

# ANNALS

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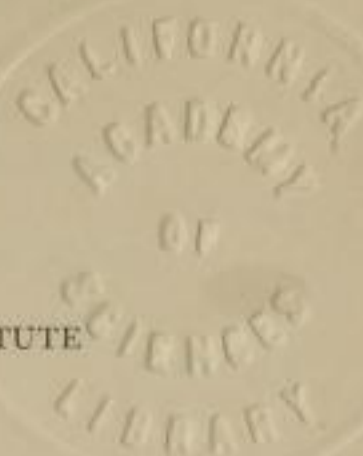
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XIV. RHINOCEROSSES FROM THE OLIGOCENE AND  
MIOCENE DEPOSITS OF NORTH DAKOTA  
AND MONTANA.

BY EARL DOUGLASS.

(PLATES LXIII-LXIV.)

**Aphelops montanus** sp. nov.

(PLATE LXIII.)

(Type No. 1569, Carnegie Museum Catalogue of Vertebrate Fossils.)

The type consists of a skull with the mandible, the two femora, parts of a humerus, and other fragments of the skeleton. It came from the Flint Creek (Upper Miocene) beds on the west side of the Flint Creek valley, near New Chicago, Granite County, Montana. It was collected by Professor Fred D. Smith and Earl Douglass in 1899, but it was not fully cleared from the matrix and its characters determined until the summer of 1906.

The following are some of the distinguishing characters of the type:

*Skull long (dolichocephalic); supraorbital region not broad; nasals long and tapering, not laterally compressed and not possessing horn-rugosities; posttympanic rounded, not wing-like as in *Aphelops ceratorhinus*; teeth brachyodont or brachyhypsodont; number of premolars complete (4); all the upper cheek teeth except  $P^1$  having crotchets, and all except  $M^1$  and  $M^2$  with antecrotchets; limbs long and slender for so large a rhinoceros.*

The skull of this species appears to be similar in form to that of *Aphelops ceratorhinus*, though the cranium of the type of the latter is not complete. The posterior upper portion of the skull of the type of *Aphelops montanus* is crushed, but the upper contour was evidently straighter than that of most of the American Miocene rhinoceroses which have been described. The nasals are smooth, moderately long, and evenly narrowed. They show no rugosities for the attachment of horns. They are convex transversely on the upper surfaces, but are not turned or rolled inward on the posterior portions of the outer borders as in *Aphelops ceratorhinus*. The frontal plane was nearly flat and there was no sagittal crest. The supratemporal ridges are

moderately broad and converge backward until they are 2 cm. apart ; then they begin to diverge 8 cm. anterior to the occipital crest. The upper posterior portion of the skull resembles that of specimen No. 840, which is described in this paper, but in the latter specimen the supratemporal ridges diverge more rapidly toward the occiput.

There are two infraorbital foramina in the maxillary above the third and fourth premolars. The lower of these foramina is large and round. The other foramen is just above and a little posterior to the first and is oblong-oval in form, with the apex of the oval antero-inferior. The malar is rather shallow beneath the orbit, but is deeper farther back. The posterior upper angle of the zygomatic portion of the squamosal is low. The external auditory opening is entirely surrounded by the temporal bone, as the postglenoid and posttympanic portions are in contact by the enlargement and forward trend of the posttympanic, which is large, rounded on the outer surface, and somewhat roughened by shallow depressions. The paroccipital processes, as seen from the side, are quite broad. They are near the occipital condyles.

The occiput appears to have been nearly perpendicular, not much inclined either forward or backward. It is low in proportion to the length of the skull and is broad, not narrowing rapidly upward as in specimen No. 854 (*Aphelops ceratorhinus?*). The middle of the occiput immediately above the foramen magnum is very convex transversely and projects backward overhanging that opening.

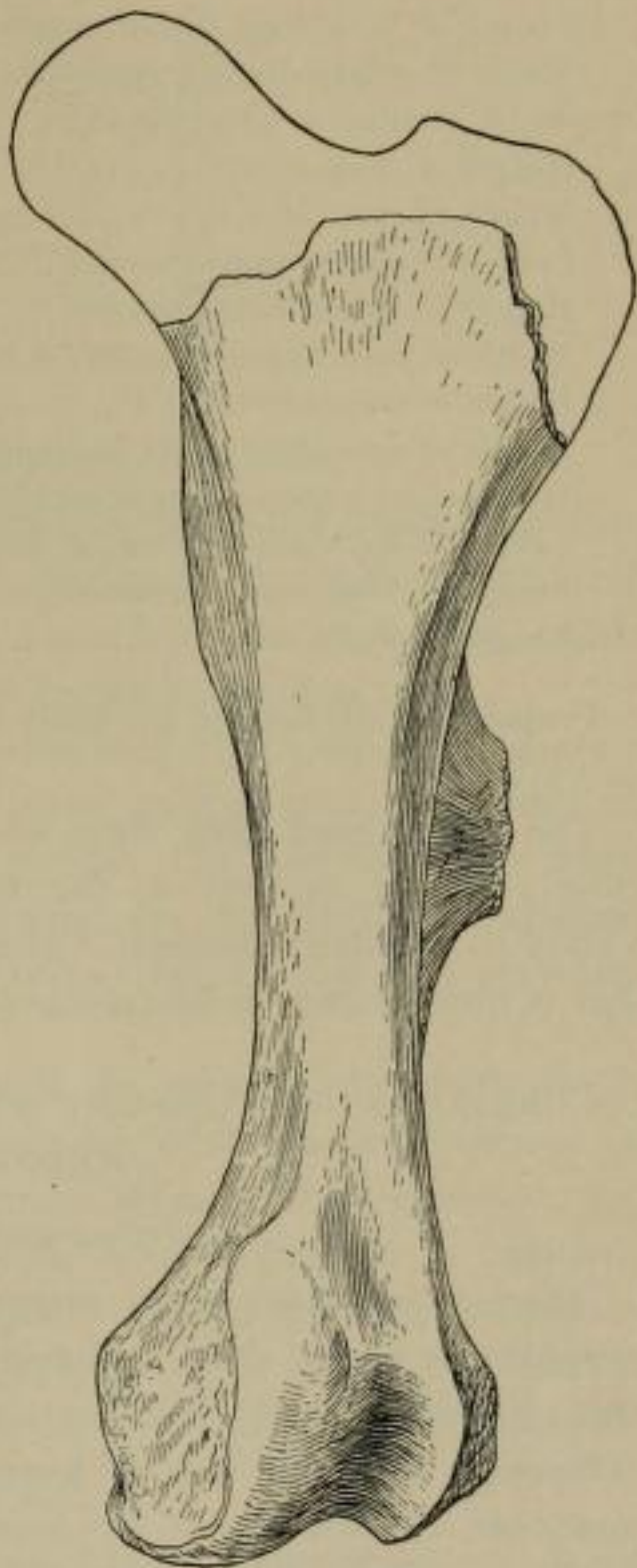


Fig. 1. Femur of *Aphelops montanus*.  $\frac{1}{4}$ .

The depth of the mandible is greater than that of the type of *Aphelops ceratorhinus*, it is much thinner transversely, and the angle is not so large.

The femur is long and very slender for so large a rhinoceros. Only portions of other bones are preserved.

## MEASUREMENTS.

	mm.
Length of skull from tips of nasals to crests of occiput.....	567
Width of skull including zygomatic arches, greatest.....	330
Width of skull at post-tympanics .....	200
Height of skull at orbit.....	205
Height of skull at occiput .....	200
Length of nasals, approximately.....	170
Height of paroccipital processes.....	51
Width of paroccipital processes at base.....	51
Height of mandible under P <sub>4</sub> .....	85
Height of ascending ramus of mandible, estimated.....	255
Width of ascending ramus of mandible from M <sub>3</sub> backward.....	150
Length of upper molar-premolar series.....	265
Length of lower molar-premolar series.....	268
Length of femur about.....	520

Proportion of height of skull at occiput to length of top of skull = 35.2 : 100.

The Flint Creek beds, from which this rhinoceros was obtained, are closely related in time to the Deep River beds of the Smith River Valley in Montana, though *Palæomeryx? borealis* is the only species that is now known to be common to the two formations.

## COMPARISONS OF APHELOPS MONTANUS WITH OTHER SPECIES OF RHINOCEROSES.

*Comparison with A. ceratorhinus.*

*Aphelops montanus* much resembles *A. ceratorhinus* in the size and proportions of the skull, in having a complete upper premolar series, and in having teeth which are not strongly hypsodont. Some of the differences are: the lack of horn-rugosities on the nasals of *Aphelops montanus*, the absence of an inward-turning scroll-like border on the posterior outer portions of the nasals, the different form of the posterior basal elements of the skull, and of the postero-superior portion. There are some differences in the proportions of the teeth, especially the molars, as is shown in the following measurements which are arranged for comparison:

	<i>A. montanus.</i>	<i>A. ceratorhinus.</i>
	mm.	mm.
Length of P <sup>1</sup> .....	27	26.5
Width of ".....	20	22
Length of P <sup>2</sup> .....	36	35
Width of ".....	40	43
Length of P <sup>3</sup> .....	41	42
Width of ".....	53	56
Length of P <sup>4</sup> .....	40	46
Width of ".....	58	58
Length of M <sup>1</sup> .....	53	50
Width of ".....	63	55
Length of M <sup>2</sup> .....	60	52
Width of ".....	62	58.5
Length of M <sup>3</sup> .....	44	45
Width of ".....	56	53

*Comparison with Aphelops Megalodus.*

*A. montanus* agrees in having the smooth elongated nasals, which are devoid of horn-rugosities, and in the comparatively brachyodont teeth, but it is a more dolichocephalic type, has a lower occiput, more slender zygomatic arches, and a broader roof to the brain-case.

Our knowledge of Miocene rhinoceroses is still too incomplete to allow us to arrange them all under their proper generic names; but as *A. megalodus* is the type of *Aphelops*, the present series which resembles it in so many particulars, should, for the present, be assigned to that genus, though the resemblance may not be due to a very close relationship.

This species, but for the fact that it has no horn-rugosities on the nasals, would, with *Aphelops ceratorhinus*, come under Professor Osborn's definition of the third phylum of Miocene rhinoceroses. This phylum, according to Professor Osborn,<sup>1</sup> is distinguished by decidedly long limbs and feet, long skull, brachyodont teeth, and flattened pointed nasals with small terminal horn-rugosities. It is barely possible that the type of *Aphelops montanus* is a female and the male possessed horns, though I do not think it probable.

<sup>1</sup> "New Miocene Rhinoceroses," *Bulletin of the American Museum of Natural History*, Vol. XX, 1904, p. 324.

***Aphelops ceratorhinus* Douglass.<sup>1</sup>**

(PLATE LXIV.)

The type of *Aphelops ceratorhinus* is No. 857, Carnegie Museum Catalogue of Vertebrate Fossils. This specimen was not all accessible or fully prepared for study when the first description was made.

Fragments of the skull were originally found in a cattle-path on a steep bluff on the east side of the Lower Madison Valley in Montana. By digging into the sand, portions of a much broken skull and a nearly complete mandible were found. A good portion of one side of the skull has been put together, but the upper posterior portion is still wanting. Fragments of vertebræ and limb-bones were found weathered out just below where the skull and mandible were obtained.

From the same beds as the type are other portions of the skulls, which, judging by the forms of the nasals and the basal portions of the skulls belong to the same or nearly related species. These enable us to get the approximate proportions of the missing parts of the cranium of *Aphelops ceratorhinus* and to make the restoration of the skull which is given in Plate LXIV.



FIG. 2. Calcaneum of type of *Aphelops ceratorhinus*.  $\frac{1}{4}$ .

*Principal Distinguishing Characters.* — Size large; skull long (dolichocephalic); nasals long and slender, with small terminal horn-rugosities; external auricular opening closed below; post-tympanic expanding outward in wing-like processes; paroccipitals concave behind and in front, separated from occipital condyles by a concave area; cheek teeth

brachyodont with cingula on interior portions of premolars;  $P^4$  to  $M^3$  with crotchets; mandible long and comparatively shallow, but thick and heavy; ascending ramus only moderately high, angle rounded, alveoli for canines large.

Judging from the posterior portion of the skull of another individual (No. 854, see Fig. 3), which is smaller, the occiput was low and narrowed upward. The nasals turned downward slightly at the tips just anterior to the nasal rugosities. The borders of the nasals, beginning at the rugosities, expand and have a decidedly downward trend for more than one half of the distance backward. On the posterior half

<sup>1</sup> "New Vertebrates from the Montana Tertiary," *Annals of the Carnegie Museum*, Vol. II, No. 2, 1903, p. 195.

the borders are folded or turned inward apparently for the purpose of strengthening the nasals for the support of the anterior weapon of defence. The anterior portion of the frontal plane is slightly convex transversely, but nearly flat.

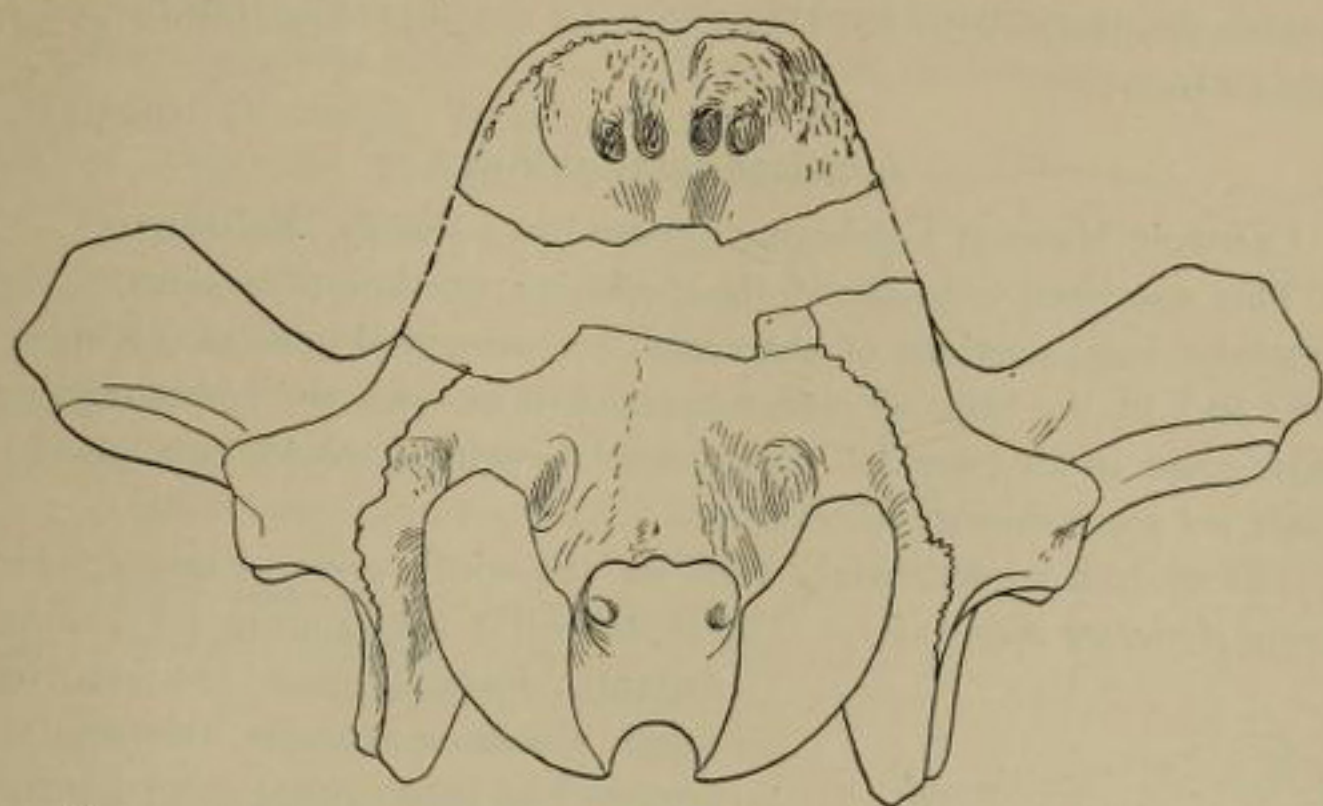


FIG. 3. Outline of back of skull of *Aphelops ceratorhinus?*  $\frac{1}{4}$ . (No. 854.)

The paroccipital process is different from that of any other species which I have observed. It is situated at some distance anterior to the occipital condyles and there is a quite large concave space between the

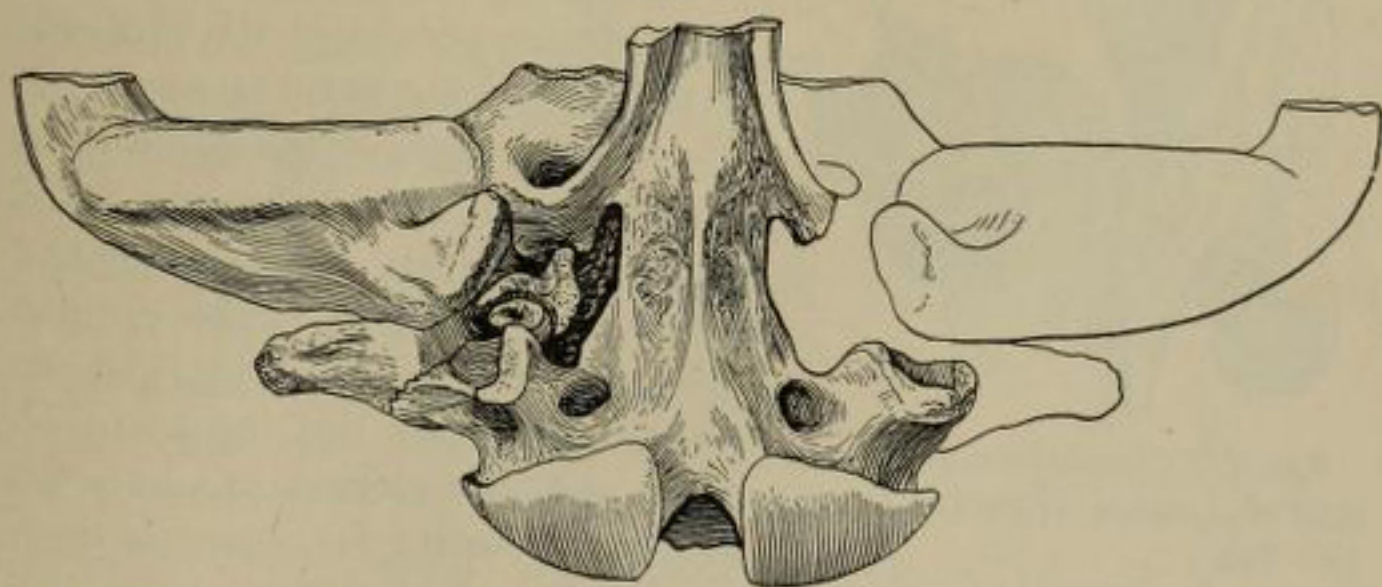


FIG. 4. Basi-occipital view of skull of *Aphelops ceratorhinus?*  $\frac{1}{4}$ . (No. 854.)

two. The process is concave on the anterior and posterior surfaces. The anterior surface is trough-shaped, but the posterior has a large depression at the base of the process, and farther down a concavity

which is smaller and deeper. The post-tympanic is very different from that of *Aphelops montanus*. It is not rounded antero-posteriorly, but is wing-like, expanding antero-externally. It is quite thick antero-posteriorly.

Measurements will be found in the original description of *A. ceratorhinus*.

### *Aphelops ceratorhinus?*

Carnegie Museum Catalogue of Vertebrate Fossils, No. 854.

This specimen consists of the posterior portion of a skull. The posterior basal portions of the crania are preserved both in this specimen and in the type of *Aphelops ceratorhinus* and the corresponding parts agree in all essential particulars, though, as would be expected, there are some minor differences.

The occiput is moderately high for the width and narrows upward as in *Aphelops megalodus*. The supraorbital ridges unite for a short

distance forming one low narrow ridge which represents the sagittal crest. The paroccipital processes and the post-tympanics are essentially like those of the type of the species. The former have deep posterior concavities in the bases, and a prominent ridge extends, external to the cavities, from the posterior portion of the processes to the base of the occipital condyles. The anterior faces of the paroccipital processes are trough-shaped. The post-tympanics are not so large and rugose as in the type. The external auditory opening is long, comma-shaped, and below this the post-tympanic and post-glenoid processes are nearly in contact for some distance.

The median basal portion of the skull has a nearly flat area between the occipital condyles and anterior to them. Anterior to this is a high, narrow, median ridge in front of which there is a rounded knob, or protuberance, just posterior to the pterygoid fossa and between the glenoid articular surfaces.



FIG. 5. Lateral view of back of skull of *Aphelops ceratorhinus?*  $\frac{1}{4}$ . (No. 854.)



	MEASUREMENTS.	mm.
Height of occiput.....		225
Width of occiput .....		270
Height of paroccipital processes.....		65

Though the type of *Aphelops ceratorhinus* represents a large rhinoceros, portions of a skull, vertebræ, and limb-bones of another individual (Carnegie Museum Catalogue of Vertebrate Fossils, No. 842, from the Madison Valley) indicate a very much larger animal, possibly belonging to a different species. The greater portion of the humerus is preserved and an outline is given in Fig. 6.

The measurements are as follows :

	mm.
Length of humerus from upper articular surface to distal end.....	487
Whole length of humerus, estimated...	500
Width of distal end, transverse.....	178
Diameter of distal end antero-posterior.	124
Thickness of shaft above distal trochlea	95

#### **Teleoceras? sp.?**

Carnegie Museum Catalogue of Vertebrate Fossils, No. 840.

This specimen is the top of a skull with the nasals and occipital crest complete. It came from the bluffs on the east side of the Lower Madison Valley a mile or two farther north than the type of *Aphelops ceratorhinus*. Like most of the remains of rhinoceroses from this region, the specimen was found in a bed of sand near the bottom of the Upper Miocene (Loup Fork) beds. The portion of the skull which is preserved suggests a somewhat different rhinoceros from any other that has been named, but there is not sufficient material on which to found a species. The following are some of the more noticeable characteristics :

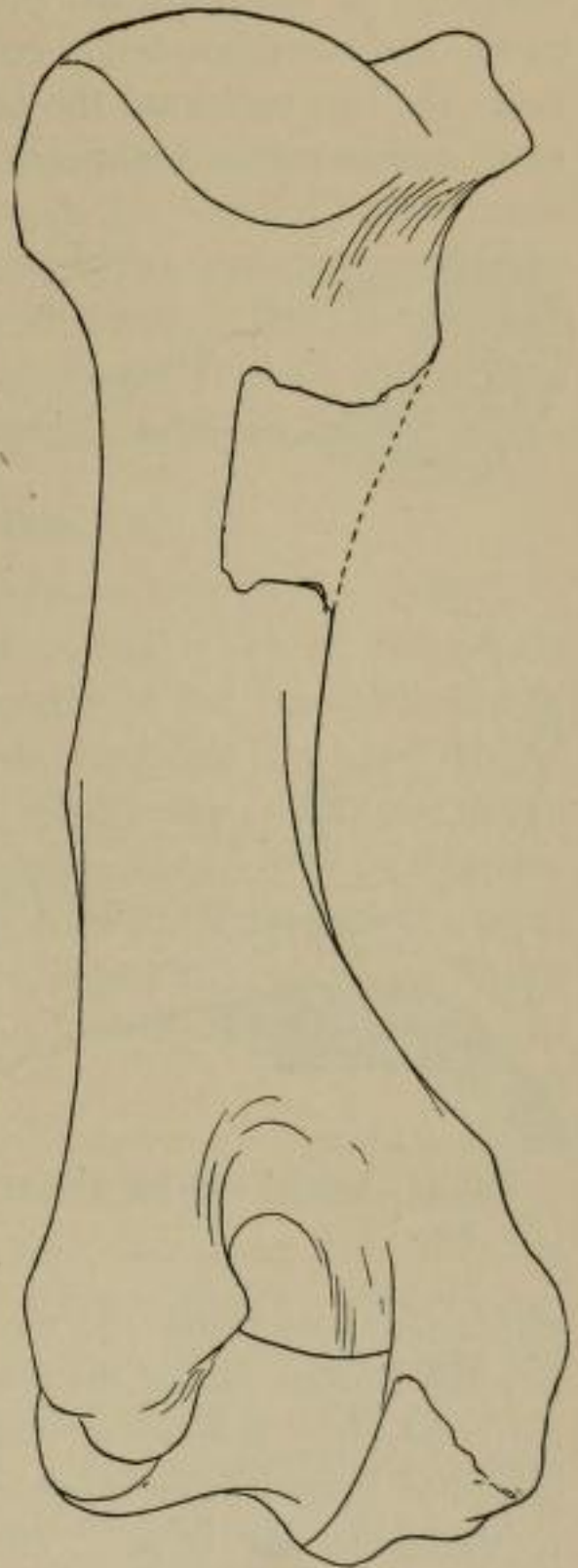


FIG. 6. Humerus of *Aphelops? sp.?*  
 $\frac{1}{4}$ . (No. 842.)

Size medium ; top of skull flattened ; occiput somewhat elevated ; sagittal crest wanting ; nasals rather short, turned upward in front, and possessing rugosities for a terminal horn.

This specimen is much smaller than the types of *Aphelops ceratorhinus* and *A. montanus*. The nasals are short, laterally compressed, and turned upward toward the points, which are roughened, evidently for the accommodation of one terminal horn. They are very convex transversely on top and correspondingly concave beneath. They are not coössified. From the tips backward the borders trend upward for a short distance, then downward and outward and then curve backward. They are

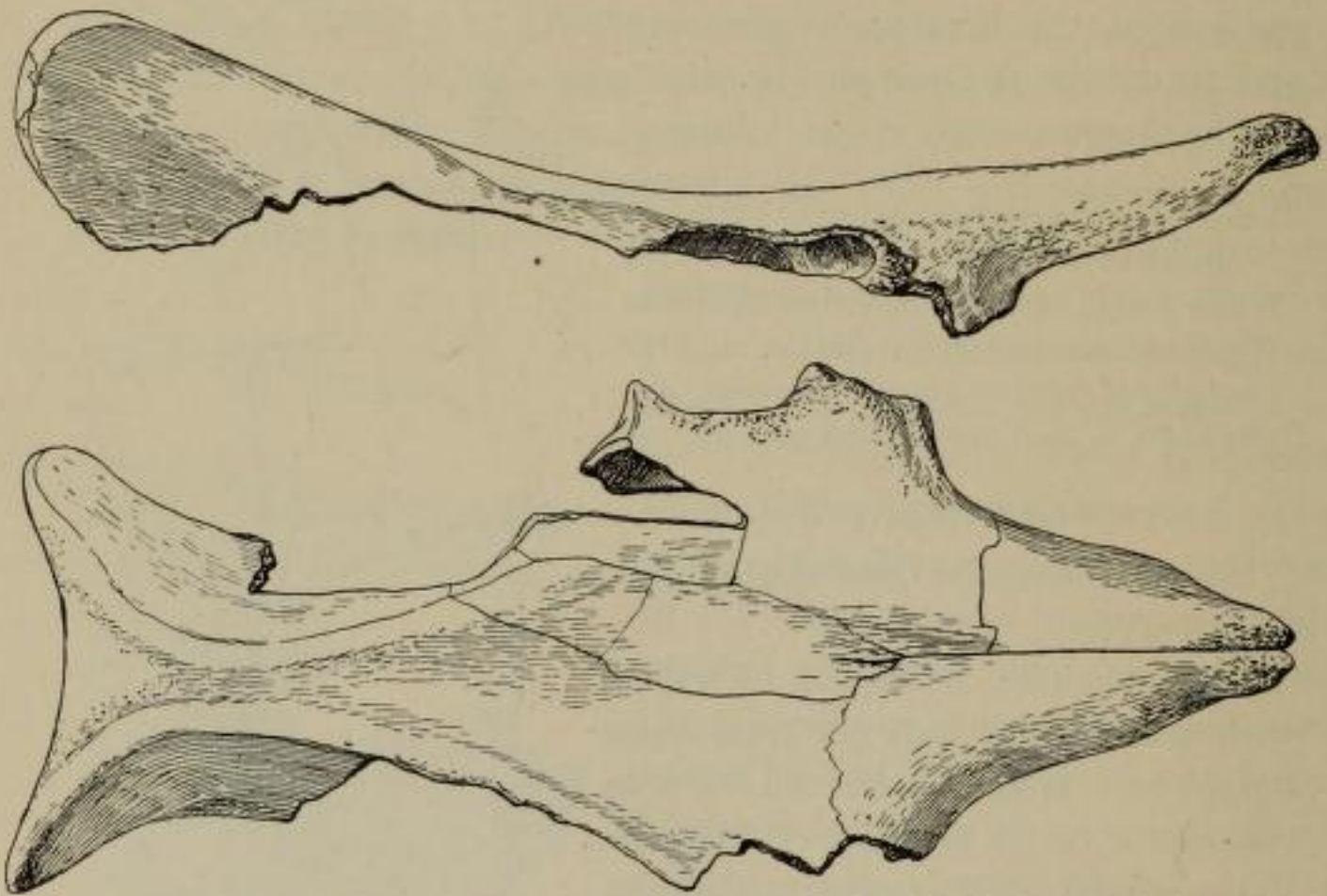


FIG. 7. Lateral and superior views of fragment of skull of *Teleoceras?* sp.?  $\frac{1}{5}$ . (No. 840.)

thickened posteriorly yet the inner edges are sharp and there is a beveled border facing inward and downward. The frontal region is flattened, but somewhat concave antero-posteriorly as the supra-occipital border is elevated. The cavities above and antero-internal to the orbits are large. There is no sagittal crest. The supra-temporal ridges are low and broad. A large concavity with one low median ridge and two lateral ridges occupies the posterior upper portion of the occiput. The lateral ridges end at the supero-external portion of the occipital crest.

## MEASUREMENTS.

	mm.
Length of skull from tips of nasals to middle of occipital crest.....	457
Width of occipital crest.....	165
Width of skull at supero-anterior borders of orbits.....	218
Length of free nasals.....	122
Width of free nasals, posterior.....	83
Width of rugosities for horn.....	35
Length of rugosities for horn.....	35

## ACERATHERIUM.

In August, and again in November, 1905, the writer obtained, at White Butte and in the Little Bad Lands in North Dakota, many remains of rhinoceroses. Among them are two exceptionally complete skulls, one of which has the mandible attached. Though there are some differences in details in the two skulls yet I place them both, provisionally, in the species *Aceratherium tridactylum*.

***Aceratherium tridactylum* Osborn.**

(Carnegie Museum Catalogue of Vertebrate Fossils, No. 1585.)

This specimen consists of a skull and mandible which are nearly complete. Small portions of the left angle of the mandible and of the occipital crest had weathered away. It was found in a hard, heavy, green sandstone concretion, or part of a sandstone stratum, just above the nodular *Oreodon* layer. A stratum of sandstone a little distance away contained many bones and teeth of rhinoceroses and some teeth of horses. Above was a gray, rather soft sandy stratum about fifteen feet in thickness containing the jaws of rodents and remains of crocodiles.

The specimen differs somewhat from the specimen figured and described by Osborn in his "Memoir on The Extinct Rhinoceroses."<sup>1</sup> The nasals are shortened and truncate, not narrowing to a point, or suddenly contracting forward at a point a little distance posterior to the apex, as in Osborn's figure. There are two incisive alveoli in the premaxillaries, the posterior is nearly as large as the anterior alveolus, and the two are very close to each other. The paroccipital processes are prismatic, having three sides. The mandibular symphysis is quite long and the canine fairly large. The most striking peculiarity of this specimen is its shortened truncate nasals.

<sup>1</sup> Memoirs of the American Museum of Natural History, Vol. I, Part III, April, 1898, p. 158, Pl. XVII.

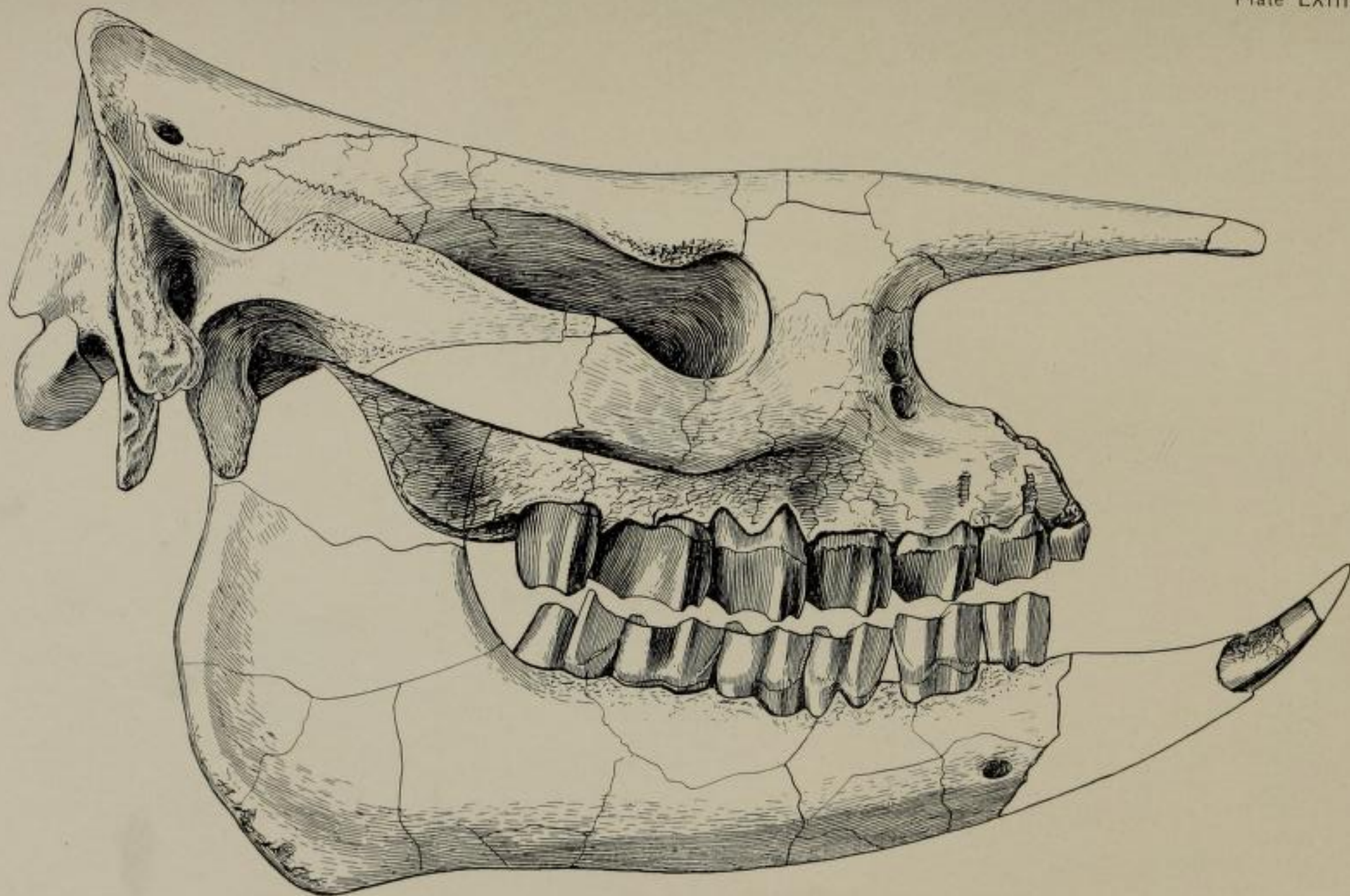
## MEASUREMENTS.

	mm.
Length of skull from premaxillaries to occipital condyles .....	512
Length of skull from nasals to occiput.....	477
Length of free nasals.....	80
Height of skull at orbits not including teeth.....	140
Height of skull at occiput .....	175
Length of upper series of cheek teeth.....	194
Proportion of height of skull at occiput to length = 175 : 512 = 34 : 100.	

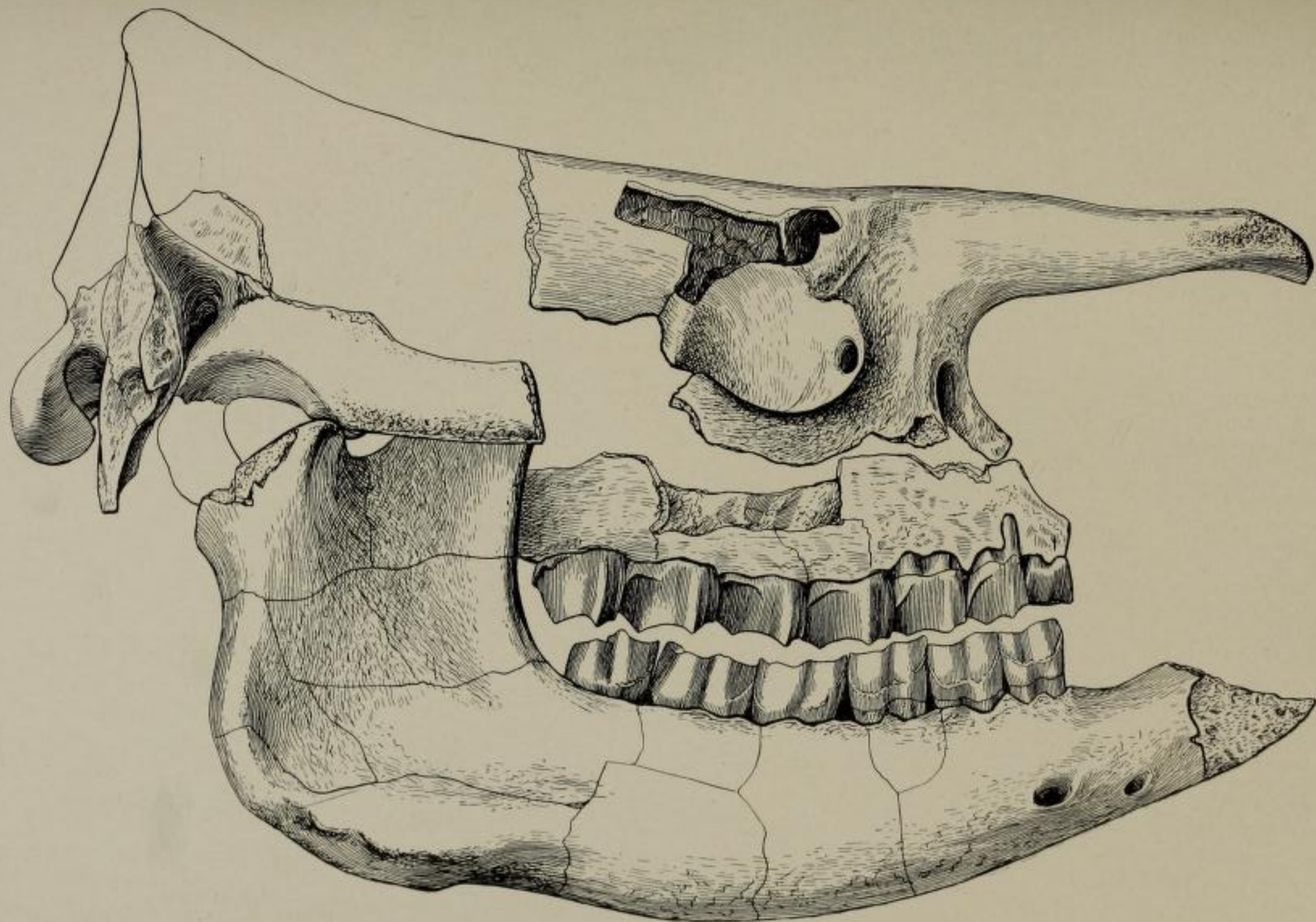
Another skull (No. 1586, Carnegie Museum Catalogue of Vertebrate Fossils) was found at White Butte, by Harry Roberts, a rancher's boy, while hunting specimens with me. It was enclosed in a block of rather soft gray sandstone on the sloping surface of the nodular Oreodon beds, but it had fallen down from a cliff above, the rocks of which undoubtedly belong to the Upper White River beds. It probably came from a slightly higher level than No. 1585 just described. The nasals are moderately long and taper gradually forward to the tips. They are bent somewhat downward. The orbits are large and the zygomatic arch slender, at least as far back as the molars extend. There is quite a wide space between the tympanic and the basisphenoid. The paroccipital processes are broad, flat, and rounded, and not pointed at the lower extremities. Their broadest surfaces face antero-externally and postero-internally. To them the post-tympanics are firmly united. The latter are quite thick and are roughened on the outside. They are triangular in cross-section and have short blunt processes extending downward and toward the post-glenoid processes from which they are separated by narrow spaces, so that the external auditory openings are not closed below.

## MEASUREMENTS.

	mm.
Length of skull from tips of nasals to crest of occiput.....	514
Length of molar-premolar series .....	194
Height of skull at orbits.....	155
Height of skull at occiput.....	167
Width of top of skull just posterior to orbits.....	180
Width of skull just anterior to glenoid articular surfaces.....	257
Proportion of height of skull to length 167 mm. : 514 mm. = 32.5 : 100.	



*Aphelops montanus* Douglass. Type.  $\frac{1}{4}$ .



*Aphelops ceratorhinus* Douglass.  $\frac{1}{4}$ .