Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PPS024-19 Room:103 Time:May 23 11:15-11:30

Validation of method for estimating abundance of FeO and TiO2 using kaguya (SELENE) Multi-band Imager data

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Understanding of elemental concentrations and its ratio on the Moon surface plays an important role to reveal a formation process of the Moon. Each mineral constituting a rock absorbs specific range of wavelengths and reflects light the rest. Especially, the colored mineral such as olivine, clinopyroxene and orthopyroxene absorbs visible and near-infraved band by Fe^{2+} containing in those minerals. Pevious studies aim to identify minerals from the feature of its reflectance spectrum observed by remote-senshing.

However, slope of the reflectance spectrum, absorption depth, and reflectivity change with progress of the space weathering generated by the cosmic ray radiations on the lunar surface. The degree of the space weathering is called ”maturity”. Several methods to eliminate influence of space weathering and estimate abundance of FeO and TiO_2 were developed from detailed studies of using a meteorite or the sample of the moon [e.g., Lucey et al. 1998., 2000]. These method are based on the following experiments with respect to FeO content : The ration of reflectance at 950nm (R_{950}) to that at 750nm (R_{750}), that is R_{950}/R_{750}, decrease as iron abundance in a mineral increases, while R_{950}/R_{750} increases and R_{750} decreases as maturity increases. As for the abundance of TiO_2, the algorithm is derived from the, relation between the ration of reflectance at 415nm (R_{415}) to R_{750} and R_{750}. However, various problems are pointed out. One of the problems is the possibility that effect of the space weathering is not completely isolated from FeO content in this method. Lucey et al. [1998] assume that a plot of R_{950}/R_{750} vs R_{750} concentrated into the optimized origin as space weathering advances for most minerals, but it is suggested that trends of constant iron but varying maturity are parallel than radial in the mare [Staid and Pieters et al., 2000]. Wilcox et al. [2005] provided a plot of R_{950}/R_{750} versus R_{750} through the study of about 10,000 craters in six mare regions using spectroscopic data of the Clementine. Their algorithm, derived from trends on the plot, better compensates for maturity and provides less uncertainties due to maturity variations than previous studies. However they did not consider the method for estimating TiO_2 content. In this study, kaguya Multi-band imager (MI) data of Humorum are used to review the method presented by Lucey et al. [1998] geological analysis as well as Wilcox et al. [2005].

Keywords: Multi band Imager, Mare Humorum