

Distinguishing garnet generations in the Sanbagawa pelitic schists along the Asemigawa-river, Shikoku

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Garnet grains of two different types seem to be recognized in the pelitic schists of Albite-biotite zone and Oligoclase-biotite zone in the Sanbagawa metamorphic belt, exposed along the Asemigawa-river, central Shikoku. Textural analysis was applied to the garnet grains on thin sections to suggest the garnet population was truly composed of two different generations of garnet. One type was larger and may well have grown during prograde metamorphism, another was relatively small and most likely grew contemporaneous with the plagioclase spots during the retrograde metamorphism. Rocks that contain both of the two generation of garnet were found exclusively from the lower Oligoclase-albite zone and the upper part of the lower Albite-biotite zone. Garnet grains in the Sanbagawa metamorphic rocks in central Shikoku have had a very important role in deducing the history of Sanbagawa metamorphism. However, they have not been reexamined for long, in spite of the fact that the mapping analysis technique became far more accessible. In this study, the occurrence of garnet grains in the Sanbagawa pelitic schists along the Asemigawa-river, central Shikoku, was reexamined to indicate that the observed garnet are of multiple generations.

The chemical zoning profiles were compared grain by grain within each thin section and investigated together with their size, shape, and spatial distribution. Garnet grains of two different types were recognized in the pelitic schists of Albite-biotite zone and Oligoclase-biotite zone. Group A garnet grains are porphyroblasts with 0.2 to 1 mm diameter, generally distributed evenly throughout within a thin section. They exhibit normal chemical zoning. Group B garnet grains are smaller and located selectively in muscovite layers or included in albite porphyroblasts. Group B garnet grains often show intrasectoral chemical zoning indicating non-equilibrium growth. Group A garnet occurred in the lower Oligoclase-biotite zone and the upper Albite-biotite zone. Group A garnet were not often included in the albite porphyroblast, but when they did, they showed no difference in the chemical profile compared to the grains not included in albite. Group A garnet seemed to have grown during the prograde metamorphism, which predated the formation of the albite porphyroblasts.

Group B garnet occurred in the Oligoclase-biotite zone and lower Albite-biotite zone. In the middle Oligoclase-biotite zone rocks, the group B garnet included in the albite porphyroblasts lacked the rim which the group B grains in the matrix had. On the contrary, the group B garnet in the lower Albite-biotite zone rocks was more preserved when they were included in the albite porphyroblasts. The rim of the grains in the matrix were often resorbed. It is indicated that formation of the group B garnet was more or less contemporaneous with that of the albite porphyroblasts, the timing of which is probably after the peak metamorphism.

Both group A and B garnet are sometimes observed in the same thin section of rocks from the lower Oligoclase-biotite zone. The result of the crystal size distribution analysis also indicates mixing of two different populations, which is consistent with the observation.

It is possible that garnet grains of post peak generation are more widely distributed than previously thought, in the Oligoclase-biotite zone of the Sanbagawa metamorphic belt.

Keywords: textural analysis, garnet, metamorphic rock, spatial distribution, crystal size distribution