Migration of Albite and Chlorite Rhythmic Bands with Temperature and Pressure Change in the Metamorphic Rocks.

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The rhythmic bands of albite and chlorite together with epidote and actinolite are very common in low grade basic schists in the plate boundary metamorphic belts. These bands are very important for investigation of the mechano-petrological process in the plate boundary mechanics because these are formed by the transition from uniform basic schist to bifurcated banded one with chemical differentiation incorporated by high pressure aqueous solution during metamorphism in the plate boundary.

The author discussed in the previous talk in JpGU and GSJ meetings that the bands are probably derived from pore banding with negative slope of yield surface and their time scale are possibly inferred by means of band width and waveform of the band boundary surface. At this time, the constant temperature and pressure condition is assumed in the formation of bands. Thus, in the present discussion the author will intend to propose the change in pressure and temperature during the formation of bands.

Toriumi and Inui (2001) clarified that the garnet growth in the progressive metamorphism of the Sanbagawa metamorphic belt is associated with heterogeneous fluid outflow from the pelitic schists. They measured quantitative outflow of water using exact P-T paths from garnet zoning and grain size frequency distribution of peliltic schists and obtained the results that the peak of outflow rates are at pressures of 0.7 and 8.5 GPa during the subduction. Thus, the banding formation should be considered under the pressure and temperature increase in the large outflow of water together with retrograde hydration process.

Dissolution and precipitation equilibrium relations of albite and chlorite should shift at the band boundaries with grain boundary pore fluid. The relations of them are controlled by Gibbs free energy difference between albite and chlorite with water and ionic species. In the simple case of chlorite and albite bands, the Gibbs free energy of general exchange reaction of them with ionic species in fluid can be obtained easily and then it results that the albite band becomes widen by resorption of chlorite band in the pressure and temperature increase. Thus, the waveform of the band boundary formed by MS instability should give the band boundary migration velocity synchronous with pressure increase.

Reference

Toriumi M., and Inui, M., 2001, Bull. Earthq.Res.Inst., Univ. Torkyo, 76, 367-376.

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