

Symbolic dynamics of metamorphic rocks 3 - interface instability of metasomatic banding and fluid flux

mitsuhiro toriumi[1]; Mayuko Fukuyama[2]

[1] Univ.Tokyo; [2] Geological Survey of Japan, AIST

<http://www.gaea.k.u-tokyo.ac.jp>

Banding and domain structure of minerals in metamorphic rocks are very common and they have been analyzed by means of symbolic dynamics. The symbolic dynamics indicates the invariant set of periodicity arising in the simple nonlinear dynamical phenomena. The basics of symbolic dynamics for banding and domains of minerals is the metamorphic process governed by reaction and diffusion of ionic species in fluid phase. This type of reaction diffusion dynamics is characterized by strong nonlinearity because rates of mineral growth and dissolution from very small amount of metamorphic solution depend upon powers of ionic concentrations. If this is the case, wavy interfaces between bands and domains resulting from boundary instability should be common in metamorphic rocks.

The authors investigated the interface instability of the metasomatic banding produced by diffusion zones between basic and carbonates metamorphic rocks. The interfaces between wollastonite and garnet bands and between garnet and clinopyroxene bands display commonly waveform and the dominant wavelengths of interfaces seem to be similar in their Fourier spectra. It suggests strongly that the stationary diffusion of component ions in porous fluid operates with frontal dissolution and growth of minerals at the bands interfaces. Further, it is very important that interface waveforms show the phase lock and antilock between gt/wo and gt/cpx interfaces. The interface dynamics satisfying this type of correlated motion involves fluid flux and ionic diffusion across the interface. In this talk, the authors propose the new dynamics having interaction of two interfaces under perpendicular diffusion flux.