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Processes influencing the Ca isotopes in porewaters of the Cascadia margin (ODP Leg 204)

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Methane-derived authigenic carbonates in the sediments of cold seep sites are a significant calcium sink. The strong depletion of dissolved Ca in the porewaters of shallow sedimentary sections (centimeters to tens of meters) due to carbonate formation has been widely observed. Our study of porewaters from ODP Leg 204 at Hydrate Ridge shows that the Ca isotopes are also highly influenced by several other processes. Here we present the data of 4 sites (Sites 1244, 1245, 1250, 1251) in an east to west and north to south profile across the accretionary prism, which show different influence of anaerobe oxidation of methane inducing authigenic carbonate formation. All sites show a strong decrease in $\delta^{44/40}$Ca of up to 0.8 permill in the upper ca. 60 mbsf indicating the release of light Ca isotopes at about 50-60 mbsf due to shallow diagenetic processes. The decrease in alkalinity and solid calcium carbonate as well as the increase in Ca concentration in porewaters of medium depth at Site 1245 suggest dissolution of carbonates. The Ca isotopes comprise even more information and indicate that authigenic carbonates, once precipitated in shallow, near-seafloor sediments, are being dissolved here. The Ca isotope signal of porewater in the deep sedimentary succession suggests a deep sourced fluid with a distinct signature characterized by high Ca concentration and light Ca isotopy. The influence of this fluid increases with distance from the accretionary toe due to increasing compaction and dewatering. Sr and B isotopes indicate that reaction with the oceanic basement and clay dehydration affect the fluid signature. This deep fluid seems to be as well transported into shallower sediment depths along a horizon (Horizon B) at Site 1244.