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Research Advances

Eopriapulites Sphinx—The Oldest Priapulid-Like Scalidophoran Animal

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Objective

Priapulid belong to scalidophoran and is located in the Cycloneuralia branch of the Ecdysozoa. It has survived for more than 50 million years, is a real "living fossil". Priapulid was extremely prosperous in the Cambrian period. It is a small phylum in the modern ocean; only 18 current types have been described. In the Cambrian life, priapulid is one of the most important living organisms in the sea of Cambrian. The abundance of priapulid is generally much higher than that of other animals, or only after the arthropod, and its differentiation is only after the arthropod and the porous sponge. The priapulid of the Early Cambrian in Chengjiang fossil Lagerstatte has 16 basic groups of seven genera. The study on priapulid fossils has made great breakthrough, but the research on the origin of priapulid has made little progress. In theory, priapulid may appear in the Cambrian explosion or even earlier, but currently there have been no reliable fossil record to prove it. Fortunately, we have discovered the oldest well preserved priapulid-like scalidophoran animal of *Eopriapulites sphinx* Liu & Xiao 2014 in the Meishucun stage Kuanchuanpu Formation of southern Shaanxi Province, which is likely to be one of the most ancient ecdysozoa and scalidophoran animals.

Methods

The priapulid fossils were extracted using standard acetic acid maceration techniques. The rock samples were first crushed into small pieces (2−3 cm in diameter), and then immersed in 5%–10% acetic acid and residues were retrieved regularly after seven days of reaction. The undissolvable residues were dried naturally and handpicked under a binocular microscope for microfossils. The microfossils were picked out and mounted on aluminum stubs for scanning electron microscopy.

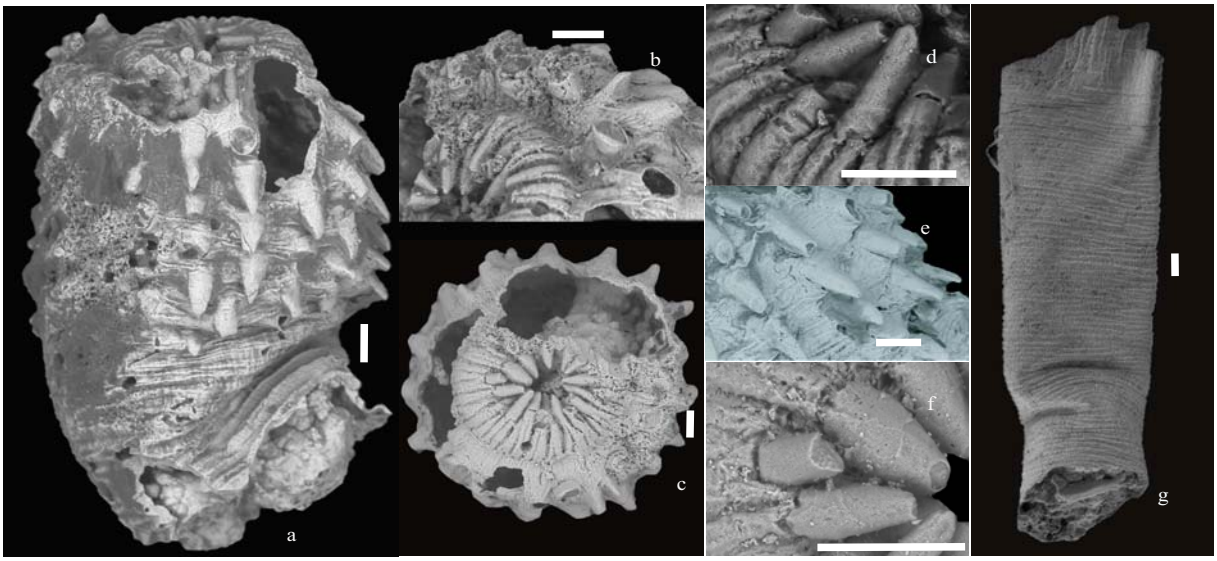

Fig. 1. Morphology of *Eopriapulites sphinx.*
(a), Lateral view to show scalids in rows and coronal scalid; (b), Part of the oral end showing pharynx and collar of the fossil; (c), Top view to show the arrangement of the pharynx and collar scalids; (d), Close-up of pharynx; (e), Close-up of the introvert scalids; (f), Close-up of oral end showing additional pharyngeal teeth in inverted pharynx; (g), Lateral view of the trunk; All scale bars represent 50 μm.

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Results

After processing more than 10 tons of rock samples, we found a precious fossil and studied it in detail. Morphological analysis shows that the body of *Eopriapulites sphinx* displays a cylindrical shape and can differentiate into introvert, collar, trunk and tail. The introvert could invert and shrink into the front of the trunk. The proboscis is located in the top center of introvert with scalids which were arranged in 18 longitudinal rows. After the introvert and collar is the trunk, with many rings but not segmented. The scalids of *Eopriapulites sphinx* show the particular hexaradially symmetrical bodyplan, but priapulids in present and even in Chengjiang biota generally have 20–25 rows of scalids on the introvert, presents pentaradial symmetry.

Conclusions

Eopriapulites sphinx is characterized by an introvert with hollow scalids arranged in 18 longitudinal rows, a collar with 12 coronal scalids, and a pharynx with multiple circlets of pharyngeal teeth (basal circlet with 18 pharyngeal teeth). Thus, the body plan of *Eopriapulites sphinx* has a component of hexaradial symmetry, which is similar to the hexaradial arrangement of certain anatomical structures in kinorhynchs, loriciferans, nematoids, and several stem-group scalidophoran fossils.

Furthermore, *Eopriapulites sphinx* also occurs in the Kuanchuanpu Formation and was previously interpreted as a hexacorallian anthozoan, may be another scalidophoran characterized with hexaradial symmetry. The widespread distribution of hexaradial symmetry indicates that the body plan of ancestral cycloneuralians may have a component of hexaradiality. If panarthropods are nested within paraphyletic cycloneuralians as suggested by molecular phylogenetic analyses, it is likely that the ancestral ecdysozoans may have been a legless worm possibly with a component of hexaradial symmetry.

The significance and value of the study are far more than that, and many problems still need to be further studied.

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