N/C ratios in embryo-like fossils preserved in Ediacaran Doushantuo Fm in Weng'an region, South China

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The Ediacaran period recorded one of the most dramatic biological episodes in Earth's history. The Ediacaran Doushantuo Formation (Fm) contains lots of fossils. Xiao and others (1998) interpreted globular fossil among them as embryo of oldest arthropod (animal). However, Bailey and others (2007) pointed out that sulfur-oxidizing-bacteria have similar features, 500 micro-meter in diameter, 20 micro-meter-thick envelope and cleavage-like division. These interpretations depend only on the morphology of fossils, so that other criteria should be required.

Modern life has individual nitrogen/carbon (N/C) ratios. Based on bulk composition, N/C ratio in arthropod is ca. 0.24 and bacteria have ca. 0.15, which is useful for discrimination between them. We tried to classify globular fossil by N/C ratio in organic matter.

The Doushantuo Fm in Weng'an region consists of Ediacaran strata successively, contain phosphorite and dolostone and black shale and lots of fossils, which is suitable for study of environmental and biological changes in the Ediacaran. Phosphorite rocks contain many globular fossil and we made thin sections from these rocks. We used hydrochloric acid for dissolution of minerals covering organic matter. The N/C ratios in exposed organic matter are analyzed by Nano-SIMS at Ocean Research Institute, University of Tokyo.

Spatial distribution of nitrogen and carbon shows correlations between them, which indicates the nitrogen is originated from organic matter. N/C ratios in a globular fossil range from ca. 0.10 to ca. 1.05. Because individual analytical spots are only 10-40 micro-meter away each other, alteration and ripeness of organic matter cannot account for this variation, and suggests that the variation represent original difference before fossilization. However, comparison of the N/C ratio variation with the internal structure should be required. Assuming that bulk N/C ratios in globular fossil range between 0.10 and 1.05, we compare our result with modern life. Echinoderm (N/C ratio = 0.94) and Fungi (N/C ratio = 0.08) correspond to bulk composition in globular fossil. However, the number of our analytical spots is insufficient and ripeness of organic matter decreases original N/C ratio. The estimate of degree of ripeness and the influence in variation of N/C ratios in globular fossil should be required.