Shallow and deep seas after the last Snowball Earth

Akihiro Kano[1]

[1] Earth and Planetary Sys. Sci., Hiroshima Univ

Oceanic structure after the last Neoproterozoic glaciation (Marinoan; 600-580Ma) was recorded in lithology, chemistry and stable isotopes in strata of the South China Block. High nutrient contents reflected to microbial bloom in shallow water. On the other hand, sulfate-reducing bacteria predominated the biofacies in anoxic deep water. Carbon dioxide build-up during the Snowball period lasted for millions of years. This caused extreme global warming and stopped deep-water circulation. Appearance of the Ediacaran Fauna was, at least in the South China, after the recovery of the circulation.

Objects of this study are three sections including the Doushantuo and Gengying Formations (Gucheng, Three Gorge, and Wangchang; western Hubei and northern Hunan), which correspond to shallow marine, shelf, and basinal facies.

Lower part of the basinal Wangchang section exposes dolomitic carbonate facies including pyrite abundantly. It records depleted carbon isotopic composition and high Mn/Sr ratio. These characteristics all indicate glowing anoxic conditions in the marine basin. The anoxic conditions were also srecognized in the Doushantuo Formation in Three George section, which yields a clear evidence of sulfate-reducing bacteria. The overlying Dengying Formation represent sharp inclrease in carbon isotope and decrease in Mn/Sr ratio, which indicates rapid oxydizing of the depositional environments. This is probably associated from recovery of deep water circulation by decreasing carbon dioxide pertial pressure. The carbonate was still dominated by dolmite in seawater of low sulfate, which was largely consumed by the extensive sulfate reduction. Upwelling of high nutrient water causes phosphatic-siliceous nodules and ooids. Cyanobacterial microbial mats and biofilms covered in very shallow water under the extremely high biologic production.

This circumstance was best observed in the Dengying Formation of the shallow Gucheng section. It contains phosphate nodule, calcified microbes, and specific textures indicating high productivity. Fenertral structure formed by degassing of photosynthetic oxygen or bacterially produced carbon dioxide. Sickle-cell structure and coated bubble are originated from biofilm on the water surface. The latter was formed on the coast by tidal force. The bubble was coated with biofilm, which was preserved by quickly calcification. These structures normally formed in pH over 10. However, this condition contradicts to carbon isotopic records, and therefore needs to be reconsidered.