Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS23-P10 Room:Convention Hall Time:May 21 17:15-18:30

Origin of lithium in pore fluid of Kumano mud volcano, Nankai accretionary prism

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Deep-rooted fluids in the accretionary prism play an important role in the occurrence of earthquakes near trench. The fluid samples from forearc mud diapirs help us to delineate possible fluid origins and/or sediment?water interactions at depth within the accretionary prisms. It is, however, difficult to research deep-seated fluids from pore water samples using traditional hydrogen and oxygen isotopic compositions owing to contamination from seawater. Lithium (Li) is relatively unsusceptible to contamination from seawater because the Li content of deep-rooted fluid is significantly higher than that of seawater. In addition, Li has two stable isotopes, 7Li and 6Li, with respective relative abundances of 92.5% and 7.5%, and 7Li/6Li ratios may provide further insight into the origin of deep-rooted fluids. We therefore analyzed 7Li/6Li ratios of pore fluids in mud volcano in the Kumano forearc basin to investigate the fluid regime in Nankai accretionary prism. In this study, we analyzed two different drilled mud cores at site C0004 and site C0005 that were recovered from center and margin of the Kumano #5 mud volcano, respectively. These samples were recovered using D/V CHIKYU that was equipped with a riser drilling system.

The results show that delta 7Li values of analyzed Kumano mud volcano fluid vary from +5.5 to +10.6 per-mil (delta 7Li = [[7Li/6Li]sample/[7Li/6Li]L-SVEC standard ? 1] x 1000). Judging from the delta 7Li values were correlated with the Rb/Li ratios, we argued that the lowest delta 7Li value, +5.5 per-mil, as that of a deep-derived end-member fluid. It has already reported that the delta 7Li value of decollement fluid in Nankai subduction zone is +10 per-mil (You et al., 1995. Geology 23, 37-40). Because the Cl/Li ratios are significantly lower than seawater value, the Li isotopic difference between Kumano mud volcano fluids and Nankai decollement fluids are not due to seawater contamination. Thus, our Li isotopic data revealed that the Li in Kumano mud volcano fluids are originated from deeper (higher temperature) than those in the Nankai decollement fluids. Based on the Li isotopic data, we further estimated the fluid-sediment reaction temperature is 300?C. From the geothermal gradient in this are, we inferred that the Li in the Kumano mud volcano fluids is originated from 10 km depth.

Keywords: lithium isotope, mud volcano, Nankai, accretionary prism, deep-rooted fluid, gas hydrate