Poster

ISOTOPE AND FAUNAL COMPOSITION OF COLD-METHANE SEEP DEPOSITS FROM THE UPPER CRETACEOUS PIERRE SHALE, SOUTH DAKOTA

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Methane seep deposits are common in the Upper Cretaceous (*Baculites scotti* to *Baculites compressus* Biozones) of the Pierre Shale of South Dakota. The seeps support a diverse community of mollusks, echinoderms, serpulids, and other invertebrates. The development of the seeps and the dynamics of the communities are still poorly understood. Several morphotypes of seep associated concretions (SACs) occur as a result of methane-enriched flow. These include platy/tabular fossiliferous pavements, pipes, tubes, irregular masses, balls, and globular masses. Study of concretion shapes, isotope signatures, and faunal composition can provide important clues into the development of the seeps and their plumbing systems. Carbonate concretions were collected from seven localities in South Dakota to identify the fauna and determine the oxygen and carbon isotope composition. In addition, the same samples were analyzed to reveal the strontium isotope composition. A single concretion from an age- equivalent non- seep deposit was also analyzed for comparison. Our data reveal that the seep concretions are composed of calcitic micrite with light values of $\delta^{13}C$ (-40‰) typical of methane influenced carbonate precipitation. The concretions also contain sparry calcite, with slightly heavier values of $\delta^{13}C$ (-10‰), suggesting that they formed later with less methane influence. Comparison of $^{87}Sr/^{86}Sr$ in seep carbonates with coeval seawater values provides information on fluid flow in the seep systems. In at least one seep studied, values are elevated markedly above seawater, suggesting equilibration of the fluids with a radiogenic source of Sr at depth in the deposit and advective fluid transfer toward the sediment-water interface. In general, pipes, tubes, and balls are relatively unfossiliferous whereas the irregular carbonate masses contain up to 15 species of molluscs. These differences may reflect where the concretions formed (at or below the sediment-water interface) and by what processes (diffusion or advection).