

Dinosaur fossil found sitting on eggs in a nest reveals well-developed parental care

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A multinational team recently announced a fossil dinosaur discovery in China that provides new evidence of advanced parental care among at least one group of the earth's once dominant vertebrate animals. The fossil, dating to 70 million years ago, during the Cretaceous Period, which ended with the mass dinosaur extinction, consists of the partially preserved remains of an oviraptorosaur, a feathered, theropod dinosaur lineage tangentially related to those that eventually gave rise to modern birds.

Of especial interest is that this animal appears to have been sitting on a brood of at least two dozen eggs. Examination of the embryos preserved in at least seven of the eggs confirmed that they belong to the same group as the adult, strongly implying that the latter was a parent sitting on a nest incubating its offspring.

The discovery, soon to be published in the journal *Science Bulletin*, was made in Ganzhou City, Jiangxi Province, southern China. Shundong Bi, lead author of the report who is a researcher at the Carnegie Museum of Natural History (CMNH) and professor at the Indiana University of Pennsylvania, said in a press release, "Dinosaurs preserved on their nests are rare, and so are fossil embryos. This is the first time a non-avian dinosaur has been found sitting on a nest of eggs that preserve embryos, in a single spectacular specimen."

According to the CMNH press release, the embryos were at a late stage of development, implying that the adult was actually sitting on the nest incubating the eggs, as is done by many modern birds, rather than that the eggs had been recently deposited to then be left to develop on their own (as is done by modern reptiles). The position of the fossil adult further implies that the nest was not simply being guarded, as is done by crocodiles.

Dr. Matt Lamanna, CMNH lead dinosaur paleontologist and a coauthor of the *Science Bulletin* article, said that although a few oviraptorid fossils had previously been found sitting on eggs, none of those eggs contained preserved embryos, meaning that their stage of development could not be determined. This new discovery, containing well-developed young, nearly ready to hatch, supports the interpretation that this lineage of dinosaurs devoted significant effort to parental care, at least prior to birth. Dr. Lamanna enthused, "This kind of discovery—in essence, fossilized behavior—is the rarest of the rare in dinosaurs." He concludes, "This dinosaur was a caring parent that ultimately gave its life while nurturing its young."

The interpretation that these dinosaur parents actively incubated their eggs is further supported by the result of oxygen isotope analysis, which indicates that the eggs were maintained at a high temperature, similar to that of modern birds, consistent with the idea that a parent was more or less continually sitting on the nest.

Furthermore, although all the embryos were found to be at a relatively advanced stage of development, there was some variation. This resembles the pattern in some modern birds, known as asynchronous hatching, which means that the offspring emerge from their shells over a somewhat extended period of time. This pattern is thought to be a hedge against variation in potential food supply for the young.

Another principal member of the team, Dr. Xu, paleontologist at the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing, commented, "It's extraordinary to think how much biological information is captured in just this single fossil. We're going to be learning from this specimen for many years to come."

Interestingly, the name *Oviraptor* is derived from the Latin meaning “egg thief.” Specimens of this group were first discovered in the 1920s in association with eggs that were thought to be those of a small, ceratopsian dinosaur. The inference made at that time was that *Oviraptor* stole and ate the eggs of other species. Only later, after a number of finds of adults in association with eggs in nests, was that interpretation discarded.

This evidence of advanced parental care among at least one group of dinosaurs, which are closely related to the ancestors of modern birds, raises interesting questions about other aspects of behavior among these long extinct animals. Dinosaurs are often depicted as savage killing machines (witness the film *Jurassic Park*). This new discovery supports a more nuanced view.

Modern bird reproductive behavior falls into two basic categories: those species that bury and abandon their eggs to hatch on their own and those that incubate their eggs and provide varying degrees of parental care after they hatch. Extended care of young provides the opportunity for the transmission of learned behavior, allowing for greater behavioral flexibility and adaptability in response to environmental variation.

Varying degrees of intelligence have evolved independently in a number of animal groups. For example, New Caledonian crows make and use tools by modifying leaves and twigs and pass that information culturally to other members of the group, much as has been observed in chimpanzees. The latter provides a baseline behavior which was likely shared by the common ancestor of chimps and humans. There is no evidence of such behavior among dinosaurs (and such would be very difficult to identify were it to have occurred). However, evolution creates many possibilities.

Biological evolution is subject to lawful patterns but also to random, sometimes catastrophic events, which can “reset the clock,” as has happened at least five times in the past. What if dinosaurs had not been driven to extinction by a massive meteor strike and resulting environmental catastrophe 66 million years ago? Would the subsequent evolutionary explosion of mammals and birds, once the dominant animal group had been swept away, not have taken place? Would mammals have remained a relatively minor part of the



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