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A preliminary comparison of the sulfur geochemistry within shallow, continental-rise sediments overlying two gas hydrate terranes

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We compare the authigenic sulfide mineral geochemistry of two, different gas hydrate terranes: the accretionary wedge of the Cascadia continental margin (offshore Oregon) and the passive margin of the Blake Ridge region (offshore southeastern US). We expect diagenetic processes effecting sulfide mineral formation (elemental sulfur, iron monosulfides, and pyrite) within these sediments to respond to differing geologic conditions at each setting. In both settings, methane diffuses upward from gas hydrates to the methane-sulfate interface (SMI), where it is consumed by reaction with sulfate during anaerobic methane oxidation (AMO). This microbially-mediated, diagenetic process produces an interstitial environment conducive to authigenic sulfide mineral formation, so that sulfide minerals tend to be concentrated near the SMI and contain more heavy sulfur (^{34}S). Sulfate reduction occurs simultaneously as sulfate is consumed by microbes utilizing sedimentary organic matter as a foodstuff. In this case, more sulfide mineralization occurs above the SMI, and so that sulfide minerals there should contain more ^{32}S . These competing sulfate-depleting processes potentially produce different vertical distributions of the concentration and sulfur isotopic composition ($\delta^{34}\text{S}$) of sulfide minerals preserved within the sedimentary record.

Preliminary geochemical results from ODP Site 1244 (Cascadia) show a shallower SMI, large concentrations of dissolved sulfide, significant levels of dissolved iron only where dissolved sulfide is low to absent, larger amounts of sulfide sulfur in the sediments, and a similar $\delta^{34}\text{S}$ profile as compared to Blake Ridge sediments. Because methane is consumed by AMO in both settings, we hypothesize that sulfate reduction is responsible for most sulfide mineralization within Cascadia sediments.