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An EBSD study on crystallographic orientation of garnet in pelitic schists from the Ogcheon metamorphic belt

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Microstructural studies using the electron backscattered diffraction (EBSD) technique are useful for delineating the growth mechanism of isotropic minerals. We applied the EBSD technique to investigate the variations of crystallographic orientations of spiral or non-spiral garnet porphyroblasts in pelitic schists from the Ogcheon metamorphic belt, Korea.

Most of the analysed garnet porphyroblasts show the bell-shaped growth zoning pattern defined by the decrease of spessartine contents from the core to the rim. On the other hand, two garnet grains are characterized by the discontinuity of spessartine contents where the distribution pattern of quartz inclusions abruptly changes. This discontinuity is attributed to the multiple-stage growth of garnet porphyroblasts. Crystallographic orientation of each garnet is identical even though they have the Mn discontinuity, suggesting no linkage between the number of growth stages and the lattice orientation of garnet. On the other hand, two other garnet porphyroblasts, which were used for analysing the foliation inflection/intersection axis by Lee (2000, Geosciences Journal), also show single lattice orientation throughout the whole grain, whereas crystallographic orientation of each spiral garnet, considered as a rotational porphyroblast, is identical from the center to the arm termination. This observation suggests no close relationship between regional stress regime and the lattice orientation of garnet during the syn-tectonic growth.

Two garnet porphyroblasts from hydrothermally altered mica schists near the Mesozoic granite show reverse growth zoning pattern of spessartine contents, in contrast to others. These garnet porphyroblasts are divided into several discrete domains based on the different crystallographic orientations and mode of quartz inclusions. Inclusion-induced brittle fracturing is possibly responsible for different crystallographic orientations of garnet porphyroblasts. This variability suggests that post-tectonic stresses could affect the lattice orientation of garnet.