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ADDITIONS TO THE PLEISTOCENE OF FLORIDA

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INTRODUCTION

In three previous papers two Pleistocene mammalian faunas from Florida have been described and a general résumé of the fossil land mammals of that State has been given.[1] A recent trip to Florida and various new discoveries there have added to previous knowledge. The notes here published include some brief stratigraphic data and description or mention of some important new fossils. The opportunity to make these observations and to study these specimens was due to the cooperation and kindness of Mr. Herman Gunter, Mr. Walter W. Holmes, and Mr. J. E. Moore.

ITCHATUCKNEE RIVER

The Itchatucknee River rises from several large springs southwest of Columbia in Columbia County and flows in a southerly direction into the Santa Fé River. The Ocala limestone is here at or near the surface, but in places there is a shallow layer of soil and in the bed of the river there is deep muck or ooze. It is said that three skeletons of mastodons were found in this river 35 or 40 years ago. These are said to have been mounted by Dr. J. Kost, first state geologist, but removed at the time of his retirement. Various other teeth and bones, chiefly mastodon or mammoth, have been found in or near the river.

Recently J. Clarence Simpson of High Springs has made a considerable collection of artifacts from the Itchatucknee River. The method of collecting is to wait until the water is low, then to wade about in the ooze until the bare feet encounter some hard object which may be recovered. In addition to arrow heads, some extraordinary awls or points of bone, apparently fossilized, were found, and also various remains of extinct animals. The association of artifacts and extinct animals is not

[1] Simpson, G. G. 1928. Pleistocene mammals from a cave in Citrus County, Florida. Amer. Mus. Novitates, No. 328.
———, 1929. Pleistocene mammalian fauna of the Seminole Field, Pinellas County, Florida. Bull. Amer. Mus. Nat. Hist., LVI, pp. 561–599.
———, 1929. The extinct land mammals of Florida. Fla. State Geol. Surv., 20th Ann. Rept., pp. 229–280.

important, in view of the type of deposit, but the animal remains are of some interest in themselves. The most important of these were presented by Clarence Simpson to the Florida State Geological Survey, and placed in my hands for study by Mr. Gunter. A preliminary list has already been published.[1]

The following is a revised list:

Didelphis virginiana
Ondatra zibethica
**Neochœrus pinckneyi*
Castor canadensis
Euarctos sp.
**?Arctodus* sp.
Procyon lotor
Lutra canadensis
**Mylodon harlani*
**Equus complicatus*
**Tapirus* sp.
Odocoileus osceola
**Mylohyus ?pennsylvanicus*
**Bison* sp.
**Mastodon americanus*
**Parelephas ?columbi*

This is the first record of *Ondatra zibethica* from Florida, two very characteristic jaws having been found here. In the recent fauna its place is taken by *Neofiber alleni*, which is also common in the Pleistocene. The beaver is also new to the Pleistocene fauna, although it is said to have ranged into the northern part of the state in recent times. It is represented by a single jaw which is very robust, but not more so than in some specimens of *Castor canadensis*. This may relate it to the subspecies *carolinensis*, the recent southeastern beaver, which is large, but I have been unable to make direct comparison.

Lutra canadensis is not a new record, but the present specimen is unusually perfect. It is very close to *L. canadensis vaga*, the otter of recent Florida. *Mylohyus* is also no new record, but the present material is unusual, perhaps unique, in preserving the post-dental part of the lower jaw quite completely. The specimen agrees more nearly with *M. pennsylvanicus* than with other species.

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[1]20th Ann. Rept. Fla. State Geol. Surv., p. 270.
*Extinct.

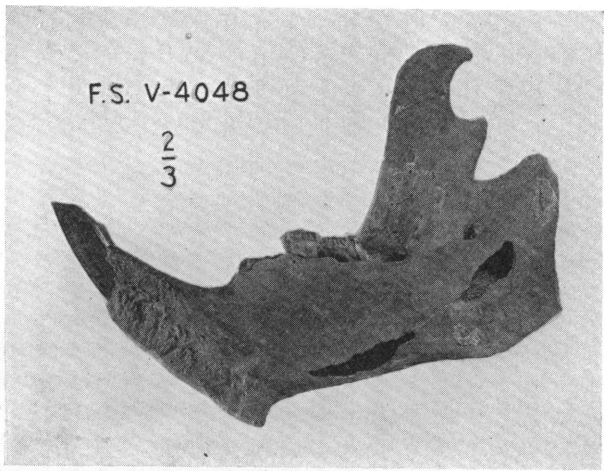

Fig. 1. *Castor canadensis.* Right lower jaw from the Itchatucknee River, internal view. Florida Survey, No. V4048. Two-thirds natural size.

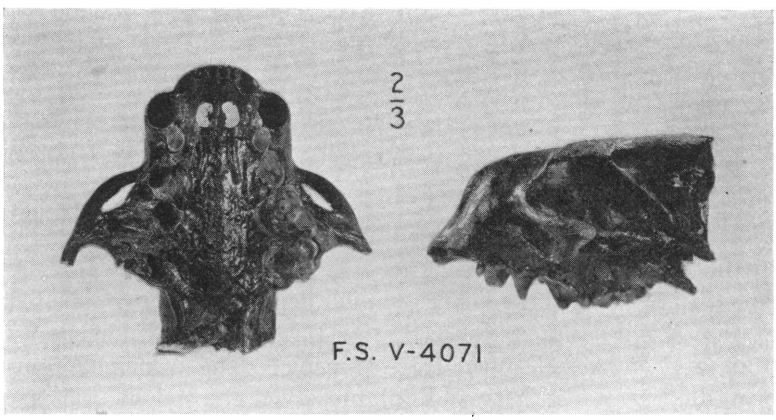

Fig. 2. *Lutra canadensis.* Anterior part of skull from the Itchatucknee River, palatal and left lateral views. Florida Survey, No. V4071. Two-thirds natural size.

SEMINOLE FIELD

The name Seminole Field has been applied by Holmes to an area in the south central part of Pinellas County northwest of St. Petersburg. From 1924 to 1927 this field was worked under the direction of Mr. Holmes, and the mammals included in the remarkably rich collections

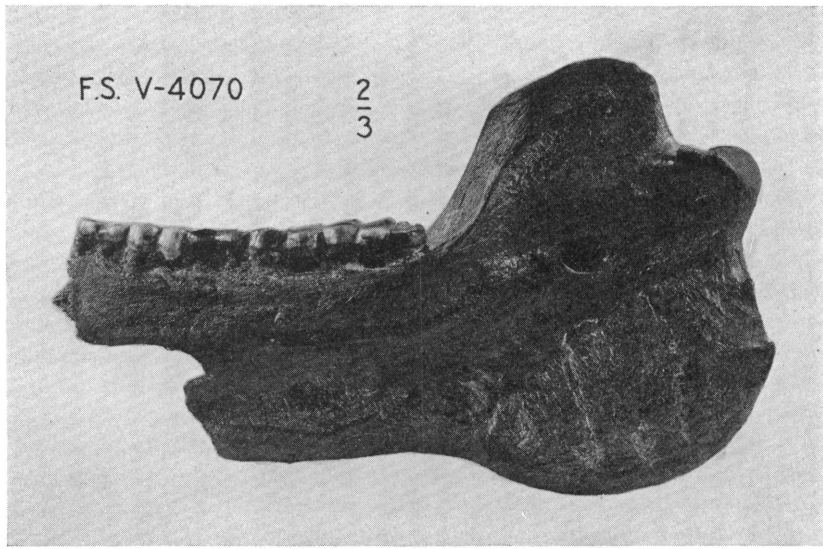

Fig. 3. *Mylohyus ?pennsylvanicus.* Posterior part of left lower jaw from the Itchatucknee River, internal view. Florida Survey, No. V4070. Two-thirds natural size.

of those years have been described elsewhere.[1] These collections were from the vicinity of Joes Creek, an area now designated Station A by Holmes. In 1929 he worked over a similar deposit about two miles south of Station A and designated it as Station B. The fauna is identical with that of Station A but much less extensive. The principal items of interest are scutes of a large and well preserved glyptodont. These will be described elsewhere.

The section at Station B is as follows:

Black sandy soil.....1′ to 1′ 6″
Yellow tenacious clay.....1′ 6″
Dark unconsolidated sand.....3′
——*Unconformity*——
Clean white sand, many shells.

[1]Simpson, 1929. Bull. Amer. Mus. Nat. Hist., LVI, pp. 561–599.

The three upper beds intergrade conformably. The fossils are almost confined to the lower six inches above the unconformity. Just above this most fossiliferous layer is a zone with numerous lime concretions. In and above this concretionary zone a few fossil bones were found. The ground water level in February, 1929, was nearly at the top of the dark fossiliferous sand, while the white marine sand is but little above the present sea level. The yellow clay of this section contains patches of bog-iron ore not far north of here and also contains a few broken shells in some places. It apparently represents a temporary depression of the area to several feet below its present level. The superficial stratum in this area may contain nodules or broad plates of sandy concretionary limestone.

The deposits at Station A are similar in a general way. A typical section is that at the No. 1 glyptodont locality, two hundred yards west of the bridge across Joes Creek:

Dark yellow sandy soil with many lime nodules and plates.....1′ 6″
Lighter yellow sand, little clay.....1′ 4″
Dark colored sand with bright yellow spots, fossil stratum.....6″
——*Unconformity*——
White sand with marine shells

The thickness may be considerably greater than here, due to the somewhat uneven present topography and also to the uneven surface at the unconformity.

The general features are the presence of a white marine sand of unknown thickness, its upper surface a definite erosional unconformity, overlain by several feet of conformable terrestrial and fluviatile deposits. These later deposits are variable and have only a vague general tendency to be separable into two parts, an upper level of yellow sand and loam with numerous hard limy concretions and lenses, and a lower level of yellow to drab or mottled sands and sandy clays with fossil bones usually present near the bottom.

BRADENTON

An important new locality for fossil mammals was found by Mr. J. E. Moore of Sarasota at a point about one mile south of the business district of Bradenton. The locality was visited by Mr. Holmes and myself, and Mr. Moore generously proposed that the material already found, as well as the direction of further work, be turned over to the

American Museum. Carl Sorensen, of the Museum staff, worked here under the direction of Mr. Holmes in February and March, 1929, and made a large collection.

The fossils occur in the bank of a drainage canal about 100 yards east of the Tamiami Trail. The section at this point is as follows:

Brown loam, darker above	1′ 4″
White and yellow mottled sand	10″
White sand	2′ 6″
Irregularly intercalated brown and white sands	1′ 6″
White sands	1′ 6″
Dark brown sand, becoming deeper northward into the bank, and containing all the fossil bones	1′ +
——*Unconformity*——	
Clean white sand with many shells especially near top	3′ +
(Water level)	

Details are almost infinitely varied, but this is typical of occurrences over most of western Manatee and Sarasota Counties. The presumable Anastasia equivalent below is a white marine sand bounded by a very sharp unconformity. The series above this is conformable throughout, highly variable, sand and loam, the lower part generally dark in color, the upper white, buff, yellow, to brown. The fossil bones almost always occur in the lowest part of this terrestrial or fluviatile series, within a foot or two of the marine sand, although there are occasional exceptions.

The most impressive material from this locality includes teeth, jaws, skulls, tusks, and skeletal parts of a new mammoth of the genus *Parelephas*. At least five individuals appear to be represented. A preliminary notice of this form by Professor Osborn has appeared elsewhere.[1] Other specimens of great importance include especially bison horn-cores and other remains, and a capybara skull. The fauna is as follows:

Neochœrus pinckneyi
Odocoileus sp. indet.
Tanupolama sp. indet.
Bison latifrons
Parelephas floridanus

[1]Osborn, H. F., 1929. American Museum Novitates, No. 393, Dec. 24, pp. 19–20.

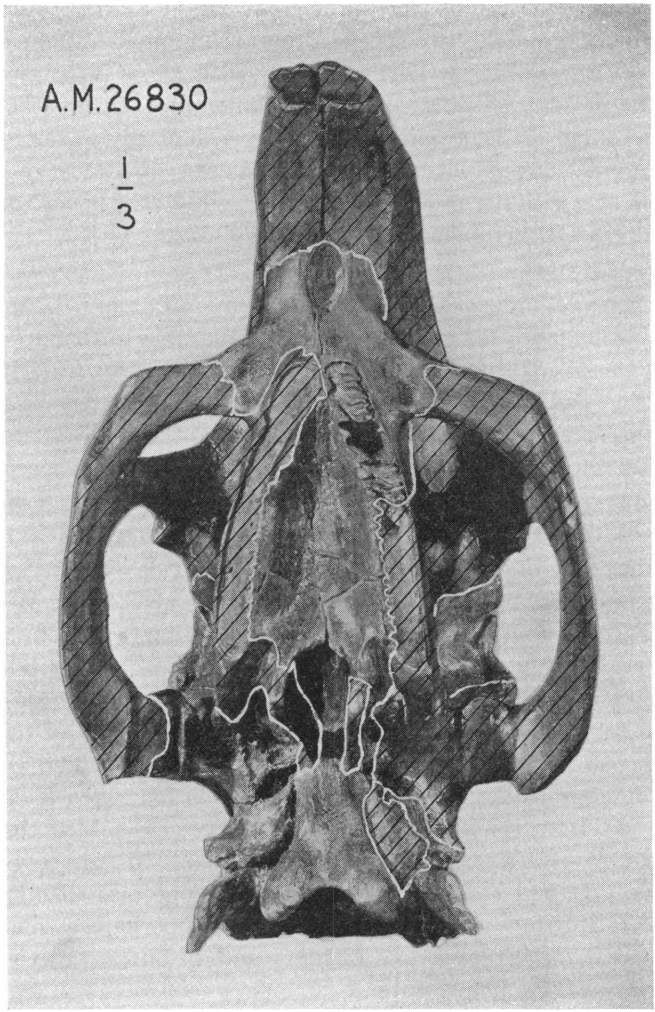

Fig. 4. *Neochœrus pinckneyi.* Skull from near Bradenton, palatal view. Cross-lined part restored. A. M. N. H. No. 26830. One-third natural size.

Neochœrus pinckneyi

Hay recorded the presence of a capybara in Florida,[1] and I have suggested that there are two species present, one smaller, named *Hydrochœrus holmesi*, and one larger, compared with *H.* or *Neochœrus pinckneyi*.[2] The present material, although fragmentary, permits the restoration of the skull. It is of remarkable interest, not only as the best fossil specimen of this group yet found but also as revealing most of the skull characters of a gigantic rodent as large as *Castoroides*, hence ranking as one of the largest members of its Order.

There are no parts comparable to the type of *H. holmesi*, but the present specimen indicates a considerably larger animal. M^3 is missing but its aveolus indicates a tooth closely comparable to that from South Carolina described by Hay as *Hydrochœrus pinckneyi*.[3] Hay later described a fragment of a lower jaw and an M_4 from Texas, referring them to this species and to a new genus *Neochœrus*.[4] The Bradenton skull is probably referable to the same species as the Charleston specimen. It makes more positive the distinctions of these larger fossil specimens from the living capybara and perhaps validates their generic separation.

Of the dentition, P^4 and M^2 are preserved on the left side, with complete alevoli of M^1 and the inner wall of the alveolus of M^3 on both sides. The cheek series probably measured about 115 mm. in length at the mouths of the alveoli, whereas it is only 84 mm. in length in an unusually large recent capybara. P^4 is like that of the recent animal save for the very marked peculiarity that the external surface of the second plate (or posterior wing of the first pair) is strongly indented vertically, so that there are five external angles rather than four as in *Hydrochœrus* proper. M^1, from its alveolus, appears to have resembled that of the living form save in size, and M^2 is quite similar. M^3 was a very large, long tooth. It had at least 15, and possibly one or two more, inner angles, so that it must have had at least 16 and perhaps as many as 18 outer angles. *Hydrochœrus* has 13 inner and 14 outer. Hay's type of *Neochœrus pinckneyi* has 17 outer.

The palate is more deeply arched, but closely similar to *Hydrochœrus* in proportions. At the anterior ends of the palatines (which are fused at the midline) are two vascular foramina, and there is another conspicuous pair in the maxillaries, in advance of these, and other smaller ones.

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[1] 1923. Pan-Amer. Geol., XXXIX, p. 103.
[2] Simpson, 1928. Amer. Mus. Novitates, No. 328, p. 7; 1929, 20th Ann. Rept. Fla. State Geol. Surv., pp. 251, 264, 268, 270.
[3] Hay, O. P. 1923. Carn. Inst. Pub. No. 322, p. 364; 1923, Pan-Amer. Geol., XXXIX, p. 103.
[4] 1926. Proc. U. S. Nat. Mus., LXVIII, Art. 24, p. 5.

The anterior roots of the zygomata and the maxillary region in front of and between them are broader and more flattened than in *Hydrochœrus*. The roots are much larger and relatively thicker (vertically) but in spite of their larger size their distance above the mouths of the alveoli is about the same as in the living form.

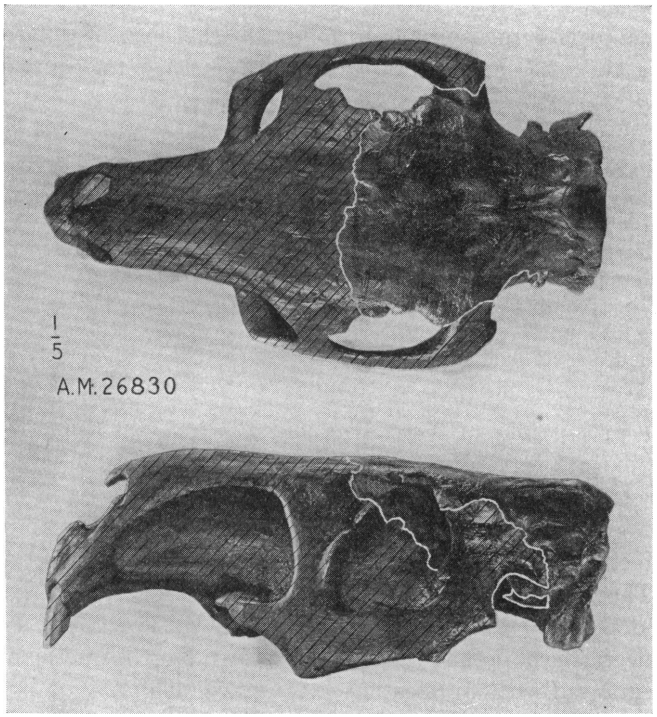

Fig. 5. *Neochœrus pinckneyi*. Skull from near Bradenton, superior and left lateral views. Cross-lined parts restored. A. M. N. H. No. 26830. One-fifth natural size.

It is the skull roof that most obviously distinguishes the fossil and recent animals. The frontal region in the fossil is very broad and nearly flat. The sagittal crests on the parietals narrow very rapidly: at the post-orbital processes they are nearly twice as wide as in *Hydrochœrus*, while at the contact with the supraoccipital (or interparietal?) they are of almost exactly the same width as in the latter. The roof of the parietals is not arched and does not curve downward posteriorly, but continues

the plane of the frontals and rises to a point at the supraoccipital suture. The interparietal part of the supraoccipital is relatively longer in the fossil, and the occiput is relatively higher.

The basifacial—basicranial flexure was probably somewhat less than in *Hydrochœrus*. The basioccipital-basisphenoid angle is less sharp than in the latter. The glenoid surfaces are somewhat lower relative to the basicranium.

Some typical measurements follow, with those of a large recent capybara and of a specimen of *Castoroides ohioensis* for comparison:

	Neochœrus pinckneyi	*Hydrochœrus capybara*	*Castoroides ohioensis*
Length of skull, excluding incisors	ca. 350 mm.	254 mm.	302 mm.
Width across zygomata	ca. 210	133	ca. 225
Minimum width of skull roof at interorbital constriction	124	67	64
Width across paroccipital processes	115	83	165
Depth of occiput to lower edge of foramen magnum	93	67	72
Maximum depth of skull in molar region	ca. 105	ca. 70	ca. 120

The proportions of *Neochœrus* and *Hydrochœrus* differ somewhat, but the extinct form appears to have been about 40% larger than a robust recent capybara. The proportions of *Neochœrus* and *Castoroides* differ so greatly in almost every particular that exact comparison is impossible, but their heads appear to have been of about the same bulk. The skull of *Neochœrus* is about 15% longer, but the average outside depth and width were probably slightly less. The two forms must henceforth share the title of largest known North American rodents, hitherto granted without question to *Castoroides* alone.

Bison latifrons

The occurrence of a large *Bison* in the Pleistocene of Florida has long been known. It has been found at twenty or more localities throughout the State. Good specimens have been so rare, however, that specific determination of any of this material has not yet been made. Horn cores, indispensible for the exact determination of any species of bison, have been unknown except for a specimen from near Grove City which was not figured and has been lost. In the Bradenton quarry were found numerous bison bones, a lower jaw, part of a skull, and part of a second skull with one horn core nearly complete and the base of the other.

The limb bones and the lower jaw (with M_{1-3} preserved) agree with specimens from the Seminole Field,[1] and elsewhere and represent the common Pleistocene bison of Florida. There can be little doubt that the skull fragments and horn cores belong in the same species as the teeth and limb bones, so that this species may now be definitely identified. It is *Bison latifrons.*

In the Bradenton specimen the horn cores are smaller by about 5%, or a little more, than in the type or principal referred specimens of *B.*

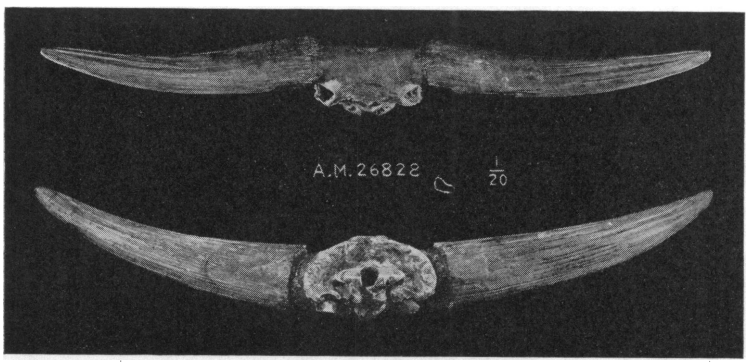

Fig. 6. *Bison latifrons.* Horn cores and posterior part of skull, from near Bradenton, views from above and slightly behind (upper), and from behind and slightly below (lower). The tip of the left horn-core and about two-thirds of the right are restored. A. M. N. H. No. 26828. One-twentieth natural size.

latifrons. The distance between the horn cores is smaller in proportion to the size of the horn cores than in the Adams County, Ohio, specimen described by Allen, Lucas, and Hay. The horn cores do, however, agree almost exactly in proportion, curvature, and general form with typical *B. latifrons* and differ in one respect or another from all other established species of the genus. The narrow frontal region may be a sexual character, associated with the slightly smaller horns.

Approximate measurements follow (based on partly restored specimen).

[1]Simpson, 1929. Bull. Amer. Mus. Nat. Hist., LVI, p. 598.

Width between horn cores	300 mm.
Length of core on upper curve	ca. 760 mm.
Length of core on lower curve	ca. 795 mm.
Maximum diameter of base	160 mm.
Minimum diameter of base	135 mm.
Circumference of base	475 mm.
Distance between tips of cores	ca. 1720 mm.

SARASOTA COUNTY

The activities of Mr. J. E. Moore of Sarasota have revealed a large part of the rich Pleistocene fauna of Sarasota County. Some of this

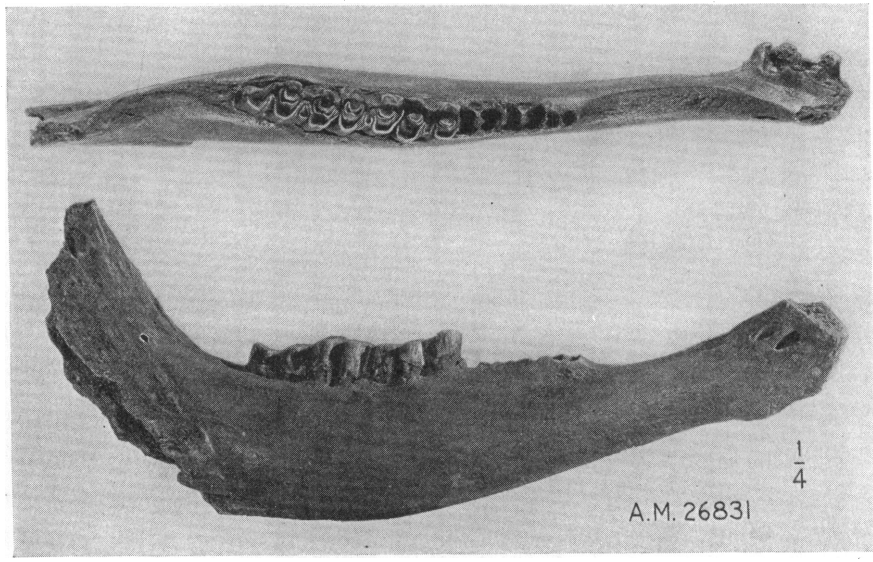

Fig. 7. *Bison latifrons.* Right lower jaw from near Bradenton, superior and external views. A. M. N. H. No. 26831. One-fourth natural size.

material has been briefly listed,[1] but it remains to consider its bearing on west coast Pleistocene geology in slightly more detail.

The occurrences are of three sorts:

1. Beach Deposits. These deposits, although of recent age, often contain Pleistocene fossils and not infrequently also Tertiary fossils. These have been found at various points from Venice north to Piney Point in Manatee County, and generally consist of horse or shark teeth

[1]Simpson, 1929. 20th Ann. Rept. Fla. State Geol. Surv., pp. 274–275.

(especially *Carcharodon*) and plates of mammoth teeth. They are obviously derived by erosion from older beds and are not of geologic or morphologic importance.

2. Hog Creek. This is a unique deposit at the mouth of Hog Creek, a mile and a half northwest of the Sarasota courthouse. The fossils were all dredged, but Mr. Moore, who followed the operations closely, states that the fossils were derived from a blue clay 8 to 14 inches in thickness and 11 to 12 feet below the present sea level. Below this clay is a solid limestone, and above it a thick gray clay with phosphate pebbles.

The peculiar features of this deposit are (a) its depth, the absolute elevation of the bone layer much lower than elsewhere in this region, (b) the argillaceous rather than sandy nature of the bone stratum and the presence of phosphate in it and in the overburden, (c) the fact that the bone bed lies directly on Miocene limestone, the marine Pleistocene which usually underlies it being absent, and (d) the nature of the fauna, which includes Pliocene as well as Pleistocene species.

All of these peculiarities seem well accounted for by the theory that this is a Pleistocene River deposit, whereas the typical Pleistocene, as in the Seminole Field, was deposited by small streams, in bogs, and by the wind. The incision of the Hog Creek beds below the present or the Pleistocene sea-level was probably due to the scour of an estuary. Phosphate is present because the stream reached into the phosphate areas headward and cut into the Miocene along its course, whereas the smaller streams were shorter and did not cut through the marine Pleistocene, which is generally not phosphatic.

The absence of the marine Pleistocene here may be due either to non-deposition because of the presence of estuarine rather than littoral conditions, or may be due to erosion after the post-marine uplift. Absence of the marine Pleistocene through non-deposition may be seen at several places along the west coast, representing either extensions of the restricted peninsula or islands not covered by the sea. An example probably of the latter sort is seen in the so-called travertine quarry about two miles southeast of the town of Manatee. Here the impure terrestrial Pleistocene sands, with a few fossil bones, rest directly on impure fuller's earth, probably of Miocene age, which in turn rests on phosphatic limestone (the so-called "travertine") surely of Miocene age.

The Hog Creek fauna, as represented by the Moore collection, consists of twenty-three species of Pleistocene land mammals and three apparently Pliocene species (*Hipparion ingenuum, H. plicatile, Serri-*

dentinus sp.). With the exception of these three, the species of land mammals all occur in the unit fauna of Seminole Station A. The Pliocene remains, like some of the phosphate, were surely washed down from an older deposit by the Pleistocene river.

3. Deposits similar to the Seminole Field and Bradenton occurrences. These are the most important numerically and in the variety and perfection of the fossils. Mr. Moore has found fifteen or more localities of this sort for Pleistocene mammals in Sarasota County. They fall into two groups—(1) a series of about a dozen localities east, northeast, and southeast of Sarasota, from near the Manatee County line about four miles northeast of the Sarasota courthouse southward and south southeastward for a distance of about six miles. This includes the faunas from the Fruitville Ditch and Philippi Creek previously listed.[1] The bones occur in sand or sandy clay either immediately above the white marine sand or within a foot or two of it. The fauna is that of Seminole Station A, except that less than half as many species are known. Only one species, *Castoroides ?ohioensis*, has not been found in the Seminole Field.

A second group of localities includes the Parker farm and adjacent region five or six miles east of Venice. Here the common Pleistocene species are all found; mammoth, horse, bison, deer, camel, tapir, glyptodont, and others. In place in a soft white sand along a canal the following typical but limited fauna was found in a small pocket by Moore and Sorensen:

Equus leidyi
Equus littoralis
Tanupolama mirifica
Bison latifrons

Near this locality are a few shells apparently in place above the bone level—inconclusive but suggestive evidence of a subsidence following the post-Anastasia uplift.

A NEW RECORD

F.S.G.S. V1539, a very small jaw from Stratum No. 2 (Melbourne Beds) at Vero proves to belong to *Reithrodontomys humulis*. This tiny harvest mouse is still present in Florida, but neither the species nor the genus has hitherto been reported in the Pleistocene.

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[1]20th Ann. Rept. Fla. State Geol. Surv., p. 275.