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Sulfur isotope biogeochemistry and iron speciation of sediments from the Demerara rise (ODP Leg 207)

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Sediments are carriers of proxy signals for present and past microbial activity. The present study deals with diagenetic processes in the deep biogeochemical sulfur cycle of sediments recovered from Demerara Rise (Leg 207) to identify those reactions that may in part have altered, modified or formed proxy signals by means of inorganic and especially stable isotope geochemical pore water and solid phase investigations. The project focuses on the potential of the sulfur and oxygen isotopic composition and textures of sulfur-containing minerals to reflect the history of biogeochemical reactions in deeply buried sedimentary sequences as well as early diagenetic reactions during black shale formation. Are authigenic pyrite and mono-sulfides indicators for the paleoenvironment? Are deeply buried black shales acting as bioreactors for driving ongoing diagenesis by a deep biosphere via methane as intermediate substrate. Associated with the reactions in the coupled carbon-iron-sulfur cycles is the development of authigenic barite enrichments as indicators for the evolution of dissolved sulfate-barium diffusion fronts in association with methane fluxes derived from deeply buried TOC-rich strata. Additionally, we extract information about metabolic processes from the covariation of S and O isotopes in dissolved sulfate as well as preserved in authigenic barites. It is found from stable isotope analyses that extremely heavy authigenic pyrite and barite above the Cretaceous black shale sequence reflect different sulfate/sulfide pore water gradients caused by temporarely changing methane fluxes from underlying black shales. Pyrite found within the black shales shows a range of isotopic compositions, but within the range found at other settings. Heavy sulfur bearing minerals may be indicative for anaerobic methane oxidation.