Phase equilibrium modeling and P-T evolution of high-P/T Sambagawa Metamorphic rocks in Kanto Mountains, Central Japan

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Sambagawa metamorphic belt, which extends about 800 km from east (Kanto Mountains) to west (East Kyushu Island), is regarded as an excellent example of high-P/T type metamorphic belt located at the northernmost edge of the Outer Zone of southwest Japan. The high-pressure rocks were probably formed by complex subduction-accretion processes in western Pacific region during Cretaceous (Isozaki and Itaya, 1990). Numerous petrological, geochronological and structural studies have been done on the belt particularly focusing on P-T evolution and tectonics, but they are mainly on the western part of the belt in Shikoku Island which metamorphic grade is higher than the eastern part. In contrast, only very few studies have been done on the Sambagawa metamorphic rocks in Kanto Mountains which corresponds to the eastern end of the belt. This study reports new petrological and P-T data of the Sambagawa pelitic schists from Kanto Mountains and compare the results with those of Shikoku Island. This is the first report of quantitative P-T path estimated for Sambagawa schist from this region based on phase equilibria modeling approach.
The studied pelitic schist is dark grayish, very fine- to fine-grained, well foliated, and contains phengite, hematite, chlorite, biotite, epidote, garnet, quartz, and plagioclase. Plagioclase is porphyroblastic and occurs as spots. Phengite defines major foliation of the rock. Garnet is fine grained (less than 30 microns) and almandine-rich in composition. It’s spessartine component decreased from core to rim, showing normal zoning. Although biotite could be a stable assemblage, it was probably completely replaced by chlorite due to later hydration event. Metamorphic P-T evolution of the rocks was evaluated using THERIAK-DOMINO ver.16.10.2012 software based on the chemical system Na_2O-CaO-K_2O-FeO- MgO-Al_2O_3-SiO_2-H_2O-TiO_2 (NCKFMASHT). The peak P-T condition of the rock was inferred from the stability field of the inferred peak assemblage (plagioclase + ilmenite + garnet + phengite + biotite + zoisite + quartz) as 580-630^{o}C and 9-13 kbar, which is nearly consistent with the results of garnet-phengite geothermometry applied to the same sample. The event was followed by decompressional cooling toward a retrograde stage of 370-440^{o}C and 1.4-5.5 kbar as inferred from a retrograde assemblage of plagioclase + ilmenite + chlorite + garnet + phengite + biotite + quartz. The peak condition is, however, about 100^{o}C higher than the available P-T data of Fe-Mn rich nodule from the studied region (7-12 kbar and 460-540^{o}C; Hirajima, 1995), but nearly consistent with the condition of Oligoclase-Biotite zone of the Sambagawa schists from Central Shikoku Island. The results of this study therefore suggest that the Sambagawa metamorphic belt in Kanto Mountains might have experienced a similar metamorphism with the belt in Shikoku. The Sambagawa metamorphic rocks in the two areas probably subducted to a similar depth and underwent similar high-pressure metamorphism.

Keywords: Sambagawa metamorphic belt, Phase Equilibria Modering, Pelitic schist, Peak P-T conditions, Kanto mountains

