

Heterogeneity in magma eruption on the lunar farside

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Lunar maria are limited to the topographic low and/or thin crust regions. It implies that magma eruptions on the Moon are largely controlled by the surface structure as well as the lateral heterogeneity in magma production in the upper mantle. Morota et al. (GSL Special Publications, 401, 127-138, 2015) conducted a global survey of regional differences in magma eruption on the lunar surface. As a result, they found that the South Pole-Aitken (SPA) region has high mare ratio compared to the Feldspathic Highlands Terrane (FHT) even they have same crustal thicknesses. Their explanation for the result is that crustal density of SPA is higher than that of FHT. In contrast, our estimate of magma volume in the SPA provides the result that there are no significant difference in magma volume between maria in the SPA and the FHT (Taguchi et al., JpGU Meeting 2015, PPS23-P0). Morota et al. (2015) considered only crustal thickness as an indicator of condition for magma eruption. However, altitude is also an important indicator for the ease of magma eruption to the surface, thus systematic investigation of both crustal thickness and altitude on the mare region is required.

In this study, we aim to reveal the relationship between magma eruption and surface structure on the lunar farside maria and put constraints on a condition of magma eruption. Therefore, we redefined mare region and investigated their crustal thickness and altitude.

As a result, we found that magma erupted selectively in the area that has thin crust and low altitude, as have been reported by previous studies. However, in comparing the SPA and the FHT, magma eruption can occur at higher altitude in the FHT than in the SPA. In addition, there is a spatial variation in mean crustal thickness and altitude of the mare regions in the SPA compared with the FHT, indicating heterogeneity in conditions for magma eruption in the SPA. For example, there is much volume of magma in the Ingenii basin, but not in the Apollo basin. Also, a latitudinal dependence of magma eruption is confirmed within the SPA.

The spatial distribution of magma observed on the surface reflects amount of magma production and/or easiness for magma eruption to the surface. In particular, the latter depends on both density structures in the crust and magma density. Since the SPA crust consists of relatively high-Fe rocks, it is expected that the SPA was better place for magma to erupt to the surface compared to the FHT. However, our results show opposite trend, implying that magma production within the SPA was less than that within the FHT.

Keywords: lunar farside, mare volcanism, South Pole-Aitken basin