



Press Release
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Newly Discovered Dinosaur Illuminates Ancient Lineage

Tawa hallae, a new species of small carnivorous dinosaur discovered at Ghost Ranch Conference Center near Abiquiu, New Mexico, is the oldest North American dinosaur known from almost complete skeletons. This discovery provides new information on the evolution of early dinosaurs and their dispersal across ancient continents.

Ghost Ranch, N.M., December 10, 2009 – In the Dec. 11, 2009 issue of *Science*, a team of paleontologists presents fossils of a previously unknown dinosaur *Tawa hallae*, including several of the best preserved dinosaur skeletons known from this time period.

Based on an analysis of the relationships among *Tawa* and other early dinosaurs, the researchers hypothesize that dinosaurs originated in what is now South America and soon diverged into theropods (like the much later *Tyrannosaurus rex*), long necked sauropodomorphs (like *Seismosaurus*) and ornithischians (like *Triceratops*); and they dispersed across the Triassic world more than 220 million years ago.

“*Tawa* gives us an unprecedented window into early dinosaur evolution, solidifying the relationships of early dinosaurs, revealing how they spread across the globe, and providing new insights into the evolution of their characteristics,” says Sterling Nesbitt of the University of Texas at Austin, the lead author on the paper.

Nesbitt’s co-authors included Nathan Smith of the University of Chicago and the Field Museum of Natural History; Randall Irmis of the Utah Museum of Natural History and the University of Utah; Alan Turner of Stony Brook University; Alex

Downs of the Ruth Hall Museum of Paleontology at Ghost Ranch; and Mark Norell of the American Museum of Natural History.

“If you have the continents splitting apart, you get isolation,” says Nesbitt. “So when barriers develop, you would expect that multiple species of carnivorous dinosaurs in a region should represent a closely related endemic radiation. But that is what we *don't* see in early dinosaur evolution.”

Instead, Nesbitt and his colleagues found distantly related carnivores in the fossil-rich, Late Triassic beds they investigated at Ghost Ranch near Abiquiu in Rio Arriba County in Northern New Mexico, implying that each carnivore descended from a separate lineage before arriving in North America, instead of all evolving from a local common ancestor.

At Ghost Ranch, the researchers found fossils from a carnivorous dinosaur related to *Coelophysis*, common to that region, and fossils from a carnivore closely related to *Herrerasaurus*, which lived in South America. The two- to four-meter-long skeletons of *Tawa* display characteristics that exist in both animals, and features found in neither, implying a separate lineage.

“The old view was that *Herrerasaurus* split off of the family tree after the ornithischians diverged, but before the split between sauropodomorphs and theropods,” says Nesbitt. “*Tawa* now appears to show that the three groups split from each other soon after dinosaurs evolved,” though paleontologists have not yet found a concrete example of a dinosaur that existed before the split of sauropodomorphs and theropods,

“*Tawa* is a good example of a fossil that fills a in what we call a morphological gap,” says Nesbitt. Such a gap arises because the fossil record is so incomplete. Theropod dinosaurs were changing quickly in the Triassic and paleontologists have found few animals that preserve the “steps” from the sequence of changes.

“One of the biggest morphological gaps in early dinosaurs lies between *Herrerasaurus* and animals that are clearly more closely related to birds, such as *Coelophysis* or *Dilophosaurus*,” says Nesbitt. “*Tawa* fits perfectly in between, morphologically. It is not a missing link, it evolved on its own lineage, but retains characteristics that existed in *Herrerasaurus* that we thought were more primitive while also possessing features seen in unmistakable theropods (including birds), such as the presence of air sacs surrounding the braincase and neck.”

“Usually, early dinosaur specimens are not as complete or as well preserved, so they spur a lot more questions than answers,” says Nesbitt. “*Tawa* is so well preserved that every bone we have we can examine in three dimensions. And we can analyze five of the skeletons this way, with examples of both mature and immature animals.”

North America is emerging as a major source of information on the origin and early radiation of dinosaurs, however the fossil record is incomplete, and the researchers recognize that more studies need to be done.

“This is just the tip of the iceberg,” says Nesbitt. “All dinosaurs share a common feature, an open hip socket, and you can dissect your Thanksgiving turkey and still see that original feature. But the earliest lineages that lie in between are far from understood.”

The research was sponsored by the National Geographic Society with other participating institutions including the University of Chicago, the Field Museum of Natural History, The Utah Museum of Natural History, Stony Brook University and the Ruth Hall Museum of Paleontology at Ghost Ranch Conference Center.

Ghost Ranch is a 21,000-acre education and retreat center located 60 miles north Santa Fe just beyond the small town of Abiquiu in northern New Mexico. Along with offering over 300 courses a year, Ghost Ranch is home to The Ruth Hall Museum of Paleontology, The Florence Hawley Ellis Museum of Anthropology, and The Piedra Lumbre Education & Visitor Center. Visitors to the ranch will find hiking trails, gift shops, art galleries, a coffee shop, a 24-hour library, conference and meeting spaces and overnight accommodations. Ghost Ranch is renowned for the landscapes made famous by painter Georgia O’Keeffe.

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