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Sulfide mineralization in deep-water marine sediments related to methane transport, methane consumption, and methane gas hydrates

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Sulfide mineralization in deep-water marine sediments related to methane transport, methane consumption, and methane gas hydrates

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Patterns of sulfide sulfur concentration and sulfur isotopic composition ($\delta^{34}S$) are perhaps related to upward methane transport, especially in sediments underlain by methane gas hydrate deposits. Increased methane delivery augments the affect of anaerobic methane oxidation (AMO) occurring at the sulfate-methane interface (SMI). Sulfate and methane co-consumption results in production of dissolved sulfide at the interface that is eventually sequestered within sulfide minerals (elemental sulfur, iron monosulfide, pyrite).

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. The remaining iodine ions are then back-titrated with sodium thiosulfate solution, avoiding leakage of hydrogen sulfide gas, thus increasing measurement accuracy. 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 the SMI 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 $\delta^{34}S$ near the interface. Discrete horizons showing sulfide mineralization with ^{34}S enrichments potentially record periods of increased methane flux, highlighting an increased role for AMO as a biogeochemical process and perhaps identifying existence of underlying gas hydrates.

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