MARE IMBRIUM: A WINDOW INTO THE PKT MANTLE. S. Nagihara[1] and R. E. Grimm[2], [1]Department of Geosciences, Texas Tech University, Lubbock, TX 79409 (seiichi.nagihara@ttu.edu), [2]Southwest Research Institute, Boulder, CO 80302.

Introduction: Previous orbital observations show that the Procellarum KREEP Terrane (PKT) has higher proportions of radionuclides than elsewhere of the Moon [1-3] (Fig. 1). It has been debated, however, whether these incompatible elements have been efficiently partitioned into the crust of the PKT or the uppermost mantle remains enriched [4]. This is an important question for further understanding the partition style and hence the thermal evolution of the Moon. We believe that one way to answer it is to carry out heat flow and magnetotelluric measurements in Mare Imbrium on a future CLPS mission. Combination of these two measurements would yield vertical profiles of temperature and composition through the crust and the uppermost mantle.

Rationale: Whether or not the PKT mantle is more enriched in radionuclides than the mantle elsewhere may be assessed by comparing heat flow out of the mantle inside and outside the PKT. If the PKT mantle is more enriched, mantle heat flow would be greater there. Direct measurement of the mantle heat flow is currently impossible, but it can be estimated from surface heat flow and magnetotelluric observations. Heat flow through the lunar surface, however, is heavily influenced by radiogenic heat production within the crust [5]. Thus reliable estimation of the mantle heat flow would require knowledge the vertical cumulative radiogenic heat production through the crust as well.

Alternatively, we may select areas where crustal heat production is expected to be minimal. In such areas, surface heat flow should closely approximate the mantle heat flow. Mare Imbrium is considered one of such areas. Even though it is within the PKT, surface concentration of radionuclides there is much lower (Fig. 1) and crust is much thinner (Fig. 2) than in the rest of the PKT, because the basin-forming impact removed much of the radionuclide-rich crust [6].

For comparison with non-PKT mantle, heat flow and magnetotelluric measurements have already been planned for *Blue Ghost 1*, a CLPS mission scheduled to land in Mare Crisium in September 2023. Mare Crisium is far away from the PKT. Surface concentration of radionuclides is very low and crust there is very thin (< 10 km).

In conclusion, Mare Imbrium is a window into the PKT mantle. Landing a future CLPS mission and carrying out heat flow and magnetotelluric measurements there would help us better understand the thermal evolution of the Moon and add more values to the investigations already planned for the CLPS mission to Mare Crisium.

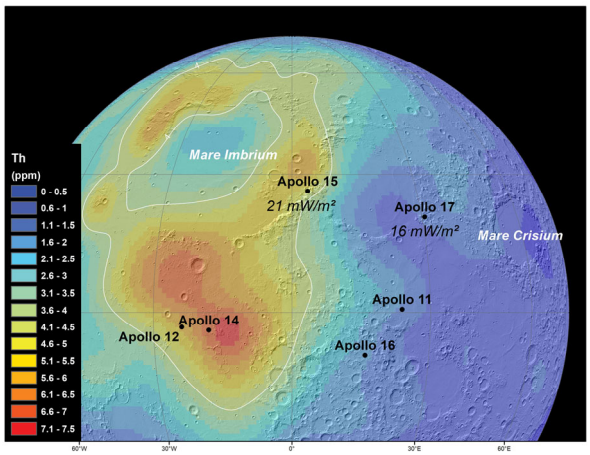

Figure 1. A near side map of surface Thorium abundance based on the Kaguya gamma-ray spectrometer measurements [3]. The white lines are the 4-ppm contours. The heat flow values at the Apollo 15 and 17 sites are also shown [8].

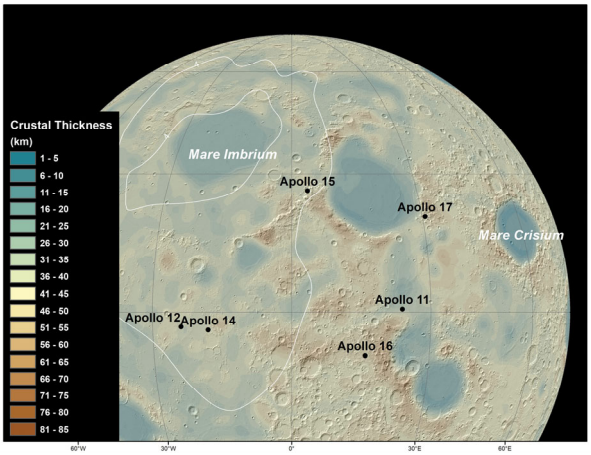

Figure 2. A near side map of crustal thickness estimates from the GRAIL mission [6].

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