Base metal concentration in single fluid inclusions from granitic pegmatite and hydrothermal veins

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Introduction

Element concentrations of fluid inclusions in pegmatites and hydrothermal veins provide direct information about hydrothermal-ore formation and elemental transportation related to magmatic process. Although fluid-inclusion analyses for hydrothermal veins have been largely performed, studies on compositional changes of granitic fluids from a pegmatite to a hydrothermal stage are still few. Thus, we have determined base-metal concentrations of single fluid inclusions in quartz from pegmatite and hydrothermal veins by micro PIXE to elucidate the compositional changes.

Sample and Experimental

Quartz samples were collected from pegmatite at Tatsuno-daira, a hydrothermal vein at Suisyo-toge, and a hydrothermal vein near Fe-Cu ore at Kawahage, central Japan. Three veins are genetically related to a Miocene granite body. The quartz samples were cut and double-polished, and inclusions in the quartz were measured._Almost all the fluid inclusions in the samples had a negative-crystal shape (20-170 μm in size). Fluid inclusions from Tatsuno-daira are a two-phase inclusion (~10% NaCl eq.), and inclusions from Suisyo-toge and Kawahage are a polyphase inclusion including halite crystals (~30% NaCl eq.). These fluid inclusions were analyzed by a 4-MeV proton beam at a micro-PIXE course, University of Tsukuba.

Results and Discussion

Determined concentrations are as follows: 200 ppm for Fe, 150-500 ppm Cu, 150-250 ppm Ge, 20-100 ppm for Br, Rb, and Pb from Tatsuno-daira; 900 ppm for Fe, 2300 ppm for Mn, 250-400 ppm Cu, 120 ppm Ge, 10-350 ppm for Br, Rb, Sr, Zn, and Pb from Suisyo-toge; 2000-90000 ppm for Ca and Fe, 300-8000 ppm for Mn and Zn, 40-3000 ppm for Cu, 100-4000 ppm for Br, Rb, Sr, and Pb, less than 100 ppm for Ge, from Kawahage. The contents of Mn, Fe, Cu, Pb, Zn, Rb, Sr, and Br increase from the pegmatite to the hydrothermal veins, whereas the Ge contents decrease. Since the salinity of the inclusions also increases in the hydrothermal vein, the base-metal enrichment could relate to a formation of hyper saline water and a metal separation by boiling of fluids after pegmatite stage. The decrease of Ge may reflect a small partition of Ge into hyper saline water during boiling.

Reconstruction of paleoenvironments based on the assemblages of planktonic foraminifera in the northwestern North Pacific

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A core MD01-2409 was taken off Shimokita (41°33.9'N, 141°52.1'E) from a water depth of 970m during 2001 IMAGES cruise. This site is under the influence of Oyashio Current. Warm water from the subtropics (Tsugaru Current) enters the Pacific Ocean through the Tsugaru Strait and meets the cold subpolar Oyashio around 42°N. Therefore this site is sensitive to the fluctuation in sea surface environment around northern Japanese islands. The age model was constructed based upon ^{14}C data of planktonic foraminifera and shell fragments.

In this core planktonic foraminiferal assemblage was mainly composed of subpolar species; *N. pachyderma, G. bulloides, G. quinqueloba*, and *N. dutertrei* and the relative abundance of these species was 72.1%, 19.6%, 2.8% and 1.6%, respectively.

Left-coiling *N. pachyderma* showed high abundance throughout the core. The ratio of right coiling *N. pachyderma* showed a minimum (<1%) around LGM, increased gradually until 6 ka (about 10%), and rapidly increased ~ 5 ka (48%). On the other hand, in the cores KT95-14-NP2 and KT97-15-P3 from the opposite side of the Tsugaru Strait in the Japan Sea, *N. pachyderma* changed from left-coiling to right-coiling at 8.3 ka (northern core) and 4.8 ka (southern core) (Takei et al., 2002). It suggests that the inflow of the Oyashio Current into the Japan Sea started to decrease after LGM and almost disappeared at ~ 4.8 ka in the Japan Sea. The core MD01-2409 shows that the site had been under the influence of the Oyashio Current at until 3.5 ka.