Possible methods for analysis of mineral composition on the lunar surface using SELENE/MI

Shinya Okuno[1]; Shinsuke Kodama[2]; Makiko Ohtake[3]; Yasushi Yamaguchi[4]

[1] Earth and Planetary Sci., Nagoya Univ.; [2] AIST; [3] ISAS/JAXA; [4] Earth and Planetary Sci., Nagoya Univ

1. Introduction

The Japan Aerospace Exploration Agency (JAXA) plans to launch the lunar explorer, SELENE, in this summer. Multi band Imager (MI) onboard SELENE takes the visible and near-infrared images in nine spectral bands. The spatial resolution of visible range of SELENE/MI is 20m, about ten times higher than that of Clementine launched by National Aeronautics and Space Administration (NASA). We investigated the possible methods for analysis of mineral composition on the lunar surface using SELENE/MI data.

2. Data

Reflectance spectra of mixtures of Anorthite (An), Olivine (Ol) and Clinopyroxene (CPx) measured by JAXA (Hoashi, 2003MS) were used in this study. The size of minerals ranges from 75 to 105 microns. All spectra were measured over the spectral range of 0.25 to 2.6 micrometer with about 6nm sampling resolution at a phase angle of 30 degrees. Also used reflectance spectra of the lunar mare soils and lunar highland soils were measured by the Lunar Soil Characterization Consortium (LSCC). The size of soils ranges from 10 to 20 microns. All spectra were measured over the spectral range of 0.3 to 2.6 microns with 5nm sampling resolution at a phase angle of 30 degrees.

3. Method

The effects of Space weathering are the darkening and reddening of lunar surface materials, along with the changes to the depths of absorption bands in their reflectance spectra. We took band ratios and continuums in order to remove the effects of space weathering. The continuum line is drawn by connecting the reflectance at 750nm and 1550nm bands. And we took Relative-Band Depth (RBD), is the ratio using 3 bands, in order to calculate An abundaunce. Analysis flow shows the following figure.

4. Result

The low-Ca pyroxene abundance can be calculated from the 950nm/1000nm ratio of reflectance spectra. The low-Ca Px/(Ol+Px) ratio can be calculated from the 1050nm/900nm ratio after continuum removal. If olivine abundance is high, the Ol/(Ol+Px) ratio can be caluculated from the 1050nm/1250nm ratio after continuum removal. But in cases of immature high land samples, the continuum line is drawn by connecting the reflectance at 415nm and 750nm bands, because highland samples generally have high low-Ca Px abundance and low-Ca Px has absorption band at 1550nm. The (An+Ilm)/(An+Ilm+Px+Ol) ratio can be calculated from the (750nm+1550nm)/950nm ratio. By combining these methods, we can estimate major mineral compositions by using SELENE/MI data. These mineral compositions combined with the information to be obtained by the other instruments onboard SELENE will provide insights into the moon's origin and evolution.