Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS01-10 Room:302 Time:May 19 14:45-15:00

Boron and strontium isotope constraint on the origin of interstitial water from IODP Expedition 343, JFAST

Tsuyoshi Ishikawa[1*], SAMPLE, James[2], Ken Takai[1], James Mori[4], CHESTER, Frederick[3], EGUCHI, Nobuhisa[1], TOCZKO, Sean[1], Expedition 343 scientists[5]

[1]JAMSTEC, [2]Northern Arizona Univ., [3]Texas A&M Univ., [4]Kyoto Univ., [5]IODP

The Integrated Ocean Drilling Program (IODP) Expedition 343, Japan Trench Fast Drilling Project (JFAST), drilled three holes through the plate boundary near the Japan Trench to investigate the cause of very large fault slip during the 2011 Tohoku-Oki earthquake. Twelve interstitial water samples were recovered from the Hole C0019E at the depths predominantly between 689 mbsf and 831 mbsf. Here we report the results of onshore boron and strontium isotope analyses as well as onboard inorganic chemical analyses for the interstitial water samples.

The 87Sr/86Sr ratios of the interstitial water samples show relatively constant, seawater-like values at the depths above 730 mbsf, but clearly decrease with increasing depth below 780 mbsf. The relationship between strontium concentrations and the 87Sr/86Sr ratios indicates that the interstitial water compositions are essentially controlled by three-component mixing, and the waters around two major fault zones require distinct end-component fluids. This conclusion is also supported by significantly different characteristics of some minor and trace element concentrations in the interstitial waters around these two fault zones.

The boron isotope ratios (d11B values) of the interstitial waters are all higher than that of seawater, and show a small minimum around 700 mbsf and a clear maximum around 820 mbsf. The increase of d11B value around 820 mbsf, where the presence of a plate boundary fault is inferred, is associated with decrease in boron content. This indicates effective removal of light boron from the water around this depth possibly through adsorption of boron onto solid surface, and requires much larger effective solid surface area per unit fluid mass compared to the surrounding area. Such an increase of solid surface area may have been derived from extensive fracturing around the plate boundary fault.

Keywords: IODP, Tohoku, earthquake, geochemistiry, fluids, isotope