A Survey of D-type Spectra on the Moon based on Hyperspectral Remote Sensing

*Satoru Yamamoto¹, Sei-ichiro WATANABE², Tsuneo Matsunaga¹

1. National Institute for Environmental Study, 2. Nagoya University

Spectral D-type asteroids are characterized by dark, red-sloped, and featureless spectra in the visible and near-infrared wavelengths, and are though to be composed of rocks rich in organic compounds. The Martian two satellites, Phobos and Deimos, resemble spectrally D-type asteroids, suggesting that their origins are by capture of D-type asteroids outside the Martian system, while we need to explain how they were captured and evolved into near-circular and equatorial orbits around the Mars. Alternative explanation is that the two satellites originated from the accumulation in a disc of debris orbiting around the Mars that were ejected by a giant impact of a protoplanet. If so, dark, red-sloped, and featureless spectra for these satellites may be accounted for by alteration due to shock processes and/or space weathering. In addition, while Phobos possesses the red and blue units that are spectrally different in the visible and near infrared wavelengths, there is no information about the difference in composition between the two units. Furthermore, recent observations with the continuous spectral reflectance (hyperspectral) data for the Moon revealed that rocks composed of anorthosites affected by space weathering show dark, red-sloped, and featureless spectra, which may resemble D-type spectra. Therefore, it remains unknown of what kind of materials the bodies showing D-type spectra are composed.

From this point of view, we focus on the Moon, because the huge data set of the hyperspectral data obtained by the recent lunar missions allow us to examine whether and what kinds of D-type like spectra could exist on the lunar surface. In this presentation, we discuss the occurrence trends and spectral characteristics of dark materials on the lunar surface based on the data mining analysis with the hyperspectral data obtained by Spectral Profiler onboard the lunar mission SELENE/Kaguya.

Keywords: Remote Sensing, Hyperspectra, Moon, Mars, Asteroid, Kaguya/SELENE