

ORIGIN OF PYRITE NODULES AT THE TOP OF THE NANTUO DIAMICTITES, SOUTHERN CHINA

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Pyrite nodules up to 20 cm in diameter are found at the top of the Marinoan (~635 Ma) Nantuo glacial diamictite as well as in the cap dolostones and shale/siltstones in the lower Doushantuo Formation in eastern Guizhou, southern China. Earlier studies on the occurrence and stable sulfur and triple oxygen isotope composition of barite in the cap dolostones concluded that seawater sulfate concentrations in shallow oceans in the South China Block were low during the deposition of the cap dolostones. Therefore, the occurrence of pyrite nodules suggests two scenarios: 1) Formation before the precipitation of the cap dolostone, when seawater sulfate concentration was high enough to result in pyrite formation in sediments, either via direct precipitation from a euxinic water column or through in-sediment sulfate reduction; or 2) Diagenetic formation via sulfate reduction the precipitation of the cap dolostone when seawater sulfate content became high enough to diffuse into the organic-rich cap dolostone and the underlying diamictite. Field occurrences, petrography, and stable sulfur isotopic compositions of pyrite nodules were studied from a section at Taoying, eastern Guizhou, China. Pyrite $\delta^{34}\text{S}$ values from different nodules varied from 7.3‰ to 60.5‰ at different stratigraphic levels. No stratigraphic trend existed for the $\delta^{34}\text{S}$. Pyrite $\delta^{34}\text{S}$ values were also homogeneous within individual nodules at a 0.3 to 1 cm sampling scales, but were heterogeneous at a 2 mm sampling scale. Homogeneity was not expected from the particular model for pyrite nodule formation in a largely closed or semi-closed environment. Therefore, pyrite formation likely occurred prior to cap dolostone deposition, when seawater sulfate rose appreciably to support extensive sulfate reduction in sediments. Differential cementation and compaction of the pyrite-bearing sediments may have produced the nodular shape of the pyrite deposit. Future work needs to test this alternative model for pyrite nodule formation at multiple Marinoan sections in South China.