# 地球型惑星のサイズと火成活動の型：マントル•ダイナミクスモデルからの予測
# The style of magmatism on terrestrial planets of various sizes predicted from numerical models of mantle dynamics

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A series of numerical models of magmatism in the convecting mantle suggest that the vigor and style of mantle magmatism critically depend on the planetary size because of its effects on the elementary processes that exert control over mantle dynamics. On a small planet like the Moon, a mild magmatism continuously occurs for several hundred million years in upwelling limbs of mantle convection and then wanes, because the magmatism extracts heat-producing elements (HPEs) from the mantle. Magmatism, however, often becomes more vigorous and episodic, as observed for the Large Igneous Provinces on Mars and larger planets, because the buoyancy of the generated magma boosts the upwelling flow in the mantle that causes the magmatism itself. The convective stirring enhanced by the MMU feedback keeps the mantle rather homogeneous, despite that the vigorous magmatism due to the feedback differentiates the mantle. The effect of the MMU feedback is particularly important in Venus and the Earth where the lower mantle develops: The solid-solid phase transitions that occur at the top of the lower mantle make mantle upwelling flow pulsating, when the mantle is strongly heated by HPEs and magmatism is vigorous. This pulse or burst of hot materials from the lower mantle causes a vigorous magmatism, especially in the early mantle. Due to this vigorous magmatism, the crust enriched in HPEs recycles back to the mantle to serve as the energy source for the magmatism that continues throughout the history of the mantle. On the Earth, plate tectonics also causes magmatism and recycling of the generated crust. In contrast to Venus, this magmatism differentiates the mantle, because tectonic plates and subducting slabs stir the mantle only mildly.

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