

in the African Plio-Pleistocene. A definite specific identification is of course impossible. The only other remain of this genus from Melka Kunture is a fragment of maxilla from Garba XII.

Proboscidea (D.G.)

Elephantidae gen. et sp. indet., cf. *Elephas recki recki* DIETRICH, 1915

In Addis Ababa, only two specimens from Garba IV are of a Proboscidean. These are a pelvis fragment, GAR IV-79-10476, and a small piece of tooth-plate, GAR IV-78-4225. Of course, they cannot be identified beyond family level. We could not find the tooth figured by Piperno and Bulgarelli-Piperno (1975, Fig. 17.5). It is probably a dp3, which looks similar to those of *E. recki recki* from Omo Shungura (Beden 1979, Fig. 89C).

Perissodactyla (V.E.)

The material is poor (150 specimens) and often fragmentary. *Equus* is represented by 84 specimens, *Hipparion* by 13 specimens, and 53 specimens are uncertain as to their generic attribution (fragments of teeth and a few limb bones, see Table 4).

Genus *Equus* (Plate 1.a-o)

E. cf. capensis (macrodont), *E. cf. stenorhis* (medium sized), *Equus* sp. (microdont).

Upper cheek teeth

Biometrical data on the upper adult cheek teeth are in Table 1. They appear (Fig. 3) to cluster into three groups: one premolar (GAR IVD-74-7150) and two molars (GAR IVD-73-2969 and GAR IVD-76-9319) seem large and have long protocones, the premolar (GAR IVD-81-12305) and two molars (GOM

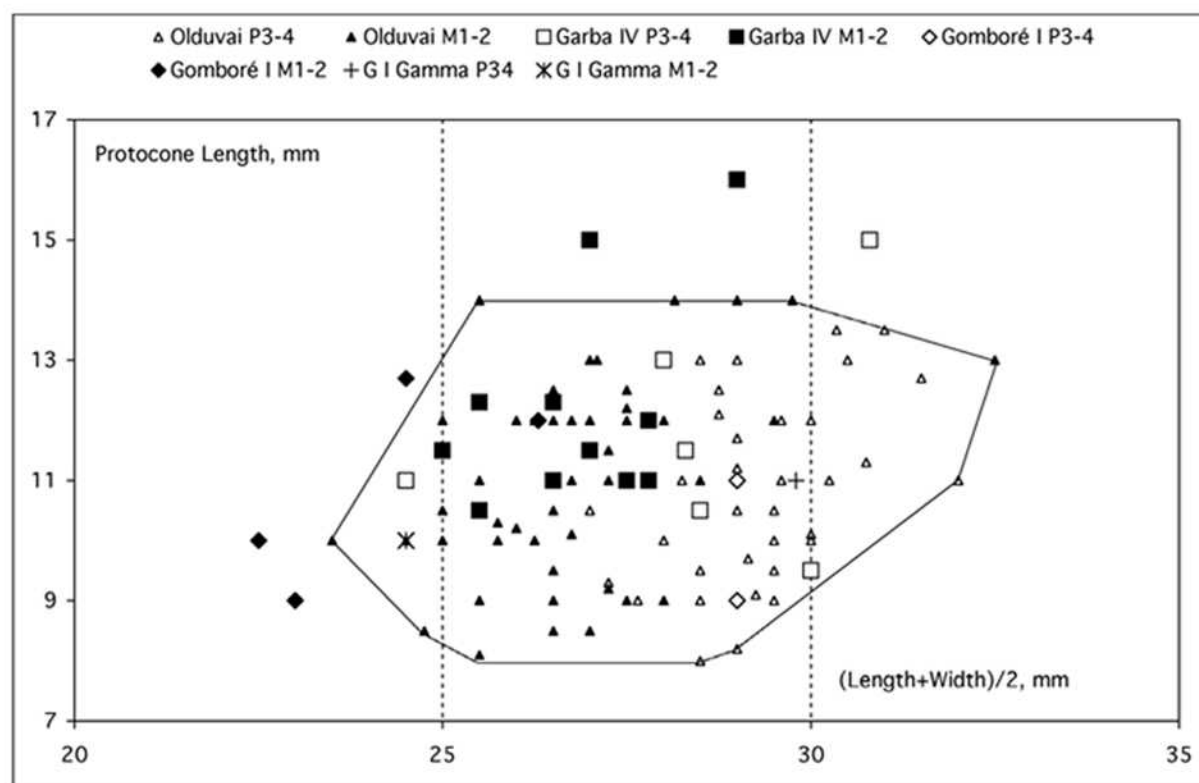


Fig. 3. *Equus* upper P3-P4 and M1-M2. Scatter diagram of the protocone length versus the mean occlusal diameter [(occlusal length+width)/2] in millimeters. Comparison with the range of variation observed at Olduvai.

	Garba IV D	Garba IV	Garba IV D		Garba IV	Gomb I	Gomb I γ	
P2	75-166	73-970	76-9159	M3	76-2531	73-6847	78-1912	
OL		38	35,5	L mid-height	26		25	
PL	9	9	7.5	PL	13		12*	
OW	29*	29		W mid-height	25.5		21.5	
Ht	45	36	33	Ht	33	51	33	
PI		23.7		PI	50		48*	
	Garba IV D	Garba IV D	Garba IV D	Garba IV D	Garba IV D	Garba IV D		
P3 or P4	72-2088	72-3958	74-6980	74-7150	75-7746	81-12305		
OL	27	30	28	31	27.5	24		
PL	13	9.5	10.5	15	11.5	11		
OL+OW/2	28	30	28.5	30.8	28.3	24.5		
OW	29	30	29	30.5	29	25		
Ht	48	40	32		38	25		
PI	48.1	31.7	37.5	48.4	41.8	45.8		
	Gomb I	Gomb I γ	Gomb I γ	Gomb I A	Gomb I B			
P3 or P4	74-4017	78-1843	74-311	72-55	81-2969			
OL	30*	32	30*	29	29			
PL	9		11	11*				
OL+OW/2	29*	29	29.8*					
OW	28	26	29.5					
Ht		47	52	64	38			
PI	30*		30*	37.9*				
	Garba IV D	Garba IV D	Garba IV C/D	Garba IV D	Garba IV D	Garba IV D	Garba IV D	
M1 or M2	75-538	79-832	76-1615	72-2054	72-2175	73-2969	76-3010	
OL	25.5	25		24	27.5	30	28	
PL	12.3	11.5		10.5	11	16	11	
(OL+OW)/2		25		25.5	27.5	29	27.8	
OW		25	28	27	27.5	28	27.5	
Ht		42	22	39	70	72	53	
PI	48.2	46		43.8	40	53.3	39.3	
	Garba IV D	Garba IV D	Garba IV C/D	Garba IV D	Garba IV D	Garba IV D	Garba IV	
M1 or M2	76-4748	77-5279	74-7398	77-8514	78-8800	76-9319	79-21032	
OL	26.5	26.5	27.5	26.5	28	29	24.6	
PL	12.3	11	12		11.5	15	11.4	
(OL+OW)/2	26.5	26.5	27.8		27.5	28		
OW	26.5	26.5	28	28	27	27		
Ht	70*	21.5	30	30	60	72		
PI	46.4	41.5	43.6		41.1	51.7		
	Gomb I B	Gomb I B	Gomb I B	Gomb I γ	Gomb I γ	Gomb I C	Gomb I A	Gomb I A
M1 or M2	74-3163	74-3678	73-2153	78-1732	78-1848	68-1988	69-2633	72-4174
OL			22	27	24	21	26	25
PL	10		9		10	10	12	12.7
(OL+OW)/2			23	27.3	24.5	22.5	26.3	24.5
OW		25*	24	27.5	25	24	26.5	24
Ht		27	40	45	72	19	42	64
PI			40.9		41.7	47.6	46.2	50.8

Tab. 1. *Equus* upper cheek teeth of Garba IV and Gombore I. Measurements in millimeters. OL = occlusal length; PL = protocone length; OW = occlusal width; Ht = height; PI = protocone index. Measurements marked with asterisks are approximate.

Lower cheek teeth

Biometrical data on the lower adult teeth and one lacteal are in Table 2. One M3 (GAR IVD-75-7996) and possibly three P3 or P4 (GOM IA-72-67, GAR IVD-79-884, GOM IB-3495) seem larger than the others. All have stenonine double knots. The stem of the double knot may be very long (Plate 1.n). The ectoflexids of the molars are deep. There are no protostylids on the P2.

Limb bones

One MC III (GAR IVD-77-8274), perfectly preserved, is smaller than the others. It is robust, the proximal epiphysis is deep, and the distal articular width is larger than the supra-articular. Unfortunately the other

	Garba IV	Garba IV	Gomb I γ	Gomb I γ		Garba IV D		
p2	73-690	73-733	74-245	78-1834		dp3 or dp4	76-9181	
OL	31	32	33.5	32.5		OL	31	
Postflexid L	13.9	13.5	16.6	15		Postflexid L	11	
OW	14		15.2	14.5		OW	14	
Ht		25		28		Ht	20	
PI	44.8	42.2	49.6	46.2		PI	35.5	
	Garba IV D	Garba IV D	Garba IV D	Garba IV	Garba IV D	Garba IV D	Garba IV D	Garba IV D
p3 or p4	79-884	74-1741	72-2180	73-2542	78-3776	72-3894	74-7329	77-8382
OL	29	27.5		26.5	28.5		26.5	28*
Postflexid L	12.5	11	11	14	14.5	13.5	12.5	14.2
OW	16	15	17*	16	16.5		16	16.2
Ht	36	64	31	42	60	28	45	28
PI	43.1	40		52.8	50.9		47.2	50.7*
	Gomb I B	Gomb I B	Gomb I B	Gomb I B	Gomb I B	Gomb I A	Gomb I γ	Gomb I γ
p3 or p4	7662	76-7724	69-1204	72-2772	3495	72-67	79-1057	1870
OL	26.5		27.5		29	29	28	
Postflexid L	11	15	12		12.8	13.8	14.5	16
OW	16	15	17	16	17	17.8	15.5	16
Ht	42		28	35	45	57	55	36
PI	41.5		43.6		44.1	47.6	51.8	
	Garba IV	Garba IV D	Garba IV D	Garba IV D	Garba IV D	Gomb I	Gomb I B	Gomb I B
m1 or m2	73-777	74-1440	72-2169	75-7896	79-10342	71-1229	1241	5027
OL	24	24			22	24.5	21	26.5
Postflexid L	7	10	9	7.5	7	8	6	8
OW	14.1	14	13*	14.5	13	13	13.5	14.3
Ht	37		28	30	26	18	20	37
PI	29.2	41.7			31.8	32.7	28.6	30.2
	Gomb I γ			Garba IV C	Garba IV D	Garba IV D	Gomb I B	Gomb I γ
m1 or m2	476		m3	75-20	75-7996	77-8280	2231	74-119
OL	24		OL	28	36	28	30	
Postflexid L	9							
OW	15		OW	11.5	14.5	11	13	11.5
Ht	53		Ht	54	34		50	59
PI	37.5							

Tab. 2. *Equus* lower cheek teeth of Garba IV and Gombore I. Measurements in millimeters. OL = occlusal length; L = length; OW = occlusal breadth; Ht = height; PI = postflexid index. Measurements marked with asterisks are approximate.

MC III are fragmentary or badly preserved. The only specimen for which the distal epiphysis is good enough (GAR IVD-79-395) has also an articular width larger than the supra-articular. One well preserved metatarsal (GOM IB-72-1222) is very robust and flat, its distal supra-articular width is much larger than the articular one. Another, badly preserved (GAR IVD-74-7126), is also robust and flattened. One fragment of tibia is rather large. One posterior third phalanx is narrow (Plate 1.o). Measurements are in Tables 3 and 4.

Discussion

Three upper cheek teeth fall completely outside the range of variation of the sample of Olduvai because of their longer protocones (Fig. 3). These teeth, however, are little worn: the molars are 72 mm high (the premolar is broken). It would be interesting to have them sectioned at mid-crown to see if the protocones remain long. If so, the teeth could be referred to *E. cf. capensis*, although their real identification with a Middle Pleistocene species would be surprising (Eisenmann and Baylac 2000).

The metacarpals of Garba IV (Fig. 4) are more robust and shorter than in *E. numidicus-E. tabeti*, and one at least is shorter than in *E. oldowayensis* (as represented by specimen 346 from BK II, Table 3). Moreover, and unlike *E. oldowayensis*, their distal articular width is larger than the supra-articular. The

MC	Olduvai BK II 346	East Turkana Chari - 2067	Melka Kun. Garba IV D 79-395	Melka Kun. Garba IV D 74-1042	Melka Kun. Garba IV D 72-2354	Melka Kun. Garba IV D 76-9950	Melka Kun. Garba IV D 77-8274
1	216	199		211			203
3	35.5	22.3	35	36	37	36	32
4	27.8	18	26	27			24
5	53	33		52		51	46
6	34.1	24					31
10	51	33	45	49	48		42.5
11	48	33	47				43
12	35.2		33				31.7
13	28	20	26	27.5	26		25.1
14	31	22	27.5				27
7	44	28.5				43	37
8	17					17	16.7
MC	Sterkfontein Post 5 Infill S 94 12550	Swartkrans Member 2 4000 A	MT	Swartkrans Member 2 4002 D	Olduvai BK II 874-1277	Melka Kun. Gomb IB 72-1222	Melka Kun. Garba IVD 74-7126
1	207	210	1		263	240	250
3	33	32.1	3		36	35	37
4	24	26.2	4		33.5	29	33
5	47*	48.1	5		51	47	
6	27*	30	6		42	40	
10	44	41.1	10	40	49	49	
11	44	44	11	40	46	46	
12	31	33.6	12	30	36.5	34	
13	25	27.1	13		29	25.5	
14	26*	29.1	14		32	29	
7		40.5	7		48	42	
8		14.3	8		10.2	10	

Tab. 3. Third metacarpals (MC) and metatarsals (MT) of African *Equus*. Measurements in millimeters.

1, maximal length; 3, breadth at mid-diaphysis; 4, antero-posterior diameter (APD) at mid-diaphysis; 5, proximal breadth; 6, proximal APD; 10, distal breadth at the supra-articular tuberosities; 11, distal articular breadth; 12, maximal APD of the keel; 13, minimal APD of the medial condyle; 14, maximal APD of the medial condyle; 7, diameter of the articular facet for the magnum (MC) or the large cuneiform (MT); 8, diameter of the anterior articular facet for the unciform (MC) or for the cuboid (MT). Measurements marked with asterisks are approximate.

Garba IV D	Radius 75-230	Calcaneum 72-3919	Tibia 72-4099 E	Tibia 78-4538
Maximal length	299	111		
Length proximal part		75		
Proximal breadth max.	78	31		
Proximal depth	40*	51		
Minimal breadth	41	24		40.5
Minimal depth	29		34*	29
Distal breadth max.	69*	52	73,5	
Distal depth	30	53	48*	
Gombore I γ	Tibia 74-169	Tibia 76-835	Tibia 78-1378	Tibia 78-1639
Minimal breadth		50		
Minimal depth		32		33*
Distal breadth max.	72	73	70	68*
Distal depth	42.5	50	41	46
	Talus 78-1230			Third phalanx 78-1751
Greatest length	65	Greatest length		53
Medial length of trochlea	60	Anteroposterior diameter (DAP)		60
Greatest breadth (DT)	61	Height		43
Trochlear DT	29	Transverse diameter (DT)		59
DT articular distal	50	DT of the articular facet		41
DAP articular distal	36	DAP of the articular facet		24.5
Medial depth (DAP)	51	Circumference of the sole		143

Tab. 4. Limb bones of Garba IVD and Gombore Iγ. Measurements in millimeters. Max. = maximum. DAP = antero-posterior diameter. DT = transverse diameter. Measurements marked with asterisks are approximate.

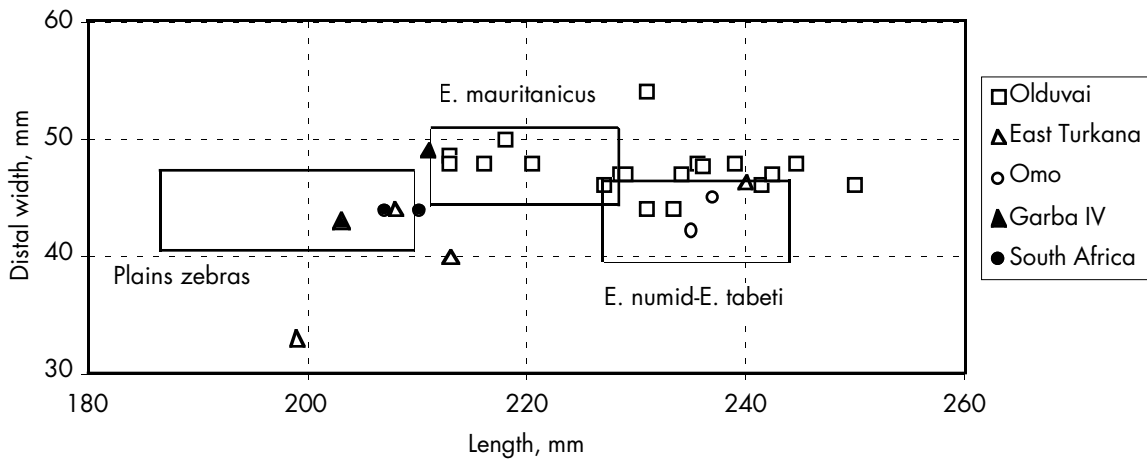


Fig. 4. Scatter diagram of distal articular widths versus maximal lengths of *Equus* third metacarpals. One specimen of Melka Kunture is compared to metacarpals of Olduvai, East Turkana, Omo, and South Africa and to the ranges of variation of modern Plains zebras, *E. mauritanicus* of Tighenif (Algeria), and *E. numidicus* and *E. tabeti* of Aïn Boucherit and Aïn Hanech (Algeria).

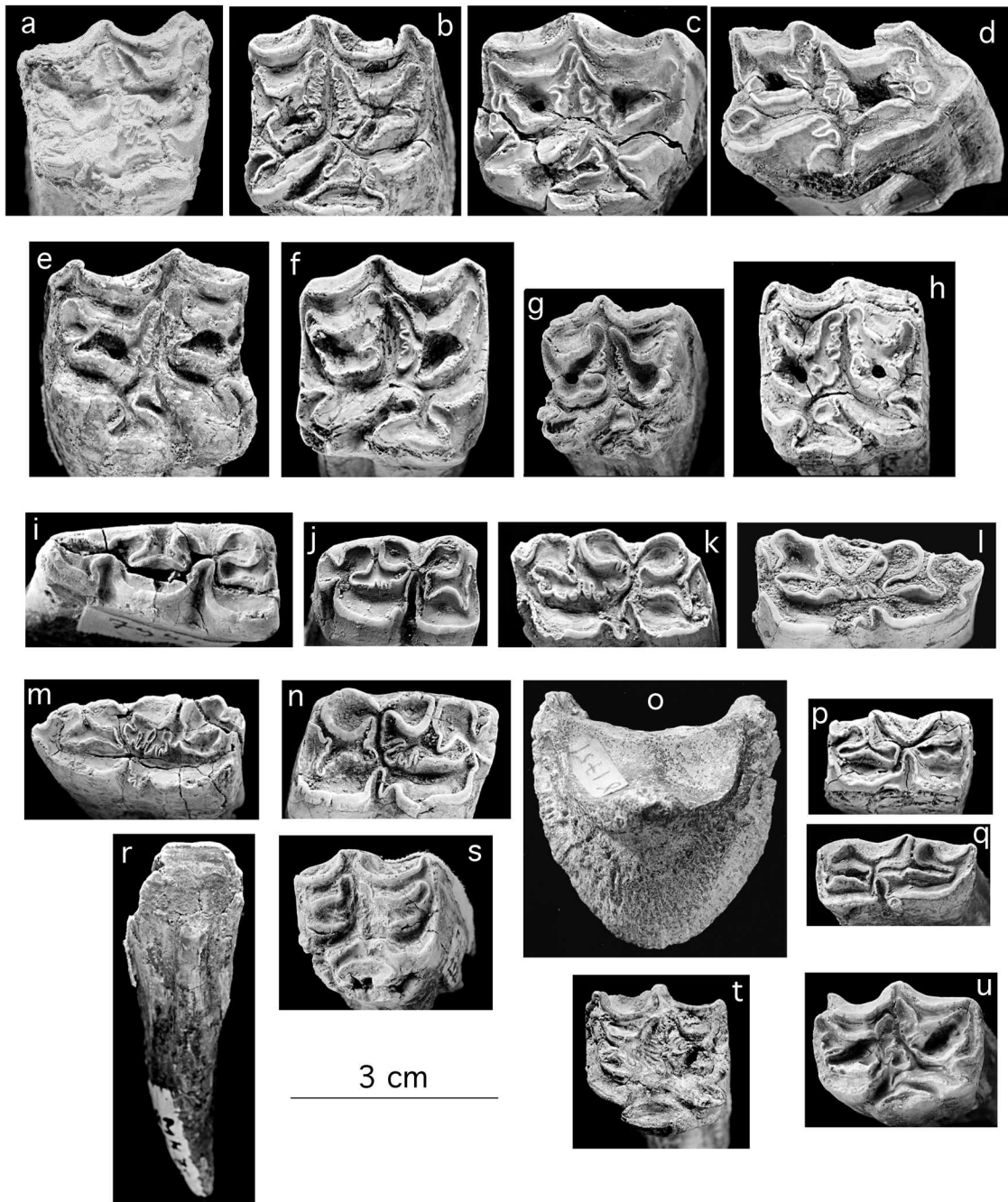


Plate 1. Equidae. a. Garba IV D-76-9319. *E. cf. capensis*. Upper right M2. b. Garba IV D-72-2088. *Equus* sp. Upper right P. c. Garba IV D-74-7150. *E. cf. capensis*. Upper right P. d. Garba IV D-76-9159. *E. cf. stenonis*. Upper right P2. e. Garba IV D-72-3958. *E. cf. stenonis*. Upper left P. f. Garba IV D-78-3010. *E. cf. stenonis*. Upper right M. g. Gombore IB-73-2153. *Equus* sp. microdont. Upper right M. h. Garba IV D-72-2054. *E. cf. stenonis*. Upper left M. i. Garba IV D-75-7996. *E. cf. capensis* ? Lower right M3. j. Gombore Iγ-76-476. *E. cf. stenonis*. Lower right M. k. Garba IV D-78-3776. *E. cf. stenonis*. Lower right P. l. Gombore Iγ-74-245. *E. cf. stenonis*. Lower right P2. m. Garba IV-73-690. *E. cf. stenonis*. Lower left P2. n. Gombore IA-72-67. *E. cf. capensis* ? Lower left P. o. Gombore Iγ-78-1751. *Equus* sp. Posterior third phalanx. p. Garba IV D-74-1349. *Hipparion* sp. Lower right M. q. Gombore Iγ-74-220. *Hipparion* sp. Lower left M. r. Garba IV D-75-134. *Hipparion* sp. Lower left Incisor. s. Garba IV-73-2922. *Hipparion* sp. Upper right P. t. Gombore IB-69-1201. *Hipparion* sp. Upper left P ? u. Gombore IB-73-2338. *Hipparion* sp. Upper left M.

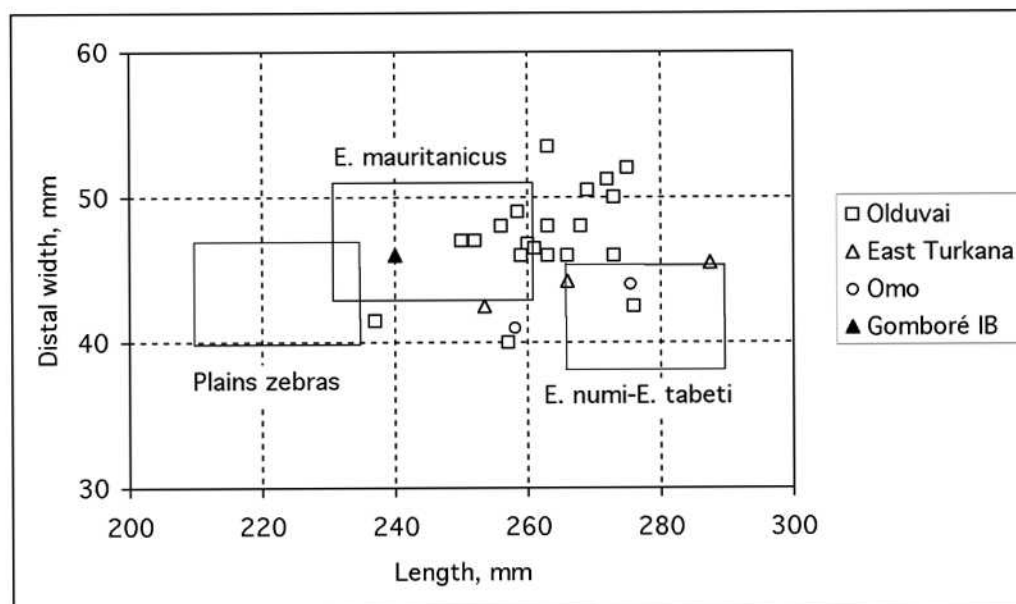


Fig. 5. Scatter diagram of distal articular widths versus maximal lengths of African *Equus* third metatarsals. See captions of Figure 3.

unique and very robust metatarsal (Fig. 5) appears also too short for *E. oldowayensis* (as represented by specimen 874-1277 from BK II, Table 3). The bones of Melka resemble more the small European *E. stenonis-E. stehlini* that are found at Casa Frata, Valdarno, and Senèze. Metacarpals of about the same size and proportions were also found in Swartkrans Member 2 and in the Post Member 5 Infill at Sterkfontein. Thus, while most of Garba IV teeth fall inside the range of variation observed at Olduvai (Fig. 3), the metapodials do not agree with such an identification. We refer the medium group of teeth and most limb bones to a small *E. cf. stenonis*. The robustness of the metapodials does not suggest adaptation to dry conditions. Neither does the great degree of enamel plication on the cheek teeth. The third phalanx, however, is rather narrow, which could indicate a hard ground and/or a climbing adaptation like in the modern asses or mountain zebras.

One upper premolar and two molars suggest the occurrence of a smaller species, possibly present also at Olduvai (Churcher 1982) and/or East Turkana (Eisenmann 1983). Such teeth are rare in the samples of similar ages I have studied. The teeth from Olduvai (Tanzania) and 'Ubeidiya (Israel) are bigger (Eisenmann 1987). The teeth of *E. tabeti* (Ain Hanech, Algeria) have smaller protocones (Eisenmann 1980) as do the small teeth of East Turkana (sub KF Unit) referred to *E. cf. tabeti* (Eisenmann 1983). In South Africa, however, at Sterkfontein 5, and in the member 2 of Swartkrans, several upper cheek teeth match the small teeth of Melka Kunture in size and protocone length. The smallest third metacarpal of Garba IVD (77-8274) could belong to the same species. It is not very different from a specimen of Sterkfontein (Post member 5 infill, where a very small third phalanx) was also found, and from another of the member 2 of Swartkrans. At Swartkrans (member 2) a fragment of a small third metatarsal (Table 3) was also found. All other metapodials of similar age are larger and/or more slender.

Thus, there were possibly three species of *Equus* at Garba IV, one with large and plicated teeth and probably long protocones which is very tentatively referred to *E. cf. capensis*; one of medium size referred to a smallish and robust *E. cf. stenonis*; and one microdont *Equus* sp. In all cases, the less different *Equus* specimens are not East African, but either European or South African. The robustness of bones and the plications of teeth point to rather humid conditions.

Genus *Hipparion* (Plate 1.p-u)*Stylohipparion* sp. (not *Eurygnatohippus cornelianus*)

The mandibular symphysis (GAR IVD-74-6767) was discussed and illustrated previously (Eisenmann 1998). Its proportions indicate a grass-eater. The incisors are crenulated as often in *Hipparions*. Their occlusal surface is nearly orthogonal to the crown. A lower left incisor (GAR IVD-75-134) shows also the characteristic crenulation but it is clearly proclive (Plate 1.r), and its occlusal surface is bevelled, oblique to the crown. It is difficult to tell if these differences result from different eating adaptations in two different species, or merely from individual intraspecific variation.

Data on upper cheek teeth are in Table 5. They are all middle-sized with rather long protocones (Plate 1.s-u).

The lower cheek teeth (Table 6) have caballine double knots and ectostylids. The vestibular groove is deep on one moderately worn molar (Plate 1.p), shallow on another – little worn – molar (Plate 1.q).

From Gombore I, there is a fragmentary third metatarsal (78-1604) about 32 mm wide in the diaphysis, 44 mm at the supra-articular tuberosities, and 43 mm at the distal articulation. The depth of the keel is 34.5 mm, the depths of the medial condyle are 28.5 mm (minimum) and 31.7 mm (maximum). A fragment of lateral metapodial (GAR IV-73-870) has a distal articular antero-posterior diameter of 17 mm.

		P Garba IV 73-2922	M Gombore IB 69-1201	P♀ Gombore IB 73-2338	M3 Gombore IB 72-2684
Wear stage		III	II	I	II
Height		28	49		53
Length	Occlusal			25	
	At 2cm	22	21.5	22.5	20.5
Width	Occlusal			20	
	At 2cm	21.5	21		17.5
Protocone L	Occlusal			9	7.2
	Mid crown	9	8	8	
Protocone W	Occlusal			2.5	
	At 2cm	4			
Plis Fossette		6	15	9	10
Plis Caballin		+	+	+	+

Table 5. *Hipparion* upper cheek teeth of Garba IV and Gombore I. Measurements in millimeters. L = length; PL = protocone length; W = width.

	dP Garba IVD 72-3937	M Garba IVD 74-1349	M Gombore I γ 74-220
Wear stage		II	I
Height	25	32	77
Length at 2cm		22	22.5
Length double knot		14	12.7
Length postfossette		9.5	11.5
Width at 2cm	17.5	13	10.5
Ectostylid	9	4.5	2.5

Table 6. *Hipparion* lower cheek teeth of Garba IV and Gombore I. Measurements in millimeters.

Discussion

Hipparion remains of this age are rare. In the Shungura Formation (member L9) there are 6 upper cheek teeth, 4 of which are fragmentary (Eisenmann 1985). In East Turkana, there is one upper premolar and one upper molar from the sub Chari levels; from the slightly older sub KF levels, there are 4 molars (Eisenmann 1983). At Olduvai, Hooijer (1975) described a few upper cheek teeth, some of them associated in series. It seems that the Garba IV upper premolar is slightly smaller than the teeth from Olduvai and East Turkana. It is difficult to assign these specimens to any specific taxon but it is certain that the symphysis of Garba IV cannot belong to the same *Hipparion* as the symphysis of Olduvai Bed II referred to *H. cf. cornelianum* (Eisenmann 1998, Fig. 5).

Not a single remain from Melka Kunture can be referred to the Rhinocerotidae.

Artiodactyla (D.G.)

Family Hippopotamidae

Genus *Hippopotamus* L.

Hippopotamus cf. amphibius L.

The Hippo is probably the most common large Mammal of Melka Kunture, and certainly the dominant one in terms of biomass. As for most other animals, however, its remains are largely fragmentary; they consist mostly of bone and teeth fragments. The bulk of the material can be referred to a single species of large size. It is strongly dimorphic, like the Recent *H. amphibius*; the largest males reach the size of the largest Recent specimens, but not that of the gigantic ones from Djibouti (Bonis *et al.* 1988). Since there does not seem to be any difference between the various sites, they will be described together.

The canines are noticeably large in males, but not morphologically different from those of the Recent species. It is impossible to tell the relative proportions of the lower incisors, which play an important role in Hippo systematics, because no symphysis has been recovered in the Oldowan of Melka Kunture. It is unlikely, however, that these proportions were much different from those of the Recent species, as suggested by incisors from other sites at Melka Kunture. The premolars display the usual variability found in the Recent species; the main tubercle of a P4 from Gombore I (GOM IB-70-2710) is a 5-branch star, while a specimen from Garba IV (GAR IV-75-218: Colour Plate XII.5) has two intra-cingular cusps, as sometimes found today. The molars provide the only definite evidence of a morphological difference from other large tetraprotodont Hippos. While those of *H. amphibius*, like those of the Pleistocene *H. gorgops* and *H. sirensis*, are rather high-crowned, with their lingual and labial walls almost parallel, those of Garba IV and Gombore I are more brachyodont, with the lateral walls converging towards the apex, and the anterior and posterior cingula are lower. Taken alone, this difference would perhaps not demand taxonomic distinction, but in conjunction with the large size and large canines, we believe that it points to a somewhat different way of life. We might surmise that it fed on softer grasses than other large Pleistocene and recent Hippos, although isotopic analysis (Bocherens *et al.* 1996) shows that it fed mainly on C4 grasses.

We should also mention that we do not believe that the morphology of the single lower molar, GAR IVD-72-2104, referred to *Hexaprotodon* by Gèze (1980: 74) is distinct enough to establish the occurrence of another species of large Hippo in this site.

The diversity of Plio-Pleistocene Hippos has been stressed more than once; it is certainly due, in part, to geographic isolation (contrasting with today's wide range of *H. amphibius*), and it may be that the upper Awash basin was, at that time, not fully connected with the rest of the Ethiopian hydrogeographic system.