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Research Advances

A New Oogenus of Dendroolithidae from the Late Cretaceous in the Quyuangang Area, Henan Province, China

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Objective

The oofamily Dendroolithidae is elliptical or oblate eggs with loosely arranged dendritic eggshell units and large cavities between eggshell units (Zhang et al., 2018). Dendroolithidae is represented by two oogenera, *Dendroolithus* (Zhao Zikui and Li Zuocong, 1988), and *Placoolithus* (Zhao Hong and Zhao Zikui, 1998) according to the latest classification (Zhang et al., 2018). Recently, a clutch of well-preserved dinosaur eggs from the Quyuangang area, Huiche Town, Xixia County, Henan Province could be referable to a new oogenus different from the known material. In this paper, we provide the first description of these new specimens and present a simply comparison and discussion of them.

Methods

The well-preserved dinosaur eggs described here are housed in the Henan Geological Museum, China. The external morphology was described based on indoor investigations and measurements. Five eggshell fragments from each egg with least weathering were collected and examined for microstructural observations. All fragments were cleaned with hydroxide peroxide in an ultrasonic bath and the loose sediments on the outer surface were removed with a small needle. Selected eggshells were cut with an EXAKT 300CP automatic microtome to make thin sections at Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, China. The microstructure of the thin sections was photographed with an Olympus BX53 polarized light microscope at the geological laboratory of Anhui University.

Results

Dendroolithidae Zhao et Li, 1988

***Pionoolithus* oogen. nov.**

Etymology: 'pion', Greek prefix for plump, in reference to the fully spherical eggs.

Diagnosis: As for the type and only oospecies.

***Pionoolithus quyuangangensis* oogen. et oosp. nov.**

Etymology: "quyuangang" is the Chinese phonetic alphabet of the dinosaur egg locality.

Holotype: An incomplete nest composed of 11 well-preserved eggs (Fig. 1a).

Type locality and horizon: Zhaoying Formation, Late Cretaceous, Quyuangang area, Huiche Town, Xixia County, Henan Province, China.

Diagnosis: Eggs are spherical with shape index of 81.3-96.4, closely arranged in nest. Eggshell units asymmetrically branch in the middle part of eggshell; one of the branches occasionally divide into two near the compact layer which measures 1/7-1/4 of the whole eggshell.

Description： The whole nest should be nearly circular in shape approximately 54 cm in diameter. All eggs are fully spherical and occur in the same level with a close arrangement in the nest. The long axis ranges between 135 and 170 mm (average: 153 mm) while the short axis ranges between 130 and 150 mm (average: 135 mm); Egg shape index varies between 81.3 and 96.4 with an average of 89.1. Eggshell thickness varies between 1.46 and 1.60 mm, and the outer surface is smooth with no prominent ornamentation.

In radial thin sections, eggshells are mainly composed of asymmetrically dendritic eggshell units under PLM (Fig. 1b). The first asymmetrical branch usually appears in the middle part of eggshell while occasionally close to cones. The main branch sometimes divides into two small branches in the outer part of eggshell. Eggshell units are tightly arranged and form an evenly compact layer near the outer surface, which is approximately 1/7–1/4 of the eggshell. Tangential thin sections of eggshell units exhibit honeycomb-like structures through the middle-outer part of the eggshell. Pores are subcircular, oval, or rimiform (Fig. 1c). Through the middle-inner part of the eggshell, the eggshell units are oval or irregularly shaped with large cavities between them (Fig. 1d).

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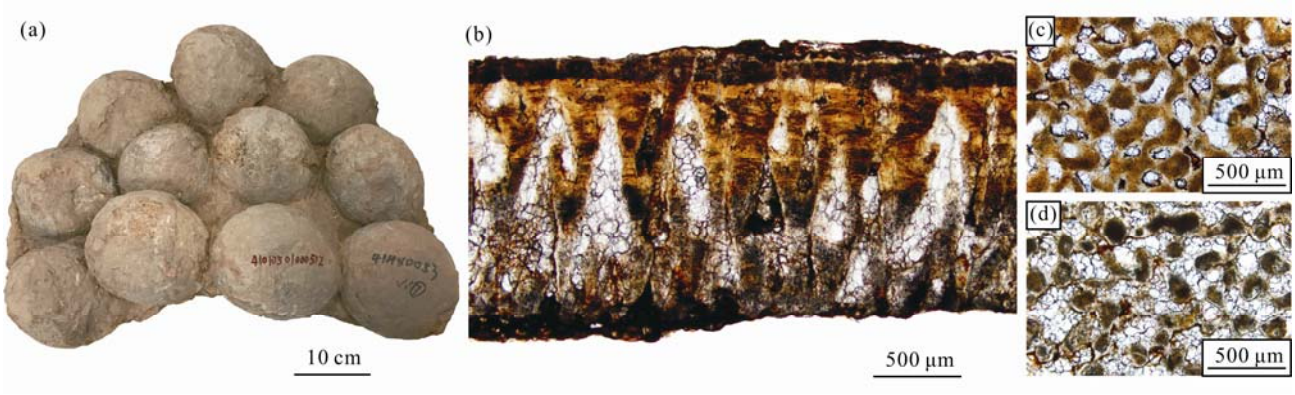


Fig. 1. *Pionoolithus quyuangangensis* from the Quyuangang area, Henan Province, China.
(a), A clutch containing 11 eggs; (b), Radial thin section under PLM, showing asymmetrically branched eggshell units and the compact layer; (c), Tangential thin section through the middle-outer part of eggshell, showing the honeycomb-like microstructure and subcircular and rimiform pores; (d), Tangential thin section through the middle-inner part of eggshell, showing the oval and irregularly shaped eggshell units and large cavities.

Discussion

Characteristics of Quyuangang eggs described above (the dendritic eggshell units, the large cavities in the inner part of eggshell and the compact layer near the outer part of eggshell) correspond to those of dendroolithid eggs (Zhao Zikui and Li Zuocong, 1988). Due to the oogenus *Paradendroolithus* has been proved to be invalid (Zhang et al., 2018), only two oogenera, *Dendroolithus* and *Placoolithus*, actually refer to Dendroolithidae. Although the asymmetrically branched eggshell units of Quyuangang eggshell are similar to those of *Placoolithus taohensis*, their spherical egg shapes are different from the known oogenera *Dendroolithus* (the elliptical eggs) and *Placoolithus* (the oblate eggs). Furthermore, the eggs of *Placoolithus* clutches are separated from each other, differing from the closely arranged Quyuangang eggs. Therefore, the Quyuangang eggs should be assigned to a new oogenus *Pionoolithus* and a new oospecies *Pionoolithus quyuangangensis*.

Conclusions

The Quyuangang dinosaur eggs from the Late Cretaceous in the Henan Province, China, can be assigned to a new oogenus and a new oospecies *Pionoolithus quyuangangensis* based on their spherical shape, the close arrangement in nest, and asymmetrically branched eggshell units.

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