

## Amblyrhiza and the Quaternary Bone Caves of Anguilla, British West Indies

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**Abstract:** The island of Anguilla, British West Indies, is the type locality for a giant extinct rodent described in the late 19th Century. Few additional specimens have come to light in this century, and the original localities are very imperfectly known. This paper summarises knowledge of the Quaternary bone caves of the island in the light of fieldwork conducted in 1988.

The islands of the West Indian archipelago are known to have lost almost 90% of their non-flying land mammals (Morgan and Woods, 1986) since the late Pleistocene, an extraordinary catastrophe whose record has survived solely in the natural bone reliquaries provided by the caves of the islands. Neither the proximate nor the distal causes of these extinctions are known with any certainty, although most workers infer that man's activities were largely responsible, in some combination of direct hunting, the destruction of habitat, and the introduction of exotics (particularly *Rattus* and *Herpestes*). Recently, the West Indies have emerged as a potential key to the debate concerning late Quaternary extinctions in general (MacPhee et al., 1989), because, whereas in North American terminal Pleistocene climate changes were nearly synchronous with human colonisation, humans did not reach the Antilles until the mid-Holocene (Rouse and Allaire, 1978). Accurate dating of the West Indian extinction chronology therefore provides an opportunity to distinguish between climatically- and anthropogenically-mediated processes.

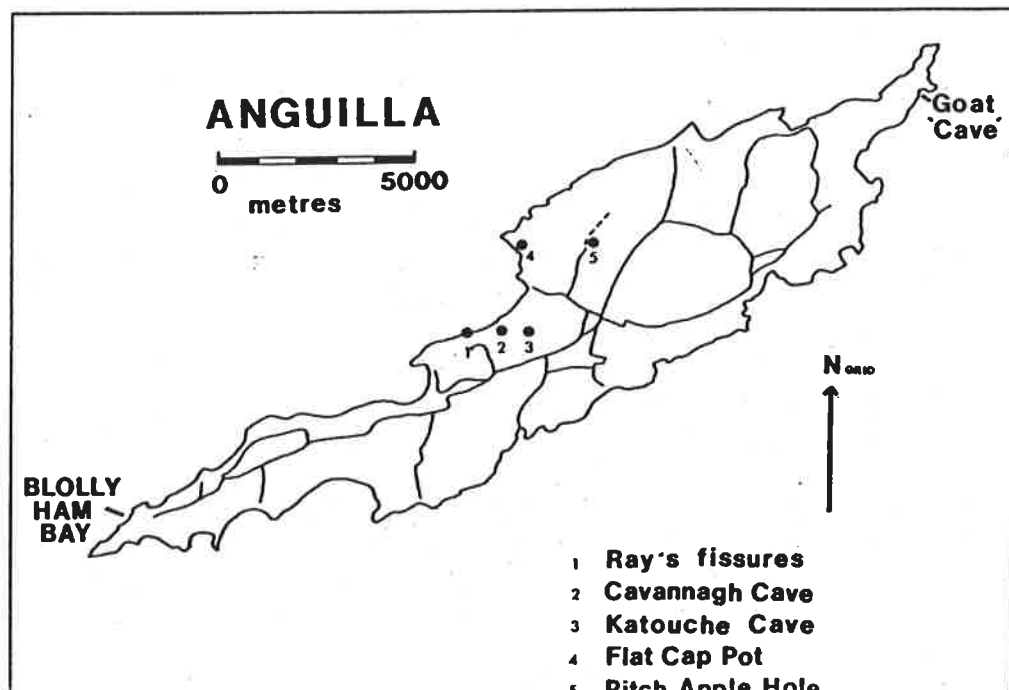
Among the more unusual members of the ill-fated West Indian fauna were a diverse assemblage of heptaxodontid rodents. These are defined here as a family endemic to the West Indies, with no living representatives, and of uncertain relationships to the other caviomorph rodents of South America and the Antilles. Insular rodent faunas commonly evolve large body sizes, but the heptaxodontids took this trend to an extreme. The largest known member of the family, *Amblyrhiza*, has been variously estimated to have weighed as much as a Virginia deer or a small American Black Bear. Remarkably, this giant beast is known only from the tiny islands of Anguilla (78km<sup>2</sup>) and St. Martin (93km<sup>2</sup>), the most northerly members of the Lesser Antillean chain.

The original discovery of *Amblyrhiza* was made in 1868 during phosphate mining operations, but unfortunately field notes have not survived and there is no contemporary account describing the excavations from which the fossils were recovered. In June of 1988 the present authors visited Anguilla with the intent of tracing the original localities and finding additional sites from which datable remains might be collected.

The caves of Anguilla have been very poorly documented in the speleological literature (cf. Murray, 1972). Except for a basement of igneous rocks exposed at two coastal localities, Anguilla consists of a single limestone formation of early Miocene age (Christman, 1953). Karst features on the island include a number of springs which feed the few permanent bodies of water on Anguilla (e.g. Caul's Pond), and extensive exposures of limestone pavement. Significant caves are few, and no active systems are known.

The finds of 1868 were made in a shipment of phosphatic cave earth sent to Philadelphia to determine its value as a fertiliser. The large bones in the material were brought to the attention of the famous palaeontologist Edward Drinker Cope (1869a, 1883), who recognised their importance and requested that H. E. van Rijgersma, colonial physician of neighbouring Sint Maarten (= St. Martin), make a visit to Anguilla with a view to securing additional specimens. Rijgersma made at least three such visits and was successful in collecting numerous remains from a cave or caves whose identity is not known with any certainty (but see description of Cavannagh Cave). However, in the Cope's Anguilla collection (now at the American Museum of Natural History), a handwritten note was found which appears to pertain to the first set of specimens sent by van Rijgersma. The note reads: "1868. From out the Bat Cave. H. E. van Rijgersma". Unfortunately 'Bat Cave' is not a present-day named feature and could apply to any of several caves where bats are normally resident.

Cope first described the giant rodent at a meeting of the Philadelphia Academy of Natural Sciences on December 1st 1868, the report of the meeting appearing in February of the following year (Cope, 1869a). Cope named the animal *Amblyrhiza inundata*, and brought attention to its exceptional size and its phylogenetic relationship to caviomorph rodent stock. In subsequent months, Cope went on to describe three 'closely related' animals, *Loxomylus longidens*, *L. latidens*, and *L. quadradens* (Cope, 1869b, 1871a, 1871b). Finally, in his summary of 1883 (Cope, 1883), *Loxomylus* was combined with the earlier



genus *Amblyrhiza*, although the three original species were retained (*A. inundata*, *A. latidens* and *A. quadridens*). These nominal species differ principally in size and several later workers have inferred that only a single species, *A. inundata*, may be valid (e.g. Schreuder, 1933).

The geologist J. W. Spencer visited Anguilla around the turn of the century, and he recorded the first mention of new *Amblyrhiza* finds since the Rijgersma expeditions (Spencer, 1901). He described a visit to a number of eroded sea caves and fissures located in the cliffs between what is now Benzies Bay and Katouche Bay. However, Spencer's wording is enigmatic on the question of whether these fissures were the ones from which Cope's (Rijgersma's) material was obtained, or whether they were merely of a similar nature:

"In Anguilla, Mr. Wager Ray found a number of mammalian remains when digging for phosphate. I was fortunate in finding him on the island, and he kindly took me to the locality where he had obtained them — perhaps a mile northeast of the present landing, east of Road Bay . . . In such a fissure the bones were obtained, among which Cope discovered remains of three species of *Amblyrhiza* — a rodent as large as a Virginia Deer" (Spencer, 1901).

Spencer noted the presence of a mammalian radius in one of these fissures, but he evidently did not collect it and recorded no further details of the locality. We did not have the opportunity to examine this area in 1988 and no further insight can be provided.

The next expedition to Anguilla and Sint Maartin was organised by H. E. Anthony of the American Museum. In April of 1926, after concluding field operations in Sint Maartin where a few *Amblyrhiza* remains were collected, he dispatched his assistant, George Goodwin, on a short visit to Anguilla to search for additional specimens. Goodwin's field notes, which have been preserved in the archives of the Department of Mammalogy, American Museum of Natural History, were examined prior to our 1988 fieldwork. According to these notes, Goodwin collected *Amblyrhiza* bone fragments from a lateritic matrix exposed in shallow fissures in the limestone pavement along the north coast. These fissure fills consist of a distinctive, hard red matrix filling enlarged subaerial joints. Goodwin believed them to be remnant fills of collapsed caves, but they more closely resemble the ironstone fills of the Portland Ridge of southern Jamaica (Wadge *et al.*, 1979). None of Goodwin's localities is well described. He mentioned finding fossiliferous fissures near "Briningham? Hollow about 5 miles west of Flat Cap". This is not an existing place name, although there is a "Blolly Ham Bay" some 8 miles WSW of Flat Cap Point. Elsewhere, Goodwin referred to the locality as being closest to the general area known as 'Goat Cave' on the northern tip of the island. Goat 'Cave' is apparently not a subterranean feature, the limestone surface being only a few meters above sea level in this area. In addition, Goodwin collected material from a cave in the ridge of Flat Cap Point, and from a cave on the North Side Estate. The cave in Flat Cap Point, which

he described as a "deep cavern going through to the face of the cliff" could not be located in 1988. A shaft mined for phosphate in this immediate locality is described elsewhere in this paper. The description of the North Side Estate cave is so vague as to be useless in relocating this site.

With the exception of a few isolated and unpublished finds, there appear to have been no significant recoveries of *Amblyrhiza* on Anguilla between Goodwin's 1926 visit and our fieldwork in 1988. The 1988 field season yielded a large quantity of *Amblyrhiza* material representing at least four individuals, from a new locality called Pitch Apple Hole. This site is described here for the first time, together with two other historically important localities. A summary of Anguilla's known *Amblyrhiza* sites appears in Table 1 and Figure 1.

The demise of *Amblyrhiza* has given rise to considerable speculation as to the cause and timing of its extinction. In the same blocks of matrix that yielded bones of the giant rodent, Cope (1883) recovered shells of the mollusc *Turbo picta*. He used this as evidence for applying a post-Pliocene date to *Amblyrhiza*. However, he also noted that *Amblyrhiza* may have survived until comparatively recent times, because in one of the shipments received from van Rijgersma there was a shell of the bivalve *Strombus* modified into a scraper. Although Cope pointed out that there was no sure association between the scraper and the rodent bones, some later authors have made this assumption and postulated that humans were responsible for the extinction of the beast (Anderson (1984) takes the extreme view that *Amblyrhiza* may not have been exterminated until the 16th century.) If the extinction of *Amblyrhiza* was indeed caused by human agency, we would have yet another instance of the rapid, anthropogenic extinction of a native island land mammal (Martin, 1984). However, at the present time such an interpretation is unsupported by any direct evidence, and other viable explanations exist. *Clidomys*, a somewhat smaller relative of *Amblyrhiza* that lived on Jamaica, may have disappeared as early as 120,000 years ago (MacPhee *et al.*, 1989). If *Amblyrhiza* died out around the same time, we would have evidence of a truly Pleistocene wave of extinction that took place long before the arrival of human colonists on the islands.

In order to test these alternatives, it was originally proposed to utilise two radiometric dating methods — radiocarbon and uranium (U) series — to fix the date of the disappearance of *Amblyrhiza*. A 500g sample of bone fragments submitted for radiocarbon dating proved to have too little organic material for analysis, although it is not clear whether this is the result of great age or rapid diagenesis in a moist environment. Earlier attempts to use uranium-series methods to date bone samples from Caribbean cave sites have proven unsatisfactory (MacPhee *et al.*, 1989), but experience has shown that more reliable results can often be obtained by dating associated flowstone. None of the 1988 specimens were recovered in association with speleothems, although some of the material in the AMNH collections has

Summary of Known *Amblyrhiza* sites in Anguilla

Locality	Date	Collector	Comments
Unnamed	1868	—	Block of guano and cave-earth sent to E. D. Cope by a phosphate mining company; <i>Amblyrhiza inundata</i> described
Bat Cave	1868	H. E. van Rijgersma	One of the caves visited by van Rijgersma and the source of the first shipment to Cope. <i>Loxomylyus longidens</i> described from this material
Unnamed	1869?	H. E. van Rijgersma	Van Rijgersma made two more visits to Anguilla, probably in 1869. <i>Loxomylyus latidens</i> and <i>Loxomylyus quadridens</i> were described from this material. (The genus <i>Loxomylyus</i> was sunk into <i>Amblyrhiza</i> in 1883.)
Caves at Flat Cap Point, North Side, and fissures at "Brinington Hollow"	1926	G. G. Goodwin	Numerous caves visited, but success only at the listed sites
Pitch Apple Hole	1988	R. MacPhee D. McFarlane	Remains of at least 4 <i>Amblyrhiza</i>

Table 1

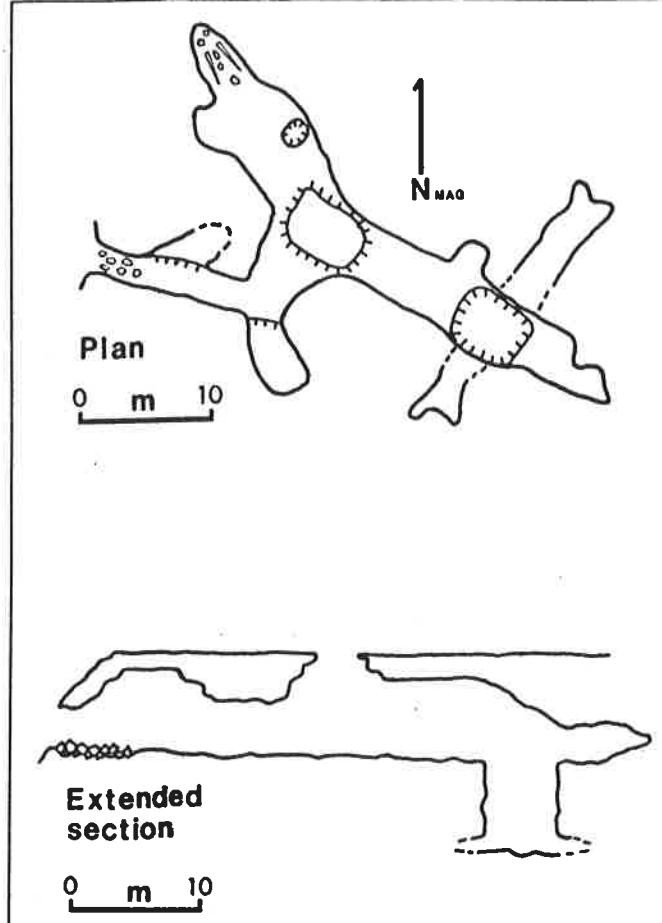


Figure 2. Cavannah Cave, Anguilla.

preserved remnants of a calcite matrix. Unfortunately, a test of one calcite-matrix sample failed to yield any thorium, indicating that this material at least may not be usable for uranium-series dating (Derek Ford, pers. comm.)

## CAVE DESCRIPTIONS

### Cavannah Cave

Grid Reference: 866/140. Altitude: 38 metres. Length 87m. Located some 350m north-northwest of the Governor's Residence, in the south wall of Katouche Valley. Cavannah Cave is frequently confused with Katouche Cave, a significant abandoned stream cave located up-valley at grid reference 871/140.

The Anguilla Archaeological and Historical Society believes Cavannah Cave to be the original locality from which *Amblyrhiza* was recovered, based on the evidence of extensive phosphate mining in the cave. If this is correct, then Cavannah Cave is Rijgersma's 'Bat Cave'. Antillean Fruit Bats (*Brachyphylla cavernarum*) roosted in the cave in 1988. Shot-holes in the walls indicate that phosphatic earth or sediment originally filled the cave to a depth of at least 2.5 metres in the main passage and presumably much deeper in the excavated pit. Unfortunately the thoroughness of the mining operation precludes any possibility of recovering additional *Amblyrhiza* from this site.

### Flat Cap Pot

Grid Reference: 8690/1607. Altitude: 25m. Depth: 10m. Located on the west side of the road to Limestone Bay from Crocus Bay.

Flat Cap Pot is a simple shaft choked with rubble. Significant quantities of red earth have been eroding into the cave from fissures in the fractured limestone. The shaft has been extensively modified by phosphate mining operations, and shot-holes are obvious on all the walls. No fossils were recovered from here in 1988. However Rijgersma referred to the source of his *Amblyrhiza* finds as follows:

"Perhaps it will please you to learn that I have found some fossils in the phosphate of lime pit on Anguilla, and also some in a cave there . . ." (Private correspondence of H. E. van Rijgersma to Snellen van Vollenhoven, March 26th 1869, quoted in

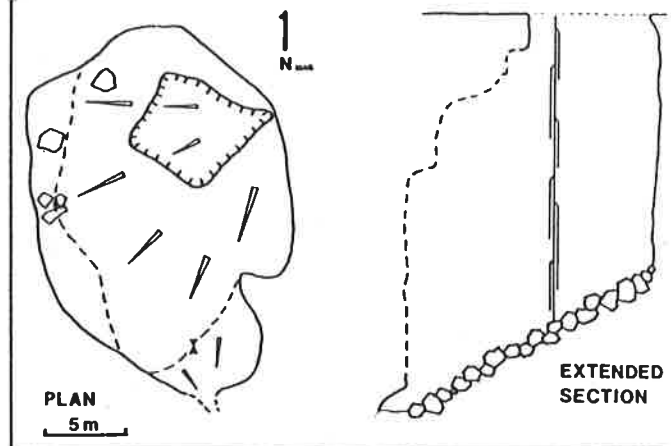


Figure 3. Pitch Apple Hole, Anguilla.

translation in Holthuis (1959)).

Clearly, two different sites were involved and Rijgersma makes the distinction between a 'pit' and a cave. The only two phosphate mining sites we were able to locate in 1988 were Cavannah Cave and the site we have called Flat Cap Pot. Although we have not examined Wager Ray's fissures, Cavannah Cave and Flat Cap Pot are currently the best candidates for Rijgersma's cave and pit respectively.

### Pitch Apple Hole

Grid Reference: 8870/1633. Altitude: 53m. Depth: 23m.

Located on the east side of the North Side road, beneath a large pitch-apple tree.

Pitch Apple Hole is a collapse feature with overhanging walls. The large talus cone blocks any horizontal passage that might be present, with the exception of a short, constricted bedding plane passage beneath the southwest wall.

The west wall of the pit is undercut into a protected alcove, free of talus debris. The floor here consists of a narrow strip of deep red, lateritic cave earth of undetermined depth. *Amblyrhiza* bones were widely distributed in the earth, from a depth of some two centimetres to approximately 40cms. The specimens are now the property of the Anguillan Government, in the care of the Anguillan Archaeological and Historical Society.

In addition, the site yielded bones of the bats *Brachyphylla cavernarum* and *Artibeus jamaicensis*, and a number of birds and reptiles currently under study.

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