# Textural development of amphibole grains in the deformed amphibolites

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To clarify the deformation mechanism of the lower crustal rocks is the most important to reveal the strength of the continental lithosphere. The rocks widely distributed in the lower crust are considered to be mainly comprised of amphibole and plagioclase. Although such rocks have been considered to deform by dislocation creep of plagioclase, recent studies point out dominant deformation mechanism of the rocks is dissolution-precipitation creep (e.g. Imon et al., 2002). As the rocks deformed by dislocation creep are much stronger than that deformed by dissolution-precipitation creep, the strength profile of lithosphere may be changed. Imon et al. (2002) revealed that deformation mechanism of amphibolites in the shear zone in the Cretaceous Ryoke metamorphic belt, SW Japan is dissolution-precipitation creep, based mainly on plagioclase analysis. In this study, we concentrate on the lattice preferred orientation (LPO) and shape preferred orientation (SPO) of amphibole grains in the deformed amphibolites

In this study, we measured three types of the amphibole grains; core part of the porphyroclastic grain, rim part of the same grain, and fine grain in the matrix. The first type grains are brownish in color and the last two are in greenish variety, indicating multi-stage, at least two stages, crystallization of amphibole. Texture analysis of amphibole was carried out with a conventional universal-stage in thin sections parallel to the lineation and perpendicular to the foliation (XZ-sections). In the case of amphibole, the crystallographic axes are not parallel to the optic elasticity axes but with additional information from cleavage and twin planes the complete orientation could be determined with streogram. However, some amphibole grains, especially green amphibole grains, do not show cleavage and twin planes, and the we cannot determine the complete orientation for all amphibole grains in the samples, and then we show textural characteristics of the amphibolites as a plot of optic elasticity axis (na, nb, and ng). Furthermore, we measured the angle between the direction of the long axis and the foliation (q), and aspect ratio (R) in the XZ-sections.

Measured optic elasticity axes ng concentrate and slightly forms a small circle about the lineation. The ng axes of core part of the grains show dispersive distribution rather than that of rim part of the same grains and matrix. The ng axes of core part with higher aspect ratio concentrate around the lineation than that with lower aspect ratio. The na axes of the grains concentrate on the region normal to the foliation with a tendency to spread as a girdle about the lineation. The nb axes concentrate as a maximum in the foliation, perpendicular to the lineation.

Almost all of the matrix grains with various aspect ratio elongate parallel to the foliation, indicating preferential growth of the matrix grains under non-hydrostatic condition. Because the angle between the direction of the long axis and the foliation decreases with increasing aspect ratios in core part of the grains, it indicates that textural development of SPO of the core part of the grains dominates rigid-body rotation within more ductile matrix. The degree of the relation between q and R is different in the samples, and it may be depended on the variety of non-coaxiality of its deformation.

These textural characteristics of the amphibole grains suggest that the brown amphibole was fractured firstly along cleavage planes, rotated, and then their optic elasticity axes systematically distributed. Furthermore, under non-hydrostatic condition, the rim part of the porphyroclastic grains and the matrix grains were preferentially grown. This result is similar to the deformation mechanism of plagioclase in the same amphibolites essentially, and this indicates that the cataclasis/dissolution-precipitation creep dominates in the lower crustal rocks, rather than dislocation creep.