Geophysical Research Abstracts
Vol. 12, EGU2010-6343, 2010
EGU General Assembly 2010

Li/B ratio in deep fluids an indicator of their generation depth

Takao Hirajima (1), Yoshiteru Sengen (1), Koshi Nishimura (2), and Shinji Ohsawa (2)

(1) Kyoto University, Graduate School of Sciences, Geology and Mineralogy, Kyoto 606-8502, Japan (hirajima@kueps.kyoto-u.ac.jp. 0081-75-753-4189), (2) Kyoto University, Graduate School of Sciences, Inst. Geothermal Sciences, Beppu 874-0903, Japan

Deep fluids derived from subducted terrestrial materials significantly affect and cause various physicochemical processes in the subduction zone, e.g., earthquakes in the subducting plate, partial melting in the mantle wedge, which causes island arc volcanism, the exhumation of high pressure metamorphic rocks, and so on (e.g., Schmidt and Poli, 1998). However, nature of deep fluids is still under the deep veil. To evaluate precisely the effect of deep fluids which affect various subduction processes, following aspects concerning the nature of deep fluids should be evaluated well, 1) the depths and the amounts of fluid release, 2) species and compositions of fluids, 3) the fluid paths and scale of motion, and etc. (e.g., Scambelluri and Philippot, 2001). In recent years, the depths and amounts of fluid release become to be evaluated well by synthetic experiments and thermodynamic calculation in the basaltic system (e.g., Schmidt and Poli, 1998; Hacker et al., 2003). The information on species and compositions of fluids can be obtained directly from fluid inclusions trapping in natural HP/UHP metamorphic rocks, but quantitative analyses of their major and trace element composition are still in the hard task.

This paper reports the Li-B-Cl ratio of deep fluids extracted from quartz veins/lenses developing parallel to the main foliation of LT/HP type metamorphic rocks crystallized from 20 to 60 km depths in the Sanbagawa belt, Japan. The quartz veins crosscutting the main foliation, i.e., formed during the retrograde stage, are out of scope in this paper. Raman spectroscopy for fluid inclusions in quartz veins/lenses reveals that most inclusions are composed of aqueous liquid and gas species of CO2, CH4 and/or N2. Aqueous bubble was not detected. Microthermometry for them reveals that freezing temperature varies from -15oC to 0oC .Rough negative correlation is detected between the freezing temperature and homogenization temperature (120-450 oC). These results suggest that the fluid inclusions in the studied specimens were produced during multi-stages, probably higher salinity syn-metamorphic ones and lower salinity post-peak metamorphic ones.

The deep fluids contained in the quartz veins/lenses were leached into the extra-pure water by the crush leaching technique, mainly following Banks and Yardley (1992) and Bottrell et al. (1988). Composition in the leached fluids was analyzed using gas-chromatography and ICP-MS. All extracted fluids are characterized by significantly lower Cl/(Lix2000+Bx500+Cl) (<0.2) ratio than the value of the modern sea water (ca. 0.8). Li(x2000)/B(x500) ratio of extracted fluids varies from 0.1 to 1.0 and shows a positive correlation with the metamorphic grade of the host rock., i.e., ca. 0.1 in the chlorite zone, ca. 0.2 in the garnet zone, ca. 0.4 in the biotite zone and 0.4-1.0 in the eclogite unit. Literature data of Li-B contents in natural HP metamorphic rocks suggest that Li/B ration of dehydrated fluid released from subducted meta-basalts increases with the metamorphic depth (Marschall et al., 2006; 2007). These evidences suggest that Li/B ratio of deep fluids has a potential evaluating the generated depth, although there remains several factors which control should Li/B ration ratio in the fluid should be clarified.