XIV. A MOUNTED SKELETON OF DICERATHERIUM COOKI PETERSON.

By O. A. Peterson.

(*Science*, Vol. XXIV, pp. 281–282, 1906; Ann. Car. Mus., Vol. IV, pp. 47–48, text-figures 12, 13, plate XIV, 1907.)

Some recent publications by Professors Frederic B. Loomis[1] and Erwin H. Barbour[2] on *Diceratherium* remains from the now well-known Agate Spring Fossil Quarries in Sioux County, Nebraska, have appeared, but no detailed description of the osteology, outside of an illustration of a half-relief mount by the latter author, has hitherto been published. The present paper is only intended to briefly treat of the articulated skeleton recently placed on exhibition in the Hall of Mammalian Paleontology of the Carnegie Museum, reserving for a later publication more detailed work on the extensive collection of material representing this genus in this museum.

No. 2499, the basis of the articulated skeleton, consists of the skull with the lower jaws, the complete cervical series, seven dorsals, a number of ribs, portions of both fore limbs and fragments of hind limbs and feet. This material establishes a good basis for the determination of the different parts of the bony structure in this species and the composite skeleton is thought to accurately represent *D. cooki*.

From the large number of individuals already cleared from the matrix we are still unable to state definitely whether there were eighteen or nineteen dorsals in the presacral series. On the other hand the number of the lumbars as well as the cervicals and sacrals are well established from our material, while the caudal series is approximately correct.

Skull.

The skull used in this restoration (No. 2499) is typical of *Diceratherium cooki* described in previous publications. The teeth are somewhat more worn down than those of the type No. 1572, showing that the crotchet on M^2 is completely united with the already broad-

[1] *Amer. Jour. Sci.*, Vol. XXVI, pp. 51–64, 1908.

[2] Nebraska Geological Survey, Vol. III, Plate 1, 1909.

ened ectoloph, while on $M^{\frac{3}{}}$ both crotchet and crista are quite plain. The diameters of the teeth of the present skull are only very slightly greater than those in the type, in fact there is practically no difference in all the measurements of the two skulls here compared when an allowance is given for the slightly larger size and crushing of No. 2499. A curious feature of some individuals is seen in the presence of the upper canine. This feature is, however, not to be regarded as of any great morphological importance and may be regarded as a case of atavism, pointing back to the Oligocene forms (*Leptaceratherium* and *Aceratherium*[3]) which have the superior canines much more strongly developed. The premaxillaries are restored from other individuals.

The lower jaws are quite heavy, the transverse diameter of the horizontal ramus being thick and the diastema between the large incisor and $P_{\frac{}{3}}$ rather short. The inferior border of the ramus terminates posteriorly in a heavy and excessively everted process, which is a characteristic feature of the angle of the lower jaw of old individuals (especially males) of this species. The glenoid condyle is very broad transversely and the coronoid process has rather an excessive forward direction. The median incisors are not present, but are plainly indicated by alveoli. The lateral, or cutting, incisors are much worn, as is also the case with the molar pre-molar series.

The deciduous dentition in all the different stages is well represented in the material of *Diceratherium* from this fossil quarry. In this connection it may be interesting to say a few words in regard to the deciduous lower incisors and canines. From the material in the Carnegie Museum there have been selected three individuals of a slight difference in ages in order to illustrate my point. In each case the lower canines or their alveoli are present and in two of the three pairs the full series of incisors are represented; the third pair being farther advanced in maturity.

In the valuable monograph on the "Extinct Rhinoceroses" by Professor Henry F. Osborn he has distinguished the Rhinocerotidæ as follows: "Manus functionally tridactyl. Upper canines atrophied. Median upper incisors and lower canines opposed and irregularly developed" (*l. c.*, p. 80). In later publications Lucas and Hatcher[4]

[3] Osborn, H. F., "The Extinct Rhinoceroses," *Mem. Amer. Mus. Nat. Hist.* Vol. 1, pp. 132, 146, 1898.

[4] *Proc. National Museum*, Vol. XXIII, No. 1207, pp. 221–223; ANN. CARN MUS., Vol. I, 1901, pp. 135–144.

maintain that the second inferior incisor of *Trigonias osborni* from the lower Oligocene has already become hypertrophied into a large procumbent cutting tooth while immediately behind it is placed the canine. Quite recently there has appeared a paper on *Diceratherium* by Loomis in which this large procumbent tooth is again referred to as the lower canine (*l. c.*, p. 52). From the material now at hand it is possible not only to substantiate the contention of Lucas and Hatcher but entirely to establish as a fact that *the upper incisor of the Rhinocerotidæ does not oppose the lower canines but opposes the lower incisor two or three.* The deciduous incisor dentition as well as the canine of the lower jaw in *Diceratherium* is complete. The second or third permanent incisor has entirely taken up the space of $I_{\frac{2}{2}}$ and $_{\frac{3}{3}}$, while at some distance behind the canine occurs In adult forms all evidence of the canine is entirely obliterated. When the earlier Tertiary ancestors of the Rhinocerotidæ are found the lower canine will undoubtedly be found to be much more reduced in size than the upper, while $I_{\frac{2}{2}}$ or $I_{\frac{3}{3}}$ will be found to oppose the enlarged upper incisor

VERTEBRAL COLUMN.

Cervicals, 7; Dorsals, 19 (?); Lumbars, 5; Sacrals, 4–5; Caudals, 26 (?).

The cervical vertebræ are comparatively short and heavy. The axis has a strong overhanging neural spine, the third cervical lacks the spine, while the fourth has it only faintly indicated. On the succeeding three cervicals the increase in length of the neural spines is more rapid, the seventh being of considerable height. Nineteen dorsals are inserted in this skeleton which is thought to be approximately correct inasmuch as certain species in the ancestral line from the upper Oligocene (*Aceratherium tridactylum*[5]) have this number. The anterior dorsals have short, broad, and depressed centra, and high and heavy neural spines. Further back the centra are higher, narrower, and terminate ventrally in more defined keels, while the neural spines are lighter and lower; the five or six last dorsals already assuming the lumbar-like neural spines. There are five lumbar vertebræ in *A. tridactylum* which is also true of the present form. The sacrum on the other hand is composed of from four to five coössified vertebræ, while in the Oligocene form there are three (Osborn, *l. c.*, p. 85). A series of caudals, seventeen in number, are of one individual (No. 1843) found in consecutive order from the first to the seventeenth.

[5] Osborn, H. F., *Bull. Am. Mus. Nat. Hist.*, Vol. V, p. 85, 1893.

Nine caudals have been added to the end of this series, twenty-six in all, which is approximately the correct number of vertebræ in the tail.

The ribs are rather long which gives the animal a large thoracic cavity similar to that in *A. tridactylum*. In their shape they are also quite similar to those of the latter species. The manubrium is an elongated, laterally compressed, and vertically deep plate of bone. Anterior to the contact for the first pair of ribs there is a long heavy process, extending directly forward, constituting the greater half of the antero-posterior diameter of the presternum. Posteriorly the bone is slightly expanded transversely and has a rough surface for the attachment of the succeeding segment of the mesosternum. The first two segments of the mesosternum are of considerably greater vertical diameter than the transverse; the posterior end of the fourth sternebra is nearly cubical in outline, while the fifth is broader than deep. The lumbar region is rather short, the sacrum has four to five coössified centra, and the caudal region is of moderate length.

LIMBS.

The scapula is rather long and narrow; the spine is heavy and greatly overhangs the postscapular fossa; the coracoid is prominent; the glenoid border is much concave supero-inferiorly, while the coracoid border, some distance above the glenoid cavity, is greatly convex in the same direction. The humerus may be regarded as short and heavy, with a powerfully developed deltoid crest, a prominent supinator ridge, a deep anconeal fossa, and the intercondylar ridge shifted well towards the ulnar border of the trochlea. Proximally and distally the radius and ulna are well interlocked by rough attachments, and in adult or old individuals the shafts come in contact with one another by prominent and rugose ridges, which supported a heavy cartilaginous band. The olecranon process of the ulna is large and truncated and the shaft is comparatively heavy.

The manus is functionally tridactyl. The fifth metacarpal is, however, present in a rudimentary condition, while that of *Aceratherium tridactylum* is said to be strictly tridactyl.

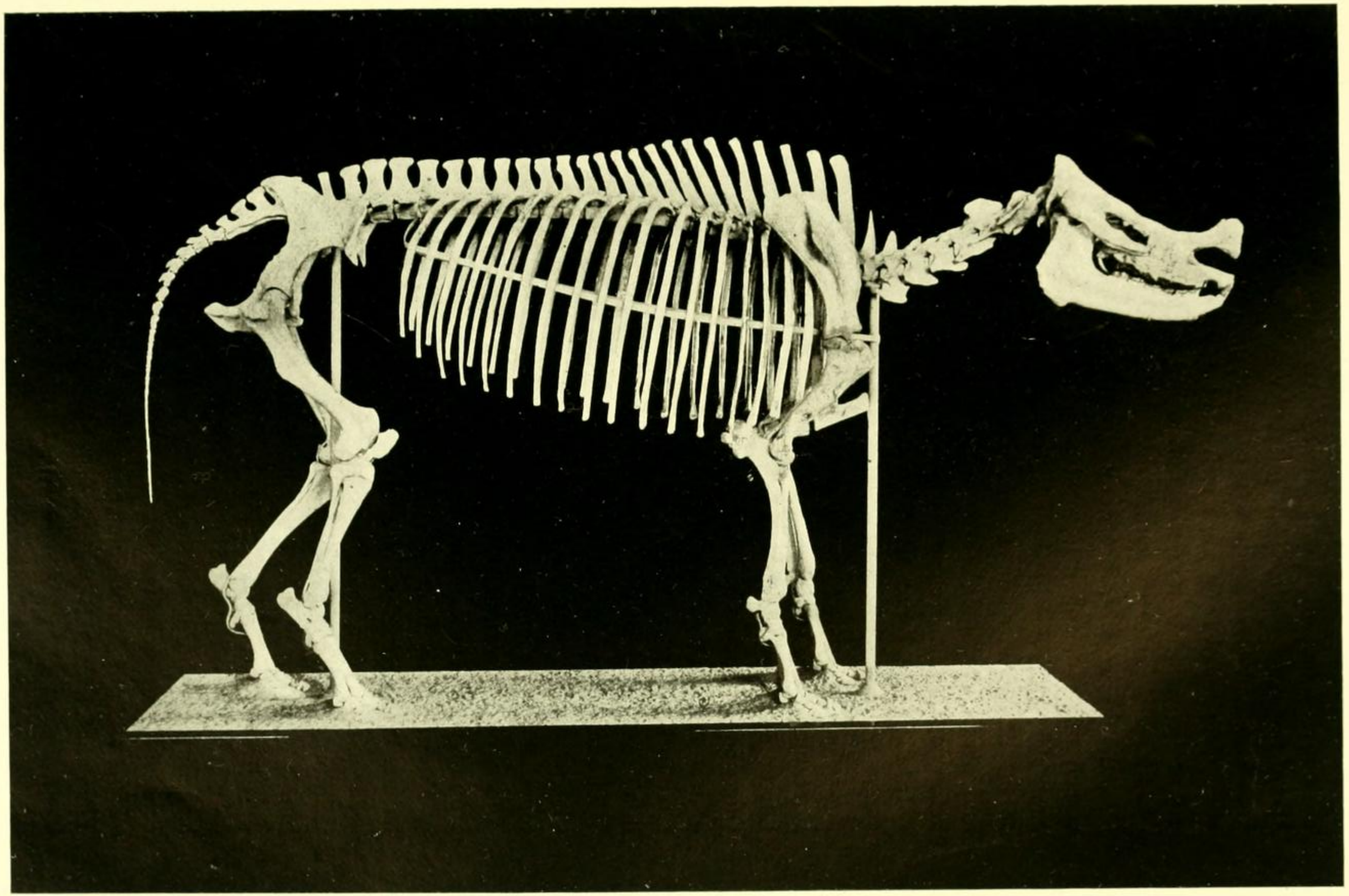
The presence of mc. V in *D. cooki* led to a closer study of Professor Osborn's memoir on "The Extinct Rhinoceroses" previously cited. The illustration of *A. tridactylum* on page 84 of this work appears to

have mc. V present and does not agree with the statement on page 159 of the same work; viz., "There are only three digits in the manus, hence the name *tridactylum*, there being no trace of the fifth digit. . . ." I infer, however, from his statement on pages 130 and 131 that mc. V might be present in a rudimentary form in *A. tridactylum*. This would seem perfectly natural in the light of present facts, since we should otherwise be forced to accept a rather involved variation of considerable morphologic importance. That is we should expect the various species in the Oligocene, leading up to the *Diceratheres* to be differentiated in a very marked degree so far as the absence and presence of mc. V is concerned, and also that these differences held good until the close of the lower Miocene.

In all the material of *Diceratherium* from the Agate Spring Fossil Quarries which I have seen, mc. V is present in a rudimentary form; nor is this surprising considering the fact that this digit is yet of considerable size in some of the earlier forms (*Aceratherium tetradactylum* Lartet and *Trigonias osborni* Lucas). The late Eocene and early Oligocene ancestors of *Diceratherium* had undoubtedly the manus more or less tetradactyl, the fifth digit, however, was rapidly reduced in later forms but was still present in a rudimentary condition, possibly in all the species of that genus, at the close of the lower Miocene.

The carpus is of equal height and breadth, the three functional metacarpals are of medium length with their shafts placed rather close together and displaying but slight divergency at the distal ends. The second phalanx of the median digit is raised very slightly from the ground while the lateral toes appear to be more elevated.

The pelvis is short and broad, the ilium being broadly expanded with a large area for the gluteal muscle, while the supra-iliac border is strongly emarginated as in older forms (*A. tridactylum*), but the ischium and pubis are apparently shorter. The femur is quite long, but comparatively slender, the different trochanters are, however, well developed, indicating a heavy thigh, and the antero-posterior diameter of the distal end is great in porportion, due chiefly to the very large internal border of the rotular trochlea. One of the more characteristic features of the tibia and fibula is the tendency of the proximal and distal ends to become coössified in fully adult and old individuals. The pes is strictly tridactyl. It is high and narrow with a broad, rather low astragalus, a very heavy tuber of the calcaneum, and quite elongated metatarsals. The ungual phalanges, especially the median pair,



Mounted Skeleton of *Diceratherium Cooki* Peterson. (In Carnegie Museum.)

are shorter than in the manus. The articulated skeleton represent an animal with a well proportioned head, a short neck, a long and rather heavy body supported by legs comparatively short and heavy. The dentition, together with other anatomical features of the skeleton, strongly suggest an animal whose habitat was among shrubs and vegetation along streams and other bodies of water.

MEASUREMENTS.	Cm.
Length of skeleton from anterior point of nasals to ischial tuberosity	180
Length of skull	40
Length of neck	35
Length of dorsal region	75
Length of lumbar region	21
Length of sacrum	18
Length of tail	50
Greatest transverse diameter of thorax	43
Greatest transverse diameter at point of ilia	33
Height of skeleton at fourth dorsal vertebra	100
Height of skeleton at fifth lumbar vertebra	93
Height from base to acetabulum of pelvis	70