Crystallographic preferred orientation analysis of Sanbagawa eclogites using a Scanning Electron Microscope EBSD method

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Sanbagawa metamorphic belt in Japan is characterized by the high-pressure and low-temperature (HP/LT) intermediate type belt which extends from northeast Kanto through the Kii peninsula, passing through central Shikoku until Kyushu in the southwest. The belt is mainly composed of basic, quartzose, pelitic-psammitic schists with several eclogite and ultramafic bodies.
In this paper, we present our study conducted on three three eclogite samples collected from the Iratsu eclogite body. Samples Sb-1 and Sb-3 represent hornblende eclogite whereas Sb-2 represents the quartz-bearing eclogite. From each eclogite samples thin sections in 3D were prepared (i.e. XY-direction, XZ-direction, and YZ-direction). The samples were then studied(1) petrographical under the optical microscope for textural and mineralogical features, (2) chemical features (elemental maps), and (3) Physical features (crystallographic preferred orientations). (1) Petrographically, Sb-1 and Sb-3 are mainly composed of light green omphacite (Omp), pinkish red garnet (Grt), dark green secondary hornblende (Hbl), and actinolite (Act) with pale yellow or colorless epidote (Ep). The samples exhibited granoblastic texture in which Grt was embedded in clustered imp and hHbl. Most of the Omp grains have been retrogressed to Hbl and Act. Garnet porphyroblasts have numerous cracks. Sample Sb-2 was composed of Grt, Omp, secondary Hbl, Ep with abundant quartz. Garnet porphyroblasts have identical features to those observed in Sb-1 and Sb-3, however in this sample they are heavily fractured. In this sample too, Omp grains have secondary Hbl along their rims.(2) Based on chemical elemental mapping (using XGT), all the three samples exhibited Fe-rich Grt with some amount of Mn-component, Ca-rich Omp and Hbl. (3) For physical features, we measured selected areas in each samples for crystallographic preferred orientations (CPO) using Backscattered electron backscattered diffraction (EBSD) method. EBSD maps were collected and from representative phases (Grt, Omp, Hbl, Act) CPOs were presented in pole figures which were constructed along a-axis [100], b-axis [010], and c-axis [001], respectively. The data obtained show that Grt did not show any specific pattern of orientation, hence behaved like rigid body whereas Omp and Hbl/Act display the strongest CPO along [001]-axes, typical for the L-type fabric, representing subduction-related deformation rheology at mantle depth. Hornblende and Act, are secondary after Omp, hence did not modify the CPO during the retrogression stages.

