

Research Advances

Xixiang Biota—Another Rare Scientific Window of the Cambrian Explosion

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Objective

The Xixiang biota is a specially preserved micro oryctocoenose discovered in the Lower Cambrian Kuanchuanpu member of Dengying Formation at Zhangjiagou section of Xixiang County in southern Shaanxi Province. The Kuanchuanpu member is a set of neritic carbonate sedimentary formation containing phosphorus and silicon. Its lithology is mainly grey massive fine crystalline, dense massive phosphorus-containing biolithite and flaggy microcrystalline-crystalline dolomitic limestone. It is in a conformable contact with the underlying upper dolomite member of Dengying Formation and a parallel unconformable contact with the overlying Guojiaba Formation. The fossil assemblages of the Xixiang biota could be compared with the microfossils from the Lower Cambrian Meishucun Stage, and their age is the Early Cambrian Meishucun Stage.

Methods

The fossils from the biota 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 (SEM).

Results

More than ten tons of rock samples were crushed and immersed; and tens of thousands of microfossils were extracted from them. About 7600 electron microscope photographs which were scanned by SEM, the inner and outer morphological characteristics of microfossils were

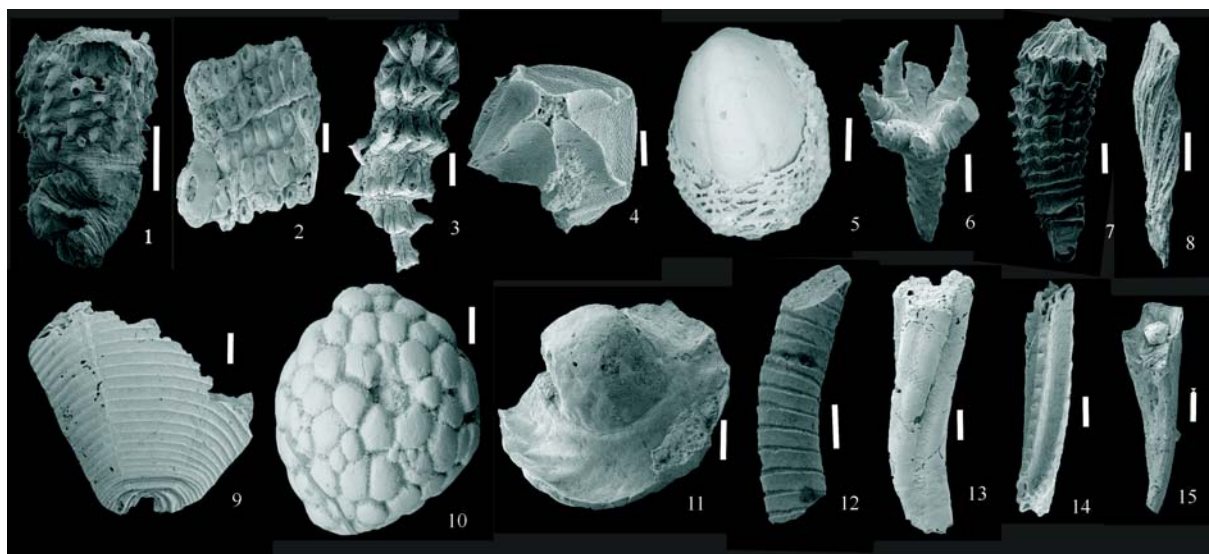


Fig. 1. The SSFS from Xixiang boita.

(1), Priapulida; (2,3), Kinorhyncha; (4), Punctatus; (5), Maikhanellid; (6), Acanthocassis; (7), Quadrapyrgites; (8), Cambricodium; (9), Hexangulacnulariids; (10), Embryos; (11), cap-like fossil; (12), tubular fossil; (13), Anabaritids; (14), Carinachitids; (15), Protoconodont; All scale bars represent 200 μm.

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researched. The energy dispersive analysis method was also been used in some particular fossils to identify their composition, and micro CT was used to study the internal structure of a significant fossil—*Eopriapulites sphinx* sp. nov.. About 80% of the total fossils are tubular microfossils, including Hyoliths and some other species; 10% are Quadrapyrgites, Monoplacophora and algae fossils; the specific species Priapulida and Kinorhyncha just accounts for less than 1% of the fossils from this biota; the rest 9% are other species.

Conclusions

(1) The main fossil types of the Xixiang biota include Priapulida, Kinorhyncha, Hyoliths, Quadrapyrgites, Punctatus, Anabaritids, Acanthocassis, Monoplacophora, Siphonochitids, Hexangulacouleriids, Carinachitids, Paracarinachitids, Chancelloriids, Protoconodont, Cambroclavids, Sponges, Cambricodium, Spirellus columnaris, Spheroidal fossils and Embryos. A total of 20 categories and cover the most common fossil taxa in the Early Cambrian.

(2) Two significant kinds of fossils (Priapulidea and Kinorhyncha) are also recovered from the Xixiang biota. They belong to Scalidophora and Meishucun stage is the lowest output layer in the world. They may help to identify the common ancestor of Ecdysozoa and the main branch events.

(3) Quadrapyrgites is the sister group of Punctatus, and is abundant in this biota. The classification, internal structure, and growth pattern of Quadrapyrgites have been

discovered by SEM and energy dispersive analysis method. Based mostly on the Xixiang specimens, the individual developmental sequence of Quadrapyrgites has been reconstructed, including embryonic development stage, larvae stage and post-embryonic development stage. The affinity of Quadrapyrgites is considered related with coronate scyphozoans after a lot of researches.

(4) Tubular microfossils contain the largest number of this biota; including Anabaritids, Hyoliths, Siphonochitids and Polyp. The evolution of symmetric modes of the Anabaritids has been studied in detail. And the reproductive mode of Polyp is gemmation.

(5) As a group of the oldest Monoplacophora, Maikhanellids of this biota has been divided into six genera, and a new species *Mediata xixiangensis* sp. nov. has been discovered and described in Xixiang biota. Acanthocassis is a kind of helmet-like fossil and may represent primary polyp or sedentary planula rather than outer hard parts of metazoans. Cambricodium is classified into cyanobacteria, and may provide a new niche with new food resources and thus possibly accelerate the evolution of the metazoan in the Early Cambrian.

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