SHADES OF GREY: IAPETUS' SECRETS AREN'T JUST BLACK AND WHITE. K. S. Jarvis[1], E. S. Barker[2], F Vilas[3], and T. Owen[4], [1]Lockheed-Martin Space Missions Systems & Service, 2400 NASA Rd 1, C23, Houston, TX, 77058-3799. Kandy.S.Jarvis1@jsc.nasa.gov [2]McDonald Observatory, The University of Texas at Austin, 1 University Station C1402, Austin, TX 78712-0259. esb@pecos.as.utexas.edu [3]NASA-JSC, Houston, TX 77058. Faith.Vilas@jsc.nasa.gov [4]University of Hawaii Institute for Astronomy, 2680 Woodlawn Dr., Honolulu, HA 96822. owen@ifa.Hawaii.edu.

Introduction: Until the Cassini mission flies to the Saturnian satellite Iapetus, we are limited to ground-based data and Voyager I and II flyby data to puzzle together the secrets of this moon that displays extreme albedo contrasts. Iapetus' leading side is carbon black with an albedo of 0.081[1]; its trailing side is brilliant ice with an albedo of 0.41[1]. Very few moderate-resolution visible/near IR spectra of Iapetus exist. New spectra of both the leading and trailing sides covering a wavelength range of 0.575 - 1.03 μm were taken in 2000. The new leading side spectra fail to match spectra of either Vilas et al. [2] or Bell et al. [3] in both inflections and slope (where slope is defined here as change in reflectance with changing wavelength). The new spectra do, however, appear to match Buratti et al.'s [4] spectrum of the leading side.

Iapetus Leading Side Spectra: Narrowband reflectance spectra of the trailing (W elongation, bright) and leading (E elongation, dark) sides of Iapetus were obtained around elongations on 21 – 22 Sep 2000 (W), and 28 – 29 Oct 2000 (E). The McDonald Obs. 2.1-m telescope was used with a facility spectrograph and CCD to obtain spectra having a two-element resolution of ~10A. These spectra were obtained to confirm or negate the existence of visible/near infrared absorption features previously seen in spectra of Bell et al. [3] and Vilas et al. [2]. When the slopes of the new leading side spectra did not match these previously acquired spectra, and no hint of previously identified features was apparent, other spectra were also examined. The 2000 spectra match those of Buratti et al. [4] well. See Figure 1. The sub-Earth locations on Iapetus when the spectra were acquired were compared. The longitudes ranged around the apex of the leading edge at 90°. The spectra of Vilas et al. and Bell at al. were located at 0° and +3.2° latitude, respectively. The Buratti et al. and the 2000 spectra, however, were located at latitudes that ranged from -13.4 to -14.7°.

Location, Location, Location: Buratti and Mosher [5] showed that albedo varies gradationally with latitude and longitude across the surface of Iapetus, increasing in brightness with distance from the apex (0° lat., 90° long.). Using a cone covering 45° around the sub-Earth point, visual examination of Iapetus' maps based on Voyager data shows that the variation in latitude changes the percentage of bright terrain (polar ice) contributing to the leading side's spectra. Initial results suggest that the slope of leading side spectra will show latitude-based variation caused by the polar ice contribution. Older photometric data are being evaluated to determine if they, too, display the expected slope variation with latitude.

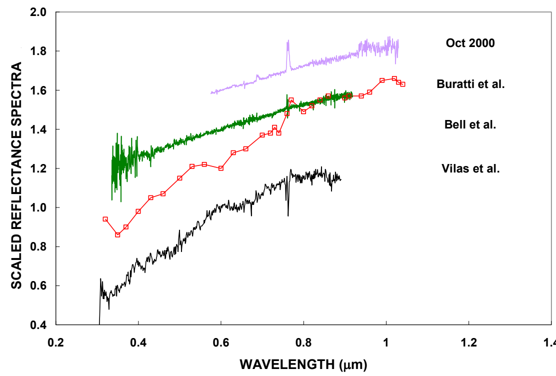

Figure 1. Shown are four of the leading side spectra of Iapetus. They have been offset by 0.2 vertically. The Buratti et al. and Oct. spectra display no apparent inflections or absorptions whereas the Vilas et al. and Bell et al. spectra do.

0.67-μm Absorption Feature: Some spectra of the dark material on Iapetus extracted from leading side spectra [2,3] display an absorption feature around 0.67 μm. The 2000 spectra show no indication of this feature. Using a linear mixing model, we attempt to determine what percentage of the bright material combined with the dark material is necessary to mask the 0.67-µm absorption feature, and reduce the positive slope seen in spectra of the leading side. The effects of albedo changes with latitude will be included.

One remaining question is the origin of the 0.67-µm absorption feature. The assignment of the feature to Fe^{3+} in iron alteration materials [2] is indefinite at best. Recent work on the effects of UV-pumped luminescence of surface ices could explain the origin of this feature [6]. We are considering how this proposal meshes with the location dependency of the visible/near IR Iapetus spectra.

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