A LATE PLIOCENE RHINOCEROS FROM LANGEBAANWEG, CAPE PROVINCE

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(With plates 21–34 and 51 tables)

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Introduction

The rhinoceros remains described in the present paper are from the 'E' Quarry at Langebaanweg, situated approximately 32°58'S, 18°9'E in the Sandveld region of the south-western Cape Province, some 105 km N.N.W. of Cape Town. They are more abundant than those of any other large mammal in the Langebaanweg fauna. The literature on the geology and palaeontology of the Langebaanweg deposits is reviewed in Hendey (1970*a*); the geological age is discussed in Hendey (1970*b*) and Maglio & Hendey (1970). The 'E' Quarry rhinoceros has been cited as *Diceros* aff.*bicornis*, but I found it to be a very early *Ceratotherium*, the same as that from Kanapoi, Ekora and Lothagam-1 in N.W. Kenya described as *Ceratotherium praecox* Hooijer & Patterson (1972). This species is still very close to a *Diceros* like *D. bicornis* (L.) in some dental characters which take the eye even at a cursory look, such as the transversely placed proto- and metaloph, absence of medifossettes, well-developed paracone style, and angular antero-internal crown corners. In these as well as other characters the fossil teeth from Langebaanweg and those of *D. bicornis* differ from those of *Ceratotherium simum* (Burchell), which has obliquely placed proto- and metalophs, medifossettes, no paracone style, and rounded antero-internal crown angles. We believe that *Ceratotherium praecox* is directly ancestral to the living *C. simum*, and its occurrence at the Kenya sites, near the 4 million year level (Maglio 1970; Cooke & Maglio 1971; Bishop 1971*a*: 511) is perfectly in accordance with the Late Pliocene age that is now becoming accepted for the Langebaanweg deposits.

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Abbreviations used in this paper are:

K.N.M.	Kenya National Museum
L.M.	Leiden Museum
M.C.Z.	Museum of Comparative Zoology, Harvard University
S.A.M.	South African Museum

CERATOTHERIUM PRAECOX Hooijer & Patterson

Ceratotherium praecox Hooijer & Patterson 1972: 19.

The present species was based on three incomplete skulls and mandibles with teeth, some fragments without teeth, an upper molar and an imperfect humerus from Late Pliocene sites in north-western Kenya. The Langebaanweg rhino collection comprises four upper dentitions, parts of three skulls and ten mandibles (mostly with teeth), 100 isolated upper and 50 isolated lower cheek teeth, 3 upper incisors, 20 deciduous cheek teeth, and 650 postcranial bones. The cranial and dental characters of the Langebaanweg rhinoceros are the same as those of the Kenya collection already described, but the Langebaanweg collection adds to our knowledge of the species information on the upper incisors and milk teeth which were unknown before, and the postcranial characters which were virtually unknown until the Langebaanweg material became available. The data provided in the present paper show the amount of individual variation within a single species of Pliocene rhinoceros. It is not saying too much now that *C. praecox* odontologically and osteologically is better known than its extant descendant, although, of course, its external characters are for ever lost to us.

The cranial characters of the present species are as follows: dorsal surface more concave, posterior portion less extended behind, occiput less posteriorly inclined, nuchal crest less thickened than in *Ceratotherium simum*. The premaxillae bear two incisors each, about 10 mm in diameter. The symphysial part of the mandible is narrower than in *C. simum*, and similar to *D. bicornis*. The premolars and molars (upper as well as lower) are more hypsodont than those in *D. bicornis*, but decidedly less so than in *C. simum*. The flattened ectolophs, marked protocone folds in the molars, strong internal cingula in the premolars, angular antero-internal corners of the crowns in premolars and molars alike, the posterior bulging of the protocones, which make up three-fifths of the internal crown faces, the medifossettes that rarely occur (mostly in P^{2-3} and M^3, if at all), and the medisinus and postsinus depths being very nearly equal, all these are characters shared by the Kanapoi and the Langebaanweg *C. praecox*.

The species in question is rather *Diceros*-like in skull and dentition, the teeth differing in their relatively higher crowns, with a flattened ectoloph on which the paracone style is almost completely suppressed, the postsinus being very nearly as deep as the medisinus, and the posterior protocone bulge slightly more marked. In these points the Kanapoi and Langebaanweg rhinoceros is evolving toward the Quaternary *Ceratotherium simum*, in which the crown height

is still greater, the paracone style completely suppressed and the parastyle raised, forming a concave area on the ectoloph where the paracone style had been, medifossettes are common, formed by the union of crochet and crista, postsinus and medisinus are equal in depth, the protocone bulge is more marked, the protoloph is obliquely placed and the antero-internal crown angles are rounded. In the early subspecies *C. simum germanoafricanum* (Hilzheimer), which is indistinguishable from the extant *C. simum simum* cranially, and which occurs at Laetolil, the basal Olduvai Beds, and Chemeron Formation locality J.M.90 (=91), the crowns are not quite so hypsodont and the metaloph is still transverse in its course rather than oblique as in the modern form, although the rounded antero-internal crown angles and the medifossettes of *C. simum germanoafricanum* are as in *C. simum simum*. In my earlier paper on Pleistocene East African rhinoceroses (Hooijer 1969), published at a time when I had not yet studied the material from Kanapoi, Lothagam-1 and Ekora, I referred specimens from the Chemeron Formation, locality J.M.507, and from the Mursi Formation of the Omo Basin (=lower level of the Omo collection made by Mr. R. E. F. Leakey in 1967) to *C. simum germanoafricanum* which I now recognize as belonging to *Ceratotherium praecox* instead; this will be dealt with in the final section of this paper. The discovery of *Ceratotherium praecox* vindicates the view of Thenius (1955) that *Ceratotherium* split off from the *Diceros* stock sometime in the Pliocene.

Dentition and skull

The individually youngest upper dentition, L13935, comprises P^2–M^3 from the right side as well as M^{1-3} sin. (Pl. 21). The crowns of P^3 and M^2 dext. only are virtually complete. There was a DM^1 or P^1 as there is an anterior facet on P^2.

P^2 is worn down to a height of 28 mm externally. The external enamel layer is missing for the most part; only the metastyle portions remain. There is a very marked internal cingulum, rising on the protocone and the hypocone from its lowest point at the medisinus entrance. The internal portions of protoloph and metaloph are connected at their bases by a small ridge; there is a small pit between it and the internal cingulum. The medisinus is slightly deeper than the postsinus, and there is a very small crochet, hardly more than a point.

P^3, worn to 45 mm from the base externally, has a very prominent internal cingulum, reaching its lowest point at the entrance to the medisinus, which is narrow and V-shaped. There is a very weak crochet, and no crista or antecrochet. Medisinus and postsinus are equal in depth. The ectoloph is flattened, with a weak cingulum; there is no parastyle fold or paracone style. The protoloph is hardly indented anteriorly, but there is a vertical groove in the metaloph marking off the hypocone.

P^4, with an external height as worn of 60 mm, has the flattened ectoloph detached from the remainder of the crown, which shows the narrow, V-shaped

medisinus entrance, the heavy internal cingulum, weak crochet, and the medisinus depth equal to that of the postsinus, as in P^3. An internal view of P^{2-4} dext. of L13035 is given in Plate 25, top.

M^1, the right of which lacks most of ectoloph and protoloph, and the left of which is entire but for the antero-external angle, is worn to a height of 52 mm externally. The lingual entrance to the medisinus is V-shaped, and there is an anterior fold in the metaloph marking off the hypocone. This molar, in contrast to the premolars, has a deep fold anteriorly in the protoloph marking off the protocone (the protocone fold), a strong crochet extending all across the medisinus, not receding near the base, and the internal cingulum hardly marked except along the protocone and for a tubercle at the entrance to the medisinus. The inner portion of the protoloph is recurved backward, forming three-fifths of the internal surface. The ectoloph is flattened, without styles, and medisinus and postsinus are of the same depth.

M^2, nearly entire on both sides, is worn to 75 mm from the external base. This is clearly a hypsodont tooth, the anteroposterior diameter of the crown being 62 mm externally. A weak paracone style is seen in the upper part of the crown only, to 60 mm from the base, flattening out further rootward. There is no groove marking off the hypocone, but the description of M^1 would otherwise fit the M^2.

M^3 of dentition L13035, both incomplete behind, are 90 mm high as worn and the length of the outer surface is about 75 mm. The marked protocone fold, internal protocone cingulum, and strong, even bifid crochet, are as in the other molars of this individual. The paracone style is weak but discernible, reaching from the top of the crown to approximately 50 mm from the crown base.

Another upper dentition, L2519, likewise consists of isolated teeth, which are P^2–M^3 dext. and P^3–M^1 sin. (Pl. 22). They are rather well preserved although a number of crown angles are missing.

P^2 is just 20 mm high as worn externally. The medisinus is still open internally. It shows a crochet united with a small crista so that a medifossette is formed. The same feature is seen in both P^3, which are worn down externally to 35 mm from the crown base. The protocone fold, which is preserved only in P^3 dext., is more marked than that in P^3 of dentition L13035. The postsinus is almost as deep as the medisinus; the ectoloph is just as flattened, with a weak cingulum, and the internal cingulum is just as prominent as that in P^3 of L13035. P^4, present on both sides in L2519, is 45 mm high as worn externally, and the right specimen has an imperfectly formed medifossette, while the left has a bifid crochet and a small crista that do not join. There is no difference in depth between the postsinus and the medisinus, and the ectoloph and the internal cingulum are as in P^3.

M^1, on both sides, has a particularly powerful crochet, nearly twice as thick as that in M^1 of L13035, but no crista. The external crown height is 35 mm, as worn. In addition to the anterior protocone fold there is an internal indentation in the protocone as seen in M^1 sin. The posterior bulging of the protocone is such that it forms three-fifths of the internal crown face. There is a distinct hypocone fold, visible in both the right and the left molar. The internal cingulum is not preserved in these molars but externally there is a very weak cingulum, mainly posteriorly, as in all the molars. The ectoloph is flattened, and the narrow postsinus appears to be slightly less deep than the medisinus.

The M^2 dext. of L2519, 50 mm high as worn, has a crochet that is not thickened; it is recurved outward at the apex but the crista is just barely indicated and no medifossette is formed. The posterior bulging of the protocone is such that it occupies 27 out of the 45 mm long internal basal anteroposterior diameter. The lingual entrance to the medisinus is V-shaped, and the protocone is indented lingually. The portion of the crown that would have shown the protocone fold is missing; the hypocone fold is weakly developed, and so is the internal cingulum; the ectoloph is flattened, without styles. The two sinuses are equally deep.

M^3 dext. of L2519 lacks most of the outer surface (ecto-metaloph) so that no measurements can be given. It has a crown height as worn of about 60 mm. There is a very marked protocone fold, and a weak cingulum on the depressed internal surface of the protocone. The crochet is well-developed and there is a crista, too. These projections, however, remain separate down to the bottom of the medisinus. On this rather worn molar there is no trace of a paracone style such as we see on less worn specimens; the paracone style is no longer visible in the basal 50–60 mm of the crown.

The next upper dentition to be described is L13747 (Pl. 23). Of this set of teeth the small anterior premolar P^1, or a persisting DM^1, is preserved on the right side, as the teeth are still *in situ* in the maxillary. It is about 23 mm anteroposteriorly, and about 20 mm transversely; nothing can be said about its structure as the crown is worn flat.

P^2 is nearly entire on both sides. Although the worn crown height is the same as that in P^2 of L2519 (20 mm) the valley between protocone and hypocone is closed as wear has reached the bottom of the sinus in between. There is a rather strong internal cingulum, and a pit is formed between it and the joint bases of proto- and hypocone, as in P^2 of L13035. Postsinus and medisinus are of equal depth. There is a crochet but no crista.

P^3 lacks the entire outer surface on the left side, and has only the antero-external angle on the right. The protocone fold is weakly developed. The internal cingulum is very marked, continuous with that on the anterior surface, and it carries a series of tubercles. It extends all along the protocone, reaching its lowest point at the narrow medisinus entrance, and rises along the hypocone, i.e. the same development that we noticed in the premolars of the two upper dentitions dealt with above. There is only a crochet, which is not very prominent, making the central portion of the medisinus rather wide. The depth of this portion of the medisinus is the same as that of the postsinus.

P^4, the worn ectoloph height of which is 40 mm, is rather damaged on the left but well preserved on the right side. There is a paracone style, which is rather more developed than that in the less worn dentitions L13035 and L2519; in these teeth there is no trace left of the paracone style, but in L13747 it continues to about 20 mm from the crown base. There is a weak external cingulum along the posterior moiety of the ectoloph. The posterior bulging of the protocone occupies three-fifths of the internal surface of the crown. The internal cingulum is less developed, and the crochet more prominent than that in P^3. The protocone fold is hardly shown. The medisinus is as deep as the postsinus and has a narrow, V-shaped entrance.

M^1, which is between 20 and 25 mm in worn ectoloph height, has the protocone fold well marked. The protocone takes up 30 out of the 50 mm of internal anteroposterior crown diameter, and is slightly indented internally. The bottom of the narrow internal medisinus entrance is almost reached by wear, but its central portion is still about 15 mm deep, which is also the depth of the postsinus. The very thick crochet is free from the ectoloph at the level of wear. In M^1 dext. it would have closed off a medifossette with the small crista if wear had proceeded some 5 mm more, but in M^1 sin. no medifossette would have been formed in this way. In this advanced stage of wear no trace remains of the paracone style; the internal cingulum is so weak as to be practically absent.

M^2 is 40 mm high at the worn ectoloph. M^2 dext. has a vertical fracture in the ectoloph, but the external surface of M^2 sin. is undamaged although detached from the remainder of the crown. The paracone style is shown as a weak bulge only along the worn edge of the crown. The protocone fold is very distinct, and the internal indentation of the protocone shows just as it does in the M^1. The protocone occupies 40 out of the 65 mm of internal anteroposterior crown diameter. The crochet is narrower than that in M^1 and does remain free at its apex so that no medifossette is formed. There is hardly any trace of an internal cingulum.

M^3, incomplete on both sides, has the external surface worn down to 50 mm; the paracone style is shown only in the apical 15 mm. The anterior fold, internal indentation, and posterior bulging of the protocone are as in M^2. The crochet extends all across the medisinus but does not close off a medifossette.

Whereas the two dentitions first described (L13035 and L2519) are rather similar in dimensions (see Table 1) dentition L13747 is larger, but there are no significant differences in structure. The only point worth making is that the paracone style is slightly more marked in these large teeth than in those earlier described.

A crushed skull, L6658, has a good portion of the palate with P^4–M^2 dext. and P^2–M^2 sin., and the two last molars detached (Pl. 24). The dental dimensions are more or less intermediate between those of L2519 and L13747

(Table 1). There is a small portion of the anteriormost premolar, on the left side. P^2 sin. is incomplete internally and much worn down: the ectoloph height is reduced to 15 mm, and the medisinus is cut off from the lingual border. There is a tiny medifossette, which would have disappeared with a little more wear. P^3 sin. has a medifossette too; its external height as worn is almost 30 mm, and no paracone style is shown. The medisinus is just closed off lingually. The internal cingulum, with its lowest point at the junction of protocone and hypocone, is well developed. It is slightly less marked in P^4, present on both sides, with a worn ectoloph height of 40 mm. The crochet is bifid in P^4 dext., and single in P^4 sin. The premolars P^3 and P^4 agree in the postsinus being as deep as the medisinus, the posterior bulging of the protocone forming three-fifths of the internal surface (21 out of 35 mm in P^3, and 27 out of 45 mm in P^4), and in their weak protocone folds.

M^1, lacking the antero-external angle on both sides, is some 25 mm high as worn externally. The protocone fold is very marked, and there is an internal indentation in the protocone, which occupies three-fifths of the internal border. The lingual cingulum is weakly developed, the lingual medisinus entrance very narrow, and the crochet is rather thick, as usual in first molars. M^2, the right of which is partially embedded in the bone, has a worn ectoloph height of 45 mm, and does not show the paracone style any more. The characters are those of M^1; only the crochet is more slender. The M^3, of which the left is virtually complete, is 60 mm high as worn externally. The paracone style can be traced in the apical 15–20 mm only. The crochet extends all across the medisinus, and joins the posterior wall of the protoloph, thus cutting off the external portion of the medisinus. The protocone fold is strongly marked, the internal cingulum very weak.

TABLE 1

Measurements of upper teeth of *Ceratotherium praecox* from Langebaanweg (mm)

No. of specimen	L13035	L2519	L13747	L6658
P_2, ant.post.	*c.* 35	33	36	32
ant.transv.	—	40	44	37
post.transv.	*c.* 45	—	50	40+
P^3, ant.post.	45	46	—	43
ant.transv.	58	57	66	62
post.transv.	54	—	—	58
P^4, ant.post.	48	51	53	50
ant.transv.	—	65	75	67
post.transv.	—	60	73	63
M^1, ant.post.	—	58	*c.* 60	57
ant.transv.	70	70	80	73
post.transv.	64	*c.*64	72	—
M^2, ant.post.	62	64	68	64
ant.transv.	72	72	82	74
post.transv.	67	65	*c.*70	69
M^3, ant.post.(int.)	65	—	67	66
ant.transv.	72	—	78	73
length outer surface	*c.* 75	—	79	83
Length P^2–M^3	*c.* 300	*c.* 300	330	305
Length P^2–P^4	*c.* 135	130	135	125
Length P^4–M^3	*c.* 230	*c.* 225	245	235

To dentition L13035 belongs a skull portion, giving a zygomatic width of 390 mm, very near to the maximum, observed by Heller (1913) in modern *Ceratotherium simum*, viz., 384 mm. The length from M^3 to the back of the postglenoid process is *c.* 220 mm, slightly less than the length P^4–M^3 (*c.* 230 mm). In subadult skulls of *C. simum* in which M^3 has not erupted yet the length P^4–M^3 exceeds the postdental length from M^3 to the back of the postglenoid process (e.g., S.A.M. 21381: P^4–M^3 *c.* 225 mm; postdental length *c.* 190 mm). In skulls with M^3 slightly worn the two lengths are subequal (S.A.M. 21382: P^4–M^3 215 mm; postdental length 200 mm; S.A.M. 21379: P^4–M^3 225 mm; postdental length 210 mm). In fully adult *C. simum* skulls with M^3 well worn down the length P^4–M^3 is exceeded by the postdental length (M.C.Z., Dept Mamm. 24917 and 34850: P^4–M^3 190–205 mm; postdental length 270–275 mm). In the holotype skull of *Ceratotherium praecox* from Kanapoi, which is quite adult, the postdental length is the larger of the two, though not to the extent seen in the recent species (Kanapoi P^4–M^3 205 mm; postdental length 230–250 mm).

The premaxillaries of L13747 are preserved, and they show two alveoli on each side, one behind the other. The anterior alveolus holds a tooth crown that is unerupted, about 12 mm anteroposteriorly and 9 mm transversely. The posterior alveolus is of the same size but empty; its depth is only 7 mm. The specimens are shown in Plate 28, top. The occurrence of rudimentary upper incisors in *C. praecox* is interesting, as the recent species of *Ceratotherium* no longer shows them. An isolated I^1 has a rounded crown and a strong, posteriorly recurved root. The height of the crown and root combined is 37 mm, while the crown diameter is 11 mm (Pl. 28, top right).

The nasal horn boss of L6658 is crushed, but its width is about 180 mm. The nasal portion of another skull, L2520, is 180 mm wide at the horn boss; this width is 170–208 mm in adult males, and 146–173 mm in adult females of recent *Ceratotherium simum* (Heller 1913). The frontal region of the skull L2520 shows the second horn boss, on the frontals, but the upper borders of the orbits are not preserved. Dorsal views of skulls L2520 and L6658 are given in Plate 27.

Skull L13747 is broken in many pieces; the right half of the top of the skull has been reassembled (Pl. 26). Although the angle between the dorsal and the occipital planes cannot be exactly measured it is approximately 60°. This is 65° in skull K.N.M. KP30 from Kanapoi, against 65–80° in *Diceros bicornis*, and 45–50° in *Ceratotherium simum*. These figures tend to show that in the fossil *C. praecox* the occiput is less posteriorly inclined relative to the dorsal surface than in *C. simum*, and rather resembles *D. bicornis* in this respect. In keeping with the less marked posterior inclination of the occiput, the nuchal crest in *C. praecox* is not as thickened as it is in modern *C. simum*, in which it is quite massive, overhanging the occipital condyles.

The mandible L13035 is nearly entire, lacking only part of the ventral border of the left horizontal ramus and the right coronoid process (Pl. 30).

P_3–M_3 dext. and P_2–M_3 sin. are in situ; an internal view of the right ramus is given in Plate 31. Mandible L11849 has the symphysis as well as P_2–M_3 dext., somewhat more worn than L13035 (Pl. 32, right). There is further a symphysial portion of the mandible, L6058, with the alveoli for P_2 (Pl. 33). There appear to be small alveoli for incisors in the symphyses examined, but none of these elements has been found. The premolars and molars of the Langebaanweg *Ceratotherium* do not show the tendency toward obliqueness of the lophids, or that toward fossettid formation seen in *Ceratotherium simum*.

The length of the mandible, L13035, is 570 mm; this measurement is 565–635 mm in adult males, and 550–588 mm in adult females of recent *C. simum* (Heller 1913). The length of the symphysis is 125 mm in L13035 and 145 mm in L11849; 129–155 mm in adult males, and 128–147 mm in adult females of *C. simum*. The fossil specimens agree with the recent in both length measurements. However, the width at the symphysis is 60 mm in L11849 and 65 mm in L6058, which is decidedly less than that in recent males (96–125 mm) and females (91–111 mm) of *C. simum* (Heller 1913). It follows from this that in *C. praecox* the symphysis is relatively (and absolutely) narrower than in *C. simum*. It is in *D. bicornis* that we find such a narrow symphysis: S.A.M. 35658 has a length of symphysis of 105 mm by a width at symphysis of only 45 mm.

In the height at M_1, 125 mm, the fossil mandible L13035 equals *C. simum* (S.A.M. 21379), whereas in *D. bicornis* (S.A.M. 35658) this height is only 85 mm. The distance from the dental foramen to the base of the posteromedial articular surface is 160 mm in L13035, against 230 mm in *C. simum* and 135 mm in *D. bicornis*; the jaw orientation in the fossil was evidently nearer to that in *D. bicornis* than to that in *C. simum*. The condyles in L13035 are not entire, but the condylar area appears to be more massive, and wider below the condyle than in *C. simum*. The medial surface below the condyle is more hollowed than in either of the two living species. These are also the characters of the Kanapoi *C. praecox*.

TABLE 2

Measurements of lower teeth of *Ceratotherium praecox* (mm)

No. of specimen	L13035	L11849		L13035	L11849
P_3, ant.post.	30	—	M_1, ant.post.	(54)	—
ant.transv.	15	17	ant.transv.	32	35
post.transv.	17	17	post.transv.	32	37
P_3, ant.post.	—	—	M_2, ant.post.	63	56
ant.transv.	—	24	ant.transv.	36	37
post.transv.	27	—	post.transv.	34	37
P_4, ant.post.	48	45	M_3, ant.post.	*c.* 64	60
ant.transv.	30	31	ant.transv.	35	35
post.transv.	32	32	post.transv.	32	34
			Length P_2–M_3	290	290
			Length M_1–M_3	175	170

Dental measurements of the two mandibles are given in Table 2. Isolated lower teeth to be recorded further on considerably expand the variation ranges in size.

Among the isolated teeth from Langebaanweg there are a few unworn or very slightly worn crowns showing the degree of hypsodonty; these will be mentioned in the following pages.

An unworn P^4 sin., L13760 (Pl. 25, bottom left) has an ectoloph height of 90 mm by a greatest anteroposterior length of the ectoloph, in the apical third of the crown, of 55 mm, which gives a height/length index of 164. An unworn recent P^4 of *Diceros bicornis* (Leiden Museum, cat.ost.e) has the same greatest ectoloph length by an ectoloph height of 80 mm, giving a height/length index of 145. On the other hand, an unworn P^4 of recent *Ceratotherium simum* (S.A.M. 21382) has an ectoloph height of 103 mm by a greatest anteroposterior ectoloph length of 46 mm, giving a height/length index of 224.

Among the last upper molars in particular there are several nearly unworn crowns, as follows: an M^3 dext., L6696 (Pl. 25, middle), an M^3 sin., L7106, of the same individual; an M^3 dext., L6291 (Pl. 25, middle), an M^3 sin., L6461, of the same individual as L6291; an unworn M^3 dext., L6638, incomplete basally and a very slightly worn M^2 sin., L6636. In L6696 the total height of the outer surface is 94 mm by a length of the outer surface of 78 mm, giving a height/length index of 121. The paracone style is a narrow ridge, which fades away in the basal 35 mm of the ectoloph. L6291 has a height of the outer surface of 85 mm; the length of the outer surface is 70 mm, giving a height/length index of 121. Finally, L6638 has a height of the outer surface of 96 mm by a length of this surface of approximately 80 mm; height/length index *c.*120. This is just about the height/length index of M^3 in modern *Diceros bicornis* (outer surface height 64 mm, outer surface length 54 mm, height/length index 119: Hooijer 1969: 87), but the Pleistocene *Diceros bicornis* from the Omo Beds is lower-crowned than the living form (two specimens of M^3, height of unworn outer surface 56–59 mm, length of outer surface 55–58 mm, height/length index 102: Hooijer 1969: 87). In modern *Ceratotherium simum* M^3 is 120–130 mm high (Dietrich 1945: 59), and a slightly worn recent M^3 (S.A.M. 21379) is 100 mm high at the outer surface, while an unworn recent M^3 (S.A.M. 21382), the outer surface of which is not quite fully calcified at base, is just over 100 mm high at the incompletely formed external surface. In these recent M^3 there is no paracone style but a depression behind the parastyle instead.

The M^2 from Langebaanweg, L6636, slightly worn, has an ectoloph height at the metaloph origin of 98 mm by a greatest anteroposterior ectoloph length of 73 mm; its height/length index is 134. The hypsodonty of *Ceratotherium praecox* M^2 has already been demonstrated in a slightly worn M^2 from Lothagam-1 (K.N.M. LT89 in Hooijer & Patterson 1972) that has an ectoloph height at the metaloph origin of 74 mm by a greatest anteroposterior ectoloph length of 63 mm, giving a height/length index of 117. In modern *Diceros bicornis* M^2 (two specimens) the ectoloph is not so much higher than wide, although the difference is small: M.C.Z., Dept Mamm., no. 51479, height at metaloph origin 56 mm, length 54 mm, height/length index 104, and Leiden Museum, cat.ost.b, height 74 mm, length 68 mm, height/length index 109.

Since the Omo M^3 of *Diceros bicornis* (Pleistocene) is less hypsodont than the modern M^3, the same doubtless holds for the M^2. In the fossil M^2 from Langebaanweg the paracone style is present on the apical half of the crown only.

There are two very slightly worn P_4 in the Langebaanweg collection, L5356 and L6693, both from the right side. They are rather similar in dimensions (Table 3), and intermediate in height/length indices between recent *Diceros bicornis* (first column) and recent *Ceratotherium simum* (last column of Table 3). The discrepancy in height/length indices is the same as that found in P^4.

TABLE 3

Measurements of P_4 in *Diceros* and *Ceratotherium* (mm)

	D. bicornis	*Ceratotherium praecox*		*C. simum*
No. of specimen	L.M.cat.e	L5356	L6693	S.A.M.21382
Greatest length of outer surface	44	49	48	47
Height of metalophid	63	74	70	94
Height of hypolophid (*b*)	55	68	65	88
Height/length index (*a*)	143	151	146	200
Height/length index (*b*)	125	139	135	187

Four isolated lower molars, either M_1 or M_2, are unworn or very slightly worn. These are L6667 and L2526, from the right side, and L6664 and L6680, from the left. The height of the anterior (meta-) lophid, taken from the external base of the crown, varies from 70 to 80 mm; the hypolophid height varies between the same limits. Unworn M_{1-2} of recent *D. bicornis* are *c.* 55 to 65 mm high, and those of *C. simum c.* 80 to 100 mm.

The isolated upper premolars and molars from Langebaanweg are enumerated in the tables that follow.

Of P^2 we have nine specimens (Table 4) the first three of which are from the right side, the others from the left. There is a double crochet in L6649, a medifossette in L6751, L4750, and L6648, while a bifid crochet is shown in L6623.

TABLE 4

Measurements of P^2 of *Ceratotherium praecox* (mm)

No. of specimen	L6649	L6751	L4750	L6648	L9124	L11957
Ant.post.	38	*c.* 34	35	—	34	*c.* 40
Ant.transv.	41	40	42	39	44	39
Post.transv.	40	—	46	41	45	40

No. of specimen	L6623	L6629	L9129
Ant.post.	*c.* 37	*c.* 34	*c.* 40
Ant.transv.	38	37	44
Post.transv.	41	41	46

P^3 is represented by nineteen specimens (Table 5) the first eight of which are from the right side, the others (starting with L11801) from the left. In L6630 there is seen a slender crista extending to the tip of the crochet; the internal cingulum is rather weak in this specimen as well as in L6627. L6625 and L5665 have a bifid crochet, L5665 has in addition a very small crista.

TABLE 5

Measurements of P^3 of *Ceratotherium praecox* (mm)

No. of specimen	L6629	L6630	L6631	L5444	L6625	L6295	L6646
Ant.post.	48	*c.* 50	47	40	43	40	*c.* 45
Ant.transv.	65	*c.* 67	64	59	60	60	62
Post.transv.	58	—	56	52	55	57	58
No. of specimen	L13765	L11801	L6639	L11996	L6627	L5695	
Ant.post.	45	45	43	—	47	44	
Ant.transv.	58	64	62	60	68	61	
Post.transv.	51	57	58	56	61	58	
No. of specimen	L5671	L9114	L5451	L6640	L5665	L13099	Aterir
Ant.post.	45	—	50	46	48	44	45
Ant.transv.	60	64	66	63	65	61	58
Post.transv.	54	58	63	57	59	56	54

There are twenty specimens of P^4 (Table 6) the first eleven of which are from the right side, the others (from L11132 onward) from the left. L2525 has a crista joining the crochet. L11132 belongs to the same individual as L11121, has a double crochet the lateral part of which is joined to a crista, thus forming a medifossette (Pl. 29, bottom). L6655, slightly worn, shows a double crochet and a crista (Pl. 29, bottom). L13760 shows the full height of the ectoloph, with a height/length index of 164 (Pl. 25, bottom left). Medifossette formation is very rare in P^4 and M^{1-2}, one in twenty or three in forty Langebaanweg teeth.

TABLE 6

Measurements of P^4 of *Ceratotherium praecox* (mm)

No. of specimen	L6717	L2525	L6652	L6299	L11167	L6619	L6635
Ant.post.	51	54	49	49	51	50	50
Ant. transv.	70	74	70	70	75	71	76
Post.transv.	63	69	61	61	67	61	70
No. of specimen	L6739	L5696	L3454	L11121	L11132	L6618	
Ant.post.	*c.* 57	51	47	48	48	*c.* 52	
Ant.transv.	75	69	67	68	68	71	
Post.transv.	64	63	56	62	62	66	
No. of specimen	L6632	L6296	L4612	L6622	L13760	L13099	
Ant.post.	—	48	50	*c.* 50	47	48	
Ant.transv.	69	70	71	68	68	64	
Post.transv.	63	64	68	63	62	60	

TABLE 7

Measurements of M^1 of *Ceratotherium praecox* (mm)

No. of specimen	L6626	L6624	L6703	L5445	L9113	L6628	L11798
Ant.post.	58	55	—	57	60	52	55
Ant.transv.	73	72	73	72	74	71	72
Post.transv.	68	67	66	65	65	63	67
No. of specimen	L5912	L6293	L12039	L5311	L6647	L5418	L6621
Ant.post.	55	—	*c.* 52	56	56	61	—
Ant.transv.	68	67	66	69	73	72	75
Post.transv.	65	60	61	65	68	68	—
No. of specimen	L6465	L4749	L5919				
Ant.post.	*c.* 53	54	58				
Ant.transv.	69	70	70				
Post.transv.	66	61	65				

M^1 is represented by seventeen specimens (Table 7) the first eight of which are from the right side, the left specimens beginning with L6293. Medifossettes are not formed; L6626 has a double crochet (Pl. 28, bottom right).

There are twenty-four specimens of M^2 (Table 8) the first ten of which are from the right side, the remaining specimens (starting with L6636) from the left. A true medifossette, formed by the union of crochet and crista, is shown only in L9116, L5916 (external surface broken off: Pl. 28), and L10983. A small crista is seen in L5917, L6617 (in which the crochet makes a contact with a small projection on the posterior face of the ectoloph: Pl. 28), L6746, L6654, L6641, L6644A, and L12360. L9118 consists of ectoloph and crochet only; the crista is in contact with the crochet apically (Pl. 29). L6636 is the specimen with the ectoloph slightly worn, and a height/length index of 134, already referred to above.

TABLE 8

Measurements of M^2 of *Ceratotherium praecox* (mm)

No. of specimen	L5917	L6617	L6694	L9116	L6631	L6634	L5911	L6746
Ant.post.	*c.* 50	67	*c.* 62	62	*c.* 60	61	63	*c.* 64
Ant.transv.	75	82	82	75	79	77	79	74
Post.transv.	68	75	69	73	71	72	—	—
No. of specimen	L6637	L6643	L6636	L5916	L9118	L6654	L6645	L10983
Ant.post.	—	—	*c.* 60	—	—	*c.*55	56	55
Ant.transv.	80	80	73	—	—	76	78	71
Post.transv.	72	73	66	—	—	68	67	67
No. of specimen	L6644B	L6654	L6641	L6644A	L11898	L12360	L6653	L9115
Ant.post.	*c.* 62	63	67	65	65	*c.*55	*c.* 55	—
Ant.transv.	74	70	75	79	77	73	71	77
Post.transv.	67	65	67	72	68	70	65	68

We have seventeen specimens of M^3 (Table 9) the first ten of which are from the right side, the remaining (to begin with L7106) from the left. L6696 is a slightly worn specimen with a height/length index of 121 (Pl. 25); L6291 is a somewhat smaller specimen likewise slightly worn and with the same index (Pl. 25). The left M^3 L7106 belongs to the same individual as L6696, and the left M^3 L6461 belongs to the same individual as L6291. The specimen L6638 is unworn but incomplete at the base of the crown; its height/length index is *c.* 120.

TABLE 9

Measurements of M^3 of *Ceratotherium praecox* (mm)

No. of specimen	L6696	L6291	L6638	L6294	L6620	L5666	L10984
Ant.post. (int.)	66	58	*c.* 65	56	58	61	61
Ant.transv.	71	65	75	68	69	74	66
Length outer surf.	78	70	*c.* 80	78	75	75	70
No. of specimen	L6641	L6290	L11997	L7106	L6461	L13614	
Ant.post. (int.)	64	61	72	—	58	60	
Ant.transv.	71	75	75	—	65	73	
Length outer surf.	76	81	80	78	*c.* 70	72	
No. of specimen	L6289	L6642	L11091	L6466			
Ant.post. (int.)	60	57	58	66			
Ant.transv.	67	69	69	72			
Length outer surf.	75	73	68	74			

These specimens have already been referred to above. L6294 has a crochet extending all across the medisinus; L6641 and L11997 have a very large crochet, and L10984 has a small crista and an internal projection at the base of the crochet.

Some of the remaining lower cheek teeth are *in situ* in incomplete mandibles, as follows: L6615, a right mandibular ramus, has the posterior portion of P_4 and the three molars; the lengths are reduced as a result of interproximal wear, their transverse diameters slightly exceed those in L13035 and L11849 (Table 2), and the height at M_1 is 130 mm. P_2–M_3 sin. and P_2–P_4 dext. of one and the same individual, L6659, are narrower-crowned, as are those recorded in Table 2. A right and a left mandibular ramus with the much worn M_1–M_3 on either side (L6612, L6614), give an M_1–M_3 length shorter than that in the less worn dentitions. The height of the ramus at M_1 is 125 mm. L6793 is a right mandibular ramus with P_2–M_2; L11989 is a right ramus fragment with M_1, M_2, and part of M_3. Two parts of right rami, L13759 and L13805, have M_2, and M_3, respectively, *in situ*. The measurements of these teeth are given in Table 10.

TABLE 10

Measurements of lower teeth of *Ceratotherium praecox* (mm)

No. of specimen		L6615	L6659	L6612	L6793	L11989	L13759 L13805
P_2,	ant.post.	—	—	—	—	—	—
	ant.transv.	—	18	—	—	—	—
	post.transv.	—	20	—	—	—	—
P_3,	ant.post.	—	(47)	—	—	—	—
	ant.transv.	—	24	—	—	—	—
	post.transv.	—	28	—	—	—	—
P_4,	ant.post.	—	52	—	(43)	—	—
	ant.transv.	—	29	—	31	—	—
	post.transv.	—	31	—	—	—	—
M_1,	ant.post.	(40)	57	(44)	—	55	—
	ant.transv.	37	32	37	—	35	—
	post.transv.	—	34	36	—	—	—
M_2,	ant.post.	(51)	65	(52)	(54)	59	—
	ant.transv.	38	—	37	37	37	36
	post.transv.	—	—	39	37	38	37
M_3,	ant.post.	59	—	58	—	—	63
	ant.transv.	38	—	—	—	—	37
	post.transv.	38	—	35	—	—	38
Length M_1–M_3		160	—	150	—	—	—

There are seven isolated specimens of P_2 (Table 11) the first four of which are from the right side. The first and the last specimen are decidedly larger than the P_2 in the two mandibles of Table 2.

TABLE 11

Measurements of P_2 of *Ceratotherium praecox* (mm)

No. of specimen	L11812	L6684	L6676	L11999	L11959	L6665	L11815
Ant.post.	33	(30)	—	(27)	30	32	34
Ant.transv.	20	18	17	17	18	17	21
Post.transv.	23	23	21	18	20	18	23

There are ten isolated specimens of P_3 (Table 12) the first three of which are from the right side.

TABLE 12

Measurements of P_3 of *Ceratotherium praecox* (mm)

No. of specimen	L12107	L11810	L6671	L6681	L6669	L11811
Ant.post.	(40)	(44)	(41)	48	(45)	(38)
Ant.transv.	25	27	24	25	28	24
Post.transv.	28	30	31	26	28	26
No. of specimen	L2525	L5698	L11809	L3697		
Ant. post.	(42)	(42)	(43)	50		
Ant.transv.	25	24	27	27		
Post.transv.	30	28	30	28		

P_4 is represented by eight specimens (Table 13) the first two of which are from the right side. L6687, L12108, and L11804 are larger, especially wider, than their homologues in the dentitions of Tables 2 and 10.

TABLE 13

Measurements of P_4 of *Ceratotherium praecox* (mm)

No. of specimen	L6687	L12108	L11804	L11816	L6762
Ant.post.	49	53	51	(45)	50
Ant.transv.	33	33	33	30	29
Post.transv.	34	34	37	31	31
No. of specimen	L6670	L4751	L6662		
Ant.post.	(47)	55	(49)		
Ant.transv.	28	—	31		
Post.transv.	35	31	33		

Fourteen isolated lower molars represent either M_1 or M_2 (Table 14); the first eight are from the right side, the remaining six (beginning with L6672) from the left.

TABLE 14

Measurements of M_1 and M_2 of *Ceratotherium praecox* (mm)

No. of specimen	L6678	L6679	L2525	L6690	L6302	L5690	L11894
Ant.post.	(56)	58	60	(57)	60	65	(50)
Ant.transv.	34	30	31	34	35	34	37
Post.transv.	35	33	33	35	34	34	37
No. of specimen	L6677	L6672	L4752	L9126	L5669	L6689	L13390
Ant.post.	62	60	—	60	(55)	(49)	65
Ant.transv.	38	37	38	38	38	35	38
Post.transv.	36	39	35	37	37	37	36

The last lower molar, M_3, is easily distinguishable from M_1 or M_2 by its reduced posterior cingulum; in well-worn specimens the absence of a posterior pressure scar of course is characteristic for M_3. There are eight isolated M_3 (Table 15) the first two of which are from the right side.

TABLE 15

Measurements of M_3 of *Ceratotherium praecox* (mm)

No. of specimen	L5667	L11802	L6613	L11989	L9609	L9125	L9110	L9120
Ant.post.	68	66	(55)	65	67	65	65	(57)
Ant.transv.	38	40	37	42	41	39	36	36
Post.transv.	34	37	36	37	35	34	34	34

In Tables 10 to 15, inclusive, the anteroposterior diameter is in parentheses when it is much reduced because of interproximal wear.

There are a number of teeth belonging to the milk dentition of *Ceratotherium praecox*. Deciduous teeth were not present among the material of this species described from Kanapoi, Lothagam-1 and Ekora (Hooijer & Patterson 1972). Therefore, the Langebaanweg milk teeth are compared below with those of the two living African species. The differential characters of the milk molars of *Diceros bicornis* and *Ceratotherium simum* are recorded in Hooijer (1959). In a collection from Late Pleistocene sites near Swartklip, Cape Province, reported upon by Hendey & Hendey (1968), there are milk molars of *C. simum*, which have been used for comparison.

The maxillary milk dentition of *Ceratotherium praecox* comprises two isolated and much worn DM^1, both from the left side, L6674 and L6675, measuring 22 mm anteroposteriorly and 23 mm transversely. In *C. simum* DM^1 is more elongated anteroposteriorly than in *D. bicornis* because of the greater forward projection of the parastyle in the former, but this character is lost in much worn specimens like those from Langebaanweg and a distinction cannot be made at this stage of wear.

Of DM^2 there are two specimens in the Langebaanweg collection, L4608 (Pl. 29) and L5664, both from the left side. DM^3 is represented only by a single specimen, L9105B (Pl. 29), from the left side and lacking most of the ectoloph. Finally, of the last upper milk molar, DM^4, we have three specimens, one right lacking the outer surface, L6727, one entire left DM^4, L13818, and another left specimen, much worn down, L6651 (Pl. 29). The upper milk molars in *C. simum* are distinguished from those in *D. bicornis* by the more prominent parastyle, suppression of paracone style, greater crown height, absence of inner cingula, stronger crista joining the crochet and forming a medifossette, and the postsinus being approximately as deep as the medisinus instead of shallower. The inner portion of the protoloph is more distinctly curved backward in *C. simum* than in *D. bicornis*, but this difference is more marked in the posterior milk molars than in DM^2, in which it is not or hardly evident. Upper milk dentitions of *C. simum* and of *D. bicornis* have been described from the Early Pleistocene Makapansgat caves (Hooijer 1959); they tend to be on the large side but otherwise indistinguishable from their recent homologues. Variation ranges in dimensions of the milk teeth of the recent species are presented in Table 16 along with the measurements of the Langebaanweg specimens and those from Swartklip in the South African Museum; the Swartklip specimens conform to those of *C. simum* in every respect (they bear catalogue numbers preceded by ZW).

The DM^2 of *Ceratotherium praecox*, L4608, has a prominent parastyle as in *C. simum* but has an internal cingulum along the protocone, as in *D. bicornis*. There is a tubercle at the medisinus entrance that is absent in L5664; both specimens have a well-developed crista joining the crochet and forming a

medifossette. The postsinus is almost as deep as the medisinus; these are, again, *C. simum* characters.

TABLE 16

Measurements of upper milk molars of *C. praecox* and recent species (mm)

DM^2, no. of specimen	L4608	L5664	*D. bicornis*	*C. simum*	ZW192	ZW2610
Greatest length ectoloph	42	—	38–41	41–51	41	42
Antero-transverse	37	35+	33–39	36–41	36	34
Postero-transverse	42	38+	35–40	35–43	—	33
DM^3, no. of specimen	L9105B	*D. bicornis*	*C. simum*	ZW1842		
Greatest length ectoloph	—	45–52	53–61	53		
Antero-transverse	—	40–50	46–48	46		
Postero-transverse	—	39–47	44–46	45		
DM^4, no. of specimen	L13818	L6651	*D. bicornis*	*C. simum*		
Greatest length ectoloph	60	54+	50–55	66–68		
Antero-transverse	56	53	45–53	c. 54–55		
Postero-transverse	53	52	40–51	52–60		

L5664 is incomplete internally, but the minimal transverse diameters can be given. The Langebaanweg DM^2 tally well in size with those of *C. simum*. The two Swartklip specimens of DM^2, ZW192 and ZW2610, both from the right side, lack the internal cingulum, display well-formed medifossettes, and have the postsinus as deep as the medisinus, as in *C. simum* to which they belong. The same holds good for the Swartklip DM^3, ZW1842, which is from the left side. In the Langebaanweg collection there is but one DM^3, L9105B, wanting most of the ectoloph. There is a slender crista, not joining the crochet, hardly any trace of an inner cingulum (except at the medisinus entrance), but the postsinus is less deep than the medisinus, as in *D. bicornis*. No measurements can be given. Of DM^4 we have three Langebaanweg specimens, one right, lacking the outer surface, and two from the left side, as listed above. The entire specimens show the absence of the paracone style, the formation of a medifossette, and the absence of an inner cingulum, as in *C. simum*, although the postsinus is decidedly less deep than the medisinus, as in *D. bicornis*. Thus, the *C. praecox* milk molars combine characters found in *C. simum* and *D. bicornis*, whereas in size they are intermediate between the two.

Of the mandibular milk dentition there are the following specimens: L6686, DM_2 dext., slightly worn; L9105C, DM_3 dext., unworn (Pl. 32), metalophid height 41 mm, and hypolophid height 38 mm; L6301, DM_3 dext., slightly worn; L9105A, DM_4 dext., unworn, metalophid height 50 mm, and hypolophid height 46 mm; L6689, DM_4 dext., much worn down; L6795, left ramus with incomplete DM_{3-4}; L6660, DM_4 dext. in ramus fragment, slightly worn (Pl. 32), crown not fully erupted, anteroposterior diameter 54 mm, as in L9105A; L2524, DM_4 sin. in ramus fragment, crown edge broken, lingual base not exposed; L12870 and L6757, both DM_4 sin., slightly worn.

As shown in Table 17, the Langebaanweg lower milk molars are larger than those in *D. bicornis*, as were the upper milk molars, but they correspond rather well with those from Swartklip, which represent *C. simum*. These Swartklip specimens are: ZW1837, DM_{2-4} dext. in ramus fragment; ZW2036,

DM_{2-3} dext.; ZW1867, DM_2 dext.; ZW1876, DM_3 dext., and ZW1966, DM_3 sin., unworn, metalophid height 45 mm, hypolophid height 42 mm. The DM_3 of *C. praecox* that is unworn, L9105C, has the anteroposterior diameter

TABLE 17

Measurements of lower milk molars of *C. praecox* and recent species (mm)

DM_2, no. of specimen	L6686				ZW 1837	ZW 2036	ZW 1867	*D. bicornis*
Ant.post.	41				40	40	39	27–33
Ant.transv.	16				16	—	—	13–15
Post.transv.	18				20	—	—	15–18
DM_3, no. of specimen	L9105	L6901	L6795		ZW 1837	ZW 1876	ZW 1966	*D. bicornis*
Ant.post.	48	46	*c.* 47		46	45	44	38–41
Ant.transv.	20	—	*c.* 23		22	—	22	19–20
Post.transv.	22	21	25		23	—	23	20–22
DM_4, no. of specimen	L9105	L6689	L12870	L6757	ZW 1837			*D. bicornis*
Ant.post.	54	(46)	51	51	48			41–45
Ant.transv.	23	23	25	25	—			22–23
Post.transv.	26	25	27	23+	—			23–25

longer than that in the unworn DM_3 of *C. simum*, ZW1966 (48 against 44 mm), whereas both in metalophid height and in hypolophid height L9105C is less than is ZW1966 (41 and 38 mm against 45 and 42 mm). It follows from this comparison that the milk tooth of *C. praecox* is less hypsodont than that of *C. simum*; we got the same result from the unworn permanent premolars and molars.

POSTCRANIAL SKELETON

The postcranial material, which is very abundant at the Langebaanweg 'E' Quarry, is listed in the tables of measurements that follow (18 through 50). Measurements of the bones of *D. bicornis* and *C. simum* have been given in previous papers (Hooijer & Singer 1960; Hooijer 1969) from skeletons in the South African Museum, Cape Town, and in the Osteology Department, National Museum Centre for Prehistory and Palaeontology, Nairobi, respectively. In both cases the *C. simum* skeleton is larger than that of *D. bicornis*, with more massive metapodials (higher width/length ratios), but other than that no skeletal differences between the two extant species are apparent. Most of the Langebaanweg bones are larger than their homologues even in *C. simum*.

Eleven proximal portions of scapulae are in the Langebaanweg collection (Table 18) the first five of which are from the right side.

TABLE 18

Measurements of scapula (mm)

No. of specimen	L8244	L11773	L11524	L8245
1. Ant.post. diameter of collum scapulae	135	—	—	*c.* 130
2. Ant.post. diameter over tuber scapulae and glenoid cavity	*c.* 170	155	—	*c.* 170
3. Ant.post. diameter of glenoid cavity	*c.* 110	*c.* 100	*c.* 110	*c.* 105
4. Transverse diameter of idem	*c.* 95	*c.* 90	95	95
5. Transverse diameter of tuber scapulae	—	55	—	60

No. of specimen	L8306	L13857	L8288	L8287	L8290	L8266	L13779
1.		125	120	130	125	—	135
2.	—	165	*c.* 155	165	165	165	175
3.	*c.* 105	105	*c.* 100	105	105	105	—
4.	95	*c.* 90	*c.* 90	100	—	—	—
5.	—	65	65	*c.* 60	*c.* 60	*c.* 70	—

No. of specimen	*D. bicornis*	*C. simum*
1.	100	130
2.	130	160
3.	85	105
4.	80	100
5.	45	60

The mid-portion of the shaft of a right humerus, L3421, has a width at the deltoid tuberosity of 170 mm, and a least width of 85 mm, as in *C. simum* (Hooijer 1969: 91). There are further only distal portions of the humerus, nine in all (Table 19) the first six of which are from the right side.

TABLE 19

Measurements of humerus (mm)

No. of specimen	L6886	L6977	L13559	L6947	L6878	L6899
1. Least width of shaft	90	80	*c.* 90	85	—	90
2. Greatest distal width	—	190	—	—	*c.* 180	*c.* 190
3. Width of trochlea	135	130	130	*c.* 130	125	125

No. of specimen	L3423	L6965	L13463	*D. bicornis*	*C. simum*
1.	80	—	80	60	70–85
2.	185	—	—	150–155	180
3.	120	125	—	100	120

A radio-ulna dext., L12818, is slightly damaged proximo-medially; the radius is longer than any of the fossil radii, four of which are nearly entire (Table 20); only the last specimen in this table, L4967, is from the left side.

TABLE 20

Measurements of radius (mm)

No. of specimen	L12818	L7997	L6375	L8114
1. Median length	400	375	*c.* 370	385
2. Proximal width	—	125	130	130
3. Proximal ant.post. diameter (medial side)	—	80	85	85
4. Least width of shaft	75	75	70	70
5. Greatest distal width	120	120	115	—
6. Width distal articular surface	105	100	100	95

No. of specimen	L4967	*D. bicornis*	*C. simum*
1.	390	345–350	365–380
2.	135	100	120–125
3.	90	60	75
4.	75	45–55	65–70
5.	—	95	120
6.	105	80	100

There are twenty-one proximal portions of the radius (Table 21); the first seven are from the right side.

TABLE 21

Proximal measurements of radius (mm)

No. of specimen			L13175	L6371	L6370	L3425	L9981	L7983
2. Proximal width			135	130	125	125	120	*c.* 130
3. Proximal ant.post. diameter (medial side)			90	*c.* 80	80	85	*c.* 85	90
4. Least width of shaft			—	65	65	—	—	—
No. of specimen	L7934	L7968	L8017	L8007	L4205	L13845	L12888	
2.	130	—	125	*c.* 125	115	125	130	
3.	90	*c.* 95	80	—	85	85	90	
4.	—	—	—	65	70	65	70	
No. of specimen	L7986	L4959	L9978	L2229	L8015	L2289	L7958	L9988
2.	125	130	135	*c.* 125	125	125	125	*c.* 120
3.	80	85	*c.* 90	85	80	*c.* 80	*c.* 85	80
4.	75	70	80	70	—	—	—	—

Distal radius portions number thirty-three (Table 22), fifteen from the right and eighteen from the left side.

TABLE 22

Distal measurements of radius (mm)

No. of specimen	L6369	L6367	L7973	L6177	L4202	L13843	L5234
4. Least width of shaft	65	70	70	—	—	65	—
5. Greatest distal width	120	120	120	120	*c.* 115	*c.* 110	110
6. Width distal articular surface	100	105	105	110	95	90	95
No. of specimen	L9985	L7911	L8010	L7961	L6362	L6173	L3065
4.	—	—	—	—	—	—	—
5.	120	120	*c.* 115	120	120	*c.* 120	120
6.	100	105	105	105	100	105	100
No. of specimen	L5174	L8012	L13842	L2290	L2293	L2291	L9733
4.	—	70	70	70	65	65	65
5.	*c.* 120	110	*c.* 120	115	—	120	—
6.	95	90	105	105	100	100	90
No. of specimen	L9986	L4203	L9730	L6170	L4194	L6372	L3067
4.	—	—	—	—	—	—	—
5.	115	115	*c.* 115	110	*c.* 115	120	110
6.	105	100	100	95	100	100	100
No. of specimen	L7924	L8006	L4957	L7920	L4200		
4.	—	—	—	—	—		
5.	120	*c.* 105	110	110	115		
6.	95	100	90	90	100		

The ulna of the radio-ulna dext., L12818, is the only entire ulna in the Langebaanweg collection; it has a maximum length of 530 mm (*D. bicornis* 450 mm; *C. simum* 510 mm), and a length from the processus anconaeus (beak) to the extremity of the olecranon of 175 mm (*D. bicornis* 140 mm; *C. simum* 165 mm). Further measurements are given in Table 23. In this table, twenty proximal and distal ulna portions are listed; the first twelve are from the right side, the remaining eight (beginning with L8052) from the left.

TABLE 23

Measurements of ulna (mm)

No. of specimen			L12818	L8060	L13836	L8038	L8071	L8055
1. Width at semilunar notch			—	—	*c.* 95	95	*c.* 105	105
2. Greatest distal diameter			90	—	—	—	—	—
3. Ant.post. diameter distal articular surface			60	—	—	—	—	—
No. of specimen	L4210	L7984	L7959	L8029	L8025	L7985	L8041	
1.	—	—	—	—	—	—	—	
2.	85	*c.* 80	*c.* 80	*c.* 80	*c.* 70	85	—	
3.	60	55	*c.* 50	55	55	55	55	
No. of specimen	L8052	L13833	L9994	L6251	L13839	L12891	L3554	
1.	105	110	105	105	—	—	—	
2.	—	—	—	—	80	85	90	
3.	—	—	—	—	60	60	60	
No. of specimen	L7927	*D. bicornis*	*C. simum*					
1.	—	90	110					
2.	80	75	90					
3.	55	60	65					

There are twenty-six scaphoids (Table 24) the first ten of which are from the right side.

TABLE 24

Measurements of scaphoid (mm)

No. of specimen			L6010	L6012	L6003	L6009	L9477
1. Posterior height			63	60	58	57	60
2. Anterior height			58	60	59	59	61
3. Proximal width			55	56	54	55	54
4. Proximal ant.post. diameter			75	73	74	70	78
5. Maximum diameter, distal facets			70	70	69	68	71
No. of specimen	L11767	L7850	L11768	L5284	L9483	L13472	L6218
1.	63	60	65	62	60	66	62
2.	62	60	63	61	58	64	59
3.	55	61	57	60	53	55	61
4.	74	76	79	77	75	77	77
5.	75	77	75	79	75	73	75
No. of specimen	L7809	L6014	L6008	L7849	L5986	L3569	L7803
1.	60	67	60	63	67	63	65
2.	59	60	63	63	64	64	59
3.	55	60	57	58	60	55	57
4.	75	87	73	84	80	74	78
5.	75	78	72	75	77	74	76
No. of specimen	L7735	L7826	L4290	L13616	L7861	L7738	L5282
1.	66	65	61	64	64	67	57
2.	63	65	59	60	63	68	58
3.	60	60	56	55	59	59	54
4.	76	79	73	81	82	77	68
5.	73	75	69	75	80	77	68
No. of specimen	*D. bicornis*	*C. simum*					
1.	50	62					
2.	54–60	58–65					
3.	55	60					
4.	63	75					
5.	62–70	73–78					

Of the lunar there are thirty-six specimens (Table 25), and the first eighteen are from the right side.

TABLE 25

Measurements of lunar (mm)

No. of specimen		L4253	L12379	L6006	L7853	L7829	L7882
1. Anterior height		64	61	65	69	61	61
2. Proximal width		67	61	64	68	63	62
3. Greatest ant.post. diameter		79	83	81	87	78	80
No. of specimen	L5281	L4270	L3049	L4787A	L9475	L4287	L13828
1.	65	57	58	60	59	60	63
2.	68	58	66	58	61	60	60
3.	75+	72	76	78	78	77	77
No. of specimen	L5290	L13823	L7737	L7755	L5975	L13824	L12187
1.	62	62	58	64	59	66	63
2.	64	60	59	62	56	66	66
3.	79	78	76	80	75	78	82
No. of specimen	L11596	L7885	L7822	L7771	L13727	L9184	L9183
1.	66	58	61	60	58	63	62
2.	65	60	63	60	66	64	63
3.	86	76	76	78	76	83	81
No. of specimen	L5293	L11598	L7896	L4286	L5972	L7890	L9457
1.	60	58	64	63	61	65	66
2.	60	63	65	63	63	65	63
3.	75	75	80	81	79	78	82
No. of specimen	L3806	L7774	*D. bicornis*	*C. simum*			
1.	59	64	44–48	54–60			
2.	58	65	48	58–62			
3.	77	80	64–68	75			

Fifteen specimens of the cuneiform are in the Langebaanweg collection (Table 26), ten right and five left; L9465 is presented in anterior view in Pl. 33 (bottom).

TABLE 26

Measurements of cuneiform (mm)

No. of specimen			L12765	L3405	L5218	L4265	L5286
1. Anterior height			57	51	52	47	61
2. Distal width			56	48	46	49	51
3. Proximal ant.post. diameter			51	47	44	43	46
4. Greatest horizontal diameter			68	63	58	58	61
No. of specimen	L7808	L7833	L7869	L7858	L13821	L9254	L7749
1.	55	53	56	57	56	45	59
2.	—	44	50	51	c. 47	43	50
3.	48	41	43	47	45	43	49
4.	61	56	61	64	60	57	64
No. of specimen	L3566	L9471	L9465	*D. bicornis*	*C. simum*		
1.	59	52	53	50	56–58		
2.	52	50	53	38–40	45–59		
3.	51	43	48	38–40	48–51		
4.	67	57	62	53	66		

Three pisiforms, one right, L6004, and two left, L7854 and L7892, are in the Langebaanweg collection (Table 27); L7892 is presented in anterior view in Plate 33 (bottom). The bones have the two facets, for ulna and cuneiform.

TABLE 27

Measurements of pisiform (mm)

No. of specimen	L6004	L7854	L7892	*D. bicornis*	*C. simum*
1. Length	71	72	67	61	60
2. Distal height	51	49	43	35	36

An exceptional bone is L7823, a cuneiform sin. with the pisiform completely ankylosed to it. The part representing the cuneiform is normal in shape, but it forms a solid mass with the pisiform, and the ulnar facets of the two bones are confluent (Pl. 33, middle). The greatest horizontal diameter of the anomalous bone is just over 110 mm (the distal extremity of the pisiform is incomplete). For comparison a cuneiform and a pisiform are figured along with the cuneipisiform (Pl. 33, bottom).

The trapezium, the radial of the distal row of carpal bones, with facets for the scaphoid and the trapezoid, is represented in the Langebaanweg collection by a single specimen, L3497; it is from the right side. In Table 28 the fossil bone is shown to be larger than its homologue in *C. simum*, as is usual for Langebaanweg bones.

TABLE 28

Measurements of trapezium (mm)

No. of specimen	L3497	*D. bicornis*	*C. simum*
1. Height	35	31	35
2. Proximal diameters	33 × 22	25 × 15	29 × 17

The trapezoid is represented in the Langebaanweg collection by five specimens, three from the right and two from the left side (Table 29).

TABLE 29

Measurements of trapezoid (mm)

No. of specimen	L7798	L11881	L13999	L4263	L4267	*D. bicornis*	*C. simum*
1. Anterior width	35	37	37	35	38	30	35
2. Anterior height	38	45	34	39	38	31	32
3. Posterior height	35	50	33	36	37	29	36
4. Ant.post. diameter	51	55	49	48	52	41	49

Of the magnum we have twenty-one specimens (Table 30) the first ten of which are from the right side.

TABLE 30

Measurements of magnum (mm)

No. of specimen			L7793	L4244	L12824	L4078	L5568
1. Anterior width			59	59	65	58	56
2. Anterior height			40	40	38	34	42
3. Proximal ant.post. diameter			83	80	83	68	76
4. Greatest diameter			103	104	115	*c.* 85	96
No. of specimen	L9473	L9460	L9459	L6013	L4264	L5184	L6217
1.	62	61	57	52	56	56	56
2.	38	45	41	38	40	40	41
3.	80	85	84	74	77	82	78
4.	—	—	—	—	—	105	107
No. of specimen	L7876	L5259	L7743	L11592	L9476	L4283	L7745
1.	59	*c.* 60	57	60	*c.* 55	54	57
2.	38	42	45	43	42	40	*c.* 40
3.	77	86	88	—	80	77	78
4.	94	105	112	101	101	—	—
No. of specimen	L7797	L7759	*D. bicornis*	*C. simum*			
1.	51	*c.* 55	44–49	57–58			
2.	34	40	32	38			
3.	77	82	63–67	70–71			
4.	—	—	77–85	84–85			

There are forty specimens of the unciform in the Langebaanweg collection (Table 31), twenty from the right, and the same number from the left side.

TABLE 31

Measurements of unciform (mm)

No. of specimen		L7762	L7812	L12824	L9193	L12766	L5262	L7747
1. Anterior height		58	64	65	57	62	56	61
2. Anterior width		81	87	83	77	81	75	83
3. Greatest diameter		103	112	107	100	108	98	105
No. of specimen	L11590	L6016	L4240	L9461	L9201	L6005	L7879	L11597
1.	62	62	55	60	56	55	63	61
2.	85	81	76	78	72	80	88	85
3.	111	105	102	100	98	96	*c.* 115	103
No. of specimen	L9456	L7855	L5260	L7870	L9184	L4076	L11097	L7837
1.	56	64	55	60	57	58	56	62
2.	72	87	73	77	75	83	75	83
3.	98	108	98	102	95	109	97	105
No. of specimen		L4285	L12826	L9468	L5973	L13829	L11591	L7840
1.		57	61	60	54	58	63	58
2.		76	79	81	76	83	91	85
3.		100	105	102	96	108	112	110
No. of specimen		L4789A	L4256	L11600	L5263	L5258	L7742	L9469
1.		55	63	53	55	65	60	57
2.		74	85	78	77	82	80	80
3.		104	107	95	99	106	102	108
No. of specimen		L5257	L9466	L9464	*D. bicornis*	*C. simum*		
1.		57	60	57	49–51	51–55		
2.		74	84	79	63–65	74–78		
3.		100	106	105	84–90	99–100		

There are twenty entire second metacarpals (Table 32) the first five of which are from the right side. The ratio middle width/median length in the fossil series varies from 0,21 to 0,28, which includes the observations on the recent Mc.II (taken from Hooijer & Singer 1960, and Hooijer 1969).

TABLE 32

Measurements of second metacarpal (mm)

No. of specimen			L3066	L4890	L5934	L12819	L5988
1. Median length			173	177	167	172	160
2. Proximal width			42	39	43	44	38
3. Proximal ant.post. diameter			52	*c.* 50	55	54	50
4. Middle width			43	40	42	—	38
5. Middle ant.post. diameter			24	23	23	—	21
6. Greatest distal width			50	49	56	56	50
7. Width distal trochlea			44	43	45	46	44
8. Distal ant.post. diameter			51	49	49	50	46
9. Ratio middle width/length			0,25	0,23	0,25	—	0,24
No. of specimen	L9225	L7111	L7129	L7109	L7072	L9395	L7083
1.	175	158	172	167	159	172	176
2.	45	37	44	40	37	41	41
3.	55	55	53	51	47	58	51
4.	45	37	42	36	35	41	37
5.	25	20	23	23	21	25	24
6.	53	52	49	46	47	52	56
7.	46	44	45	42	42	45	47
8.	48	48	48	47	45	51	45
9.	0,26	0,23	0,24	0,22	0,22	0,24	0,21
No. of specimen	L7093	L7090	L4104	L7064	L7154	L4132	L6064
1.	162	176	176	158	183	157	163
2.	42	40	42	40	41	40	38
3.	*c.* 50	52	57	49	53	54	51
4.	41	39	41	35	45	39	35
5.	19	26	29	22	23	24	24
6.	50	53	53	47	57	52	50
7.	42	46	42	42	46	45	45
8.	45	47	48	43	51	48	45
9.	0,25	0,22	0,23	0,22	0,25	0,25	0,21
No. of specimen	L7071	*D. bicornis*		*C. simum*		Chemeron	
1.	166	147	148	160	160	165	
2.	—	32	40	44	45	*c.* 45	
3.	58	46	36	44	49	*c.* 50	
4.	47	33	31	40	40	42	
5.	28	19	18	20	24	23	
6.	57	39	37	45	50	—	
7.	48	33	—	—	40	—	
8.	50	41	38	43	45	—	
9.	0,28	0,22	0,21	0,25	0,25	0,25	

The third metacarpal is represented in the Langebaanweg collection by twenty-two entire specimens (Table 33), eleven right and eleven left. The bone L3070 is a diseased specimen, somewhat like the second metatarsal of *Diceratherium leakeyi* Hooijer (1966, pl. 15) from Rusinga Island.

TABLE 33

Measurements of third metacarpal (mm)

No. of specimen	L5962	L11356	L7086	L7081	L7100
1. Median length	186	206	192	198	185
2. Proximal width	67	78	65	76	71
3. Proximal ant.post. diameter	58	67	55	65	63
4. Middle width	57	66	56	63	57
5. Middle ant.post. diameter	27	31	27	28	26
6. Greatest distal width	74	78	70	78	73
7. Width distal trochlea	63	72	62	69	65
8. Distal ant.post. diameter	51	57	52	58	51
9. Ratio middle width/length	0,31	0,32	0,29	0,32	0,31

No. of specimen	L7080	L13750	L3070	L6215	L2275	L6045	L2276
1.	193	186	195	187	203	194	200
2.	70	64	69	65	72	67	74
3.	56	57	—	57	—	58	57
4.	58	54	*c.* 60	58	61	59	61
5.	30	24	—	27	27	26	31
6.	75	67	—	69	80	70+	78
7.	63	58	65	62	67	62	68
8.	51	50	—	54	55	50	54
9.	0,30	0,30	—	0,31	0,30	0,30	0,31

No. of specimen	L7001	L12822	L5937	L5931	L4149	L13756	L9381
1.	183	195	182	188	188	206	192
2.	72	77	70	72	78	69	71
3.	57	61	57	56	58	58	54
4.	63	66	55	58	64	63	57
5.	25	28	24	27	26	24	24
6.	73	—	73	71	75	71	73
7.	61	66	61	58	64	60	62
8.	—	56	53	50	54	54	51
9.	0,34	0,34	0,30	0,31	0,34	0,31	0,30

No. of specimen	L9408	L7085	L13580	*D. bicornis*		*C. simum*	
1.	186	183	192	162	166	173	176
2.	72	78	77	59	60	70	68
3.	58	61	60	48	51	55	52
4.	64	64	58	46	45	56	58
5.	27	30	30	22	22	24	28
6.	—	82	74	61	52	66	71
7.	69	64	60	51	—	—	59
8.	—	52	53	44	41	48	48
9.	0,34	0,35	0,30	0,28	0,27	0,32	0,33

The variation range in width/length ratio in the Langebaanweg Mc.III, 0,29 to 0,35, is such that it includes the observations of *C. simum* but the two *D. bicornis* metapodials are relatively more slender than the fossil specimens, although the difference is small.

There are sixteen entire fourth metacarpals in the Langebaanweg collection (Table 34), the first five of which are from the right side. In this metacarpal, only one of the two *D. bicornis* is below the variation range in width/length ratio in the fossil specimens.

TABLE 34

Measurements of fourth metacarpal (mm)

No. of specimen	L6631	L7084	L5936	L5949	L7098	L12820
1. Median length	148	147	155	151	149	157
2. Proximal width	53	50	54	55	53	58
3. Proximal ant.post. diameter	47	52	51	48	50	50
4. Middle width	39	42	40	37	40	44
5. Middle ant.post. diameter	24	24	24	23	27	25
6. Greatest distal width	50	58	—	48	52	55
7. Width distal trochlea	46	49	46	42	42	45
8. Distal ant.post. diameter	46	45	—	42	44	46
9. Ratio middle width/length	0,26	0,29	0,26	0,25	0,27	0,28

No. of specimen	L2285	L9411	L7078	L4131	L9246	L7089	L7102
1.	150	153	147	160	161	163	155
2.	54	50	51	57	57	58	51
3.	50	—	49	53	52	55	51
4.	39	39	40	36	38	43	37
5.	23	21	24	22	25	24	26
6.	54	48	50	51	51	52	51
7.	46	43	42	43	45	42	42
8.	44	41	42	43	46	44	45
9.	0,26	0,25	0,27	0,23	0,24	0,26	0,24

No. of specimen	L7095	L9401	L7101	*D. bicornis*		*C. simum*	
1.	156	145	157	136	135	145	143
2.	64	57	59	43	38	55	54
3.	53	49	51	43	44	51	50
4.	42	38	38	33	30	40	41
5.	25	25	26	18	19	23	23
6.	58	47	52	43	35	48	52
7.	47	46	46	37	—	—	42
8.	48	43	44	38	34	43	45
9.	0,27	0,26	0,24	0,24	0,22	0,28	0,29

The fifth metacarpal of *Ceratotherium praecox* is reduced, mammiform, as it is in the recent species. There is one specimen in the Langebaanweg collection, L11606, with the two facets for the unciform and Mc.IV. It is 46 mm in length, and 35 by 29 mm in proximal diameters. In *D. bicornis* these diameters are 35 mm, and 27 by 26 mm; in *C. simum* the bone is larger, as usual, viz., length 45 mm, and 33 by 26 mm proximally.

Of the femora in the Langebaanweg collection there is only one that is nearly entire, L12292, from the left side, lacking portions of the caput and of the trochanter major, and most of the medial part of the trochlea (first column in Table 35). In length from caput to medial condyle it exceeds the femur of *C. simum*, but in diameter of the caput it is just as large as the larger of the two *C. simum* femora. There are two isolated femur heads, L12632 and L12676, with the same diameter as L12292. The width across the third trochanter, 175 mm, is also found in a mid-shaft portion of a left femur, L13254. There are several juvenile shaft portions showing the third trochanter, viz., L13831, L13867–13869, and L3409. Three distal portions of femora, L8118 and L12681 from the right side, and L11758 from the left, complete the list of femora in the Langebaanweg collection (Table 35).

TABLE 35

Measurements of femur (mm)

No. of specimen	L12292	*D. bicornis*		*C. simum*	
1. Greatest length	590	440	460	510	530
2. Diameter of caput	110	80	85	110	95
3. Width across third trochanter	175	—	140	155	—
4. Greatest distal width	*c.* 175	120	125	155	150
5. Distal ant.post. diameter, medial side	—	160	165	190	190
6. Distal ant.post. diameter, lateral side	155	—	125	155	—

No. of specimen	L8118	L12681	L11758
4. Greatest distal width	175	180	165
5. Distal ant.post. diameter, medial side	210	225	*c.* 200
6. Distal ant.post. diameter, lateral side	*c.* 160	*c.* 175	*c.* 145

Twenty-one entire patellae are in the Langebaanweg collection (Table 36), nine from the right, and eleven from the left side. All of them are larger than the recent bones even of *C. simum*.

TABLE 36

Measurements of patella (mm)

No. of specimen	L14035	L13725	L11589	L9210	L4250	L11387	L3069
1. Length	130	115	105	110	115	130	*c.* 135
2. Width	120	110	105	105	105	120	125

No. of specimen	L6226	L6060	L4268	L7766	L7895	L7739	L4061
1.	130	115	120	125	120	115	130
2.	110	110	110	110	105	105	110

No. of specimen	L12833	L13968	L7787	L4246	L5817	L5927
1.	135	120	120	115	110	115
2.	125	110	115	105	105	100

No. of specimen	L5926	*D. bicornis*		*C. simum*	
1.	115	95	100	105	105
2.	105	85	90	90	95

Of the tibia there are no entire specimens in the Langebaanweg collection; the most complete specimen, L1805, has only the medial portion of the proximal articular surface, and distally the lateral portion is damaged. The length, measured along the medial surface, is 355 mm, and the greatest length was probably 380 mm (*D. bicornis* 335 mm, *C. simum* 350–380 mm). There are five proximal portions of the tibia (Table 37), the first three of which are from the right side.

TABLE 37

Proximal measurements of tibia (mm)

No. of specimen	L9702	L12619	L7934	L13174	L7944
1. Proximal width	—	150	140	150	155
2. Proximal ant.post. diameter	115	145	120+	—	*c.* 135
3. Least width of shaft	70	—	—	75	80

No. of specimen	*D. bicornis*		*C. simum*	
1.	110	115	135	140
2.	—	120	—	145
3.	—	55	—	65

There are no less than forty-one distal portions of the tibia (Table 38); the first nineteen from the right side, and the remaining twenty-two (starting with L13477) from the left.

TABLE 38

Distal measurements of tibia (mm)

No. of specimen		L7947	L7908	L6171	L7953	L1806	L4968
3. Least width of shaft		80	75	70	55	70	65
4. Distal width		105	100	95	90	95	100
5. Distal ant.post. diameter		100	90	85	85	80	90
No. of specimen	L11770	L7909	L4963	L4742	L9980	L3073	L6167
3.	—	—	—	—	—	—	
4.	95	100	105	100	*c.* 95	95	100
5.	90	95	95	90	85	85	95
No. of specimen	L7910	L7930	L6174	L6373	L6374	L7948	L13477
3.	—	—	—	—	—	—	75
4.	90	100	90	100	105	100	100
5.	85	95	80+	90	95	—	95
No. of specimen	L4965	L13858	L7941	L7940	L4969	L2262	L6165
3.	65	—	70	85	75	70	—
4.	95	95	95	100	95	95	100
5.	90	90	85	100	—	85	95
No. of specimen	L7946	L7914	L7950	L7931	L7947	L7951	L7912
3.	75	—	—	—	—	—	—
4.	90	95	100	105	100	95	100
5.	90	90	95	100	85	85	90
No. of specimen	L2264	L7926	L6366	L11529	L4186	L4187	
3.	—	—	—	—	—	—	
4.	100	95	90	95	100	90	
5.	90	95	85	90	—	—	

No. of specimen	L7921	*D. bicornis*		*C. simum*	
3.	—	—	55	—	65
4.	90	85	95	95	115
5.	—	70	95	80	85

The astragalus is represented in the Langebaanweg collection by sixty-seven entire specimens (Table 39), thirty-six from the right side, and thirty-one (beginning with L4166) from the left. The astragalus is the numerically best represented bone in the Langebaanweg collection, to which its solid build undoubtedly contributed.

Like the other bones from Langebaanweg, the astragali are on the large side when compared with their homologues in the living African species. Twenty-six out of the sixty-seven Langebaanweg astragali exceed the larger of the two *C. simum* astragali in all dimensions taken. The ratio medial height/total width varies between much wider limits in the Langebaanweg series (0,74–0,91) than it does in the few recent bones of *D. bicornis* and *C. simum*, as may be expected. However, the variation range in this ratio in the *Ceratotherium praecox* series does not overlap with that in the Miocene brachypotheres of Africa and Europe (*Brachypotherium heinzelini* and *B. brachypus*: 0,64–0,73; cf. Hooijer 1966: 148). In nearly all of the Langebaanweg astragali the trochlea width is

TABLE 39
Measurements of astragalus (mm)

No. of specimen		L5886	L5891	L5929	L4169	L5888	L4173
1. Lateral height		93	96	89	91	94	94
2. Medial height		90	94	88	81	85	90
3. Total width		110	110	104	101	110	116
4. Ratio medial height/total width		0,82	0,85	0,85	0,80	0,84	0,78
5. Trochlea width		103	95	93	95	98	105
6. Width of distal facets		86	90	82	90	93	92
No. of specimen	L5928	L7222	L7230	L7226	L7209	L7207	L7204
1.	85	88	84	85	96	90	90
2.	88	85	83	80	94	87	87
3.	109	100	103	99	111	106	115
4.	0,81	0,85	0,81	0,81	0,85	0,82	0,76
5.	102	96	93	92	103	96	100
6.	82	86	83	82	90	78	95
No. of specimen	L7211	L7212	L7195	L4865	L1803	L7197	L7198
1.	95	90	94	80	83	92	94
2.	92	89	94	80	81	85	85
3.	110	108	119	104	100	115	111
4.	0,84	0,82	0,79	0,77	0,81	0,74	0,77
5.	103	99	103	89	90	102	96
6.	90	84	95	83	78	80	92
No. of specimen	L7200	L11577	L11903	L6349	L13822	L4161	L6209
1.	100	88	91	95	91	88	94
2.	89	92	94	96	92	88	90
3.	120	116	112	116	111	115	112
4.	0,74	0,79	0,84	0,83	0,83	0,77	0,80
5.	104	95	98	98	102	97	97
6.	98	94	93	94	92	93	88
No. of specimen	L11581	L5427	L4874	L2267	L4868	L4864	L7196
1.	93	91	87	91	105	89	92
2.	94	84	84	89	98	84	88
3.	117	113	107	111	122	113	112
4.	0,80	0,74	0,79	0,80	0,80	0,74	0,79
5.	103	99	96	97	105	96	102
6.	88	86	85	81	103	87	87
No. of specimen	L9489	L12515	L4166	L4162	L4168	L6065	L5890
1.	88	88	88	93	85	77+	86
2.	87	88	89	95	84	87	89
3.	105	103	109	112	103	107	115
4.	0,83	0,85	0,82	0,85	0,82	0,81	0,77
5.	93	90	102	100	90	94	105
6.	82	79	93	90	77	83	87
No. of specimen	L4167	L7213	L7225	L7215	L7216	L5930	L9492
1.	87	86	94	88	91	88	90
2.	86	91	91	87	92	94	88
3.	116	115	120	110	107	115	111
4.	0,74	0,79	0,76	0,79	0,86	0,82	0,79
5.	99	105	105	96	98	108	98
6.	83	96	95	87	82	88	95
No. of specimen	L12655	L7488	L9495	L7219	L5717	L7208	
1.	85	87	80	86	83	85	
2.	92	82	81	85	80	88	
3.	104	105	98	107	105	108	
4.	0,88	0,78	0,83	0,79	0,76	0,81	
5.	90	90	87	95	94	92	
6.	83	83	80	84	83	85	

No. of specimen	L7210	L7203	L7206	L11578	L11583	L4164
1.	91	88	85	87	92	84
2.	87	91	87	93	92	92
3.	107	100	110	120	106	103
4.	0,81	0,91	0,79	0,78	0,87	0,89
5.	92	91	98	105	100	92
6.	86	79	86	101	86	84
No. of specimen	L11582	L5889	L5869	L4870	L9491	L4863
1.	85	94	87	87	85	83
2.	93	97	93	90	82	84
3.	114	108	108	104	106	100
4.	0,82	0,89	0,86	0,87	0,77	0,84
5.	94	97	96	93	90	92
6.	91	88	85	83	84	86

No. of specimen	L9486	*D. bicornis*		*C. simum*	
1.	92	65	71	74	76
2.	94	68	70	75	84
3.	114	86	83	95	104
4.	0,82	0,79	0,84	0,79	0,81
5.	99	78	78	83	87
6.	87	73	72	85	88

greater than the medial height, although in some by a narrow margin only; in three specimens (L7203, L4164, and L5889) the trochlea width equals the medial height, and in one (L12655) the trochlea width is just a little less than the medial height. This evidently exceptional condition in *C. praecox* is the rule in *Aceratherium* and *Dicerorhinus* (Hooijer 1966: 173); in *Brachypotherium* trochlea width exceeds medial height, as it does also in *Paradiceros* (Hooijer 1968: 89) and *Chilotheridium* (Hooijer 1971: 377).

The calcaneum is represented in the Langebaanweg collection by fifty specimens, twenty-four right and twenty-six left (Table 40). In greatest height all of these exceed the recent bones used for comparison; in anteroposterior diameter thirty-six fossil calcanea exceed the recent.

TABLE 40
Measurements of calcaneum (mm)

No. of specimen		L11584	L11771	L5867	L4174	L7186	L5980
1. Greatest height		149	153	143	140	141	145
2. Greatest width		85	90	—	—	—	—
3. Ant.post. diameter		—	83	76	72	73	76
No. of specimen	L5893	L5855	L5982	L5981	L4177	L5851	L3052
1.	142	144	134	146	143	148	140
2.	83	81	81	—	—	82	—
3.	70	78	69	75	76	76	73
No. of specimen	L3052	L4881	L7180	L7169	L7184	L5856	L7190
1.	140	143	146	142	149	152	146
2.	—	—	—	—	95	97	88
3.	73	74	76	73	77	88	79
No. of specimen	L7182	L7198	L7181	L7191	L7166	L6348	L13804
1.	145	157	153	150	152	146	148
2.	90	95	—	94	—	—	—
3.	77	81	77	81	80	76	76

No. of specimen	L5892	L3536	L3149	L7194	L6055	L5853	L9503
1.	144	145	140	156	153	151	145
2.	83	—	87	—	—	84	83
3.	78	76	70	84	80	79	72
No. of specimen	L4175	L5461	L7175	L3790	L8654	L7188	L7187
1.	150	145	152	142	143	141	147
2.	—	—	—	90	—	—	85
3.	73	77	79	*c.* 75	80	80	77
No. of specimen	L7177	L7171	L7172	L4179	L11585	L6054	L1802
1.	143	145	140	146	161	141	141
2.	—	79	—	—	*c.* 95	85	83
3.	75	70	73	77	83	72	74
No. of specimen	L9501	L7192	L13825	*D. bicornis*		*C. simum*	
1.	152	153	138	110	110	125	125
2.	82	83	—	65	70	80	82
3.	75	82	79	60	65	75	66

The naviculars in the Langebaanweg collection number twenty-seven (Table 41), the first fifteen of which are from the right side.

TABLE 41

Measurements of navicular (mm)

No. of specimen	L9516	L7775	L5567	L3675	L9515	L9512	L9181
1. Anterior height	35	32	34	37	31	31	34
2. Total width	56	62	58	54	57	63	60
3. Ant.post. diameter	71	72	82	75	72	76	80
No. of specimen	L7852	L7854	L7888	L11623	L6064	L4242A	L6067	L4251
1.	32	31	32	30	33	33	34	33
2.	56	57	61	53	60	55	59	54
3.	76	72	73	69	76	69	72	74
No. of specimen	L7757	L9507	L6065	L9510	L5241	L4242B	L4257	L5264
1.	33	32	32	30	37	30	32	34
2.	66	58	58	56	60	52	53	54
3.	70	72	69	72	78	70	76	75
No. of specimen	L12627	L7889	L7841	L6066	*D. bicornis*		*C. simum*	
1.	33	33	33	33	24		29	
2.	60	58	55	63	45		55	
3.	73	76	66	78	56		62	

There are twenty-nine cuboids (Table 42), the first eleven of which are from the right side.

TABLE 42

Measurements of cuboid (mm)

No. of specimen	L6221	L3804	L4262	L3676	L3496	L9482	L12823
1. Anterior height	53	49	49	48	51	50	54
2. Anterior width	53	48	54	49	47	49	58
3. Greatest ant.post. diameter	77	75	76	69	75	73	86
No. of specimen	L4269	L7796	L11750	L4069	L6223	L4260	L7871
1.	51	55	51	51	53	49	46
2.	49	54	50	49	53	44	48
3.	76	79	73	78	82	73	70

No. of specimen	L9458	L9474	L6620	L4068	L7785	L12008	L7803
1.	48	52	52	52	46	50	53
2.	51	—	51	52	49	54	54
3.	72	71	81	83	76	78	87
No. of specimen	L9472	L7770	L5273	L4289	L5287	L5288	L5280
1.	49	52	55	44	50	55	47
2.	44	50	48	43	44	47	53
3.	77	79	78	73	71	76	78
No. of specimen	L5294	*D. bicornis*	*C. simum*				
1.	48	37	43				
2.	46	44	52				
3.	73	65	80				

The cuboid of *Ceratotherium praecox* is higher than wide anteriorly in sixteen specimens, and wider than high in nine. We find the same variation in *Aceratherium* and *Dicerorhinus* (Hooijer 1966: 176); it is in *Brachypotherium* and *Chilotherium* that the width is distinctly greater than the height, and this is true to a lesser extent in *Chilotheridium* (Hooijer 1971: 380).

Eight ectocuneiforms, six right and two left (Table 43), have the anterior width about two times the anterior height, as in the recent African species, *Aceratherium* and *Dicerorhinus*, and *Chilotheridium*; in *Chilotherium* the width is three times the height (Hooijer 1966: 177; 1971: 380–381).

TABLE 43

Measurements of ectocuneiform (mm)

No. of specimen	L4075	L9514	L9517	L7820	L4053	L4070
1. Anterior height	30	32	28	30	27	27
2. Anterior width	60	56	54	57	53	55
3. Ant.post. diameter	71	59	57	57	51	56
No. of specimen	L7749	L7773	*D. bicornis*	*C. simum*		
1.	33	33	24	27		
2.	57	58	45	57		
3.	58	59	53	54		

One mesocuneiform, from the left side, is the remaining tarsal bone in the collection (Table 44).

TABLE 44

Measurements of mesocuneiform (mm)

No. of specimen	L12663	*D. bicornis*	*C. simum*
1. Height	24	14	19
2. Width	24	24	22
3. Ant.post. diameter	45	34	43

A set of right metatarsals, L13548–13550, belong to one and the same individual (Pl. 34). Their measurements are given in the first columns of Tables 45–47.

Of the second metatarsal there are fifteen entire specimens (Table 45), the first seven of which are from the right side. The variation range in width/

length ratio is rather small, 0,18–0,22 only, and one of the *D. bicornis* metapodials remains below these limits, that is, it is more slender in build.

TABLE 45

Measurements of second metatarsal (mm)

No. of specimen	L13550	L2279	L4118	L4886	L13802
1. Median length	176	166	161	164	162
2. Proximal width	41	35	37	35	37
3. Proximal ant.post. diameter	—	49	55	51	54
4. Middle width	32	32	30	33	29
5. Middle ant.post. diameter	32	30	29	26	29
6. Greatest distal width	49	45	—	44	—
7. Width distal trochlea	44	41	39	39	—
8. Distal ant.post. diameter	52	43	44	45	43
9. Ratio middle width/length	0,18	0,19	0,19	0,20	0,18

No. of specimen	L5943	L7075	L11772	L6052	L4109	L4127	L9380
1.	174	158	162	153	160	168	162
2.	43	33	36	33	33	33	39
3.	56	51	58	50	50	54	56
4.	35	29	30	28	32	30	35
5.	33	27	32	24	27	30	30
6.	48	43	49	41	41	44	48
7.	43	38	42	39	38	38	44
8.	48	43	45	42	44	48	45
9.	0,20	0,18	0,19	0,18	0,20	0,18	0,22

No. of specimen	L7097	L11904	L4142	*D. bicornis*		*C. simum*	
1.	157	153	160	129	135	148	151
2.	38	35	39	25	24	38	34
3.	56	51	55	42	33	49	47
4.	32	33	32	25	22	30	28
5.	30	30	31	19	20	22	24
6.	46	45	44	33	31	40	39
7.	45	40	41	29	—	—	36
8.	47	44	48	36	35	42	40
9.	0,20	0,22	0,20	0,20	0,16	0,20	0,19

There are twenty entire third metatarsals (Table 46), ten from the right and ten from the left side. The range of variation in width/length ratio of the fossil bones (0,26–0,33) is very nearly the same as that in the four recent bones.

TABLE 46

Measurements of third metatarsal (mm)

No. of specimen	L13548	L6048	L4138	L13752	L13754
1. Median length	198	192	179	181	171
2. Proximal width	70	62	62	61	55
3. Proximal ant.post. diameter	—	57	57	56	53
4. Middle width	60	53	55	54	47
5. Middle ant.post. diameter	35	31	30	30	25
6. Greatest distal width	82	68	—	71	58
7. Width distal trochlea	69	57	54	58	54
8. Distal ant.post. diameter	55	50	50	—	49
9. Ratio middle width/length	0,30	0,28	0,31	0,30	0,27

No. of specimen	L7058	L7065	L7062	L12615	L11855	L5960	L6043
1.	191	187	182	180	188	198	186
2.	63	64	57	61	62	67	58
3.	61	55	—	57	55	c. 60	51
4.	54	52	53	52	57	62	49
5.	29	29	26	31	27	33	28
6.	67	67	—	68	70	80	—
7.	59	56	56	56	60	66	53
8.	52	51	—	51	51	58	49
9.	0,28	0,28	0,29	0,29	0,30	0,31	0,26

No. of specimen	L7000	L5932	L4148	L13801	L13749	L9379	L7152
1.	180	171	178	190	183	177	182
2.	59	58	58	59	59	61	60
3.	53	52	55	—	54	51	53
4.	48	53	49	55	53	54	60
5.	26	29	28	29	31	31	29
6.	66	64	66	71	—	68	74
7.	55	54	55	59	55	59	62
8.	50	46	48	54	51	49	51
9.	0,27	0,31	0,28	0,29	0,29	0,31	0,33

No. of specimen	L7092	*D. bicornis*		*C. simum*		Aterir
1.	183	148	152	160	169	180
2.	59	48	50	59	55	58
3.	—	48	45	47	49	50
4.	50	40	40	51	48	49
5.	28	21	19	22	25	24
6.	65	54	45	56	66	68
7.	57	47	—	—	51	—
8.	50	42	40	46	47	45
9.	0,27	0,27	0,26	0,32	0,28	0,27

There are sixteen entire fourth metatarsals in the Langebaanweg collection (Table 47), eight right and eight left. The width/length ratio does not vary a

TABLE 47

Measurements of fourth metatarsal (mm)

No. of specimen	L13549	L3555	L4888	L7073	L3785
1. Median length	170	166	153	166	155
2. Proximal width	65	54	52	53	48
3. Proximal ant.post. diameter	52	44	46	48	43
4. Middle width	33	32	33	31	27
5. Middle ant.post. diameter	48	40	38	38	32
6. Greatest distal width	—	43	42	41	37
7. Width distal trochlea	–	39	39	41	35
8. Distal ant.post. diameter	49	44	41	45	41
9. Ratio middle width/length	0,19	0,19	0,22	0,19	0,17

No. of specimen	L7114	L7070	L7063	L4111	L4151	L4158	L13748
1.	162	157	156	160	163	158	174
2.	54	50	49	53	49	53	53
3.	46	42	46	50	48	55	48
4.	35	27	29	30	31	32	34
5.	38	33	32	35	35	38	40
6.	47	40	40	41	42	40	47
7.	41	38	34	37	39	40	40
8.	45	42	40	43	43	43	46
9.	0,22	0,22	0,19	0,19	0,19	0,20	0,20

No. of specimen	L5942	L9390	L9241	L7099	*D. bicornis*		*C. simum*	
1.	152	157	155	154	125	127	138	146
2.	49	57	45	49	42	39	44	49
3.	46	55	56	46	40	40	47	45
4.	29	30	30	27	26	26	35	29
5.	35	40	34	33	24	23	26	28
6.	38	42	40	41	36	31	44	39
7.	34	36	36	38	33	—	—	37
8.	39	39	42	40	38	34	41	41
9.	0,19	0,19	0,19	0,18	0,21	0,20	0,25	0,20

great deal (0,17–0,22). One of the recent bones (the first under the head *C. simum*) is not within these limits but above them; it is more massively built than the other recent, and the fossil fourth metatarsals.

There are nineteen first phalanges of median digits (Table 48), whether from the manus or from the pes I am unable to tell.

TABLE 48

Measurements of phalanx I, median digit (mm)

No. of specimen		L3046	L8418	L6099	L8416	L4214	L9250
1. Median length		38	41	40	43	38	42
2. Proximal width		66	67	67	66	64	60
No. of specimen	L8417	L5276	L9520	L8415	L5326	L8420	L6216
1.	43	44	37	37	37	40	42
2.	61	64	58	61	—	60	57
No. of specimen	L8419	L9251	L5993	L13767	L5275	L7252	
1.	39	37	40	44	39	—	
2.	65	57	61	64	57	71	

No. of specimen	*D. bicornis*		*C. simum*	
	manus	pes	manus	pes
1.	31	33	42	41
2.	51	49	58	63

Four second phalanges of median digits are available (Table 49).

TABLE 49

Measurements of phalanx II, median digit (mm)

					D. bicornis		*C. simum*	
No. of specimen	L8426	L9253	L9518	L11607	manus	pes	manus	pes
1. Median length	30	33	34	26	26	28	30	30
2. Proximal width	64	62	53	64	55	56	65	73

There is one third phalanx of a median digit (Table 50).

TABLE 50

Measurements of phalanx III, median digit (mm)

		D. bicornis		*C. simum*	
No. of specimen	L8427	manus	pes	manus	pes
1. Median length	32	26	28	—	34
2. Greatest width	93	84	80	—	107

Five bones (L8421, L8422, L9256, L9519 and L11879) represent first phalanges of lateral digits; they vary in median length from 35 to 37 mm, and in proximal width from 42 to 50 mm. A third phalanx of a lateral digit, L9257, has a median length of *c.* 30 mm, and a greatest diameter of 31 mm. Two proximal sesamoids remain to be recorded; the larger bone, L7364, length 41 mm, width 21 mm, presumably belonged to a median digit, while the smaller, L4074, length 28 mm, width 17 mm, may have belonged to a lateral digit.

OTHER *C. PRAECOX* SITES IN EAST AND SOUTH AFRICA

We have evidence of the occurrence of *Ceratotherium praecox* at sites other than Kanapoi, Ekora and Lothagam-1 in Kenya, and Langebaanweg in the Cape Province. Fragmentary teeth from the Mursi Formation of the Omo Basin in southern Ethiopia and from the Chemeron Formation in Kenya, previously referred to *Ceratotherium simum germanoafricanum* (Hooijer 1969: 86, 77), in the light of the discovery of *Ceratotherium praecox* at Kanapoi and Langebaanweg, should be identified as *C. praecox*. The teeth from the 'lower level' (Mursi Formation), which had been collected by R. Leakey in 1967, were re-examined by me in July 1971 at the Centre for Prehistory and Palaeontology, National Museum, Nairobi. There are a P^4 sin. and a M^{2-3} sin. in palatal portions (Hooijer 1969, pl. 5, figs 4–5) displaying, as far as preserved, an angular antero-internal corner. In M^3 there is a true medifossette, whereas in P^4 and M^2 the crochet extends across the medisinus without uniting with a crista to form a medifossette. P^4 shows the internal indentation of the protocone also seen in M^2. The internal face of M^2 is 50 mm anteroposteriorly, and 30 mm of this are taken up by the protocone. Although all the teeth are incomplete externally the basal external crown outline is preserved, and the transverse diameters can be approximately given (Table 51). They are within the limits of their homologues in the Langebaanweg collection. Although the ectolophs of the Mursi Formation specimens cannot be studied, in all observable characters these teeth agree with those of *Ceratotherium praecox*; the medifossette is not normally formed in this species, and its presence in the Mursi M^3 is exceptional. The Chemeron maxilla with M^{1-3} (Hooijer 1969, pl. 2, fig. 1), from locality J.M.507, do not have medifossettes, and M^2 has a distinct antero-internal crown angle. The teeth are very much worn down, and M^1 and M^3 are so fragmentary that the width cannot be determined, but those of M^2 are approximately the same as those in the Mursi specimen (Table 51). The skull from J.M.91, Chemeron Formation (Hooijer 1969: 76, pl. 1) is more advanced in its dentition and shows the rounded antero-internal crown angles, the medifossettes, and the posterior extension of the protocone characteristic of the modern species; this specimen moreover has the backwardly inclined occiput, extending beyond the occipital condyles, characteristic of *C. simum germanoafricanum*, and as such it was identified in my earlier paper. The presence of both *Ceratotherium praecox* and *Ceratotherium simum germanoafricanum* in the Chemeron Formation is puzzling,

for the mammalian fossils in the Chemeron Formation were found so closely together (Dr. W. W. Bishop, pers. comm.) as to make it unlikely that they were not of the same age. The Chemeron locality J.M.90 (=J.M.91) is placed by Cooke & Maglio (1971, fig. 2) at the 2 million year level, whereas the remainder of the Chemeron Formation is left at the 4 million year level. This arrangement is in accordance with the evidence provided by the rhinoceroses. Bishop (1971*b*), with a faunal list, gives the age of the Chemeron Formation as greater than 2,0 m.y. and less than 5,4 m.y.

A metapodial of a rhinoceros from the Chemeron Formation, locality J.M.511, is a left second metacarpal. Whether it represents *C. praecox* or *C. simum* I am unable to tell; the measurements have been added to Table 32 and agree with those of either of the two species.

From locality J.M.511 of the Chemeron Formation there is a P^4 dext. of a large chalicothere, a new element to the Chemeron Formation fauna (cf. Bishop 1971*b*). It was collected on 5 August 1967; I found it in the Chemeron collection of the Department of Geology at Bedford College, London, on 18 November 1971, and it was given to me for study by Dr. W. W. Bishop. The specimen is of considerable interest as it adds to the younger elements of the Chemeron Formation fauna, and chalicothere teeth are rare anyway. The specimen is referable to *Ancylotherium hennigi* (Dietrich), a species recorded before from Lactolil and Bed I at Olduvai (Dietrich 1942: 105; Butler 1965: 226). It is very well preserved and not much worn; the lingual cusp is only just touched by wear, and the height of the worn ectoloph is 33 mm. The crown measures 28 mm anteroposteriorly and 31 mm transversely, and has all the characters of *Ancylotherium* (Thenius 1953: 98 and fig. 1). The Olduvai material consists of a few carpals, metacarpals and phalanges only, but among the Laetolil collection there is an M^2 (Dietrich 1942, pl. IV, fig. 37; pl. XII, fig. 79), measuring 55,0 mm anteroposteriorly and 40,0 mm transversely. The newly found P^4 and the Laetolil M^2, when compared with their homologues in an upper dentition of *Ancylotherium pentelicum* (Gaudry & Lartet) as figured by Thenius, prove to be on a par for size. In the *A. pentelicum* dentition P^4 measures 33,3 by 37,5 mm, and M^2 67,2 by 50,5 mm (Thenius 1953: 105); the Chemeron P^4 and the Laetolil M^2 are both one-sixth smaller in dimensions than the corresponding teeth in *A. pentelicum*. Laetolil and Olduvai Bed I are around the 2 million year level (Maglio 1970; Cooke & Maglio 1971), and that is where part of the Chemeron Formation (locality J.M.90 and 91) was placed by Cooke & Maglio. However, as stated above, in the opinion of geologist Dr. Bishop, the geological evidence does not support a time gap of 2 million years between some Chemeron sites (J.M.90, 91) and others. The tooth of *Ancylotherium hennigi* (locality J.M.511) as well as the skull of *Ceratotherium simum germanoafricanum* (locality J.M.91) and stage 2 or 3 of *Elephas recki* (Cooke & Maglio 1971) suggest an age for the Chemeron Formation closer to 2 million years than to 4 million years. On the other hand we have elements like the maxillary of *Ceratotherium praecox* (locality J.M.507) in addition to *Loxodonta adaurora* Maglio, *Mammuthus subplanifrons* (Osborn), *Anancus* cf. *kenyensis* (Cooke & Maglio 1971) or *Anancus* sp. (Bishop 1971*b*), and *Nyanzachoerus* species 'A' of Cooke & Ewer, which are suggestive of an age around 4 million years. If the Chemeron Formation fauna is really unified as to age, it may tentatively be placed around the 3 million year level, as suggested to me by Dr. W. W. Bishop. However this may be, further faunal studies are needed, and the record of *Ancylotherium hennigi* from locality J.M.511 of the Chemeron Formation is here given as a contribution for that end.

TABLE 51

Measurements of upper teeth of *Ceratotherium praecox* (mm)

	Langebaanweg	Mursi Fm.	Chemeron Fm. J.M.507	Swartlintjes Farm, Namaqualand
P^4, ant.post.	47–c. 57	—	—	—
ant.transv.	65–76	c. 68	–	—
post.transv.	56–73	c. 60	—	—
M^2, ant.post.	c. 50–68	·	—	—
ant.transv.	70–82	c. 75	c. 75	74
post.transv.	63–75	c. 65	c. 65	70
M^3, ant.post. (int.)	56–72	c. 60	—	—
ant.transv.	65–78	c. 67	—	—
length outer surface	68–83	—	—	—

The Aterir Beds in the Baringo area, Kenya, which are placed by Maglio (1970), Cooke & Maglio (1971) and Bishop (1971*b*) near the 4 million year level (as is the Mursi Formation = Yellow Sands), contain material of *C. praecox*. The inner portion of an upper right molar, marked 5/B4/6, has the marked protocone fold, internal indentation of the protocone, slight internal cingulum, a crochet but no medifossette, and the marked antero-internal crown corner characteristic of the present species. No measurements can be given, but in its internal anteroposterior diameter, nearly 50 mm (of which 28 mm for the protocone), and the massive crochet it is nearest to M^1. Another Aterir specimen, an upper left premolar, marked 5/B1, again with the angular antero-internal corner, no medifossette, and a very weak paracone style, has the dimensions of P^3 in dentition L13035. Its measurements have been added to Table 5. There is further in the Aterir collection a right third metatarsal (marked 1/18 and 1/23) indistinguishable from its Langebaanweg homologue; its measurements have been added to Table 46: Finally, there is a proximal sesamoid, presumably of a median digit, marked 5/B1. This Aterir specimen is 41 mm long and 20 mm wide, just about as large as the Langebaanweg sesamoid L7364.

An isolated, rolled M^2 dext., lacking the antero-external and postero-external angles, and originating from Swartlintjes Farm, Hondeklipbaai, Namaqualand, C.P. (about 160 km north of Langebaanweg), represents the same species of *Ceratotherium* as that from Langebaanweg. According to the geologist who presented the specimen to the South African Museum, Mr. A. J. Carrington, the fossil molar came from ill-sorted angular felspathic fluviatile gravels at an elevation of *c.* 18 m. The gravels overlie what are taken

as Lower Pleistocene marine sands, and would be Upper Pleistocene. However, it is difficult to reconcile this view with the characters of the rhinoceros molar, which are those of the Late Pliocene *Ceratotherium praecox*. Its rolled condition suggests that it was derived from an earlier deposit. The specimen is figured in Plate 25 (bottom right), and bears the South African Museum number Q1771. The ectoloph is 77 mm high as worn. There is a well-marked protocone fold and internal indentation of the protocone, an angular antero-internal crown corner, and further there are a weak cingulum internally at the protocone, a strong but relatively slender crochet, no crista, and a postsinus very nearly as deep as the medisinus. The antero-transverse diameter is 74 mm, the postero-transverse 70 mm, very close to those in L6658.

The Namaqualand site is the only one in the Cape Province other than Langebaanweg from which *Ceratotherium praecox* is recorded, and this species is further known only from north-western Kenya and southern Ethiopia. It is already proving useful in African correlations, and may become more so if and when found in other parts of Africa.

Summary

Numerous remains of an extinct species of rhinoceros have been obtained by parties of the South African Museum at the 'E' Quarry of the Langebaanweg site, 104 km north-northwest of Cape Town, C.P. They are more abundant than those of any other large mammal in the Langebaanweg fauna; there are remains of seven skulls, ten mandibles (most of them with teeth *in situ*), 170 isolated teeth, and 650 postcranial bones. This material is referred to *Ceratotherium praecox* Hooijer & Patterson described from the Late Pliocene of Lothagam-1, Kanapoi, and Ekora in north-western Kenya. *Ceratotherium praecox* is little removed from the point of divergence of the genus *Ceratotherium* and the genus *Diceros*, and is held to represent the immediate ancestor of the modern white rhinoceros, *Ceratotherium simum*. The species is further recorded in the Cape Province from Swartlintjes Farm, Hondeklipbaai, Namaqualand (approximately 160 km north of Langebaanweg). It is also known from the Mursi Formation in southern Ethiopia, and the Chemeron Formation and the Aterir Beds in the Baringo area, Kenya, all deposits dated around the 4 million year level. The discovery of this species is proving most useful in inter-African correlation and adds to the evidence already available that the 'E' Quarry Langebaanweg site is Late Pliocene in age.

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Explanation of the Plates

Note. All specimens are *Ceratotherium praecox* Hooijer & Patterson from Langebaanweg, except Plate 25, bottom right, which is from Swartlintjes Farm, Namaqualand.