Ostwald ripening of plagioclase in deformed amphibolite: evidence for chemical reaction and mass transport during deformation

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Plagioclase crystals in the well-deformed amphibolites, with an intensive metamorphic recrystallization, occurring in ductile shear zone of the Ryoke metamorphic belt (SW Japan) represent characteristic microstructures and mineral chemistry that are promoted by Ostwald ripening. Plagioclase grains are usually disrupted and have subangular to subrounded shapes. At the side parallel to foliation, large plagioclase grains occasionally have well-developed asymmetric wings with low anorthite content (X_{An}), whereas small grains do not develop the wings. These microstructures of plagioclase suggest that it was dominantly deformed by cataclasis and formed by new crystallization at rims of large plagioclases during deformation. Distribution profiles of grain size normalized to mean size of plagioclase in the well-deformed amphibolites are similar to that predicted by the theory of Ostwald ripening, known as LSW distribution. Because Ostwald ripening causes the selected growth of larger crystals together with dissolution of smaller crystals, plagioclase wings with low X_{An} can be crystallized on large plagioclase grains together with dissolution of small fragments. In contrast size distribution of plagioclase grains in the weakly deformed samples is distinct from the theoretical distribution. Difference in the microstructural features between the well-deformed and weakly deformed amphibolites may be caused by variation in fluid flow, because the well-deformed amphibolites develop many shear planes having retrograde actinolitic ferrohornblende and chlorite grains, indicating that the planes are loci of fluid flux. Higher fluxes of fluid along shear planes and grain boundaries should promote more extensive reaction and mass transport to progress Ostwald ripening.