THE SHORT WAVELENGTH END OF THE SPACE WEATHERING OF S-COMPLEX ASTEROIDS. 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 and, in some cases, a spectral reversal 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. This type of space weathering has been proposed as the source of spectral differences between ordinary chondrite meteorites and their proposed parent bodies, S-complex asteroids [1,3]. Recently, the solar wind has been identified as the root of rapid reddening in the inner asteroid population, affecting near-Earth asteroids quickly [4].

Our previous work has shown that the effect in the UV/blue spectral region for S-complex asteroids is consistent with the addition of iron or iron-bearing minerals. 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 (such as pyroxenes and feldspars, or "non-opaques"), opaque, iron-bearing minerals can be relatively bright at FUV-NUV wavelengths. In the 150-450 nm 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 150-450 nm 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: Our continued investigation has taken two directions. We have first obtained new ground-based observations of several S-complex asteroids emphasizing the 320 – 620 nm 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 is particularly sensitive to space weathering processes, and exhibits a diagnostic spectral shape in response to weathering [5]. Two objectives for these new spectra are considered here: Do UV/blue high-resolution spectra of the same S-complex asteroids that we analyzed using IUE data coupled with broadband photometry confirm our earlier results? If so, ground-based higher resolution reflectance spectra are a valid probe of these characteristics. Using this probe, what are the characteristics of family members of the recently discovered very young asteroid families (e.g., Datura, Karin, Lucascavin, etc.)? We have obtained spectra of S-complex asteroids including Datura, Karin, Lucascavin members. Figure 1 shows a comparison of existing data on 471 Papagena with the new MMT spectrum. Figure 2 shows a new MMT spectrum of Karin family asteroid 10783.

We also extend the consideration of a UV/blue probe to the photometry of small moving bodies acquired by the SDSS. The SDSS data are considered in the context of the two lowest wavelength filters (u', g'), and whether they serve as a sufficient pointer to finer variations in the UV/blue spectral region. The results of our probes of S-complex asteroids in this context will also be presented here.

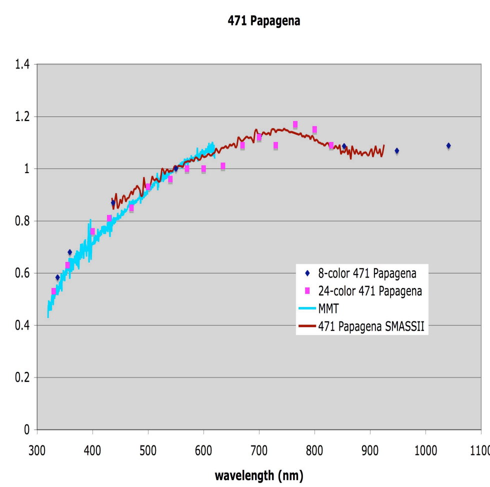

Fig. 1. MMT UV/blue spectrum of 471 Papagena compared with 8-color [7], 24-color [8], and SMASSII [9] data.

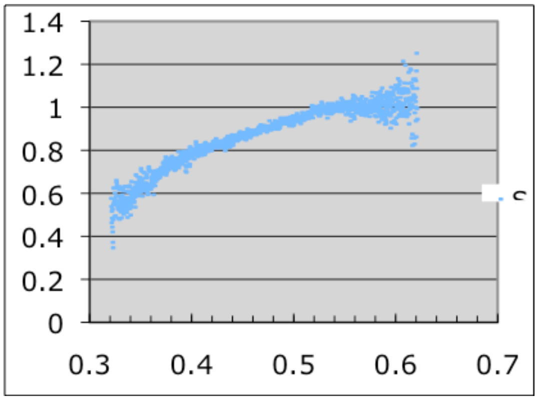

Fig. 2. MMT spectrum of Karin family asteroid 10837.

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