Science & Technology

Back a While, Crocodile

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In 1947, a team of paleontologists from New York City's American Museum of Natural History unearthed hundreds of dinosaur fossils in the badlands of northern New Mexico. The ground was so dense with bones that the team preserved large, unexamined sections in plaster and burlap to study later.

Some of those slabs lay undisturbed in the museum's basement until Sterling Nesbitt, a 23-year-old researcher, cracked them open last year. He made the discovery of a lifetime: a 210-million-year-old fossil of a previously unknown animal. The six-foot-long biped, with its shrunken arms, gangly neck, and toothless beak, looks like a Cretaceous-period dinosaur called an ornithomimid. But Nesbitt, a PhD student in Columbia's earth and environmental sciences department, and Mark Norell, a Columbia adjunct professor and a paleontologist at the museum, concluded that the animal is actually a relative of the crocodile, whose ancestral path diverged from that of dinosaurs some 250 million years ago.

In a recent paper published in the online journal Proceedings of the Royal Society B, Nesbitt and Norell argue that the creature's spot-on dinosaur impression is an extreme example of what scientists call convergence — when animals with distinct lineage develop similar physical traits. They named the animal *Effigia okeeffeae*. *Effigia* means "ghost," which refers to the famous Ghost Ranch Quarry where the fossil was found; the species name, *okeeffeae*, honors Georgia O'Keeffe, who lived and painted nearby.

Columbia spoke recently to Nesbitt, the paper's lead author.

This certainly doesn't look like a crocodile. What makes you think it is one?

Effigia has several features that are extremely rare in the line of archosaurs that includes crocodiles and alligators, like being bipedal and terrestrial, and having a beak. But the ankles, pelvis, and skull all indicate that it's part of the croc line. It has

a type of ankle, for example, shared by all relatives of the crocodile, as well as by many aquatic animals. Dinosaurs all lived on land and had a different ankle morphology. In comparison, a trait like walking upright is kind of superficial. Animals in a lot of lineages developed that ability.

What were *Effigia*'s habits?

We don't know what it ate because with a beak you can eat just about anything. We know that it didn't live in water, obviously. And that it lived in the southwestern United States and that its closest relative lived in South America, based on some other bones that Mark and I have since identified.

Where did you find the other bones?

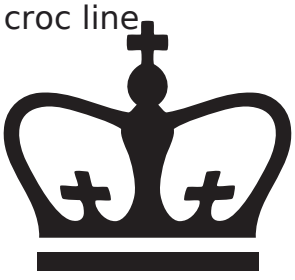
I've spent a lot of time in the last year visiting museums known to have fossils from the Triassic period. Sometimes I'll find a few bones marked simply "carnivorous dinosaur, Triassic." And it turns out they're really from an *Effigia*.

How have colleagues received the news?

Some don't want to believe it at first. Most come around. It helps that our fossil was well preserved and 80 percent complete. Our discovery does carry some controversial implications for the study of Triassic dinosaurs, because before we found this fossil that's almost whole, a few *Effigia* bones found here or there could have been classified as being from a new type of dinosaur. So past estimates for the numbers of Triassic dinosaur species might have been inflated.

What does *Effigia* tell us about crocodiles?

In the past, there were also some *Effigia* bones found that scientists suspected were from a relative of the crocodile, but in no one's wildest dreams did the animal look this much like a dinosaur. This shows us that the crocodile line was much more diverse than we had thought, at least in this period.We know that *Effigia* was a failed experiment because the only animals in its line to survive past the early Jurassic period were those with the sprawling body type of today's crocs and alligators. Animals resembling the modern crocodile, by the way, appeared tens of millions of years after the *Effigia* but didn't evolve from it. They all had a common ancestor. What I'm going to study now is the relationships between those early animals in the croc line.



Guide to school abbreviations