IMPLICATIONS FOR THE ORIGIN OF JOVIAN IRREGULAR SATELLITES FROM REFLECTANCE SPECTRA. Faith Vilas[1] and Amanda R. Hendrix[1], [1]Planetary Science Institute (1700 E. Fort Lowell Rd., Suite 106, Tucson, AZ, 85719, fvilas@psi.edu).

Introduction: Recent dynamical studies of Solar System evolution advance our understanding of the physical distribution of objects out through the Kuiper Belt. In the Nice model [1,2,3], the Jovian planets experienced a violent reshuffling event ~3.9 Gyr ago. In this process, gravitational interaction with planetesimals leaving the planetesimal disk induced slow planetary migration in the jovian planets. Eventually, Jupiter and Saturn crossed their mutual 1:2 mean motion resonance, triggering a reorganization of the Solar System: giant planets moved, existing small body reservoirs were depleted or eliminated, and new small-body reservoirs were created. The Nice model and subsequent refinements (e.g., [4]) predict that transported KBOs should dominate in the outer part of the main asteroid belt. Based on existing observations of the KBOs, these main-belt asteroids should appear dark and show increasing reflectance with increasing wavelength ("reddening"). Spectral evidence shows, however, that the outer main asteroid belt is dominated by the grossly spectrally neutral ("grey") C-complex asteroids from 2.6 to 3.2 AU. Approximately 50% of these C-complex asteroids also show absorption features in the 0.3- to-3.5 μm range suggesting aqueous alteration (the alteration of material by the interaction of that material with liquid formed by melting of incorporated ice) (c.f., [5]).

Bottke et al. [6] argue that more than 90% of weakly-indurated objects captured in the outer main belt could have been eliminated by impacts in the violent reshuffling episode; pieces of these disrupted objects should then be left behind in the ancient regoliths of stronger asteroids. The observed aqueous alteration absorption features have generally not been detected in spectra of D-class asteroids. The existence of features attributed to aqueous alteration products has, however, been suggested in the reddened broadband photometry spectra of outer irregular jovian satellites [7]. As well, a 3.0-μm water of hydration feature has been observed in the NIR spectrum of JVI Himalia [8]. We aimed to explore the possibility that evidence of remnants of disrupted weaker objects could be present on surfaces of stronger objects that have been captured in these outer orbits around Jupiter as a result of the proposed violent shuffling of small objects, and that this evidence manifests itself in a combination of aqueous alteration spectral features existing with spectral reddening.

Visible/Near-Infrared Spectra of Outer Irregular Jovian Satellites: Moderate resolution VNIR narrowband spectroscopy was obtained of the jovian irregular satellites JVI Himalia, JVII Elara, JVIII Pasiphae, JIX Sinope, JX Lysithea, JXI Carme, JXII Ananke and JXVII Callirrhoe in 2006, 2008, 2009, and 2010 using the MMT Observatory facility Red Channel spectrograph to confirm the presence of this feature. The spectra are centered near 0.64 μm in order to cover the 0.7-μm feature entirely (generally ranging from 0.57 to 0.83 μm). When possible, the object was observed on more than one night for confirmation purposes. The spectra generally have a dispersion/element of ~0.6 nm (6Å); this varied by observing run. In some cases, we averaged reflectance values around a central wavelength in order to smooth the spectra and improve the signal-to-noise ratio. These spectra sample three prograde ($i = 28^o$), four retrograde ($i = 149^o$, 165^o) and one independent satellite.

We observe these initial findings among these spectra:

- An absorption feature centered near 0.7 μm exists in the spectra of the three prograde ($i = 28^o$) satellites. None appears spectrally reddened. This suggests a common parent body.

- A different absorption feature appears in the spectra of the three retrograde ($i = 149^o$) satellites, also suggesting a common parent body. Varying reddening is observed.

- Reddening, but no absorption feature, is observed in the individual observation of ($i = 165^o$) and one independent satellite, similar to the D-class asteroids dominating the Trojan population.

- Characteristics of both observed absorption features vary from what has generally been observed among the C-complex asteroids, suggesting that the compositional origins of these features could be different.

Progress in these findings, and implications for the origins of these objects, will be discussed.

Acknowledgements: The MMT Observatory is a joint facility of the University of Arizona and the Smithsonian Institution.

References: [1]Tsiganis K. et al. (2005) Nature 435, 459 - 461. [2] Morbidelli A. et al. (2005) Nature 435, 462 - 465. [3]Gomes R. et al. (2005) Nature 435, 466 - 468. [4] Nesvorny D. et al. (2014) ApJ 784, 6pp. [5] Rivkin A. et al. (2002) In Asteroids III, 235-253. [6] Bottke W. et al. (2008) LPSC XXXIX Abstract #1447. [7] Vilas F. et al. (2006) Icarus 180, 453-463.