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Dissolution-precipitation process in the deformed amphibolites from the Ryoke metamorphic belt, SW Japan

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In granite mylonite zone, deformed amphibolites occur as thin layers. It suggests that they are deformed nearly as much as surrounding granites. In the amphibolites, hydration reaction during deformation can be established. Size distributions of plagioclase in highly foliated amphibolites (HFA) are comparable with that predicted by theory of Ostwald ripening, but those in the weakly ones (WFA) differ from the theoretical one. This difference between more and less foliated amphibolites may be caused by greater fluid flow in the former, because the amount of hydration-reaction products in HFA is much greater than those of WFA. Deformation of the amphibolites was controlled by dissolution-precipitation process in relation to Ostwald ripening, induced by fluid influx.

Granitic mylonite zone develops in the Cretaceous Ryoke metamorphic belt, SW Japan. In the zone, deformed amphibolites enclosed by the granitic mylonites occur as thin layers. The amphibolite layers do not show pinch-and-swell and boudinage structures, even when they enclosed in high-strain granitic mylonites. This mode of occurrence suggests that they are deformed nearly as much as the surrounding granites. In the highly deformed zone, well-foliated amphibolites comprised by Ti-poor ferrohornblende and chlorite mantling Ti-rich ferrohornblende porphyroclasts are elongated to form shear planes defined by preferential distribution of chlorite and titanite. Porphyroblastic plagioclase in the well-foliated amphibolites can be divided into two parts: anorthite-rich core and anorthite-poor rim. Based on these, mass-balanced reaction associated with deformation can be established as

Ca-rich plagioclase + Ti-rich ferrohornblende + ilmenite + quartz + H2O

= Ca-poor plagioclase + Ti-poor ferrohornblende + chlorite + titanite.

Because products of the reaction form an inter-connected weak matrix, strain rate of the amphibolites may be controlled by rate of dissolution-precipitation processes through fluids. Although weakly foliated amphibolites in the low-strained zone show many cataclastic microstructures, the well-foliated amphibolites do not involve those features. The microstructural and chemical changes suggest that it was initially deformed by cataclasis and subsequently resulted from modification by metamorphism. Grain size distributions of plagioclase in the well-foliated amphibolites are comparable with that predicted by the theory of Ostwald ripening, but those in the weakly foliated amphibolites differ from the theoretical one. This difference between more and less foliated amphibolites may be caused by greater fluid flow in the former, because the amount of hydration-reaction products in the well-foliated amphibolites is much greater than those of the weakly foliated ones. In conclusion, deformation of the amphibolites has been controlled by a dissolution-precipitation process induced by fluid influx, which is in relation to Ostwald ripening.