Geophysical Research Abstracts
Vol. 13, EGU2011-11917-3, 2011
EGU General Assembly 2011

Brooding behaviors of Cretaceous oviraptorids Dinosaurs of China

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The phylogenetic relationship between dinosaur and bird has long been in debate. Recently, several research results from excavation of feathered dinosaurs, paired-eggs in pelvic region of oviraptorid dinosaurs, small theropod and paleognath bird fossils, and significant progress in cladistics proposed that bird is members in the clade of Dinosauria. The issues of the reproductive behaviors and oological features of troodons or oviraptoria thus are crucial to investigate their phylogenetic relationship to bird.

Brooding behaviors of oviraptors can be divided into four related sequences stages, i.e. nest construction, brooding behaviors in pre-hatching stage, feeding, and protecting behaviors in post-hatching stage. Previous researches postulate that “feathers” imprints preserved with the oviraptor fossils might be an indication of an endothermic physiological feature for insulation and incubation. The postulation was further enhanced by the oviraptor fossils excavated in Mongolia, which disposition in the field demonstrates a distinct linkage between the adult skeletons and the nest - the legs are folded beneath the main body and the forelimbs surround the egg clutch. Such posture is very similar to that of extant bird behavior. According to the discoveries, paleobiologists come to the conclusion that the brooding behaviors of Avian were originated from dinosaurs deep in the past of Cretaceous. However, our preliminary researches on the Cretaceous fossil oviraptorids nests from China invalidate this hypothesis.

We analyzed five oviraptorids nests excavated from the Cretaceous strata in the Hongcheng Basin, Ganzhou, Jiangxi Province of China. We did some detailed analysis, including measurement of external form of the nests, observation of eggshell thin section through polarization microscope and SEM, and, further more, compared the profile structure of the eggshell thin section with that of the extent birds (Ostrich and Gallus), turtles and crocodilians (Tomistoma schlegelli and Crocodylus porosus). All the fossil eggs were laid in pairs and tilted outward. Most of the eggs occur in two “layers”, which are interbedded with matrix, indicating that the layers were not laid en masse. The blunt ends of the long ellipsoid-shape eggs all point inward in the nest. While the outer surface of sharp end of the fossil egg microscopically is smooth, the blunt end is characterized by linearituberculate ornamentation in the outer surface, in contrast to the entirely smooth surface of the avian eggshell. Finally, there is a major difference in the accretion characters and layering between the oviraptor and avian eggshells.

Based on the preliminary studies, we propose two conclusions about the brooding behaviors of oviraptors. Firstly, the derived feather character marks with oviraptors could not be the supportive evidence to speculate the endothermic physiology for insulation and incubation of oviratorids dinosaur. Secondly, brooding in extent Aves is a post-existing behavior, which had not derived yet in the non-avian dinosaurs of the Mesozoic.