

Depositional processes and SHRIMP age of phosphate-chert facies of the Doushantuo Formation in the type Sinian, South China

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The Doushantuo Formation, a stratigraphic unit of the Sinian (upper Neoproterozoic), is widely distributed in South China. The formation exhibits typical sedimentary characteristics of Neoproterozoic Era and contains well-preserved fossils in phosphate-chert facies. Especially, assemblage including animal embryos found in Wengan (Guizhou province) rewrote the evolutionary records of the Neoproterozoic life.

The Doushantuo Formation in Yangtze George area (the type locality of Sinian) consists of carbonate-siliciclastic sediments of about 295m thick, which overlies on glacial deposits (the Nantuo Formation) and is covered by thick carbonate (the Dengying Formation). This formation is divided into four; the basal cap carbonate (unit 1), bedded mudstone intercalating thin carbonate layers (unit 2), bedded carbonate (unit 3), and bedded mudstone (unit 4). Microfossil assemblages were mainly found from phosphoric chert facies of units 2 and 3, and are mainly composed of filaments (bacteria and algae) and spherical acritarchs. The filamentous microfossils tend to show a concentrated and tangled occurrence associated with pyrite. Pyrite grains with spherical morphologies (framboidal pyrite) fill inside and coat outer surface of microfossils. Phosphate normally occurs in marginal parts of the silicified grains. The textures indicate that the silicification have proceeded from the center of the grains. Extreme fossil preservation resulted from rapid mineralization in a local ambient environment induced by microbial activity. The proposed model suggests that the most important reactions were decompositions of Fe-P and silicate-sulfate complexes under a reduced condition. These reactions first resulted in precipitation of apatite, and then microbial sulfate reduction induced precipitation of opal-CT and pyrite in microbial mats or around sediment-water interface.

Apatite of the study material was dated using ion microprobe (SHRIMP II). The obtained U-Pb age of about 750Ma is much older than a recent age dated for phosphate from Wengan (about 600Ma), and indicates that the Nantuo glaciation is correlated to the Sturtian glaciation. The difference of these two ages indicates reconsideration of regional stratigraphic correlation and may reflect to difference in fossil assemblages between the type section and Wengan.