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FOSSIL PROBOSCIDEAN REMAINS FROM BOLT'S FARM AND OTHER TRANSVAAL CAVE BRECCIAS

by

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ABSTRACT

Proboscidean remains are very rare in the Transvaal cave breccias and the few specimens recovered are generally fragmentary but deserve description because of their potential value in correlation and dating. The best specimen is the back half of a left lower molar from Pit 7 of the University of California African Expedition's work at Bolt's Farm. It was regarded by Maglio as representing *Elephas ekorensis* but closer examination suggests that there are some more progressive characters and it most likely represents *Elephas recki brumpti*. The stump of a second molar from Bolt's farm also accords with this taxon. Makapansgat has furnished 14 fragmentary fossils, 6 of them tusk or root remains. Particularly interesting is the occurrence of a pair of cones from a molar of *Anancus*. The scrappy elephantid material from Makapansgat may be referred tentatively to an early stage of the *Elephas recki* lineage, as also a mandible fragment from Sterkfontein with the two anterior milk teeth. An anterior milk tooth from Swartkrans Member 3 exhibits broader and higher lamellae than in *E. recki* and most probably belongs to the more advanced *E. iolensis* to which most of the Vaal River elephants have been referred.

KEY WORDS: Proboscidea, Plio-Pleistocene

INTRODUCTION

Whereas proboscidean remains are often found in the various Pliocene-Pleistocene deposits in East Africa, they are an extremely rare element in the South African australopithecine cave breccias. This is unfortunate as elephants, like suids, were evolving and diversifying rapidly and are thus of value in correlation and relative dating. There are a few specimens from the Transvaal cave breccias but hitherto they have not been described, largely because most are fragmentary and difficult to diagnose; however, they are worth recording as some inferences can be drawn from them in the light of what is now known of the East African sequence.

Thick sequences of sediments that accumulated in the downwarps and rift valleys of Ethiopia and East Africa during the later Pliocene commonly contain vertebrate fossils, including hominids. Notable deposits include Hadar, East and West Turkana, the Omo Basin, Olduvai Gorge and Laetoli. Volcanic tuffs form valuable marker horizons and many of them provide radiometric ages to act as controls. Some tuffs have been recognized over wide areas by their geochemical "signature", making possible objective correlation between the different basins. The Shungura Formation of the Omo Basin (and the related Usno and Mursi Formations) provide a useful "standard", divided stratigraphically by marker tuffs designated A - L lying at the base of the respective Members A - L (see Figure 1) and now well dated and geochemically correlated with the Koobi Fora and Nachukui Formations of East and West Turkana (Brown et al 1985, Harris et al 1988). The classic Olduvai sequence is also shown in Figure 1.

The elephants were reviewed by Maglio (1973) and the remains from most of the East African deposits were analysed and evaluated by Beden in his doctoral thesis (1979), much of which was later published (1983, 1987). The material relevant to the South African material belongs to the genus *Elephas* of which the earliest taxon is *E. ekorensis* Maglio 1970 with a time range from 4.5 Ma to 3.0 Ma. It is regarded as ancestral to the wide-ranging *E. recki* Dietrich 1916, of which the lectotype came from Olduvai Bed IV and is now regarded as the most advanced variant of a long lineage that has been divided by Beden (1979) into five stages or subspecies of *E. recki: E. r. brumpti, E. r. shungurensis, E. r. atavus, E. r. ileretensis* and *E. r. recki*, although the defining criteria are perhaps a little less firm than the nomenclature might imply. The time ranges, based on Beden's horizon data adjusted to the revised time scale, are shown in Figure 1.

E. ekorensis has second and third molars with 11 or 12 plates which have moderately thick cementum between them and the valleys between plates tend to be U-shaped at the base. Third molars are broad anteriorly and narrow markedly at the back. In transverse section the plates are subtriangular with the greatest breadth not far above the base and the maximum height of the crown is only slightly greater that the breadth, giving a hypsodonty index (Height x 100/Breadth) close to 100. The enamel is fairly thick (c 3.5 mm) and is not

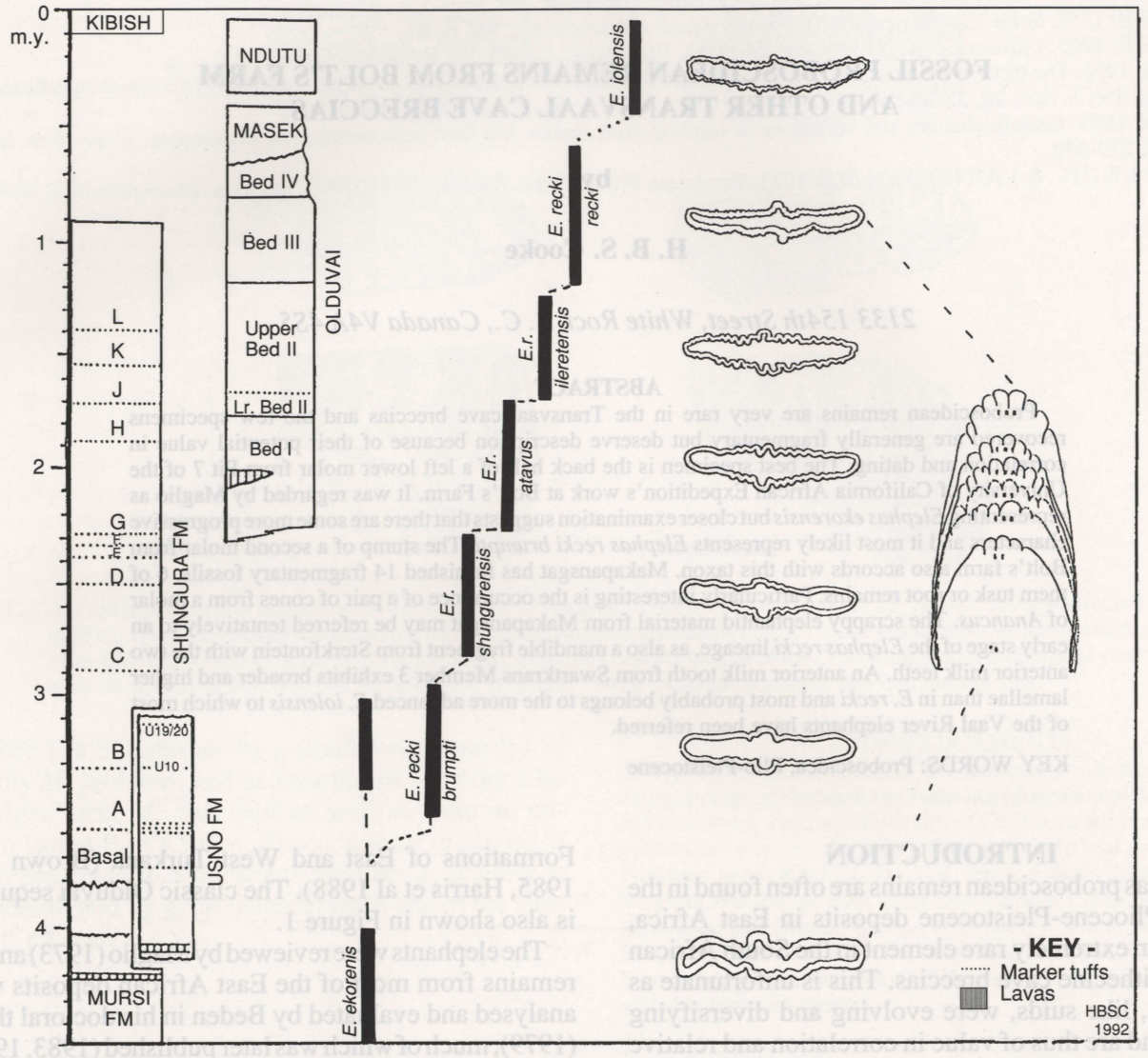

Figure 1. Time ranges of species and subspecies of *Elephas* in East Africa. The Omo basin and Olduvai successions are given for reference. Typical enamel patterns on moderately worn plates are drawn to the right of the corresponding species or subspecies. The last column shows characteristic profiles of the plates in these taxa. (In part after Beden 1979, adjusted for revised dating).

significantly crimped, although the median area may be coarsely folded. In the *E. recki* lineage there is a progressive change in the transverse shape of the plates, which become more nearly parallel sided and also higher crowned (See Figure 1). The enamel becomes thinner (3-2.5 mm) and progressively more crimped in the younger subspecies (see Figure 1). The actual breadth of the crown changes very little throughout and for second molars is generally in the range of 70-90 mm and for third molars 70-100 mm. The hypsodonty index is about 105-125 in *E. r. brumpti* and *E. r. shungurensis*, 110-150 in *E. r. atavus*, 130-170 in *E. r. ileretensis* and 160-200 in *E. r. recki*. A separate species *E. iolensis* is known from North Africa and South Africa but only rare specimens have been found in the middle to later Pleistocene in East Africa. The molars are a little broader and higher crowned than in *E. r. recki* and the plates are thicker and are separated only by relatively thin cementum. The enamel is 2-3 mm thick but is very strongly and irregularly folded.

BOLT'S FARM

Lower molar from University of California Pit No. 7

The University of California African Expedition in 1947 and 1948 excavated a number of small deposits, or "pockets" of bone-bearing breccia at Bolt's Farm but most of the material collected has not been described, apart from a new mustelid and some fine cranial material of *Dinofelis barlowi* (Cooke 1985, 1991). In the latter paper the features of the Bolt's Farm deposits were outlined and a map based on Dr Frank Peabody's survey was given showing the location of the two dozen separate sites. "Pit 7" or "Elephant Cave" (University of California Museum of Paleontology Locality V-67262) lay some 400 m due west of Mr Bolt's house. It comprised a small patch of brownish breccia that yielded the well preserved back half of an elephant molar, but otherwise only three very fragmentary specimens and some rodent breccia. A cast has been retained by the Museum of Paleontology at the University of California (VE 64610) but the

original specimen was donated to the Transvaal Museum, Pretoria, and is catalogued as TM BF 7-202. The specimen is the back half of a left lower third molar; there is no posterior indentation indicating the existence of a succeeding tooth (Figure 2). It comprises the posterior 6 1/4 plates, the hindmost complete but not rooted, and the length parallel to the base is 159 mm. The posterior plates slope rather strongly forwards and the tooth narrows towards the back. It is not possible to determine how many additional plates were originally present but the general form of the tooth suggests that about half of the crown is missing. The very tip of the foremost plate is just abraded and its maximum height from the base of the enamel is 104 mm. The greatest breadth at the least damaged lamella (No. V) is 85 mm. The anterior plates are almost parallel-sided for one third of the height above the base and then taper gently inwards, while the posterior plates show increasing taper from the base.

The hindmost plate divides into two conelets, the next one into three and the remainder into four conelets. In order to appreciate what the enamel pattern would be like with wear, the tooth has been cut at a slight angle from a point 30 mm above the enamel of the foremost plate to the point of fusion on the talonid plate. The enamel pattern disclosed is shown in Figure 2. The thickness of the enamel ranges from a rare 2.5 mm to a maximum of 4.0 mm and is usually close to 3.0-3.2 mm. In the isolated islands the enamel is uncrimped and unfolded. In the central islands of the "middle plate", the borders are wavy and in the two plates anterior to it the enamel is distinctly folded in the central area. The two central conelets seem to be separated by a persistent notch on the posterior side even on the foremost plate, but there is nothing resembling a true loxodont sinus. The lateral parts of the plates have the anterior and posterior borders approximately parallel and the enamel is not crimped. The individual complete plates have a thickness of about 10-12 mm laterally but the central folded area may be as much as 20 mm thick. A wide band of cementum separates the plates and there are about 4 ½ plates to 10 cm. The length lamellae ratio is 25 or 26 near the base but is closer to 22 on the sectioned surface where the length is reduced to 136 mm. Although the

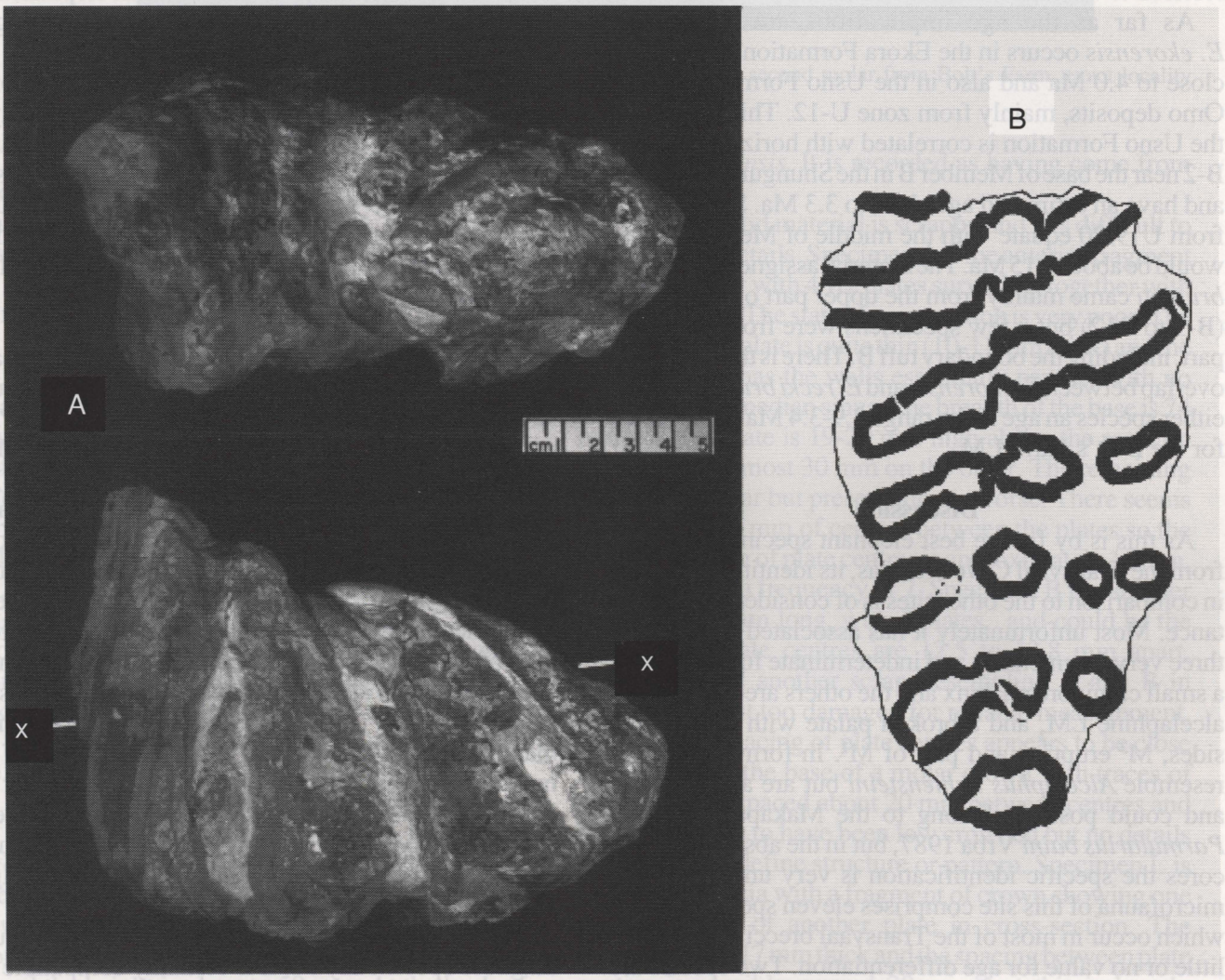

Figure 2. Back half of lower left third molar (TM BF 7-202) from the University of California African Expedition 1947-48 collection at Bolt's Farm, Pit 7. A - crown and outer lateral views (One half natural size); x - x marks the line of sectioning. B - drawing of enamel pattern on sectioned surface. Two thirds natural size.

tooth is relatively low crowned, the index of hypsodonty is 122 and it is possible that the missing anterior plates could have been very slightly higher.

The thick uncrimped enamel leaves little doubt that this represents a Pliocene stage of evolution. Maglio (1973) unhesitatingly included this specimen in his hypodigm of *Elephas ekorensis*, known from the type site of Ekora and from the Usno Formation. However, compared with the East African material, the Bolt's Farm specimen appears somewhat more progressive, having slightly thinner enamel and a hypsodonty index of 122 compared with about 105-110 in typical *E. ekorensis*.

Both in *E. ekorensis* and in *E. recki brumpti* there are small cylindrical pillars anteriorly and posteriorly on the central digitations, which produce the "points" on the median sinus, but these do not extend the full height of the plate and the apex of the pillar is rarely free, except occasionally in the anterior plates. These pillars are not apparent in the Bolt's Farm molar but they may have existed in the missing anterior plates. In other respects, the Bolt's Farm specimen is more or less intermediate between *E. ekorensis* and *E. recki brumpti*, perhaps being better referred to the latter than to the former taxon.

As far as the age implications are concerned, *E. ekorensis* occurs in the Ekora Formation with an age close to 4.0 Ma and also in the Usno Formation of the Omo deposits, mainly from zone U-12. This horizon in the Usno Formation is correlated with horizons B-1 and B-2 near the base of Member B in the Shungura Formation and have an estimated age close to 3.3 Ma. Some scraps from U19/20 equate with the middle of Member B and would be about 3.15 Ma. The material assigned to *E. recki brumpti* came mainly from the upper part of Member B (B-9 to B12) but a few specimens were from the lower part, including the boundary tuff B. There is thus temporal overlap between *E. ekorensis* and *E. recki brumpti* and for either species an age in the range 2.9-3.4 Ma is suggested for the Bolt's Farm LM_3.

Discussion

As this is by far the best elephant specimen to come from the Transvaal Cave breccias, its identity and its age in comparison to the other sites is of considerable importance. Most unfortunately it has associated with it only three very fragmentary and indeterminate fossils. One is a small carnivore phalanx and the others are a little worn alcelaphine LM_2 and a broken palate with M^2 on both sides, M^3 erupting and part of M^1. In form these teeth resemble *Alcelaphus lichtensteini* but are a little larger and could possibly belong to the Makapansgat form *Parmularius baini* Vrba 1987, but in the absence of horn cores the specific identification is very uncertain. The microfauna of this site comprises eleven species, four of which occur in most of the Transvaal breccias and are of little or no value for age differentiation. Two species are shared by Sterkfontein, Swartkrans and Taung; one occurs at Taung and Swartkrans; one at Makapansgat, Sterkfontein and Taung; one at Sterkfontein, Swartkrans and Kromdraai; two are noted only at Taung (first recorded from these collections and perhaps undetected elsewhere); one at Sterkfontein only (*Mus* cf *major*); and one at Makapansgat only (*Elephantulus antiquus*). The only consistent interpretation is that pit 7 is most probably about coeval with Sterkfontein and Makapansgat, but the evidence is less than satisfactory.

Additional Specimen from Bolt's Farm

The area where the University of California African Expedition worked on Bolt's Farm has become a large open-cast quarry and many of the former sites have been destroyed. In the course of the quarrying operation, bone-bearing material was encountered and some of it was rescued by Alun Hughes and taken to the Sterkfontein Research site. It is now in the collection of the Bernard Price Institute for Palaeontological Research. Included in this material are two specimens representing elephant remains. The one in a block containing a substantial piece of a tusk about 10 cm in diameter, broken diagonally through the core. Apart from the fact that it belonged to a large elephant, it is not further identifiable.

The second specimen is a portion of an elephant molar in very advanced wear and possessing a very strong root (BPI M 8898). There is a curved indentation at the back which looks like the impression of the front of the following tooth so this specimen is most probably the worn out stump of an **M1** or **M2** (Figure 3). It is not certain whether it is an upper or a lower but the very slight convexity of the wear surface fits best with an upper molar, probably of the left side. The curved indentation is in part a surface of enamel of what was presumably the terminal plate (or half plate, designated Pl I in conventional nomenclature for partial teeth). Plate IV is worn to dentine and Plate III has part of the enamel at the back on the right (? external) side. The enamel curves back to form the front of Pl II. The lateral part of Pl II is preserved and from the centre the enamel again loops back to form the front of Pl I. On the left (? internal) side of the crown there is a ghostly ring marking the base of cement-filled valleys and there are some remnants of the enamel of Pl I. The pattern of the enamel can be visualized and it suggests that there may have been a slight median sinus. The wear surface is oblique to the axes of the plates – about 20° from the vertical – and the height of enamel above the roots on Plates I and II is only a little more than 1 cm. The crown is 74 mm long and the maximum width is 76 mm excluding 4 mm of root materials on the left side. The distance between plate centres, measured perpendicular to the plates is approximately 20-21 mm giving a lamellar frequency close to 5. The enamel is thick (3-3.5 mm) and slightly wavy but not crimped.

The state of wear of this tooth makes it difficult to diagnose specifically but it is certainly compatible with either *E. ekorensis* or *E. recki brumpti* and it is by no means impossible that it could be the remnant of the M2 of the same individual as the LM_3.

Figure 3. Stereo pairs showing occlusal and outer lateral views of stump of a first or second molar from Bolt's Farm, exact locality unknown (BPI M 8898).

MAKAPANSGAT

The collection in the Bernard Price Institute for Palaeontological Research include 14 undescribed fragments of elephant tusks and teeth from Makapansgat. For convenience they have been labelled A - N and are described briefly.

Tusks

The largest piece of tusk is H (BPI M 8901) and it is split down the middle. The diameter is 11 cm and the length of the piece is 21 cm. It is comparable in size with living elephant but is not identifiable even at the generic level. The specimen is recorded as having been collected by G.L. Roets 3/7/70 and came from the cone of collapsed material. Another fragment of tusk, N (M 8902) is recorded as having come from the grey breccia (Member 3). It was broken obliquely into a "slice" 28 cm thick; its "length" is 167 mm and the transverse breadth is 65 mm. Specimen I is a flake from a large tusk and there are two other scraps of tusk. The worn tip of a small tusk may represent a juvenile.

Molars

Most of the molar fragments are elephantid but there is one specimen, M (M 8899) which comprises a piece of crown with a pair of stout cones belonging to a gomphothere (Figure 4). The thickness of the cone is 23-24 mm and the height is close to 50 mm. At the back of the pair of cones is a small attached pillar or conelet 32 mm high, suggesting affinity with the East African *Anancus kenyensis*. It is recorded as having come from Member 4.

The elephantid material is scrappy and it is difficult to make out any details. Specimen A is the anterior fragment of a worn molar with 4 1/2 plates surviving, together with part of the root. The state of preservation is very poor. The central enamel plate is quite thin (10-11 mm thick) and the enamel island has the walls essentially parallel with no indication of a median sinus. The breadth of the base is 74 mm and this plate is 19-20 mm high above the roots on one side and almost 30 mm on the other. The remaining plates are similar but preservation is worse. There seems to be about 3-6 mm of cement between the plates so the average spacing of plate centres is approximately 14 mm, giving a lamella frequency of 7. Specimen B is a smaller fragment, 40 mm long, with 4 plates, and could be the mate of A; plate centres are 12.5 to 13.8 mm apart. Specimen D is another scrap, resembling A and B in morphology but too damaged for reliable measurement, although the spacing of plate centres appears to be close to 20 mm. J is the base of a molar crown with traces of former plates, spaced about 20 mm between centres and the tooth seems to have been low crowned but no details can be seen to define structure or pattern. Specimen L is a block of breccia with a fragment of crown showing one plate and part of another plate in cross-section. The enamel plate is 17 mm thick and the spacing between plate centres is possibly around 20 mm, but this is largely guesswork. The enamel is thick (3-3.5 mm) and uncrimped.

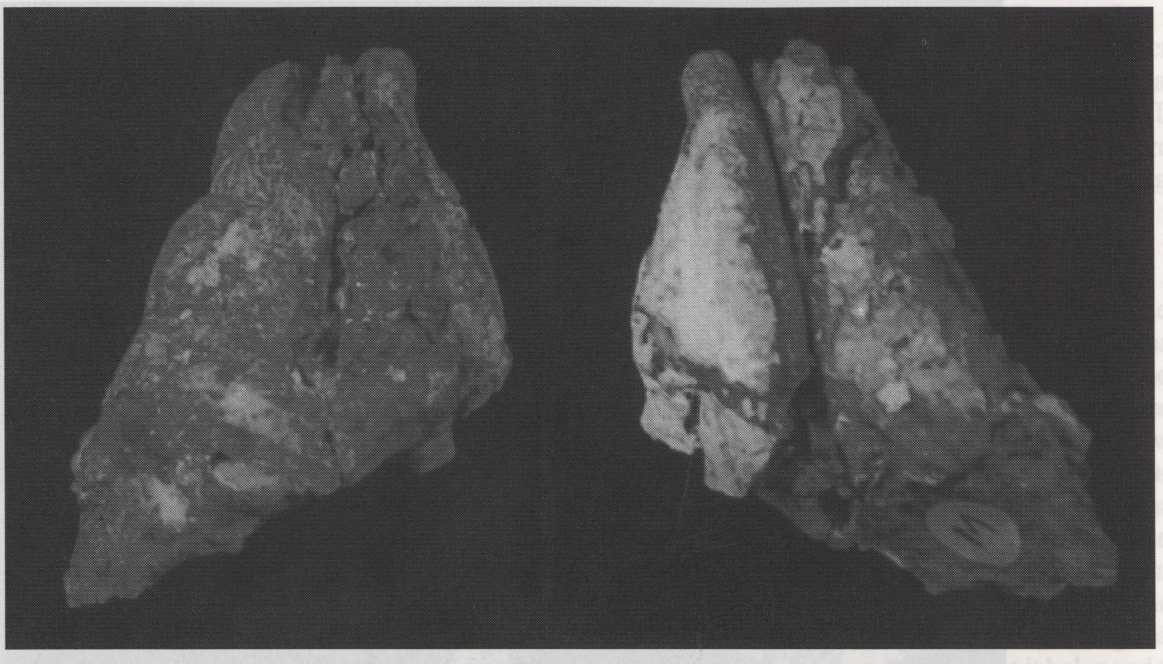

Figure 4. Anterior and posterior views of a pair of cones from a gomphothere molar ascribed to *Anancus* (*cf kenyensis*) from Makapansgat (BPI M 8899, Specimen M). Natural size.

Figure 5. Detached, unworn isolated incomplete plate (BPI M 8900, Specimen C) from Makapansgat, seen in anterior and posterior views. Natural size.

Specimen C (M 8900) comes from the cone and is an irregular, unworn, detached plate broken diagonally so that the inter-plate valley shows on one side (Figure 5). The height of the unworn central part is 78 mm and the maximum width as preserved is 61.8 mm but was probably close to 75 mm when complete. The stout central cone, or buttress, is 19 mm wide and 13.4 mm thick so the lamella must have had a thickness of at least 17-18 mm. On the one side the lateral part of the plate is 9.5 mm thick but on the "valley" side is only 5.5 mm. The enamel is slightly crimped and approximately 2.5 mm thick . Another isolated piece of a plate, K, is 15 mm wide and 87 mm high, but no detail can be seen.

Specimen F is a shattered large anterior root, divided at the back into two "wings". G is a root fragment and there are other scraps of root material, none of which is very informative.

TABLE 1
Measurements of elephant teeth from Bolt's Farm and Makapansgat

SPECIMEN	N	L	B	H	Et	F	L/N	100H/B
TM BF 7-202	+6x	+159	85	104	2.5-4	4.5	25	122
(sectioned)		+136	84			4.8	22	
BPI M 8898	+3 1/2+	+74+	76	10++	3-3.5	c 5	20-21	-
MK "A"	4+	+41+	74	30+	2.5-3	7	14	-
MK "B"	+4+	+40+			2.5-3	c 7	13-14	-
MK "C"	+1+		(75)	78	2.5	c 5	?17-18	c 105
MK "J"	+4+					5	20	
MK "K"			+15+	87				
MK "L"	+1 1/2+				3.3-3.5	5	20	

N = Number of plates; x = terminal partial plate; L = length perpendicular to plates; B = greatest breadth; H = height of tallest plate; Et = enamel thickness; F = lamellar frequency (number of plates in 100 mm); L/N = length/lamellae ratio (=mean thickness of plate); 100H/B = hypsodonty index; + = missing or incomplete; c = approximate or estimated.

Discussion

In view of the very poor preservation, it is extremely difficult to arrive at any firm diagnosis of these elephant teeth. A few specimens, namely D, J, K, L and C have moderately thick enamel, a lamellar frequency of about 5, a crown width of 75 mm or so and a slightly greater crown height. They probably belong to second or third molars of some stage of *Elephas recki* and fall within the range of variation for *Elephas recki brumpti* second molars, but also within the range for *Elephas recki shungurensis*.

The second group of specimens, represented by Specimens A, B, has thinner, somewhat crimped enamel, a lamellar frequency of about 7 but a broad crown (c75 mm) and are probably from first molars. There is also little or no sign of a median sinus. The combination of relatively thin lamellae, coupled with the breadth of the plates lies near the limit of the range for *E. r. brumpti* but the moderately thick enamel suggests that the specimens did not belong to an advanced form. A and B are metrically close to the normal limit in *E. recki shungurensis*, the morphology is appropriate for that species, and there are two specimens of M^2 from Shungura Member C (Omo 40.68.3029 and L 284.4) that are closely comparable. Accordingly it seems reasonable to suggest that the Makapansgat teeth represent a fairly early member of the *E. recki* lineage, probably *E. r. brumpti* or possibly *E. recki shungurensis*. This latter variety has a known time range from 2.8 to 2.3 Ma and the morphology suggests at least the earlier part of this time range. As the provenance of most of the individual specimens is uncertain, it is always possible that two different ages may be represented. The occurrence in Member 4 at Makapansgat of an *Anancus* is another indicator of a fairly early age. *A. kenyensis* occurs at Kanapoi, Kanam, Laetoli, Mursi, Kaiso, Hadar and Chemeron, all with ages of at least 3.5 Ma.

STERKFONTEIN

Only one specimen of an elephant has been found at the Sterkfontein Type Site, a mandible fragment with the two anterior milk teeth, possibly of the left side (TM STS 1863; Figure 6A,B). The dM_2 has 4 plates, three of which show very slight wear. The length is 21.5 mm, maximum breadth 17.8 and height 14.3+. There are 5 transverse digitations on the last plate and the enamel is about 1 mm thick and slightly wavy but not crimped. The dM_3 has 7 plates preserved and may have had an additional posterior element. The "length" is 66.9 mm but plates 6 and 7 have been separated and tilted backwards, suggesting that the crown was still not completely formed so the "true" length was probably close to 60-64 mm. The first 5 lamella occupy 47.5 mm giving a length/lamellae ratio (or mean lamellar thickness) of 9.5, or a lamellar frequency of 10-10.5 per 100 mm. There is slight wear on the anterior plates and the enamel so far exposed is 1-1.3 mm thick and slightly corrugated rather than crimped. There are 3-5 digitations on each side and a marked median division of the plates with a slight offset, but no apparent median expansion, although at this early stage of wear central accessory pillars may not show. The greatest basal breadth (at the 4th plate) is 39.7 and the height on the slightly worn anterior plate 32+ mm, while at plate 5, which is unworn, it is still only 32 mm. The morphology and dimensions accord with corresponding teeth in the *Elephas ekorensis - E. recki* lineage, all of which are very similar in size. Comparisons may be made with an LdM^3, ER 75 FS 926, in a piece of mandible from Koobi Fora, and with L 36-45 from Shungura Member D, comprising a mandible with the socket for dM^2 and, on each side, dM^3 and dM^4 still in alveolus. Comparative measurements are given in Table 2.

The enamel in the Shungura teeth is slightly crimped, more so than in the Sterkfontein specimen and this, coupled with the greater crown height suggests that the Sterkfontein example is a little more primitive. The Koobi Fora tooth is closer in breadth but also a little more hypsodont; the enamel is coarsely grooved or corregated rather than crimped. The Shungura teeth are placed by Beden (1979, 1987) in *E. recki shungurensis* and the Koobi Fora specimen (1979, 1983) in *E. recki*

TABLE 2
Measurements of Sterkfontein dm_3 compared with corresponding teeth from Omo and Koobi Fora

	N	L	B	H	Et	F	L/N	100H/B
STS 1863	7x	64e	39.7	32	1-1.3	10-10.5	9.5	82
OMO								
L 36-45 Le	7x	68.2	43.1	43+	1-1.3	10	9.7	100
Rt	7x	67.7	42.8	42+	1-1.3	10	9.7	100
KOOBI FORA								
ER 75 FS926	7	62.5	33.5	35	1.2	11	8.9	104

brumpti; the Sterkfontein specimen may be regarded as close to the latter.

SWARTKRANS

Two specimens have been recovered from Member 3 at Swartkrans, both representing anterior milk teeth. TM SKX 32051 is a piece of an incompletely formed plate with six digitations and apparently similar to the more complete specimen. SKX 36082 has two complete lamellae and a partial lamella forming the anterior cingulum, as well as most of the talon, which is damaged at the back (Figure 6C-E). The one side of the crown is slightly broken so that the central plates have lost about 2-3 mm. The main plates have two lateral elements partly separated by a furrow so that the digitations are not quite in line and with wear the enamel island would show a slight central "kink". There are two digitations on the larger half and three on the smaller one, all just worn at the tips. The anterior cingulum is lower and has 5 digitations that are unworn. A strong root is present anteriorly. The two main lamellae are each close to 8 mm thick and the overall length of the crown is 20.9 mm. The breadth as preserved is 18.9 mm and is estimated to have been 20-21 mm when complete. The height is 28.7 mm and probably did not exceed 30 mm when unworn, giving a hypsodonty index of about 140. In the *E. recki* lineage, there are usually 4 lamellae (sometimes 5) and a terminal element in the upper dM^2, but only 3 and the talonid in the lower dM_2. The lower teeth normally tend to be rather triangular in shape, tapered at the front, but the uppers are more rectangular. It is thus a little uncertain whether the Swartkrans specimen is an upper or a lower anterior tooth but most probably a lower. As far as dimensions are concerned, the Swartkrans tooth is both wider and higher crowned than the rather few known teeth of any of the subspecies of *E. recki*, for which the observed ranges are given in Table 3.

The lamellar frequency and hypsodonty index for the two anterior milk teeth are very similar in the few known specimens assigned to *E. ekorensis* and the members of the *E. recki* lineage. Unfortunately these teeth are unknown in *E. r. ileretensis* and *E. r. recki*. All that can reasonably be inferred is that the Swartkrans milk tooth could have belonged to an advanced member of the *E. recki* lineage, possibly *E. r. ileretensis* or *E. r. recki*. However, it is somewhat more likely that it belongs to the more advanced *E. iolensis* in which the teeth are still more hyposodont than in *E. recki recki* but tend also to have thicker lamellae. Most of the elephantid species described from the Vaal River gravels are now regarded as synonyms of *E. iolensis* and it is very likely that the Swartkrans Member 3 specimen belongs to this middle to later Pleistocene form.

GLADYSVALE

The University of California African Expedition collected a limited amount of material at Gladysvale, which included an elephantid molar fragment and pieces of dentine and root (UC 88747) but they are not identifiable even at the generic level.

CONCLUSION

The rather unpromising elephantid material from the cave breccias has, nevertheless, yielded some

TABLE 3
Comparative measurements for dm2 in subspecies of *Elephas recki*

Subspecies	Upper dm^2				Lower dm_2			
	no	B	H	100H/B	no	B	H	100H/B
brumpti	1	19	-	-	4	15-17	-	c 100
shungurensis	8	17-22	16	76	17	14-17	13-18	66-129
atavus	3	19-21	16-17	66-128	4	13-16	10-19	66-129
ileretensis	0				0			
recki	0				2	12-17	17	100-141

no = number in sample; B = greatest breadth; H = height of tallest plate; 100H/B = hypsodonty index, c = approximate or estimated.

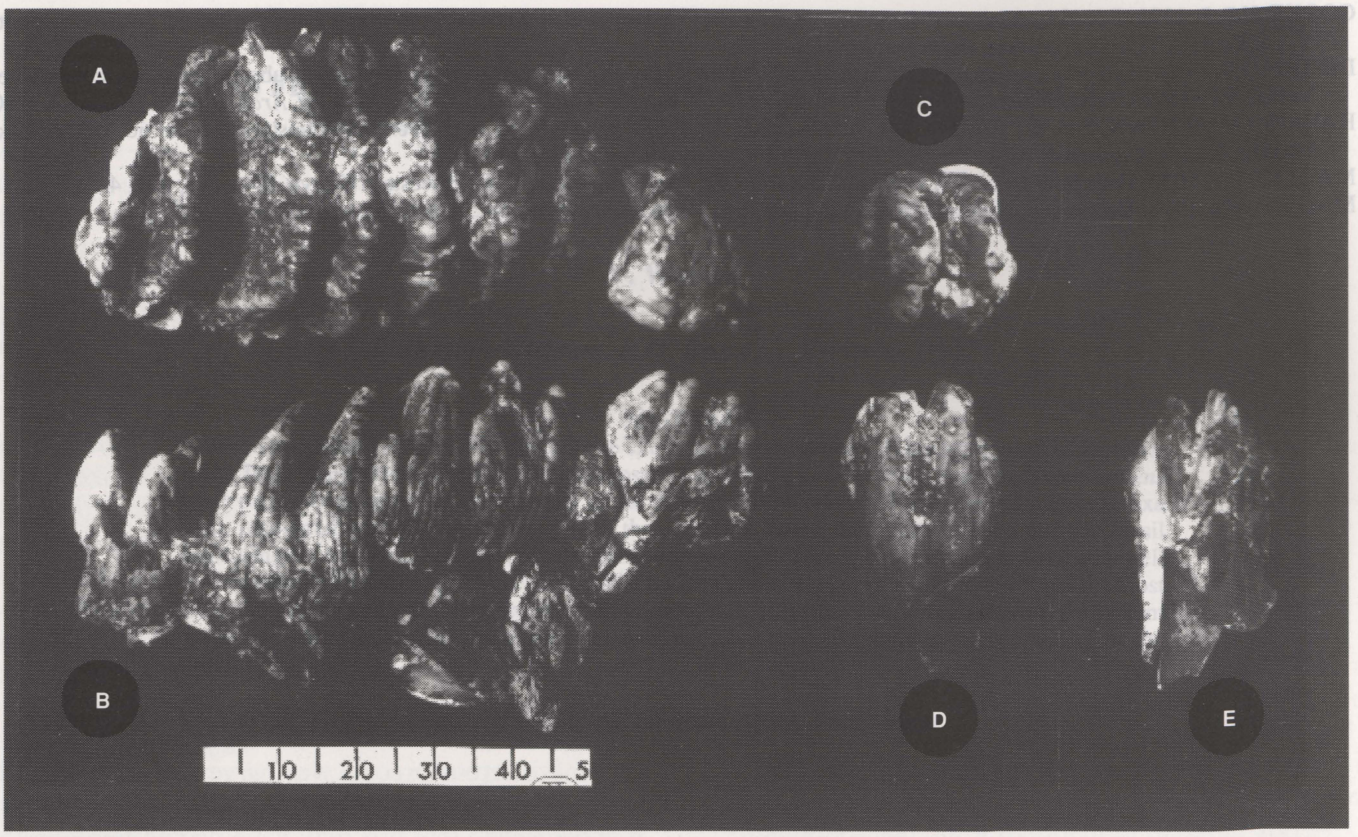

Figure 6. Occlusal (A) and lateral (B) views of mandible fragment with dm2 and dm3 from Sterkfontein Type Site (TM STS 1863). Occlusal (C), inner (D) and outer (E) views of anterior milk molar from Swartkrans Member 3 (TM SKX 36082). All natural size.

information of interest. The best specimens, from Bolt's Farm, represent an early stage of evolution in the *Elephas* lineage and are assigned to either *E. ekorensis* or, more probably, to an early *E. recki brumpti*. These two taxa are in part contemporary and suggest an age in the range 3.0-3.5 Ma. Unfortunately the associated faunal material does not provide good evidence for correlation with other sites but on balance is probably about coeval with Makapansgat and/or Sterkfontein. Poorly preserved material from the two latter sites also indicate an early stage of the *E. recki* lineage, suggesting an age in the vicinity of 3.0 Ma. The occurrence of *Anancus* at Makapansgat is unexpected as it is normally characteristic of the early to middle Pliocene with ages of 3.5 Ma or more and, although always rare, has not been found in such later deposits as the Usno Formation, at Hadar or Laetoli. (Its reported ocurrence in Bed I at Olduvai Gorge is an error). The Swartkrans specimen clearly belongs to a more advanced form and suggests a middle to later Pleistocene age.

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