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Sulfide mineralization within modern, deep-sea marine sediments and oxygenation of the early Earth

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The Earth's atmosphere and oceans have not always been oxygenated. The exact pathway and timing of the oxygenation of the Earth's early oceans is poorly constrained, although it appears that oxygenation was essentially complete by the beginning of the Cambrian (545 million years ago). Indeed, the appearance and diversification of the first animals may have been dependent on threshold levels of oxygen. Eventually we intend to use the sulfur isotopic composition of sulfide minerals (iron monosulfides and pyrite) present in sedimentary rocks to reconstruct the oxygenation of Proterozoic oceans, but first must strive to understand sulfide mineral formation in the modern ocean – specifically with reference to certain deep-sea environments.

We examine the sediments of two piston cores collected over the Blake Ridge gas hydrate deposits (offshore southeastern North America) by extracting total sedimentary sulfide using chromium reduction. We use an improved titration procedure to assay for sulfide sulfur concentration that involves addition of an excess amount of potassium iodate/potassium iodide (KIO_3/KI) solution in order to completely oxidize dissolved sulfide to elemental sulfur. Our results show that authigenic sulfide sulfur generally increases in concentration downcore from ~0.05 to peak concentrations approaching 0.4 weight per cent sulfur. These results are consistent with localized sulfide production at about 13 meters and rapid sulfide mineral formation there. We will further test the hypothesis by examining $\delta^{34}S$ values of authigenic sulfide minerals, expecting to see enrichments in $\delta^{34}S$ where peak sulfide concentrations occur.

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