TEXT-BOOK
OF
PALAEONTOLOGY

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septum. Manus tetradactyl; pes tridactyl. Now living in South and Central America and East Asia. Fossil tapirs were widespread in the Miocene and Pliocene of Europe: *Tapirus telleri* Hofmann, Upper Miocene of Styria; *T. priscus* Kaup, Lower Pliocene of southern Germany; *T. hungaricus* Meyer, Middle Pliocene of Styria and Hungary; *T. arvernensis* Croizet and Jobert, Upper Pliocene of Auvergne. A gigantic tapir, *Tapirus sinensis* Owen, lived during the Pleistocene in China. In the Pleistocene of North America occurs *Tapirus haysi* Leidy; and *Tapirus tarijensis* Ameghino is known from the Pleistocene of Bolivia.

Family 2. **Rhinocerotidae** Gray.[1]

Nasal bones standing out freely, often with a rugose cushion for one or two horns. Narial openings much prolonged backward. Dental formula: $\frac{3\text{-}0.\ 1\text{-}0.\ 4\text{-}2.\ 3.}{3\text{-}0.\ 1\text{-}0.\ 4\text{-}2.\ 3.}$. *Incisors and canines sometimes wanting. Premolars more or less molariform, less complex only in the oldest forms. Upper molars with thick ectoloph, without a median fold, and with two oblique gently curved transverse ridges intimately connected with the ectoloph. Inferior cheek teeth with two ridges bent at right angles, the posterior of which unites with the protolophid at the antero-external corner. Third molar without talon. Manus with three or four digits.*

To the *Rhinocerotidae* belong chiefly large heavy herbivorous quadrupeds, with a short neck, short legs, and a short tail. They still exist in the low swampy grounds of tropical India, the Sunda Islands, and in Central Africa. The fossil forms appear in the Middle Eocene of Europe and North America, and in the Miocene, Pliocene and Pleistocene had spread over the entire Northern Hemisphere and Northern Africa. They are characterised in part by the presence of stout horns, which originate as true epidermic structures from agglutinated tufts of hair, and are borne on rugose pad-like protuberances of the nasal bone, sometimes also of the frontal bone. If two horns are present, they are usually arranged one behind the other, more rarely side by side (*Diceratherium*).

Only in the earliest types is the dentition complete; in the later forms the canines first become aborted, and afterwards the incisors. In the older forms, either all or the two anterior premolars are much less complex than

[1] *Abel, O.*, Über die paläogenen Rhinocerotiden Europas. Abhandl. k. k. geol. Reichsanst., xx., 1910.—*Brandt, J. F.*, Mém. Acad. Imp. Sci. St-Pétersbourg, vol. viii., 1864; vol. xxiv., no. 4, 1877; and vol. xxvi., 1878.—*Cope, E. D.*, On the American Rhinoceroses and their allies. Amer. Nat., p. 770, 1879.—*Douglass, E.*, Rhinoceroses from the Oligocene and Miocene of North Dakota and Montana. Ann. Carnegie Mus., vol. iv., 1908.—*Duvernoy, G. L.*, Nouvelles études sur les Rhinocéros fossiles. Arch. Muséum Paris, vol. vii., 1853.—*Flower, W. H.*, On some cranial and dental characters of the existing species of Rhinoceroses. Proc. Zool. Soc. London, p. 443, 1876.—*Hatcher, J. B.*, New fossil Vertebrates. Ann. Carnegie Museum, 1907.—*Meyer, H. von*, Die diluvialen Rhinoceros-Arten. Palaeontgr., Bd. xi., 1864.—*Niezabitowski, L.*, Die Überreste des in Starunia gefundenen Rhinoceros antiquitatis. Bull. Acad. Sci. Cracovie, 1911.—*Osborn, H. F.*, The Extinct Rhinoceroses. Mem. Amer. Mus. Nat. Hist., pp. 79-164, 1898.—Phylogeny of the Rhinoceroses of Europe. Bull. Amer. Mus. Nat. Hist., pp. 229-267, 1900.—*Pavlow, Marie*, Études sur l'histoire paléontologique des ongulés. III. Rhinoceridae et Tapiridae. Bull. Soc. Imp. Nat. Moscou, 1888; VI. Les Rhinoceridae de la Russie et le développement des Rhinoceridae en général. *Ibid.*, 1892.—*Peterson, O. A.*, A mounted skeleton of *Diceratherium cooki*. Ann. Carnegie Mus., vol. vii., 1911.—*Weber, M.*, Über tertiäre Rhinocerotiden der Insel Samos. Bull. Soc. Imp. Nat. Moscou, 1904, 1905.—*Roman, F.*, Le Cadurcotherium. Arch. Mus. Lyon, 1908.—*Toula, F.*, Das Nashorn von Hundsheim. Abhandl. k. k. geol. Reichsanst., 1902, 1906.—*Scott, W. B.*, Osteologie von Hyracodon. Festschr. f. Gegenbaur, 1896.

the molars; in all later rhinoceroses, the premolars and molars, with the exception of the most anterior premolar, exhibit essentially the same composition. Thus, from the transverse ridges of the superior molars (Fig. 172) several folds project into the median valley; according to Osborn's terminology, one from the ectoloph (crista), one from the protoloph (antecrochet), and one from the metaloph (crochet). These folds sometimes unite, enclosing island-like spaces or fossettes. The last inferior molar never has a third lobe.

The skull is low, elongated, occiput surmounted by a sharp occipital crest. The orbits are open posteriorly, and the temporal fossae are unusually large. The nasal bones stand out freely, have very diverse length and stoutness, according as they bear horns or are hornless, and are sometimes supported by a co-ossified mesethmoid. The unusually large narial apertures often extend back as far as the first molar. The well-developed postglenoid process is either separated from the mastoid process (post-tympanic) by a groove or is united with it.

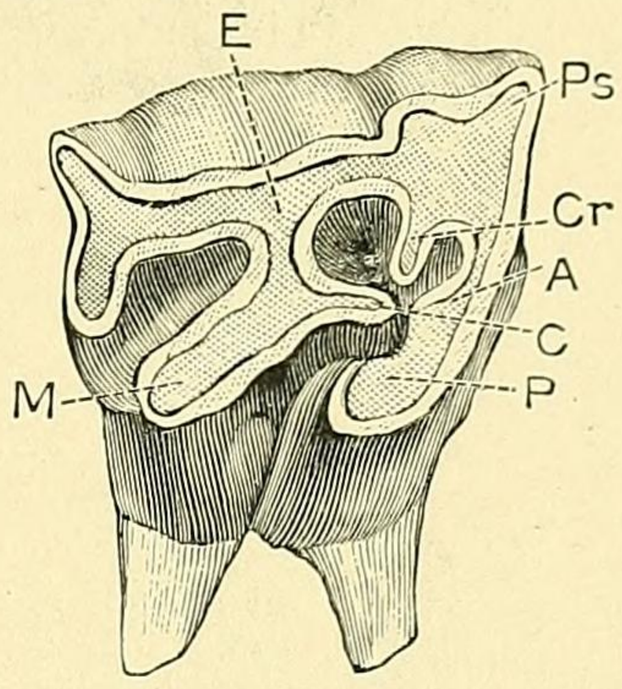

FIG. 172.

Upper molar of *Rhinoceros*. *A*, Antecrochet; *C*, crochet; *Cr*, crista; *E*, ectoloph; *M*, metaloph; *P*, protoloph; *Ps*, parastyle. 1/2.

The extremities are usually short and stout. The radius and ulna are well developed and entirely distinct, as in the tapir. In the older forms, the carpus exhibits nearly the same construction as in the tapir. Of the four metacarpals, the third is stouter than the two adjacent ones, while the fifth is short. In the later forms, the manus has but three toes; the carpals and metacarpals become shorter and broader, and the third metacarpal is considerably stouter than the two lateral metacarpals. The femur is always characterised by a strongly marked third trochanter, situated rather low down on the shaft. In more primitive forms, the tarsus and metatarsus are somewhat elongated and narrow; in more modern types, they are short and broad.

Subfamily 1. HYRACODONTINAE Cope.

Skull short, with a sagittal crest and with periotic conspicuous laterally. Nasal bones projecting freely, hornless. Dentition complete: $\frac{3.1.4.3.}{3.1.4.3.}$. *Canines weak and immediately following the chisel-shaped incisors, but separated from the cheek teeth by a short diastema. Premolars and molars either heterodont or homoeodont, the superior molars being composed of an ectoloph and two oblique transverse crests, the inferior consisting of two angular crescents, the posterior horn of which forms a transverse crest. Neck long. Extremities long and slender. Manus with three or four digits; pes tridactyl.*

In their general proportions, these slightly built animals, with their long limbs and long and slender neck, bear a far closer resemblance to the horse or *Anchitherium* than to *Rhinoceros*, although the skull and cheek teeth agree more closely in structure with those of the latter genus. They approach the tapirs in the skeleton structure, and form an independent extinct lateral branch of the rhinoceros stem. They are at present known only from the Eocene and Oligocene of North America.

Hyrachyus Leidy (*Colonoceras* Marsh) (Fig. 173). Premolars less complex than the molars, the upper ones trigonodont. Molars short-crowned. Manus tetradactyl, pes tridactyl. Middle Eocene; Bridger beds, Wyoming.

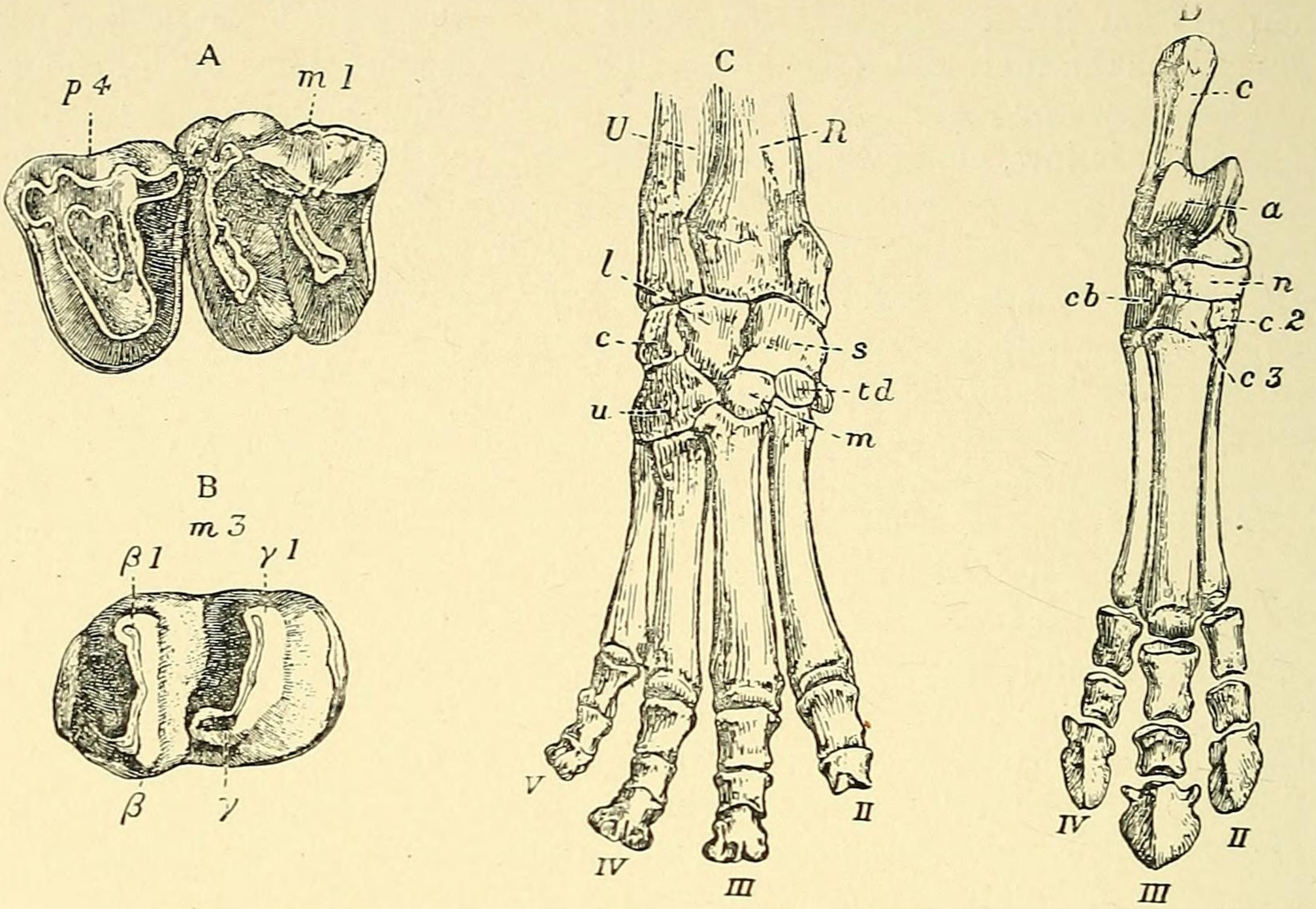

Fig. 173.

Hyrachyus eximius Leidy. Middle Eocene (Bridger beds), Wyoming. *A*, Last upper premolar and first molar. 1/1. *B*, Last lower molar. 1/1. *C*, Right fore-foot. *D*, Right hind-foot. 1/5. (After Cope.)

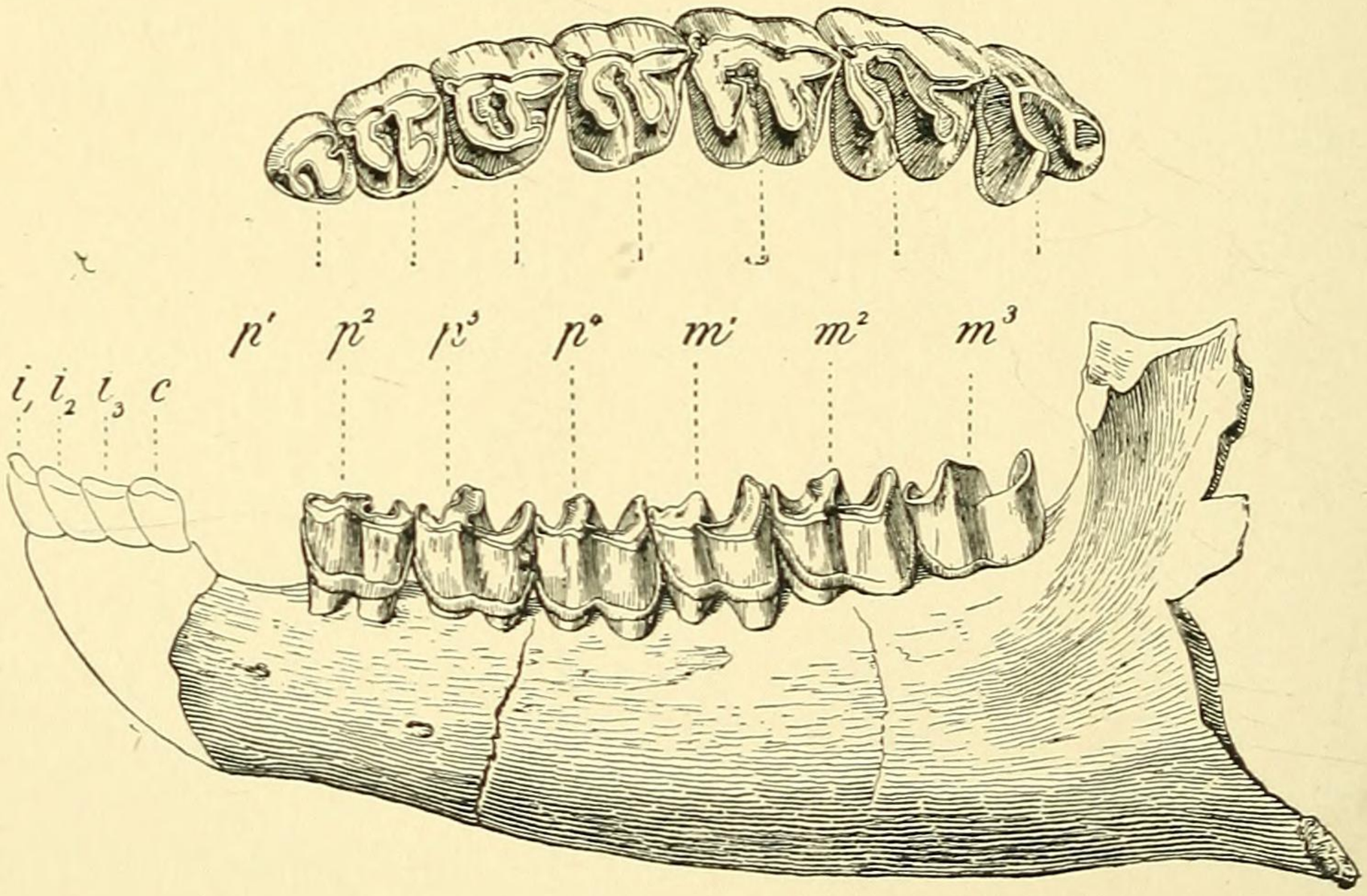

Fig. 174.

Hyracodon nebrascensis Leidy. Oligocene (White River beds), Nebraska. *A*, Upper cheek teeth from below. *B*, Lower jaw from outer side. 1/2.

Triplopus Cope. Molars with higher crowns. Manus tridactyl. Upper Eocene; Wyoming.

Hyracodon Leidy (Figs. 174, 175). Teeth high-crowned. Three posterior

premolars molariform. Manus tridactyl. Oligocene; White River beds, Nebraska and Colorado. *H. nebrascensis* Leidy, *H. major* Osborn.

Subfamily 2. Amynodontinae Scott and Osborn.

Skull deeply excavated in front of the orbits, anterior border of the snout broad, postglenoid process well developed. Nasal bones very short, without horns. Superior and inferior canines peccary-like tusks much more robust than the incisors. Molars like those of Rhinoceros, yet the transverse crests of the superior molars may be either without or with a very weak crochet. Superior premolars less complex or smaller than molars. Manus tetradactyl, pes tridactyl.

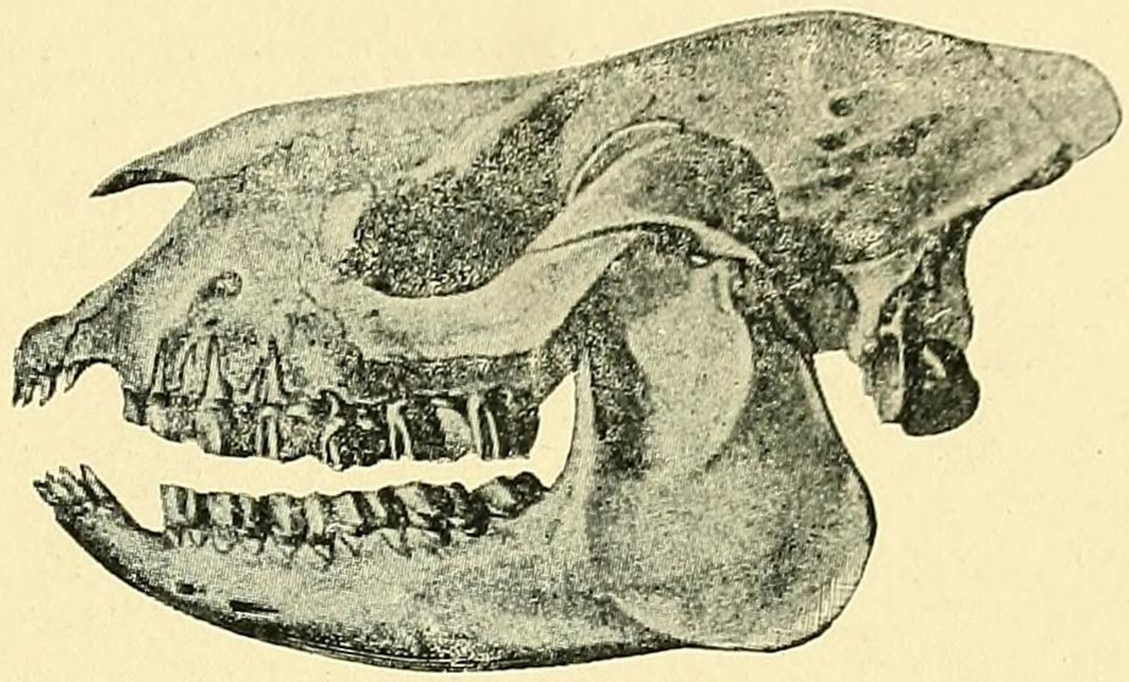

Fig. 175.

Hyracodon nebrascensis Leidy. Oligocene (White River beds), Nebraska. Skull. 1/6. (After W. B. Scott.)

The skeleton of one genus (*Metamynodon*) of these heavy aquatic quadrupeds is well known. The skull, however, more nearly resembles that of the bear than of a perissodactyl. For the most part, these comparatively rare remains come from the Upper Eocene and Oligocene of North America and from the Oligocene of Europe.

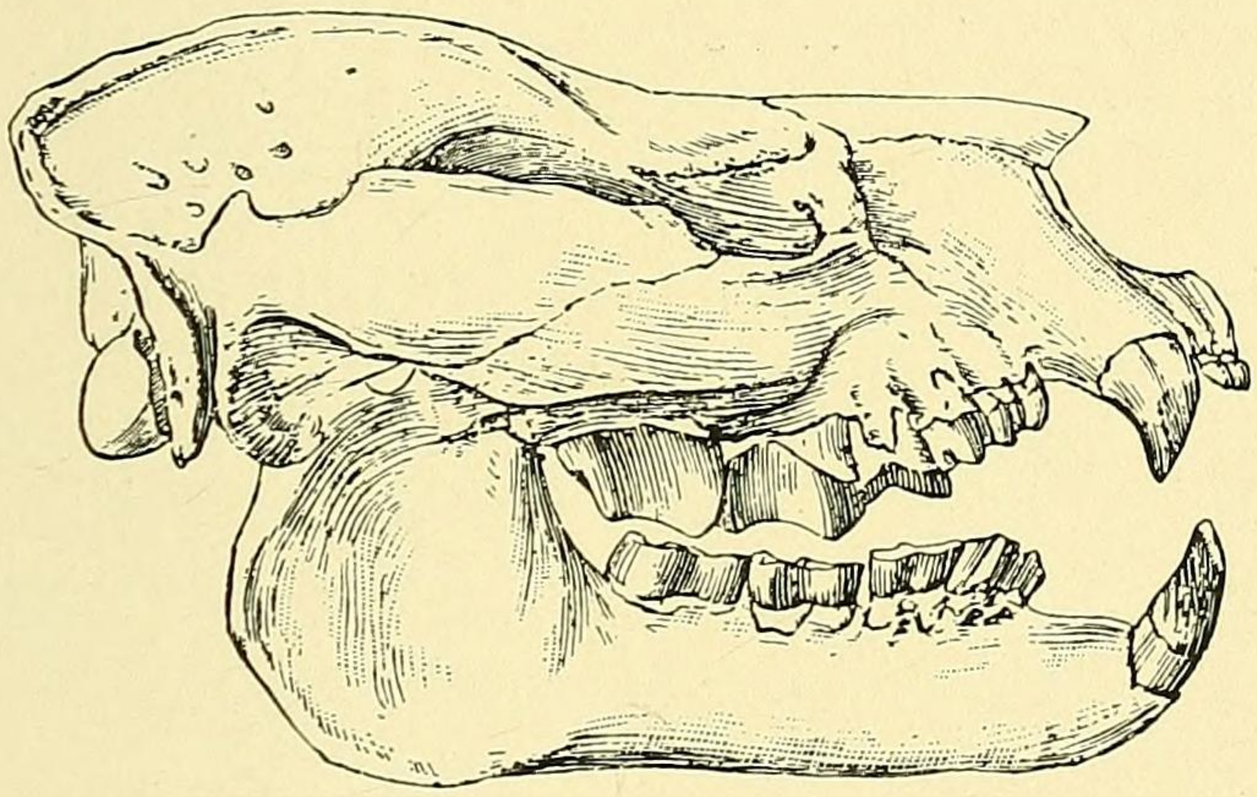

Fig. 176.

Metamynodon planifrons Osborn. Oligocene (White River beds), Dakota. Skull. 1/10. (After Osborn.)

Amynodon Marsh (*Orthocynodon* Scott and Osborn). Dental formula: $\frac{3\text{-}2.1.4.3.}{2\text{-}1.1.4.3.}$. Upper Eocene; Wyoming.

Metamynodon Scott and Osborn (Fig. 176). Dental formula: $\frac{2.1.3.3.}{1.1.2.3.}$. Cheek teeth laterally compressed. Crowns of the teeth very high. Oligocene; White River beds, Dakota. According to Pilgrim, also in Burma.

Cadurcotherium Gervais. $\frac{2.1.3.3.}{1.1.2.3.}$. Premolars and molars strongly compressed laterally. Oligocene; Phosphorites, Quercy, Gypsum of Isle-sur-Sorgues.

Subfamily 3. Rhinocerinae.

Skull elongated, elevated posteriorly, without sagittal crest; occiput surmounted by a sharp occipital crest; periotic not appearing on the outer surface of the skull; nasal bones long, projecting, of diverse strength, with or without horn-pad. Dentition never quite complete. Dental formula: $\frac{3\text{-}0.1\text{-}0.4\text{-}3.3.}{3\text{-}0.\ 0.\ 4\text{-}3.3.}$. *Superior canines nearly always absent; incisors frequently so. Superior first incisor and lower second incisor*

specialised; superior cheek teeth with ectoloph and two oblique transverse ridges; metaloph with crochet, ectoloph usually with crista. Superior and inferior premolars generally molariform. Neck short. Extremities robust. Manus with four or three digits, pes tridactyl.

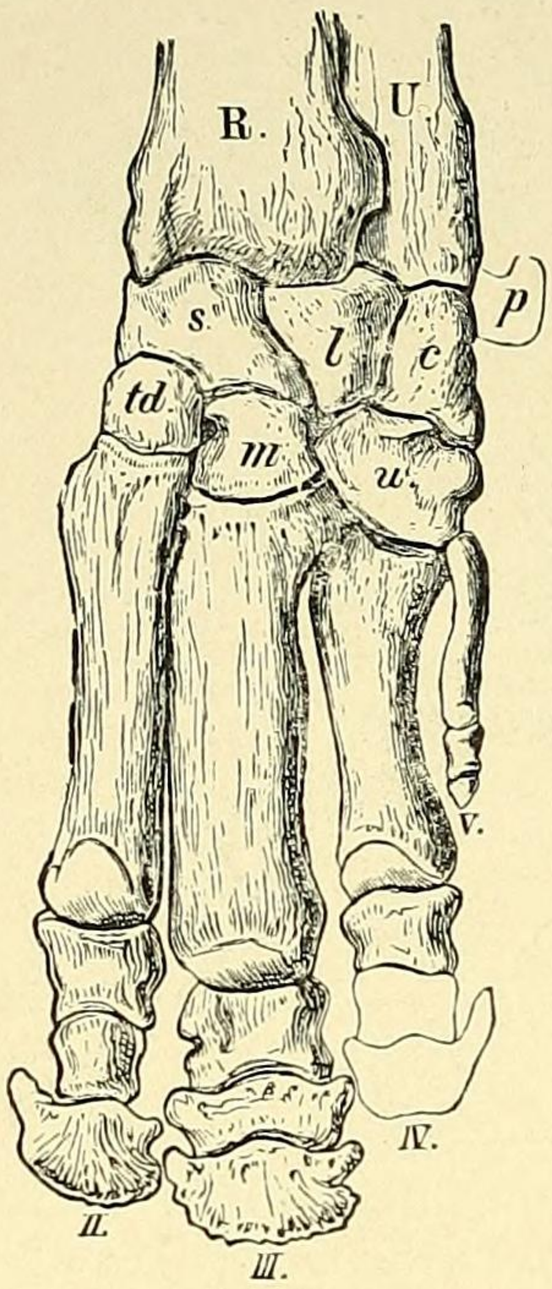

Fig. 177.

Aceratherium tetradactylum Lartet. Upper Miocene, Sansan (Gers). Left fore-foot. 1/5. (After Blainville.)

All members of this subfamily were included by

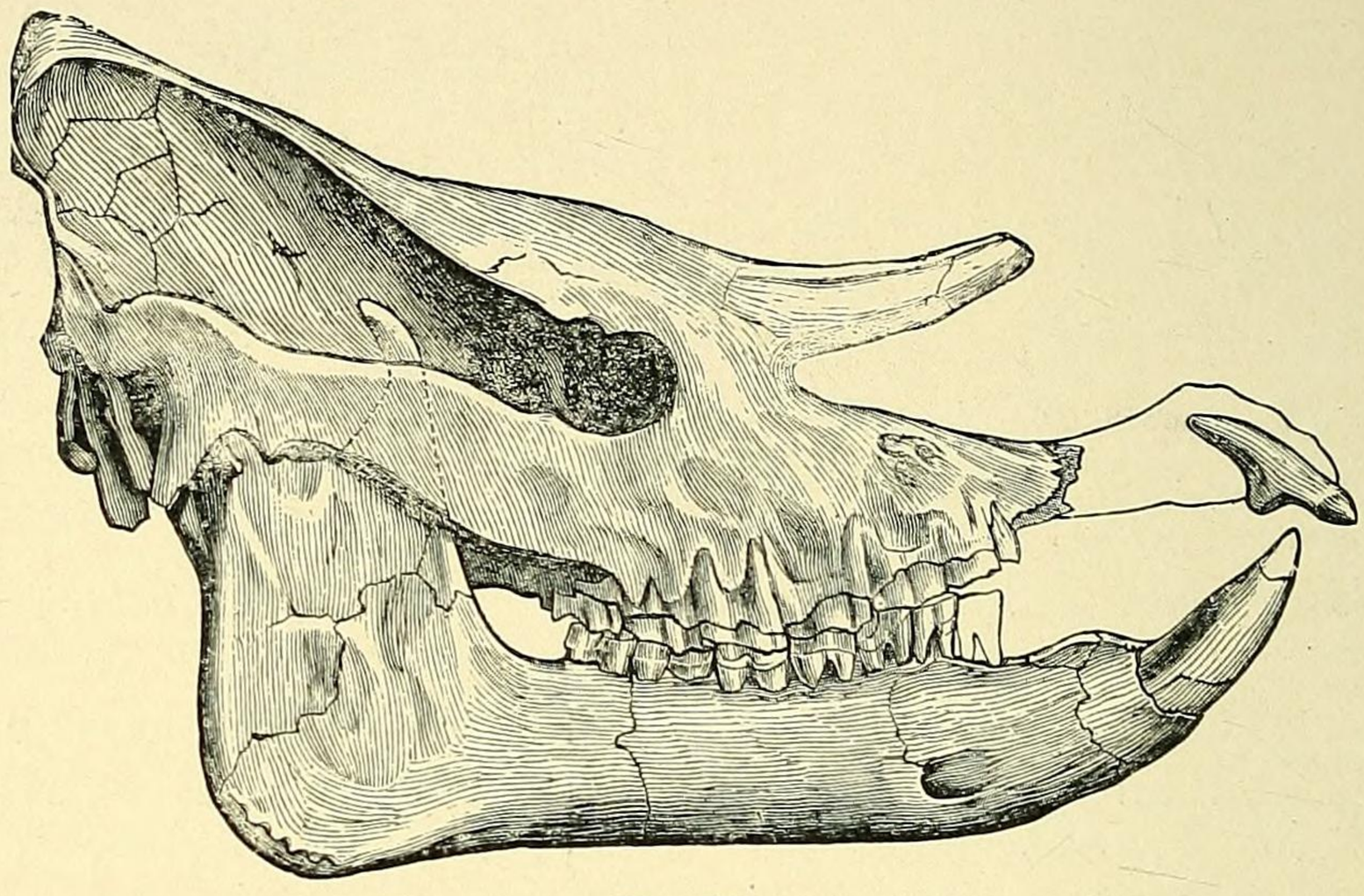

Fig. 178.

Aceratherium incisivum Cuvier sp. Lower Pliocene, Eppelsheim. Skull. 1/7. (After Kaup.)

Cuvier in the single genus *Rhinoceros* Linnaeus; now, however, they are separated into a number of genera.

(*a*) *Prohyracodon* Koch. Bones and dentition imperfectly known. Middle Eocene; Transylvania.

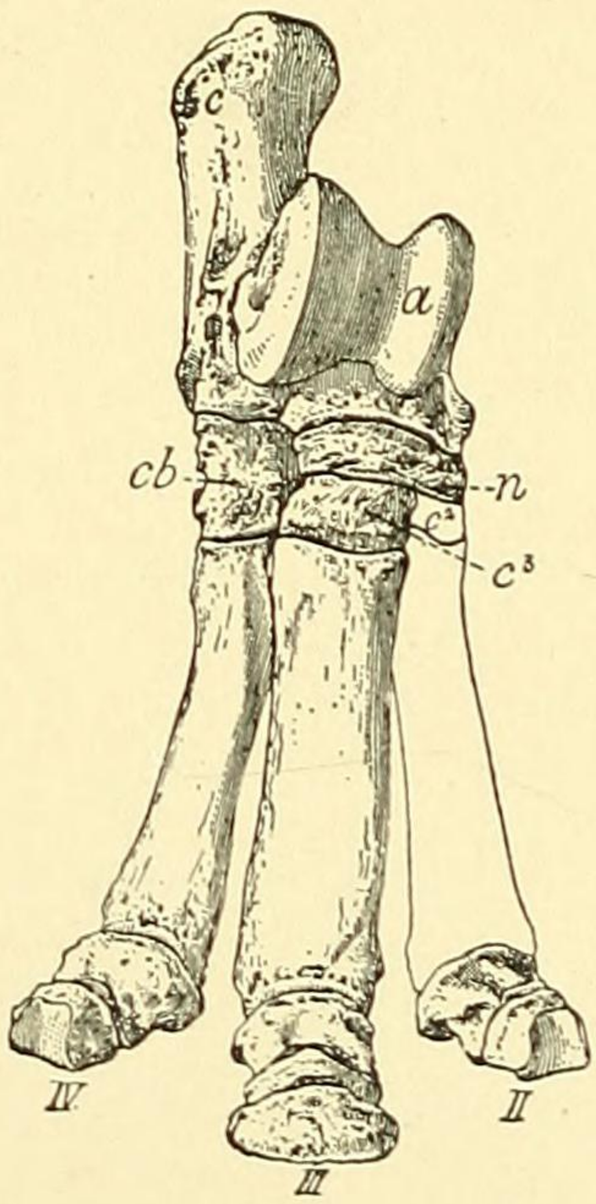

Fig. 179.

Aceratherium sp. Miocene, North America. Right hind-foot. 1/5. (After Osborn.)

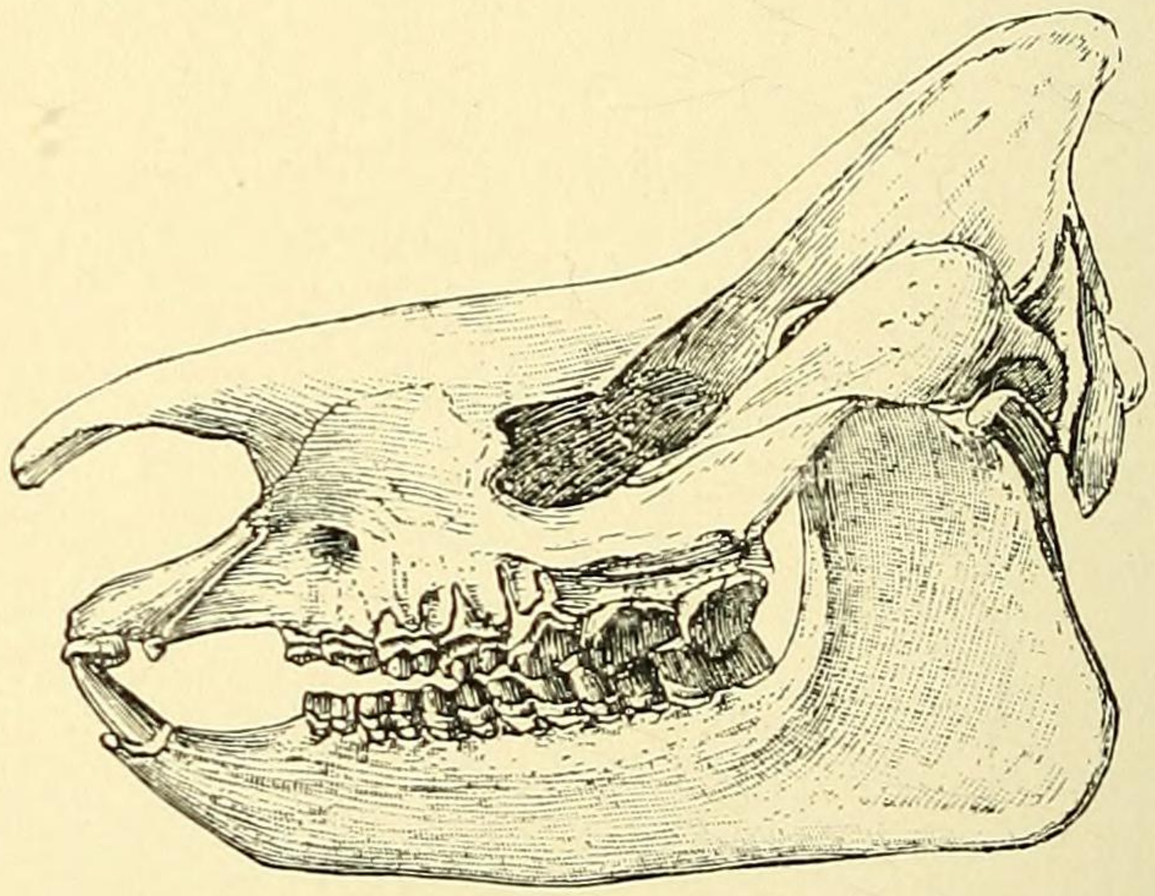

Fig. 180.

Aceratherium tridactylum Osborn. Oligocene (Upper White River beds), Nebraska. Skull. 1/9. (After Osborn.)

(*b*) *Trigonias* Lucas. Dental formula: $\frac{3.1.4.3.}{3.0.4.3.}$. First upper incisor and second lower incisor much larger than the others. Premolars much