THE CULTURAL IMPLICATIONS OF THE RHINOCEROS TEETH FROM LIMEWORKS, MAKAPANSGAT

By J. M. Anderson

Introduction

The evidence concerning the behaviour and Osteodontokeratic culture of the australopithecines that can be assessed from a study of the rhinoceros teeth found in the grey breccia at the Limeworks cavern, Makapansgat is discussed.

The material examined consists of ninety-nine identifiable teeth or portions of teeth, only a few of which are still attached to jaw fragments, and eighty-two tooth fragments too small to be identified.

Identification of the Material (tables 1, 2 and 3)

Hooijer (1958) recognised the Limeworks rhinoceros material as belonging to the two extant African species, *Ceratotherium simum* (White or Broad-Lipped rhinoceros) and *Diceros bicornis* (Black rhinoceros). Only the upper molars of the two species differ sufficiently in morphological characters to enable them to be classified.

Of the 99 identifiable teeth 94 are deciduous molars and of these the great majority have either unworn or only very slightly worn occlusal surfaces indicating the very young age of the animals represented. 68 of the deciduous molars are upper and of these 52 derive from *Ceratotherium* and 16 from *Diceros*. These molars can be identified further according to their position in the jaw (fig. 1 and 2).

Signs of Preparation and Use of the Teeth as Tools

Of the 99 identifiable teeth 70 are detached and only 29 remain attached to fragments of jaw (either singly, six specimens; in pairs, two specimens; in threes, five specimens or as in one particular specimen, a complete deciduous tooth row of four teeth) (tables 1, 2 and 3).

27 of the 70 detached teeth display fine markings, possibly indicating where they have been chipped away from the jaws. The unnatural nature of this damage was first observed and commented upon by J. W. Kitching (1957) (pers. comm.) In the case of the upper molars of *Diceros*, this chipping occurs mostly along the cingulum and is continued at approximately the same level across the buccal face. In the upper molars of *Ceratotherium*, in which the cingulum is neither as continuous nor as well developed, the majority of the teeth have been broken off along the enamel line (i.e. the junction between the roots and the crown). This is also the case in the lower molars.

The chipping best displayed in specimen M2096 (Plate I fig. 1b) must have been accomplished by some hard sharply pointed object. The markings show clearly that the teeth were struck with oblique blows directed towards the roots. It is possible to deduce these facts from the fine shallow asymmetrical punctate marks deepening in towards the freed edge and from the triangular shaped flaking adjacent to this edge.

Well worn notches, ranging in width from 5mm to 20mm, have been developed along the chipped edges of ten upper molar specimens (table 4). The best defined and preserved of these are to be found in specimens M2096, M169, M171 and M2364 (plate I).

A very interesting comparison can be made between these notched teeth from the grey breccia and the abundant notched stone tools found by Maguire in the succeeding pink breccias and overlying surface soil, and which are described elsewhere in this journal.

Thus not only were skeletal parts used for making notched tools during australopithecine times, but also a variety of lithic materials, and preponderantly those native to the dolomitic cavern site viz. dolomite, chert and vein quartz. These materials were furthermore supplemented by waterworn quartzite pebbles that were seemingly first introduced into the cavern at a fairly late stage in the accumulation of pink breccia. Although hard, relatively intractable and primarily used for pounding (Maguire 1965) many of the resultant accidental (sometimes apparently deliberate) flakes and fragments were utilised as notched scrapers.

Discussion

The following discussion will be carried out under the assumption that research to date (Dart 1956, 1957, 1958, 1964a, 1964b, 1965a, 1965b) has proved that the abundant bone, tooth and horn-core material found in the Limeworks cavern was accumulated by australopithecines and that they fashioned a large variety of tool forms from them.

The first point to note is the very great discrepancy between the numbers of deciduous and permanent teeth that have been found in the deposit. The australopithecines apparently concentrated their efforts on the very young calves. The fully-grown white rhinoceros weighs 3½ tons (the black rhinoceros 2½ tons) and has a hide an inch thick. It is, therefore, not surprising that the adults were left unscathed.

The second interesting point is that, considering only the upper milk molars (tables 1 and 2), a minimum of 28 *Ceratotherium* calves is represented as compared with a minimum figure of 6 for the *Diceros* calves. This uneven distribution is most likely due to environmental factors. *Ceratotherium* keeps to open grassy plains, whilst *Diceros* prefers bushy acacia country. Both conditions probably prevailed in and around the Makapansgat valley, but with a bias towards the grassy plain type. The lethargic docile nature of *Ceratotherium* as opposed to the irritable inquisitive ways of *Diceros* could also have had a bearing on the problem.

Unlike the great apes, the australopithecines appear to have had permanent (or possibly seasonal) abodes, in this case the Limeworks cavern. Co-operation between members of a tribe must have been essential to their existence. The females probably stayed at the cave with the young children, whilst the males went out to hunt. In the case of rhinoceros calves one group of hunters probably diverted the mothers' attention, whilst the others moved in for the kill. Under this set of circumstances it is most likely that the whole animal would have been carried back to camp.

Dart (1965b) described a number of skin working tools from Limeworks and wrote that these "would be meaningless if the australopithecine phase of human existence had not brought with it the discovery of dorsal load-carrying with the aid of cordage and thongs". The preparation and use of thongs is strongly supported by the presence of the worn notches in the freed edges of the rhinoceros teeth. If this theory is correct then the hunters had a quick and efficient means of transporting the rhinoceros calf back to the cave.

At the cave the meat was shared out and the potential tool-making parts of the skeleton retained. Numbers of skeletal remains, other than teeth, have been found in the deposit.

It is obvious that the teeth were found most useful when detached from the jaws. As scrapers the attached teeth and jaw are not as efficient as the maxillae and mandibles of medium and small bovidae. The few attached specimens that there are must almost certainly have been used as scrapers, but there are not sufficient signs of wear, distinct from that caused by chewing in the living animal, to demonstrate this conclusively.

Specimens M2107 (left jaw with $\frac{1}{2}$ $DM^2 + DM^3 + DM^4$) and M2108 (right jaw with $DM^2 + DM^3 + \frac{1}{2}$ DM^4) from the same *Diceros* individual provide the best evidence as scrapers. Both specimens, unfortunately, have been partially damaged by the blasting of the limeworkers. The teeth are fairly deeply worn due to chewing, but in each set the highest points on the occlusal surfaces (the exposed enamel rim of the paracone style (fig. 3) of $DM^3 + DM^4$ in M2107 and of DM^3 in M2108) are slightly rounded, possibly due to post-mortem abrasion.

When considering the detached teeth the selection of conveniently sized material becomes apparent (fig. 2). *Ceratotherium* teeth are larger than their counterparts in *Diceros*, DM^2 in the former being roughly the same size as DM^3 in the latter. The fact that these two teeth are the most common, in the respective animals, indicates that this size of tooth must have been the most convenient to handle.

Conclusions

The peculiarly damaged rhinoceros teeth from the Limeworks cavern provide concrete evidence of the relatively advanced mental capacity of the australopithecines. The ability to fashion a sharp pointed object in order to chip a tooth from a jaw and then to use the chipped edge of that tooth as a scraper, requires foresight and imagination superior to that found in any of the great apes. The notches in the chipped edges of the teeth are suggested to have been worn during the softening of thongs, which were very possibly used in dorsal load-carrying.

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Bibliography

DART, R. A., 1956. The myth of the bone accumulating hyaena. *Am. Anthrop.* **58**, 40–62.

——1957. *The osteodontokeratic culture of Australopithecus prometheus.* Pretoria: Transvaal Museum.

——1958. The minimal bone-breccia content of Makapansgat and the Australopithecine predatory habit. *Am. Anthrop.* **60**, 923–931.

——1964a. Australopithecine acceptance and some of its effects. *Presidential address to the Associated Scientific and Technical Societies of South Africa.*

——1964b. A brief review of the Makapansgat investigations 1925–1963. *Academia das Ciencias de Lisboa.* **9**, 3–17.

——1965a. The unavoidable Osteodontokeratic culture. *Dr D. N. Wadia Commemorative Volume Mining and Metallurgical Institute of India* **1965**. 231–254.

——1965b. Australopithecine cordage and thongs. *In Homenajo a Juan Comas en su 65 aniversario.* **2**, 43–61.

HOOIJER, D. A., 1958. Fossil rhinoceros from Limeworks Cave, Makapansgat. *Palaeont. Afr.* **6**, 1–13.

MAGUIRE, B. 1965. Foreign pebble pounding artefacts in the breccias and the overlying vegetation soils at Makapansgat Limeworks. *S. Afr. Arch. Bull.* **20**, 117–129.

EXPLANATION OF PLATE 1

Fig. 1: Rhinoceros upper milk molars. Occlusal edge downwards.
- a: M169, *Diceros bicornis*, DM^3 left, buccal view.
- b: M2096, *Diceros bicornis*, DM^3 right, buccal view.

Demonstrating the irregular markings resulting from deliberate chipping of the tooth away from the maxillae. The chipping occurs across the buccal face just within the enamel line.

Fig. 2: Rhinoceros upper milk molar. Occlusal edge downwards.

An enlargement of M2096 (see Fig. 1b) tipped slightly to improve the view of the two obviously chipped notches worn smooth by abrasive use.

Fig. 3: Rhinoceros upper milk molars. Occlusal edge downwards.
- a: M2364, *Ceratotherium simum*, broken DM^2 left, buccal view.
- b: M171, *Ceratotherium simum*, DM^3 right, buccal view.

Demonstrating notches of a size larger than those seen in Fig. 2. In M171 damage along the remaining edge can clearly be seen as partly deliberate and partly accidental (part which might have occurred prior to fossilisation and part during preparation of the specimen).

EXPLANATION OF TEXT FIGURES

Fig. 1: Diagram to show frequency of occurrence of the different Makapansgat Limeworks rhino teeth.

Fig. 2: Diagrammatic representation of the upper milk molars of the two species of rhinoceros to indicate the frequency of occurrence of the respective teeth.

Fig. 3: Occlusal view of a slightly worn left DM^3 of *Ceratotherium simum* showing the parts of the tooth.
Natural size.

a. parastyle.
b. paracone style.
c. mesostyle.
d. metacone style.
e. metastyle.
f. enamel.
g. dentine.
h. postsinus.
i. metaloph.
j. medisinus.
k. crochet.
l. cingulum.
m. protoloph.
n. medifossette.
o. crista.
p. ectoloph.

TABLE 1

Upper Molars of CERATOTHERIUM SIMUM

DM[1]	DM[2]	DM[3]	DM[4]
M 8219 rt.	M 8219 rt.	M 8219 rt.	M 8219 rt.
	M 164 rt.	M 164 rt.	M 164 rt. (probably not of same set)
	M 2105 left	M 2105 left	
	M 2102 rt.		
	M 168 left		
	M 166 (+ jaw) left		
	M 2094 left		
	M 2089 rt.		
	M 172 (+ jaw) rt.		
	{ M 174 left M 2091 rt. }		
	M 2095 left		
	M 178 rt.		
	M 2090 rt.		
	M 2092 left		
	M 2102 rt.		
	M 2099 left		
	M 641 rt.		
	M 2093 rt.		
	M 2088 left		
	M 2097 left		
	M 2359 rt.		
	M 170 rt.		
	M 2364 left		
	M 176 rt.		
	M 2125 left		
	M 2129 rt.		
	M 2123 rt.		
	M 2130 rt.		
		{ M 2104 rt. M 2098 left }	
		M 2112 rt.	
		M 640 (+ jaw) left	
		M 171 rt.	
		M 167 rt.	
		M 2358 left	

TABLE 1 (*Continued*)

DM 1	DM 2	DM 3	DM 4
M 179 left M 2103 left		M 2362 left M 2363 rt. M 2360 left	M 2110 left M 639 (+ jaw) left { M 2357 rt. { M 2111 left M 2356 rt.
L. 2 R. 1	L. 12 R. 17	L. 6 R. 7	L. 3 R. 4
Total No. of teeth 3	Total No. of teeth 29	Total No. of teeth 13	Total No. of teeth 7
Total No. of animals 3	Total No. of animals 28	Total No. of animals 12	Total No. of animals 6

Where two teeth are bracketed pairing is indicated (i.e. the teeth are from the corresponding positions of the right and left jaws of the same animal.)

TABLE 2

Upper Molars of DICEROS BICORNIS

DM^1	DM^2	DM^3	DM^4
M 180 left	M 2108 rt. M 2107 left M 2106 (642) rt. M 165 left	M 2108 rt. M 2107 left M 2106 (642) rt. M 165 left M 169 left M 2100 rt. M 2096 rt. M 2368 left	M 2108 rt. M 2107 left M 2106 (642) rt.
L. R. 1 0	L. R. 2 2	L. R. 4 4	L. R. 1 2
Total No. of teeth 1	Total No. of teeth 4	Total No. of teeth 8	Total No. of teeth 3
Total No. of animals 1	Total No. of animals 3	Total No. of animals 6	Total No. of animals 2
M^1 M 2109 left			

TABLE 3

Lower Molars of CERATOTHERIUM plus DICEROS

Left	Right	Left	Right
Deciduous		Permanent	
M 2114	M 175	M 2164 (3 teeth and jaw)	
M 2115	M 2113	M 2120	
M 2116	M 2353		
M 2118	M 2354		
M 2127	M 8252		
M 2355	M 8259		
M 2117 (+ jaw)	M 8258		
M 8253 (+ jaw)	M 177		
M 8254			
M 8261			
M 8264			
M 173			
M 8253			
M 8257			
M 8256			
M 8262			
M 8260			
M 8263			
Total No. of teeth 18	Total No. of teeth 8	Total No. of teeth 4	Total No. of teeth 0

TABLE 4

Upper Milk Molars Displaying Chip Marks

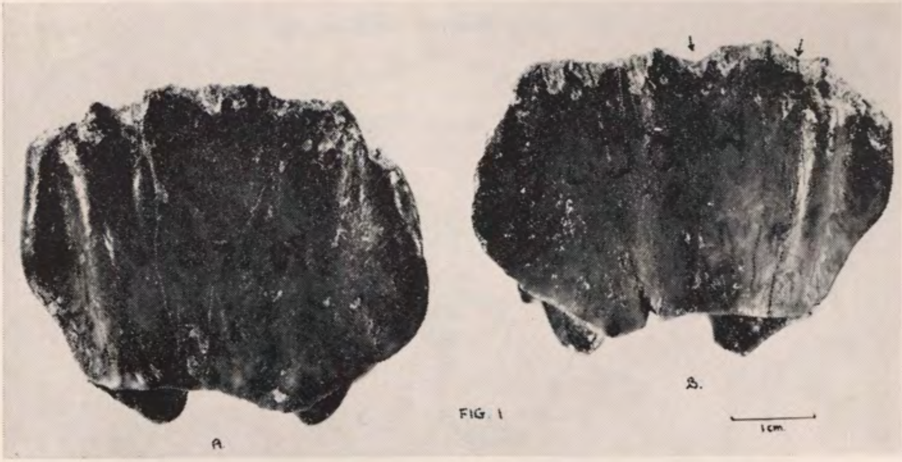
Chip marks and small notch or notches	Chip marks and relatively large notch	Chip marks only
M 170 6 mms	M 2359 12 mms	M 2363
M 2096 6 mms		
and $5\frac{1}{2}$ mms	M 171 15 mms	M 174
	M 2102 (20) mms	M 2358
	*M 2100 (12) mms	*M 169
	M 2364 15 mms	M 2362
	M 2095 (?) mms	M 2110
	†M 2104 (13) mms	†M 2098
	M 2097 (10) mms	M 2103
		M 179

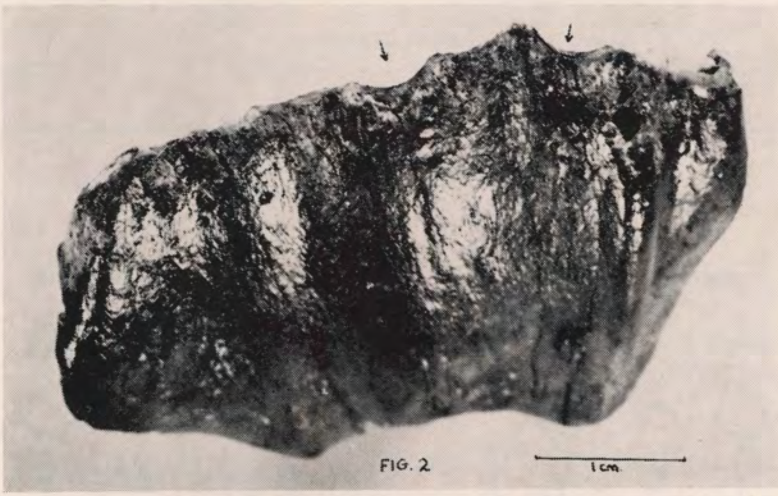
* and † indicate pairs.

The millimetre measurements refer to the breadth of the notches. Where the figure is put in brackets the notch has been partially broken and its original size has been estimated. On M 2095 only a very small portion of the notch remains and no estimation was possible. On M 2096 two notches occur.

Lower Milk Molars Displaying Chip Marks

	Chip marks only
	M 2120
	M 2116
	M 8262
	M 175
	M 8255
	M 8288
	M 2115
	M 8259





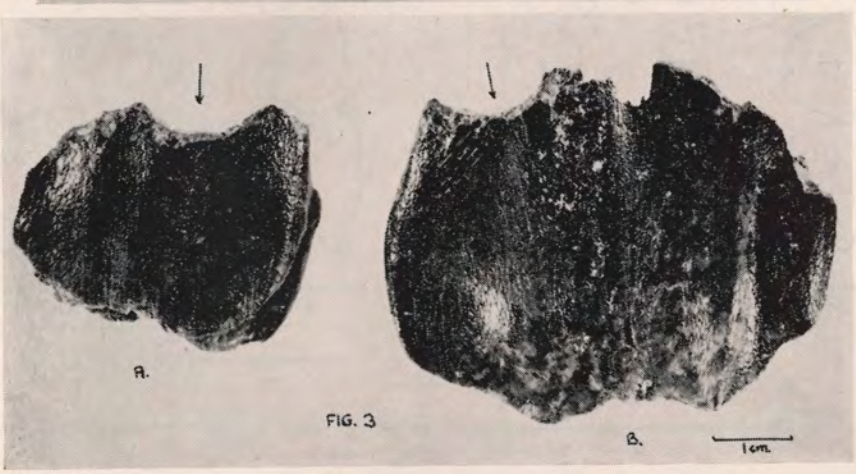


Plate I.

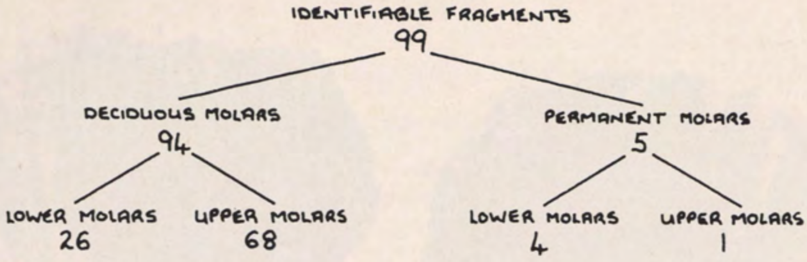

IDENTIFIABLE FRAGMENTS
99
DECIDUOUS MOLARS
94
PERMANENT MOLARS
5
LOWER MOLARS
26
UPPER MOLARS
68
LOWER MOLARS
4
UPPER MOLARS
1

Fig. 1

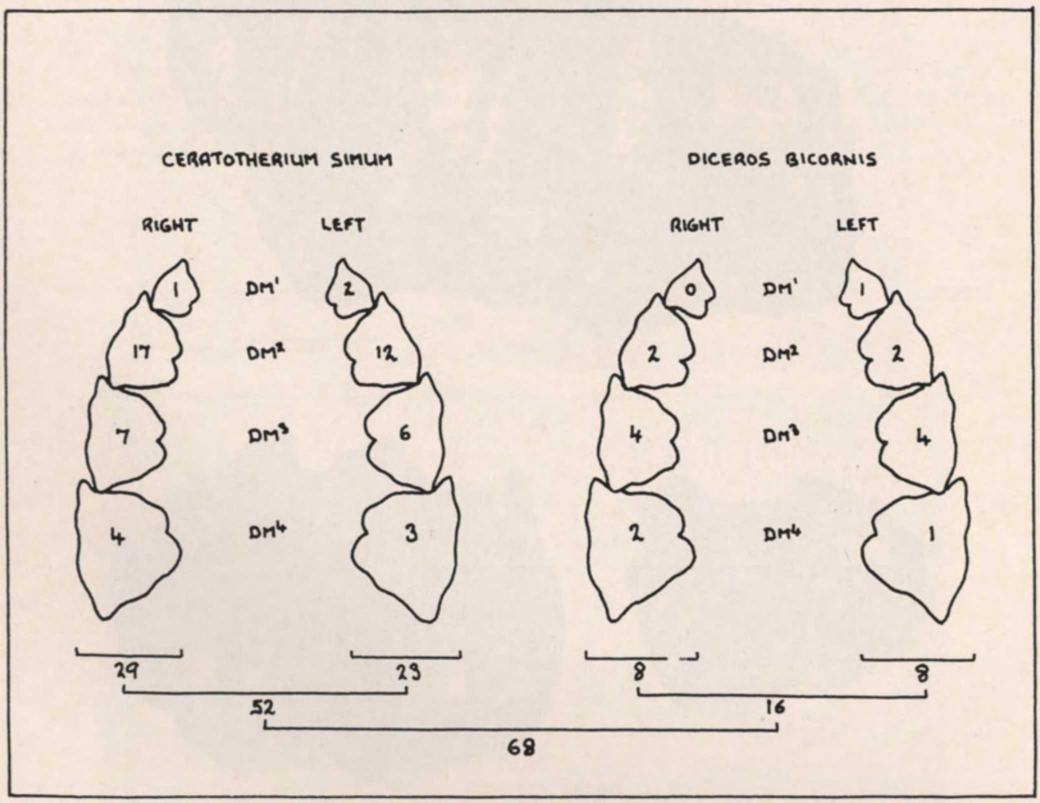

CERATOTHERIUM SIMUM
DICEROS BICORNIS
RIGHT
LEFT
RIGHT
LEFT
DM1
DM2
DM3
DM4
DM1
DM2
DM3
DM4
1
17
7
4
2
12
6
3
0
2
4
2
1
2
4
1
29
23
8
8
52
16
68

Fig. 2

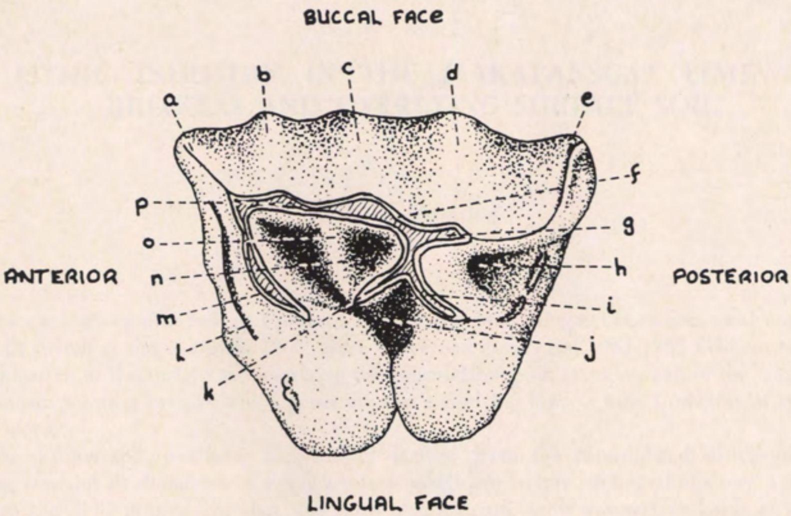

BUCCAL FACE
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
ANTERIOR
POSTERIOR
LINGUAL FACE

Fig. 3