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Spatio-temporal fluctuation of garnet and cracks

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In the previous papers of JpGU meeting (1), we studied the grain size distribution patterns of metamorphic garnet and albite in the banded metamorphic rocks with grain size grading. The average grain size increases with increasing distance across the banding but normalized distribution patterns of the grain sizes within the individual bands are very similar with each other. The banding structure should be derived from the unidirectional flow of metamorphic fluid with ionic diffusion, therefore suggesting that the growth conditions changed across the bands. It follows that the distribution patterns of grain size of garnet and albite display the summation of multiple simple distribution function such as Ostwald type or simply Gaussian, forming the lognormal to power law type.

In the plate boundary region, the metamorphic rocks also experienced frequent generation of small cracks with fluid and then occupied by minerals. However, the mechanical conditions controlling the crack formation and propagation must be fluctuated in terms of stresses, fluid pressure, temperature, and other parameters. Then, the observed frequency distribution of cracks filled with fluid and also minerals should show the summation of many simple distribution functions and it is approximately lognormal or power law. The fluctuation of the distribution patterns can be simply represented by drifts of mean and variant values with time and space.

In this paper, we would like to discuss the rapid growth of grains and cracks at the case of over - the critical fluctuations by drifts by means of stochastic resonance.

(1) Toriumi M. and M. Fukuyama, 2014, Grain size grading in the Liesegang banding of the plate boundary rocks. Proceeding of JpGU meeting 2014.

Keywords: size distribution, average and variance, spatio-temporal fluctuation, garnet, crack