Variation of pore water geochemistry across the mass transport deposits off Cape Erimo, Hokkaido, Japan

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Marine pore water geochemistry is often constrained by the redox potential and microbial activities in shallow sediment and also receives dissolved elements from minerals under high temperature/pressure environment in deep sediment. The concentration gradients of these elements therefore reflect the gradual change of physicochemical environment in the sediment column, which characterize basic material migration system in surface area. However, the sediment environment is disturbed and becomes discontinuous when a drastic environmental change such as submarine landslide occurs. The pore water in the mass transport deposit (MTD) can be also disturbed and changes thereafter to stabilize again under the given new condition. This may significantly disrupt the material circulation system via pore water at the Earth's surface, however, the relationship between these phenomena and the distribution of MTD has not been sufficiently discussed. In this study, we analyzed geochemical composition of pore waters collected across the MTD and investigated how the pore water geochemistry responded to the disturbance of sediment environment.

Pore waters were collected from sedimentary sequences intercalated with MTDs down to ~100 mbsf off Cape Erimo, Hokkaido, Japan during the Chikyu Shallow Core Program (SCORE) by D/V Chikyu in 2017. The pore water geochemistry shallower than sulfate-methane interface (SMI) rapidly changes due to anaerobic methane oxidation, decomposition of organic matter, methane production from organic matter, precipitation of carbonates etc. On the other hand, below the SMI, the pore water composition was changed mainly by the mineral alterations in high temperature environments and the diffusion of components which released into or removed from the pore water due to decomposition of biogenic sedimentary rocks and organic matter. In particular, the concentration gradients of iodine and magnesium become smaller around the upper boundary of the MTD, unlike the gradual changes in concentration through the entire drilling depth. In addition, barium and lithium showed a curve-like concentration change with minimum values at the upper boundary of the MTD. The radioisotopic analysis of iodine showed significantly high value in the MTD, reflecting seawater component dominates in the interval. These changes were caused by trapping, migrating, and accumulating shallow pore water in the deeper sediments, pore water geochemistry can be modified along with the development of the MTD.

Keywords: Chikyu SCORE, Mass transport deposit, 129I, Iodine geochronology, Pore water

