Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

U004-P12 Room: Convention Hall Time: May 24 17:15-18:45

Chemical speciation analysis of arsenic in core samples from TCDP cores

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Transportation of elements associated with fluid-rock interaction has been estimated from laboratory experiments, but mobilization of elements during the interaction in fault zones has not been well understood. Recently our group found significant elemental loss and gain in fault zones caused by co-seismic high temperature fluid-rock interactions (350 degrees Celsius) for the samples collected in Taiwan Chelungpu Drilling Project (TCDP) from about 1000m depth (Ishikawa et al., 2008). The identification of mineral phases which control the mobilization of elements is our further aim for the better understanding of the interaction.
Here, chemical speciation analysis of arsenic in the TCDP core samples was carried out on the basis of As K-edge XANES spectra using a synchrotron X-ray source (PF BL-12C). It is known that As tends to move to the fluid phase during fluid-rock interaction at high temperatures (e.g. You et al., 1996), and its K-edge XANES spectra is very sensitive as being applied to As speciation analysis of sediments (e.g. Takahashi et al., 2003). Resultant As oxidation states observed in the host shales were -1, +3, and +5, and trivalent species predominated at the center of the fault gauge zone in contrast. This suggests that As in sulfide phases (-1 valency) and As onto Fe hydroxide (pentavalent) were selectively dissolved into the fluid phase during the fluid-rock interaction, which resulted in a significant decrease of As in the center of the fault gauge zone.

Keywords: fault, fluid, synchrotron