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FOSSIL TORTOISES FROM THE TURKS AND CAICOS ISLANDS, B.W.I.

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ABSTRACT

Fossils of a large extinct tortoise (*Geochelone*) and other vertebrates were found at Indian Cave on Middle Caicos and Coralie archaeological site (GT-3) on Grand Turk in the Turks and Caicos Islands, B.W.I. The Indian Cave fossils appear to span an extensive period of time. Many of the tortoise bones collected in the upper levels of the excavation are charred, suggesting that the prehistoric human population cooked tortoises for food. The presence of tortoises at Coralie is reported here but without further comments. Tortoise fossils are also known from Andros, New Providence, and Abaco in the Bahamas and from several islands in the Greater and Lesser Antilles in the Greater Caribbean area. Tortoise fossils from Middle Caicos probably represent an undescribed taxon that is related to tortoises in the South American subgenus *Chelonoides*.

INTRODUCTION

Tortoise fossils have been obtained from cave deposits, fluvial sediments, and archaeological sites in the Bahamas (Abaco, Andros, and New Providence) (Auffenberg, 1967; Franz et al., 1996), Cuba (Williams, 1950), Hispaniola (Franz and Woods, 1983), Mona Island (Williams, 1952), Navassa Island (Patton, 1967; Auffenberg, 1967), Sombrero Island (Leidy, 1868; Julien, 1867 & 1878; Auffenberg, 1967), Anguilla (Cope, 1883; Lazell, 1993), Curacao (Hooijer, 1963), and Barbados (Ray, 1964). No living species of tortoises occur in the Bahamas or the Greater Antilles today. Living *Geochelone carbonaria* are reported from many islands in the Lesser Antilles (Ernst and Leuteritz, 1999). Schwartz and Henderson (1991) considered these populations to represent human introductions; however, reports of prehistoric remains of a tortoise, cf. *Geochelone carbonaria,* from unidentified Pleistocene deposits in Anguilla suggest that at least some populations are native. The purpose of this note is to report the presence of fossil tortoises in the Turks and Caicos Islands, British West Indies, and provide a preliminary description of this material.

Indian Cave

Fossils were recovered from cave soils at Indian Cave on Middle Caicos on the Caicos Bank. Mike Witt, who initially discovered Indian Cave, showed the site to Bill Keegan and Dick Franz in January 1998. Realizing the site's potential for terrestrial vertebrate fossils, Keegan, Franz, and David Steadman organized a return trip to Indian Cave in May 1998. The excavation team included Dick Franz, Bill Keegan, Dave Steadman, Anne Stokes, Barbara Toomey, and Reed Toomey from the Florida Museum of Natural History, and Brian Riggs from the Turks and Caicos National Museum.

Indian Cave consists of a cathedral-like room, a large fissure in the rear of the cave, several small alcoves, two large entrances, and numerous skylights in the ceiling of the main room. Extensive root systems extend down through the skylights into the cave and are rooted in the cave floor. Most of the cave is dimly lit with ambient light from the outside. Sediments cover the floor of the entire room. Old bat guano and the smell of bats are particularly evident in the rear of the room. Bats were seen during excavations. Barn owls roost in the rear of the cave. Barn owl feathers, some owl skeletal remains, and large accumulations of modern *Rattus* bones are found on the cave floor and in several alcoves under obvious owl roosts.

Coralie Archaeological Site

Remains of tortoises were also recovered from a prehistoric, early Taino habitation site (Coralie GT-3) on Grand Turk. These bones were obtained by Bill Keegan, L.A. Carlson and field crews from the Florida Museum of Natural History and the Turks and Caicos National Museum during archaeological field seasons in 1995-1997. We will not elaborate on this material at this time, since L. A. Carlson currently is studying it as part of her doctoral research at the University of Florida.

Excavations at Indian cave

Excavations included two 1-m^2 pits (Units 1-2), 210 cm and 140 cm deep, inside the main entrance of the cave and six shallow pits (Units 3-8) along the east wall. Samples from Units 1-6 were collected stratigraphically in 10-cm increments. Levels were numbered 1-20 in Unit 1, 1-14 in Unit 2, and 1-2 in Units 3-6. A Roman numeral was assigned to groups of levels in Units 1-2 that showed similarities in sediment characteristics. Fossils were mined from Units 7 and 8 without care given to stratigraphy. Sediments were sieved in coarse- and fine-mesh screens to insure sampling the smallest lizard and bird bones. We have not yet obtained radiocarbon dates for the bones, but estimate that the deeper layers in Units 1-2 may extend back thousands of years.

Important Discoveries

Excavations at Indian Cave produced thousands of bones. These bones are currently under study, and specific identifications for most specimens are not available at this time. We will provide more complete descriptions of these bones in future publications. Tentative identifications of recovered materials from Indian Cave include the following:

Fish: Unidentified marine fishes and shells of marine mollusks.

Reptiles: Tortoise (*Geochelone* sp.), curlytail lizards (*Leiocephalus* cf. *psammadromus*), anoles (*Anolis* cf. *scriptus*), skinks (*Mabuya* cf. *mabouya*), large geckos (cf. *Aristelliger*), rock iguanas (*Cyclura* sp.), and small boas (cf. *Tropidophis* sp.). We recovered a series of vertebrae from a very large *Cyclura*, suggesting that more than one species of *Cyclura* are represented in the sample from Indian Cave. Large vertebrae also were found at Coralie. Estimates for the larger *Cyclura* indicate animals in excess of a meter. Today, there is only a small species (*C. carinata*) in the Turks and Caicos Islands, which reaches a total length of about 75 cm (Iverson, 1979).

Birds: Herons, doves, songbirds, petrels, hawks, two types of rails, thick-knees, quail-doves, parrots, and 2 or 3 types of owls. Many of the identified bird species are either extinct or extirpated from these islands.

Mammals: 4 or 5 species of bats. No terrestrial mammals were recovered from Indian Cave sediments.

Human artifacts: Burnt bones, charcoal, a metal thimble, and Meillac style pottery (500-1,200 years BP). Fish bones, mollusk shells, and charred bones probably represent remnants of former meals. Charcoal in the top layers of the units probably represents sites of old hearths.

Indian Cave Tortoise Material

Fossils at the surface show little evidence of mineralization. Unburned specimens are the color of fresh bone and look as if the tortoise died within recent times. Buried bones are more mineralized and possess a gray coat of calcium carbonate. Tortoise fossils were found in all of the eight units. Bones were recovered over the entire range of depths in Units One and Two, including the lowest levels (Levels 20 and 14, respectively) in the excavations.

Tortoise bones from Indian Cave include a mandible, cervical (6) and caudal (10) vertebrae, limb (25) and girdle (26) bones and fragments, and more than 650 carapacial (including 2 nuchals) and plastral bones and fragments. Except for peripheral bones and bridge elements, most shell elements are incomplete and unidentifiable.

Mandible. One nearly complete specimen. No skull elements were found.

Nuchal bones. Nuchal scale is absent on the two recovered nuchal bones. The smaller nuchal bone (total frontal width, 3.9 cm) is the more complete of the two. The largest nuchal bone is broken with most of the left side missing (length of right side [natural edge to nuchal sculus], 7 cm; estimated total frontal width, 14 cm).

Other shell bones. Most of the pleural, neural, and plastral bones are fragmentary and are useless in reconstructing the shell contour or the arrangement of neural bones. Pleural and neural bones are eggshell thin (<3 mm in thickness), which accounts for their fragmentary nature. The peripheral bones and the outer portions of 18 plastral elements are thickened (5-10 mm) and survive in a more complete state. The inner portions of the plastral bones apparently are also thin. These bones did not survive intact. Several of the posterior plastral bones show evidence of concave surfaces, indicating that males are represented in the sample. The xiphiplastral notch is very reduced. Intact peripherals from larger tortoises show little or no flaring of the anterior or posterior edges of the carapace. The shape and configuration of peripheral bones indicate an elongate species with a high-domed carapace, a condition more similar to *Geochelone denticulata* and *Geochelone carbonaria*. Sulci are prominent on peripherals, bridge elements, and some plastral bones, and more obscure on pleurals and neurals; sulci are not on raised ridges as seen in the Cuban and Hispaniolan fossils.

Neck vertebrae. Cervical vertebrae (numbers 2, 3, 6, and 7) are represented in the sample. The largest vertebra measures 4.5 cm in total length. None of the dorsal vertebrae from inside the shell were found.

Tail vertebrae. The caudal vertebrae are robust. The neural arch roof is thinner than the centrum. The entire vertebra is compressed dorso-ventrally in all of the caudal vertebrae in the sample, so that the ball and socket portions of the centrum and the neural canal are much wider than tall. The canal is so compressed that it is hard to imagine enough space to accommodate the nerve cord.

Limb bones. The limb bones include 7 humeri, 7 femora, and 11 other bones. Humeri have a slight depressional muscle scar for the attachment of latissimus dorsi muscle. The humeri of Caicos tortoises are mostly incomplete. The estimated total lengths of the largest humerus and femur are 14.0 and 10.5 cm, respectively; cross-sections of the humeral shafts are more or less rounded to slightly compressed with shaft diameter ratios from 1.1:1 to 1.3:1.

Girdle Elements. Numerous girdle bones are available for study, including several from large individuals.

Measurements of largest fossil bones are compared to those of 8 modern South American tortoises, *Geochelone (Chelonoides) denticulata*, of different sizes (Table 1). Proportional calculations indicate that carapace lengths of Caicos tortoises ranged from 51.2-85.4 cm. Based on these comparisons, we can assume that the tortoises from Middle Caicos grew large, attaining maximum carapacial lengths of at least 60 cm, and possibly as much as 90 cm.

DISCUSSION

The discovery of tortoise fossils at Indian Cave and Coralie adds testimony to the pervasiveness of tortoises in the Caribbean region in the past. The occurrences of tortoise fossils on the Great Bahama Bank (Andros, New Providence), Little Bahama Bank (Abaco), Caicos Bank (Middle Caicos), and Turks Bank (Grand Turk) suggests that they were also widespread in the Bahamian archipelago. The presence of charred bones at Coralie and in the upper most layers at Indian Cave indicates that tortoises were contemporary with indigenous human populations in the Turks and Caicos Islands and may have survived into the historic period. The extinction of this species probably resulted directly from human predation.

Table 1. Measurements (in cm) of bones from modern *Geochelone denticulata* from South America and the largest bones from the Indian Cave fossil tortoise. Specimens (UF collection), CL= carapace length, Nuchal= right side of nuchal bone (edge to sulcus), Humerus and Femur= total length, (est)= estimate of CL of fossil tortoise in cm based on proportional calculations between CL and the nuchal, humerus, or femur of modern tortoises and that of the similar bones of the fossil tortoise (listed on table).

Specimens	CL	Nuchal (est)	Humerus (est)	Femur (est)
33668	30.7	2.3	7.2	6.2
61931	31.8	2.9	7.6	6.2
33671	32.7	2.9	7.8	ND
33663	34.4	2.9	ND	ND
56936	36.5	3.0 (85.2)	ND	7.3
33670	36.6	3.0 (85.4)	8.5 (60.3)	7.5 (51.2)
33672	44.0	4.2 (73.3)	ND	ND
33637	45.0	3.8 (82.9)	ND	ND
largest fossils		7.0	14.0	10.5

Ecological Significance of Tortoise Fossils

The presence of tortoises suggests that the Turks and Caicos Islands were wetter and more mesic in the past. Herbivorous tortoises and rock iguanas (*Cyclura*) played significant roles that shaped island environments in the Turks and Caicos region. Grazing and selective browsing by tortoises and iguanas probably affected floral composition and structure of plant communities by thinning the understory and creating more open environments. These herbivores also could have been important players in the dynamics of seed dispersal and the enhancement of seed germination for certain plant species

Taxonomic Interpretations

None of the tortoise fossils from the Bahamian archipelago have been named. We believe that the Middle Caicos tortoise material represents an undescribed taxon that is endemic to the Caicos Islands. The taxonomic status of the Grand Turk fossil tortoise is unknown at this time. The excavation of more sites containing tortoise material is necessary before we can fully appreciate the level of diversity or the patterns of distribution of these turtles in the region.

Three names currently available for West Indian tortoise fossils include: *Geochelone cubensis* (Leidy), (Type Locality) "Chapepote Springs, Banos de Ciego Montero, Las Villas Province, Cuba" (Leidy, 1868) (=Chapepote thermal spring, Analla River at the Banos de Ciego Montero, Santa Clara Province, 30 miles northwest of Cienfuegos, Cuba, [see Williams, 1950]); *Geochelone (Monochelys) moniensis* Williams, (Type Locality) "Liro Cave, Mona Island, West Indies" (Williams, 1952), and *Geochelone sombrerensis* (Leidy) (Type Locality) "in the so-called Sombrero guano, Sombrerite or Ossite, a material rich in phosphate of lime, largely mined in the island of Sombrero" (Leidy, 1868). These named species do not appear to be conspecific with the Caicos tortoise.

The lack of a nuchal scale on the two nuchal bones places the Caicos tortoise with the South American group of tortoises (*Chelonoides*), a condition also found in the Cuban tortoise (Williams, 1950) and probably in other West Indian fossil taxa. The Andros and New Providence tortoise material is too fragmentary to make any significant comparisons, and the Abaco tortoise fossils remain unstudied.

We suspect that the Caicos tortoise is related to Hispaniolan and Mona Island tortoises, based on the condition of the humeral muscle scar. The characteristic first dorsal vertebra, which Williams (1952) used to

separate his Mona Island species, has not yet been found for the Middle Caicos tortoise. We also are missing other critical bones from the Caicos tortoise, as well as from essentially every other fossil tortoise population in the Caribbean region, which limits our ability to make appropriate comparisons across taxa. Therefore, final resolution of the systematic relationships of West Indian tortoises must await further discoveries and detailed anatomical studies.

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LITERATURE CITED

Auffenberg, W. 1967. Notes on West Indian tortoises. Herpetologica, 23: 34-44.

Cope, E. D. 1883. On contents of a bone cave in the island of Anguilla (West Indies). Smiths. Contrib. Knowl., 25: 1-30.

Ernst, C. and T. E. J. Leuteritz. 1999. *Geochelone carbonaria*. Cat. Amer. Amph. Rept., 690.1-690.7.

Franz, R., C. K. Dodd, and S. D. Buckner. 1996. A review of the herpetology of the Bahamian archipelago. Bahamas J. Sci., 6: 22-30.

Franz, R. and C. Woods. 1983. A fossil tortoise from Hispaniola. J. Herpetol., 17(1): 79-81.

Hooijer, D. A. 1963. *Geochelone* from the Pleistocene of Curacao, Netherlands Antilles. Copeia,1963: 579-580.

Iverson, J. B. 1979. Behavior and ecology of the rock iguana *Cyclura carinata*. Bull. Florida State Mus., 24(3): 175-358.

Julien, A. J. 1867. On the geology of the key of Sombrero. Ann. Lyc. Nat. Hist. New York, 8: 251-278.

Julien, A. J. 1878. Gigantic land tortoise. Nature, 19: 30-31.

Lazell, J. 1993. Tortoise, cf. *Geochelone carbonaria*, from the Pleistocene of Anguilla, Northern Lesser Antilles. J. Herp. 27(4): 485-486.

Leidy, J. 1868. Notice of some vertebrate remains from the West Indian islands. Proc. Acad. Nat. Sci. Phil., pp.178-180.

Patton, T. 1967. Fossil vertebrates from Navassa Island, W.I. Quart. J. Florida Acad. Sci., 30(1): 59-60.

Ray, C. E. 1964. A small assemblage of vertebrate fossils from Spring Bay, Barbados. J. Barbados Mus. Hist. Soc., 31: 11-22.

Schwartz, A. and R.W. Henderson. 1991. Amphibians and reptiles of the West Indies, descriptions, distributions, and natural history. Univ. Presses Florida, Gainesville.

Williams, E. E. 1950. *Testudo cubensis* and the evolution of Western Hemisphere tortoises. Bull. Amer. Mus. Nat. Hist., 95: 1-36.

Williams, E. E. 1952. A new fossil tortoise from Mona Island, West Indies, and alternative arrangement of the tortoises of the world. Bull. Amer. Mus. Nat. Hist., 99: 545-5