The detailed distributions of Th and K in the high-Th concentration regions of the Procellarum KREEP terrane observed by Kaguya Gamma-ray Spectrometer

*HOKUTO SEKINE[1], Hiroshi Nagaoka[1], Nobuyuki Hasebe[1,2]

1.School of Advanced Science and Engineering, Waseda University, 2.Research Institute for Science and Engineering, Waseda University

Thorium (Th) and potassium (K) are incompatible elements that remained in the melt phase during the crystallization process of the lunar magma ocean. Therefore, the distributions of these elements on the lunar surface provide valuable information regarding magmatic activity and differentiation of the Moon.

Kaguya Gamma-ray Spectrometer (KGRS) [*Hasebe et al.*, 2008] onboard Japanese lunar explorer Kaguya determined elemental composition of the lunar surface with the high precision among previous gamma-ray remote sensing missions. The KGRS, which employed a high-purity germanium (Ge) detector, observed lunar gamma rays from the high altitude (100±20km) from December 14, 2007 to December 10, 2008. Subsequently, the KGRS resumed observation from the low altitude (50±20km) from February 10, 2009. The energy resolution of gamma-ray lines at 2615 keV was ~0.8% in full width at half maximum throughout the low-altitude phase, which was better than that of the high-altitude phase and was ~9 times better than that of Lunar Prospector Gamma-Ray Spectrometer (LP-GRS). It contributed to unique and high-precision identification of Th and K lines. Furthermore, the spatial resolution of the KGRS was ~$(67km)^2$ throughout the low-altitude phase, which was ~4 times better than that of the high-altitude phase. It enabled us to produce higher spatial resolution maps of Th and K.

Global distribution maps of Th and K on the lunar surface derived from the data acquired by LP-GRS and the data acquired by the KGRS during the high-altitude observation have been reported. According to them, there are several areas where Th concentration is prominently higher than their surrounding regions on the lunar surface. Th concentrations in some of the high-Th regions located in the province known as the Procellarum KREEP terrane (PKT) of the near side (e.g., Aristarchus crater, Aristillus crater, Mairan crater, La Condamine crater, Birmingham crater, and Archytas crater) are 7-12 ppm, whereas they are 3-5 ppm in their surrounding regions. In this study, using the low-altitude data set of KGRS, we derive higher spatial resolution maps of Th and K abundance of the PKT, based on 3°× 3°pixels, and we discuss the detail distributions of Th and K in the high-Th concentration regions of the PKT.

Keywords: Moon, gamma ray spectroscopy, thorium, potassium, the Procellarum KREEP terrane

