

## 月のマントル対流の三次元球殻モデリング Toward a 3D spherical modeling of lunar mantle convection

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Earlier two-dimensional models of coupled magmatism-mantle convection system raise two issues concerning the evolution of the lunar mantle. One is to understand why lunar magmatism continuously occurs with a characteristic time of several hundred million years. When the Rayleigh number of the lunar mantle  $Ra$  exceeds the critical value for the onset of thermal convection  $R_c$ , earlier two-dimensional models suggest that a positive feedback, called the magmatism-mantle upwelling (MMU) feedback, operates to make magmatism episodic and vigorous; magmatism occurs continuously and mildly as observed on the Moon only when  $Ra < R_c$ . Another issue is to understand why mare magmatism continued until as recent as about a billion years ago. Magmatism extracts heat producing elements (HPEs) and earlier two-dimensional models predicts that lunar magmatism should have waned much earlier because of this HPEs extraction. A possible solution to this issue is that the lunar mantle contains a reservoir that is enriched in HPEs and compositionally dense at depth. The nature of thermal convection in a basally heated mantle with a small core, however, has not been investigated enough to resolve these issues. To estimate  $R_c$  and to understand the nature of thermal convection in the lunar mantle, we are carrying out a linear perturbation analyses and numerical simulation of thermal convection in a spherical shell with a small core.

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