

火成活動とプレートテクトニクスの3次元モデリング: 岩石惑星マンツルの熱化学進化の解明に向けた取組み

Attempts at numerical modeling of 3-D mantle convection with magmatism and plate tectonics

*亀山 真典^{1,2}、小河 正基^{3,2}、宮腰 剛広²、柳澤 孝寿²

*Masanori Kameyama^{1,2}, Masaki Ogawa^{3,2}, Takehiro Miyagoshi², Takatoshi Yanagisawa²

1. 国立大学法人愛媛大学地球深部ダイナミクス研究センター、2. 国立研究開発法人海洋研究開発機構、3. 東京大学大学院総合文化研究科

1. Geodynamics Research Center, Ehime University, 2. Japan Agency for Marine-Earth Science and Technology, 3. University of Tokyo at Komaba

We are developing 3-D numerical models of mantle convection including the effects of mantle magmatism and plate tectonics, in order to deepen the insights into the thermo-chemical evolution of the mantles of terrestrial bodies. The mantle magmatism is modeled by the generation of liquid phase (magma) owing to the pressure-release melting induced by ascending flows of solid-state convection and the motion of the generated magma as a permeable flow through the solid matrix driven by a buoyancy due to the density difference between the solid and the liquid phases. The coherent motion of tectonic plates is, on the other hand, helped by the narrow zones of low viscosity within the highly viscous "lithosphere" along the top cold surface generated by the stress-history-dependent rheology. However, despite their crucial roles in controlling the overall flow structures, these two mechanisms are incompatible with the solid-state convection of the mantle in essence from the numerical aspects: the localized irregularities caused by them severely deteriorate the large-scale numerical solution of solid-state convection particularly by the multigrid method. In this presentation, we will show the current status and outcrops of our attempts to overcome the numerical difficulty, together with some examples of 3-D experiments running on massive (super)computers.

キーワード：岩石惑星、マンツルダイナミクス、マンツル内火成活動、プレートテクトニクス

Keywords: rocky planets, mantle dynamics, mantle magmatism, plate tectonics