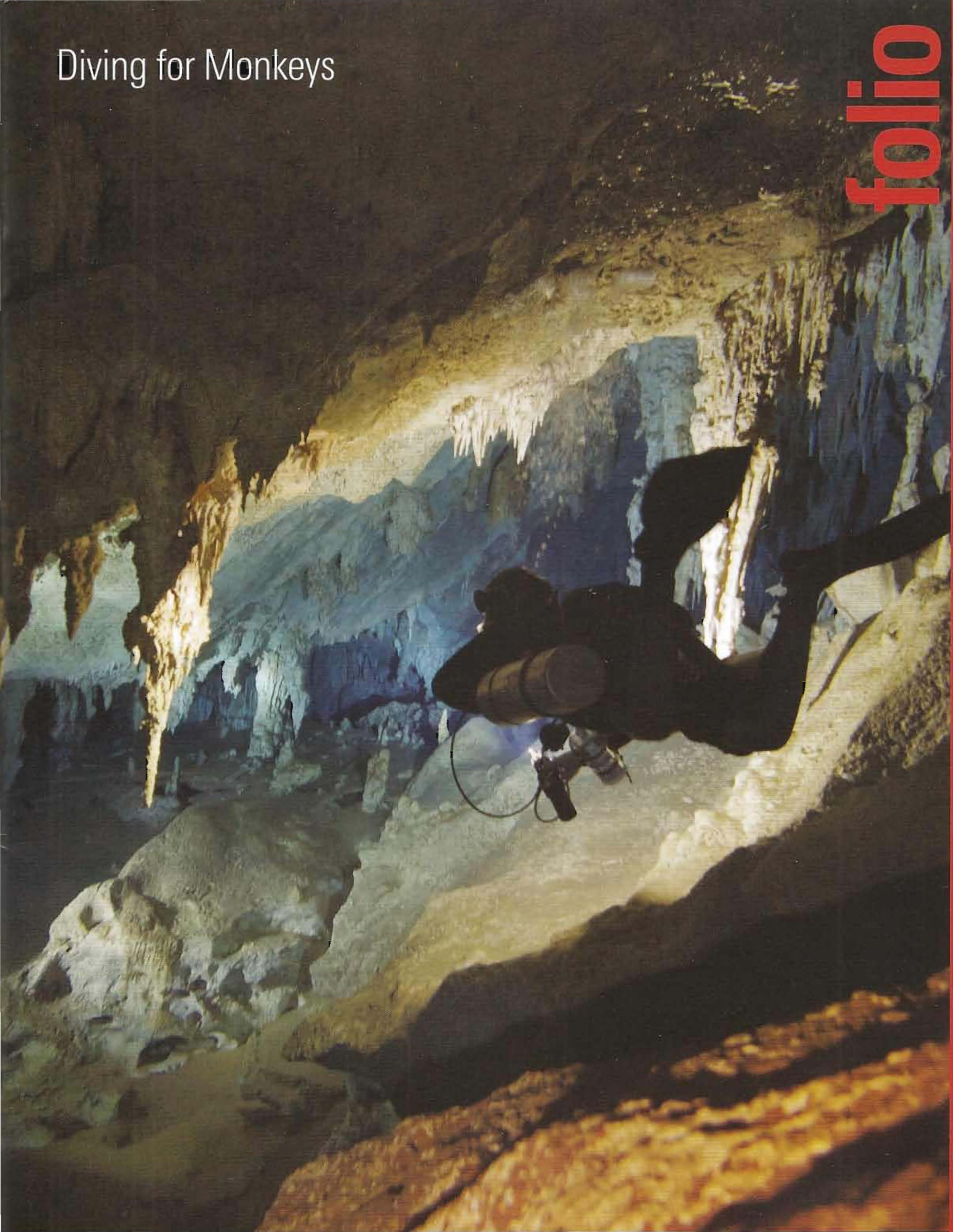
Diving for Monkeys



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DIVING FOR MONKEYS

From deep in the pools of Caribbean caves, GC anthropologists retrieve the remains of a long extinct primate and other prize fossils

For much of his academic career, Professor Alfred (Alfie) Rosenberger has been scouring parts of South America for traces of long-lost primates. But it was surfing the net that led to the discovery of the near-pristine remains of a Caribbean monkey extinct for hundreds and possibly thousands of years.

A biological anthropologist at the Graduate Center and Brooklyn College, Rosenberger happened across a blog by scuba diver Walter Pickel, describing the fossil he and his partners had discovered underwater in a Dominican Republic cave. Rosenberger found the description startling. "On the mainland, monkeys are still an important part of the tropical forest," he says. "But in the Caribbean they have long gone extinct. Now they are known only from a handful of fos-

Collecting fossils from the Padre Nuestro cave, Philip Lehman, leader of the Dominican Republic Speleological Society (DRSS) diving team, wears "side-mounted" tanks for maneuvering through narrow underwater channels, carries Tupperware containers to hold the fossils, and trails a mesh bag for raising them to the service. DRSS divers, working with the GC anthropologists, are the official dive team of the Museo del Hombre Dominicano.

sils." The blog excited him; its surprisingly sophisticated description clearly identified the fossil as that of a primate. "Few fossils had been discovered in Hispaniola. That meant the likelihood of finding something important was very high."

In October 2009, financed by an emergency grant from the CUNY faculty union's Professional Staff Congress, Rosenberger and Siobhan Cooke, then a Ph.D. candidate at the Graduate Center studying Caribbean primates, met up with Pickel and his diving partner Curt Bowen, as well as and Rosenberger's collaborating colleague Dr. Renato Rimoli from the Museo del Hombre Dominicano and the Universidad Autónoma de Santo Domingo, at Parque del Este, a wildlife preserve in the eastern Dominican Republic. As conscientious divers, Pickel and Bowen had not disturbed the bones they had earlier found. Now, they were to bring them up for the scientists.

"Paleontologists love surprises," Rosenberger says, but he was in no way prepared for the moment when his partners emerged twenty minutes later from the Cueva La Jeringa. Resting in a Tupperware container Rosenberger had given them were nearly two dozen skull fragments—soon recognized as only the second specimen ever found of the species known as *Antillothrix bernensis*. The first had been discovered in 1977 by Rimoli himself.

"We're used to working with a limited amount of material," Rosenberger says. "Mammal paleontologists are normally delighted when they find just a tooth." Professor Rimoli's 1977 find, for example, was just three teeth. Subsequent dives by Pickel and Bowen brought up a forearm, thigh, vertebrae and ribs. "Paleontologists are not used to getting complete pieces," Rosenberger says. "What the divers found were nearly pristine remains, the most complete skull, dentition, and partial skeleton of any monkey ever found in the Caribbean."

> Fossils from the Dominican caves, says Rosenberger, "give us a window on the great biodiversity of Hispaniola before the recent extinctions."

From the fragments the divers brought to the surface, Rosenberger has reconstructed a complete skull, which measures about two inches. He surmises that the monkey weighed about two pounds and stood roughly a foot high, "about the size of a small cat." For further study, precise images and three-dimensional models of the skull were created using laser digitalization, a technique, according to Rosenberger, at which the biological anthropology program at the Graduate Center excels.

The remains provide clues to when this line of monkeys arrived in the Caribbean, which is the site of the world's highest rate of extinction, having lost nearly 90 percent of its mammals over the past ten thousand years. "We're pretty sure that the arrival of these animals, or their ancestors, occurred well over ten million years ago," Rosenberger says. "If you compare the dental remains of our monkey to other fossils that we know of, we see strong similarities with Pantagonian fossils that are around fifteen million years old." The findings support the hypothesis that monkeys of Hispaniola, Cuba, and Jamaica (all now extinct) did not descend from a single common ancestor, but rather from primates that somehow traveled from South America, partly over water, and were stranded by geologic changes. "Thanks to a bit of underwater excavation, we now know more than ever before about what *Antillothrix bernensis* looked like and to whom it is related," Rosenberger says. "This gives us a window on the biodiversity of Hispaniola before the recent extinctions." The data from these findings will be used for papers to be presented this summer at an international conference in Cancun, Mexico, by Rosenberger and no fewer than five CUNY graduate students or recently minted Ph.D.s.

The original site has yielded additional treasures: "a cache of the tiniest, most fragile sorts of fossils—thin finger bones of bats, jaws of mice-sized rodents, mandibles of a shrew-like mammal that would fit rather well on the head of a pin. I'm totally overwhelmed by the value of this material," says Rosenberger. Since that initial find three years ago, he has returned repeatedly to the Dominican Republic, where underwater caves are a treasure trove of specimens. Bones captured naturally at these sites are less prone to the breakage and erosion common to fossils discovered on or in the ground. "This is a new thing," Rosenberger says. "The world is full of water-filled caves, and some will harbor fossil remains entirely new to science."

Rosenberger's ongoing research is funded by the National Geographic Society/Waitt Foundation, which has produced stunning video records of the divers' excavation of a skeleton and skull of an ex-

Cristian Pittaro, of the DRSS team, prepares to bring to the surface the thigh and arm bones of a ground sloth. Long extinct, the ground sloth was once the largest mammal in Hispaniola.

Shown here (above), as it was first displayed in a scientific publication, is the reconstructed skull of the monkey *Antillothrix bernensis*. Rosenberger's team is now at work on a three-dimensional image of the animal's brain, showing grooves and ridges that define the brain's functional areas as they had been imprinted on the inside of the braincase.

Beside the block and tackle used to lift heavy objects up from the cave floor (left), Rosenberger and GC Ph.D. Siobhan Cooke peer down the shaft that leads into what is actually named Oleg's Bat House Cave.

Suited up for exploration of the Bat House Cave pool (below), Pittaro descends one of the ladders leading down nearly thirty feet to the water.

tinct crocodile. (The video may be accessed at: http://news.nationalgeographic.com/news/2011/09/pictures/110927-crocodile-fossils-found-underwater-cave.) That particular discovery taxed Rosenberger's ingenuity in finding containers to protect fragile specimens as they were salvaged. He had scoured local markets for Tupperware containers, which he lined with damp towels to secure the divers' first discoveries. For the crocodile head, much too large for Tupperware, Rosenberger hurried to a nearby supermarket to buy the biggest beer cooler in town. The precious specimens are now dried and stored in cell phone boxes, jewelry boxes, glass vials, and prescription pill bottles.

Part of the fun, he says, has been such improvisations. On one trip, he and his wife arranged five hundred bat skulls on their hotel beds and coated them with combinations of nail polish and hair spray to keep the fragile bones from flaking away to unidentifiable lumps of nothingness. Damp toilet paper, he says, has been especially useful in securing specimens.

To carry on the project, a new and larger international team has been assembled, with experts in the various groups of animals the divers have uncovered—primates, shrews, bats, sloths, rodents, birds, reptiles, and amphibians. Rosenberger, who received his Ph.D. from the Graduate Center in 1979, continues to focus on South and Central American monkeys—an interest, he says, that dates from the fascination he felt during childhood visits to the Monkey House at the Bronx Zoo, which was recently closed.

"This find has opened up a whole new world of opportunities to find fossils. I'm sure that it'll be a large part of what I'll be doing over the next ten years."

Fearsome indeed was the prize find in Oleg's Bat House Cave. Showing its snout above the sandy surface was the complete skull of the extinct Cuban crocodile, the first specimen of the species to be found on the island of Hispaniola. It took block and tackle (shown on page 8) to lift the skull, in its water-laden beer cooler, up to the surface, once it had been freed from the cave floor.