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Revisiting Sabath's "Larger Avian Eggs" from the Gobi Cretaceous

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In 1991, Sabath described “larger avian eggs” from the Upper Cretaceous Barun Goyot and Djadokhta Formations of
Mongolia. These were later included in the ootaxon *Gobioolithus major*. Here we recognize the larger avian eggs of Sabath as a distinct ootaxon, *Styloolithus sabathi*, oogen. et oosp. nov. These eggs differ from those of *Gobioolithus* in being larger (70 by 32 mm) and more elongate. Microscopically, the shell bears a third layer (possible external zone) thicker than the mammillary layer and nearly as thick as the second layer (possible squamatic zone); the continuous layer (including layers two and three) to mammillary layer thickness ratio is 3.1:1. Within the clutch, the tightly spaced eggs stand with their long axes steeply inclined. Adult remains are associated with two clutches, suggesting an incubation mode similar to that of troodontid maniraptorans, where adults sat atop largely buried eggs. *S. sabathi* provides evidence that relative egg size in Mesozoic non-ornithuromorph birds had increased markedly from the non-avian theropod condition in oviraptorids and troodontids, but had not yet reached the modern egg-adult proportions of Neornithes. Sediment-bound upright eggs appear common to Enantiornithes and more basal avians, suggesting that like non-avian theropods, these birds lacked chalazae, the chords of albumen allowing egg rotation in modern birds. Absence of this simple structure may have restricted these basal birds to ground nesting in areas with appropriate substrates and not permitted the type of nesting diversity found in Neornithes. Neornithes are the only Mesozoic clade of Dinosauria to nest completely free of sediment; this may have played a crucial role in their surviving the K-Pg mass extinction event.

Key words: Aves, Enantiornithes, ootaxa, birds, reproduction, eggs, Cretaceous, Mongolia.

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