

## Jadeite-bearing garnet glaucophane schists from the Sambagawa metamorphic belt in the Bizan area, eastern Shikoku, Japan

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Discovery of jadeite-bearing garnet glaucophane schists from the Bizan area offers a new locality of eclogite facies metamorphic rocks and extension of the distribution of eclogites to the easternmost part of the Shikoku Island. The Bizan area of the Sambagawa metamorphic belt 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 a melange zone containing tectonic blocks of serpentinite, metagabbro and garnet-amphibolite (garnet-glaucophane schist) occurs within a ductile shear zone between spotted and non-spotted schist zones. Jadeite-bearing garnet glaucophane schists are newly found in the melange zone.

Jadeite-bearing garnet glaucophane schists consist mainly of garnet, jadeite, amphibole (glaucophane and barroisite), epidote, phengite, paragonite, chlorite, albite, rutile, titanite, calcite and quartz. The porphyroblastic garnets are almandine-rich composition and display prograde growth zoning with decreasing  $X_{Spss}$  (0.23-0.02), increasing  $X_{Alm}$  (0.47-0.66) and slightly increasing  $X_{Prp}$  (0.01-0.03) from core to rim. The cores of the garnets contain inclusions of barroisite, epidote, muscovite (Si 6.04-6.15 pfu), chlorite, calcite, titanite and quartz and polyphase inclusions of barroisite +/- epidote +/- chlorite + titanite + quartz assemblage. The rims of garnet contain inclusions of glaucophane, epidote, phengite (Si 6.49-6.73 pfu), paragonite, chlorite, rutile and quartz and polyphase inclusions of jadeite +/- glaucophane +/- epidote + chlorite + titanite + quartz. Impure jadeite inclusions are present throughout garnet grain ( $X_{Jd}$  0.49-0.75,  $X_{Aeg}$  0.19-0.47). Glaucophanes in the matrix contain inclusions of phengite, epidote, chlorite, titanite and quartz and they are partly replaced by barroisite. Phengites (Si 6.61-6.67 pfu) in the matrix contain inclusions of glaucophane, epidote and chlorite. Some large grains of epidotes and chlorites contain inclusions of matrix minerals such as glaucophane, phengite, epidote, titanite and quartz.

The metamorphism of the garnet glaucophane schists is divided into three events based on petrography and chemistry of constituent minerals, i.e. (i) precursor metamorphic event (muscovite inclusions in the garnet cores), (ii) first high-pressure metamorphic event of eclogite facies, and (iii) second high-pressure metamorphic event (large epidote and chlorite in the matrix).

Chloritoid-bearing garnet glaucophane schists lack of jadeite represent multi-stage metamorphic evolution (Kabir *et al.*, 2012; Takasu *et al.*, 2012; Kabir *et al.*, 2013). *P-T* conditions of prograde stage are estimated as 450-500°C and 9-11 kbar (epidote-blueschist facies metamorphic conditions) using inclusion mineral assemblage in garnet core. The peak metamorphic conditions of eclogite facies (550-600°C and 17-19 kbar) are obtained from inclusions minerals in the rims of the porphyroblastic garnets and schistosity-forming matrix minerals. *P-T* pseudosection in the MnNCKFMASH model system and garnet compositional isopleths also consistent with the obtained prograde and the peak metamorphic conditions. Prograde and peak metamorphic conditions of the garnet glaucophane schists are similar to those of newly found lawsonite eclogites in the Kotsu area, eastern Shikoku (Tsuchiya and Hirajima, 2012), probably suggesting both of them have similar metamorphic evolution. Large grains of epidotes and chlorites in the matrix, which contain minerals of the peak metamorphic stage suggest another high-pressure prograde metamorphism occurred and the metamorphism is correlated with the Sambagawa metamorphism in the Besshi area, central Shikoku (Aoya, 2001; Kabir and Takasu, 2010a, b). Both jadeite-bearing and chloritoid-bearing garnet glaucophane schists are considered to experience similar high-pressure metamorphic history.

Keywords: Sambagawa metamorphic belt, Bizan area, garnet-glaucophane schist, eclogite, jadeite