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Metamorphism of garnet glaucophane schists from the Bizan area, Sambagawa metamorphic belt, eastern Shikoku, Japan

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The Bizan area is located in the Tokushima Prefecture of eastern Shikoku, Japan and it is mainly composed of pelitic schists, basic schists and siliceous schists with minor garnet glaucophane schists. Faure (1983) suggested that there occur a melange with tectonic blocks of serpentinite, metagabbro and garnet-amphibolite (garnet glaucophane schists in this study) along the ductile shear zone between spotted and non-spotted zones in the Bizan area. Garnet glaucophane schists consist mainly of garnet, amphibole, epidote, phengite (Si 6.41-6.80 pfu), paragonite, chloritoid, chlorite, albite, rutile, titanite, ilmenite and quartz. A schistosity is defined by preferred orientation of glaucophane, phengite and chlorite.

Garnets are almandine-rich composition and display prograde growth zoning with decreasing X_{Sps} (0.18-0.01) and increasing X_{Alm} (0.54-0.70) from the core to the rim. The cores of garnet contain inclusions of chloritoid (X_{Mg} 0.08-0.23), chlorite, epidote, phengite (Si 6.41-6.55 pfu), paragonite, titanite and quartz and polyphase inclusions of phengite + paragonite + epidote + chloritoid + chlorite + quartz assemblage. The rims of garnet contain inclusions of amphiboles (glaucophane; zoned amphibole with barroisite core and glaucophane rim), epidote and quartz and polyphase inclusions of glaucophane + epidote. Garnets are partly replaced by chlorite. Glaucophanes in the matrix contain inclusions of phengite, epidote, chlorite, titanite and quartz. Some of them are partly replaced by Wnc, Brs, Mg-Ktp and Act at their rims and cracks. Phengites (Si 6.50-6.80 pfu) in the matrix are contain inclusions of glaucophane, epidote and chlorite. Some large grains of epidotes and chlorites contain inclusions of glaucophane, phengite, epidote, titanite and quartz.

Textural relationship, mineral assemblage and thermobarometric results suggest a polyphase tectonometamorphic evolution of the garnet glaucophane schists. The mineral assemblages of polyphase inclusions within the cores of the garnet such as barroisitic amphiboles, cloritoid, chlorite, epidote, phengite, paragonite and quartz constrain the *P-T* conditions of a prograde stage at 450-500^{o}C and 9-11 kbar (by THERMOCALC) at epidote-blueschist facies metamorphic conditions. The rims of the porphyroblastic garnets include inclusions of glaucophane, epidote, quartz and schistosity-forming matrix phengite suggesting the peak metamorphic mineral assemblages. THERMOCALC average *P-T* calculation suggests a metamorphic condition of the eclogite facies metamorphism of 550-600^{o}C and 17-19 kbar. Porphyroblastic garnets are partly replaced by chlorite at their rims, and matrix glaucophanes are replaced by Wnc, Brs, Mg-Ktp and Act along rims and cracks suggests a retrograde metamorphism took place at the epidote-amphibolite facies to follow a clockwise decompression path.

Large grains of epidotes and chloretes in the matrix which contain peak metamorphic mineral assemblages of glaucophane, phengite, epidote and quartz suggesting another high-pressure prograde metamorphism took place. This high-pressure metamorphism can be correlated with the Sambagawa metamorphism in the Besshi area, central Shikoku (Aoya, 2001; Kabir and Takasu, 2010a, b).

The eclogite facies metamorphism followed by another high-pressure metamorphism as the Sambagawa metamorphism is first described from the garnet glaucophane schists in the Bizan area, Sambagawa metamorphic belt. The metamorphic evolution is similar to that of the eclogites in the Besshi area, central Shikoku (Kabir and Takasu, 2010a, b). Eclogite in the Sambagawa belt occurs mainly in the Besshi area, central Shikoku and slightly in the Kotsu area, eastern Shikoku. This study revealed that the occurrence of eclogites now extend to the Bizan area in eastern Shikoku.

Reference:

Aoya (2001) *J Petrology*, 42, 1225-1248; Faure (1983) *J Geol Soc of Japan*, 89, 319-329. Kabir and Takasu (2010a) *J Meta Geol*, 28, 873-893; Kabir and Takasu (2010b) *Earth Sci*, 64, 183-192.

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