First discovery of dinosaur eggs in Nanhu Gebi of Hami, Xinjiang Uygur Autonomous Region of China (Postprint)

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Abstract

This study reports the first discovery of dinosaur eggs from the Nanhu Gobi in Hami, including Elongatoolithus elongatus and Ovaloolithus oosp. The discovery of these dinosaur eggs not only expands the paleogeographic distribution of elongatoolithids and ovaloolithids, but also indicates that the geological age of the egg-bearing strata in the Nanhu Gobi is the latest Late Cretaceous; whether this stratigraphic unit can be correlated with the Subashi Formation in the Turpan Basin remains to be confirmed by further work.

Full Text

First Discovery of Dinosaur Eggs in the Nanhu Gebi of Hami, Xinjiang Uygur Autonomous Region, China

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Abstract

We report the first dinosaur eggshells discovered in the Nanhu Gebi of Hami, Xinjiang, including *Elongatoolithus elongatus* and *Ovaloolithus* oosp. These findings not only expand the paleogeographic distribution of elongatoolithid and ovaloolithid eggs but also indicate that the egg-bearing strata date to the end of the Late Cretaceous. Whether these strata can be correlated with the Subashi Formation in the Turpan Basin remains to be clarified.

Keywords: Nanhu Gebi; Hami, Xinjiang; Late Cretaceous; dinosaur eggs

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Introduction

Nanhu Gebi is located in the southeastern part of the Turpan-Hami Basin. In 2020, we discovered dinosaur bones for the first time in the Middle Jurassic Xishanyao Formation. Building on this work, our 2021 investigation of dinosaur-producing strata and geological relics in the surrounding areas yielded the first dinosaur eggshells from Nanhu Gebi, providing new paleontological evidence for the division and correlation of red beds in the region. Eggshells were recovered from three separate sites; however, no complete egg fossils were found, and all specimens were preserved within weathering horizons.

Materials and Methods

All eggshells collected in the field were cleaned ultrasonically, and specimens with well-preserved internal and external surfaces were selected for thin-section preparation. A total of twenty radial thin sections were prepared to determine eggshell types. Thin sections were observed and photographed using a polarizing microscope. All experiments were conducted at the Key Laboratory of Vertebrate Evolution and Human Origins, Chinese Academy of Sciences.

Systematic Paleontology

Oofamily Elongatoolithidae Zhao, 1975
Oogenus *Elongatoolithus* Zhao, 1975
Oospecies *Elongatoolithus elongatus* Zhao, 1975

Specimens: Eggshell slices IVPP V 31375.2-6 and fifteen eggshell fragments (V 31375.1).
Locality and Horizon: Nanhu Gebi, Hami; Subashi Formation (?), Upper Cretaceous.

Description: The eggshell' s outer surface exhibits ridge, nodular ornamentation, or smooth areas. In radial section, the ornamentation is unevenly distributed, with slight variations reflecting different positions on the egg (Fig. 1A–E [Figure 1: see original paper]). The eggshell comprises a cone layer and a columnar layer with an indistinct boundary between them. Based on eggshell

thickness (excluding ornamentation), specimens fall into two groups. The thinner group measures 0.65–0.80 mm, with a cone layer thickness of 0.18–0.23 mm (approximately one-quarter to one-third of total eggshell thickness). The thicker group measures 1.13–1.30 mm, reaching up to 1.54 mm including ornamentation, with a cone layer thickness of 0.24–0.33 mm (approximately one-quarter of total thickness). The cones are short and conical, with obvious gaps between them, and several cones are typically clustered together (Fig. 1A–B, D–E). Pore canals are straight and tubular in radial view (Fig. 1B).

Oofamily Ovaloolithidae Mikhailov, 1991
Oogenus *Ovaloolithus* Zhao, 1979
Oospecies *Ovaloolithus* oosp.

Specimens: Eggshell slice IVPP V 31376.2–4 and twelve eggshell fragments (V 31376.1).
Locality and Horizon: Nanhu Gebi, Hami; Subashi Formation (?), Upper Cretaceous.

Description: Eggshell thickness ranges from 2.35–2.47 mm. The microstructure is compact, composed of distinct cone and columnar layers (Fig. 1F–H). The cone layer is incomplete in radial section due to weathering. The columnar layer consists of inner and outer zones: the inner zone (1.00 mm thick) comprises slender prismatic calcite crystals and accounts for approximately two-fifths of total eggshell thickness, while the outer zone exhibits fan-shaped or pinna-shaped crystals arranged radially. Pore canals are nearly straight and unevenly distributed in radial section (Fig. 1G, H).

The eggshell microstructure displays typical ovaloolithid characteristics. Oospecies of ovaloolithid eggs have traditionally been distinguished by the position and number of stripes in the inner and outer zones of the columnar layer. However, detailed observation of numerous thin sections reveals that these stripes represent unstable characteristics unsuitable for oospecies identification within Ovaloolithidae. A comprehensive classification of global ovaloolithid specimens, including those from Hami, will be addressed in a separate article; thus, the Hami specimens are here considered an undetermined oospecies.

Discussion

Dinosaur eggs were first discovered in Xinjiang during the 1960s (Zhao, 1980). Fang et al. (2009) described dinosaur eggshells (*Pinnatoolithus sangequanensis*) from the Upper Cretaceous Wulunguhe Formation in the Junggar Basin, which Zhao et al. (2015) later synonymized with *Ovaloolithus* and revised to *Ovaloolithus sangequanensis*. Zhang and Wang (2010) described dinosaur eggs from the Subashi Formation in the Turpan Basin (Zhai et al., 1978), naming them *Ovaloolithus turpanensis*. The discovery of dinosaur eggshells in Nanhu Gebi represents a major paleontological breakthrough following the 2020 dinosaur bone discovery.

The Nanhu Gebi assemblage, comprising *Elongatoolithus elongatus* and ovaloolithids, significantly expands the paleogeographic distribution of these two ootaxa. In China, elongatoolithid and ovaloolithid eggs are known from the Pingling Formation in the Nanxiong Basin, the Jingangkou Formation in the Laiyang Basin, and the Sigou Formation in the Xichuan Basin, all dated to the middle–late Late Cretaceous (Campanian–Maastrichtian) (Wang et al., 2012). Therefore, the egg-bearing strata in Nanhu Gebi should similarly be assigned a middle–late Late Cretaceous age. Whether these strata can be correlated with the Subashi Formation in the Turpan Basin requires further investigation.

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Figure Caption

Fig. 1 Microstructure in radial section of dinosaur eggshells from Hami. A-E. *Elongatoolithus elongatus*: A-C. Thinner eggshell (0.85-1.12 mm) composed of cone and columnar layers with an indistinct boundary between them, showing clustered cones with clear gaps and straight tubular pore canals (B); D-E. Thicker eggshell (1.42-1.54 mm including ornamentation) with unevenly distributed ornamentation showing slight undulations (E). F-H. *Ovaloolithus* oosp.: Incomplete cone layer, inner and outer zones of the columnar layer, slender prismatic calcite crystals in the inner zone and fan-shaped or pinna-shaped crystals in the outer zone, nearly straight pore canals (G), and unevenly distributed pore canals (H). A-E: IVPP V 31375.2-6; F: V 31376.2; G-H: V 31376.3. Scale bars = 200 m.

Note: Figure translations are in progress. See original paper for figures.