Geophysical Research Abstracts
Vol. 20, EGU2018-17105-1, 2018
EGU General Assembly 2018

Early Neoproterozoic 'molar-tooth' carbonate: its origin and significance

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The unusually widespread abundance of early diagenetic 'molar-tooth' (MT) low-Mg calcite microspar is one characteristic feature of the early Neoproterozoic. In this study, MT samples were compared with their surrounding 'bulk' carbonate rock matrix in correlative successions on the North China craton in order to 1) demonstrate their propensity to preserve a primary seawater isotopic signature; 2) test the existing models of the formation of these mysterious early marine cements; 3) together with published data, reconstruct the strontium (and carbon) isotopic evolution of early Tonian seawater.

By comparison to the MT samples, this study also shows that whole rock samples, when carefully selected, show high isotopic fidelity, especially for oxygen and strontium isotopes, but perhaps less so for carbon isotopes which are systematically lower. This supports that the formation of the 'molar-tooth' carbonate can be linked with organic decomposition within microbial mats.

With the data from this study, second-order fluctuations of less than $\sim$0.001 are superimposed on a general rise of the Sr isotopic value from $\sim$0.7052 to $\sim$0.7063 by c. 920 Ma, accompanied by a profoundly negative carbon isotope excursion. Increased chemical weathering has been linked with both climatic and carbon isotope instability, and this study indicates an earlier beginning to such carbon cycle perturbations, which coincide with early stages of supercontinent rifting, as evidenced by the newly dated Dashigou igneous province of North China.