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ADDITIONAL LARGE MAMMALIAN FAUNA FROM THE NAMURUNGULE FORMATION, SAMBURU HILLS, NORTHERN KENYA

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ABSTRACT Some 1150 late Miocene vertebrate fossils were collected by the Japan-Kenya Expedition from the Namurungule Formation in the Samburu Hills, Northern Kenya. The Namurungule mammalian local fauna has simillarities to late Miocene Eurasian faunas from Samos and Pikermi (Greece), Maragheh (Iran), and the Nagri and Dhok Pathan Formations of the Siwalik Hills (India). This similarity indicates mammalian interchanges between Eurasia and Africa during the late Miocene. The svanna fauna of the Namurungule Formation differs completely from the earilier Aka Aiteputh Formation fauna, which indicates a woodland environment (Pickford et al. 1984). This great change in the mammalian fauna of the East African late Miocene coincided with the beginning of the opening of the Gregory Rift.

INTRODUCTION

During 1982 and 1984, the Japan-Kenya Expedition team surveyed the Samburu Hills. Vertebrate fossils were collected from 64 sites, with sites 50 to 64 being added to the 1982 list (Figure 1). All the new sites belong the lower member of the Namurungule Formation.*

The new material included some specimens of Rhinocerotidate, a skull of *Tetralophodon*, a mandible of Deinotheriidae, a skull of *Hipparion* and a mandible of *Kenyapotamus*. No

* The lower member of the Namurungule Formation overlies the Aka Aiteputh Formation, and is overlain by the thick upper mud flow deposit, while the upper member of the Namurungule Formation overlies this mud flow (see Fig. 9 in Makinouchi *et al.* 1984, Fig. 10 in Pickford *et al.* 1984, Fig. 2 in Matsuda *et al.* 1984 and Fig. 6 in Sawada *et al.* 1987). The lower member of the Namurungule Formation ferers to a horizon named the "lower alternation" and the upper member refers to the "upper alternation" used of Nakaya *et al.* (1984).

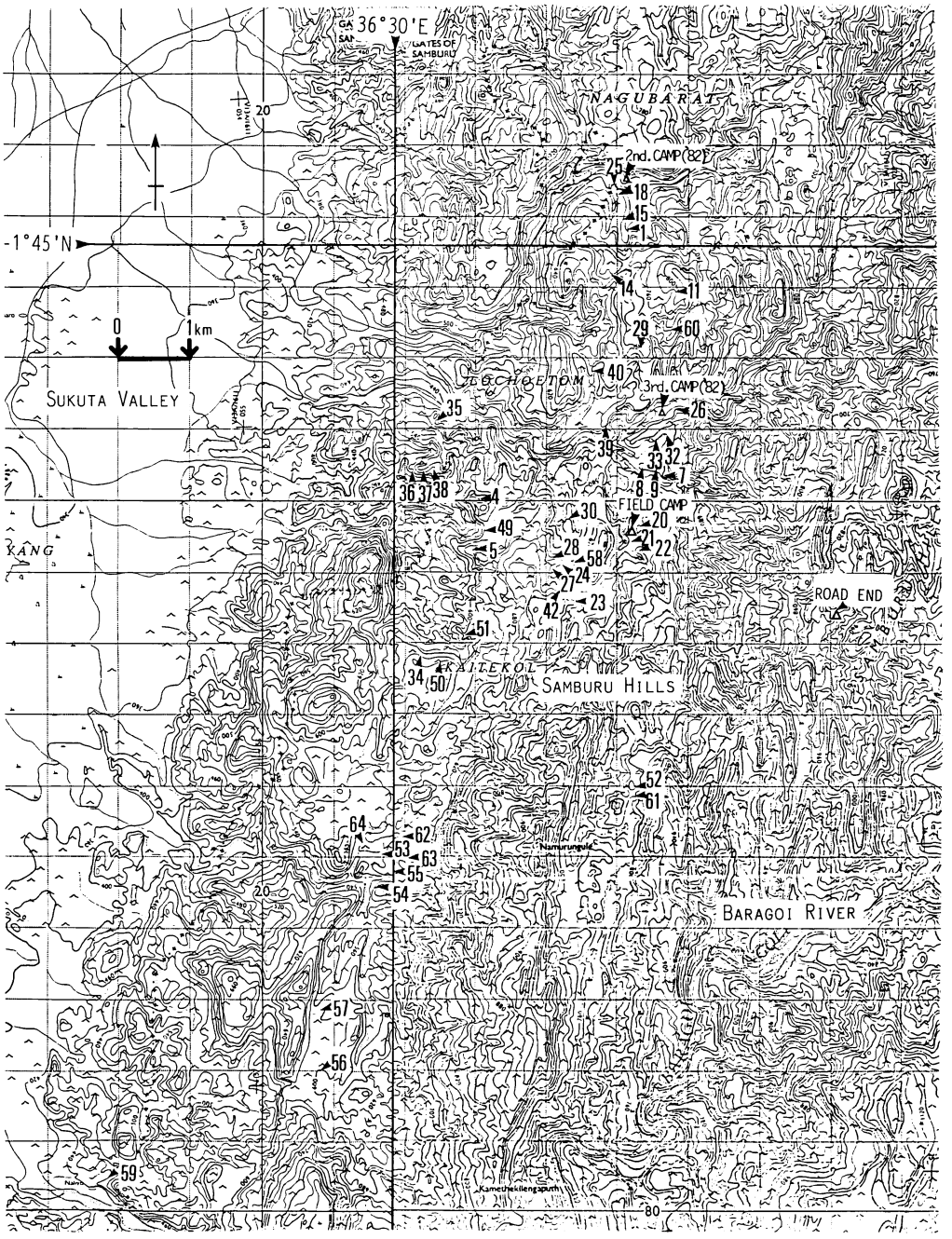

Fig. 1. Fossil locality map of Samburu Hills area. Base maps are based on sheets "Lobar" (65/1), "Kangaurak" (65/3), "Skuta Valley" (65/2) and "Lomaro" (64/4) of Series Y731 (D. O. S. 423) ; 1 : 50,000 Topographic map published by D. O. S. for the Kenya Government (Survey of Kenya), 1982. each gird is 1 km square.

			Number of speimens
CARNIVORA	Hyaenidae gen. et sp. indet.	sp. A	1
		sp. B	1
		sp. C	1
	Fissipedia fam., gen et sp. indet	sp. D.	1
RODENTIA	Thryonomyidae	*Paraulacodus* sp.	1
		gen. et sp. indet.	1
PROBOSCIDEA	Gomphotheriidae	*Tetralophodon* sp.	4
DEINOTHERIOIDEA	Deinotheriidae	*Deinotherium* sp.	5
PERISSODACTYLA	Equidae	"*Cormohipparion*" *perimense*	13
		Hipparion sitifense	38
	Rhinocerotidae	*Paradiceros* sp.	5
		Chilotheridium sp.	3
		Kenyatherium bishopi	1
		gen. et sp. indet.	8
ARTIODACTYLA	SuideE	*Nyanzachoerus* sp.	4
	Hipporotamidae	*Kenyapotamus coryndoni*	5
	Giraffidae	*Palaeotragus* sp.	8
	Bovidae	*Pachytragus* sp.	7
		Palaeoreas sp.	13
		Gazella sp.	6

specimens of the previously recorded Hominoidea, Tubulidentata, Chalicotheriidae, and Tragulidae were collected in 1984.

The Namurungule fauna is similar to the faunas from Samons and Pikermi of Greece, Maragheh of Iran, and the Nagri and Dhok Pathan Formations of the Siwaliks of India. The Namurungule Formation comformable overlies the Aka Aiteputh Formation (Sawada *et al.* 1987) which has been dated at between 12.0 and 14.6 milion years (Matsuda *et al.* 1984). Itaya and Sawada (1987) have since dated nineteen volcanic rock samples of the Aka Aiteputh Formation at between 10.8 to 15.0 million years. The Namurungule fauna is therefore correlated with the Turolian of Europe (later than 10 million years old), rather than the Vallesian as indicated earlier (Nakaya *et al.* 1984). The younger age is supported by faunal similarities and palaeomagnetics stratigraphy (Nakajima and Torii 1986). This fauna is particularly significant in providing evidence regardiong the late Miocene faunal interchange between African and Eurasia. The present paper is preliminary report on the large mammalian fauna of the 1984 excavation in the Samburu Hills. Full descriptions of some taxa from the Namurungule fauna will be prepared by the author, and Kawamura and Nakaya have described the Rodentia from the Namurungule Formation (this volume).

Almost all materials of 1984 excavation were collected from the surface in the Samburu Hills, but a part of collection was made in situ the Namurungule Formation. Especially, the materials from site 22 (loc. SH-22) were collected by detailed excavation. The evidence of the matrix of fossils and

the topography of the site shows that all these materials were contained in a similar horizon. All excavation data for each specimen were recorded on the formal forms of the National Museums of Kenya (KNM), and stored in the reference of KNM. Staffs of the KNM prepared, registered and housed all the materials from the Samburu Hills. The number following all fossils in this report is the accession number of the KNM and the locality number of the Japan-Kenya Expedition. For example "KNM-SH 0000" is the accession number of the specimen from the Samburu Hills, and "loc. SH-00" shows the locality number in the Samburu Hills.

SYSTEMATIC DESCRIPTION

CLASS MAMMALIA
ORDER CARNIVORA
SUBORDER FISSIPEDIA
Family Hyaenidae GRAY, 1969
Hyaenidae gen. et sp. indet.

sp. A

(Plate 1, fig. 1,2)

Material ..... Left M_1(KNM-SH 14755 loc. SH-22)
Horizon ..... Namurungule Formation, lower member

Description

The tooth is an unworn lower carnassial, with an anterior cingulum and a talonid.

Measurements (mm) of the tooth are as follows:

length of crown	19.8
breadth of crown	9.0
height of crown	14.1
length of talonid	2.9
breadth of talonid	4.1

Hyaenidae gen. et sp. indet.

sp. B

(Plate 1, fig. 3,4)

Material ..... Right P_4(KNM-SH 15841 loc. SH-51)
Horizon ..... Namurungule Formation, lower member

Description

The tooth is an unworn premolar with a lingual cingulum and a mataconid.

Measurements (mm) of the tooth are as follows:

length of crown	16.7
breadth of crown	8.6
height of crown	10.1

Hyaenidae gen. et. sp. indet.

sp. C

(Plate 1, fig. 5)

Material ..... Right P_3or P_4(KNM-SH 15872 loc. SH-51)
Horizon ..... Namurungule Formation, lower member

Description

The specimen comprises the anterior part of a large premolar with a lingual cingulum.

Measurements (mm) of the tooth are as follows:

breadth of crown	18.6
height of crown	17.0

Fissipedia fam., gen. et sp. indet.

sp. D

(Plate 1, fig. 6)

Material ..... Left lower canine (KNM-SH 14794 loc. SH-22)
Horizon ..... Namurungule Formation, lower member

Description

The specimen comoprises the root and crown of a large canine. The crown has a strong buccal

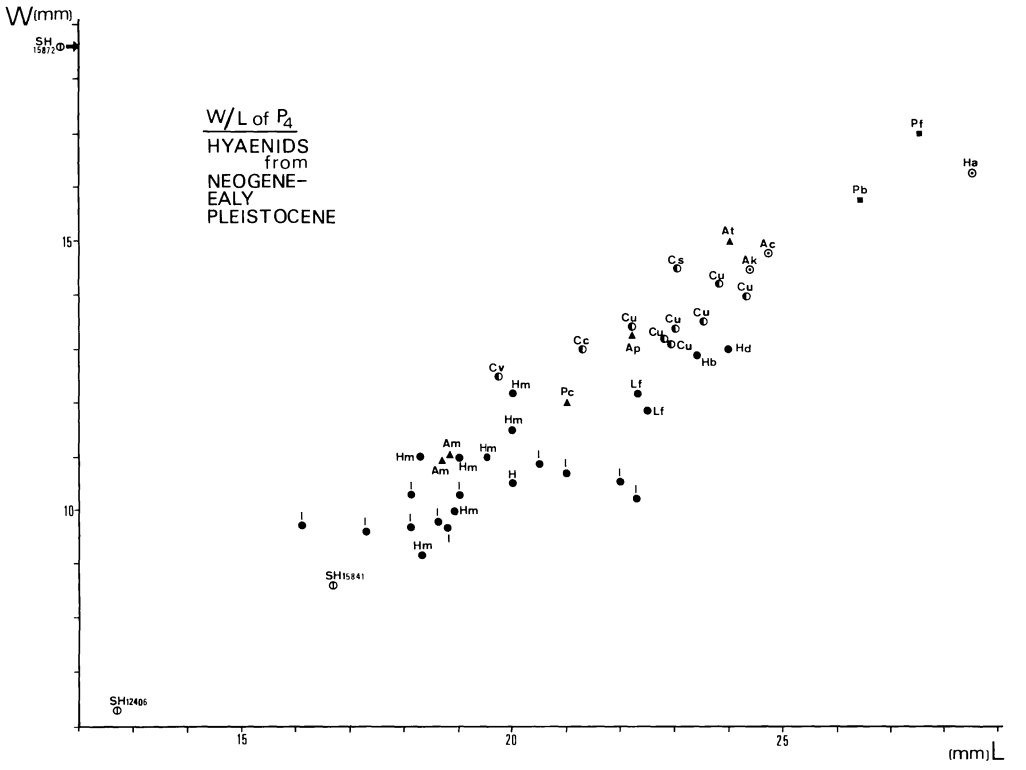

Fig. 2. Comparison of lower P4 of Hyaenids from Neogene to early Pleistocene of Afro-Eurasia. (Measurements from Ficcarelli and Torre 1970, Nakaya *et al.* 1984 and this report)
● ; "Fossil Hyaenas", ○ ; "Fossil Crocutas", ■ ; "Pachycrocutas", ▲ ; "Percrocutas and Adcrocutas", ⊙ ; "Other Fossil Hyaenids" (from Ficcarelli and Torre 1970), ⏀ ; Samburu Hills Materials Ac ; *Allohyaena csakvarensis*, Ak ; *All. kadici*, Am ; *Adcrocuta(?) miocenica*, Ap ; *Ad. precursoe*, At ; *Ad. tungurensis*, Cc ; *Crocuta colvini*, Cs ; *C. sivalensis*, Cu ; *C. crocuta ultra*, Cv ; *C. c. venustula*, H ; "*Hyaena*" sp., Ha ; "*H.*" *Algeriensis*, Hb ; *H. burnea dispar*, Hd ; *H. donnezani*, Hm ; *H. makapani*, I ; *Ictitherium hyaenoides*, Lf ; *Leecyaena forfex*, Pb ; *Pachycrocuta bellax*, Pc ; *Percrocuta carnifex*, Pf ; *Pachy. felina*

keel, and the root is rounded rectangular in cross section.

Measurements (mm) of the tooth are as follows:

total length of tooth	81.7
breadth of tooth	15.8
diameter of crown	21.8
lingual length of crown	38.0
buccal length of crown	36.8

Discussion

Comparison of Carnivora

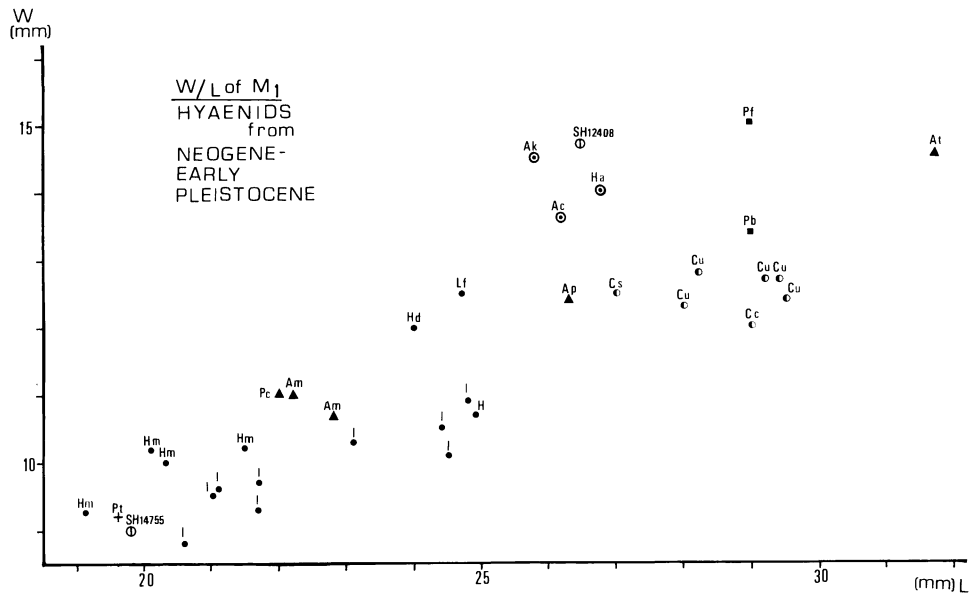

Fig. 3. Comparison of lower Ml from Neogene to early Pleistocene of Afro-Eurasia (ibid.)

The lower Ml of sp. A is smaller than that of KNM-SH 12408 (*Percrocuta* sp., Nakaya *et al.* 1984). The lower P4 of sp. B is smaller than that of sp. C. Tooth sizes of sp. A and sp. B are compatible the genus group designated as "the Fossil Hyaena" from the old world (Ficcarelli and Torre, 1970, see Figure 2,3). The group includes tha genera *Hyaena, Leecyaena* (*Lycyaena*), *Ictitherium*. Tooth size of sp. C is greater than that of "*Pachycrocuta*" group (Ficcarelli and Torre, 1970) and *Percrocuta* and *Adcrocuta* from Asia Minor (Schmidt-Kittler, 1976). Canine of sp. D is similar in size ot Recent *Felis leo*, but recent felids and hyaenids do not have a strong keel on the canine. This specimen seems to be similar to Machairodontinae (Churcher, personal Communication). The authors will make further comparisons.

ORDER PROBOSCIDEA
SUBORDER COMPHOTHERIOIDEA
Family Gomphotheridae HAY, 1922
Genus *Tetralophodon* FALCONER et CAUTLEY, 1857
Tetralophodon sp.

(Plate 1, fig. 7, Plate 2 Figs. 1,2)

Material ..... Skull with M^2 & M^3 (KNM-SH 15858 loc. SH-33), fragment of M^1 or M^2 (KNM-SH 15779 loc. SH-53), DP_3 (KNM-SH 15781 loc. SH-53), right DP_2 (KNM-SH 15782 loc. SH-23)

Horizon ..... Namurungule Formation, lower member

Description

The skull has been deformed, and the brain case is weathered. It is still being prepared by staffs of the National Museums of Kenya. Lamella number (LN) of the intermediate molars (P4-M2) is four, and of the third molar is six. The angle between the upper M2 and M3 is 117° on the right and 118° on the left side.

Measurements (mm) of the materials are as follows:
Measuring points of the skull follow Inuzuka (1977):

greatest length of the skull	850+
greatest breadth of the brain case	500+
greatest breadth of the zygomatic arch	ca700
greatest breadth incisive bone	540
vertical height of the skull	ca900
breadth of the alveoli of M2	236
breadth of the alveoli of M3	289
transverse diameter of the root of the incisor (left)	157+
(right)	177
antero-posterior diameter of the root of the incisor (left)	180
(right)	154+

		crown length	crown breadth	LN
left	M^2	166	100	4
right	M^2	190	101	4
left	M^3	244	114	6
right	M^3	237	121	6
right	DP_2	32.5	21.2+	2
	DP_3	45.3	32.8	2

Discussion

The number of lophs of the teeth of those specimens indicate the genus *Tetralophodon* (Osborn 1936, Tobien 1978). Until *Tetralophodon* sp. was recorded from the Samburu Hills (Nakaya *et al.* 1984), it was known in sub-Saharan Africa only from the Lake Albert area of Zaire (Madden, 1977) from Sub-Saharan Africa, but the identification of this specimen was changed to *Stegotetrabelodon grandincisivum* by Madden (1982). The new skull (KNM-SH 15858) is smaller than that of *Tetralophodon longirostris* from Spain (Alberdi 1977), and the angle between the upper M2 and M3 indicates that the skull is more advanced than in *T. longirostris* (ibid) and *Paratetralophodon* from the Siwaliks (Tassy 1983). This skull is terefore potentially a very important link between the Elephantidae and the Gomphotheriidae. After preparation, a detailed study should establish its relationships with *Stegotetrabelodon* (Maglio 1973, 1974) and *Anancus* (Mebrate and Kalb 1981,

1983).

ORDER DEINOTHERIOIDEA
Family Deinotheriidae BONAPARTE, 1845
Genus *Deinotherium* KAUP, 1829

Deinotherium sp.

(Plate 3, figs. 1,2,3,4)

Material ..... Mandible with left P_3-M_3 (KNM-SH 15776, loc. SH-54 excavation), mandible with right P_3-M_3, left P_3 & P_4, tusk (KNM-SH 15778 loc. SH-40), left M_2 or M_3 (KNM-SH 15783 loc. SH-57), tusk (KNM-SH 15777, loc. SH-28)

Horizon Namurungule Formation, lower member

Description

The almost complete mandible (SH-15776) lacks the lower ineisors. The symphysis of the mandible is bent ventrally in the manner characteristic of deinotheres. The lower Ml is a trilophodont tooth, while the other molars have two lophs. The lower M3s also possess large talonids.

Measurements (mm) of the material (SH-15776) are as follows:

Lower		crown length	crown breadth	crown height
left	P_3	57.6	48.4	50.1
left	P_4	64.0	53.2	34.7
right	P_4	67.1	55.7	30.0
left	M_1	84.9	58.8	24.0+
right	M_1	84.2	59.9	20.0
left	M_2	74.4	70.0	33.1
right	M_2	73.6	74.3	37.2
left	M_3	89.6	68.0	34.2
right	M_3	89.0	70.9	33.0

The right mandible fragment (SH-15778) has a complete cheek tooth row. The lower M3 has a weak talonid. In all other respects, this specimen is very similar to the mandible KNM SH-15776.

Measurements (mm) of the materials are as follows:

		crown length	crown breadth	crown height
left	P_3	57.7	43.9	45.2

right	P_3	56.9	44.9	48.7
left	P_4	63.4		
right	P_4	64.0	51.1	35.5
right	M_1	73.9	55.4	30.2
right	M_2	70.8	65.7	39.4
right	M_3	73.0	68.2	41.0
left	$M_{2/3}$	71.8	36.9+	

	total length	proximal height	proximal breadth	distal height	distal breadth
left I		92.0		72.0	42.4
right I	265.0	98.8	73.7	73.5	53.4

The lower incisor (SH-15777) has the curvature characteristic of deinotheres. No cheek teeth were found in association with this specimen.

Measurements (mm) of the tusk (SH-15777) are as follows:

Lower	total length	proximal height	proximal breadth	distal height	distal breadth
left I	650.0	118.0		34.5	32.0

Discussion

Comparison of *Deinotherium*

Two different deinotheres existed at the same time and in the same area on the basis of the talonid on lower M3. We do not decide that this morphological difference of the deinothere teeth is the individual variation, sex dimorphism or specific difference in this report. The tooth size of these deinothere is similar. Since deinotheres at the Namurungule Formation are only represented by the mandible and lower teeth. It is difficult to identify whether they belong to *Deinotherium* or *Prodeinotherium* on the morphological characters of teeth. Nevertheless, size of the lower cheek teeth of the Namurungule Formation sample is larger than minimum size of all teeth of *Deinotherium* and the maximum size of *Prodeinotherium* (Harris 1973) except M2. In previous a report (Nakaya *et al.* 1984), deinothere materials were identified with *Prodeinotherium* because the only material available were a lower M2 and a fragment of M1. In this report, these materials are identified as *Deinotherium*.

ORDER PERISSODACTYLA
SUBORDER HIPPOMORPHA
Family Equidae GRAY, 1821
Genus *Cormohipparion* SKINNER et MACFADDEN, 1977
?"*Cormohipparion*" (*Sivalhippus*) *perimense* (PILGRIM, 1910)

(Plate 4, figs. 1-12)

Material ..... Skull (KNM-SH 15683 loc. SH-53), maxilla with right P^3-M^1 (KNM-SH 14773 loc. SH-50), left P^4 (KNM-SH 15663 loc. SH-59, 15662 loc. SH-53),left M^1 or M^2 (KNM-SH 15668 loc. SH-53), left M^3 (KNM-SH 14766 loc. SH-53), right M^3 (KNM-SH 15664 loc. SH-53), left P_3 or P_4 (KNM-SH 15648 loc. SH-52), right P_3 or P_4 (KNM-SH 15650 loc. SH-15) right M_3 (KNM-SH 15649 loc. SH-15, 156534 loc. SH-53), navicular (KNM-SH 15681 loc. SH-50), 3rd. middle phalanx (KNM-SH 14777 loc. SH-62, 14788 loc. SH-51)

Horizon ..... Namurungule Formation, upper and lower member

Description

The preobital fossa (POF) in skull (SH 15683) is moderately long, its posterior pocket is shallow, and the anterior rim is poorly defined. The POF is oriented anteroposteriory, its medial depth is moderate to shallow, the outline of the POF is moderately and its ventral border not irregular.

The upper cheek teeth show complex plication within the fossettes, the pli-caballine are double, protocones are elongate and the hypoconal grooves are deep.

Measurements (mm) of the materials are as follows:

Skull (KNM-SH 15683)	(left)	(right)
length of POF	62.8	64.0
height of POF	36.7	45.4
length of POB	50.8	53.2
length of orbit	57.4	58.4
height of orbit	50.0	40.5
length of P^2-orbit	147.9	155.0
length of cheek teeth (P^2-M^3)	149.3	150.0
length of premolar row (P^2-P^4)	81.6	81.3
length of molar row (M^1-M^3)	68.2	70.1
length of P^2-occipital condyle		356
breadth at anterior end of left and right P^2		60.0
breadth at anterior end of left and right M^1		105.0
breadth at posterior end of left and right M^3		87.6
breadth of zygomatic arch		159.5
breadth of brain case		90.8

	KLM-SH	crown length	crown breadth	protocone length	protocone breadth	crown height
left P^2	(15683)	32.7	26.0	9.0	4.6	
right P^2	(15683)	33.0	25.9	8.6	4.7	
right P^2	(14761)	30.0	23.4	6.9	5.2	20.8
left P^3	(15683)	26.8	27.0	9.8	4.7	
right P^3	(15683)	37.4	27.2	10.0	4.5	
left P^4	(15683)	25.7	25.8	8.3	3.6	
left P^4	(15653)	25.9	23.6	7.5	2.9	20.7
left P^4	(15662)	25.6	24.4	6.6	3.8	51.1
right P^4	(15683)	26.0	25.9	8.0	3.8	
right P^4	(14773)	26.1	24.2	7.2	3.8	
left M^1	(15683)	24.4	23.6	9.2	3.0	
left M^1	(15668)	23.0	24.1	9.1	4.8	27.0
right M^1	(15683)	24.1	23.9	9.1	4.7	
right M^1	(15668)	23.5	23.1	8.8	4.5	23.2
left M^2	(15683)	24.3	24.0	8.9	4.1	
right M^2	(15683)	24.2	23.7	9.0	4.3	
left M^3	(15683)	22.1	19.9	8.2	3.4	
left M^3	(14766)	23.2	19.0	7.5	3.4	41.4
right M^3	(15683)	23.4	20.0	8.0	3.1	
right M^3	(15664)	22.7	19.9	7.2	3.2	30.2

		crown length	crown breadth	crown height
left $P_{3/4}$	(15648)	28.3	13.8	50.5
right $P_{3/4}$	(15650)	29.6	18.8	52.0
right M_3	(15649)	30.2	13.3	39.3
right M_3	(15654)	30.3	10.5	34.0

Plication number of the upper cheek teeth of KNM-SH 15683

(Measuring method of plication follows Hooijer 1975)

	prefossette	postfossette
left P^2	6	7
right P^2	4	6
left P^3	14	7
right P^3	8	6
left P^4	12	7
right P^4	8	4
left M^1	7	5
right M^1	8	6

left M^2	8	6
right M^2	9	7
left M^3	7	2
right M^3	5	1

3rd. middle phalanx

KNM-SH	(14777)	(14788)
total Length	37.0	36.9
length of the proximal-distal articular surface	28.9	31.4
breadth of the proximal end	37.6	39.6
breadth of the body	31.4	34.4
breadth of the distal end	31.3	32.9
diameter of the proximal end	26.3	29.1
diameter of the body	16.7	18.5
diameter of the distal end	18.7	18.6

Hipparion sitifence POMEL, 1897

(Plate 5, figs. 1-16)

Material ..... Left DP^2 (KNM-SH 15706 loc. SH-22), left DP^3 (KNM-SH 15665 loc. SH-53), left DP^4 (KNM-SH 15669 loc. SH-53), DP^3 or DP^4 (KNM-SH 15818 loc. SH-52), right P^2 (KNM-SH 14764 loc. SH-53), left P^2 (KNM-SH 14796 loc. SH-53, 15651 loc. SH-54), right P^3 or P^4 (KNM-SH 15656 loc. SH-50, 15659 loc SH-54), left P^3 or P^4 (KNM-SH 15671 loc. SH-54, 15705 loc. SH-53), left M^1 (KNM-SH 14763 loc. SH-53, 15661-A loc. SH-54), right M^1 (KNM-SH 15641 loc. SH-53), left M^2 (KNM-SH 15652, 15661-B loc. SH-54), right M^2 (KNM-SH 15672 loc. SH-53, 15676, 15817, loc. SH-54), right M^3 (KNM-SH 15658 loc. SH-54), right M^1-M^3 (KNM-SH 14774 loc. SH-51), left P^3 or P^4 (KNM-SH 15647 loc. SH-54), right P^2 (KNM-SH 15644-A loc. SH-53), right P^3 or P^4 (KNM-SH 15646 loc. SH-54), right M^1? (KNM-SH 15644-B loc. SH-53), right M^2 (KNM-SH 15645 loc. SH-53), left M^3 (KNM-SH 15663 loc. SH-63),, left magnum (KNM-SH 15673 loc. SH-50), right talus (KNM-SH 14762 loc. SH-52), left talus (KNM-SH 15643, 15709 loc. SH-53), right calcaneum (KNM-SH 15682, 15819, loc. SH-53), left navicular (KNM-SH 15670 loc. SH-54), right cuneiform (KNM-SH 14814-L loc. SH-53), right 3rd. metacarpal (KNM-SH 15678 loc. SH-50), 3rd. metatarsal (KNM-SH 14814-A, D, E loc. SH-53, 15679 loc. SH-51), lateral metapodial (KNM-SH 14814-B, C, F, G, K loc. SH-53), right 3rd. proximal phalanx (KNM-SH 15674 loc. SH-53, 15677 loc.

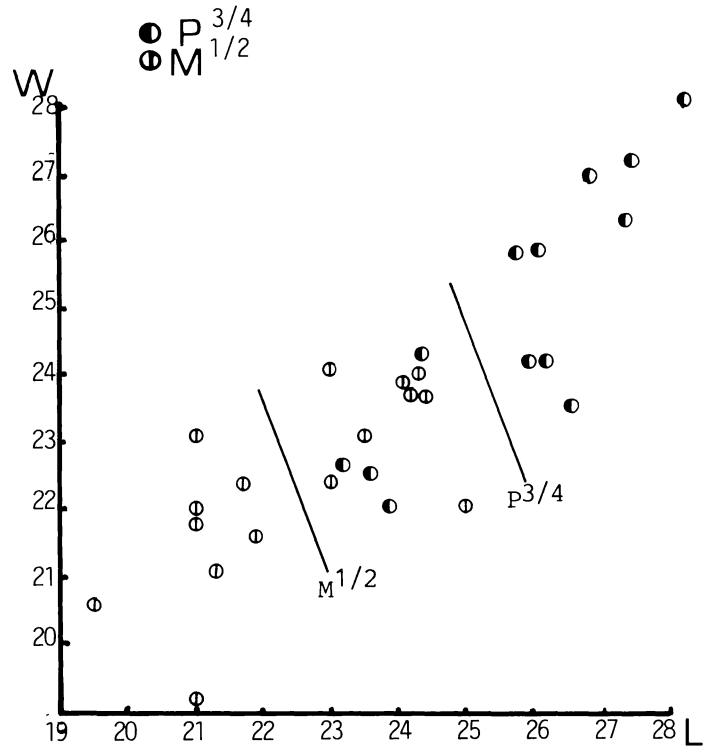

Fig. 4. Comparison of the Breadth/Length of the cheek teeth of Hipparionine from Samburu Hills
Line $P^{3/4}$ and $M^{1/2}$ shows size boundary of $P^{3/4}$ and $M^{1/2}$ of large hiparionines and small hipparionine.

SH-61), 3rd. middle phalanx (KNM-SH 14814-H loc. SH-53), lateral middle phalanx (KNM-SH 15708 loc. SH-53), 3rd. distal phalanx (KNM-SH 15675 loc. SH-53), sesamoid of distal phalanx (KNM-SH 14814-I, J loc. SH-53)

Horizon ..... Namurungule Formation, upper and lower member

Description

The cheek teeth are small and the limb bones are slender and long. This material, and that previously reported as a small form of *Hipparion* (Nakaya *et al.* 1984) is identified as *H. sitifense* (Figure 4).

Measurements (mm) of the materials are as follows:

	KNM-SH	crown length	crown breadth	protocone length	protocone breadth	crown height
left	DP^3 (15665)	24.9	20.0	6.8	3.1	49.5

left	DP^4 (15669)	24.9	20.5	6.0	3.7	47.2
left	P^2 (14796)	28.2	21.9	7.8	4.5	31.5
right	P^2 (14764)	28.9	22.1	7.8	5.0	28.1
left	$P^{3/4}$ (15705)		20.5	7.6		34.0+
right	$P^{3/4}$ (15656)	23.8	22.1	7.0	2.9	32.5
right	M^1 (15641)		22.3	7.7	4.9	21.0
left	$M^{1/2}$ (14763)	21.7	22.4	7.9	3.9	39.5
right	M^2 (15817)	21.0	22.0	7.6	4.5	24.6
right	M^2 (15672)	21.0	23.1	7.2	5.5	21.0

	KNM-SH	crown length	crown breadth	crown height
right	P_2 (15644)	26.7	12.0	32.3
left	$P_{3/4}$ (15647)	23.1	11.8	44.0
left	$P_{3/4}$ (15646)	26.0	13.9	43.5
right	M_1 (14774)		11.0	32.7
right	M_2 (14774)	23.5	10.5	42.0
right	M_2 (15645)	22.5	12.1	
left	M_3 (15663)	25.1	10.1	42.2
right	M_3 (14774)			33.6
right	CT (15644)	21.7	10.9	41.2

CT : Cheek teeth

	KNM-SH	1	2	3	4	5	6	7	8
3rd. metacarpal	(15678)			33.5	28.3		26.7	20.7	
3rd. metatasal	(15679)				28.3	33.4		21.9	27.2
3rd. metatarsal	(14814-A)				25.4			22.9	
3rd. metatarsal	(14814-E)					31.1			27.6
lateral metatarsal	(14814-B)				3.3			5.7	
lateral metatarsal	(14814-B)				3.1			5.9	
lateral metatarsal	(14814-C)			5.5	4.6		12.0	5.9	
lateral metatarsal	(14814-C)			5.5			13.0		
right proximal phalanx	(15674)	52.2	50.2	29.5+	21.6	23.8	27.0+	27.9	19.8
right proximal phalanx	(15677)	51.5	49.0	30.6+	25.0	28.5	23.0+	15.2	16.0
middle phalanx	(14814-H)	32.9	26.6	28.5+	26.2	25.6	24.5	15.8	16.3
phalanx	(15708)	18.9	12.4	12.1	10.5	7.4	15.1	11.3	9.4

1 : total length

2 : length of the proximal-distal articular surface

3 : breadth of the proximal end

4 : breadth of the body
5 : breadth of the distal end
6 : diameter of the proximal end
7 : diameter of the body
8 : diameter of the distal end

distal phalanx (KNM-SH 15675)	
dorsal length	38.8
ventral length	40.0
total height	25.7
height of the articular surface	20.5
total breadth	32.7+
breadth of the articular surface	26.1

Discussion

Comparison of Hipparionine

Many taxa of *Hipparion* have been described from the Neogene of Africa, for example *Hipparion afarense, H. africanum, H. albertense, H., ethiopicum, H. libycum, H. primigenium, H. stifense* and *H. turkanense* (Aramborg 1956 ; Bone & Singer 1965 ; Hooijer & Maglio 1973, 1974 ; Aguirre & Leakey 1974 ; Hooijer 1975). The phylogenetic and geographical relationships of the Old World hipparions have also been studies (Forsten 1968 ; Eisenmann 1979, 1982 ; Bernor & Hussain 1985).

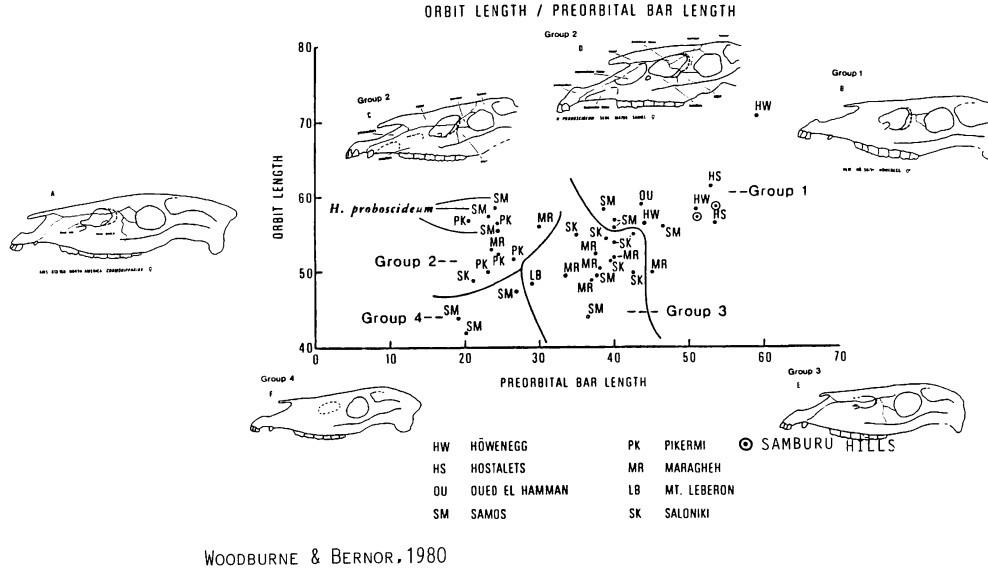

Fig. 5. Comparison of Orbit length/Preorbital bar length of Old World hipparionine (Woodburne and Bernor, 1980) and large hipparionine from Samburu Hills.

Late Miocene *Hipparion* from sub-Saharan Africa has been assigned to two species, *H. primigenium* (large form) and *H. stifense* (small form). A skull of a large form of *Hipparion* was found in the Samburu Hills in 1984. Since the preorbital fossa was preserved, we are able to assess its phylogenetic relationships. On the basis of length of preorbital bar and orbit, this skull (Figure 5) belongs "Group 1" *Hipparion* from the Old World (Woodburne & Bernor, 1980).

Furthermore, the characteristic shape of the preorbital fossa and the form of the enamel plication on the upper cheek teeth indicates that this material is conspecific with "*Cormohipparion*" (*Sivalhippus*) *perimense* from the Siwaliks (Bernor & Hussain, 1985). Bernor and Hussain (1985) showed that this taxon may be a synonym of *H. primigenium* from Africa and ancestral to *H. turkanense*. The relationships of *H. africanum* to the Samburu Hills skull and the status of *Cormohipparion* require further studies.

The Samburu Hills skull is from approximately the same age as "*C.*" (*S.*) *perimense* from the Siwaliks. This suggests that the immigration of this *Hipparion* to the Siwalik region and to Africa took place at about the same time.

SUBORDER CERATOMORPHA
Family Rhinocerotidae OWEN, 1845
Genus *Paradiceros* HOOIJER, 1968

Paradiceros sp.

(Plate 6, figs. 1,2,3)

Material ..... Left maxilla with P^4-M^3 (KNM-SH 15835 loc. SH-53), left and right P^4 (KNM-SH 15859 loc. SH-55), right DP^2 or DP^3 (KNM-SH 15834 loc. SH-54)

Horizon ..... Namurungule Formation, lower member

Description

A medium-sized Rhinocerotidae having brachyodont molars with anterior and lingual cingula, and a well developed crochet and antecrochet. The ectoloph is strongly curved and inclined lingually. The lingual-buccal cross section on the upper molar is trapezoidal in shape.

Measurements (mm) of the teeth are as follows:

		KNM-SH	crown length	crown breadth	crown height
right	$DP^{2/3}$	(15834)	30.0	25.8	25.5
left	P^4	(15859)	42.6	47.1	38.4+
left	P^4	(15835)	37.8+	46.4	33.8+
right	P^4	(15859)	39.0+	47.9	23.2+

left	M^1	(15835)	46.8	44.0+	32.7+
left	M^2	(15835)	50.2	52.2	43.7+
left	M^3	(15835)	36.0+	47.1+	44.2+

Discussion

In the late Miocene of East Africa, brachyodont rhinocerotid of the genera *Acerathrium, Brachypotherium*, and *Paradiceros* are recorded (Hooijer 1963, 1966, 1968 ; Hooijer and Patterson, 1972). The upper molars of *Acerathrium* have constricted procones, and those of *Brachypotherium* have flattened ectolophs, no crista and weak crochets and antecrochets. Those of *Paradiceros* have curved ectolophs and well developed cristae and crochets, and the Samburu Hills material is accordingly identified with *Paradiceros*. Its specific identity must await the discovery of more and better specimens.

Rhinocerotidae gen. et sp. indet. KNM-SH 12175 (Mandible) from Samburu Hills (Nakaya *et al.* 1984) seems to belong the same taxa.

Genus *Chilotheridium* HOOIJER, 1971

Chilotheridium sp.

(Plate 6, fig. 4, Plate 7, figs. 1-5)

Material ..... Right M^2 & M^3 (KNM-SH 15833 loc. SH-64), left M^3 (KNM-SH 15861 loc. SH-55), left M^3 (KNM-SH 15831 loc. SH-54, 15832 loc. SH-55), right M^2 & M^3, left M^3 (KNM-SH 15840 loc. SH-55), right DP_2-DP_4 (KNM-SH 15753 loc. SH-62), right DP_4-M_2 (KNM-SH 15749 loc. SH-62), left M_1 & M_2 (KNM-SH 15754 loc. SH-64), left M_1-M_3 (KNM-SH 15774 loc. SH-52), right M_2 & M_3 (KNM-SH 15769 loc. SH-64), right P_2 or P_3, left M_1 & M_2 (KNM-SH 15752 loc. SH-54), right M_1 & M_2 (KNM-SH 15751 loc. SH-54), right M_1 & M_3 (KNM-SH 15866 loc. SH-64), right M_1 or M_2 (KNM-SH 15757 loc. SH-55), fragment of maindible (KNM-SH 15758, 15775 loc. SH-54, 15773 loc. SH-55, 15771, 15772 loc. SH-62, 15761, 15764, 15765, 15770 loc. SH-64)

Horizon ..... Namurungule Formation, lower member

Description

A large sized Rhinocerotidae with hypsodont molars. The upper molars have anterior cingula, and developed crochets and antecrochets, but no crown cement. The lower molars have weak external grooves. The dark colored enamel of the cheek teeth has a rugose surface. The mandibular body is relatively deep, and the cross section is an elongated oval shape.

Measurements (mm) of the teeth are as follows:

	KNM-SH	crown length	crown breadth	crown height
right M^2	(15833)	54.5+		31.0
right M^2	(15840)	67.2	61.0	46.0+
left M^3	(15840)	66.4	55.0+	40.0+
left M^3	(15861)	65.0	55.0+	29.0
left M^3	(15832)	60.1	54.3	39.6+
left M^3	(15831)	63.2	50.4+	72.3 (unworn)
right M^3	(15840)	62.4+	55.8+	47.8+
right M^3	(15833)	42.0+	51.7	37.8

	KNM-SH	crown length	crown breadth	crown height
right DP_2	(15753)	21.4+	10.6	
right DP_3	(15753)	34.1	18.4+	21.2
right DP_4	(15753)	40.0+	20.1	25.7
right DP_4	(15753)	39.0	23.0	19.2
right $P_{2/3}$	(15752)	31.6	19.1	24.0
left M_1	(15754)	45.1+	27.1	31.9
left M_1	(15752)	44.4+	24.0+	
left M_1	(15774)	38.0+	24.0+	
right M_1	(15751)	47.9	24.7+	46.6
right M_1	(15749)	44.3	25.8	39.3
right M_1	(15866)		27.3	28.9
right $M_{1/2}$	(15757)	45.8	26.8	32.3
left M_2	(15754)		22.0+	58.9 (unworn)
left M_2	(15774)	41.8	26.0+	32.4+
right M_2	(15751)	45.0+	29.0	55.0+ (unworn)
right M_2	(15769)		29.3	11.8
left M_3	(15774)	47.6	27.0	35.0+
right M_3	(15769)	42.9+	30.0	12.9
right M_3	(15866)	51.2	29.9	30.6

Discussion

Ceratotherium, Chilotherium and *Chilotheridium* have been described as Miocene hypsodont rhinocerotids from East Africa (Hooijer 1971, 1973). The characteristics of the Samburu Hills molars indicate that these materials are similar to *Chilotheridium pattersoni* Hooijer 1971, but because the preservation of the specimens is poor, we identify these materials as *Chilotheridium* sp.

Genus *Kenyatherium* AGUIRRE et GUERIN, 1974

Kenyatherium bishopi AGUIREE et GUERIN, 1974

(Plate 8, fig. 1)

Material ..... Right M^1 (KNM-SH 15827, loc. SH-50)
Horizon ..... Namurungule Formation, lower member

Description

A small-sized Rhinocerotidae. Only one well worn molar is known from the Smaburu Hills. This upper molar has a anterior cingulum, a constricted protocone, a large antecrochet, and a smaller crochet and crista, and some crown cement is preserved.

Measurements (mm) of the tooth are as follows:

	crown length	crown breadth	crown height
right M^1	32.4+	40.0+	16.0

Discussion

The paratype of *Kenyatherium bishopi* Aguirre and Guerin 1974 (KNM-NA 199, left M1) from Nakali, south of the Samburu Hills, is very similar to this tooth., However, according to Aguirre and Guerin, molars of *K. bishopi* have no crown cement, although it could have been lost through weathering or during preparation. The type of *K. bishopi* is similar to *Hispanotherium* (Crusafont and Villalta, 1947, Villalta and Crusafont, 1952), *Caementodon* (Heissig, 1972) and *Sinotherium* (Ringstrom, 1922) of the Iranotheriinae (Auirre and Guerin 1974).

Rhinocerotidae gen. et sp. indet. (KNM-SH 12142, lower molar) from the Samburu Hills (Nakaya *et al.* 1984) seems to belong the same taxon.

Rhinocerotidae gen. et. sp. indet.

(Plate 8, figs. 2-5)

Material ..... Left M^2 & M^3 (KNM-SH 15826 loc. SH-50, 15830 loc. SH-53), right M^3 (KNM-SH 15824 loc. SH-55, 15825 loc. SH-50, 15828 loc. SH-55), right P^3 or P^4 (KNM-SH 15829 loc. SH-54), right P^3-M^3 (KNM-SH 15767 loc. SH-50), left P_4 (KNM-SH 15768 loc. SH-50), left mandible (KNM-SH 15711 loc. SH-53)
Horizon ..... Namurungule Formation, lower member

Description

A medium-sized Rhinocerotidae. The molars represented are all well worn. The upper molars have well constricted protocones and hypocones, crown cement is present, and only the anterolingual cingula are developed. The light-colored enamel has a smooth surface. The mandibular

body is low, and the cross section of the body anteriorly is round or oval.

Measurements (mm) of the teeth are as follows:

	KNM-SH	crown length	crowm breadth	crown height
right $P^{3/4}$	(15829)			15.0+
left M^2	(15826)	46.2+	59.5	24.1
left M^3	(15826)	51.6	53.0	30.5
right M^3	(15824)			17.4
right M^3	(15825)		44.0	14.0
right M^3	(15828)	53.4	40.4+	28.4
left P_4/M_1	(15768)	36.1	29.0	16.5
right P_4	(15767)	33.6	29.9	12.0
right M_1	(15767)	39.7	32.0+	6.7
right M_2	(15767)	47.7+	30.5+	11.1
right M_3	(15767)	47.1		

Discussion

The characteristics of these specimens are not found in any of the recorded Miocene rhinocerotids from East Africa. Only *Kenyatherium* is similar in the character of the protocone. However, the cheek teeth of *Kenyatherium* are smaller. A comparison with other Tertiary Rhinocerotidae is necessary before indetification may be attempted.

ORDER ARTIODACTYLA
SUBORDER SUIFORMES
Family Suidae GRAY 1821
Genus *Nyanzachoerus* LEAKEY 1958

Nyanzachoerus sp.

(Plate 9, figs.1-3)

Material ..... Left M_3 (KNM-SH 14758 loc. SH-51), left mandible (KNM-SH 14760 loc. SH-50), left and right I_1 & I_2 (KNM-SH 14768 loc. SH-51), right I_2 (KNM-SH 14784 loc. SH-51)

Horizon ..... Namurungule Formation, lower member

Description

The left mandible has well worn cheek teeth and an almost complete set of lower incisors. The enamel of the cheek teeth is moderately wrinkled, and the cusps are columnar.

Measurements (mm) of the teeth are as follows:

		KNM-SH	crown length	crown breadth	crown height	
left	I_1	(14768)	14.7	7.9	12.0	
right	I_1	(14768)	16.7	7.8	12.0	
left	I_2	(14768)	21.2	8.5	13.5	
right	I_2	(14768)	22.3	8.7	13.8	
right	I_2	(14784)	29.8	8.3	14.0	
left	P_1	(14760)		ca 5.3		(no crown)
left	P_2	(14760)		ca 8.4		(no crown)
left	P_3	(14760)		ca 13.6		(no crown)
left	P_4	(14760)	23.5	16.5	5.8	
left	M_1	(14760)	18.5	13.8	7.0	
left	M_2	(14760)		20.0	8.8	
left	M_3	(14758)	35.1	20.3	11.7	

Discussion

With the exception of the M_3, the characteristics of the cheek teeth have been obscured by wear, but it is clear that the material represents the genus *Nyanzachoerus*. The M_3 is shorter than those of *N. pattersoni* (Cooke & Ewer, 1972), *N. jaegeri* and *N. kanamensis,* but is similar in length to the M_3 of *N. tulotos* (Harris & White, 1979).

Family Hippopotamidae GRAY, 1821
Genus *Kenyapotamus* PICKFORD, 1983
Kenyapotamus coryndoni PICKFORD, 1983

(Plate 9, figs.4-8)

Material ..... Right M^1 or M^2 (KNM-SH 15850 loc. SH-53), left M^1 or M^2(KNM-SH 15851 loc. SH-53), left and right C, P_3-M_3 (KNM-SH 15857 loc. SH-15), left M_1 or DP_4(KNM-SH 14789 loc. SH-53), left M_1 & M_2 (KNM-SH 14792 loc. SH-53)

Horizon ..... Namurungule Formation, upper and lower member

Description

A nearly complete mandible lacking only the ventral parts. The cheek teeth are well worn. The plication on the cheek teeth is weak but the enamel is thick.

Measurements (mm) of the teeth are as follows:

KNM-SH	crown length	crown breadth	crown height

	C	(15875)	49.0	19.4	31.5
	C	(15875)	72.0	24.6	37.8
left	$M^{1/2}$	(15851)	26.2	21.3	
right	$M^{1/2}$	(15850)	20.3	19.0	
left	C	(15857)		27.9	36.7
right	C	(15857)		21.7	39.5
left	P_3	(15857)	31.1	16.9	15.6
right	P_3	(15857)	36.1	15.5	12.8
left	P_4	(15857)	25.1	16.7	10.7
right	P_4	(15857)		17.2	14.4
left	DP_4/M_1	(14789)		17.2	
left	M_1	(14792)	25.2	18.9	
left	M_1	(15857)	27.9	13.7	
right	M_1	(15857)	25.0	25.7	
left	M_2	(14792)	24.8	18.5	
left	M_2	(15857)	32.9	26.3	10.0
right	M_2	(15857)	33.5	26.1	9.3
left	M_3	(15857)	43.4	23.8	6.8
right	M_3	(15857)	42.8	23.6	7.1

Discussion

The characters of the cheek teeth are obscured by wear, but the size of cheek teeth of specimen clearly accords with *Kenyapotamus coryndoni* (Pickford, 1983).

SUBORDER RUMINANTIA
Family Giraffidae GRAY, 1821
Genus *Palaeotragus* GAUDRY, 1821

Palaeotragus sp.

(Plate 10, figs.1-5)

Material ..... Left M^1 & M^2 14759 loc. SH-51), right P^2 (KNM-SH 15843 loc. SH-22), left M_3 (KNM-SH 15860 loc. SH-53), right M_{1-3} (KNM-SH 15845 loc. SH-53), left DP_2 or P_2 (KNM-SH 15838 loc. SH-22), left P_3 (KNM-SH 15844 loc. SH-22), left M_1 or M_2 (KNM-SH 15842 loc. SH-22), left M_2 & M_3? (KNM-SH 15846 loc. SH-56)

Horizon ..... Namurungule Formation, lower member

Description

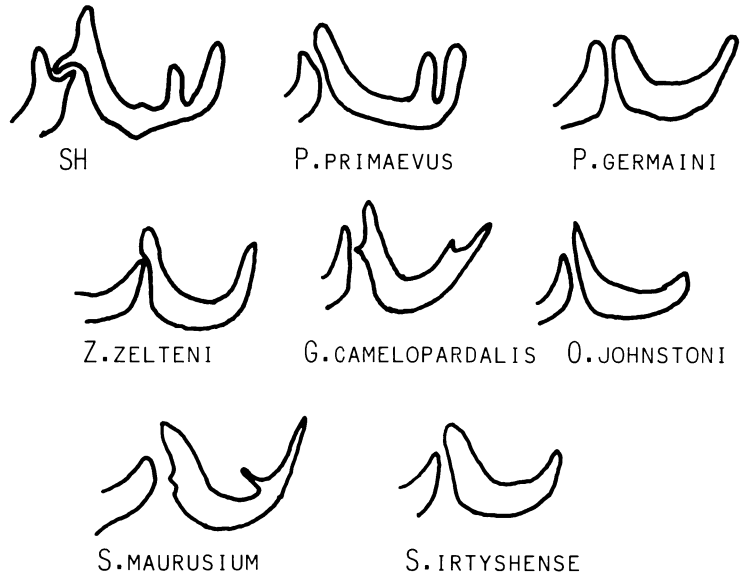

Fig. 6. Comparison of hypocone of upper M1 of Giraffids from Africa (Churcher 1978, 1979) and Samburu Hills material. G.; *Giraffa*, O.; *Okapia*, P.; *Palaeotragus*, S.; *Sivatherium*, Z.; *Zarafa*, SH; Samburu Hills material.

The enamel of the cheek teeth has vertical wrinkles, and the plication of the hypocone of the upper molar is four branched. The anterior cingulum of the upper molar is longer than the posterior cingulum, and a lingual accessory cusp is present. There is a buccal accessory cusp on the lower cheek teeth.

Measurements (mm) of the teeth are as follows:

			length	breadth	height
right	P^2	(15843)	11.0	8.8	16.5
left	M^1	(14759)	28.5	28.9	16.1
left	M^2	(14759)	32.9	31.6	22.9
right	M_2	(15845)	28.4	18.8	16.5
left	DP_2	(15838)	16.9	9.8	9.2
left	P_3	(15844)	23.1	12.0	17.0
left	M_1	(15842)	24.5	18.1	9.3
left	M_3	(15860)	34.0+	15.0+	16.5

Discussion

The characters of the upper molars seem to indicate the genus *Palaeotragus* reported by Churcher (1979), but the Samburu Hills materials differ from *P. genmaini* in the shape worn curves (Figure 6, Churcher, 1979). Although Hamilton (1978) discussed the phylogenetic relationships of Miocene Giraffoidea, he did not use characters of upper and lower molars to differentiate species, and the specific identification of the Samburu Hills giraffoid is therfore uncertain.

MATERIAL LIST AND MEASUREMENTS OF BOVIDAE

The authors have not enough data of discussion Bovidae from the Samburu Hills. Therefore, in the following paragraphs we use only provisional taxonomic names list the material and give measurements.

Family Bovidae GRAY, 1821
Genus *Pachytragus* SCHLOSSER, 1904

Pachytragus sp.

(Plate 10, figs. 6-7)

Material ..... Frontal with left and right horn core (KNM-SH 15717 loc. SH-55), left horn core (KNM-SH 15728 loc. SH-54, 15740 loc. SH-51), right horn core (KNM-SH 15718-A loc. SH-53, 15720 loc. SH-54), horn core (KNM-SH 15718-B loc. SH-53), right horn base (KNM-SH 15713, 15748 loc. SH-53)

Horizon ..... Namurungule Formation, lower member

Measurements (mm) of the horn cores are as follows:

			(base of horn)			(10 cm above)		(20 cm above)	
		KNM-SH	total length	antero-post. length	trans-verse breadth	length	breadth	length	breadth
right	horncore	(15720)	205	51.0	38.1	42.7	23.3	35.5	20.6
right	horncore	(15717)	145	53.0	30.7	42.6	22.9		
left	horncore	(15717)	122	52.9	31.8	43.9	23.5		
left	horncore	(15728)	65	55.0	30.5				
right	horncore	(15718-A)	150	43.5	30.5	34.3	21.3		
	horncore	(15718-B)	105			39.7	26.3		

Genus *Palaeoreas* GAUDRY, 1861

Palaeoreas sp.

(Plate 10, figs. 8-9)

Material ..... Frontal with left horn core (KNM-SH 15716 loc. SH-52), left horn core (KNM-SH 15731 loc. SH-53), right horn core (KNM-SH 15710

loc. SH-52, 15723 loc. SH-55, 15725 loc. SH-53), horn core (KNM-SH 15714, 15715, 15719, 15721, 15722 loc. SH-52, 15734 loc. SH-53, 15738 loc. SH-51, 15711 locality unknown)

Horizon ..... Namurungule Formation, lower member

Measurements (mm) of the horn cores are as follows:

	KNM-SH	total length	(base of horn) length	breadth	(10 cm above) length	breadth	(20 cm above) length	breath
left horncore	(15716)	241	35.3	28.6	20.4	22.0	16.5	14.7
right horncore	(15723)	51.4	32.8	26.9				
left horncore	(15731)	70.6	35.2	26.6				
right horncore	(15725)	70.5	30.7	29.5				
right horncore	(15710)	90.5	29.9	30.0				

Genus *Gazella* BLAINVILLE, 1816

Gazella sp.

(Plate 10, figs. 10-12)

Material ..... Left horn core (KNM-SH 15712 loc. SH-11), right M^1 (KNM-SH 15726 loc. SH-51,15737 loc. SH-50), left P_2-P_4 (KNM-SH 15735 loc. SH-51), right P_3 or P_4 (KNM-SH 15727 loc. SH-51), left M_1 & M_2 (KNM-SH 15736 loc. SH-51), left M_3 (KNM-SH 15739 loc. SH-51)

Horizon ..... Namurungule Formation, upper and lower member

Measurements (mm) of the materials are as follows:

	KNM-SH	crown length	crown breadth	crown height
right M^1	(15737)	15.0	9.0	9.7
right M^2	(15737)	19.0	17.3	16.4
right $M^{1/2}$	(15726)	15.9	13.5	11.1
left P_3	(15735)	9.1	6.8	8.2
right $P_{3/4}$	(15727)	12.5	6.2	10.0
left M_1	(15736)	11.1	6.7	7.5
left M_2	(15736)	14.8	7.9	17.0
left M_3	(15739)	22.9	10.0	5.4

	total length	proximal length	proximal breadth	distal length	distal breadth
left horncore	78.8	28.0	17.6	20.9	14.9

CONCLUSION

The Namurugule fauna differs significantly from the fauna of the Aka Aiteputh Formation near the Samburu Hills, a fact which is ascribed to differences in age and paleoenvironments. The Namurungule fauna reflects a typical savanna environment, whereas the Aka Aiteputh fauna reflects a woodland environment.

Some of the mammals from the Namurungule fauna are advanced forms, which were the fundamental group that developed into the Plio-Pleistocene mammalian fauna of the East African savannas.

Many researchers have studied the Tertiary faunal relationships of Eurasia and Africa (Bernor 1983 ; Bernor *et al.* 1980 ; Eisenmann 1977 ; Guerin 1979, 1980 ; Tassy 1979 ; Thomas 1984a, b ; Thomas *et al.* 1982). All mention the immigration of mammals from Eurasia to Africa. It is clear that there was an appreciable interchange of mammals between the two continents during the late Miocene and the Namurungule fauna is significant in documenting the extent of this interchange (see following table).

Similarity of the Namurungule Fauna (from Nakaya *et al.* 1984 and this report) and other Eurasian Fauna.

Hominoidea gen. et sp. nov.	A
Paraphiomys sp.	A
Paraulacodus sp.	A, S
Hyaenidae spp.	A, E
Tetralophondon sp.	M, S, E
Deinotherium spp.	A, E
Cormohipparion perimense	A, S
Hipparion sitifense (small form)	A, E
Chalicotheriidae gen. et sp. indet.	A, E
Paradiceros sp.	A
Kenyatherium bishopi	A, (M, S, C)
Rhinocerotidae gen. et sp. indet	
Nyanzachoerus sp.	A
Kenyapotamus coryndoni	A
Tragulidae	A, E
Palaeotragus sp.	A, M
Giraffidae (large form)	A, M
Miotragocerus sp A	A, M
Pachytragus sp.	A, M
Palaeoreas sp	A, M
Gazella sp.	A, E

A : unique African taxa, C : Chinese taxa, E : common Eurasian taxa, M : Mediterranean taxa,

S : Siwaliks taxa

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Explanation of Plate 1

(Scale bar represents 20 mm in fig. 1-6)

Hyaenidae gen. et sp. indet.

sp. A

Fig. 1 Buccal view of the left M_1 (KNM-SH 14755)×1

Fig. 2 Longual view of the left M_1 (KNM-SH 14755)×1

Hyaenidae gen. et sp. indet.

sp. B

Fig. 3 Lingual view of the right P_4 (KNM-SH 15841)×1

Fig. 4 Buccal view of the right P_4 (KNM-SH 15841)×1

sp. C

Fig. 5 Buccal view of the right $P_{3/4}$ (KNM-SH 15871)×1

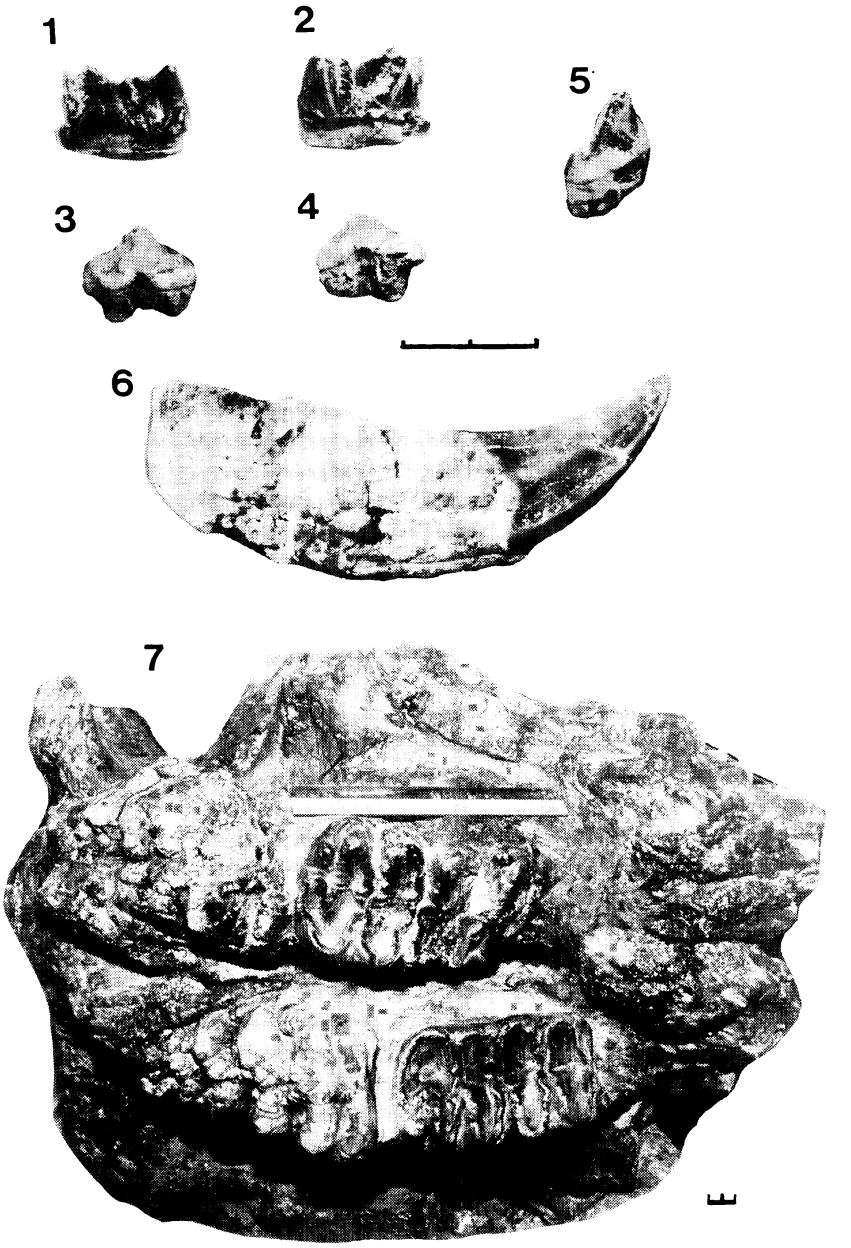
Fissipedia fam., gen. et sp. indet.

Fig. 6 Lingual view of the left lower canine (KNM-SH 14794)×1

Tetralophodon sp.

Fig. 7 Occlusal view of the skull (KNM-SH 15858)×1/5

Plate 1



Explanation of Plate 2

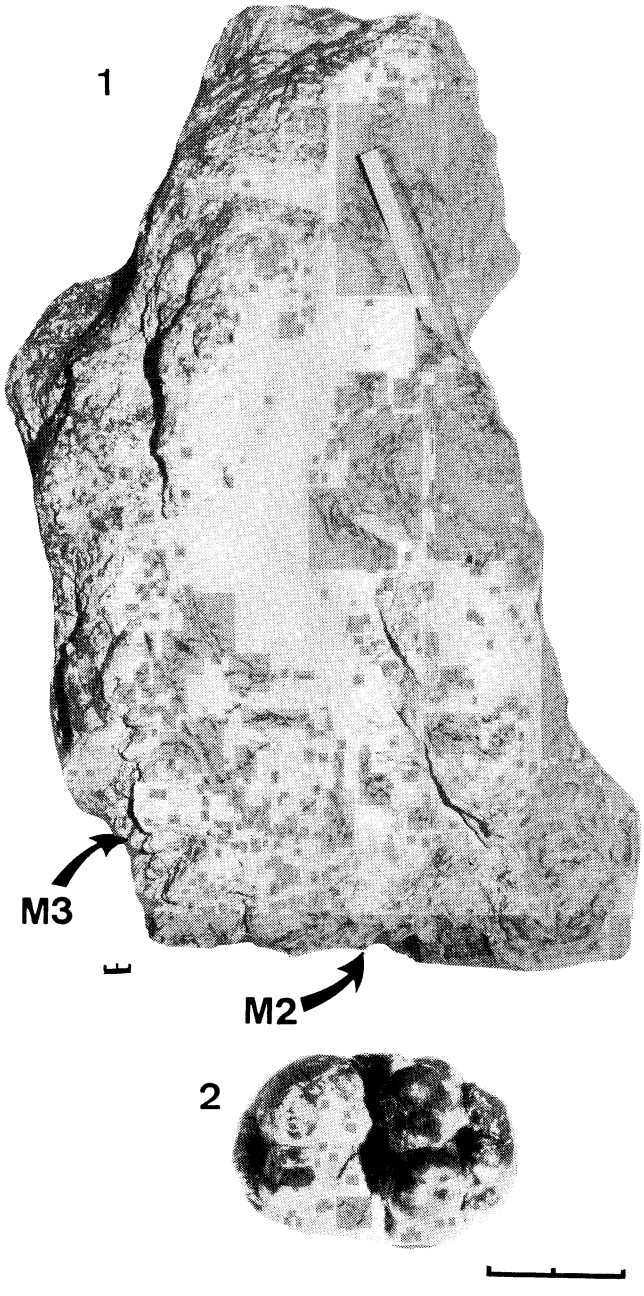
(Scale bar represents 20 mm in fig. 1-2)

Tetralophodon sp.

Fig. 1 Right lateral view of the skull (KNM-SH 15858)×1/5

Fig. 2 Occlusal view of the right DP_2 (KNM-SH 15782)×1

Plate 2



Explanation of Plate 3

(Scale bar represents 20 mm in fig. 1-4)

Deinotherium sp.,

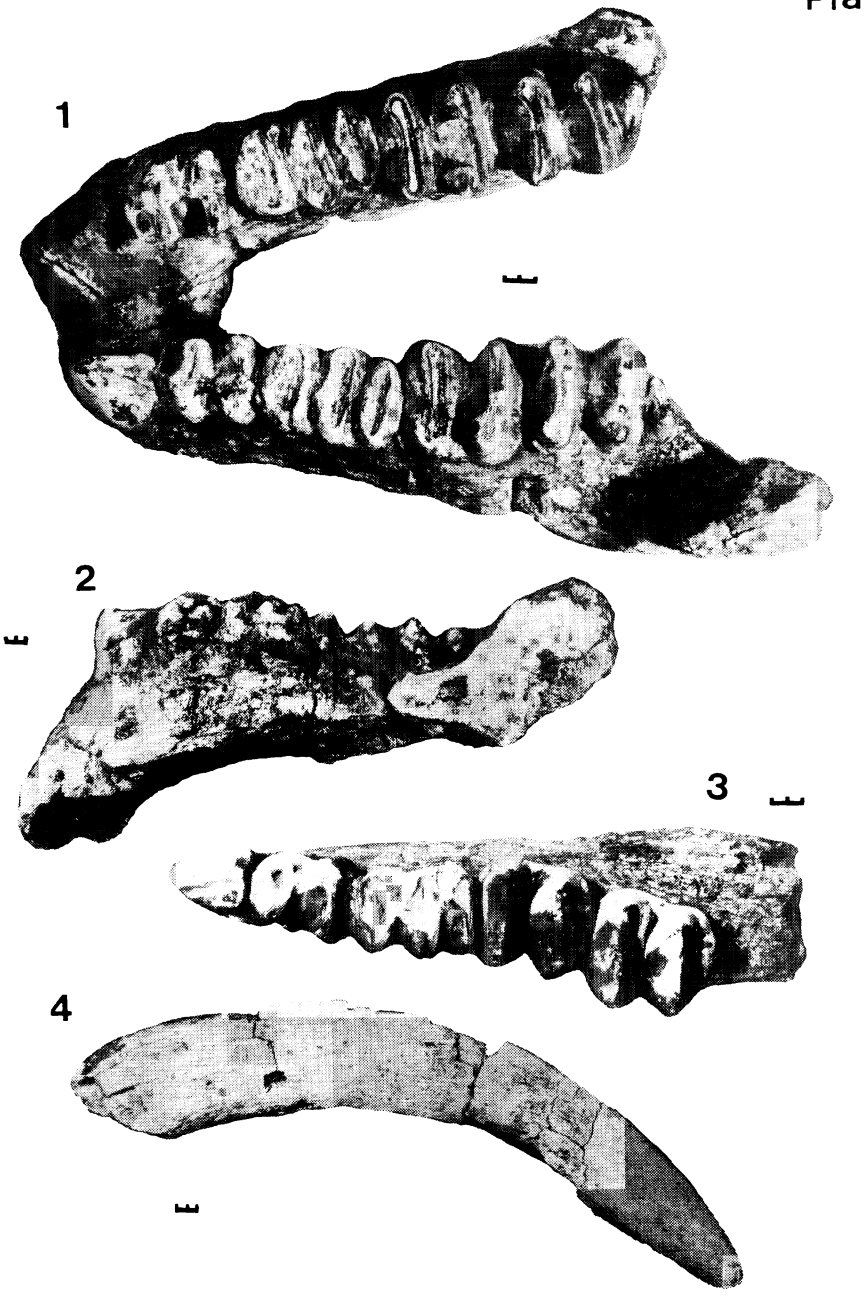
Fig. 1 Occlusal view of the mandible (KNM-SH 15776)×1/4

Fig. 2 Left lateral view of the mandible (KNM-SH 15776)×1/5.3

Fig. 3 Occlusal view of the right mandible (KNM-SH 15778)×1/4

Fig. 4 Lateral view of the tusk (KNM-SH 15777)×1/6.25

Plate 3



Explanation of Plate 4

(Scale bar represents 20 mm in fig. 1-12)

"*Cormohipparion*" (*Sivalhippus*) *perimense*

Fig. 1 Left lateral view of the skull (KNM-SH 15683)×1/4

Fig. 2 Dorsal view of the skull (KNM-SH 15683)×1/4

Fig. 3 Ventral view of the skull (KNM-SH 15683)×1/4

Fig. 4 Occlusal view of the right P^3-M^1 (KNM-SH 15773)×1

Fig. 5 Occlusal view of the right P^2 (KNM-SH 15761)×1

Fig. 6 Occlusal view of the left $M^{1/2}$ (KNM-SH 15668)×1

Fig. 7 Occlusal view of the right M^3 (KNM-SH 15664)×1

Fig. 8 Occlusal view of the left M^3 (KNM-SH 15766)×1

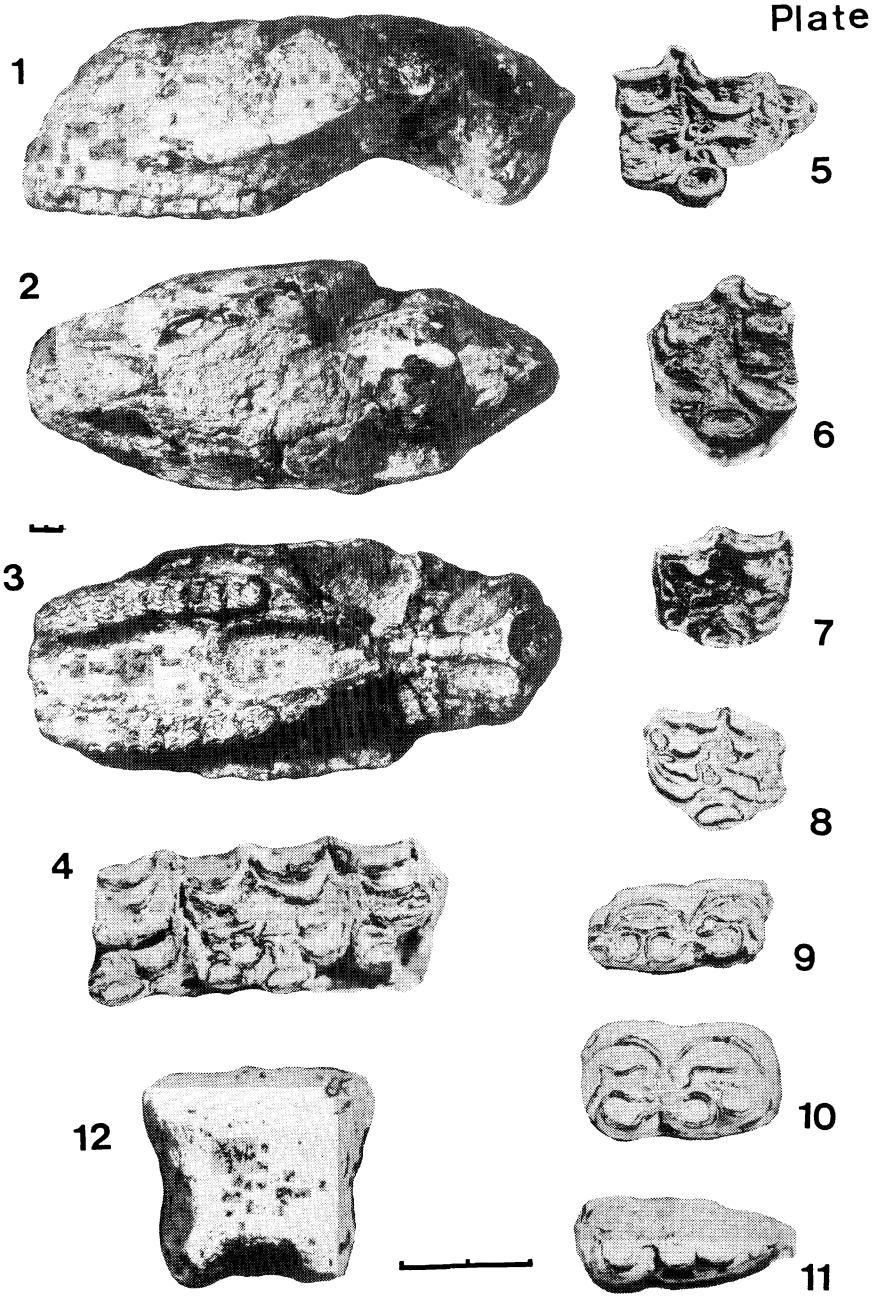
Fig. 9 Occlusal view of the left $P_{3/4}$ (KNM-SH 15648)×1

Fig. 10 Occlusal view of the right $P_{3/4}$ (KNM-SH 15650)×1

Fig. 11 Occlusal view of the right M_3 (KNM-SH 15649)×1

Fig. 12 Anterior view of the 3rd. middle phalange (KNM-SH 14777)×1

Plate 4



Explanation of Plate 5

(Scale bar represents 20 mm in fig. 1-16)

Hipparion sitifense

Fig. 1 Occlusal view of the left P^2 (KNM-SH 15651)×1

Fig. 2 Occlusal view of the right P^2 (KNM-SH 14764)×1

Fig. 3 Occlusal view of the left DP^3 (KNM-SH 14665)×1

Fig. 4 Occlusal view of the right $P^{3/4}$ (KNM-SH 15659)×1

Fig. 5 Occlusal view of the left P^4/M^1 (KNM-SH 15671)×1

Fig. 6 Occlusal view of the left M^1 (KNM-SH 15661-A)×1

Fig. 7 Occlusal view of the left M^1 (KNM-SH 14763)×1

Fig. 8 Occlusal view of the left M^2 (KNM-SH 14652)×1

Fig. 9 Occlusal view of the right M^3 (KNM-SH 14658)×1

Fig. 10 Occlusal view of the right P_2 (KNM-SH 15644)×1

Fig. 11 Occlusal view of the left $P_{3/4}$ (KNM-SH 15647)×1

Fig. 12 Occlusal view of the right M_2 (KNM-SH 15654)×1

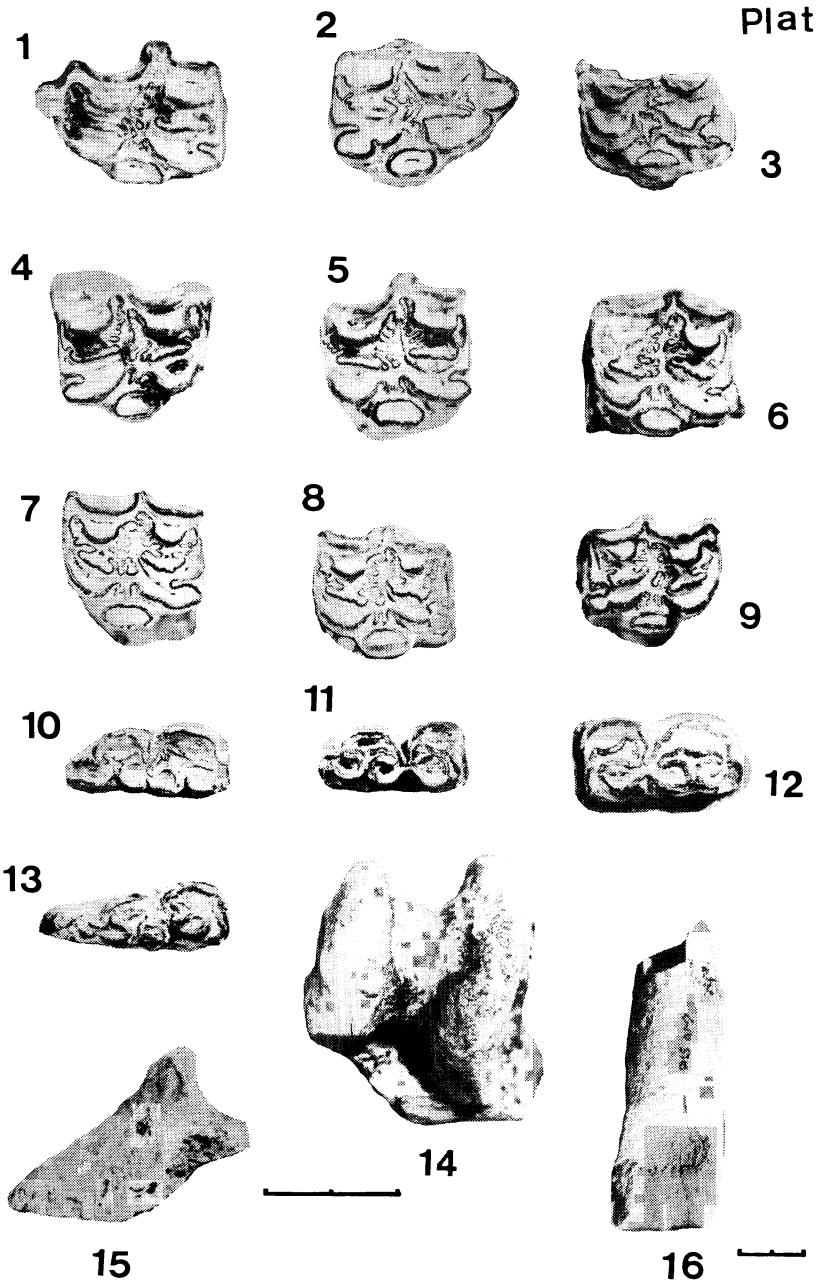
Fig. 13 Occlusal view of the left M_3 (KNM-SH 15663)×1

Fig. 14 Anterior view of the right talus (KNM-SH 14762)×1

Fig. 15 Lateral view of the 3rd. distal phalange (KNM-SH 15675)×1

Fig. 16 Anterior view of the 3rd. metatarsal (KNM-SH 15679)×1/2

Plate 5



Explanation of Plate 6

(Scale bar represents 20 mm in fig. 1-4)

Paradiceros sp.

Fig. 1 Occlusal view of the left P^4-M^3 (KNM-SH 15835)×1

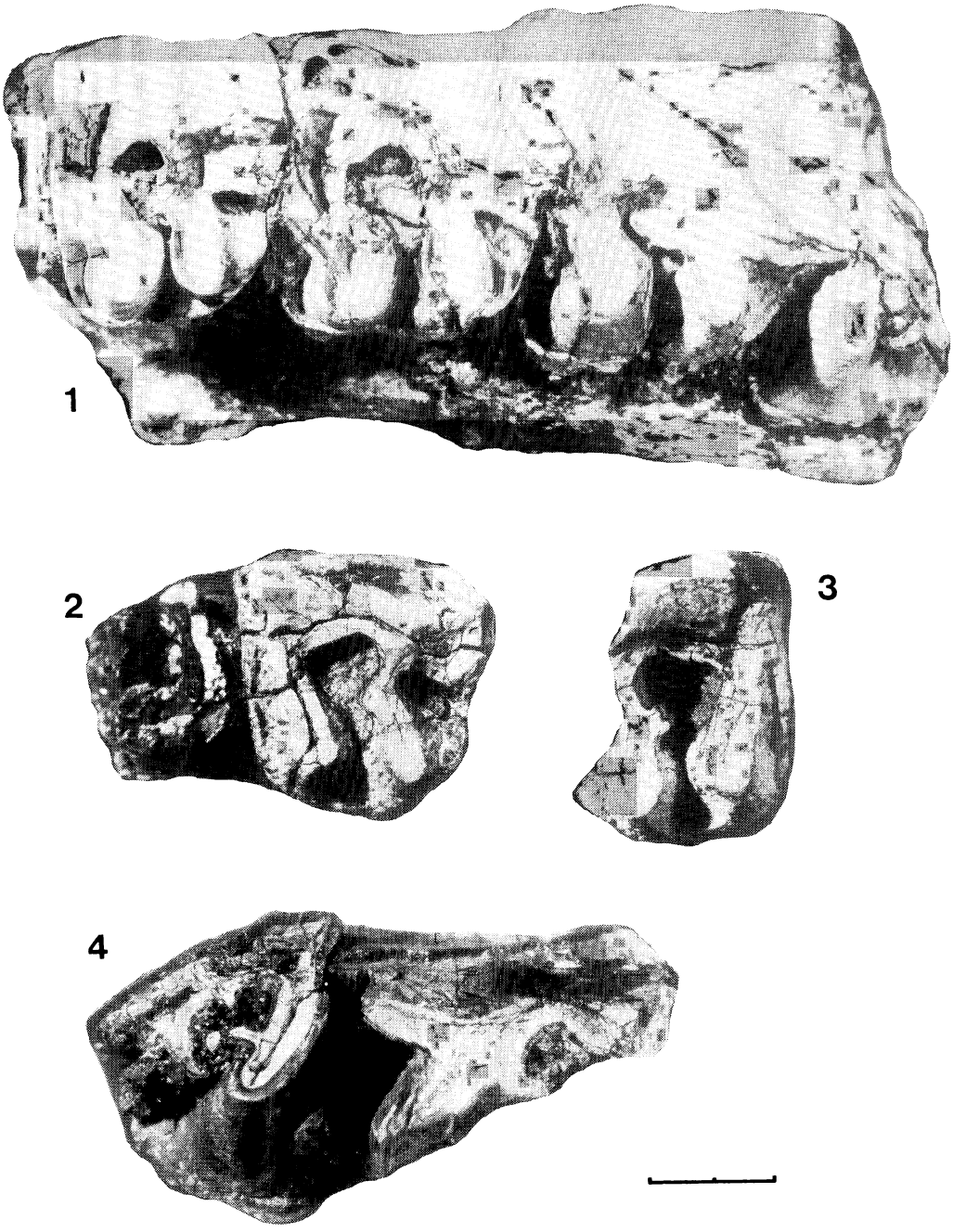
Fig. 2 Occlusal view of the left P^4 (KNM-SH 15859-A)×1

Fig. 3 Occlusal view of the right P^4 (KNM-SH 15859-B)×1

Chilotheridium sp.

Fig. 4 Occlusal view of the right $M^{2\&3}$ (KNM-SH 15833)×1

Plate 6



Explanation of Plate 7

(Scale bar represents 20 mm in fig. 1-5)

Chilotheridium sp.

Fig. 1 Buccal view of the right $M^{2\&3}$ (KNM-SH 15833)×1

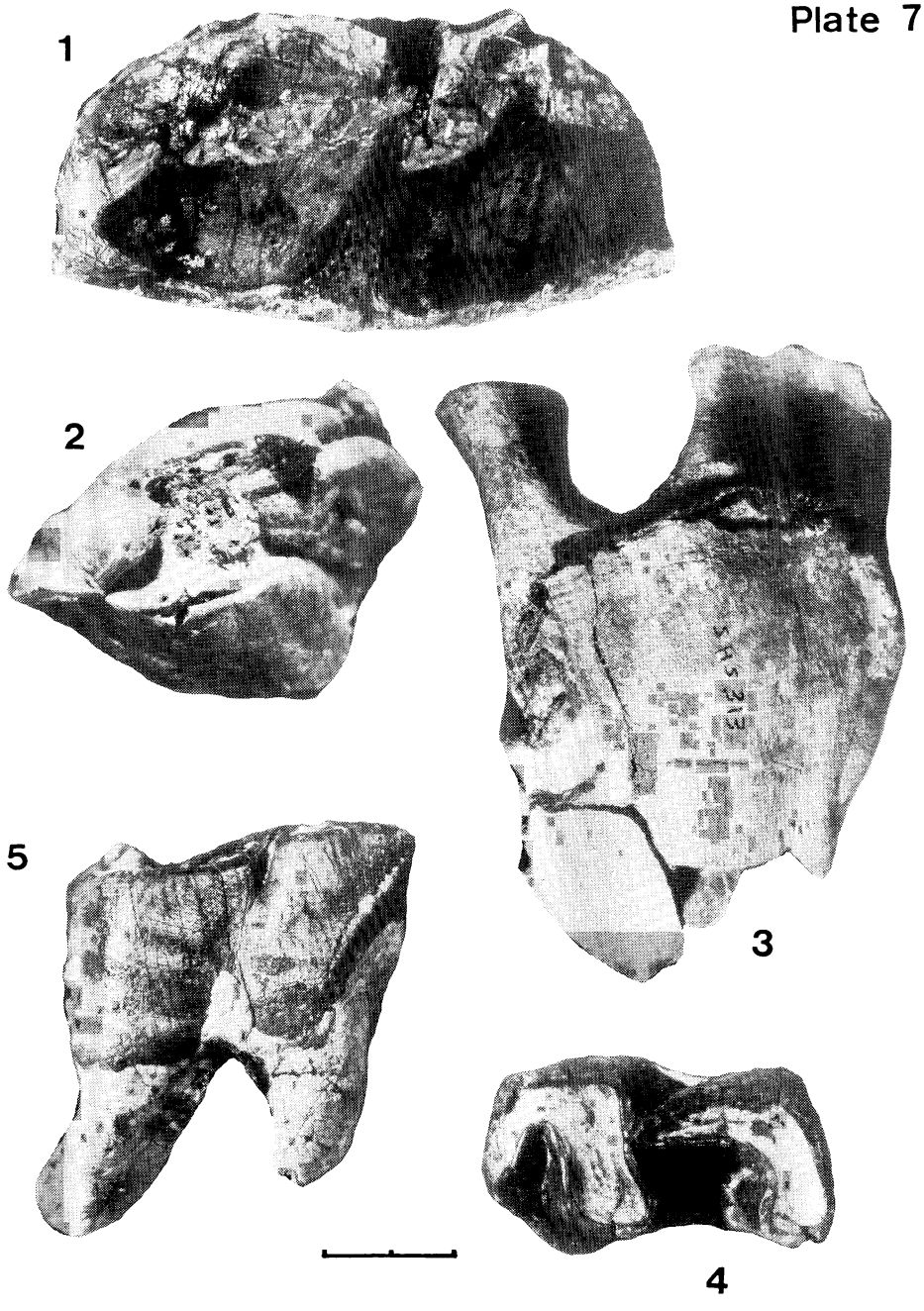
Fig. 2 Occlusal view of the left M^3 (KNM-SH 15831)×1

Fig. 3 Buccal view of the left M^3 (KNM-SH 15831)×1

Fig. 4 Occlusal view of the right $M_{1/2}$ (KNM-SH 15866-A)×1

Fig. 5 Buccal view of the right $M_{1/2}$ (KNM-SH 15866-A)×1

Plate 7



Explanation of Plate 8

(Scale bar represents 20 mm in fig. 1-5)

Kenyatherium bishopi

Fig. 1 Occlusal view of the right M^1 (KNM-SH 15827)×1

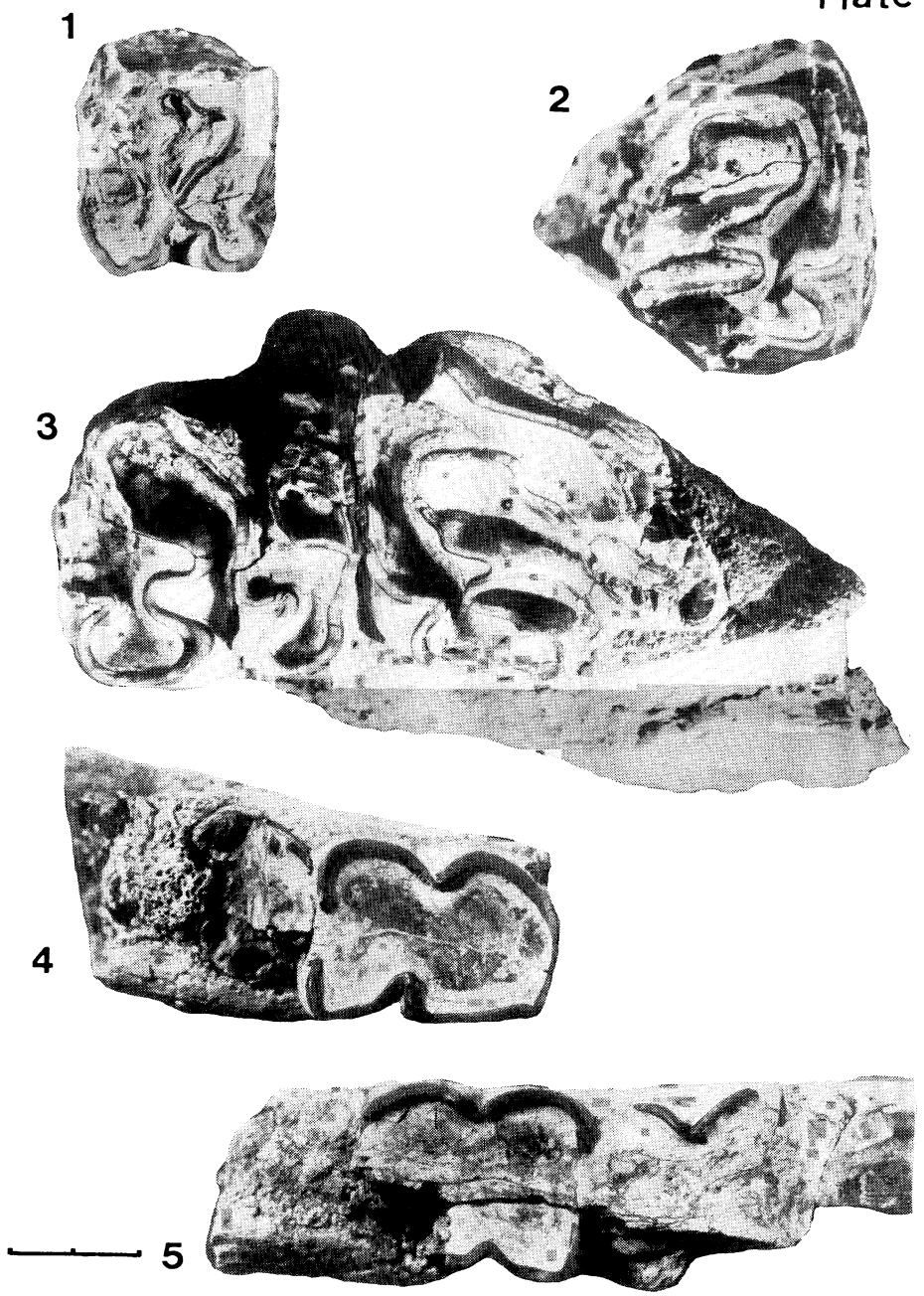
Fig. 2 Occlusal view of the right M^3 (KNM-SH 15826)×1

Fig. 3 Occlusal view of the left $M^{2\&3}$ (KNM-SH 15826)×1

Fig. 4 Occlusal view of the right P_4 (KNM-SH 15768)×1

Fig. 5 Occlusal view of the left P_4 & M_1 (KNM-SH 15767)×1

Plate 8



Explanation of Plate 9

(Scale bar represents 20 mm in fig. 1-8)

Nyanzachoerus sp.

Fig. 1 Occlusal view of the left mandible (KNM-SH 14760)×1/4

Fig. 2 Buccal view of the left mandible (KNM-SH 14760)×1/4

Fig. 3 Occlusal view of the left M_3 (KNM-SH 14758)×1

Kenyapotamus coryndoni

Fig. 4 Occlusal view of the mandible (KNM-SH 15857)×1/4

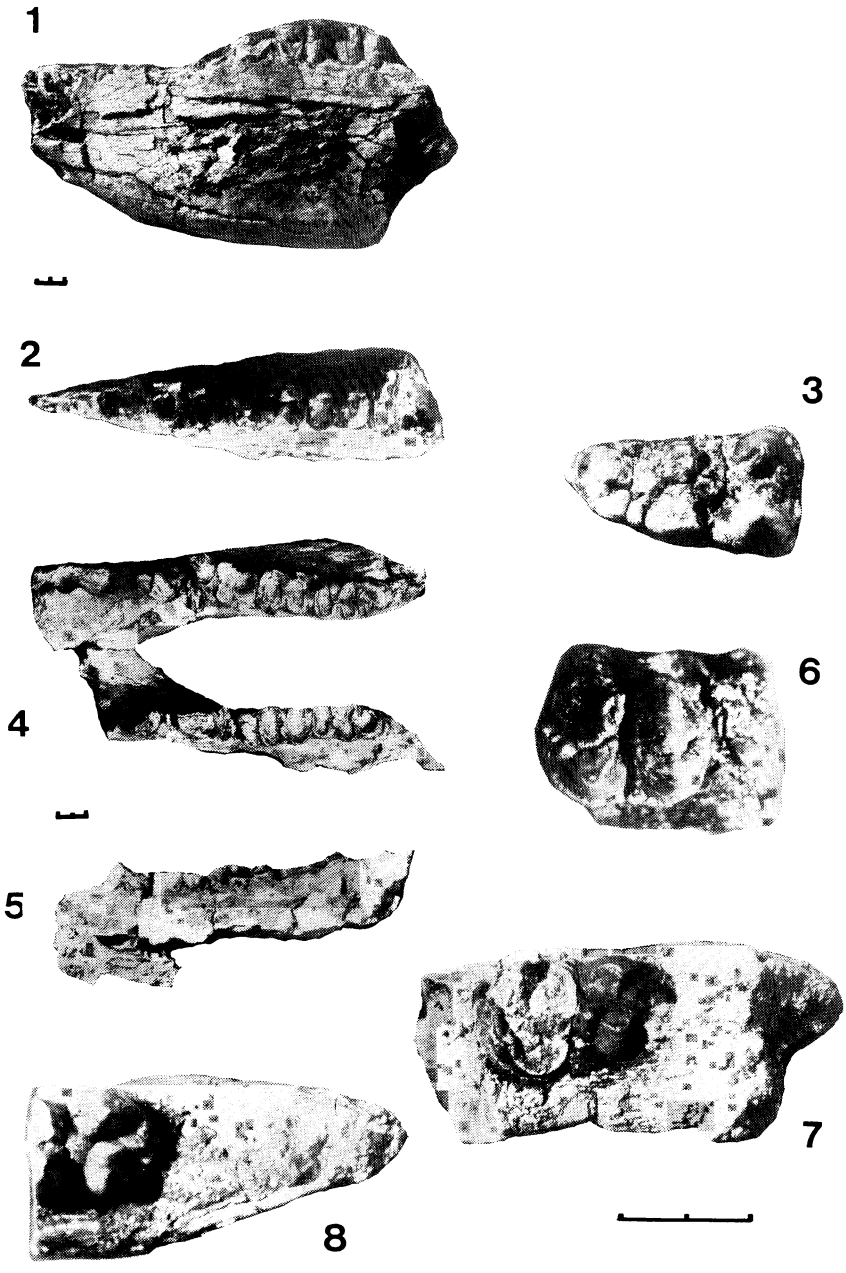
Fig. 5 Left buccal view of the mandible (KNM-SH 15857)×1/4

Fig. 6 Occlusal view of the left $M^{1/2}$ (KNM-SH 15851)×1

Fig. 7 Occlusal view of the left $M_{1/2}$ (KNM-SH 14792)×1

Fig. 8 Occlusal view of the left DP_4/M_1

Plate 9



Explanation of Plate 10

(Scale bar represents 20 mm in fig. 1-12)

Palaeotragus sp.

Fig. 1 Occlusal view of the $M^{2\&3}$ (KNM-SH 14759)×1

Fig. 2 Occlusal view of the right P_2 (KNM-SH 15843)×1

Fig. 3 Occlusal view of the left DP_2/P_2 (KNM-SH 15838)×1

Fig. 4 Occlusal view of the left M_1 (KNM-SH 15842)×1

Fig. 5 Occlusal view of the right M_2 (KNM-SH 15845)×1

Pachytragus sp.

Fig. 6 Posterior view of the frontal with right and left horn cores (KNM-SH 15717)×1/2

Fig. 7 Right lateral view of the frontal with right and left hown cores (KNM-SH 15717)×1/2

Palaeoreas sp.

Fig. 8 Dorsal view of the frontal with left horn core (KNM-SH 15716)×1/4

Fig. 9 Left lateral view of the frontal with left horn core (KNM-SH 15716)×1/4

Gazella sp.

Fig. 10 Medial view of the left horn core (KNM-SH 15712)×1/2

Fig. 11 Occlusal view of the right $M^{1\&2}$ (KNM-SH 15737)×1

Fig. 12 Occlusal view of the left M_3 (KNM-SH 15739)×1

Plate 10