Stratigraphy of mare basalts and topographic features in the central region of the Procellarum KREEP Terrane of the Moon

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Reconstructing the volcanic history of the Moon is essential to understand the solidification process and subsequent thermal evolution of lunar mantle. Lunar mare basalts provide insights into compositions and thermal history of lunar mantle. According to previous crater counting analysis with remote sensing data, magma activity has a second peak at the end of mare volcanism (~2 Ga), and the latest eruptions were limited in the Procellarum KREEP Terrane (PKT), which has high abundances of heat-producing elements. To understand the mechanism for causing the second peak and its magma source is important to constrain models of lunar thermal evolution. We have examined the correlation between the titanium contents and eruption ages of mare basalt units using compositional and chronological data updated by SELENE/Kaguya. As a result, we found that a rapid increase in mean titanium (Ti) content occurred at 2.3 Ga in the PKT, suggesting that the magma source of mare basalts changed at that time. The high-Ti basaltic eruption, which occurred at the late stage of mare volcanism, can be correlated with the second peak of volcanic activity at ~2 Ga. The latest volcanic activity can be explained by a high-Ti hot plume originated from the core-mantle boundary. If the hot plume was occurred, the topographic features formed by the hot plume may be remained. We calculated the difference between topography and selenoid and found the circular feature like a plateau in the center of the PKT, which scale is ~1000 km horizontal and ~500 m vertical. We investigated the stratigraphic relationship between mare basalts and mare ridges in the PKT by using Kaguya TC and MI data. We found that the mare ridges were formed before and after the high-Ti basaltic eruptions and seem to be along with the plateau. Considering that ridges were formed during formation and relaxation of the plateau, the timing of the plateau formation is consistent with the timing of ridge formation.

Keywords: Moon, Volcanism, Lunar mare, Topography, Mare ridge, Stratigraphy

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