High temperature fluid flow within accratinary complex revealed by using SEM-CL and fluid inclusion analysis J

Taketo Kikuchi[1]; Atsushi Okamoto[2]; Noriyoshi Tsuchiya[3]

[1] Environmental Studies.,Tohoku Univ; [2] Tohoku Univ.; [3] Environmental Studies, Tohoku Univ.

Fluid migration plays significant role on mass transfer and seismic event within subduction zones. Mineral veins forms by complex processes of fracturing, fluid flow and mineral precipitation, and thus the analyses of these veins within accretionary complex provide an insight of dynamics of fluid flow at the depth of the seismogenic zone.

The focus of this study is vein formation within the Yokonami melange;lange of the Cretaceous Shimanto Belt in southern Shikoku, SW Japan. Yokonami melange;lange is considered as tectonic melange;lange that formed by layer parallel shearing along decollment. We investigated mineral veins by combination of observations by optical microscope, SEM-CL and fluid inclusion microthermometry. The purpose of this study is to reconstruct of vein formation processes by using SEM-CL and fluid inclusion microthermometry. The contrast of CL-intensity in quartz grains provides information on crystal growth pattern within the vein. Vein quartz from the Yokonami melange;lange are commonly composed of three regions that show contrasting CL-intensity: CL-dark, CL-grey and CL-bright with increasing CL-intensity.

On the basis of occurrence in the outcrops, mineral veins in Yokonami melange;lange are divided into two types. Type I veins occur only within boudinaged sandstone blocks, and develop in direction normal to the elongation of sandstone block. Type II veins occur in association with minor faults, and they develop along foliation of mudstone or cut on melange;lange fabric.

Type I veins commonly contain euhedral to subhedral quartz grains that elongate in direction normal to the vein wall, and anhedral calcite and quartz in the central parts of veins. Elongate quartz grains contain CL-bright regions within crystal interior, indicating that these grains nucleated on the both side of the vein wall and grew toward the center of the veins. In addition, euhedral shape and record of growth competitions (elongate-blocky texture) suggests that these grains grew within an open cavity. In Type I veins, there are no evidence for multiple crack-seal events. Type II veins are composed of many lenticular veins parallel to vein wall, indicating repeated shear displacement and mineral filling along a fault. As individual lenticular parts show elongate-blocky textures as similar to Type I veins, open fractures would have formed as the result of shear dilation. Within individual Type II veins, elongate quartz grains growing from vein wall show CL-bright, large euhedral grain grains in central part of the veins show CL-dark, and other blocky quartz grains show CL-grey, respectively.

P-T conditions of Type I veins and Type II veins are estimated to be 150 and 260 degrees C, respectively, on the basis of fluid inclusion microthermometry. The temperature estimated from Type I veins is consistent with smectite/illite transition, and it is interpreted that Type I veins formed during development of melange;lange fabric by influx of fluid from surrounding mudstones. The temperature estimated from Type II veins is consistent with peak temperature of Yokonami melange;lange (250 degrees C; Sakaguchi, 1996), indicating that Type II veins formed at the deeper level within the subduction zone (i.e. underplating stage). Detailed analyses of fluid inclusions in different CL-intensity parts within Type II veins reveals that the Th value of CL-bright quartz grains, CL-dark grains (euhedral large grains) and calcite are 230, 260, and 290 degrees C, respectively. The temperatures estimated from CL-dark quartz and calcite that occupy the central part of the Type II veins are clearly higher than maximal temperature of host rocks. This implies that possibility of long-distance upward fluid flow along fracture network from deeper part of subduction zone.

Reference

Sakaguchi, 1996, Geology, 24, 795-798.