

山东莱阳晚白垩世恐龙蛋化石一新类型¹⁾

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山东莱阳是中国最早发现的含有丰富的晚白垩世恐龙及恐龙蛋化石产地。上个世纪 50 ~ 60 年代,周明镇(1951,1954)及杨钟健(1954,1959,1965)对莱阳首次发现的恐龙蛋化石进行了研究。1974 年,赵资奎、蒋元凯在前人工作基础上,采用显微镜技术方法重新研究了莱阳恐龙蛋壳的显微结构,结果发现它们的显微结构有很大差异。根据赵资奎(1975)提出的恐龙蛋分类方法(Parataxonomy),将莱阳地区已发现的恐龙蛋分别归入圆形蛋科(Spheroolithidae)、椭圆形蛋科(Ovaloolithidae)和长形蛋科(Elongatoolithidae)等 3 个科,共 5 个属 12 个种(赵资奎,1979,1993)。最近,大连自然博物馆在整理馆存的化石标本时,发现有 4 枚形状为扁圆形的恐龙蛋化石是 1973 年 10 月从山东莱阳将军顶采集到的。根据目前有关莱阳地区晚中生代地层划分修订的标准(胡承志等,2001),这些标本的出土层位应为上白垩统王氏群将军顶组。我们的初步观察表明,蛋化石的形状、大小及其蛋壳显微结构特征与上述已报道的莱阳恐龙蛋 3 个类群的明显不同,在此简单记述,以期对莱阳地区晚白垩世恐龙蛋群的综合研究提供些许资料。

网形蛋科 Dictyoolithidae Zhao, 1994

网形蛋属 Dictyoolithus Zhao, 1994

修订属征 蛋化石扁卵圆形或扁圆形。蛋壳层由形状很不规则的基本结构单元重叠一起构成,排列松散。气孔道形状不规则。

蒋氏网形蛋(新种) Dictyoolithus jiangi oosp. nov.

(图 1 ~ 2)

释名 种名 jiangi 赠给已故古生物学者蒋元凯先生,表彰他在开展中国恐龙蛋专题研究所做的贡献。

正型标本 4 枚完整程度不同的蛋化石,大连自然博物馆标本编号:D737, D738, D739, D740。

地点和层位 山东莱阳将军顶,上白垩统王氏群将军顶组下部。

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特征 蛋壳一般由 2~3 个长短不一的基本结构单元重叠一起组成;在某些部位,蛋壳层则由 3~4 个相对比较短小的基本结构单元重叠一起组成;蛋壳外表面的气孔形状不规则。

蛋化石描述 根据蛋化石采集者记录提供的情况,这 4 枚蛋在同一地点被发现,可能是一窝蛋,或代表一窝蛋的一部分(图 1)。由于在发掘时没有注意到这 4 枚蛋化石的埋藏位置,现在已无法确定它们在蛋窝中原来的排列形式。蛋化石呈扁圆形,有的比较扁平。这可能是它们在石化过程中受到了外力的压挤,因而呈现出不同程度的变形。D738 和 D739 两枚蛋比较完整;其余的两枚蛋则在从地层中取出时受到了不同程度的破坏,大部分蛋壳都已脱掉。虽然 D737 破损比较严重,但其大小及外形轮廓仍很清楚。蛋的长径和最大横径测量见表 1。



图 1 蒋氏网形蛋(新种)(D737, D738, D739, D740),
标尺 = 30 mm

Fig. 1 *Dictyoolithus jiangi* oosp. nov. (D737, D738, D739, D740),
scale bar = 30 mm

表 1 蒋氏网形蛋(新种)大小测量

Table 1 Measurements of *Dictyoolithus jiangi* oosp. nov. (mm)

编号 No.	长径 Long diameter	横径 Equatorial diameter	形状指数(%) Egg shape index
D737	131	118	90.1
D738	144	124	86.1
D739	136	123	90.4
D740	126	110	—

蛋壳呈暗灰色,外表面无纹饰,比较平滑。在低倍镜下观察,可见外表面有近乎圆形、长椭圆形、方形、马蹄形或不规则形的气孔(图 2A),但分布疏密很不均匀,某些部位气孔很少,有的甚至没有。气孔大小不一,最大气孔直径为 0.3 mm,最小的为 0.04 mm。

蛋壳厚度 1.50~1.65 mm。径切面显示,蛋壳的基本结构单元像树枝那样呈不规则分枝。在锥体处开始分裂为两枝,有时其中的一枝又再分裂成 2 个侧枝。每个基本结构单元长短不一,排列松散。通常由 2 个或 3 个长短不一的分枝基本结构单元叠加一起,由里向外延伸至蛋壳外表面(图 2C)。在某些部位,蛋壳层则由 3~4 个相对比较短小的分枝基本结构单元重叠一起组成(图 2D)。

蛋壳基本结构单元之间有比较大的、不规则形腔隙(气孔道)(图 2B~D),其间距一般

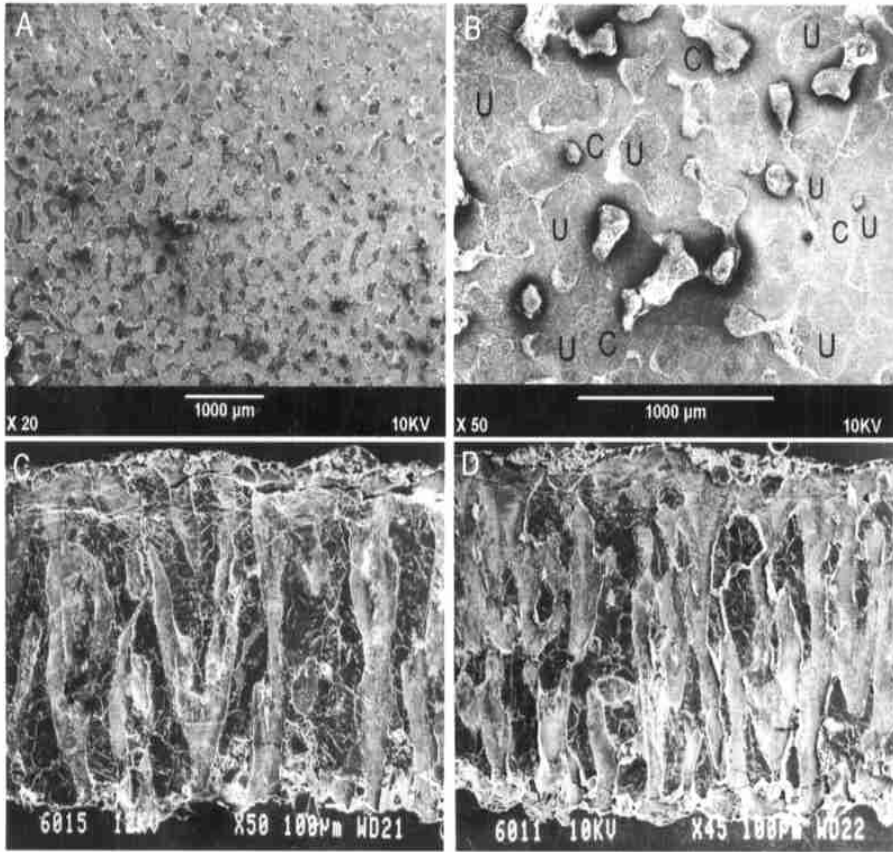


图2 蒋氏网形蛋(新种)蛋壳显微结构

Fig. 2 *Dictyoolithus jiangi* oosp. nov.

A. 蛋壳外表面, 示不规则形气孔 Outer surface, showing pores of various shapes in the outer surface of the eggshell; B. 靠近蛋壳外表面处的弦切面, 示蛋壳基本结构单元(U)及气孔道弦切面(C)形状 Tangential view near the outer surface of the eggshell, showing basic structural units (U) and pore canals (C); C~D. 蛋壳径切面, 示蛋壳基本结构单元及气孔道的形状和排列特征 Radial view of eggshell, showing size, shape and arrangement of the basic structural units, and type of pore canal system

在 0.2~0.5 mm 之间。对蛋壳不同水平的弦切面观察, 基本结构单元和气孔道弦切面的形状各式各样。尤其是那些基本结构单元的弦切面, 有近乎圆形、S 形或不规则形等(图 2B), 在蛋壳外表面处, 蛋壳基本结构单元之间相互连结、融合。因此贯穿在蛋壳层中的气孔道有的在蛋壳外表面处被封闭起来, 而那些没有被封闭的则开口于蛋壳外表面, 直接与外界相通。由于蛋壳基本结构单元呈不规则形分枝, 排列松散, 因此在这些基本结构单元之间的腔隙非常发育, 形状极不规则。它们与蛋壳外表面的气孔组成一个复杂的通气孔系, 为胚胎发育呼吸时的通气孔道。

比较与讨论 本文记述的山东莱阳蛋化石的长径平均为 137 mm, 最大横径平均为 121.7 mm, 蛋的形状指数为 88.8; 蛋壳层一般由 2~3 个不规则形分枝的基本结构单元重叠一起组成。根据这些特征可将本文记述的标本归入网形蛋科(Dictyoolithidae)。

Dictyoolithidae 是赵资奎(1994)根据在河南省西峡县白河湾赤水沟(No. 79001)和内乡县赤眉乡石板沟(No. 79007)两个地点发现的蛋化石标本建立的,包括一个属 2 个种——*Dictyoolithus hongpoensis* 和 *D. neixiangensis*。产于西峡县的 *D. hongpoensis* 的主要特征是蛋壳厚度为 2.5~2.8 mm,蛋壳层由 5 个以上的不规则形基本结构单元相互重叠组成;发现于内乡县的 *D. neixiangensis* 的主要特征是蛋壳的厚度为 1.5~1.7 mm,蛋壳层仅由 2~3 个不规则形的基本结构单元重叠一起组成。可以看出,本文记述的山东莱阳蛋化石的特征与 *Dictyoolithus neixiangensis* 的比较接近。然而本文记述的标本,在蛋壳的某些部位由相对比较短小的 3~4 个不规则形基本结构单元重叠一起组成;蛋壳外表面的气孔形状很不规则,分布疏密很不均匀。根据这种情况,我们将本文记述的山东莱阳蛋化石定为一新种,命名为蒋氏网形蛋(*Dictyoolithus jiangi* oosp. nov.)。

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A NEW OOSPECIES OF THE DINOSAUR EGGS (DICTYOOLITHUS) FROM LAIYANG, SHANDONG PROVINCE

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Key words Laiyang, Shandong, Upper Cretaceous, Jiangjunding Formation, Dinosaur egg

Summary

A new oospecies of dinosaur eggs, *Dictyoolithus jiangi* oosp. nov., is briefly described in the present paper. The material was collected in the Upper Cretaceous Jiangjunding Formation of Laiyang, Shandong Province in 1973.

Dictyoolithidae Zhao, 1994

Dictyoolithus Zhao, 1994

Emended diagnosis Eggs, flat oval or oblate in shape. Eggshell layer of superimposed basic structural units loosely disposed. Pore canals irregular.

Dictyoolithus jiangi oosp. nov.

(Figs. 1~2)

Etymology Oospecies name is dedicated to the late paleontologist Yuan Kai Jiang, one of the pioneers in the study of Chinese dinosaur eggs.

Holotype 4 more or less completely preserved eggs (No. D737, D738, D739, D740).

Locality and horizon Jiangjunding village of Laiyang, Shandong Province; lower part of Jiangjunding Formation, Upper Cretaceous Wangshih Group.

Description Four eggs were found very close to each other, apparently representing either a clutch or a partial clutch. The eggs are oblate in shape, two (D738 and D739) of which are more or less complete and the other two are partial (Fig. 1). The outer surface of the eggshell is relatively smooth. On the eggshell surface often a considerable variety of strange pore openings can be observed under a low magnification (Fig. 2A). These pore openings are 0.3~0.04 mm wide. Occasionally, there may be portions of the eggshell surface in which pore openings are few or lacking.

The eggshell thickness varies between 1.5 ~ 1.65 mm. The basic structural units are branched. Each unit divides near its cone and forms two branches, one of which sometimes splits up into two ones, like branches of a tree. The units with wide variation in length are loosely disposed and variously developed (Fig. 2B ~ D). The interstices among the units are rather irregular with a varying diameter, 0.2 ~ 0.5 mm wide. Radial views of the eggshells generally show a peculiar arrangement of growth basic structural units, indicating a very irregular unit deposited on a primary one, or three superimposed units. Occasionally, there are 3 or 4 superimposed relatively shorter units in some portion of the eggshell (Fig. 2D). The units near the outer surface of the eggshell are laterally interlocking, with some tendency to fusion. Therefore, some canals may end blindly before reaching the surface of the eggshell.

Comparative examination of the basic structural units and pore canals in different level of tangential views reveals a considerable variation in shape (Fig. 2B). Although many of the basic structural units are irregular shape, some are nearly circular, and some like S shaped.

Comparison and discussion As described above, the fossil eggs are oblate in shape. The eggshell layer is composed of 2 ~ 3 superimposed basic structural units. It is doubtless that the eggs can be referred to the oofamily Dictyoolithidae that was erected by Zhao (1994) on the basis of eggs from Xixia County (No. 79001) and Neixiang County (No. 79007), Henan Province. It includes the single oogenus *Dictyoolithus* with two oospecies, *D. hongpoensis* and *D. neixiangensis*.

The eggshell thickness of *D. hongpoensis* from Xixia County is 2.5 ~ 2.8 mm. The eggshell layer is composed of five or more superimposed basic structural units. The eggshell of *D. neixiangensis* found in Neixiang County is 1.5 ~ 1.7 mm thick, and the microstructure of the eggshell is similar to *D. hongpoensis*, but with only two or three superimposed basic structural units. It can be seen from the above-mentioned characters of Laiyang eggshell that it is more similar to *D. neixiangensis* than to *D. hongpoensis*. However, there are 3 or 4 relatively shorter superimposed units in some portion of the Laiyang eggshell. The pore openings on the outer surface show more variety in shape. Judging from all the features we designate the Laiyang egg fossils studied here as a new oospecies of *Dictyoolithus*: *Dictyoolithus jiangi*.

References

- Chao T K (赵资奎), Chiang Y K (蒋元凯), 1974. Microscopic studies on the dinosaurian eggshells from Laiyang, Shantung Province. *Sci Sin*, 17(1): 73 ~ 90
- Chow M C (周明镇), 1951. Notes on the Cretaceous dinosaurian remains and the fossil eggs from Laiyang, Shantung. *Bull Geol Soc China*, 31: 89 ~ 96
- Chow M C (周明镇), 1954. Additional notes on the microstructure of the supposed dinosaurian egg shells from Laiyang, Shantung. *Sci Sin*, 3(4): 523 ~ 525
- Hu C Z (胡承志), Cheng Z W (程政武), Pang Q Q (庞其清) et al., 2001. *Shantungosaurus giganteus*. Beijing: Geol Publ House. 1 ~ 139 (Chinese with English abstract)
- Yung C C, 1954. Fossil reptilian eggs from Laiyang, Shantung, China. *Sci Sin*, 3(4): 505 ~ 522
- Yung C C (杨钟健), 1958. The dinosaurian remains of Laiyang, Shantung. *Palaeont Sin, New Ser C*, (16): 1 ~ 138
- Yung C C (杨钟健), 1959. On a new fossil egg from Laiyang, Shantung. *Vert PalAsiat (古脊椎动物学报)*, 3(1): 34 ~ 35
- Yung C C (杨钟健), 1965. Fossil eggs from Nanhsiung, Kwangtung and Kanchou, Kiangsi. *Vert PalAsiat (古脊椎动物学报)*, 9(2): 141 ~ 189
- Zhao Z K (赵资奎), 1975. The microstructures of the dinosaurian eggshells of Nanxiong Basin, Guangdong Province (1) — On the classification of dinosaur eggs. *Vert PalAsiat (古脊椎动物学报)*, 13(2): 105 ~ 117 (in Chinese)
- Zhao Z K (赵资奎), 1979. The advancement of research on the dinosaurian eggs in China. In: IVPP, NGPI eds. *Mesozoic and Cenozoic Redbeds in Southern China*. Beijing: Science Press. 330 ~ 340 (in Chinese)
- Zhao Z K, 1993. Structure, formation and evolutionary trends of dinosaur eggshells. In: Kobayashi I, Mutvei H, Sahni A eds. *Structure, Formation and Evolution of Fossil Hard Tissues*. Tokyo: Tokai Univ Press. 195 ~ 212
- Zhao Z K, 1994. Dinosaur eggs in China: on the structure and evolution of eggshells. In: Carpenter K, Hirsch K F, Horner J eds. *Dinosaur eggs and babies*. Cambridge: Cambridge Univ Press. 184 ~ 203