SPECTRAL SIMILARITIES BETWEEN JUPITER IRREGULAR SATELLITE HIMALIA AND MAIN BELT C-TYPE ASTEROIDS.

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Introduction

Himalia (JVI) is an irregular satellite of Jupiter and is the largest member of the Himalia dynamical family (prograde group). It orbits Jupiter at distance of about 11.5 million km (∼165 Jovian radii) with orbital period of 250.6 days[1]. Himalia has low thermal inertia, with significant surface roughness with visible albedo of 5.7±0.8% [2] indicating an absence of bright ice on its surface [3]. The Cassini spacecraft obtained resolved images of Himalia that showed it to be an elongated object with axes of 150X120 km [4]. The photometric color studies of Himalia suggest it is compositionally similar to C-and D-type carbon-rich asteroids from the outer main belt [e.g., 3, 5–11].

The NIR telescopic observations of Himalia suggested lack of aqueously altered phyllosilicates on its surface [8]. Contrary to this result, Cassini spacecraft observations found an absorption band near 3-μm suggesting the presence of water in some form [12, 13].

Telescopic observations

We obtained NIR spectra of Himalia on September 19, 2012 using the SpeX instrument on the NASA IRTF in low-resolution (R 150) prism mode with a 0.8" slit. The slit was oriented along the parallactic angle in order to reduce the effects of differential atmospheric refraction. The prism data were processed using the IDL-based Spextool provided by the NASA IRTF [14]. The data reduction process followed is as described in [15, 16].

Figure 1 shows the normalized reflectance spectrum of Himalia with standard errorbars representing the standard deviation computed at each pixel location divided by the square root of total number of measurements.

Results

We observed several unique spectral features in Fig. 1 mainly around 1, 0.75, and 2.3 μm with a moderately red slope. The absorption band positions suggest the presence of ferric phyllosilicates, an important indicator of past aqueous alteration of its parent body [e.g., 17, 18].

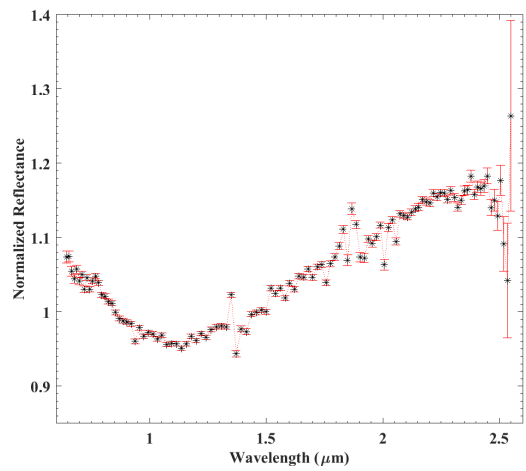

Figure 1: Normalized NIR reflectance spectrum of Himalia. Higher scatter in some wavelength ranges is due to incomplete telluric correction.

An excellent match between Himalia and main belt C-type asteroid (52) Europa was found by [19] by comparing their absolute reflectance values for 3-μm region by changing the absorption band depth and the continuum slope of (52) Europa by 70% and 23%, respectively. We compared the normalized reflectance spectrum of Himalia with the normalized reflectance spectrum of C-type asteroids (52) Europa and (24) Themis in Fig. 2. We observed that the absorption band shape is comparable to (52) Europa and (24) Themis in NIR wavelength range and the normalized spectrum of Himalia falls in between the spectrum of (52) Europa and (24) Themis. The surface composition of (52) Europa and (24) Themis

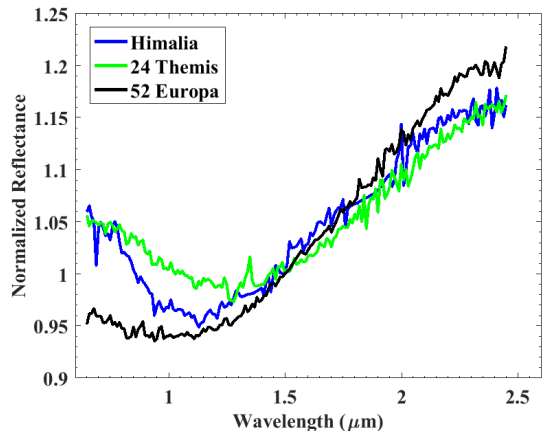

Figure 2: Near-IR spectrum of Himalia compared to spectra of main belt asteroids (52) Europa and (24) Themis. Spectra are normalized to unity at 1.5 μm.

is unknown and are classified as C-types under the Bus-DeMeo taxonomic system. We find that the 1-μm absorption band depth of Himalia is larger in comparison to (52) Europa and (24) Themis with the band center position shifted towards shorter wavelengths.

The results from Fig. 1 and 2 indicate that the parent object of Himalia may have spectral properties similar to some C-type asteroids from the main belt as also reported by previous studies [e.g., 3, 5–11].

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