Surface geology analysis of the moon using data obtained by Clementine;

Jun-ya Terazono[1], Yoshisada Takizawa[1], Jun'ichi Haruyama[1], Hisashi Ohtake[1], Keiichi Kumita[2], Yoneharu Matano[2], Hiroshi Kanbara[2], Tomoji Sanga[2], Ryoichi Kouda[3]; 1 *National Space Development Agency of Japan (NASDA)*, 2 *Nikko Exploration and Development, Co. Ltd. (NED)*, 3 *Geological Survey of Japan (GSJ)*

We studied the lunar surface geology and mineralogy with using image maps which we made from the Clementine image data released by NSSDC (National Space Science Data Center). We could discriminate geological differences of the area that covers the Apollo 17 sampling sites. Our investigation using the Clementine image data will contribute to future lunar missions.

We have made lunar surface maps by tiling raw images obtained by the Clementine spacecraft for each band of the UVVIS (ultraviolet-visible) camera and the NIR (near-infrared) camera. From original images, we eliminate the commonly appeared low frequency components which are regarded as the effect of aberration. Spatial resolutions which differ in each image are reduced to the poorest one in each map. We made color ratio image maps from our tiled lunar surface maps with color assignments being blue = C band (900 nm) / A band (415 nm), green = C band / B band (750 nm) and red = C band / D band (950nm).

We investigated the lunar surface geology for an area which includes the rock sampling sites of the Apollo 17 mission. The area is divided into six geological regions in the USGS geological map [2]: Iba (mare basalt and ash), Cl (material of light mantle), pIm (massif material), pIhs (material of sculptured hills), Ccy (material of sharp-rimmed craters) and Cco (material of craters and crater clusters). Iba is distributed over Taurus-Littrow valley around the Apollo 17 landing site. Cl, pIm and pIhs cover highland regions such as North Massif, South Massif and Sculptured Hills [2] around the landing site.

The color difference in our color ratio image map is in good agreement with the geological classification in the USGS map: the regions corresponding to Iba, Cl, pIm, and pIhs are clearly discernible each other, and the regions to Cco are emerged as spots in the Iba region in our map.

The border between the Cl region and the pIm region is undiscernible on the ratio image, which means that both regions are composed of similar materials. We note that the light mantle material was supplied by the avalanche occurred at South Massif [3].

We examined if our geological map is consistent with mineral composition data deduced from Apollo samples. The Iba region is represented by red on our color ratio image map, which indicates that this region has a large content of minerals as olivine and/or pyroxene of higher reflectance ratio of C/D than that of C/A and C/B [4]. On the other hand, the mineral composition

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of the Apollo samples (e.g., sample #70181) collected from the Iba region is rich in Diopside (18.57%) and Hypersthene (23.12%) [5]. The color tones of the pIm and Cl regions are blue and/or green on our map. In other words, the regions should be occupied by minerals as plagioclase of higher reflectance ratio of C/A than that of C/D and C/B [4]. Apollo samples of these regions are rich in Anorthite (e.g., 54.05% for sample #72500 and 53.94% for sample #72701) [5]. Accordingly, the mineral compositions indicated from our map are consistent with those of the Apollo samples.

We could discriminate the geological differences around the Apollo 17 landing site using the Clementine image data. We found that color tones in the ratio image are consistent with mineral composition data of the collected samples by the Apollo 17 mission. However, it is difficult to figure out mineral compositions quantitatively only from the color tones. More detailed spectral data are required. In early 2000's, Japan will launch a lunar orbiter by the H-II rocket. Spectrometer specifications are now under review in the mission working group. Our present study will contribute to the definition of the band assignments and the spatial resolution.

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