Spacial distribution of garnet associated with foliation in the Sanbagawa metamorphic rocks, Kanto Mountains, Japan

Ayato Tanifuji[1], *Mutsuko Inui[2]

1. FamilyMart Co.,Ltd., 2. School of Science and Engineering, Kokushikan University

Reconstruction of the local thermal structure within metamorphic rocks are important since the thermal structure shows the deformation regime during the exhumation of the terrain. The deformation regime of the Sanbagawa metamorphic rocks of the Kanto Mountains have long been controversial, whether it is one plastic continuous body or it is composed of several parts separated by faults or thrusts. One of the key must lie in the area where apparent isograd is outcropped. Most of the Nagatoro area is categorized as the zone I by Hashimoto et al. (1992), which is the lowest metamorphic grade zone and is equivalent to the Chlorite Zone defined in the Shikoku Area of the Sanbagawa Metamorphic Belt. Zone I is defined by the mineral assemblage without garnet. Appearance of garnet is the index of zone II, which is the second lowest metamorphic grade zone defined in this area. Several outcrops in this area are known as being the zone II rocks since they show the mineral assemblage including garnet. Hashimoto et al. (1992) interpreted the appearance of garnet as being the result of the brittle structural deformation such as faults and thrusts. In that case, the local occurrence of garnet means that the area shows discontinuity in metamorphic grade, and the discontinuity results from juxtaposition of different grade rocks through some thrusting. However, raman spectrometry of the carbonaceous material indicated no gap in the metamorphic temperatures between the samples with and without garnet from the same outcrop. In this study, spacial distribution of garnet within an outcrop several tens of meters long was determined.
Mineral assemblage was quartz, plagioclase, muscovite, chlorite. Not all the samples had garnet, calcite, titanite, and zoisite. Carbonaceous material was also included in many of the samples. 36 of the 55 samples included garnet in its mineral assemblage. Garnet grains were small, most of them with diameters 50 to 100 micrometers. Most of the garnet grains were euhedral and were found within the relatively mafic layers within the pelitic metamorphic rocks which were mostly composed of muscovite. Chlorite was often associated with garnet.
Occurrence of garnet was not at random, but seemed to form groups with lenticular or tabular distribution. The lens (if it was a lens) was subparallel to the foliation, which is known to be subparallel to the lithologic boundary in this area. Spacial distribution of garnet occurrence seemed to form lenticular or tabular groups subparallel to the lithology.
Chemical analyses of garnet using EPMA showed that the garnet grains were normally zoned, exhibiting euhedral growth of the crystal. Mn (spessartine) content was quite high (<50 Xsps). Some of the grains lacked part of the outermost rim, indicating resorption of garnet grains, but not in large amount. No evidence of large retrograde metamorphism was found. It is explained that the garnet grains started to grow during the last stage of the prograde metamorphism. Those cores were formed and started to grow but the growth did not last long because the grains are all so small compared to the proper garnet grains from the garnet zone.
The sharp euhedral chemical zoning profile indicates that the garnet grains were not kept hot for long time. Spacial distribution of garnet was probably controlled by the lithology parallel layers, namely the bulk rock chemistry.
Reference
Hashimoto et al. (1992) Journal of the Geological Society of Japan. 98, 953-965.

Keywords: lithology, Sanbagawa metamorphic belt, temperature

