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Is Methane-derived Carbon recorded in Benthic Foraminiferal Tests' δ^{13}C at Cold Seep Sites? A Case Study from the Okhotsk Sea

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The discovery that a number of abrupt, global climate shifts correlate with highly negative δ^{13}C anomalies recorded in fossil benthic and planktic foraminifera, lead to the assumption that these negative excursions might reflect intervals of past, massive dissociations of gas hydrates during earth's history. Subsequently, intense debate was initiated on biases arising from possible diagenetic overprinting of primary δ^{13}C signals, questioning the overall use of foraminiferal carbon isotopes as proxies for methane dissociation events. Thus, it is of considerable interest to understand if, to what extent, and how methane-derived, isotopically light δ^{13}C is incorporated in foraminiferal calcite during biomineralisation.

Recently, during Cruise 178 of R/V SONNE to the Okhotsk Sea, we recovered a number of surface sediment profiles from various cold seep sites at the NE Sakhalin continental margin with a video-controlled Multicorer device. This area is characterized by both extensive methane seepage from numerous cold seep sites and widespread occurrence of near sediment surface gas-hydrate layers as reported from a number of sediment cores. Methane concentrations in the water column at our Multicorer sites are significantly elevated and vary widely, from less than 200 to more than 10,000 nl/l in some of the bottom water samples. Sedimentary characteristics of the Multicorer-profiles vary from soft sediments covered by thick, dark bacterial mats with large, rising gas bubbles to sites with authigenic carbonate concretions near the surface, com-

bined with a rich, chemoautotrophic mollusk fauna. The upper 10 to 20 cm of these profiles were sampled for living (i.e. rose Bengal-stained) benthic foraminifera, stable carbon and oxygen isotopes of pore and bottom waters and respective pore water ion concentrations. δ^{18}O and δ^{13}C analyses of benthic foraminifera are carried out on single tests of the most abundant species to assess intra- and interspecific variability and compare it to the respective DIC pore and bottom water isotopic signatures. Our first results suggest a significant, but rather small shift to more negative $\delta^{13}C_{carb.}$ values in a number of samples from the vent settings, compared to datasets from non-vent reference datasets. Furthermore, values between live and well-preserved dead specimen do not exhibit significant gradients, suggesting a signal incorporation of CH_4-derived, isotopically light DIC into the test. However, to date we were unable to provide evidence for incorporation of carbon isotope values in benthics that reflect values close to original pore water $\delta^{13}C_{DIC}$ values. Our study is complemented by a comparison of how different seep settings (bacterial mats/clambeds) affect the uptake of carbon isotopic signals into foraminiferal tests through ambient DIC and/or isotopically depleted food sources for benthic foraminifera.