

地質学セミナー

Geology seminar

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 Advanced Research B

Ediacaran multicellular red algae and larvae and eggs from the Neoproterozoic black phosphorite in South China

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Metaphytes and metazoans are often considered to evolve more or less contemporaneously during the Late Precambrian. Both microfossils of multicellular red algae and larvae of early possible Arthropoda have been identified in the lower black facies of the phosphorite deposited in the Doushantuo Formation in Weng'an of the Guizhou province, southern China.

Thallus of the erect frond of the red algae, in morphology from blade like to lanceolate, with margins smooth or dentate, consisting rectangular and rounded cells arranged in cell filaments which roughly parallel to each other. The fronds are divided into several tissue units by fibrous bands or network-like fibrous structure. Blades arise singly from a small knife-point shaped or prolate rhizoid. Stipe absent or minute. These morphological details indicate that the fossils are related to extant species in the genus *Porphyra*.

Compared with previously reported microfossils, our animal fossils are small (about 100 μm in diameter) and intriguing because both the pre-hatching stages and the larval stages are preserved. With the application of the phase contrast synchrotron radiation X-ray tomographic microscopy (PCSRXTM) which has allowed non-destructive study of exterior and interior features, we've obtained complete three-dimensional images of these microfossils which share a number of characteristics with the Arthropoda, including head with mouth and eyes and segments with appendages. Three-dimensional visualizations of embryos from the pre-hatching stage to the larval stage not only partially resolve outstanding questions about the phylogenetic relationships of the phosphatized embryos from the late Neoproterozoic but also provide insight into the diversification of metazoan phyla.

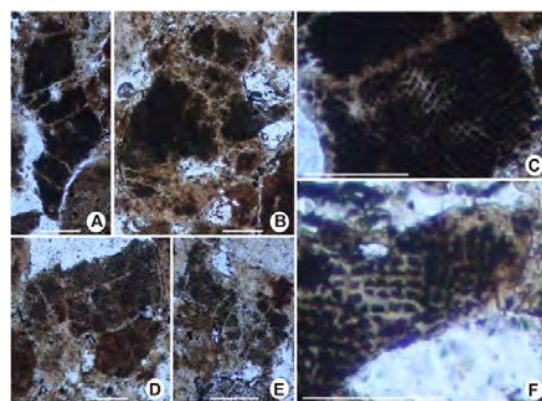


Figure 1

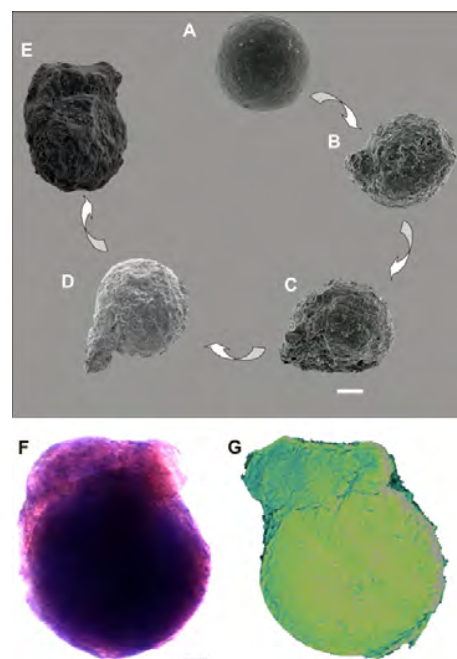


Figure 2

Figure 1. Images of the new genus. A. *Bangiaceae* n. gen. n. sp. A with blade-like germling and knife-point shaped rhizoid. B. *Bangiaceae* n. gen. n. sp. B with hand shaped germling and rhizoidal prolate holdfast. C. Magnified view of A, showing small rectangular cells arranged in unbranched cell filaments. D. *Bangiaceae* n. gen. n. sp. C with a gracile cylindrical stipe. E. *Bangiaceae* n. gen. n. sp. D. with lanceolate thallus and podgy cylindrical stipe. F. Magnified view of protuberance in B. Scale bar represents 100 μm .

Figure 2. A-E: Phosphatized embryos and larvae from the Ediacaran Doushantuo Formation in Weng'an, Guizhou, southern China. (A) A complete embryo with the outermost smooth thin shell layer. (B) The elongated embryo with a tuber in organogenesis stage. (C) The pre-hatching of embryo with possible head and eye. (D) The pre-hatching of embryo with one part of larva body. (E) A hatched larva body and its shell. F-G: PCSRXTM scans of the hatched larva body and its chorion. (F) PCSRXTM external 3D rendering. (G) PCSRXTM virtual section, showing the broken chorion and part of the larva body was still in chorion. Scale bar, 20 μm .