variable, unambiguous identification of these teeth is impossible. All extant features considered, however, they compare most closely with second permanent molars.

The dental remains (Fig. 2) are probably 1) a complete right M^2 crown; 2) a partial crown of a left M^2 ; and 3) a complete right M_2 crown. None are worn, and roots are only slightly developed; they are a uniform yellow to dark brown in color. Given this physical state, similar crown features (see below), and lack of duplication in the dental arcade, the teeth are likely those of one individual, 7 to 9 years of age.

The presumed permanent right M^2

This crown has three well-developed cusps, two buccal and one lingual, along with a very small DL cusp (hypocone). Among the cusps, DB (metacone) is somewhat smaller than MB (paracone), and ML (protocone) is nearly as high as MB but wider mesiodistally.

Buccal, distal, and central grooves derive from the central pit of the trigone. The distal groove, running towards the DL cusp, is broken by the oblique ridge. The crown has supplemental pits and grooves. Mesiodistal length of the Mumba XXI crown is 10.3 mm and buccolingually it is 11.2 mm across.

An M^2 with weakly developed DL cusp frequently resembles an M^3 (Wheeler, 1974), but comprehensive comparisons favor the conclusion that this tooth is a second molar. Thus, despite its greatly reduced DL cusp, it exhibits a rhomboidal outline, not the triangular or heart-shaped form typical of most third molars. Also, the oblique ridge is clearly visible. The XXI cusp pattern, with reduced DL cusp, is a well-documented variant of up-

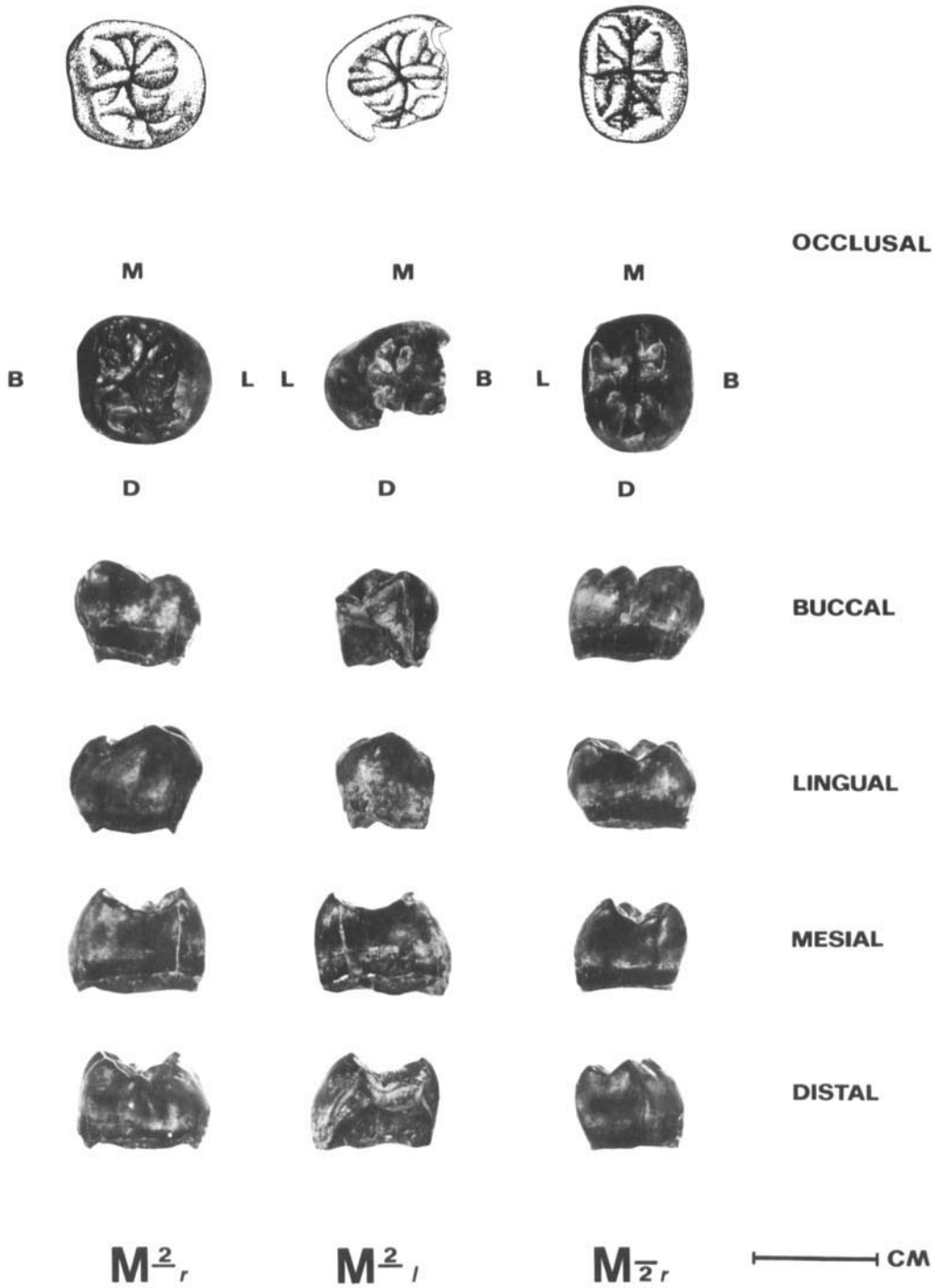


Fig. 2. Standard views of the Mumba XXI molars.

TABLE 1. Mumba XXI and comparative M^2 metric data

	M-D	B-L	Crown area
Mumba XXI r	10.3	11.2	115.4
Northern Tanzania			
Mumba X r	10.5	12.0	126.0
Eyasi I ¹ l	10.2	12.2	124.4
Eyasi III ¹ r	11.5	12.4	142.6
Olduvai I r	10.0	11.8	118.0
Kinto 2 r	10.7	13.1	140.2
Kinto 3 r	11.6	12.6	146.2
Africa (other regions)			
Broken Hill 1 l	13.0	14.0	182.0
Salé ²	11.5	13.8	158.7
Rabat ²	11.5	13.0	149.5
Tangier ³	11.7	13.7	160.3
Wadi Halfa ⁴	\bar{x} 11.1	12.3	136.5
(n = 9)	Range 9.7-11.7	11.2-13.2	—
South Sahara 'Neolithic' ⁵	\bar{x} 10.3	11.2	115.3
Iberomaurusian (North Africa) ²	$\bar{x} \pm s$ 10.3	12.4	127.7 \pm 14.05
(n = 23) ♂	Range 9.0-12.0	11.0-13.0	—
Iberomaurusian (North Africa) ²	$\bar{x} \pm s$ 10.0	11.8	118.1 \pm 11.36
(n = 17) ♀	Range 9.0-12.0	11.0-13.0	—
South African Bantu ⁶	$\bar{x} \pm s$ 10.3 \pm 0.7	11.9 \pm 0.7	123.8 \pm 11.0
(n = 303) ♂	Range 8.6-12.8	10.2-14.6	89.1-179.8
South African Bantu ⁶	$\bar{x} \pm s$ 10.0 \pm 0.6	10.5 \pm 0.7	115.3 \pm 12.6
(n = 99) ♀	Range 8.6-11.9	9.8-13.9	83.9-155.9
Bushmen (San) ³	\bar{x} 9.7	10.6	(102.8)
(n = 30)			

¹Protsch, 1981.²Chamla, 1980.³Wolpoff, 1971.⁴Greene et al., 1967.⁵Chamla, 1968.⁶Jacobson, 1982.

M-D, mesiodistal length; B-L, buccolingual width.

per second molars (Osborn, 1981; Kraus et al., 1969). It occurs frequently in recent samples (Wajeman and Levy, 1979) and in prehistoric remains, including the Mesolithic Wadi Halfa teeth (Greene et al., 1967).

The presumed permanent left M^2

The mesial half of this fragmentary tooth, including ML and MB cusps and central pit, has been preserved. Groove and cusp patterns of the existing portion mirror those of the molar described above.

The presumed permanent right M_2

This lower molar has 5 cusps. Primary grooves exhibit a +5 pattern. A distal cusp is situated only slightly distal to the DL cusp, resulting in a nearly rectangular crown outline. The distomesial groove slants somewhat lingually, so the DL area is reduced in favor of DB; this main groove approximates a straight line running from distal to mesial side. There is no anterior fovea. A straight buccal groove, extending to the buccal side,

separates MB (protoconid) and DB (hypoconid) cusps. A lingual groove is also initially straight, curving sharply lingodistally. A relatively shallow distobuccal groove, beginning near the central pit, separates DB (hypoconid) from the distal cusps (hypoconulid). Other irregular grooves are present.

ML (metaconid) and MB (protoconid) cusps are largest in width and height. The metaconid has a very strong crest which runs to the mesial groove; the like-sized protoconid has a less developed crest. In decreasing size, they are followed by the DL (entoconid), DB (hypoconid), and distal cusps, the latter two of similar dimensions. The mesial crown (trigonid) is barely wider than the distal part (talonid). Mesiodistal length of the crown is 11.2 mm and buccolingually it is 9.2 mm.

The Mumba XXI crown outline is rectangular, not ovoid as is usual even with third molars having a +5 pattern. Its trigonid is only slightly wider than the talonid, a characteristic M_2 trait (Kraus et al., 1969). Other features, like the outline of the occlusal ta-

TABLE 2. *Mumba XXI and comparative M₂ metric data*

		M-D	B-L	Crown area
Mumba XXI r		11.2	9.2	103.0
Northern Tanzania				
Mumba X r		12.3	11.7	143.9
Mumba VII r		10.9	10.9	118.8
Mumba VIII r		12.4	12.7	157.5
Olduvai I r		10.8	11.0	118.8
Kinto 2 r		10.8	11.1	119.9
Kinto 3 r		12.9	12.6	162.5
Africa (other regions)				
Cave of Hearths ⁷		12.0	10.3	123.6
Haua Fteah I ⁷		11.7	11.5	136.9
Temara ²		12.0	12.1	145.2
Thomas I ²		15.0	13.2	198.0
Sidi Abderrahman		13.9	11.7	162.6
Wadi Halfa ⁴	\bar{x}	11.8	11.5	135.7
(n = 8)	Range	9.9-13.4	9.5-13.2	—
South Sahara 'Neolithic' ⁵	\bar{x}	11.4	11.0	125.4
(n = 15-25)				
Iberomaurusian ²	$\bar{x} \pm s$	11.1	11.3	126.0 \pm 16.5
(n = 28) ♂	Range	9.0-12.0	10.0-13.0	—
Iberomaurusian ²	$\bar{x} \pm s$	10.6	10.8	115.2 \pm 14.5
(n = 15) ♀	Range	9.0-12.0	9.0-12.0	—
South African Bantu ⁶	$\bar{x} \pm s$	11.1 \pm 0.7	10.7 \pm 0.6	119.4 \pm 13.3
(n = 284) ♂	Range	9.4-13.1	9.4-13.2	92.2-172.9
South African Bantu ⁶	$\bar{x} \pm s$	10.8 \pm 0.6	10.5 \pm 0.6	112.3 \pm 11.0
(n = 78) ♀	Range	9.7-12.0	9.4-12.6	93.6-145.6
Bushmen (San) ³	\bar{x}	10.6	10.1	(107.1)
(n = 32)				

²⁻⁶See Table 1.⁷Tobias, 1971.

M-D and B-L as for Table 1.

ble, the straight mesial marginal ridge, and the crown shape in mesial aspect, support its identification as an M₂.

The +5 pattern is a frequent M₂ variant; about 12.9% of East African Bantu M₂s have it (Chagula, 1960). The Cave of Hearths archaic *Homo sapiens* mandible has an M₂ with this configuration, as has a Holocene mandible from Kangototha (Coon, 1971).

METRIC COMPARISONS

Metric data of Mumba XXI teeth, other fossils and recent samples from Africa are assembled in Tables 1 and 2.

Upper molar measurements

Since the XXI M₂ has a reduced hypocone, its crown area is smaller than most 4 cusp forms. It is distinctly smaller (Table 1) than Mumba X, the oldest Bed III burial. Of Tanzanian fossils, anatomically modern Olduvai 1 is closest to Mumba XXI. Eyasi 1, an archaic *Homo sapiens*, is somewhat larger; crown area of Eyasi 3 is much larger, as is that of LSA Burial 3 from the Kinto Shelter

(Bräuer, 1981). Eyasi 1 has the smallest M₂ crown of any archaic *Homo sapiens*; its area is surpassed by numerous modern examples. Mumba XXI is smaller than Eyasi 1 and comparable to many East African molars from Iron Age and LSA contexts.

Mumba XXI crown size is also smaller than the Wadi Halfa sample mean (Table 1). XXI size is closest to the sample means of southern Sahara Neolithic, modern female South African Bantu and female Iberomaurusian molars.

Lower molar measurements

The Mumba XXI M₂ is exceptionally small given the presence of an extra cusp; its buccolingual width is the smallest Tanzanian record, fossil or subrecent (Table 2). XXI size is far smaller than that of Mumba X. Olduvai 1 and Mumba VII are nearest in size; Kinto 3 is the largest.

Molars from LSA levels at Gamble's Cave, Kenya, are smaller than the XXI M₂. An M₂ from the Cave of Hearths is the smallest among African archaic *Homo sapiens* fossils

(Table 2), but it is much larger than that of Mumba XXI.

Average M_2 crown width of modern Bushmen and Bantu is slightly larger than that of Mumba XXI (Table 2). Its width lies at the small end of the range for South African Bantu and female Iberomaurusian samples. Mumba XXI size is close to the mean for Bushmen.

DISCUSSION

If uranium series dates from Bed VI-B are reliable, then Mumba XXI teeth and associated MSA artifacts must have an antiquity on the same order of magnitude. *Phacochoerus* molars are compatible with an early Upper Pleistocene date, as is the depth of the stratum in which the teeth occur relative to securely C-14 calibrated overlying strata of units III and IV.

Dated MSA localities in sub-Saharan Africa are still rare. Artifactual and chronometric evidence from Mumba is broadly comparable to findings at Klasies River Mouth (Singer and Wymer, 1982) and Border Cave (Beaumont et al., 1978; Butzer et al., 1978; Rightmire, 1979) in South Africa; these two sites have provided substantial evidence of anatomically modern human remains in early Upper Pleistocene deposits.

Eyasi remains, the Laetoli Ngaloba cranium and Mumba XXI teeth currently represent the only known Tanzanian hominids from possible Middle Stone Age contexts. Features of Eyasi 1 and 2 are those of early archaic *Homo sapiens* (Bräuer, 1984a,b). A general reappraisal of the Eyasi site (Mehlman, 1984, 1987) indicates that lakeshore deposits are older than the lowest horizon at Mumba. Stratigraphy, MSA/Sangoan artifacts and fauna best agree with a later Middle Pleistocene age for the Eyasi crania.

At Laetoli, 30 km from Eyasi, L.H. 18 and MSA artifacts in the Ngaloba Beds (Day et al., 1980) are dated by uranium series to 129,000 years bp (Hay, 1987). The cranium is morphologically more modern than Eyasi 1, exhibiting a mosaic of archaic and modern features (Magori and Day, 1983; Bräuer, 1982).

Farther afield in East Africa, obsidian hydration dates suggest that middle MSA levels at Prospect Farm, Kenya, are 107,000/119,500 years old (Michels et al., 1983). In Ethiopia, human remains from the Kibish Formation at Omo (Butzer et al., 1969) are uranium series dated to 130,000 years bp;

the Omo I cranium is fully anatomically modern (Day and Stringer, 1982; Bräuer, 1984a,b).

Neither measurements nor morphology of three isolated teeth from an MSA context permits an incontrovertible statement about their taxonomic assignment. With a larger fossil sample, Mumba XXI molars might fall within an expanded range of archaic human variation; thus the teeth may have belonged to a late archaic *Homo sapiens*, keeping in mind that the label represents a classificatory type within an evolutionary continuum. Still, classification of the teeth as modern is the most reasonable conclusion based on the facts: 1) crown patterns exhibit no features unknown among modern humans; 2) their dimensions lie below the known range of variation for archaic humans anywhere in the Old World; and 3) they rank near the small end of the range in extant human samples. If Mumba XXI represents anatomically modern *Homo sapiens*, then this find is consistent with other data indicating that such individuals were present in sub-Saharan Africa from the beginning of the Upper Pleistocene period.

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