THE SEARCH FOR THE GIANT RODENT OF ANGUILLA

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Visitors to the chic French tourist mecca of St. Martin often notice a low limestone island some ten miles across the sea to the north. Lying in the extreme northeastern Caribbean, Anguilla is only about 14 miles long and less than three miles wide. Until recently it was one of the least well known of the Lesser Antilles. In the past few years Anguilla has been "discovered" by tourism. But to the natural historian Anguilla has occupied a prominent if enigmatic position in Caribbean natural history for 120 years.

In 1868, Henry Waters and Brothers, manufactures of phosphoric fertilizers in the city of Philadelphia, received a shipment of cave earth from Anguilla. In the nineteenth century, before the discovery of huge deposits of rock phosphate in Florida, sources of phosphate were much sort after by the agricultural industry as fertilizer. Caves were frequently mined for this purpose, because the decomposition of bat guano liberates phosphorous, nitrogen and carbon compounds in abundance. Carbon and nitrogen compounds are generally lost to the atmosphere, but phosphorous combines with calcium ions from insoluble "rock phosphate".

It was for the purpose of assaying the phosphate content of the earth that Mr. Waters had received his cargo back in 1868.

Henry Waters was sufficiently astute to notice the presence of fossil bones in his shipment, and promptly brought them to the attention of Edward Drinker Cope, one of the country's preeminent paleontologists who was then employed at the Carnegie Institution in Philadelphia.

Edward Cope can hardly have been less than astounded when he was first presented with the Anguilla bones. The remains were quite unmistakably those of a rodent, not just your ordinary rodent, but a rodent of phenomenal size. In reconstructing the animal several years later, Cope estimated it to have been approximately "the size of a Virginia deer". Later authors have supposed the animal to have been the size of a small black bear. Cope named his animal Amblyrhiza Inundata, the generic name "Amblyrhiza" roughly translating to "strange root" and reflecting Cope's difficulty in conceiving of the origin of such an aberrant beast. The specific name "Inundata" alludes to Copes' intention that the presence of so large an animal on so small and remote island evidenced the existence of a foundered (or Inundated) land-bridge between the Antilles and South America.

The bones that Cope received from Waters' serendipitous Philadelphia shipment were far from complete, but Cope was well aware of the importance of Waters' find. Accordingly, on learning that Dr. Rijgersma, the resident physician of Dutch Sint Maarten, was a keen amateur natural historian, Cope asked Dr. Rijgersma to travel to Anguilla and to attempt to secure additional remains of the rodent. Rijgersma was able to make several trips to Anguilla ultimately recovering a wealth of additional material.

The majority of what he obtained compromised of broken leg bones, vertebrate and teeth from numerous individuals of different sizes. The precise source (or sources) of the bones were not recorded in any known contemporary document, and the only contextual information that Rijgersma provided was the fact that they came from one or more caves being mined for phosphate. On the basis of the apparent size of the former mining operation, David Carty of the Anguilla Archeological and Historical Society believed that the original bones came from a site now called Cavannagh Cave, although there are other possibilities.

Cope summarized his finding in a Smithsonian institution report of 1813, and there the matter rested until it was taken up by H.E Anthony of the American Museum of Natural History in 1926. Anthony also believed that the Antillean Islands must have had a former land-bridge connection to North or South America, and in the search for evidence of a former, more diverse fauna he undertook a series of expeditions to the Caribbean in the 1920's. In Jamaica, Anthony discovered and described an extinct relative of Amblyrhiza, a rabbit size rodent which he called clidomys. On Puerto Rico he unearthed another member of this enigmatic, extinct family, the similarly-sized Elasmodontomys. Anthony searched for Amblyrhiza on Dutch Saint Maarten, where Rijgersma had some success, but recovered only a few tooth fragments.

Press for time, but not wishing to give up on the search, Anthony sent his field assistant, George Goodwin, to Anguilla and embarked for St. Thomas. Goodwin arrived on Anguilla on Wednesday 31st March 1926 after an hour and a quarter crossing on the sloop 'speed. After several days search Goodwin located some Amblyrhiza skull fragments in a cave at flatcap point, and subsequently a variety of tooth and bone fragments from small caves on the North side estate and at a site he call Birmingham Hallow.

The large extinct rodent of the Antilles together make up the family's heptaxodontidae, and are found nowhere except the Greater Antilles and the Northern Lesser Antilles. The heptaxodontids are caviomorph rodent, that is, they are distantly related to the guinea pig, the rabbit size agouti, there affinities are with the rodent of South America, some 650 miles to the South, rather than those of North America only 90 miles or so to the North. Their presence in the Antilles is therefore surprising, and their biographic history is as great a puzzle to mammologists today as it was to Cope and Anthony two generations earlier.

During the past decade, it has become widely believed that the wave of extinctions that decimated the large mammals of continental North America at the end of the last Ice Age maybe distributed to the simultaneous arrival of the first humans. These Clovis people (so called because of their association with distinction lance points dating from 9000 B.C. that were found at Clovis, New Mexico) entered North America by migrating across

the Bering Straits from Asia, and are regarded as sophisticated hunters who were unquestionably successful killing mammoth and other large game.

By analogy to this theory of overkill of Ice-Age mammals by the first Americans, it has been frequently suggested that the heptaxodontids were a naïve (unaccustomed to predators) fauna, exterminated by the newly arrived Arawak and Carib Indians of the Caribbean sometime after 3000 B.C unfortunately, hard evidence for this idea is lacking in the case of the heptaxodontid rodents, the giant ground sloths of Cuba and Hispaniola, and other enigmatic Antillean mammals.

In 1985, Ross Macphee, Derek Ford and I began a careful study into the age of the clidomys remains from Wallingford cave, Jamaica, originally found by H.E. Anthony in 1920. We would eventually be able to show that these fossils were between 140,000 -160,000 years old. No younger dates for clidomys have yet been obtained. Like Cope and Anthony before us, McPhee and I were intrigued by the presence of Amblyrhiza on Anguilla and St. Maarten, and were dissatisfied with the wide-spread opinion that the beast had fallen prey to the original native West Indians.

In fact, the evidence for the contemporaneity of Amblyrhiza and man is extraordinarily weak. In his original 1983 summary of his Amblyrhiza studies, Cope describes an Indian tool shell

scrapper in his shipment of material. Cope was careful to point out that there was no strati graphical information to suggest that the tool and the fossil were contemporaneous. Nevertheless, several generations of archeologists and paleontologist have chosen to suppose just such a connection, and to infer that Amblyrhiza must have entered its days on an Indian griddle.

The fact is that no evidence, contemporary or otherwise, exists to support the connection that the artifact was recovered from the same deposit and level as Amblyrhiza, or even from the same cave. All the specimen came from phosphate mining operations, to carefully paleontological excavations. Neither Cope nor Rijgersma recovery recorded the name or names of the caves from which materials were recovered, and Cope even confuses specimen from Dutch St. Maarten from those from Anguilla. No archeological midden on either St. Maarten or Anguilla has yet yielded a single Amblyrhiza bone, despite the presence of human bones, midden deposits and artifacts dating back several thousand years.

If the evidence that Amblyrhiza survived until the arrival of man is entirely lacking, the alternative that the animal died out perhaps millennia before the arrival of human colonists is equally unsupported by hard evidence. The original fossils collected without any details of their strati graphic dispositions, were of little help in resolving the issue. Mcphee and I needed dateable fossils from a documented strati graphical context to shed light on the problem, and the only option open to us was to go to Anguilla

and neighboring islands to search for new specimens. This line of reasoning was hardly original and had inspired a succession of visitors over the years, but no one had made any significant discoveries since Goodwin departed with his finds almost 60 years earlier.

When Ross and I arrived on Anguilla in May of 1988, we were well aware that our chances of success were slim. Vertebrate fossils in the Antilles are almost exclusively found in caves, where they are protected from the harsh tropical environment. On a small island like Anguilla, caves are a limited and finite resource, and only a tiny fraction of them could be expected to contain fossils. Nevertheless, some months previously Ross had located Goodwin's original field notes in the American museum of natural history, so we had a foundation to build on. We planned to returned to Goodwin's sites, reconstruct the stratigraphy of the finds, and perhaps recover additional specimens.

Unfortunately, Goodwin's notes proved less helpful than we had hoped. Lacking standardized topographic maps, he had confused several locations and referred to others by local names such as Birmingham Hallow which have not survived. As a result, we were not able to relocate any of Goodwin's fossil sites with useful precision.

It was soon apparent that before we could locate the rodent fossil, we would have to locate caves suitable for trapping such beasts and preserving their bones. Anguilla has no shortage of Limestone the principle bedrock in which caves are found but it

does lack both the surface streams and the significant topographic relief that promote cave formation. Small pits and hallows are bound on the island, but significant caves are rare and have never been systematically documented. However, the most productive approach to finding caves in the tropical bush is often to seek the advice of local farmers, and this proved almost immediately successful.

In the dry tropical forests of Anguilla certain moisture loving trees tend to grow where they can extent their roots into the damp interior of deep caves. The most distinctive of these trees are known locally as pitch apple trees, and to the experienced eye they can be recognized at a distance by their large, dark green leaves. Thus it was that Ross and I were directed to a large pitch apple trees in the forest of the North Side Estate. Pitch apple hole, as we came to call the site, proved to be an impressive gaping mouth in the forest floor. Tree roots extended down from the surface to the boulder floor some 60 feet below.

Rappelling into the chasm, we quickly established that the cave was not very extensive but it did preserve a small area of red cave earth at its lowest point. A few moments of digging yielded our quarry first an incisor tooth and then a large leg bone that clearly didn't belong to any animal now living on the island. We had found Amblyrhiza.

In the week that followed, our excavation unearthed a remarkable collection of Amblyrhiza bones belonging to at least four individuals. The animals had obviously fallen into the cave

and the bones had accumulated at the lowest point in the pit. The bones were fractured, but many parts of the skeleton were represented. We also collected sizable quantities of the bones of the large iguana, several birds and two species of bat.

As often happens, finding the fossils was to prove easier than dating them. The simplest approach to dating bones is probably the radiocarbon technique. The procedure is based on the fact that the atmosphere around us contains minute quantities of a radioactive isotope of carbon. This isotope carbon is incorporated into the food change by the normal photo synthetic activities of plants and ends up in the tissues of animals. After death, the carbon in the organic component of bone is no longer replenished and begins to disintegrate by radioactive decay at the rate of one half of the starting amount for every 5568 years. Thus, a bone can be dated by extracting its organic component and measuring the quantity of carbon remaining.

Unfortunately, a large sample of Amblyrhiza bone fragments submitted for radiocarbon dating proved to have almost no remaining organic carbon, and certainly too little for analysis. Such a circumstance might be a result of great age, but it could equally have resulted from accelerated decomposition in a warm, moist cave environment.

With radiocarbon dating no longer a viable option, the successful dating of Amblyrhiza once again depended on additional collecting of Amblyrhiza on Anguilla and its satellite islands. Some of the early Amblyrhiza finds were embedded in a

matrix of calcite, the mineral that forms stalactites and stalagmites in caves. It is now possible to date such calcite by the radioactive decay of trace amounts of uranium contained within it, and we have used this technique successfully with the Jamaican Clidomys fossils. The 19th century Amblyrhiza fossils are not associated with a large enough quantity of calcite to date, but the 1988 fossils were buried in a cave settlement deposit beneath a calcite shelf.

Derek Ford of McMaster University, Toronto, has analyzed samples of this calcite for traces of uranium and the daughter isotopes to which it decays using a newly developed mass spectroscopy technique. The results revealed that the calcite was deposited over the fossil-bearing sediments between 102,000 and 160,000 years ago (give or take 5,000 years).

In the summer of 1989 Ross and I resumed our search for Amblyrhiza. After a week and a half of unsuccessful searching across the length and breadth of Anguilla and its offshore islands, we were taken to a small, insignificant hole in an area of Anguilla known as Tanglewood. Tanglewood cave was only nine feet deep, but its low, wide chamber was floored with the characteristic red cave earth of our earlier finds at Pitch-Apple Hole. A few minutes' search brought to light an enormous incisor tooth, more than six centimeters long. We had our second Amblyrhiza locality.

In the two days reminding to us, Ross and I worked with members of the local Archeological Society to recover the bones of what appears to be a single animal. The bones so far recovered

included portions of the skeleton not found in 1988, but lack the intimate calcite association we had hoped for.

In August 1990, I returned to Anguilla to continue work at Tangle wood cave. Our brief excavation the previous year had turned up several pieces of charcoal and a few flint-like chert artifacts and it was necessary to determine whether a strati graphical (and hence chronological) association existed between the owners of the artifacts and Amblyrhiza. Ross was unable to join the work following a car accident in Cuba, where he was working on a relative project involving the fossil monkeys of that island. Fortunately the Anguilla Archeological and Historical Society, under the direction of Nik Douglas, rallied to the cause and together we were able to make a further collection of Amblyrhiza fragments and establish to our mutual satisfaction that these were not stratigraphically associated with the Indian artifacts.

The 1990 field work also revealed to further interesting sites. By squeezing through a narrow opening in the Forrest Floor of Katouche Valley, I was able to enter a small room which I have called Mitchell's Chamber after local historian Don Mitchell who brought my attention to the site. On one wall was a substantial calcite shelf containing insolated teeth of Amblyrhiza. Uranium series analysis of this calcite is expected to reveal the antiquity of these teeth in the near future.

After 120 years of obscurity, Amblyrhiza has begun to yield its secrets. Cope did not attempt a reconstruction of the animal based on his fragmentary material, and the wide range of limb bone sizes led him to propose the presence of three separate species of Amblyrhiza on the islands of the Anguilla bank. Most

authors have subsequently presumed only a single species (three different giant rodents on small islands seemed quite improbable) and our work has confirmed this.

By measuring the cross-sectional area of the animals' leg bones and comparing these with the leg bones of living rodents of known body weight, we have been able to develop a statistical model that has led us to conclude that the beasts were even larger than Cope supposed – some individuals may have weighted almost 300 lbs.

We believe that much of the variation in limb bone size, which led Cope to split the genus into three species, can be accounted for by sexual dimorphism; male caviomorph rodents are often significantly larger than females. Amblyrhiza is also structurally unlike any other known rodent, with enormously robust and powerful hind legs but gracile, almost delicate forelegs. This difference in proportion of the fore and hind legs probably also contributed to misleading Cope.

Despite its disproportionately robust hind limbs, Amblyrhiza was unlikely to have been a biped. Its feet are short and quite unlike those of kangaroos and other bipedal, hopping mammals. We believed that Amblyrhiza was a scratch-digger, occupying a quite different niche than the world's largest living rodent, the 150 pounds semi-aquatic capybara, to which Amblyrhiza appears superficially similar.

Other aspects of our work remain unresolved. We cannot yet suggest when the last of these giant rodents walked the islands of the Northeastern Caribbean. It is a perennial problem of Quaternary paleontology that a date fossil can only tell us when an animal was alive, never when the last of the line died out. Setting a date on a prehistoric extinction is a matter of marshaling circumstantial evidence.

At the present time we can only say that all dated specimens of Amblyrhiza predate the arrival of man by many tens of thousands years. We have also established that there is no unequivocal association between Amblyrhiza at any known Archeological site on Anguilla or St. Maarten, a fact that would be remarkable if indeed Indians and giant rodents had ever shared these islands.

Studies of Amblyrhiza and its relatives on the other Antillean islands have been a fruitful source of theory on the prehistoric ecology of these islands, and of the nature of the extinctions that changed the character of the islands forever. We fully accept that continuing investigation in the caves of Anguilla, and in the laboratories of the American and Los Angeles County Museums of Natural History, will turn up new insights into the processes that shaped ecology of these fascinating islands.