Mineral assemblages and mineral compositions of low-grade metamorphic rocks in the Sanbagawa metamorphic belt, Shikoku

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INTRODUCTION: The studies of low-grade metamorphic rocks in the Sanbagawa proper belt and its southern margin zone have been carried out in the Asemigawa-Shirataki area (Nakajima, 1982) and Omoiji-Nagasawa area (Nakajima et al. 1977). The purpose of this study is to clarify the areal extent of the Sanbagawa low-grade metamorphic rocks. In this presentation, I will show the mineral assemblages and mineral compositions of the Sanbagawa low-grade metamorphic rocks in the Iya area (Tokushima prefecture), Toyonaga area (Kochi prefecture), Nimyo area (Ehime prefecture) and Shingu area (Ehime prefecture), of which the first three areas belong to the Besshi nappe and the last one to the Oboke nappe.

MINERAL ASSEMBLAGES: On the basis of the mineral assemblages of the pelitic schists, the studied areas are confirmed to belong to the chlorite zone. The mineral assemblages of basic rocks are commonly epidote +/- pumpellyite + actinolite and epidote +/- Na-amphibole + actinolite + hematite. Moreover, in the Iya area, some of the basic rocks have the following mineral assemblages; epidote + Na-pyroxene + actinolite + hematite +/- quartz + albite and epidote + Na-pyroxene +/- Na-amphibole + actinolite + hematite + albite. These mineral assemblages are not reported from the pumpellyite-actinolite facies rocks of the Sanbagawa proper belt. As a result of Schreinemakers analyses (Tagiri et al., 1992) for the mineral assemblages of basic rocks, the metamorphic facies is clarified to be the pumpellyite-actinolite facies.

MINERAL COMPOSITION: Al-contents of Ep and Pmp in epidote + pumpellyite + actinolite assemblage with chlorite having the fixed range of the ChlXFe (Nakajima et al., 1977) have a tendency to increase with increasing metamorphic temperature, and AlIV in chlorite has a tendency to increase with increasing metamorphic temperature, too (e.g. Caritat et al., 1993). So the EpXFe3+, Al of Pmp and chlorite geothermometry are used to estimate a metamorphic temperature in each area. When the range of ChlXFe is fixed to be 0.45 - 0.55, the EpXFe3+, Al of Pmp and chlorite geothermometry have the values of 0.13 - 0.40, 4.05 - 4.94 and 295 - 340ºC in the Shingu area, 0.21 - 0.39, 3.98 - 4.86 and 260 - 325 ºC in the Iya area and 0.21 - 0.36, 4.44 - 4.68 and 275 - 333ºC in the Toyonaga area, (the analyses of samples from the Nimyo area is in progress). Furthermore, EpXFe3+ in the Asemigawa-Shirataki area (Nakajima, 1982) and Omoiji-Nagasawa area (Nakajima et al., 1977) are reported to be 0.17 - 0.35 and 0.25 - 0.40, respectively. Banno (1998) also reported EpXFe3+ ranging from 0.30 to 0.39 in the Omoiji area.

METAMORPHISM and THERMAL STRUCTURE: As the low-grade metamorphic rocks from the Sanbagawa belt have no hematite + pumpellyite assemblages in basic rocks, their metamorphic temperature is probably lower than the discontinuous reaction temperature (pumpellyite + hematite = epidote + actinolite + H2O) showed by Nakajima et al. (1977). Although, Na-pyroxene-bearing assemblages are recognized in the Iya area, these assemblages are not the typical mineral assemblages of the Na-pyroxene-chlorite subfacies reported in the Mikabu and Kanto region (e.g. Maruyama & Liou, 1985, Tagiri et al., 1993). Therefore, the low-grade area cannot be divided by the difference in mineral assemblages. However, judging from the mineral compositions in epidote + pumpellyite + actinolite assemblages, the areas of the pumpellyite-actinolite facies grade can be divided into the three areas, that is, high temperature (Asemigawa-Shirataki and Shingu area), medium temperature (Iya and Toyonaga area) and low temperature (Omoiji-Nagasawa, lower temperature area of Omoiji area) areas. From these results, the lowest metamorphic grade area in the Sanbagawa belt is located area near the Mikabu and Northern Chichibu belt in the Omoiji-Nagasawa area, but not in the Shingu area that belongs to the Oboke nappe, the lowest position in the stratigraphic sequence.