Hydrothermal contributions to the Marinoan cap carbonate in South China

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Two generations of carbonate cements (C1 and C2) occur in the idiosyncratic structures of Marinoan cap carbonate at Wuhe section in Guizhou, South China. C1 is dolomite cements along the wall of cracks or cavities and C2 is equant calcite spars located in the center. Meanwhile, four silica types can be distinguished. The petrographic features show that C1 cement postdated micritic dolomite wallrock but predated silica, while C2 cement deposited at the latest stage.

The geochemical data of wallrock and C1 cements are similar in REE + Y patterns and the range of $\delta^{13}C$ and $\delta^{18}O$ values, indicating that C1 cements precipitated from the same fluid as the micritic wallrock near the sediment seawater interface. Their REE + Y patterns are characterized by minor MREE-enrichment, positive Ce and Eu anomalies, large variations in Y/Ho ratios, which were probably deposited from seawater but influenced by Fe-Mn oxyhydroxides during early diagenesis. Positive Ce anomalies and Th/U ratios of wallrock suggest the anoxic depositional conditions. The positive correlation between $\delta^{18}O$ and $\delta^{13}C$ values in the wallrock may attribute to the alteration by the post-depositional fluids. The petrographic and geochemical features indicate that the idiosyncratic structures attributed to the expansive dolomite cementation which caused overpressure porewater. C2 cements are characterized by obvious MREE-enrichment, positive Eu anomalies and high Y/Ho ratios and unobvious Ce anomalies, which indicate that C2 cement precipitated from the admixture of seawater, porewater and high-temperature hydrothermal fluids. The $\delta^{18}O$ values indicate that the precipitating temperature of C2 cement would be at least 105 ºC, but lower than 120 ºC. The negative correlation between carbon and oxygen isotope compositions in C2 cement probably attributed to destabilization and oxidation of methane seeps in the lower part of sulfate reduction zone. The serve diagenesis in carbonate sediments reflects the unusual fluid chemistry after the global Marinoan glaciation.