Space Weathering and Spectral Behaviors of Lunar Crater Wall Quadrants

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Regolith on the lunar surface become darkened, reddened, and comminuted by the space-weathering agents such as solar wind and micrometeoroids. The degree of space weathering is influenced by the incident flux as well as by the local composition. Optical property variation inside an impact crater provides a good way to manifest the spectral behaviors of weathering process per effective area because the surface normal direction varies along the azimuth while the composition and the elapsed exposure time remains same. In this work, we divide a crater wall into the four quadrants (north, south, east, and west) and analyze the distribution of each quadrant on the diagram of 950-nm/750-nm reflectance-ratio and 750-nm reflectance. Using the topography-corrected images by Multispectral Imager (MI) onboard SELENE (Kaguya), the phase angles and/or shades effect became ignorable. For thousands of impact craters across the Moon, we categorize the spectral distributions of the wall quadrants on the 950-nm/750-nm versus 750-nm diagram and characterize the spectral behaviors considering their locations, surface normal directions, and regolith compositions. The solar-wind reduction by the Earth’s magnetotail shielding is considered to explain the differences between east- and west-facing wall quadrants as a function of longitude. Further analyses on the spectral behaviors of crater wall quadrants will allow us to trace the space-weathering track on the reflectance-ratio and reflectance diagram.

Keywords: regolith, space-weathering, Moon, crater, maturity

