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MUSEUM OF VERTEBRATE ZOOLOGY, UNIVERSITY OF CALIFORNIA, BERKLEY, CALIFORNIA.

The Pleistocene Herpetofauna of Saber-tooth Cave, Citrus County, Florida

J. ALAN HOLMAN

ONE of the four Pleistocene test faunas of Florida is Saber-tooth Cave (Simpson, 1929). The mammals were described by Simpson (1928) and the birds by Wetmore (1931), but only a few reptiles (Brattstrom, 1953, 1954) and no amphibians have been identified from this locality. Previous knowledge of the fauna of this cave is based upon excavations made by a party from the American Museum of Natural History in 1928. Apparently systematic excavations have not been made in Saber-tooth Cave since this date. On August 9, 1957 extensive collections were obtained at Saber-tooth Cave and the herpetofauna of 21 species forms the subject of the present paper.

Saber-tooth Cave lies in NW¼, SW¼, section 33, T 18 S, R 18 E, 1.2 miles NW of Lecanto, Citrus County, Florida, with an elevation at the top of the cave of approximately 55 feet. The cave is on property presently owned by Mr. Austin Allen. Other names have been applied to this cave in the literature, but it seems wiser to follow Simpson (1928), who uses the name "Saber-tooth Cave," in order to distinguish it from several other caves nearby. A description of the cave is provided by Simpson (*op. cit.*), who mentions that the cave is entered through two vertical shafts. These shafts are about 20 feet in depth. A third and much narrower opening into the cave, which has evidently opened since 1928, was observed by our party.

The matrix of the bone bed consists of reddish sandy clay which is reported by Simpson (1929a and b) and is thought to represent the Wisconsin stage of the Pleistocene. This sandy clay is markedly similar to that of the Pamlico marine terrace, whose top is exposed at 55 feet elevation at a road-cut near Saber-tooth Cave. The Pamlico terrace is thought to represent the Sangamon

stage of the Pleistocene (MacNeil, 1950). The sediments are well stratified in the cave, whereas the terrace sands are massive. This indicates the cave material was transported and reworked from the original Pamlico terrace. The bones, however, show no indication of having been transported, and thus the fossils must have accumulated during post-Sangamon, Wisconsin times.

The 1957 excavation was sponsored by the Florida Geological Survey. The members of the collecting party were Dr. Pierce Brodkorb, Charles J. Flora, and J. Alan Holman of the Department of Biology of the University of Florida. Catalog numbers refer to the collection of the Florida Geological Survey. Exceptionally numerous were insectivores and small rodents. The cotton rat (*Sigmodon hispidus*), mice of the genus *Peromyscus*, and the rice rat (*Oryzomys palustris*) were represented by hundreds of individuals. Birds, reptiles, and amphibians were much less abundant.

Brodkorb (1957) has suggested that the huge Pleistocene rodent beds at Reddick, Florida, could be attributed to the pellets cast by barn owls, and Wetmore (1931) reports three species of owls, including the the barn owl from Saber-tooth Cave. Thus the heavy concentration of rodent and insectivore bones as well as a few of the associated small reptiles and amphibians of various habitats were possibly derived in this manner.

AMPHIBIA: URODELA

Plethodon glutinosus Green.—A single mid-thoracic vertebra FGS V-5735). This is the first record of this genus and species as a fossil.

The middle thoracic vertebrae of *Plethodon* can be separated from species of *Desmognathus*, *Eurycea*, *Manculus*, and *Pseudotriton*

by characteristics of the anterior end of the neural arch in dorsal aspect. The prezygapophyses are deflected laterally to a greater extent in *Plethodon* than in the other genera studied. The border of the neural arch between the prezygapophyses is rounded in *Plethodon* and more angular in the other genera. The vertebrae of *Plethodon* are much larger than those of *Manculus*. The posterior dorsal portion of the neural arch is notched in *Plethodon* but is bluntly rounded in *Pseudotriton ruber*. A single specimen of *Pseudotriton montanus* examined exhibits this notched condition, but the posterior portion of the neural arch is much more upswept than in *Plethodon*. The fossil vertebra was much larger than those of *P. cinereus*, and the present geographic ranges and ecological requirements of other species of *Plethodon* make it seem unlikely that they existed in the Florida Pleistocene. As the fossil vertebra is identical in size and characters with those of Recent *Plethodon glutinosus*, it is assigned to this species.

AMPHIBIA: ANURA

Microhyla carolinensis Holbrook.—Right ilium (FGS V-5719). This is the first record of the genus and species from the Pleistocene. Auffenberg (1956a) reports this genus from the Miocene of Florida.

Scaphiopus holbrooki Harlan.—Two urostyles, two left and one right ilia (FGS V-5729). Auffenberg (1956a) reports *Scaphiopus* cf. *holbrooki* from the Miocene of Florida, but this is the first Pleistocene record for this genus and species.

Rana cf. *pipiens*.—Two sacral vertebrae, six right and eight left ilia (FGS V-5716). Tihen (1954) found that the length width ratio of the centrum of the sacral vertebrae separated the ranid frogs into two groups. The two Saber-tooth fossil sacra are similar to the *R. pipiens* group of Tihen having lengths 2.3 and 2.5 mm. and length-width ratios of .88 and .96. Because of the present geographic range and the uniform small size of the fossils they are tentatively referred to the species *Rana pipiens*.

REPTILIA: CHELONIA

Pseudemys sp.—Epiplastral elements (FGS V-5733). This element is too fragmentary to be assigned to species.

Terrepenne carolina (Linnaeus).—Carapace and plastral elements (FGS V-5734). Barbour and Stetson (1931) include all of the species

of Pleistocene box turtles into the synonymy of *Terrepenne canaliculata* and state the only difference between *T. canaliculata* and Recent *T. carolina* is the larger size of *T. canaliculata*. Millstead (1956) agrees with these workers. Auffenberg (M.S., 1957) further includes *T. canaliculata* in the synonymy of *T. carolina*. The Saber-tooth Cave material includes two large box turtles that do not differ qualitatively from Recent *T. carolina*. In size they more closely approach

TABLE 1
LENGTH OF MARGINAL SCUTES OF *Terrepenne carolina* IN MM.

Marginal no.	Saber-tooth Cave		<i>T. c. major</i>		<i>T. c. bauri</i>	
	Pleistocene range	Number	Recent range	Number	Recent range	Number
2	18.3-23.7	2	21.3-26.8	2	14.2-20.5	9
4	18.3	1	16.5-24.5	2	12.3-16.3	9
5	17.8	1	19.6-28.0	2	14.7-20.7	9
9	24.4	1	25.0-33.0	2	14.3-22.2	9
10	23.5	1	17.4-26.3	2	12.5-20.5	9
11	16.7	1	16.3-23.5	2	12.0-22.7	9

TABLE 2
WIDTH OF MARGINAL SCUTES OF *Terrepenne carolina* IN MM.

Marginal no.	Saber-tooth Cave		<i>T. c. major</i>		<i>T. c. bauri</i>	
	Pleistocene range	Number	Recent range	Number	Recent range	Number
2	15.8-17.4	2	18.1-19.4	2	10.5-16.2	9
4	16.7	1	17.7-22.9	2	14.2-17.9	9
5	26.0	1	24.5-32.0	2	14.7-23.4	9
9	23.5	1	20.3-28.8	2	12.2-24.5	9
10	21.4	1	17.4-26.7	2	10.6-18.3	9
11	19.8	1	16.5-26.7	2	12.3-17.1	9

the Recent Florida subspecies *T. c. major* than the Recent Florida *T. c. bauri* (Tables 1 and 2). Enough of a carapace of a box turtle was reconstructed from fragmentary elements to ascertain that the turtle had a very high-domed shell with very little marginal flaring, a characteristic of modern *T. c. bauri*. Recent *T. carolina* major has a more depressed shell. The fourth marginal scute of the fossil was undivided as in most *T. c. bauri*. Those of most *T. c. major* have the scute divided.

Gopherus cf. *polyphemus*.—Plastral elements (FGS V-5732), in the absence of more

diagnostic elements the specific identification is tentative.

REPTILIA: LACERTILIA

Anolis carolinensis Voigt.—Four left, seven right dentaries, three right maxillae (FGS V-5720).

Rhineura floridana Baird.—Three posterior vertebrae (FGS V-5722). The Saber-tooth specimens represent the first record of this species as a fossil. Descriptions of extinct fossils of the genus *Rhineura* (Taylor, 1951) have been based on skulls. However, for the identification of Pleistocene species the above posterior vertebrae were diagnostic.

Vertebrae depressed, cotyles and condyles extremely flattened. Neural canals semi-circular anteriorly, circular posteriorly. Width at prezygapophyses more than half the total length of vertebrae. Width and length at prezygapophyses of fossils (2.2,2.9–2.1,2.6–2.1,2.7). Prezygapophyseal faces in shape of parallelograms with acute angles projecting in an anterior direction externally and in a posterior direction internally. Long segments of "parallelograms" parallel to long axis of centra. Prezygapophyseal faces often unsymmetrical, the left or the right being more developed. Postzygapophyseal faces oval in shape and roughly half the area of prezygapophyseal faces. Neural spines low very narrow ridges, highly variable in length and prominence. Low keels variable in prominence, and number occur on either side of neural spines making acute angles with neural spines anteriorly, posteriorly or both. Posterior neural arches somewhat up-swept as narrowly notched lips.

In ventral aspect, dorsal borders of cotyla protrude indented ventral borders. Paradiapophyses large and rounded with subcentral foramina very near their postero-medial border. Centra with two lateral ridges, variable in prominence and with a single depression between them. Posterior centra and condyles somewhat downswep.

Ophisaurus ventralis Linnaeus.—Three thoracic vertebrae and two right dentary bones (FGS V-5718). Auffenberg (1955) gives vertebral characters for separation of the three existing species of *Ophisaurus*.

Eumeces sp.—Two dentary bones (FGS V-5736). The tooth count of the single complete dentary in 25, which is not diagnostic at the species level. (Auffenberg, 1956c.)

REPTILIA: SERPENTES

Auffenberg (doctoral dissertation, University of Florida, 1956) has reported *Dry-*

machon corias from the Saber-tooth deposit and Brattstrom (1953, 1954) has reported *Crotalus adamanteus*, *Crotalus giganteus*, and *Lampropeltis getulus* from this locality.

Natrix sipedon Linnaeus.—Four mid-thoracic vertebrae (FGS V-5717).

Heterodon platyrhinus Latreille.—Mid-thoracic vertebrae (FGS V-5723).

Rhadinaea flavilata Cope.—Three mid-thoracic vertebrae (FGS V-5725).

Carphophis amoenus Say.—Seven thoracic vertebrae (FGS V-5721).

Coluber constrictor Linnaeus.—Three mid-thoracic vertebrae (FGS V-5730).

Masticophis flagellum Shaw.—Two mid-thoracic vertebrae (FGS V-5727).

Elaphe sp.—One fragmentary thoracic vertebrae (FGS V-5726). The condition of the vertebrae is such that it cannot be referred to species.

Micrurus fulvius Linnaeus.—Twelve mid-thoracic vertebrae (FGS V-5727).

Ancistrodon piscivorus Lacepede.—Two mid-thoracic vertebrae (FGS V-5728).

Crotalus adamanteus Beauvois.—Six thoracic vertebrae (FGS V-5717). The six vertebrae from Saber-tooth Cave all fit into the range and variation of seven Recent *Crotalus adamanteus* skeletons in the writer's collection. The largest fossil vertebra represents an individual about five feet in length.

DISCUSSION

Paleoecology.—The Saber-tooth Pleistocene herpetofauna appears to represent more restricted ecological conditions than does the mammal fossil faunas from the same locality. Simpson (1928) believes the Saber-tooth Cave mammals indicate "a wet lowland with swamps, drier wooded areas and a few open glades." The herpetofauna is very similar to one that could be found today in a Florida pine flatwoods association dotted with small ponds. Only *Plethodon glutinosus*, *Carphophis amoenus*, and *Rhineura floridana* are absent from the above habitat in present times. However, they occur in mesophytic hardwood associations and this type of vegetation characteristically surrounds the mouths of Florida caves.

Zoogeography.—Of the still extant fossil reptiles and amphibians from Saber-tooth Cave, only the worm snake (*Carphophis amoenus*) is not found in the same area today. At present *C. amoenus* is found no further south than South Carolina, northern Georgia, and Alabama (Wright and Wright, 1957). Auffenberg (doctoral dissertation, Uni-

versity of Florida, 1956) has reported *Carphophis amoenus* from Pleistocene localities in Alachua and Marion County, Florida, and thus the Saber-tooth fossils represent a southern extension of the range of this species in the Pleistocene.

It is noted here that Simpson's fossil mammal fauna from Saber-tooth Cave included a pocket gopher (*Thomomys orientalis*) which has its Recent affinities 900 miles westward, a large vole (*Synaptomys australis*) with northern affinities, a capybara (*Hydrochoerus holmesi*) and a deer (*Blastocercus extraneus*) having present South American affinities. The 10 birds identified by Wetmore (1931) are all living in the same area today, however, at Reddick, Florida, 20 per cent of the Pleistocene avifauna of 52 species show affinities either to the north or the southwest (Brodkorb, 1957). From the above data it appears that the reptiles and amphibians have been more stable geographically through the Pleistocene than have the birds and the mammals.

Carr (1940) and Neill (1957) mention that the Florida worm lizard (*Rhineura floridana*) is probably a relict form. The fossil history of the amphisbaenid reptiles is a substantial one in the United States until the Miocene (Taylor, 1951). The genus *Ototriton* is reported from the early Eocene of Wyoming, and by Oligocene times seven species of *Rhineura* as well as two other genera of amphisbaenids were present in Colorado, Wyoming, South Dakota, and Nebraska. At the close of the Oligocene the fossil record of the amphisbaenids ends and does not begin again until *Rhineura floridana* appears in the Pleistocene of Florida.

Evolutionary aspects.—With the exception of an extinct giant rattlesnake (*Crotalus giganteus* Brattstrom, 1954) all of the fossil reptiles and amphibians from Saber-tooth Cave represent living forms. Extinction percentages for the entire Saber-tooth fossil fauna are given in Table 3.

The question exists as to the cause of the great extinction of many large mammals at the end of the Pleistocene. Some have suggested that this extinction could be due to environmental fluctuations in the Pleistocene and others that it could be correlated with the rise of man. It appears that if the temperature fluctuations of the Pleistocene were responsible for the extinction of large mammals that a similar extinction would be seen in the poikilothermous animals. This seems not to be the case, however, for 95 per cent of the reptiles and 100 per cent of

the amphibians from the Saber-tooth Cave Pleistocene survive to the present but only 42 per cent of the mammals survive. Moreover, a Pleistocene fauna from the earlier Illinoian stage at Williston, Florida, shows 97 per cent of the reptiles and amphibians surviving to the present with only 76 per cent of the mammals surviving (Holman, masters thesis, University of Florida, 1957).

TABLE 3
PERCENTAGE OF LIVING AND EXTINCT MEMBERS
OF THE SABER-TOOTH FOSSIL
VERTEBRATE FAUNA

	Forms identified	Percentage living	Percentage extinct
Amphibians	4	100	0
Reptiles	20	95	5
Birds	10	100	0
Mammals	24	42	58
Total	58	74	26

SUMMARY

1. Twenty-one reptiles and amphibians are identified from the Pleistocene of Saber-tooth Cave, Citrus County, Florida.

2. It is indicated that the deposit represents the Wisconsin Stage of the Pleistocene.

3. The derivation of the fossils is suggested to be due in part to the pellets cast by barn owls.

4. *Plethodon glutinosus*, is added to the fossil record. *Microhyla carolinensis*, *Scaphiopus holbrooki*, and *Rhineura floridana* are reported for the first time from the Pleistocene.

5. A Pleistocene habitat of pine flatwoods with associated ponds is inferred for the Saber-tooth herpetofauna.

6. The range of the worm snake (*Carphophis amoenus*) is extended south to Citrus County, Florida, in the Pleistocene.

7. It is suggested that the reptiles and amphibians in Florida have been much more stable, both geographically and as to rate of extinction through the Pleistocene than have the birds and mammals.

8. The stability of poikilothermous animals through the Pleistocene might indicate that climatic fluctuations were not the primary cause for the extinction of the large mammals.

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Fatal Bite of Captive African Rear-Fanged Snake (*Dispholidus*)

CLIFFORD H. POPE

Karl P. Schmidt died on the afternoon of September 26, 1957, twenty-four hours after being bitten by a juvenile and somewhat aberrant boomslang (*Dispholidus typus*) of uncertain provenance. The snake was about 26 in. long (estimated as 30 in. by Dr. Schmidt). Neither Dr. Schmidt nor his colleagues considered the bite to be serious because the boomslang was small, the deep wound was made by only one fang, and the victim, though sixty-seven years old, was in good health and spirits. It is hoped that the facts set forth here may shed light on this tragic case and broaden our knowledge of the effects of boomslang venom.

No one can explain why Dr. Schmidt grasped the snake just behind the part of the neck being safely held by Curator Robert F. Inger, instead of maneuvering to exchange grips, as expected. Evidently the movement was made absent-mindedly. Even if the snake had been obviously harmless, it is questionable whether Dr. Schmidt would have consciously given it opportunity to bite. Every herpetologist knows that if he wants to be bitten deeply, he has only to grip a snake a short distance behind the head.

The following account of the bite and its effects was written by Dr. Schmidt out of

scientific curiosity and in a characteristic spirit of optimism. (A first-hand report of an untreated bite has special value.)

"A boomslang with undivided anal plate.—A thirty-inch snake brought for identification to Chicago Natural History Museum by Mr. Truett of the Lincoln Park Zoo, proved to be uncommonly difficult to name. It was known to be an African snake, and with the characteristic head-shape, oblique and keeled dorsal scales, and bright color pattern should have offered no difficulty. But no key for identification would make it a boomslang, for the anal was undivided. That it was nevertheless a boomslang (*Dispholidus typus*) was dramatically attested by its behavior. Mr. Truett, Dr. Robert F. Inger, Hymen Marx, and I were discussing the possibility of its being a boomslang when I took it from Dr. Inger without thinking of any precaution, and it promptly bit me on the fleshy lateral aspect of the first joint of the left thumb. The mouth was widely opened and the bite was made with the rear fangs only, only the right fang entering to its full length of about 3 mm. Only one other tooth mark, from the penultimate tooth, appeared on the thumb when the snake was disengaged. The punctures bled