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月レーダーサウンダーによる’危難の海’磁気異常下の地下玄武岩溶岩層
Subsurface magnetized basalt layers underneath the Mare Crisium by Lunar Radar Sounder

坂東 雄一 [1], 中村 教博 [1*], 熊本 篤志 [2]
BANDO, Yuichi[1], NAKAMURA, Norihiro[1*], KUMAMOTO, Atsushi[2]

[1] 東北大学大学院理学研究科地学専攻, [2] 東北大学惑星プラズマ・大気研究センター
[1]Department of Earth Science, Tohoku University, [2]Planetary Plasma and Atmospheric Research Center, Tohoku University

Paleomagnetic measurements of 3.7-billion-year-old mare basalt sample 10020 revealed the presence of strong intensity of mean 60 microteslas as the lunar paleofield. Current lunar dynamo theory (continuous mechanical stirring dynamo) generates a long-lived lunar magnetic field for more than one billion years with an intensity of 1-10 microteslas, contradicting such intense paleomagnetic record. There are several regions showing strong lunar magnetic anomalies around the mare. The orbital magnetic field measurements with magnetic inversion techniques on the mare Crisium suggested that subsurface basalt layers ~ 1 km depth are magnetized with an intensity of 1 A/m from the estimation of Apollo return samples. However, there is no data for subsurface structure underneath the mare Crisium. In this presentation, we report the subsurface structure of layered basalt lava by using the lunar radar sounder onboard Kaguya. Lunar Radar Sounder imaging with a synthetic aperture radar analysis revealed the cryptic subsurface basalt layer of 500 m thickness at 360 m underneath the Crisium basin. Considering the surface crater age and the duration for hiatus of two paleo-regoliths as LRS reflectors, the age of the basalt is about 3.7 billion years. This thick basalt layer explains total magnetic field strength above the Crisium basin from lunar prospector data if the basalt acquired a thermo remanent magnetization under 100 microteslas with 1 % iron content. Such high iron content and large volume of basalt lava plausibly results from the eruption of thorium- and titanium-rich lunar mare basalts due to the removal of the ilmenite-rich thermal blanket at the base of the lunar mantle. Our results support the presence of the late, intense lunar paleofield.