THE PLEISTOCENE OF NORTH AMERICA AND ITS VERTEBRATED ANIMALS FROM THE STATES EAST OF THE MISSISSIPPI RIVER AND FROM THE CANADIAN PROVINCES EAST OF LONGITUDE 95°.

BY

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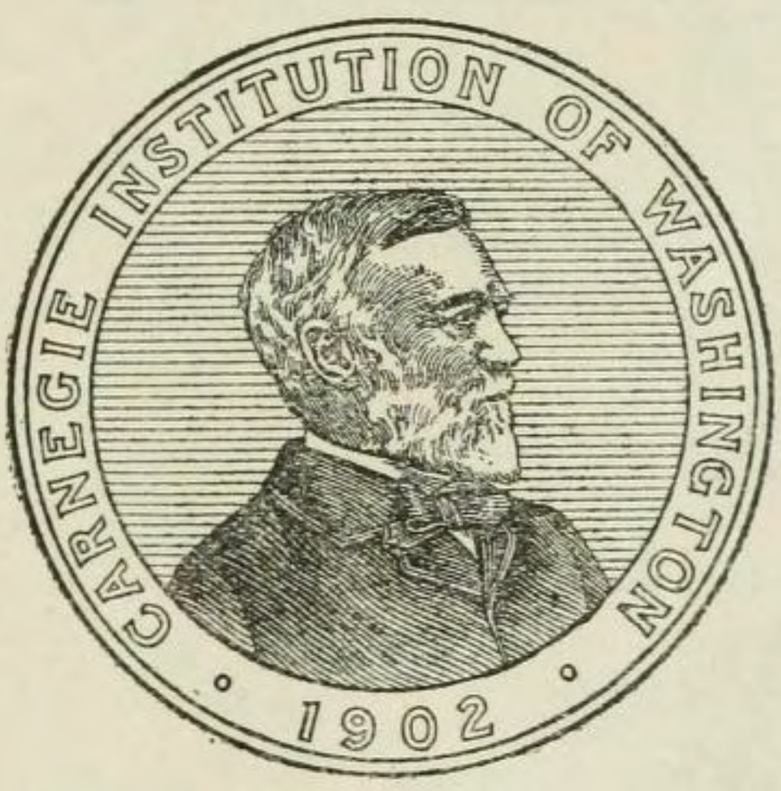

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FINDS OF RHINOCEROSES IN EASTERN NORTH AMERICA.

FLORIDA.

1. *Archer, Alachua County.*—Two species of rhinoceros have been described from this locality. In 1884 (Proc. Acad. Nat. Sci. Phila., p. 118), Dr. Joseph Leidy reported the discovery, with other fossils, of remains of a species of the genus *Rhinoceros* in Alachua clays, but he gave it no name. This was, however, done in 1885 (same Proceedings, 1885, p. 32). In 1896, after the death of Leidy, his unfinished paper, completed and edited by Professor F. A. Lucas, was published (Trans. Wagner Free Inst. Sci., vol. IV, p. 41 seq., with numerous figures). This species is now referred to *Teleoceras*, as *Teleoceras proterus*.

In 1890 (Proc. Acad. Nat. Sci. Phila., 1890, p. 94), Leidy described another species which he called *Rhinoceros longipes*, from the same place and deposit. This species is now called *Aphelops longipes*.

These species are usually credited to the Upper Miocene or Lower Pliocene. The reader is referred to page 376, where the geological position of these beds is discussed.

2. *Williston, Levy County.*—In his list of 1892 (Bull. U. S. Geol. Surv., No. 84, p. 129), furnished by Leidy, W. H. Dall included *Rhinoceros proterus* among the fossils found at Mixon's, near the village of Williston.

3. *Dunnellon, Marion County.*—In 1913 (5th Ann. Rep. Florida Geol. Surv., p. 58), Dr. E. H. Sellards stated that some remains of a rhinoceros had been found in the mines worked along Withlacoochee River, in the region about Dunnellon. In volume VIII of the Florida Survey, page 94, *Aphelops malacorhinus* (= *A. longipes*) is included among the fossils found in the Dunnellon formation. It is not included in his list of Pleistocene species found in the Withlacoochee River (Florida Geol. Surv., vol. VIII, p. 104). This was doubtless because he regarded it as belonging to an earlier formation.

4. *Mulberry, Polk County.*—In 1915 (7th Ann. Rep. Florida Geol. Surv., p. 72), Sellards stated that a tooth of *Teleoceras fossiger* (in the present work recognized as *T. proterus*) had been discovered in the Bone Valley phosphate formation, at the place named. As in other cases, the Bone Valley formation was referred to the Late Tertiary.

5. *Brewster, Polk County.*—In the volume last referred to, on page 72, Sellards mentions parts of jaws and teeth found in a phosphate mine at Brewster which are different from those of *Teleoceras proterus*. Some of these are figured by Sellards on his pages 107 and 108. They have not been specifically or generically determined.

on the youngest terrace; but that, in the opinion of the writer, belongs to the early Pleistocene.

St. John's County.—At a place 28 miles south of St. Augustine, along the Inland Waterway Canal, Mr. Fred P. Allen, of St. Augustine, collected on the Almero farm remains of *Mammut americanum* (p. 122), *Elephas columbi* (p. 158), *Mylodon harlani?* (p. 37), *Equus* sp. indet. (p. 194), the box-tortoise *Terrapene antipex,* and a dermal plate of perhaps *Alligator mississippiensis.* These were found in the banks of the canal. Here, at least, the horse and the mylodon, taking into consideration the geological circumstances, indicate early Pleistocene, equivalent to the first interglacial stage.

Levy and Alachua Counties.—Geologically these counties furnish important localities because of the presence of the Alachua clays (usually referred to the lower Pliocene or even the Upper Miocene) and deposits belonging to all three of the Pleistocene terraces, Newberry, Tsala Apopka, and Pensacola. The Alachua clays first require consideration, for in them have been found a considerable number of species of vertebrates which usually indicate Pleistocene deposits. The localities where Alachua clays have furnished vertebrate fossils, as indicated on Matson and Sanford's map (Water Supply Paper 319, U. S. Geol. Surv., plate 1), are situated, one around Archer, Alachua County (the type locality), second, about 5 miles west of Williston, in Levy County, and a third about 5 miles east of Newberry, in Alachua County.

The clays referred to form accumulations in depressions on the surface of the Ocala limestone, itself belonging to the Eocene. The deposits are said to average in depth about 10 feet, but are often thinner and occasionally much thicker. They have furnished a considerable number of species of vertebrates. A list, prepared by Dr. Leidy, of those found at Archer was published in 1892, in Bulletin 84 of the U. S. Geological Survey, on page 129. Besides these, Leidy had previously reported a tapir, a small crocodile or alligator, and a bone thought to belong to the extinct *Cervus americanus* (*Cervalces scotti?*), but which was not afterward mentioned. The rhinoceroses and the camels were described by Leidy and Lucas in 1896 (Trans. Wagner Free Inst., vol. IV, pp. 1–61 with plates).

Herewith is presented a list of such vertebrates as have been found at Archer. It appears necessary to retain for the rhinoceroses the specific names given them by Leidy.

Gomphotherium floridanum (p. 121).
Odocoileus osceola? (p. 232).
Procamelus major (p. 224).
P. minor (p. 224).
P. minimus (p. 224).
Teleoceras proterus (p. 211).
Aphelops longipes (p. 211).
Tapirus haysii? (p. 207).
Hipparion ingenuum (p. 195).
Megatherium mirabile (p. 37).
Alligator (or Crocodylus) sp. indet.

The following vertebrates have been collected east of Williston, in the place mentioned in Dall's report of 1892, on page 129, as Mixon's:

Gomphotherium floridanum (p. 121).
Procamelus major (p. 224).
Teleoceras proterus (p. 211).
Hipparion ingenuum (p. 196).
Hipparion plicatile (p. 196).
Thinobadistes segnis (p. 37).
Manatus antiquus?.
Pseudemys caelata.
Atractosteus lapidosus.

The list from the locality east of Newberry (Hallowell's place of Dall's report) is rather short. *Equus littoralis, Odocoileus osceola?, Hipparion* sp. indet., and *Parahippus* sp. indet. have been reported (Rep. Florida Geol. Surv., vol. v, p. 58; vol. VIII, pp. 42, 94). At Neals, Alachua County. *Tapirus terrestris?, Gomphotherium floridanum,* and *Hipparion* sp. indet. have been collected (Sellards as cited). At Juliette, same county, *Gomphotherium floridanum* has been secured, and at Hernando the same species; also *Hipparion* sp. indet. and *Procamelus* sp. indet. (Sellards Florida Geol. Surv., vol. v, p. 58). Along Santa Fe River, in the Buttgenbach mines, 6 miles north of Wade, have been found teeth of *Equus* and a tooth of *Bison.*

At Dunnellon, about 25 miles south of Williston, from the phosphate mines along the Withlacoochee River, have been obtained fossil vertebrates so similar to those found in the Alachua clays that Sellards concluded to unite his Dunnellon formation and the Alachua clays into one to be called the Alachua formation (6th Ann. Rep. Florida Geol. Surv., p. 161). The list of vertebrates found at and about Dunnellon is as follows, including the species dredged in Withlacoochee River:

Megalonyx sp. indet (p. 38).
Chlamytherium septentrionale (p. 138).
Ursus sp. indet.
Felis sp. indet.
*Gomphotherium floridanum (p. 122).
Mammut americanum (p. 122).
Elephas imperator (p. 162).
Trichechus manatus.
*Parahippus sp. indet. (p. 196).
*Hipparion plicatile (p. 196).
Equus leidyi (p. 196).
Tapirus sp. indet. (p. 207).
*Aphelops longipes (p. 211).
*Procamelus minor (p. 225).
Odocoileus osceola (p. 233).
Bison sp. indet. (p. 263).

The species marked by an asterisk are regarded by Doctor Sellards and others as belonging to the Miocene or Pliocene (8th Ann. Rep. Florida Geol. Surv., p. 94). See also Sellards, 1913 (5th Ann. Rep. Florida Geol. Surv., p. 58; 8th Rep., p. 104).

On the basis of the fossil vertebrates it can hardly be denied that the Alachua clays and the phosphate mines at Dunnellon are of the same geological age. According to Sellards, the formation belongs to the upper Miocene or to the lower Pliocene. Merriam (Bull. Dept. Geol. Univ. Cal., vol. x, p. 439) refers it to the Pliocene. Although there is present a strong palæontological element which represents the Pleistocene, the reference of the formation to the late Miocene or early Pliocene has seemed to be required by the presence of *Gomphotherium, Procamelus, Teleoceras,* and *Hipparion.* The Pleistocene species are usually accounted for on the supposition that they are intrusions from more recent deposits.

A figure from Sellards (Geol. Surv. Florida, vol. VII, p. 53), only slightly modified is intended to show the relation of the phosphate-bearing formations to those underlying them (fig. 21).

It is worth our while to consider whether or not the reference of the Alachua formation to the Miocene or early Pliocene is required by palæontological evidence. *Gomphotherium* is characterized by having molar teeth which on abrasion at one or both ends of each crest, present a trefoil pattern of the enamel; also by having a band of enamel on each of the upper tusks. Now, teeth having the same structure are not uncom-

mon in deposits of undoubted Pleistocene age in Kansas and Texas. That the animals possessing these teeth had tusks with enamel bands is not known, but it is quite possible that such enamel bands were present.

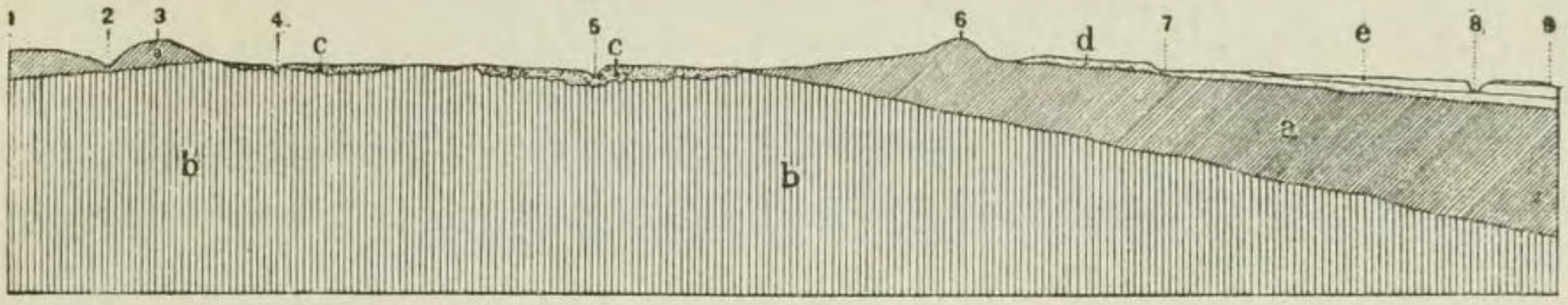

FIG. 21.—Diagrammatic sketch of geologic structure of Florida from north to south passing through the hard rock and pebble phosphate fields, showing relation of the phosphate deposits to the underlying formations. After Sellards.

1. Georgia–Florida State line.
2. Suwannee River.
3. Lake City.
4. Santa Fé River.
5. Withlacoochee River.
6. Lakeland.
7. Arcadia.
8. Caloosahatchee River.
9. Gulf Coast.

a Upper Oligocene phosphatic marls.
b Ocala limestone.
c Hard rock phosphate.
d Bone Valley formation.
e Pleistocene deposits (Pliocene and Pleistocene of Sellards).

The genus *Hipparion* is not confined to the Tertiary. Teeth have been discovered in the Aftonian of Iowa (Hay, Geol. Surv. Iowa, vol. XXIII, p. 150) and in Missouri (op. cit., p. 149). The writer has described a species of the genus, *Hipparion cragini*, collected by Professor Cragin in the Sheridan beds in Kansas (Kansas Univ. Sci. Bull., vol. x, p. 42).

One may be justified in suspecting that *Procamelus* lived on into the Pleistocene. Not only has it been found associated with Pleistocene fossils in five places in Florida—Archer, Williston, Dunnellon, Hernando, and Ocala—but it has been met with in possible Pleistocene deposits (the Idaho formation) in Idaho, which furnishes *Equus*, *Cervus*, *Castor*, and *Stegomastodon mirificus* (the type of which belongs in the Sheridan beds). Furthermore, the writer has had occasion to describe a collection of fossils, believed to belong to the early Pleistocene, which was obtained at Anita, Coconino County, Arizona. Among these fossils are two species of *Procamelus* much like those described by Leidy from the Alachua formation (Proc. U. S. Nat. Mus., vol. LIX, pp. 622–626). The writer believes that the genus *Procamelus* persisted into the early Pleistocene.

Two species of rhinoceros have been collected in the Alachuan formation, *Teleoceras proterus* Leidy and *Aphelops longipes* Leidy. Both occurred at Archer, while *T. proterus* was found near Williston and *A. longipes* at Dunnellon. A rhinoceros has been discovered in the Idaho formation, with the Pleistocene species named above in connection with *Procamelus* of these beds. In Oregon Cope made a collection which has been examined by Dr. W. D. Matthew (Bull. Amer. Mus. Nat. Hist., vol. XVI, p. 321). Here again *Teleoceras* was supposed to have been found with *Hipparion*, camels belonging to *Camelops* (or *Procamelus*), *Elephas*, and *Equus*. Matthew thought that there had happened, either before the fossils were collected or afterwards, a mingling of elements of two distinct faunas.

To the writer it seems improbable that the commingling of *Procamelus* and the rhinoceroses with Pleistocene forms should occur thus accidentally so often and at such widely removed localities. It appears more probable that these Tertiary genera did not become extinct so early as has been supposed and that the association was not a secondary one. The association is what might be expected in collections made in deposits of the earliest Pleistocene.

It must not be forgotten in these discussions that the Pleistocene genera and species with which the collections in question are being compared are those of the so-called *Equus* beds, which appear to represent the fauna of the first interglacial stage. This, however, was preceded by the Nebraskan, the first glacial, which probably occupied a long period of time; possibly it was half as long as all the rest of the Pleistocene (Chamberlin and Salisbury, Geology, vol. III, p. 383). About the vertebrate life of this long stage we know as yet very little. The writer is quite convinced that the Idaho formation and the Alachua, or Bone Valley, belong to the earliest Pleistocene.

Marion County.—In a fissure in the limestone-rock quarry at Ocala there has been found an important collection of vertebrates. The following list is thought to include all that have been reported:

Trucifelis floridana.
Sylvilagus sp. indet.
Elephas columbi (p. 158).
Bison sp. indet.
Odocoileus sp. indet. (p. 233).
Procamelus minimus (p. 224).
Tapirus sp. indet. (p. 207).
Equus leidyi (p. 196).
Dasypus sp. indet. (p. 38).
Terrapene formosa.
Testudo distans.
T. incisa.
T ocalana.

A part of this list was published by Sellards in 1916 (8th Ann. Rep. Florida Geol. Surv., p. 103). The tortoises were described in the same volume.

Inasmuch as *Trucifelis floridana* has been found in the Pleistocene at Vero, Florida, one may safely regard the specimen found at Ocala as also of Pleistocene age. All of the other mammals are admitted to be of Pleistocene age except *Procamelus minimus*. The fissure may have been open during some part of the Nebraskan stage.

Volusia County.—At Daytona, situated on the east coast, therefore on the youngest terrace, remains of *Mammut americanum* (p. 122) have been found. At DeLand there has been recovered the skull of a dolphin which Sellards (8th Ann. Rep. Florida Geol. Surv., p. 107, plate XIV) has described as *Globicephalus bæreckii* (p. 20). It was found at a depth of 10 feet, in sands which overlie Pliocene shell-marls. The sands are regarded as belonging probably to the Pleistocene. DeLand is on the Tsala Apopka terrace. At a depth of 10 feet there was reached the supposed marine base of this terrace.

Orange County.—As stated on page 196, a tooth of an extinct horse was found somewhere in the county.

Pinellas County.—On the western shore of Tampa Bay (p. 159), near St. Petersburg, at Indian Rock, a tooth of *Elephas columbi* was found.