

Effect of lithology on calcite-vein formation in the Sanbagawa metamorphic rocks

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Sealed cracks (mineral-filling veins) are common in low to medium grade metamorphic rocks, and provide significant information on generation and transport of fluids within subduction zones. Mineral veins are generally composed of simple mineral assemblages with respect to their host rocks, and they commonly include quartz. Ubiquitous occurrences of calcite veins in high-pressure metamorphic rocks and accretionary complexes suggest that fluid compositions should be treated as mixture of H_2O-CO_2 . In this study, we investigated occurrence, mineral mode and internal texture of mineral veins from the Sanbagawa metamorphic belt in Japan. Especially we focus on calcite-bearing veins, because calcite may be useful as the indicator of migration of CO_2 -rich fluid. We discuss the effects of the vein size and the composition of the host rocks on precipitation of calcite within cracks.

We investigate the mineral veins of the Sanbagawa metamorphic belt in Kanto mountains and central Shikoku. The veins analyzed in this study commonly develop in N-S direction and cut the foliation at high angle, indicating that they formed during exhumation of the Sanbagawa belt. In Nagatoro area in Kanto mountains, we investigated the veins within the chlorite zone with the area of 20x200m along Arakawa-river. This area is composed mainly of pelitic and psammitic schists, with minor siliceous and basic schists. These veins are commonly composed of some combination of quartz, albite, chlorite, and calcite. The proportion of calcite bearing veins were measured in the outcrop with the aid of HCl, and modal abundance of calcite within the veins were measured on thin sections. These measurements revealed that calcite-bearing veins are abundant in basic schists, whereas less common in pelitic schists, and the modal abundance of calcite is much larger in basic schists than pelitic schists. This indicates that precipitation of calcite was strongly controlled by host-rock type even within a single outcrop. Carbon and oxygen isotopes of calcite in veins and host rocks have been measured. The value of ^{13}C widely ranges from -12 to +2, whereas ^{18}O ranges from +14 through +17.5.

The occurrences of mineral veins were investigated in seven localities along the Asemigawa-river in Central Shikoku (P1, P2, P3, Chlorite zone, P4, P5, Garnet zone, P6 ; Albite-biotite zone, P7 ; Oligoclase-biotite zone). We set the area of 6m² at each locality, and measured the vein width and counted the number of calcite-bearing veins. In this region, we found that the proportions of calcite-bearing veins were higher in basic schists than that in pelitic schists. The average width of mineral veins systematically decreases from 5mm to less than 1mm with increasing metamorphic grade. Number density of mineral veins is highest at the higher-grade part of the chlorite zone, and it decreases in the garnet and albite-biotite zones. In the oligoclase-biotite zone, fine cracks abundantly occur in the large basic body. There are systematic changes of frequency of calcite-bearing veins with increasing metamorphic grade. These observations suggested that calcite precipitation within the cracks were mainly controlled by adjacent host rocks rather than peak metamorphic conditions of the host rocks.

We will discuss within whether vein calcite precipitated from dissolution of calcite adjacent host rocks, or by interaction between host rock and extreme CO_2 fluids.