CHARACTERIZING UV/BLUE SPECTRAL EVIDENCE OF SPACE WEATHERING IN S-COMPLEX ASTEROIDS: APPLICATIONS TO THE INNER SOLAR SYSTEM. F. Vilas[1] and A. R. Hendrix[2], [1]Planetary Science Institute, 1700 E. Fort Lowell Rd., Suite 106, Tucson, AZ 85719, fvilas@psi.edu, [2] Jet Propulsion Laboratory, 4800 Oak Grove Dr. M/S 230-250, Pasadena, CA 91109, arh@jpl.nasa.gov.

Background: In the inner Solar System, "space weathering" affects spectra of small Solar System bodies by darkening and reddening their surface materials, as well as degrading absorption features, at VNIR wavelengths [1]. At UV/VIS wavelengths, a bluing of the spectral reflectance is observed[2]. The cause of this weathering is likely grain coatings caused by vapor deposition of submicroscopic iron (SMFe) [3], through solar wind irradiation and micrometeorite bombardment of the bodies' surfaces. Recently, the solar wind has been identified as the root of rapid reddening in the inner asteroid population, affecting near-Earth asteroids quickly [4].

We have shown that effects in the UV/blue spectral region for S-complex asteroids are consistent with the addition of iron or iron-bearing minerals [2]. Opaque materials (such as elemental iron or ilmenite) are dominated by surface scattering, controlled by Fresnel reflection, and are therefore spectrally flat over a wide range of wavelengths. Thus, compared to mafic silicate minerals, opaque, iron-bearing minerals can be relatively bright at FUV-NUV wavelengths. In the 0.15-0.45 µm range, iron-bearing minerals also vary from non-opaques in spectral shape, where the non-opaques experience a decrease in brightness as they transition from reflectance dominated by volume scattering to reflectance dominated by surface scattering, and opaques tend to be spectrally flat. Therefore, in the 0.15-0.45 µm range, we expect surfaces consisting of iron-bearing opaques to be less spectrally red and potentially brighter than surfaces with lower amounts of iron-bearing minerals. Further, we expect to see the onset and effects of space weathering more rapidly in the UV/blue than in the VNIR wavelengths, as short wavelengths are more sensitive to thin coatings on grains that could be the result of weathering processes.

New Research: We have obtained new ground-based spectra of several S-complex asteroids including Datura, Karin, Lucascavin family members, emphasizing the 0.32 – 0.62 µm wavelength range using the Blue Channel facility spectrograph at the 6.5-m MMT. These new spectra are analyzed in the context of previous results that show that the MUV-VIS wavelength region exhibits a diagnostic spectral shape in response to weathering [2]. We show that UV/blue high-resolution spectra of the same S-complex asteroids confirm our earlier results, and ground-based higher resolution reflectance spectra are a valid probe of these characteristics. Figures 1, 2, 3 show the progression of UV/blue changes from older MBA to younger MBA to NEA in the new MMT spectra.

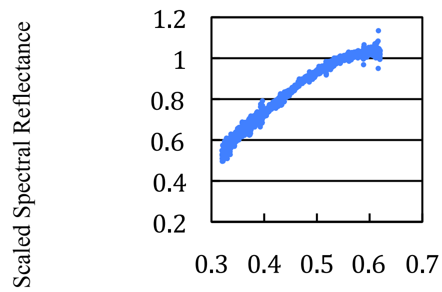

Fig. 1. MMT UV/blue spectrum of main belt asteroid 18 Melpomene.

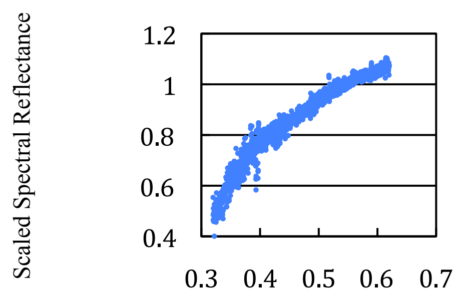

Fig. 2. MMT UV/blue spectrum of main-belt asteroid 1270 Datura.

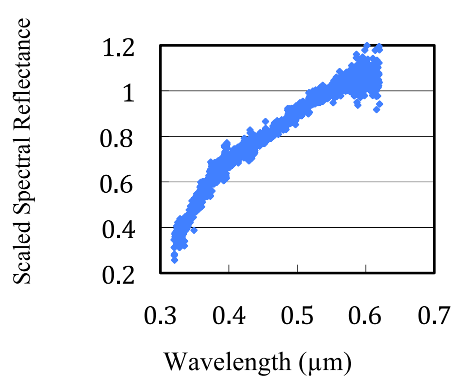

Fig. 3. MMT UV/blue spectrum of near-Earth asteroid 7341 1997 VK.

References: [1] Chapman, C. R., *MAPS, 31*, 699 -725 (1996); [2] Hendrix, A. R., & Vilas, F., *AJ, 132*, 1396 – 1404 (2006); [3] Hapke, B., *JGR, 106*, 10039-10073 (2001) [4] Vernazza et al., *Nature, 458*, 993 – 995 (2009).

Observations reported here were obtained at the MMT Observatory, a joint facility of the University of Arizona and the Smithsonian Institution.