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Stable and radiogenic Sr isotope constraints for barite formation during Marinoan deglaciation

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The combination of radiogenic ($^{87}Sr/^{86}Sr$) and stable Sr ($\delta^{88/86}Sr$) isotope data offers promise in deciphering the origin of sedimentary barites of debated origins. Here, we present new analyses for barites associated with post-Marinoan cap carbonate sequences. Specifically, samples were selected from northwestern Canada, Norway, Brazil and South China and yielded a wide range of $^{87/86}Sr$ ratios (0.7077-0.7120) and $\delta^{88/86}Sr$ values (-0.17 to +0.13‰). The range in the stable Sr values is larger than that for barites analyzed from Phanerozoic marine environments (Paytan et al., 2021). Barites from Canada and Norway preserved the most modern marine-like values (0.7077-0.7083), while samples from Brazil and South China were more radiogenic (> 0.7096) suggesting precipitation from waters with a stronger crustal influence. This inference is supported by a correlation between the Sr isotope systems and the Sr concentration in the barites.

A comparison of our new stable and radiogenic Sr isotope data with previously published triple oxygen isotopes $\Delta^{17}O$, sulfur isotopes $\delta^{34}S$ and $\delta^{138/134}Ba$ isotope analyses for the same barite samples (Crockford et al., 2019) reveals strong correlations with these tracers that can be interpreted as indicating that the barites precipitated from waters that reflect mixing between near shore and marine environments. Barites with the lower range of $\delta^{88/86}Sr$ values reflect those that precipitated from waters of a marine end-member composition as they fall within the range of $\delta^{88/86}Sr$ values in barites precipitated from Phanerozoic seawater (Paytan et al., 2012). We propose that the barites with high $\delta^{88/86}Sr$ values (> 0.13‰) reflect the addition of fresh water in a near-shore environment with higher ^{88}Sr contents. Studies of subglacial discharge waters from Greenland and Alaska also document $\delta^{88/86}Sr$ values that exceed those of local bedrock suggesting that the higher $\delta^{88/86}Sr$ values reflect the leaching of greater amounts of ^{88}Sr from the fine glacial flour bedload sediment (Stevenson et al., 2016; Andrews & Jacobson 2018).

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Crockford et al. (2019) EPSL 519, 234-244.
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