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Angel M. Nieves-Rivera

University of Puerto Rico - Mayaguez

John M. Mylroie

Mississippi State University

Donald A. McFarlane

Claremont McKenna College; Pitzer College; Scripps College

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BONES OF *PUFFINUS LHERMINIERI* LESSON (AVES: PROCELLARIDAE) AND TWO OTHER VERTEBRATES FROM CUEVA DEL AGUA, MONA ISLAND, PUERTO RICO (WEST INDIES)

ANGEL M. NIEVES-RIVERA

Department of Biology, University of Puerto Rico, Mayagüez, Puerto Rico 00681

JOHN E. MYLROIE

Department of Geosciences, Mississippi State University, P.O. Drawer 5167, Mississippi 39762

DONALD A. MCFARLANE

W. M. Keck Science Center, 925 North Mills Ave., Claremont, California 91711-5916

ABSTRACT.- *From a dive in Cueva del Agua, Mona Island, Puerto Rico, twelve un-mineralized bones of Puffinus lherminieri Lesson, one of Cyclura stejnegeri Stejneger, and one of Moormops blainvillii Leach were collected. The subfossil evidence confirms that P. lherminieri was a common species on Mona Island. Cyclura stejnegeri and M. blainvillii probably became trapped and died in the pool chamber.*

RESUMEN.- *De una buceada en Cueva del Agua, Isla de Mona, Puerto Rico, doce huesos no mineralizados de Puffinus lherminieri Lesson, uno de Cyclura stejnegeri Stejneger y uno de Moormops blainvillii Leach fueron colectados. La evidencia subfósil confirma que P. lherminieri fue una especie común en Isla de Mona. Cyclura stejnegeri y M. blainvillii probablemente quedaron atrapados y murieron en la cámara del estanque.*

Caves are among the most important places for the preservation of animal remains, and they have contributed greatly to our knowledge of the paleo- and neontology of the Antilles. Early studies of fossil and subfossil vertebrates from Puerto Rican caves began with reports on birds (Wetmore, 1922), mammals (Anthony, 1925), and reptiles (Williams, 1952). More recent studies include Choate and Birney (1968), Woods (1972) and Pregill (1981). Herein we document the presence of bones of Audubon shearwater, *Puffinus lherminieri* Lesson and two other vertebrates in an underwater section of a cave in Mona Island, Puerto Rico. This represents the first report of subfossil evidence from an underwater cave on the island.

The study area was Cueva del Agua (18°03'N, 67°53'W), located at Playa Brava, Mona Island (Fig. 1). This cave is located in a sea cliff composed of Miocene Lirio Limestone (Kaye, 1959). From the entrance, the cave extends down and inland through smaller passages cut first through the Pleistocene facies, then back into the Lirio Limestone again. The underwater portion extends to the north for approximately 30 m, through a series of three water-filled chambers, and a partially water-filled chamber. The water in the cave is that of the local water table

and is brackish. Piles of debris and breakdown form the rough floor of the cave. A detailed description of the cave's geomorphology appears in Frank (1993).

At two localities (Fig. 2, letters and arrows), the senior author collected the bones and placed them in two 75 ml plastic cylinders. Bones were identified by reference to the comparative collection of the Joint Science Department, The Claremont Colleges, and the Natural History Museum of Los Angeles County, California. Three species were identified from the samples:

1. Audubon Shearwater, *Puffinus lherminieri* Lesson. **Material.**-Five distal humeri, 5.5 to 5.7 cm long x 0.8 to 1 cm wide; two proximal humeri, 4.7 cm long x 1 cm wide, and 2 cm long x 0.7 cm wide, incomplete; two distal tibia, 5.8 cm long x 0.6 cm wide, and 3.7 cm long x 0.6 cm wide, fragmented; one proximal ulna 2.7 cm long x 1.1 cm wide, incomplete; one distal radius, 4.1 cm long x 0.4 cm wide, fragmented; and one distal femur, 3.3 cm long x 1.4 cm wide, incomplete (Fig. 3C). **Modern distribution.**- Occurs in islands of the Atlantic, Pacific, and Indian Oceans. It is a common bird in the Greater and Lesser Antilles, but is rare in Puerto Rico.

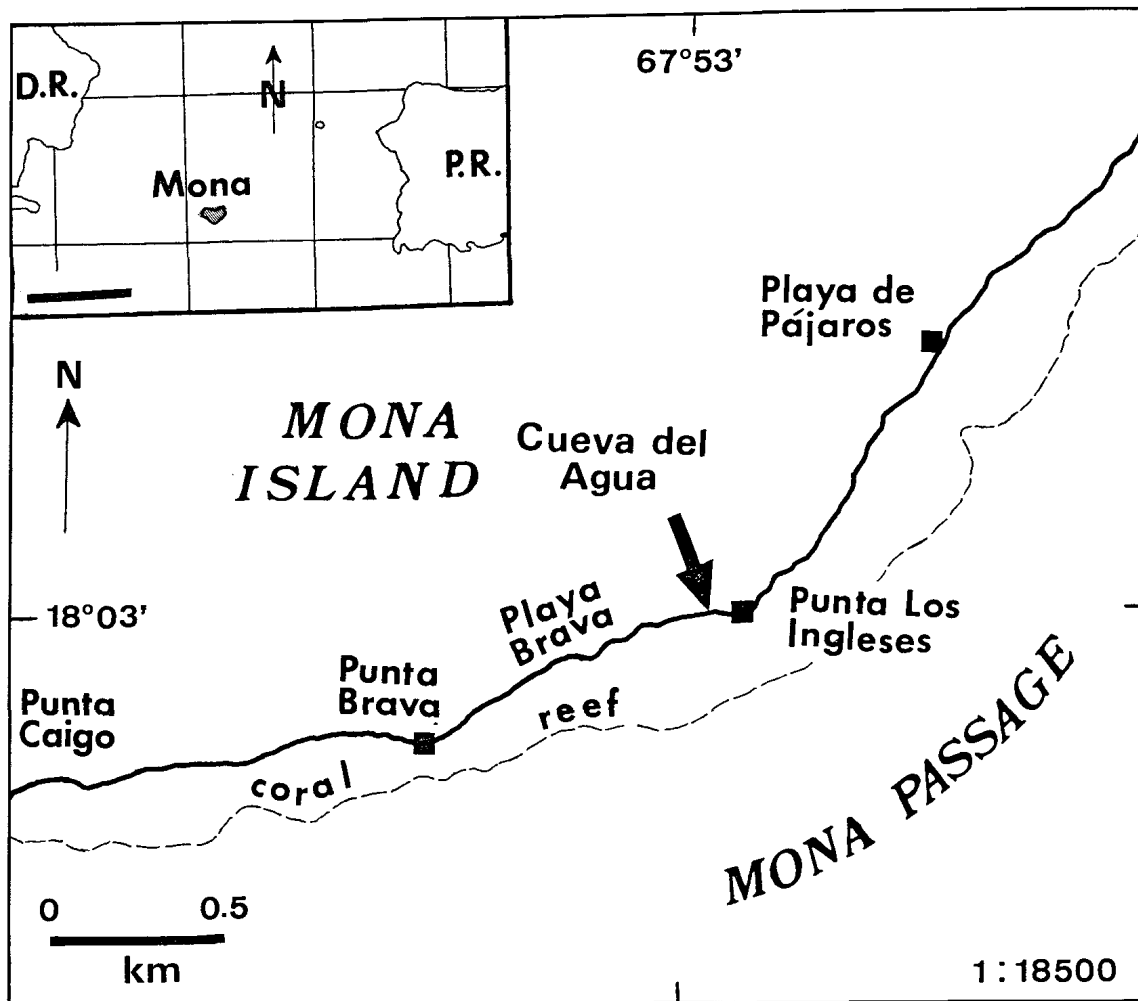


Fig. 1. Map of the study area in southwestern Mona Island, Puerto Rico. Shown on the inset is the location of the Mona and neighboring islands (D.R. = Dominican Republic; P.R. = Puerto Rico). Scale bar = 45 km.

2. Mona Island Ground Iguana, *Cyclura stejnegeri* Stejneger.

Material.- One femur belonging to a young specimen was collected, 3.3 cm long x 0.8 cm wide (Fig. 3B). **Modern distribution.**-Restricted to Mona Island.

3. Blainville's Leaf-chinned Bat, *Moormops blainvillii* Leach.

Material.- Only a partial lower jaw with no teeth was obtained, 8 mm long x 9 mm wide, from the spaces of teeth, the dentary formula is I, 2-2 x C, 1-1 x PM, 1-2 x M, 0-0 = 9 (Fig. 3A). **Modern distribution.**- Very common in Cuba, Haiti, Jamaica, and Mona Island, rare in Puerto Rico.

Specimen ages cannot be directly determined. However, their lack of mineralization and deposition in the fine silt of the underwater passages leads to the conclusion that their ages can probably be measured in tens, rather than hundreds of years. Bones of literally hundreds of birds are contained in the chamber floor.

Bones of the Audubon Shearwater were observed from Cueva Negra by Kaye (1959) and it has been suggested that early Taino settlers ate these birds. Today it is unclear if this species still nests on Mona (Pérez-Rivera and Bonilla, 1983; Raffaele, 1989). The bird spends the day at sea and returns at night to attend nest burrows. Nests are located in steep cliff crevices or inaccessible caves, making it difficult to evaluate the bird's status (Raffaele, 1973).

Remains of *Puffinus lherminieri* and *Cyclura stejnegeri* are also known from Cueva Negra on the west coast, Cueva del Caballo, Cueva de Chito, and Cueva de los Lirios on the east coast (Nieves-Rivera, pers. obs.). Anthony (1925) reported *Noctilio leporino* (Dahl) and *Moormops blainvillii* from Mona Island. Of these, *M. blainvillii* is a common bat on the island, and is frequently seen at night hunting insects (Wiedwandt, 1973; Nieves-Rivera, pers. obs.).

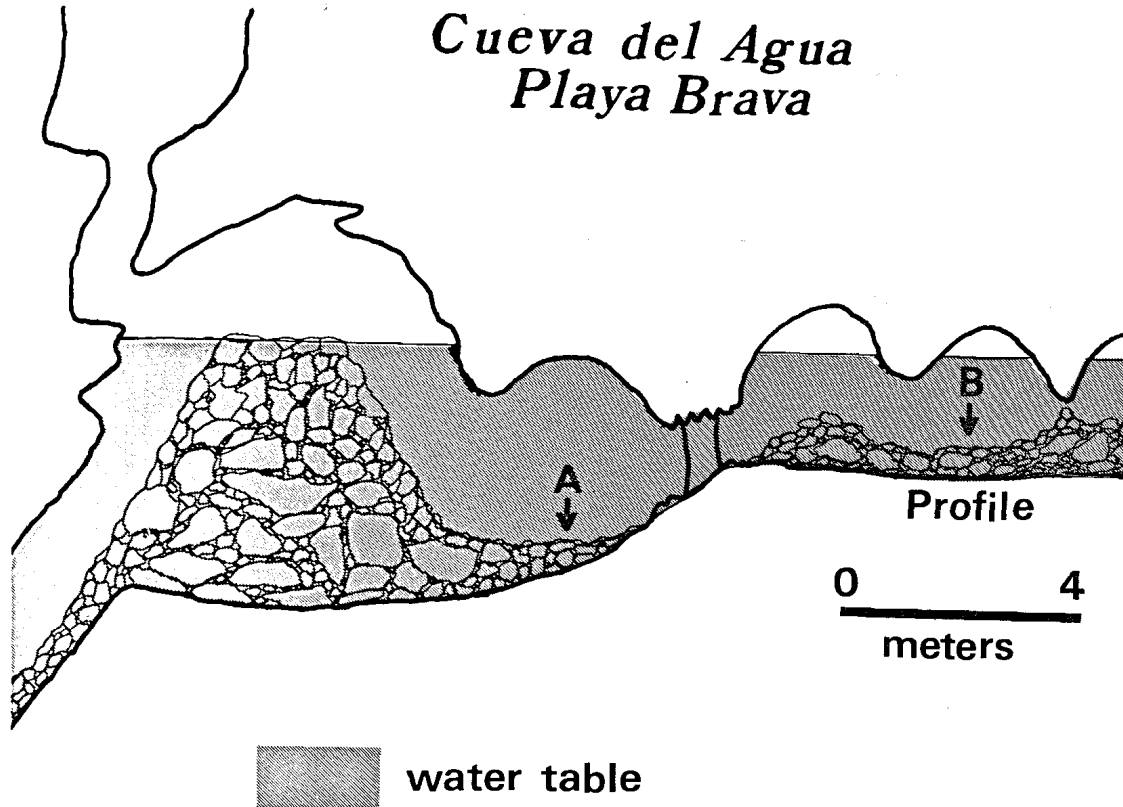


Fig. 2. Map of the underwater passages in Cueva del Agua, Playa Brava, Mona Island. The arrows (↓) and letters show collection sites. A = Station 1 (7 m from entrance); B = Station 2 (14 m from entrance).

In conclusion, *C. stejnegeri* and *M. blainvillii* are common extant species on Mona, and probably became trapped and died in the pool chamber. The abundance of *P. lherminieri* bones in Cueva del Agua and other Mona caves is more notable. Although the local extinction of this species on Mona is not certain, the birds no longer nest in Cueva del Agua, Cueva Negra, Cueva del Caballo, Cueva de Chito, or Cueva de los Lirios. The subfossil evidence confirms that *P. lherminieri* was formerly a common species on Mona.

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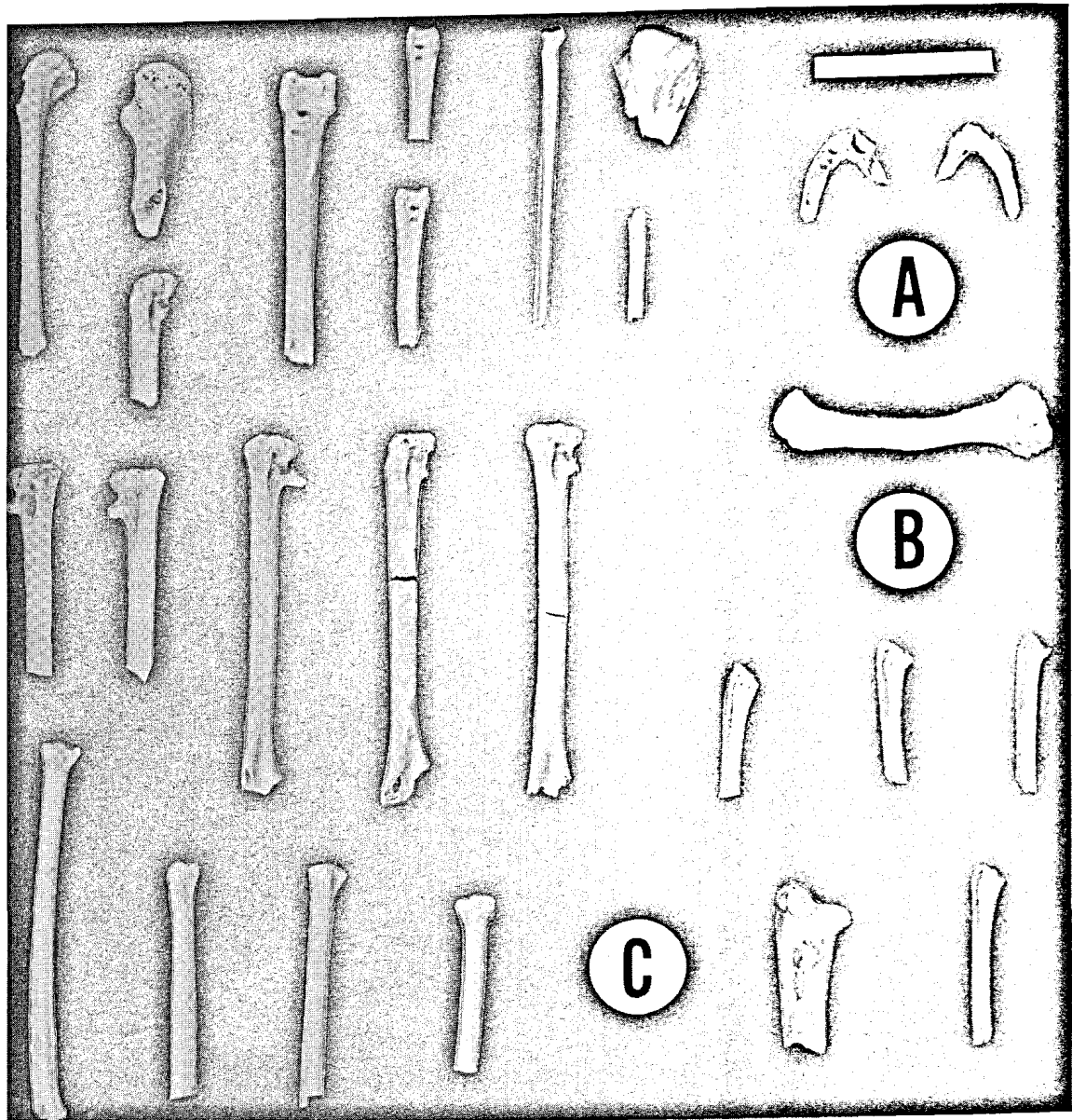


Fig. 3. Vertebrate bones from Cueva del Agua, Mona Island. A. *Moormops blainvillii* Lesson, jawbone on front (left) and back (right). B. *Cyclura stejnegeri* Stejneger, femur. C. *Puffinus iherminieri* Lesson, bones as detailed in the text. Scale bar = 1.5 cm for A; 1.8 cm for B and 3 cm for C.

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