

metamorphic banding-moving Liesegang patterns in the plate boundary

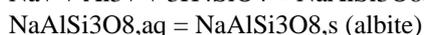
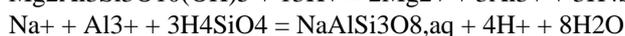
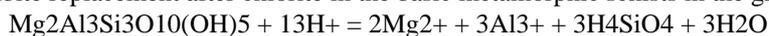
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Recent studies of parallel metamorphic bands in plate boundary rocks revealed that the band front advances accompanied with metasomatic instability by Toriumi and Fukuyama (2012) during the large scale hydration metamorphism of the plate boundary rocks, judging from waveform interface between band and matrix. The chemical reactions at the front are dissolution of matrix minerals and precipitation of metasomatic minerals together with grain boundary fluid lens partially connected and networked together with neighboring fluid lenses. Advancing fronts of the bands should be controlled also by diffusion of ionic species of constituent minerals through the network of the fluid lenses.

In the plate boundary metamorphic rocks of Sanbagawa and Alpine and also Franciscan have abundant albite bands and spots. These bands and spots of albite contain commonly inclusion trails of matrix mineral grains, indicating replacement of albite after matrix.

Considering these evidences, it is confirmed that the metamorphic band is just the precipitation band behind the diffusion front of solution penetrating the network of fluid lenses of the rock. In this case, we will propose the simple band formation model by albite replacement after chlorite in the basic metamorphic schists in the greenschist facies and low pH conditions as follows:



In this system, ionic concentrations of every species are governed by the following reaction-diffusion equations;

$$C_{i,t} = D_i C_{i,xx} + R_i(C_j) \quad (i, j = \text{Na}^+, \text{Mg}^{2+}, \text{Al}^{3+}, \text{H}^+, \text{NaAlSi}_3\text{O}_8, \text{aq})$$

where D_i and R_i are the diffusion constant and reaction term, respectively. These reactions comprise the system of inhibitor (H^+) and activator (Na^+) of ionic solutes with respect to precipitation of albite and dissolution of chlorite. Thus, it should have precipitation pattern like general Liesegang patterns (Izak and Lagzi, 2005). In this presentation, we would like to propose the dynamic Liesegang type metasomatism in plate boundary hydration metamorphism in the wide range of spatio-temporal scales.

References

Toriumi, M., Fukuyama, M., 2012, Geol. Soc. Japan, 2012 Meeting Abstract

Izak, F., and Lagzi, I., 2005, J. Phys. Chem., A, 109, 630-733.

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