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BoarCroc, RatCroc, DogCroc, DuckCroc and PancakeCroc
Cousins of Prehistoric SuperCroc Inhabit Lost World of Sahara

EMBARGOED: For release 10:30 a.m. (ET, U.S.) Thursday, Nov. 19, 2009

WASHINGTON—A suite of five ancient crocs, including one with teeth like boar tusks and another with a snout like a duck’s bill, have been discovered in the Sahara by National Geographic Explorer-in-Residence Paul Sereno. The five fossil crocs, three of them newly named species, are remains of a bizarre world of crocs that inhabited the southern land mass known as Gondwana some 100 million years ago.

Sereno, a professor at the University of Chicago, and his team unearthed the strange crocs in a series of expeditions beginning in 2000 in the Sahara. Many of the fossils were found lying on the surface of a remote, windswept stretch of rock and dunes. The crocs galloped and swam across present-day Niger and Morocco when broad rivers coursed over lush plains and dinosaurs ruled.

“These species open a window on a croc world completely foreign to what was living on northern continents,” Sereno said. The five crocs, along with a closely related sixth species, will be detailed in a paper published in the journal *ZooKeys* and appear in the November 2009 issue of National Geographic magazine. The crocs also will star in a documentary, “When Crocs Ate Dinosaurs,” to premiere at 9 p.m. ET/PT Saturday, Nov. 21, on the National Geographic Channel.

At 40 feet in length and weighing 8 tons, *Sarcosuchus imperator*, popularly known as SuperCroc, was the first and largest of the crocs Sereno found in the Sahara, but it was not the strangest, Sereno said. He and his teams soon discovered key fossils of five previously unknown or poorly understood species, most of them walking “upright” with their arms and legs under the body like a land mammal instead of sprawled out to the sides, bellies touching the ground.

The crocs and their nicknames:

- **BoarCroc:** New species, *Kaprosuchus saharicus*; fossils found in Niger. Twenty-foot-long upright meat eater with an armored snout for ramming and three sets of dagger-shaped fangs for slicing. Closest relative found in Madagascar.
- **RatCroc:** New species, *Araripesuchus rattoides*; fossils found in Morocco. Three-foot-long, upright plant and grub eater. Pair of buckteeth in lower jaw used to dig for food. Closest relative in South America.
- **PancakeCroc:** New species, *Laganosuchus thaumastos*; fossils found in Niger and Morocco. Twenty-foot-long, squat fish eater with a three-foot pancake-flat head. Spike-shaped teeth on slender jaws. Likely rested motionless for hours, its jaws open and waiting for prey. Closest relative from Egypt. The scientific paper also names a close relative discovered by the team in Morocco, *Laganosuchus maghrebensis*.
- **DuckCroc:** New fossils of previously named species, *Anatosuchus minor*. Fossils found in Niger. Three-foot-long upright fish-, frog- and grub-eater. Broad, overhanging snout and Pinocchio-like nose. Special sensory areas on the snout end allowed it to root around on the shore and in shallow water for prey. Closest relative in Madagascar.
- **DogCroc:** New fossils of named species, *Araripesuchus wegneri*. Fossils found in Niger include five skeletons, all next to each other on a single block of rock. Three-foot-long upright plant and grub eater with a soft, doglike nose pointing forward. Likely an agile galloper, but also a capable swimmer. Closest relative in Argentina.

“We were surprised to find so many species from the same time in the same place,” said paleontologist Hans Larsson, associate professor at McGill University in Montreal and a team member who discovered the bones of BoarCroc and PancakeCroc. “Each of the crocs apparently had different diets, different behaviors. It appears they had divided up the ecosystem, each species taking advantage of it in its own way.”

To better understand how these ancient crocs — mostly upright and agile — might have moved and lived, Sereno traveled to northern Australia, where he observed and captured freshwater crocs. Realizing while there that he may have stumbled onto one of the keys to crocodilian success, Sereno saw freshwater crocs galloping at full speed on land and then, at water’s edge, diving in and swimming away like fish. On land they moved

much like running mammals, yet in a flash turned fishlike, their bodies and tails moving side to side, propelling them in water.

Based on interpretation of the fossils, Sereno and Larsson hypothesize that these early crocs were small, upright gallopers. In the scientific paper, they suggest that the more agile of their new croc menagerie could not only gallop on land but also evolved a swimming tail for agility and speed in water, two modes of locomotion suggested to be evolutionary hallmarks for the past 200 million years.

“My African crocs appeared to have had both upright, agile legs for bounding overland and a versatile tail for paddling in water,” Sereno writes in the National Geographic magazine article. “Their amphibious talents in the past may be the key to understanding how they flourished in, and ultimately survived, the dinosaur era.”

To study the crocs’ brains, Sereno CT-scanned the skulls of DuckCroc and DogCroc and then created digital and physical casts of the brains. The result: Both DogCroc and DuckCroc had broad, spade-shaped forebrains that look different from those of living crocs. “They may have had slightly more sophisticated brain function than living crocs,” Larsson said, “because active hunting on land usually requires more brain power than merely waiting for prey to show up.”

To collect the croc fossils, Sereno and his teams endured temperatures topping 125 degrees F, living for months on dehydrated food. Logistics were challenging: For the 2000 expedition, they transported trucks, tools, tents, five tons of plaster, 600 pounds of water and four months’ worth of other supplies.

Sereno’s research and field expeditions were funded by the National Geographic Society and the Whitten-Newman Foundation.

More information on the crocs is available at:

<http://news.nationalgeographic.com/news/2009/11/091119-dinosaurs-crocodiles-missions.html>

The scientific paper can be accessed at:

<http://pensoftonline.net/zookeys/>

The NGC documentary “When Crocs Ate Dinosaurs” airs Nov. 21 as part of the Channel’s second annual Expedition Week.

PAUL SERENO

Paleontologist and Expedition Leader

Paul Sereno earned a doctorate in geology at Columbia University. In 1987 he joined the faculty of the University of Chicago, where he teaches paleontology, evolution and anatomy.

Discoverer of dinosaurs on five continents and leader of dozens of expeditions, Sereno's fieldwork began in 1988 in the foothills of the Andes in Argentina, where his team discovered the first dinosaurs to roam the Earth, including the most primitive of all, *Eoraptor*. This work culminated in the most complete picture yet of the dawn of the dinosaur era, some 225 million years ago.

In the early 1990s his expeditions shifted to the Sahara to unearth Africa's lost world of dinosaurs. Here, Sereno's teams have excavated more than 70 tons of dinosaur fossils from rocks dating from the Cretaceous period. These include plant-eaters like *Nigersaurus* and *Jobaria*, meat-eaters like *Afrovenator*, *Deltadromeus*, *Rugops*, the huge-clawed fish-eater *Suchomimus*, the huge *Tyrannosaurus*-sized *Carcharodontosaurus* and a series of crocs, including the 40-foot-long (12-meter-long) "SuperCroc" (*Sarcosuchus*), the world's largest crocodile.

An expedition in 2001 took Sereno and his team to western and central India. They later unveiled in Mumbai (Bombay) the Asian continent's first dinosaur skull, belonging to a new predator named *Rajasaurus*. Also in 2001 Sereno began an ongoing series of expeditions to China, first exploring remote areas of the Gobi desert in Inner Mongolia and discovering a herd of more than 20 dinosaurs that died in their tracks. Sereno's current expeditions in China target Tibet, the last unexplored fragment of the ancient southern landmass Gondwana.

The author of books and articles in *National Geographic* and *Natural History* magazines and the subject of many documentaries, Sereno's recognitions include the *Chicago Tribune's* Teacher of the Year Award (1993), *Chicago* magazine's Chicagoan of the Year (1996), *Newsweek* magazine's The Century Club (1997), *People* magazine's 50 Most Beautiful People (1997), *Esquire's* 100 Best People in the World (1997), Boston Museum of Science's Walker Prize for extraordinary contributions in paleontology (1997) and Columbia University's University Medal for Excellence (1999).

Sereno and his wife, Gabrielle Lyon, also founded Project Exploration, a nonprofit outreach organization dedicated to bringing discoveries in natural science to the public and providing innovative educational opportunities for city kids.

HANS LARSSON
Expedition Team Member

Hans Larsson is associate professor at McGill University in Montreal and associate professor at the university's Redpath Museum. He has a bachelor's degree from McGill and a Ph.D. from the University of Chicago; he completed a postdoctoral fellowship at Yale in 2002.

Larsson has conducted field work in the Canadian High Arctic, western Canada and Colombia, recovering fossil plants and animals in an effort to document paleobiodiversity in poorly studied regions of the Americas.

Larsson began his research in the field of vertebrate paleontology and later expanded it to encompass experimental embryology. His current research works at the interface between developmental biology and vertebrate paleontology. Larsson's lab focuses on two macroevolutionary transitions — the fish to amphibian and dinosaur to bird transitions. Both involve sequencing of genes implicated in the development of fins, limbs and tails, bioinformatics of the coding and regulatory regions of these genes, expression patterns of some of the genes in selected extant embryos, morphogenesis of the skeleton and other associated tissues in these embryos, and final integration of these genetic and developmental changes to the evolutionary rates and changes of the skeleton across each transition.

Larsson is the Canada Research Chair in Macroevolution, a competitive position. He has published three book chapters and leads a research program comprising six Ph.D. students and a postdoctoral fellow.