

BIOLOGY AND FUNCTIONAL MORPHOLOGY OF *CLOUDINA*, THE EARLIEST KNOWN METAZOAN WITH A MINERALIZED SKELETON

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The earliest known skeletal metazoan, *Cloudina*, was widespread in the late Neoproterozoic. We report here on phosphatized specimens of *Cloudina* sp. from dolomites of the Dengying Formation, 30 m below the first Cambrian skeletal fauna, in the Lijiagou section, Shaanxi Province, China. The specimens exhibit new details of shell morphology and fine structure that offer insights concerning the mechanism of shell accretion and the selective pressures influencing skeletogenesis in metazoans.

Cloudina formed curved to sinuous tubular shells 0.2–8 mm in diameter and up to 4 cm in length. They consist of numerous thin (5–10 μm) calcareous layers, each in the form of a slightly flaring tube. New layers were deposited above and to one side of the previous layer, giving rise to a series of eccentrically nested shell laminae. Some of the phosphatized layers exhibit tight folding or wrinkling that may have been primary (imparting additional strength) or secondary (related to plastic deformation of organic-rich shell material). Pore space existed between terminal thin flanges, but concentric ridges may have served to strengthen the free standing portions of shell layers. SEM and cathodoluminescence of polished thin sections also reveal that each shell layer may itself have been constructed of an organized layering of organic matrix and carbonate, suggesting a fairly sophisticated biologic control over shell formation. The presence of circular holes, the size of which correlates positively with tube diameter, moreover, strongly suggests that one function of the shell was to protect the *Cloudina* organism from predatorial and/or parasitic attack.

The taxonomic status of *Cloudina* remains problematic. Rare specimens of the Lijiagou *Cloudina* which show two younger tubes growing within an older single tube suggest that the organism was capable of asexual reproduction by longitudinal fission. Such a latent tendency is not compatible with previously proposed affinities with polychaete worms.