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Barium Isotope Signatures of Authigenic Carbonates in Seep Environments

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Barium (Ba) cycling is commonly used to study fluid dynamics in seep environments, but the behavior of barium isotopes in these environments is not well understood. Analyzing barium stable isotopes can improve the use of Ba as a tracer and provide insights into its cycling. However, there is a lack of data on barium isotopes in seep regions of the oceans. In this study, we analyzed the Ba isotopic compositions of authigenic carbonate sample collected from the Black Sea, Congo Fan, Gulf of Mexico, and South China Sea. Our results show significant variations in $\delta^{138/134}$Ba values, ranging from approximately −0.13‰ to +0.37‰, both within individual study sites and across multiple geographic areas. This indicates the complex geochemical nature of the system. We also observed that carbonate samples dominated by aragonite tend to have higher $\delta^{138}/^{134}$Ba values compared to calcite-dominated samples from the same site. This trend suggests carbonate formation through sulfate-driven anaerobic oxidation of methane, involving various biogeochemical processes such as sulfate reduction, mineral precipitation, and dissolution. In this presentation, we will further analyze this dataset and investigate the geochemical characteristics of these authigenic carbonates from the study sites.