Geophysical Research Abstracts
Vol. 18, EGU2016-16271, 2016
EGU General Assembly 2016

A reaction-diffusion model for migmatization in high-grade metamorphic terrains

Amiya Baruah (1,2), Manas Kumar Roy (3), Nibir Mandal (2), and Santanu Misra (4)

(1) Department of Earth Sciences, Royal Holloway University of London, Egham TW20 0EX, UK (Amiya.Baruah@rhul.ac.uk), (2) Department of Geological Sciences, Jadavpur University, Kolkata 700032, India, (3) Department of Physics, Brahmananda Keshab Chandra College, Kolkata 700 108, India, (4) Department of Earth Sciences, Indian Institute of Technology, Kanpur 208 016, India

Migmatitic rocks evolve through a complex interaction of metamorphism, anatectic melting and solid-state chemical mixing of two principal components: leucosome (quartzofeldspathic materials- L) and melanosome (ferromagnesian materials- M). Melt segregation and their migration are central to generate the features commonly observed in migmatitic rocks. Such L-M interaction leads to melt transport often maintaining a sharp interface between the two units. Existing theoretical and experimental models predicts melt segregation to occur under the combined effects of gravity-driven flow, local stress drop, convection, and advection. However, the efficiency of these processes in large scale transport of melts is largely uncertain. The present study theorizes the migmatization process, treating interactions of the two components (L and M) in the framework of prey-predator dynamics. We propose a reaction-diffusion (RD) model to explore the micro-scale attributes to explain various migmatitic structures observed in the Chotonagpur Granite Gneissic Complex, India. Our simulation couples the L-M phases to a pinning field, accounting linear and non-linear interactions in the diffusion process. The RD model shows that migration of the L-phase into M-phase produces a simple, planar to a complex, multi-ordered geometrical pattern at their interfaces, depending upon the contrast in diffusion coefficients (D) and the pinning factor (W). Furthermore, our models suggest that the linear and the non-linear coupling between L and M phases are critical for the formation of migmatitic structures.