Polyphase metamorphic history of pelitic schists in the Sambagawa metamorphic belt, Sebadani area, central Shikoku, Japan

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The Sebadani area is located in the central part of the Besshi district and it is mainly composed of the Seba basic schists, and eclogite-bearing Sebadani metagabbro mass occurs in the basic schists. Eclogitic rock types in the Sebadani area occur as basic schists and scarce interlayering pelitic schists (Aoya, 2001; Zaw et al., 2005; Kabir and Takasu, 2009).

Pelitic schists consist mainly of garnet, phengite, chlorite and quartz with a small amount of epidote, amphibole (Na, Na-Ca and Ca), albite, biotite and carbonaceous matter. Rutile, titanite, calcite, K-feldspar, tourmaline, apatite and hematite are of accessory minerals. Porphyroblastic garnets display a prograde growth zoning and contain inclusions of Na/Na-Ca/Ca-amphiboles (e.g. Gln, Brs, Trm, Ktp, Mg-hbl and Prg), albite, epidote, phengite, paragonite, hematite, titanite, chlorite, calcite and quartz. Omphacite (Jd 31-35) occurs as anhedral relict and it is severely replaced by symplectites of Na-Ca/Na-amphibole (barroisite, Mg-hornblende and actinolite) and albite. Omphacites of subhedral shape are probably included in the mantle and the rim of the garnets, but they are decomposed into aggregates consisting of Na-Ca-amphibole and albite by later hydration along fractures. Garnets are partly replaced by symplectites of Na-Ca/Ca-amphibole (barroisite, Mg-hornblende and actinolite) and albite.

Amphiboles randomly oriented and overprinted to the matrix schistosity are strongly zoned with glaucophane core, barroisite/Mg-katophorite mantle and edenite/actinolite rim. The outermost rim is occasionally decomposed into aggregates of edenite-albite symplectite. The core of the amphibole, glaucophane, includes resorbed barroisite, and it also includes symplectitic aggregates of barroisite/Mg-katophorite and albite after omphacite.

Texture, chemical compositions of minerals and thermobarometric results suggest that there are three different metamorphic events distinguished, i.e. precursor metamorphic event, 1st and 2nd high-pressure metamorphic events. The precursor metamorphic event before the high-pressure metamorphism is defined by taramite and pargasite inclusions in the garnets, indicating relatively high-temperature metamorphic conditions such as the amphibolite facies. The prograde metamorphic path and the conditions of the eclogitic metamorphism are newly constrained of the pelitic schists. The mineral assemblage included in the core to the mantle/rim of garnets in the pelitic schists reveal a prograde path of the eclogitic metamorphism from the epidote blueschist through the epidote amphibolite to the eclogite facies. The peak metamorphic conditions are estimated as $T=615-660$ °C and $P=18.5-22$ kbar from the schistosity forming minerals.

The 2nd high-pressure metamorphic event is defined by the randomly oriented amphiboles cross-cut schistosity in the matrix and superimpose over the albite-amphibole symplectite of the retrograde stage of the 1st high-pressure metamorphic event. The glaucophane core zoned to barroisite/Mg-katophorite mantle suggests a prograde metamorphism took place from the blueschist facies to the barroisite stability field probably in the epidote-amphibolite facies as the peak metamorphic conditions. The rim of randomly oriented amphiboles of edenite/actinolite is associated with albite as albite-amphibole symplectite ($T=480-510$ °C and $P=4-5$ kbar) for a retrograde stage of the 2nd high-pressure metamorphic event.

The eclogites exposed in the Onodani area occur in the Seba basic schists (Kabir and Takasu, 2008). The Onodani eclogites experienced three-folds prograde metamorphism. The 1st high-pressure eclogite facies metamorphism is deduced from the minerals preserved in the spessartine-rich core of the porphyroblastic garnet ($T=530-590$ °C at $P=19-22$ kbar). The 2nd high-pressure metamorphic event is deduced from the schistosity forming mineral assemblages ($T=630-690$ °C and $P=20-22$ kbar). The 3rd high-pressure metamorphism is deduced from the amphibole-rich vein or randomly oriented amphiboles ($T=540-600$ °C at 6.5-8 kbar). The 2nd and the 3rd high-pressure metamorphic events are correlated to those of the 1st and 2nd high-pressure metamorphism of the Sebadani pelitic schists.

The metamorphic evolution of the Seba eclogitic basic schists is as follows: precursor stage$\rightarrow$1st high-P metamorphic event$\rightarrow$2nd high-P metamorphic event$\rightarrow$3rd high-P metamorphic event.

REFERENCES