

LES FAUNES PLIO-PLÉISTOCÈNES DE LA BASSE VALLÉE DE L'OMO (Éthiopie)  
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PERISSODACTYLA OF THE OMO GROUP DEPOSITS,  
American collections

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## RÉSUMÉ

Pour chaque taxon auquel les spécimens se rapportent, on donne ici les listes du matériel par Formation, son importance, et pour la Formation de Shungura par membre et par niveau à l'intérieur de chaque membre, d'après les dernières données disponibles. On notera deux changements de nomenclature. Le petit *Hipparion* des membres B à G de Shungura, décrit comme *Hipparion* ? aff. *sitifense* Pomel par Hooijer (1975b : 22-25), ainsi que par Churcher et Richardson (1978 : 395) est maintenant attribué à *Hipparion sitifense*, et l'*Hipparion* évolué des membres F à L de la Formation de Shungura, décrit sous le nom d'*Hipparion ethiopicum* (Joleaud) par Hooijer (1975b : 66-72) sur une suggestion de Churcher et Richardson (1978 : 399), est nommé ici *Hipparion libyicum ethiopicum*.

La représentation des différents taxons est inégale. Les deux espèces existantes de rhinocéros africains, *Diceros bicornis* et *Ceratotherium simum*, apparaissant à 4 et 3 millions d'années respectivement, ne sont pas très bien représentés, et manque même d'un membre à l'autre de la Formation de Shungura, ce qui est sans doute fortuit. Dans l'unité stratigraphique la plus ancienne de la séquence de l'Omo - la Formation de Mursi de 4 millions d'années, au lieu de *Ceratotherium simum* il y a *Ceratotherium praecox*, espèce qu'on trouve ailleurs en Afrique de 7 à 4 millions d'années (Mpesida à Aterir) et ici c'est sa position la plus ancienne. Il est représenté par quelques dents seulement. Le Chalicothère *Ancylotherium hennigi* est également rare; on le trouve plus haut dans les membres D et G de la Formation de Shungura. *Hipparion turkanense*, espèce que l'on trouve de 7 à 4 millions d'années, est représenté par une seule dent, à la formation de Mursi. Les Hipparions plus récents de la séquence de l'Omo sont mieux représentés. Il y a une petite forme, *Hipparion sitifense* et *Hipparion spec.* Les dents de ce dernier suggèrent une hauteur croissante de couronne et une expansion de l'ectostylide durant la période de 4 à 2 millions d'années séparant l'*Hipparion turkanense* de Mursi du très évolué *Hipparion libyicum ethiopicum* des membres F à L de la Formation de Shungura, mais la documentation n'est pas aussi bonne qu'on aurait pu le souhaiter. Enfin, *Equus oldowayensis* apparaît au membre G de la Formation de Shungura. Le matériel dentaire et postcrânien permet d'identifier le zèbre d'Olduvai.

General accounts, and lists of the material by Formation, number, and for the Shungura Formation by Member and level within the Member, according to the latest available data, are given under each taxon to which the specimens are being referred. Two nomenclatorial changes should be noted. The small *Hipparion* from Shungura members B-G, described as *Hipparion* ? aff. *sitifense* Pomel by Hooijer (1975b : 22-25), in accordance with Churcher and Richardson (1978 : 395), is now referred to as *Hipparion sitifense*, and the advanced *Hipparion* of Shungura Formation Members F-L, described under the name *Hipparion ethiopicum* (Joleaud) by Hooijer (1975b : 66-72) following a suggestion by Churcher and Richardson (1978 : 399), has been named *Hipparion libyicum ethiopicum* in the present paper.

The representation of the various taxa is fairly uneven. The two living species of African rhinocerotids, *Diceros bicornis* and *Ceratotherium simum*, emerging at the 4 million year level, and at the 3 million year level, respectively, are not very well represented in the collection, and even missing from one or another of the Members of the Shungura Formation, which is doubtless fortuitous. In the earliest stratigraphic unit of the Omo sequence, the Mursi Formation, instead of *Ceratotherium simum* there is *Ceratotherium praecox*, a species that range elsewhere in African from 7 to 4 million years ago (Mpesida to Aterir) and here has its latest occurrence. It is represented by a few teeth only. Equally rare is the chalicothere *Ancylotherium hennigi* which occurs higher up, in the Shungura Formation Members D and G. *Hipparion turkanense*, a species that ranges from 7 to 4 million years ago, appears to be represented by a single tooth, from the Mursi Formation. The representation of the latter hipparions in the Omo sequence is better. There is a small form, *Hipparion sitifense* and *Hipparion spec.* Teeth of the latter are suggestive of increasing crown height and ectostylid expansion in the 4 to 2 million year time range separating *Hipparion turkanense* of the Mursi Formation from the highly advanced *Hipparion libyicum ethiopicum* of Shungura Formation Members F-L, but the documentation is not as good as one could wish it to be. Finally, *Equus oldowayensis* makes its first appearance at Shungura Formation Member G. The material dental as well as postcranial, allows for positive identification with the Olduvai zebra.

## INTRODUCTION

The material of perissodactyls collected by Dr F. Clark Howell and the members of the American Expedition to the Omo Valley in Ethiopia during 1967 to 1974 has all been described and published. The finds of the first field season of the International Omo Research Expedition have been dealt with by Hooijer (1969); this also included French material and some specimens collected by Richard Leakey and his team in the Omo. The American material pertaining to *Diceros*, *Ceratotherium* and *Ancylotherium* is in Hooijer (1973 and 1975a), and that of *Hipparion* in Hooijer (1975b). The study of the *Equus* specimens, briefly reported upon by Hooijer (1976), is largely the work of Churcher, who visited Hooijer during May and June 1979 at the Rijksmuseum van Natuurlijke Historie in Leiden where the American Omo perissodactyl material was then housed (Churcher & Hooijer, 1980). In these papers now readily available the Omo Perissodactyla entrusted to us have been described in detail and comparisons have been made with similar and other forms from other parts of Africa, placing them in a wider context. Within the scope of the present chapter, which Dr F. Clark Howell has asked us to contribute, no detailed accounts of the specimens are, therefore, in order as this would be mere repetition; the original papers referred to in the text should be consulted for full treatment.

## ACKNOWLEDGEMENTS

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for long hours spent answering questions and tracing and discussing the provenance of specimens with him. Hooijer's research was supported by grants-in-aid from the Wenner-Gren Foundation for Anthropological Research, Inc., in New York, and Churcher's by National Council of Canada Grant A 1704.

Order: Perissodactyla Owen, 1848

Family: Rhinocerotidae Owen, 1845

Genus: *Diceros* Gray, 1821

*Diceros bicornis* (L.), 1758

This, the modern black rhinoceros of Africa, occurs in the Mursi and Usno Formations and in Shungura Formation Members B, C, D, F, and G (Hooijer, 1969: 87-88; 1973: 158-166; 1975a: 189). The samples are small but distinctive. The upper premolars have heavy internal cingula, the upper P and M marked paracone styles, produced antero-internal crown angles, protoloph and metaloph transverse in position, crista and crochet usually separate, not forming a medifossette, postsinus shallower than medisinus. In these characteristics as well as in its decidedly lower tooth crowns *D. bicornis* differs from *Ceratotherium simum* also present in the Omo Group deposits; the differences become less marked anteriorly in the milk dentition (Hooijer, 1958). In the earliest sample of *Diceros bicornis* from the Omo Group deposits, that of the Mursi Formation, a DM<sup>4</sup> (Y.4-47) is less high-crowned than its modern counterpart, and the same is true for an unworn M<sup>3</sup> (W.12) from the Usno Formation. The skull (L.78-1) from Shungura Formation Member B12 (according to the latest available data; earlier stated as coming from Shungura Formation Member C, or D) is completely modern in characteristics but tooth crown heights cannot be determined as the teeth are worn. The full crown height of P<sub>4</sub> in a left of mandible (L.314-1) from Shungura Formation Member D2 is the same as that in a recent P<sub>4</sub>. The remaining specimens, dental as well as postcranial, are indistinguishable from their recent homologues. All are listed below.

#### Mursi Formation

- Y.4-47 DM<sup>4</sup> dext., slightly worn  
Y.4-48 astragalus dext.

#### Usno Formation

- B.366 P<sup>3</sup> sin., slightly damaged  
W.461 P<sup>3</sup> sin., fragment  
W.13 left upper molar fragment, may have belonged to the same individual as W.12  
W.12 M<sup>3</sup> sin., outer fragment, unworn  
W.598 M<sub>3</sub> sin., incomplete  
W.491B astragalus sin.

#### Shungura Formation

##### Member B

- L.68-1 B12 skull without the mandible, adult, laterally compressed, lacking condyles and right zygomatic arch  
L.1-80 B11 humerus dext., very incomplete  
L.1-27 B11 astragalus sin.

##### Member C

- L.27-20 C4 (level very tentative) M<sup>2</sup> sin., fragment  
L.27-21 C4 (level very tentative) left upper molar fragment  
L.58-2 C6 trapezoid sin.

##### Member D

- L.76-25 D4 upper molar fragment  
L.314-1 D2 left half of mandible with P<sub>4</sub> erupting  
L.12-17 D2 mandible, incomplete and with much worn teeth  
L.122-21 D3 P<sub>3</sub> dext., incomplete

#### Member F

- L.398-2576 F DM<sup>2</sup> dext. (recorded in Hooijer, 1975a: 189): Fig. 1-1  
L.398-449 F DM<sup>4</sup> sin., external portion  
L.465-72 F1 lower molar fragment

#### Member G

- L.43-22 G11 right upper P fragment  
L.628-93 G3 right upper P or M fragment  
L.16-115 G4 M<sup>1</sup> sin., much worn  
L.628-216 G3 DM<sup>3</sup> sin., fragment  
L.16-42 G4 humerus dext., proximal portion  
L.7-24 G5 humerus dext., proximal portion

#### Fault

- L.116-5 P<sup>3</sup> dext.  
L.116-6 DM<sup>3</sup> dext.

L. 116-5 and L.116-6 have been recorded in Hooijer (1973: 165) as from Shungura Member F but are from Shungura Fault according to the latest data.

Genus: *Ceratotherium* Gray, 1867

*Ceratotherium praecox* Hooijer & Patterson, 1972

In this species, which we hold to be immediately ancestral to *Ceratotherium simum*, the teeth differ from the modern form in being less high-crowned, the upper P and M with antero-internal crown corners angular instead of rounded, and hardly or no medifossette formation. Ironically enough, *C. praecox* had already been found in the Omo Group deposits by Richard Leakey in 1967, and then turned up in the American Omo collection only in the year 1973, not before, in the Mursi Formation. Two maxillary fragments, with P<sup>4</sup> and with M<sup>2-3</sup> sin. from the Omo, Lower Level (= Mursi Formation) collected by Richard Leakey in 1967 were first recorded as *Ceratotherium simum* (Hooijer, 1969: 86, pl. 5, fig. 4-5). Their true nature became apparent only upon the description of *Ceratotherium praecox* from Kanapoi (Hooijer & Patterson, 1972: 19). This was fully substantiated after the study of the extensive Langebaanweg collection of *C. praecox* and re-examination of the Omo material in Nairobi (Hooijer, 1972: 187).

#### Mursi Formation

- Y.4-70 DM<sup>1-2</sup> dext. (recorded in Hooijer, 1975a: 188-189): Fig. 1-2

*Ceratotherium simum* (Burchell), 1817

The teeth of this, the modern white rhinoceros of Africa, are much higher-crowned than those of *Diceros bicornis*, with heavy cement coatings, rounded antero-internal upper crown corners, obliquely placed lophs and lophids, reduced paracone styles, wavy ectolophs, medifossettes formed by the union of crochet and crista, and postsinus as deep as medisinus (Hooijer, 1958). This species occurs in the Usno Formation and in Shungura Formation Members B, D, E, F, and G (Hooijer, 1969: 86-87; 1973: 171-174). The samples are listed below.

#### Usno Formation

- W.332 P<sup>2</sup> dext., much worn  
W.591 P<sup>3,4</sup> sin., unworn, base incomplete  
W.549 left upper molar fragment  
W.409 M<sub>1</sub> sin.  
W.333 M<sub>3</sub> sin.  
W.442 right lower M, incomplete

Shungura Formation

Member B

L.1-84	B11	DM <sup>3</sup> sin., incomplete
L.1-37	B11	M <sub>1</sub> sin.
L.374-3	B8	right lower premolar fragment

Member D

L.9-3	D5	M <sub>1</sub> sin.
L.21-25	D1	ectocuneiform sin.

Member E

L.210-22	E5	P <sup>4</sup> sin.
L.5/6-8	E4	M <sup>2</sup> sin.
L.5/6-46A	E4	astragalus sin.
L.5/6-46B	E4	calcaneum sin.

Member F

L.465-71	F1	left upper molar fragment
L.467-45A	F1	right upper molar fragment
L.467-45B	F1	left lower molar fragment

Member G

L.628-190	G3	DM <sub>2</sub> dext., unworn
L.597-15	G13	P <sub>3</sub> dext.

Family : Chalicotheriidae Gill, 1872

Genus : *Ancylotherium* Gaudry, 1863

*Ancylotherium hennigi* (Dietrich), 1942

This chalicothere species occurs very sparingly in the Shungura Formation, Members D and G. It is otherwise known in East Africa from the Laetolil Beds (Dietrich, 1942 : 105), Olduvai Bed I (Butler, 1965 : 226), and the Chemeron Formation (Hooijer, 1972 : 188; 1973 : 152, pl. 2, fig. 7-9). The P<sup>4</sup> from Shungura Formation Member D5, L.11-28 (Hooijer, 1975a : 189-190, pl. 2, fig. 4-6) resembles that of the Chemeron closely (the Shungura P<sup>4</sup> is of the right side, and that of the Chemeron Formation of the left instead of the reverse as stated in earlier papers). One of the upper molar fragments recorded from Shungura Formation Member G (Hooijer, 1973 : 153, footnote), L.697-2, comprises the external half of a much worn crown of a right upper molar with the outer part of the base of the broad anterior and the base of the postero-external root. The postsinus is just preserved on the occlusal surface. Although the external enamel above the roots is mostly missing the shape of the ectoloph is unmistakable, agreeing as it does with that of the Laetolil M<sup>2</sup> (Dietrich, 1942, fig. 37 and 79). The anteroposterior diameter of the crown is ca.52 mm, against 55 mm in Dietrich's specimen. The other fragment recorded from Shungura Formation Member G, P.923-22, a portion of rather rugose enamel, upon closer inspection and comparison proved to belong not to a chalicothere but to the large giraffid *Sivatherium maurisium* (Pomel) instead. Thus, two dental elements of *Ancylotherium hennigi* remain in the American Omo collection :

Shungura Formation

Member D

L.11-28	D5	P <sup>4</sup> dext.: Fig. 1-3
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Member G

L.697-2	G5	right upper molar, external portion
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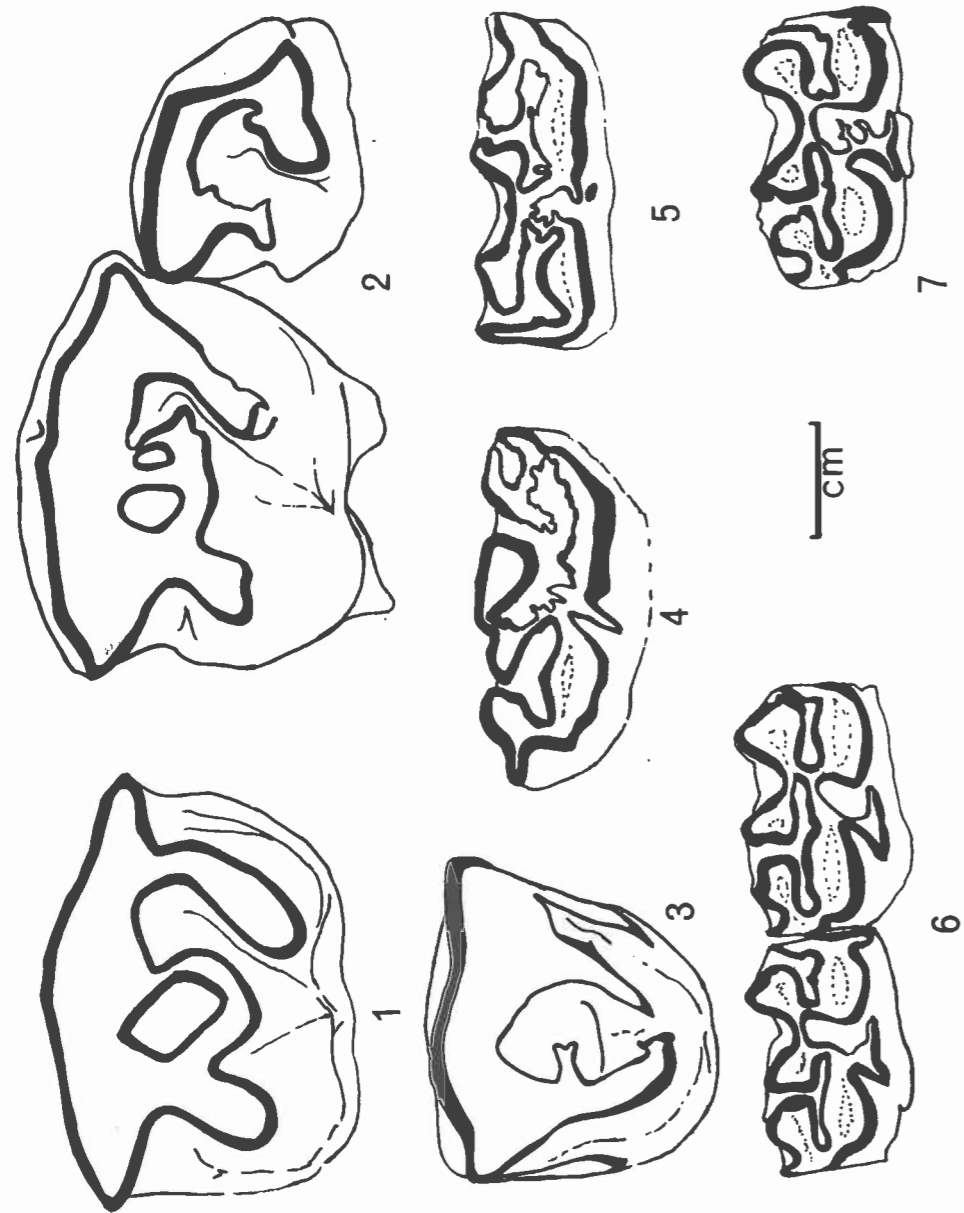


Fig. 1. -- Occlusal aspects of cheek teeth of Rhinocerotidae, Chalicotheriidae and Equidae from the Mursi and Shungura Formations, Omo, Ethiopia. Scale = 1 cm.  
 1. *Dicerops bicornis*, right DM<sup>2</sup>, L.398-2576, Shungura Formation Member F - 2. *Ceratotherium praecox*, right DM<sup>1</sup>-DM<sup>2</sup>, Y.4-70, Mursi Formation  
 3. *Ancylotherium hennigi*, right P<sup>4</sup>, L.11-28, Shungura Formation Member D - 4. *Hipparion turkanense*, left P<sub>3</sub>, Y.7-3, Mursi Formation  
 5. *Hipparion libycum ethiopicum*, left M<sub>1</sub> or M<sub>2</sub>, L.616-63, Shungura Formation Member G  
 6. *Hipparion libycum ethiopicum*, right P<sub>4</sub>-M<sub>1</sub>, L.398-11 & 12, Shungura Formation Member F  
 7. *Hipparion libycum ethiopicum*, right M<sub>1</sub> or M<sub>2</sub>, L.626-29, Shungura Formation Member G

Family : Equidae Gray, 1821

Genus : *Hipparion* de Christol, 1832

*Hipparion turkanense* Hooijer & Maglio, 1973

To this species, based upon a skull without the mandible from Lothagam-1 (Hooijer & Maglio, 1973; 1974: 8) may be referred a single tooth from the Mursi Formation (Hooijer, 1975b: 20):

#### Mursi Formation

Y.7-3 P<sub>2</sub> sin., incomplete, with no ectostylid and moderately plicated enamel: Fig. 1-4.

*Hipparion sitifense* Pomel, 1897

Cheek teeth of small size from Shungura Formation Members B, C, E, F, and G are indistinguishable from the North African species (Hooijer, 1975b: 22-25, as *Hipparion?* aff. *sitifense*). Teeth from Member G are more hypsodont than similar teeth from Lothagam and Kanapoi in the 6 to 4 million year range described as *Hipparion* cf. *sitifense* (Hooijer & Maglio, 1974: 20-26), which would serve as the best «ancestral stock» at present available. Although specific identity cannot as yet be established, these African forms are most conveniently referred to simply as *Hipparion sitifense* (Churcher & Richardson, 1978: 395).

#### Shungura Formation

##### Member B

L.1-42A B11 M<sup>1,2</sup> dext.

##### Member C

L.758-1D C P<sup>2</sup> sin.  
L.27-15B C4 (level very tentative) P<sup>3,4</sup> sin.  
L.758-1A C M<sup>1,2</sup> dext., incomplete  
L.758-1B C M<sup>1,2</sup> sin.  
L.758-1C C M<sup>3</sup> dext.

##### Member E

L.10-6 E2 P<sup>3,4</sup> dext.  
L.26-71 E2 M<sup>3</sup> sin.

##### Member F

L.465-69 F1 M<sub>3</sub> sin.  
L.465-104 F1 M<sub>3</sub> sin.  
L.398-1580 F distal end of metacarpal III

##### Member G

P.944-1A-M G1-1 P<sup>2</sup>-M<sup>3</sup> dext., P<sup>2</sup>-M<sup>1</sup> and M<sup>3</sup> sin., I<sup>1</sup> dext. and I<sup>1-2</sup> sin. of a single individual  
L.16-112 G4 \*P<sup>3,4</sup> sin.  
L.72-71 G11 M<sup>1,2</sup> dext. fragment  
L.675-2 G8 M<sup>3</sup> dext.  
L.16-31 G4 M<sup>3</sup> sin. fragment  
L.7-100 G5 M<sup>3</sup> sin.  
L.627-215 G13 M<sub>1,2</sub> sin.  
L.627-213 G13 M<sub>1,2</sub> sin.  
L.65-30 G1 distal portion of metatarsal III

*Hipparion* spec.

The *Hipparion* remains from the Usno Formation and Shungura Formation Members B, C, D, and F not referable to *Hipparion sitifense* defy identification as to species. They have all been described in detail (Hooijer, 1975b: 52-66) and do suggest crown height increase and ectostylid expansion, and hence an evolving population. The full crown height

cannot be determined in any of the cheek teeth available as none of the specimens is unworn with the base complete. The height of the ectostylid, which, as unworn crown portions show, remains 10-15 mm below the tips of the external cusps, can be measured in some cases. It is some 50-60 mm in the Usno Formation and Shungura Formation Members B-D, occasionally missing as in an M<sub>3</sub> from Member B10. In an exceptional specimen of M<sub>1,2</sub> from Member E2 the ectostylid height is in excess of 65 mm. In the advanced *Hipparion libycum ethiopicum* from Member F on up the ectostylid height is at least 70 mm by full crown heights of over 80 mm. The most probable interpretation, viz., that of an evolving population, should be based upon more material than is at present available; it is listed below.

#### Usno Formation

W. 552 P<sup>2</sup> dext.  
W. 133 P<sup>2</sup> dext.  
W. 296 P<sup>3,4</sup> dext.  
W. 629 M<sup>1,2</sup> dext.  
B.139 left upper P, portion of unworn crown  
B.367 DM<sup>4</sup> dext.  
W.134 DM<sup>3,4</sup> dext, incomplete  
W. 165 upper molar fragment  
W.22G upper molar fragment  
S.433 upper molar fragment  
N.460 P<sub>3,4</sub> sin., slightly worn, height of ectostylid ca. 60 mm  
N.458 P<sub>3,4</sub> dext., incomplete, ectostylid height at least 50 mm  
W.621 P<sub>2</sub> dext.  
W.742A M<sub>3</sub> sin., fragment  
W.932 P<sub>3,4</sub> dext., fragment  
W.290 M<sub>1,2</sub> dext., fragment  
W.524 left lower molar fragment  
N.459 M<sub>3</sub> sin., portion of unworn crown  
S.759A-C three lower molar fragments  
W.647, W.648, and N.461 three lower molar fragments

#### Shungura Formation

##### Member B

L.1-40 B11 mandible with P<sub>2</sub>-M<sub>3</sub> on both sides in situ, symphysis missing. Ectostylid height of M<sub>2</sub> at least 45 mm: Fig. 2-7  
L. 1-42D B11 P<sup>2</sup> dext.  
L.1-42E B11 M<sup>1,2</sup> dext.: Fig. 2-5  
L.380-4 B7 M<sup>1,2</sup> dext.  
L.1-61 B11 M<sup>1,2</sup> dext., fragment  
L.2-21A B10 M<sup>1,2</sup> sin.: Fig. 2-6  
L.2-2B B10 M<sup>3</sup> dext.  
L.2-2C B10 M<sup>1,2</sup> sin., fragment: Fig. 2-4  
L.1-397A-B B11 right upper molar fragments  
L.1-21 B11 upper molar fragment  
L.2-150 B10 DM<sup>4</sup> dext.  
L.1-42C B11 P<sub>2</sub> dext., ectostylid height 43 mm  
L.2-2D B10 P<sub>2</sub> sin.  
L.2-151 B10 P<sub>3,4</sub> dext., height of ectostylid 50 mm  
L.2-21B B10 P<sub>3,4</sub> sin.  
L.1-42B B11 P<sub>3,4</sub> sin.  
L.2-21C B10 M<sub>1,2</sub> sin., ectostylid height just over 55 mm  
L.1-172 B11 M<sub>3</sub> sin.

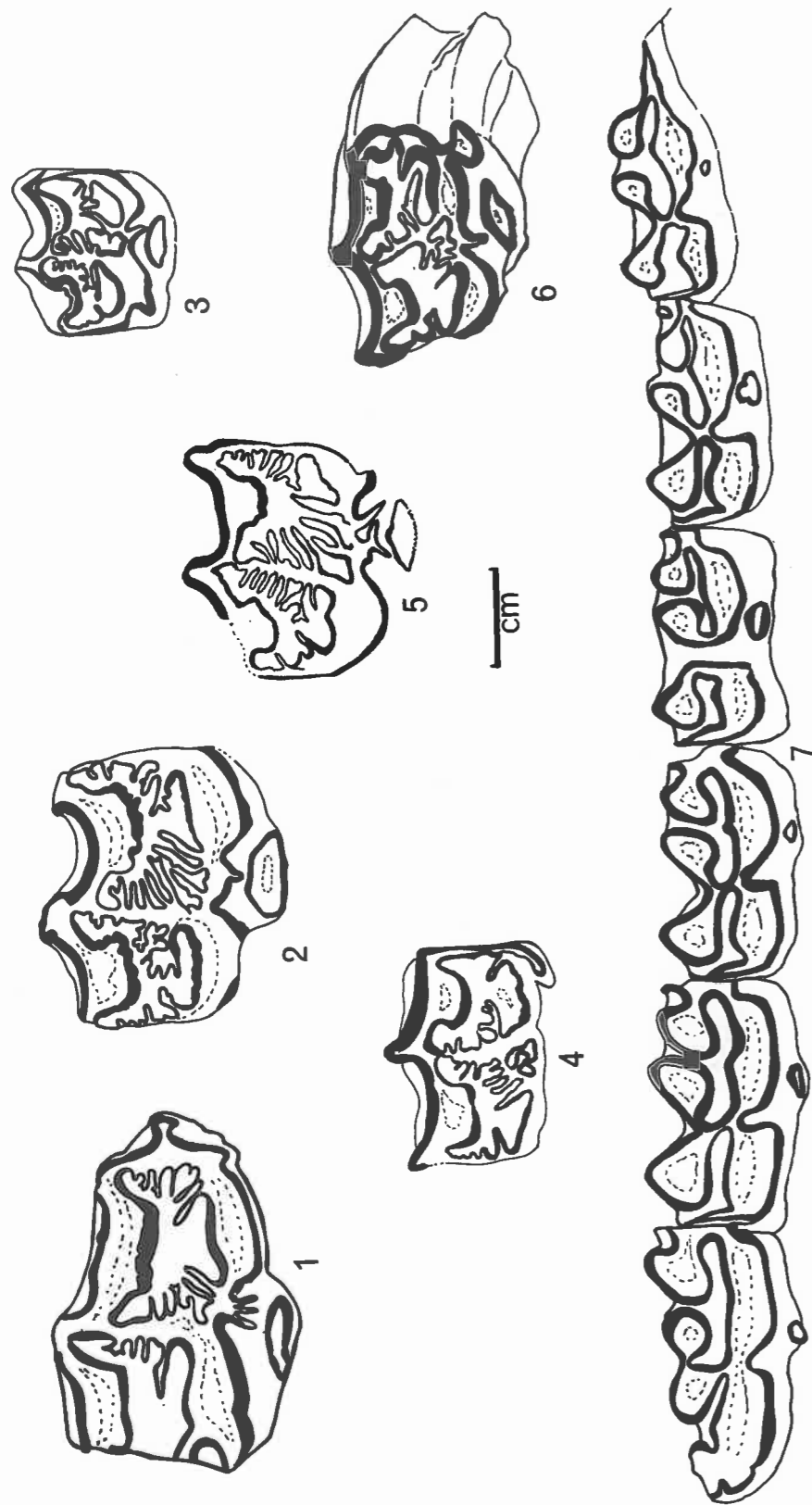


Figure 2. — Occlusal aspects of upper and lower cheek teeth of Equidae from the Usno and Shungura Formations, Omo, Ethiopia. Scale = 1 cm.  
 1. *Hipparion* sp., right P<sub>2</sub>, W. 552, Usno Formation — 2. *Hipparion* sp., right P<sub>3</sub> or P<sub>4</sub>, W. 296, Usno Formation  
 3. *Hipparion* sp., left M<sup>1</sup> or M<sup>2</sup>, W. 629, Usno Formation — 4. *Hipparion* sp., left M<sup>1</sup> or M<sup>2</sup>, L. 2-2C, Shungura Formation, Member B 10  
 5. *Hipparion* sp., right M<sup>1</sup> or M<sup>2</sup>, L. 1-42E, Shungura Formation, B 11 — 6. *Hipparion* sp., right M<sup>1</sup> or M<sup>2</sup>, L. 2-21A, Shungura Formation, Member B 10  
 7. *Hipparion* sp., left P<sub>2</sub>-M<sub>3</sub>, L. 1-40, Shungura Formation, Member B 11

L.729-5	B	M <sub>3</sub> sin.
L.2-2A	B10	M <sub>3</sub> sin., ectostylid not developed
L.1-14	B11	navicular sin.
L.1-66	B11	portion of femur sin.
L.1-65	B11	distal end of tibia sin.

Member C

L.132-11	C8	I <sub>2</sub> dext.
L.27-15A	C4 (level very tentative)	I <sub>2</sub> dext.
L.630-6	C7	P <sup>2</sup> dext.
L.768-1	C5	M <sup>3</sup> sin.
L.724-3	C6 (level very tentative)	M <sup>3</sup> sin., slightly worn, crown height 71 mm
L.724-2	C6 (level very tentative)	M <sup>1,2</sup> sin., incomplete, may well have belonged to the same individual as the last
L.46-33	C9 (level very tentative)	P <sup>3,4</sup> sin., incomplete
L.777-2	C6 (level very tentative)	left upper molar fragment
L.27-4	C4 (level very tentative)	DM <sup>3,4</sup> sin., fragment
L.51-11A	C9	DM <sup>3,4</sup> sin., much worn down
L.304-3	C	P <sub>2</sub> sin.
L.304-21B	C	P <sub>3</sub> sin.
L.304-21E	C	M <sub>1</sub> sin., ectostylid height at least 57 mm
L.304-21C-D	C	M <sub>2</sub> sin. & dext., ectostylid height just over 60 mm
L.304-21A	C	M <sub>3</sub> dext., ectostylid height 49 mm

Specimens L.304-3 and L.304-21A to L.304-21E belong to a single individual

L.55-29	C6	M <sub>1,2</sub> dext., slightly worn, ectostylid height 60 mm
L.15-16	C6 (level very tentative)	M <sub>1,2</sub> sin., ectostylid height at least 55 mm
L.327-9	C5	M <sub>1,2</sub> dext.
L.768-19	C5	M <sub>3</sub> sin., incomplete
L.45-10	C5	P <sub>3,4</sub> sin.
L.768-18	C5	P <sub>3,4</sub> dext.
L.335-30	C5	P <sub>3,4</sub> sin., incomplete
L.95-1	C9	M <sub>1,2</sub> dext.
L.27-34	C4 (level very tentative)	lower molar fragment
L.69-11	C8	lower molar fragment
L.51-11B	C9	lower molar fragment
L.327-24	C5	lower molar fragment
L.355-5	C7	lower molar fragment
L.795-14	C1	lower molar fragment
L.46-34	C9 (level very tentative)	distal portion of metatarsal III
L.183-26	C5	astragalus dext.

Member D

L.36-14	D3	I <sub>1</sub> dext.
L.9-29	D5	I <sup>2</sup> sin.
L.11-4	D5	M <sub>3</sub> sin., ectostylid just over 50 mm in height
L.581-3	D5	M <sup>1,2</sup> sin.
L.12-3B	D2	M <sup>3</sup> dext., incomplete
L.12-3A	D2	M <sup>1,2</sup> dext., fragment
L.11-5	D5	left upper molar fragment
L.12-24A	D2	lower molar fragment
L.12-24B	D2	lower molar fragment
L.9-80	D5	lower molar fragment
L.36-13	D3	distal end of tibia dext.
L.168-9	D3	astragalus dext.
L.168-10	D3	proximal portion of metatarsal III dext.

## Member E

L.26-28A	E2	M <sub>1,2</sub> sin., ectostylid height in excess of 65 mm
L.20-17	E	M <sub>1,2</sub> dext., unworn, base incomplete
L.26-99	E2	P <sup>3,4</sup> dext.
L.206-6	E5	M <sup>2</sup> sin., incomplete
L.763-2	E1	M <sup>1,2</sup> dext.
L.757-1	E4	left upper molar fragment
L.146-101D	E1	left upper molar fragment
L.5/6-63A	E4	P <sub>3,4</sub> dext.
L.5/6-63B	E4	M <sub>1,2</sub> sin.
L.127-30	E3	M <sub>1,2</sub> sin.
L.468-3	E5	M <sub>1,2</sub> dext.
L.185-4	E3	P <sub>3,4</sub> sin., incomplete
L.26-28B	E2	right lower molar fragment
L.147-24	E4	left lower molar fragment

*Hipparion libycum ethiopicum* (Joleaud), 1933

In Shungura Formation Member F, we begin to find the very hypsodont molar crowns with well-developed ectostylids that characterize the advanced *Hipparion* of the Later Omo Beds described as *Hipparion ethiopicum* (Hooijer, 1975b: 66-72). These are indistinguishable from those of Olduvai Gorge described as *Hipparion cf. ethiopicum* (Hooijer, 1975b: 26-52) as well as from those of the Ndolanya Beds, the younger deposits at Laetolil, localities 7 East and 18, also described as *Hipparion cf. ethiopicum* (Hooijer, 1979: 22-23 and 27-29). Churcher & Richardson (1978: 399) prefer to use the senior synonym *Hipparion libycum* Pomel for the advanced Pleistocene *Hipparion*, allowing for potential geographic variations under subspecific distinction, and this has been adopted in the present paper. Shungura Formation Members G and K have provided the most diagnostic specimens.

## Shungura Formation

## Member F

L.253-2B and L.253-2C	F	I <sup>1,2</sup> dext. of the same individual
L.470-3	F5	P <sup>2</sup> dext., incomplete
L.79-2A	F	P <sup>3</sup> dext.
L.398-1182	F	P <sup>4</sup> dext.
L.253-2A	F	M <sup>1,2</sup> dext.
Specimens L.79-2A, L.398-1182, and 253-2A are all in wear but still 75 mm in crown height, attesting to the extreme hypsodonty of <i>H. libycum ethiopicum</i> .		
L.398-1987	F	M <sup>1,2</sup> dext.
L.789-3	F1	M <sup>1,2</sup> dext.
L.79-2B	F	M <sup>3</sup> dext.
L.79-2C	F	M <sup>3</sup> sin.
L.421-1	F2	M <sup>3</sup> sin.
L.253-2D	F	upper molar fragment
L.399-23	F1	upper molar fragment
L.182-11A-B	F5	two upper molar fragments
L.398-11	F	P <sub>4</sub> dext.: Fig. 1-6
L.398-12	F	M <sub>1</sub> dext. of the same individual as the last: Fig. 1-6
L.52-68	F3	P <sub>3,4</sub> dext.
L.465-68	F3	P <sub>3,4</sub> dext.
L.465-67	F1	P <sub>3,4</sub> dext.
L.79-2D	F	P <sub>3,4</sub> sin.
L.465-95	F1	P <sub>3,4</sub> sin.
L.465-68	F1	P <sub>3,4</sub> sin.

L.467-44	F1	P <sub>3,4</sub> sin
L.420-12	F3	M <sub>1,2</sub> dext.
L.465-70	F1	M <sub>1,2</sub> dext
L.38-3	F2	M <sub>1,2</sub> sin., portion of unworn crown
P.935-2	F	fragment of right lower premolar
L.398-2049	F	DM <sup>2</sup> sin., incomplete anteriorly
L.398-13	F	distal articulation of metacarpal III

## Member G

L.882-4	G15	I <sub>1</sub> dext.
L.627-216	G13	I <sub>1</sub> sin., crown portion
L.627-89	G13	M <sup>1,2</sup> sin., slightly worn, crown height as preserved 84 mm
L.675-3	G8	M <sup>1,2</sup> dext.
L.613-32	G7	P <sup>2</sup> sin., fragment
L.626-36	G12	P <sup>3,4</sup> dext., crown 75 mm high as worn
F.513-12	G27	P <sup>3,4</sup> dext.
L.7-155B	G5	P <sup>3,4</sup> dext.
L.44-16	G7	(level very tentative) P <sup>3,4</sup> sin.
L.627-212	G13	M <sup>1,2</sup> dext., worn but crown height 75 mm as preserved
L.740-24	G	M <sup>1,2</sup> dext.
L.267-5	G4	M <sup>1,2</sup> dext.
L.616-62	G	M <sup>1,2</sup> sin., crown height 75 mm as worn
L.80-77	G4	M <sup>1,2</sup> sin.
L.48-24	G13	(level very tentative) M <sup>1,2</sup> sin.
L.534-4	G5	M <sup>3</sup> dext., worn, crown height 70 mm
L.663-3	G13	M <sup>3</sup> dext.
L.627-204	G13	M <sup>3</sup> dext.
L.627-205	G13	M <sup>3</sup> sin.
L.622-22	G11	M <sup>3</sup> sin.
L.74-22	G5	M <sup>3</sup> sin.
L.597-16	G13	fragment of upper molar
L.25-140	G13	fragment of upper molar
F.513-32	G27	fragment of upper molar
F.513-33	G27	fragment of upper molar, 75 mm high as preserved
L.616-63	G	M <sub>1,2</sub> sin., slightly worn, crown height 80 mm, ectostylid height 75 mm: Fig. 1-5
L.627-214	G13	P <sub>3,4</sub> dext., slightly worn, crown height as preserved 73 mm
L.627-203	G13	P <sub>3,4</sub> dext.
L.7-230	G5	P <sub>3,4</sub> dext.
L.842-1	G1	P <sub>3,4</sub> sin.
L.74-11	G5	P <sub>3,4</sub> sin.
L.65-17	G1	P <sub>3,4</sub> sin.
L.628-191	G3	P <sub>3,4</sub> sin.
L.626-29	G12	M <sub>1,2</sub> dext.: Fig. 1-7
L.65-16	G1	M <sub>1,2</sub> dext.
L.65-34	G1	M <sub>1,2</sub> sin.
L.597-17B	G13	M <sub>3</sub> dext., incomplete
L.477-6	G1	M <sub>3</sub> sin., 70 mm high as worn
L.479-8	G3	fragment of lower molar
L.504-11	G4	fragment of lower molar
L.613-33	G7	fragment of lower molar
L.626-124	G12	fragment of lower molar
L.16-57	G4	distal portion of radius sin.

- F.513-39 G27 calcaneum dext.  
 L.48-7 G13 (level very tentative) distal end of metatarsal III  
 F.596-22 G13 distal end of metatarsal III  
 F.513-38 G27 portion of lateral metapodial

**Fault**

- L.24-9 M<sub>1,2</sub> sin., 78 mm high as preserved and with ectostylid at least 70 mm high, previously (Hooijer, 1975b: 71) recorded as from Shungura Member G, according to the latest information is from Shungura Fault.

**Member H**

- F.12-9 H (level very tentative) M<sup>1,2</sup> dext.  
 F.510-47 H5 lowel molar fragment  
 P.955-1 H5 astragalus sin.

**Member J**

- F.411-23 J M<sup>3</sup> dext., incomplete

**Member K**

- F.203-10 K4 P<sup>3,4</sup> dext.  
 F.203-6 K4 M<sup>1,2</sup> sin., slightly worn, crown height 86 mm as preserved  
 F.203-8 K4 M<sup>1,2</sup> dext., slightly worn, internal portion missing. Crown height no less than 89 mm  
 F.203-59 K4 M<sup>1,2</sup> dext., incomplete behind  
 F.203-5 K4 M<sup>3</sup> dext., lacking internal portion, crown height as preserved 69 mm  
 F.203-14 K4 fragment of upper molar  
 F.406-9 K fragment of upper molar  
 F.203-7 K4 P<sub>3,4</sub> sin.  
 F.203-3 K4 M<sub>1</sub> dext., slightly worn, base preserved, crown height 82 mm, ectostylid just over 75 mm in height  
 F.203-2 K4 M<sub>2</sub> dext. of the same individual as the last (on the evidence of wear, exact fit of interproximal contact facets, and preservation), very slightly worn, base not quite complete, crown height as preserved 83 mm, ectostylid not touched by wear and at least 75 mm high  
 F.203-4 K4 M<sub>1,2</sub> sin.  
 F.203-13 K4 apical fragment of left lower molar  
 F.202-3 K4 fragment of lower molar  
 F.407-1 K fragment of lower molar

**Member L**

- P.997-19 L2 M<sup>1,2</sup> sin., incomplete

**Genre *Equus* Linnaeus 1758*****Equus oldowayensis* Hopwood, 1937**

The material of *Equus* from Shungura Formation Members G, H, J, K, L, and the Kalam Outcrop has all been described in detail and assigned to this species (Churcher & Hooijer, 1980: 267-278). In a study as yet unpublished, Churcher deals at great length with the very extensive collections of dental and postcranial elements of *Equus oldowayensis* from Beds I-IV at Olduvai Gorge that have been obtained by expeditions under the aegis of Drs. L.S.B. and M.D. Leakey. The identification of the Omo *Equus* is founded on direct comparison with the Olduvai Gorge material studied by Churcher. No characteristics have been observed by which the Omo *Equus* may be distinguished from *Equus oldowayensis* proper; the listing of the Omo *Equus* as *E. oldowayensis* by Cooke (1963: 82) and by Churcher & Richardson (1978: 381 and 404) has thus been confirmed. The loss of the type of *Equus oldowayensis* Hopwood (1937: 117) necessitated the designation of a neotype: this is now British Museum (Natural History) dentary M.14, 184 of which Hopwood (1937: 125) gave the measurements (Churcher & Hooijer, 1980: 266).

In his original description of *Equus oldowayensis*, Hopwood (1937: 117) stated it to be a zebra the teeth of which agree well with those of extant *Equus grevyi*, and indeed the characteristics of the cheek teeth and of the metapodials suggest a close relationship between *E. oldowayensis* and *E. grevyi*. On the other hand, the dental pattern of

*Equus capensis* (for the complex synonymy of this Pleistocene South African species, which dates back to 1909, see Churcher & Richardson, 1978: 405-406) is very similar to that of *E. oldowayensis*. It the two could be synonymized, *Equus capensis* Broom has priority (*Equus grevyi* Oustalet 1882 is an even more senior synonym for *E. oldowayensis* should the specific identity of *E. grevyi* and *E. oldowayensis* be established beyond doubt). For the present, we consider *Equus oldowayensis* a species in its own right. It is possible that it is an intermediate on the evolutionary lineage from the Pliocene North African *Equus numidicus* to *E. grevyi* (Churcher & Richardson, 1978: 405 and 417).

A general description of the dentition and metapodials of *E. oldowayensis* from the Later Omo Beds is presented below, condensed from Churcher & Hooijer (1980). Finally, a list of specimens is appended. Size ranges are in tables 1 and 2.

TABLE 1

Ranges of size of the cheek teeth of *Equus oldowayensis* from the Shungura Formation, Kalam Outcrop, and Omo, Ethiopia. Ranges founded on measurements given in Churcher and Hooijer (1980). N = number of measurements available. Transverse dimensions are over enamel only. Measurements are in mm

Dimensions	Shungura Formation, Members G, J and K, Kalam Outcrop	
	Min. - Max. N	Min. - Max. N
Mesiodistal diameter . . . . .	P <sup>2</sup> 37.5 - 40.4 (3)	P <sup>3</sup> 28.6 - 30.3 (4)
Buccolingual diameter over protocone . . . . .	24.9 - 27.6 (4)	25.9 - 28.3 (3)
Buccolingual diameter over hypocone . . . . .	20 <sup>+</sup> - 25.2 (4)	23.3 - 24.2 (3)
Length of protocone . . . . .	6.9 - 8.0 (4)	8.5 - 9.6 (4)
Mesiodistal diameter . . . . .	P <sup>4</sup> 26.9 - 33.3 (5)	M <sup>1</sup> 24.4 - 26.5 (4)
Buccolingual diameter over protocone . . . . .	28.0 - 29.8 (3)	25.1 - 27.4 (4)
Buccolingual diameter over hypocone . . . . .	25.8 (1)	22.4 - 24.7 (4)
Length of protocone . . . . .	9.9 - 12.3 (4)	8.5 - 10.4 (4)
Mesiodistal diameter . . . . .	M <sup>2</sup> 27.2 - 31.4 (4)	M <sup>3</sup> 25.6 - 30.0 (5)
Buccolingual diameter over protocone . . . . .	27.1 - 30.0 (4)	21.2 - 26.8 (4)
Buccolingual diameter over hypocone . . . . .	21.6 - 25.6 (3)	15.3 - 19.9 (4)
Length of protocone . . . . .	10.3 - 12.3 (4)	9.5 - 12.5 (4)
Mesiodistal diameter . . . . .	P <sub>2</sub> 34.5 - 36.3 (3)	P <sub>3</sub> 29.0 - 32.0 (3)
Buccolingual diameter over metaconid . . . . .	11.6 - 13.4 (3)	14.4 - 15.9 (3)
Buccolingual diameter over metastylid . . . . .	15.7 - 16.1 (3)	14.8 - 15.3 (3)
Length of metaconid-metastylid . . . . .	14.5 - 16.0 (3)	17.3 - 19.3 (3)
Mesiodistal diameter . . . . .	P <sub>4</sub> 26.2 - 31.0 (4)	M <sub>1</sub> 25.8 - 29.7 (4)
Buccolingual diameter over metaconid . . . . .	14.9 - 16.7 (4)	12.8 - 14.4 (5)
Buccolingual diameter over metastylid . . . . .	12.3 - 16.3 (4)	11.0 - 13.3 (4)
Length of metaconid-metastylid . . . . .	15.7 - 18.3 (4)	14.5 - 14.9 (4)
Mesiodistal diameter . . . . .	M <sub>2</sub> 23.9 - 27.9 (7)	M <sub>3</sub> 34.1 (1)
Buccolingual diameter over metaconid . . . . .	12.9 - 14.8 (7)	13.6 - 14.8 (2)
Buccolingual diameter over metastylid . . . . .	11.9 - 14.4 (7)	11.7 - 11.8 (2)
Length of metaconid-metastylid . . . . .	14.3 - 15.8 (7)	14.9 (2)

Upper incisors are represented by a single I<sup>2</sup> (G), which measures 16.3 mm mesiodistally by 11.6 mm buccolingually on the occlusal surface, and 8.2 mm by 5.3 mm respectively for the mark, which is a lozenge in cross-section. This tooth resembles those from Olduvai Gorge studied by Churcher, but the marks are usually round, oval, or elongate, and only occasionally lozenge-shaped.

A lower incisor, ? I<sub>2</sub> sin. (L), measures 14.0 mm mesiodistally by 9.6 mm buccolingually on the occlusal surface and 8.6 by 4.2 mm respectively for the mark, which is a lozenge in section and lined with cement.



TABLE 2

Size ranges of the metapodials of *Equus oldowayensis* from Shungura Formation Members G and L, Omo, Ethiopia. Measurements are in mm

Dimensions	Shungura Members G and L	
	Metacarpal III G and L Min. - Max. N	Metatarsal III G: L. 7-4 N = 1
Proximo-distal length . . . . .	235 (1)	259
Proximal transverse diameter . . . . .	46.5 (1)	44.5
Proximal anteroposterior diameter . . . . .	31.4 (1)	38.5
Midshaft transverse diameter . . . . .	29.9 (1)	30.5
Midshaft anteroposterior diameter . . . . .	25.1 (1)	27.4
Distal transverse diameter . . . . .	41.2 - 44.9 (3)	44.8
Transverse diameter of distal articulation . . . . .	41.8 - 45.2 (3)	40.9
Anteroposterior diameter of trochlear keel . . . . .	31.4 - 36.2 (3)	34.0
Anteroposterior diameter of medial trochlea . . . . .	27.8 - 31.5 (3)	28.3
Anteroposterior diameter of lateral trochlea . . . . .	25.0 - 28.8 (3)	24.2
Least anteroposterior diameter of diaphysis proximal to distal articulation . . . . .	19.0 - 21.1 (3)	23.5

The upper premolars have flattened or grooved crests to the parastyles and mesostyles (Fig. 3-1). Parastyles of P<sup>3</sup> and P<sup>4</sup> are broader and flattened mesiobuccally, and may be grooved, but those of P<sup>2</sup> are often narrow and lack grooves. Mesostyles of P<sup>2</sup> are broad and may be grooved but those of P<sup>3</sup> and P<sup>4</sup> are thinner, and the crests show less flattening, are rarely grooved, lean slightly mesially and often overhang the mesial valley of the ectoloph. The floors of the ectoloph valleys are concave buccally and range from nearly flat in worn aged specimens to arcuate in mature specimens from prime adults, to concave with a slight median convexity in newly erupted teeth. The protocones are small and nearly as broad buccolingually as mesiodistally in P<sup>2</sup>, but are mesiodistally elongate in P<sup>3</sup> and P<sup>4</sup>, and usually have a flat or concave lingual margin to give a semicircular cross-section. The mesiobuccal arm of the postfossette extends more buccal to the base of the mesostyle and beyond the distobuccal arm of the prefossette, although the difference is lessened in well worn specimens. Plis caballins vary from absent through vestigial kinks or bends and simple or small loops to double and large, and are usually present. Plis protolophis may be simple, double, or vestigial; plis hypolophis may be absent, small or vestigial, to large and simple; plis protoconules are large and single or double; plis prefossettes vary from absent to one or two small, vestigial folds or three small loops, to six loops of various sizes, and plis postfossettes have one large and one or two vestigial folds. An additional pli on the mesial surface of the protocone isthmus has been observed in on P<sup>4</sup> (G).

The upper molars differ from the premolars in being smaller and with less strongly developed characters (Fig. 3-2, 3, 4). The ectoloph crests are slimmer and narrower, seldom as flattened as in the premolars, and usually the parastyle is more likely flattened and grooved (G), although the mesostyle of one M<sup>2</sup> (K) shows these characters. Both parastyle may be tilted mesiobuccally (H, K, or G, worn specimens), or overlap the ectoloph valleys (Kalam), but do not always do so (G). The ectoloph valleys are flatter than in the premolars and may have slight median convexities or be nearly flat. The mesial valley is more likely to be buccally concave and the distal valley flat, especially in M<sup>3</sup> (G, H, J). The protocones are more elongate mesiodistally, those of M<sup>1</sup> resembling those of P<sup>3</sup> and P<sup>4</sup> in being broader and shorter than those of M<sup>2</sup> and M<sup>3</sup>. Protocones of M<sup>2</sup> and M<sup>3</sup> are elongate when newly worn and of M<sup>3</sup> even when well worn, and those of M<sup>2</sup> are attached at the mesial third and of M<sup>3</sup> by their mesial extremities or within the mesial 20% of their length. The lingual margin of the protocones may be slightly concave medially (K, L) or flat (L). Plis caballins and plis protolophis are simple, vestigial or absent; plis hypolophis are simple, double, or absent; plis protoconules are simple, small, double, or branched; plis prefossettes are single, and vestigial or vestigial and two or three, or two to four well-developed loops, or absent, and plis postfossettes show one major lingual fold and one or two smaller or vestigial loops or a graded series of loops as in a premolar, or two subequal loops (J). Hypoglyphs are usually open distally but may be closed by a distal wall in M<sup>3</sup> and may be confluent with the postfossette (J).

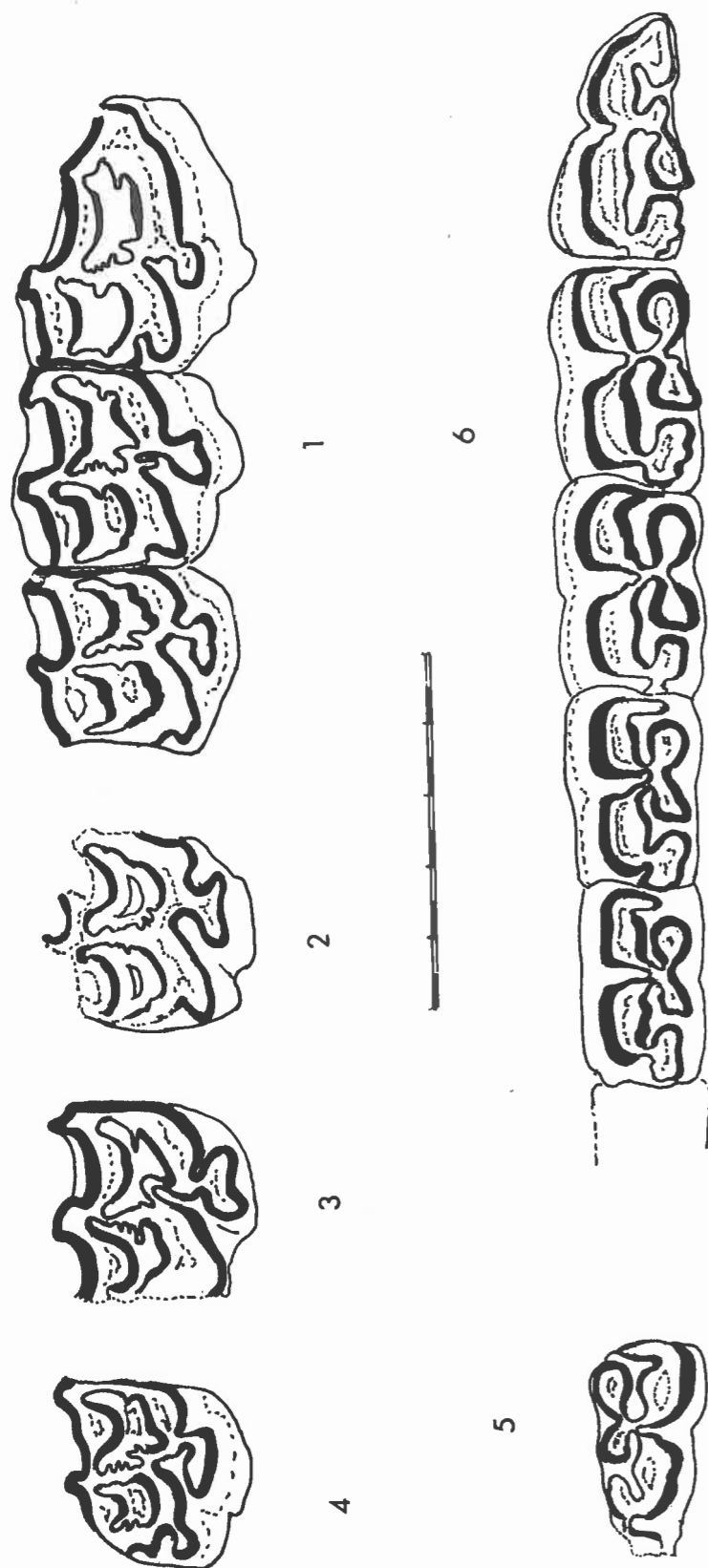


Fig. 3. - Occlusal aspects of upper and lower cheek teeth of *Equus oldowayensis* from the Shungura Formation and Kalam Outcrop, Omo, Ethiopia.

- 1. Right P<sub>2</sub>, L.490-4, Member G - 2. Partial right M<sup>1</sup>, P.1000-21, Kalam Outcrop
- 3. Partial right M<sup>2</sup>, F.17-5, Member K - 4. Right M<sup>3</sup>, L.490-4, Member G
- 5. Partial right M<sub>3</sub>, L.627-366, Member G - 6. Left P<sub>2</sub>-M<sub>2</sub>, L.508-1A, Member G

The characteristics described above, especially of the ectoloph and protocones, and the distributions and variations in the plis, correspond to those observed by Churcher in *E. oldowayensis* from Olduvai Gorge.

In the lower premolars the buccal valley penetrates lingually no further than the level of the flexid floors in P<sub>4</sub> and not as far in P<sub>2</sub> and P<sub>3</sub> (Fig. 3-6). Ptychostylids or plis caballinids are absent, represented by kinks in the enamel (G, J), vestigial (H), small (K), or broad, short loops (Kalam). Metaconids are large and subcircular in P<sub>3</sub> and P<sub>4</sub>, or elongate parallelograms (Kalam); metastylids are broad with a strong distolingual angle; metaconules in worn specimens are inflated; the metaflexid floors are slightly sinuous with a broad bend opposite the mouth of the flexid in some specimens (G), which may be double crested (Kalam) or nearly straight in well worn specimens (J), or may be very sinuous (Kalam). Plis hypolophids may be present as in *Hipparion*, but may be vestigial or present as small bends (G, H, J). Additional plis may be present on the distal third of the metaflexid floors (Kalam). A small pli is present on the metaconid-metastylid isthmus which projects mesially into the entoflexid (Omo). The metastylid of P<sub>2</sub> from Kalam is abnormally broad and lingually grooved, but with a strong distolingual angle.

The lower molars are similar to the lower premolars but slighter and have (Fig. 3-5, 6) the buccal valley penetrating between the flexid floors to within the metaconid-metastylid junction. Ptychostylids or plis caballinids are absent, present as kinks in the hypoconid wall or as small loops. Metaconids are broad and rounded and metastylids are similar but have a pointed distolingual angle. The metaflexid floors bend towards the mouths of the flexids and vestigial or small (Kalam) plis hypolophids are present.

In the conformations of the metaconids and the metastylids, the absence of well-developed ptychostylids, the sinuous or bent floors of the metaflexids, the occurrence of plis hypolophids and the massiveness of P<sub>3</sub> or P<sub>4</sub>, the Shungura *Equus* corresponds to *Equus oldowayensis* from Olduvai Gorge studied by Churcher.

The metapodial specimens from Members G and L are gracile when compared to the heavier specimens of *Equus oldowayensis* recovered from Olduvai Gorge studied by Churcher, but do match the lighter specimens in the collection (Table 2). The metacarpal III specimens show marked concave depressions proximal to the distal articulations on the posterior surface of the shaft. The comparable area on metatarsal III has a central ridge running proximally from the trochlear keel to the margin of the depression, which is absent or slight in the metacarpals, and is less developed in the metatarsal fragment from Member G, and does not reach the margin of the depressions. This condition distinguishes the metapodials of *E. oldowayensis* and many *E. grevyi* from *E. burchellii* and supports the identification of the Shungura *Equus* as *E. oldowayensis*.

The partial ungual phalanx is small, and may only be identified as *Equus*, but is not *Hipparion*.

#### Shungura Formation

##### Member G

L.490-4A	G5	I <sup>2</sup> dext.
L.490-4B	G5	P <sup>2</sup> dext.: Fig. 3-1
L.490-4E	G5	P <sup>3</sup> dext.: Fig. 3-1
L.490-4C	G5	P <sup>4</sup> sin.: Fig. 3-1
L.490-4D	G5	M <sup>1</sup> dext.
L.490-4F	G5	M <sup>3</sup> dext.: Fig. 3-4
L.490-4G	G5	M <sup>3</sup> sin., incomplete externally

The series L.490-4A-G probably derive from a single palate on the evidence of wear and preservation.

L.67-129	G7	P <sup>2</sup> sin.
F.24-7	G2	P <sup>3</sup> sin., very well worn
L.7-155A	G5	P <sup>4</sup> sin.
F.513-13	G27	P <sup>4</sup> dext.
L.73-55	G12	P <sup>4</sup> sin., incomplete anterointernally and behind
L.626-35	G12	P <sup>4</sup> sin., damaged on all sides
L.740-25	G	M <sup>2</sup> sin.
L.427-9	G4	M <sup>1</sup> dext.
L.627-95	G13	M <sup>1</sup> dext., well worn

F.163-3	G28	M <sup>2</sup> sin.
F.165-2	G13	M <sup>2</sup> dext., incomplete externally and behind
F.7-281	G5	M <sup>3</sup> sin., anterointernal portion missing
L.7-63	G5	M <sup>3</sup> dext., anterointernal portion only
L.48-20A	G13	(level very tentative) central fragment of upper molar
L.508-1A	G9	P <sub>2</sub> -M <sub>2</sub> sin. in portion of mandible: Fig. 3-6
F.513-14	G27	P <sub>3,4</sub> dext., incomplete externally and behind
L.48-20B	G13	(level very tentative) M <sub>1,2</sub> sin., posterointernal portion only
L.851-1	G1-1	P <sub>3,4</sub> sin., damaged on all sides
L.626-87	G12	M <sub>1</sub> sin.
L.48-21	G13	(level very tentative) M <sub>2</sub> sin., incomplete behind
L.627-366	G13	M <sub>3</sub> dext.: Fig. 3-5
L.627-211	G13	M <sub>3</sub> dext., incomplete anterointernally and behind
L.608-6	G5	M <sub>3</sub> dext., unworn, incomplete behind
L.7-3	G5	metacarpal III sin.
F.513-34	G27	distal end of metacarpal III dext.
L.7-4	G5	metatarsal III dext., shaft damaged

##### Member H

L.781-8	H1	M <sup>3</sup> dext., external portion only
L.781-9	H1	P <sub>2</sub> sin., posteroexternal portion only
F.161-56	H4	M <sub>2</sub> sin.

##### Member J

F.23-1	J3	M <sup>3</sup> sin., incomplete externally except for metastyle
F.23-3	J3	P <sub>2</sub> dext.
P.994-5	J6	M <sub>2</sub> dext., damaged anteroexternally
P.993-6	J6	?P <sub>4</sub> dext., incomplete internally and behind

##### Member K

F.17-9	K4	P <sup>2</sup> sin., incomplete anteriorly
F.17-6	K4	P <sup>3</sup> sin., incomplete externally and behind
F.17-8	K4	P <sup>4</sup> sin., incomplete externally and behind
Specimens F.17-9, F.17-6, and F.17-8 derive from a single individual.		
F.17-7	K4	P <sup>2</sup> dext. (includes F.17-12)
F.17-10	K4	P <sup>3</sup> dext., parastyle missing
F.17-14	K4	P <sup>4</sup> dext., incomplete externally and internally (includes F.17-11)
Specimens F.17-7, F.17-10, and F.17-11 derive from a single individual. All six specimens F.17-6 to F.17-11 may represent the same individual. Specimens F.17-5 and F.17-13 may also derive from this individual.		
F.17-5	K4	M <sup>2</sup> dext., slightly damaged: Fig. 3-3
F.17-13	K4	M <sup>3</sup> sin., posterior portion only
P.996-23	K	P <sup>3</sup> dext., internal portion missing
P.996-26	K	M <sup>3</sup> dext., slightly damaged
P.996-7	K	M <sub>1</sub> dext.
P.996-24	K	?P <sub>4</sub> sin., incomplete externally and behind
P.996-39	K	M <sub>2</sub> dext.
P.996-25	K	M <sub>2</sub> sin., slightly damaged

##### Member L

F.400-28	L2	?I <sub>2</sub> sin.
F.335-4	L	M <sup>3</sup> dext., incomplete externally
F.354-2	L	M <sup>1,2</sup> dext., fragment
F.408-39	L1	M <sub>2</sub> sin., slightly damaged
F.356-3	L	M <sup>3</sup> sin., portion of protocone only

F.410-5 L2 distal end of metacarpal III sin.  
 F.356-4 L central portion of phalanx III

*Kalam Outcrop*

P.1000-21 M<sup>2</sup> dext., slightly damaged: Fig. 3-2  
 P.1000-6D P<sub>2</sub> sin.  
 P.1000-6A P<sub>3</sub> sin.  
 P.1000-6B P<sub>4</sub> sin.  
 P.1000-6C M<sub>1</sub> sin.  
 Specimens P.1000-6A to P.1000-6D derive from a single individual.  
 P.1000-5 M<sub>2</sub> dext.

*Omo* - no locality or horizon

OMO 1967 (57) portion of right dentary with P<sub>3-4</sub> and anterior portion of M<sub>1</sub>.

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