

LOW ALBEDO MAIN-BELT ASTEROIDS: AQUEOUS ALTERATION TRENDS WITH SMALLER DIAMETERS. F. Vilas and M. V. Sykes, ¹MMT Observatory, PO Box 210065, University of Arizona, Tucson, AZ 85721 (fvilas@mmt.org), ²Planetary Science Institute, 1700 E. Ft. Lowell, Ste. 106, Tucson, AZ (sykes@psi.edu).

Introduction: Asteroids showing evidence of aqueous alteration identified by the presence of the 3.0- μm water of hydration absorption feature and the 0.7- μm $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$ charge transfer transition dominate the observed asteroid population between 2.6 – 3.5 AU (see [1] for a review). Models of proposed heating mechanisms suggest that, within this zone, nearly all asteroids with diameters above 20 km should have been heated to the point of water mobilization. In most of this region, asteroids approaching 50-km diameter have been heated to temperatures exceeding the laboratory temperatures at which thermal metamorphism began in heated Murchison carbonaceous chondrite samples. Following the collisional history of asteroids in this region, smaller asteroids are expected to be the fragments of hydrated larger asteroids, while the largest asteroids could be battered remnants of asteroids that originally underwent thermal metamorphism and aqueous alteration showing mixed materials on their surfaces. As a result, one would expect a trend in which the fraction of low-albedo asteroids showing evidence of aqueous alteration decreases with decreasing diameter. Using ECAS photometry of a sample of 153 Tholen C-class (and C subclasses B, F, G) asteroids, Vilas and Sykes [2] tested this hypothesis by identifying the 0.7- μm absorption feature in ECAS photometry, and showed that the percentage of these asteroids showing the 0.7- μm feature decreases with decreasing diameter, consistent with the smaller objects being collisionally disrupted and scattered from a parent body following a collision. Carvano et al. [3] confirmed this study down to slightly smaller diameters. Using a small sample of asteroids, Feierberg et al. [4] showed a strong correlation between the $U - B$ color and the 3.0- μm water of hydration absorption feature. We attempt here to probe the surface characteristics of smaller-diameter asteroids in a search for characteristics indicating aqueous alteration applying the method of [4] to SDSS photometry of moving objects.

Search Methodology: A sample of 47838 moving objects were identified as part of the SDSS sample (prior to the summer, 2006, release #5) [5]; a subset of 21564 have been correlated with asteroids tabulated in the ASTORB catalog of orbital elements [6]. We first eliminated observations of objects whose photometry suggests that surface materials are *not* aqueously altered. To do this, we used the ECAS survey again, as it remains the largest survey of asteroid photometric characteristics that covers the full spectral range covered by the SDSS [7]. Tholen [8] developed a taxo-

nomic system that classified the asteroid based on spectral characteristics. Most of the Tholen C class (and subclasses B, F, G) correlate with aqueous alteration characteristics, so we used the characteristics of this asteroid population to define our elimination criteria. The ECAS includes observations made at three filters, v , w , and x , centered at wavelengths of 5500, 7010, and 8530 \AA , respectively. Solar-corrected colors of $v - w$ and $v - x$ were defined as part of the original research [7]; low and high colors are tabulated in the PDS system. By using these endmember colors, we define a range of possible values for these colors that separates “flat” or “grey” asteroid photometry from photometry showing more mineralogical structure in the near-infrared (e.g., S, V classes) or large changes in slope with increasing wavelength (“reddening”) (e.g., D class). This defined range was tested as a mechanism for sorting by running through the ECAS photometric observations: notably, all other flat asteroids such as Tholen’s P class were sorted separately from the C complex asteroid photometry, in addition to those objects whose photometry shows curvature from absorption features or reddening. These colors were converted to SDSS colors $r' - i'$ and $r' - z'$. Using these limits, we eliminated objects in the SDSS catalog having other than C-class characteristics. We confirmed Feierberg’s [4] identification criteria of $U - B \geq 0.12$ by examining a larger body of data than was available in 1985, and defined the corresponding $u' - g'$ value of 1.55. Binning by 5 km increments, we examined bins extending to a lower diameter limit of 2.3 km. We see some trends for decreasing evidence of aqueous alteration with diameter, and will discuss the implications.

References: [1] Rivkin, A., et al. (2003) In *Asteroids III*, 235 – 254, [2] F. Vilas & M. Sykes (1996), *Icarus* 124, 483, [3] Carvano, J. et al. (2003), *Icarus* 161, 356, [4] Feierberg, M. et al. (1985), *Icarus* 63, 183, [5] Adelman-McCarthy et al. (2007), *ApJS* 172, 634, [6] <ftp://ftp.lowell.edu/pub/elgb/astorb.html> [7] Zellner, B. et al., (1985), *Icarus* 61, 355, [8] Tholen, D., and Barucci, A. (1989), in *Asteroids II*, 298.