Spectral Comparison between Space-Weathered Anorthosite and D-type Spectra on the Martian Satellites based on Hyperspectral Remote Sensing

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Spectral D-type asteroids are characterized by dark, red-sloped, and featureless spectra in the visible and near-infrared wavelengths. The characteristics of the D-type spectra hint at a carbonaceous chondrite composition of the surfaces such as the Tagish Lake meteorite. The Martian two satellites, Phobos and Deimos, resemble spectrally D-type asteroids, raising the possibility that their origin is by capture of carbon-rich D-type asteroids formed in the outer solar system. However, it is unclear how to explain the near-circular and equatorial orbits of the Martian satellites. An alternative formation scenario is that the two satellites originated from accumulation in a circum-Martian accretion disk formed by a giant impact. However, it remains unclear how to explain the D-type spectra in the giant impact scenario. 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.

Recently, we have found that the spectral features of lunar space-weathered anorthosite are consistent with D-type spectra, including those of Phobos and Deimos. From this point of view, we proposed a possibility that the surfaces of Phobos and Deimos are dominated by space-weathered anorthosite (SWA hypothesis). In this presentation, we will demonstrate how various observational results for Phobos and Deimos are consistent with spectra expected from SWA hypothesis. In addition, we will discuss how the red and blue units on Phobos can be explained by SWA hypothesis. Moreover, we will also discuss the relation between SWA hypothesis and the giant impact scenario.

Keywords: Martian satellites, remote-sensing, hyper spectral

