Secondary minerals of tectonic blocks of the Kiroko greenstone mé lange

*Akira Ono

Kiroko greenstone mélange is distributed in the southern margin of Atogura Nappe in the Yorii-Ogawa area, central Japan. It is composed of Kiroko metamorphic rocks, tectonic blocks and serpentinite. The tectonic blocks are geological bodies distributed in the place where the Kiroko metamorphic rocks were exhumed. Various tectonic blocks have different thermal histories for each other. However, tectonic blocks often contain prehnite as a secondary mineral, and the formation of prehnite is assumed as a common thermal incident. Here we examine secondary minerals of tectonic blocks. The locations of the tectonic blocks examined are shown in Figure A.

The **meta-gabbro** examined here is of tectonic blocks. It is scattered over a wide area, and the size of outcrops varies from about 1 m to over 50 m. The texture of gabbro remains well and foliation is absent (Figure B, 3). No minerals fractured in a preferred direction have been found. The meta-gabbro has suffered from low-grade metamorphism. In many cases it is quite remarkable. Plagioclase is partially replaced by fine-grained prehnite, chlorite and muscovite. Hornblende is partially replaced by chlorite. Calcite is small in amount. Under an optical microscope, prehnite veins and chlorite veins are commonly observed. Prehnite veins occur rarely in the field, but very thin prehnite veins rarely develop in a network, and meta-gabbro is easily crushed into rock fragments of about 10 cm in size.

The **meta-tonalite** in the Iyo area (Figure A, loc. *f*) is a very inhomogeneous rock body that consists of various mafic and felsic igneous rocks. However, schistose tonalites (meta-tonalites) occur in the northern part of the rock body, although massive tonalites are also exposed. The main constituent minerals of the meta-tonalite are hornblende and plagioclase. Plagioclase is converted to saussurite which looks almost like an opaque mineral under a microscope. Saussurite and hornblende are fractured and a large number of cracks is formed arranging in a preferred orientation. Plagioclase veins and quartz-plagioclase veins are formed to fill the cracks. Small amounts of chlorite and actinolite are crystallized in the veins (Figure *f*). Fine actinolite is often formed on the rim of hornblende. Prehnite is lack in the schistose meta-tonalite.

Metamorphic rocks and aplite granite originating from the **Higo-Abukuma belt** are distributed in the Kiroko greenstone mélange of the Iyo area. No secondary minerals occur in garnet-biotite-muscovite schist and its surrounding psammitic rocks. Prehnite is not formed in these metamorphic rocks. **Biotite tonalite** in the Kibe area has suffered from low-grade metamorphism. Many fine epidote and quartz grains are newly crystallized. However, prehnite is not formed. A large **amphibolite** is exposed to the east of the Iyo village (loc. *g*). The lithology is similar to the 402 Ma amphibolite in the Kiroko area. Plagioclase and hornblende are hardly metasomatized although a large number of quartz veins, prehnite veins, chlorite veins and quartz-actinolite veins occur in the amphibolite (Figure *g*).

<**Summary**> According to previous studies, prehnite crystals of the greenstone mélange were crystallized during the formation of mélange structure. Certainly, prehnite occurs in many tectonic blocks, and it is undeniable that prehnite was widely formed during the formation of tectonic blocks. However, there are many tectonic blocks without prehnite. Moreover, Kiroko metamorphic rocks containing prehnite are extremely rare. Therefore, it cannot be concluded that prehnite was crystallized at the same period over a wide area during the formation of the tectonic blocks. The prehnite of the tectonic blocks may have been independently formed at different places at different times for each tectonic block.

Keywords: Atogura Nappe, Greenstone mélange, prehnite, Tectonic block