

SPECTRAL ANALYSIS OF AGNIA FAMILY MEMBERS B. A. Harvison¹, C. A. Thomas¹, N. A. Moskovitz², D. E. Trilling¹, L. F. Lim³, ¹Northern Arizona University, Department of Physics and Astronomy, ²Lowell Observatory, ³NASA Goddard Space Flight Center

Introduction: Asteroid families are populations of asteroids that share similar orbital characteristics. The asteroids in these families are considered to be parts of a once larger parent body. Sunshine et al. (2004) showed that the S-type Agnia contained objects that have been shown to be a likely product of partial differentiation and are most similar to primitive achondrites [1].

Sunshine et al. only analyzed five asteroids in the Agnia family and suggested that more observations were needed to conclude that this is a characteristic of the Agnia family as a whole. We have observed 19 asteroids from the Agnia family in the wavelength range of 0.8–2.5 μm . We calculated band parameters and then used the regions defined by Gaffey et al. (1993) to determine composition and possible meteorite analogs [2]. Here onwards, we refer to the Gaffey S-type regions as the “boot” diagram (Figure 1).

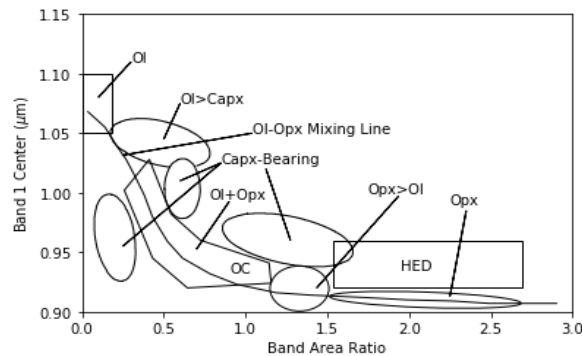


Figure 1: The Gaffey et al. (1993) regions show compositional regions, which are correlated to meteorite analogs. We refer to as the “boot” diagram. Figure generated using code from J. Sanchez [3].

Observations: We observed 19 asteroids from the S-type Agnia family with the low resolution prism mode on SpeX (0.8 – 2.5 μm , Rayner et al. 2003) at the NASA Infrared Telescope Facility (IRTF) [4]. The near-infrared spectra were collected during 2014B–2016B semesters as part of a survey that also included members of the Merxia and Massalia families. The visual spectra used in this study are from the MIT SMASS catalog (<http://smass.mit.edu/catalog.php>, Bus et al. 2002 [5]).

Methodology: We calculate Band 1 Center (B1C) and Band Area Ratio (BAR) from the 1 and 2 micron bands. With these parameters, we can determine if the members of the family have compositions similar to primitive achondrites.

We calculate band parameters for each spectrum with visible and near-infrared data. We start by finding the locations of the maxima of the 1 and 2 micron bands. For both bands, a tangent line is drawn between the band’s maxima. To determine the B1C we normalize the tangent line (slope = 1) and fit a 9th degree polynomial to the normalized band 1. We then identify the minimum value of our fitted polynomial, which we define as the B1C. To find the area of the bands we subtract the area under the band from the area under the tangent line. We calculate the BAR by dividing the area of band 2 by the area of band 1. Each asteroid analyzed has a B1C and BAR that is shown on the “boot” diagram (Figure 2). We use the “boot” diagram to determine the most likely composition and meteorite analog.

Results/Conclusion: We present the results from the 8 asteroids that had both visible and near-infrared spectral data available for our analyses. Only 8 of our 19 observed asteroids had the necessary wavelength coverage. Figure 2 shows the B1C and BAR of these asteroids placed onto the “boot” diagram. Our objects fall into regions consistent with primitive achondrite meteorites and partial differentiation. Our conclusions support those made in Sunshine et al. (2004). We also note that the spectral properties of these objects are relatively similar to each other showing that there is no evidence for significant compositional heterogeneity.

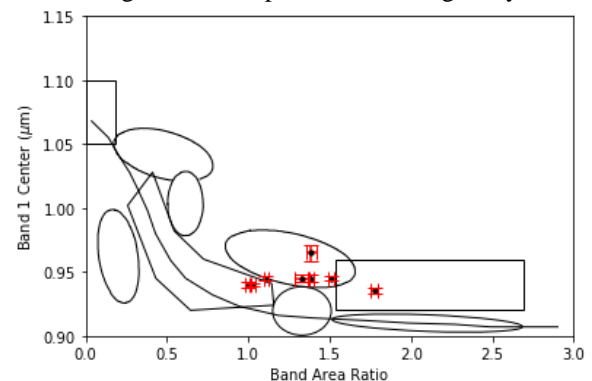


Figure 1: The “boot” diagram with plotted band parameters of the studied Agnia family asteroids.

References: [1] Sunshine, J. M. et al. (2004) *Meteoritics & Planet. Sci.*, 39, 1343–1357. [2] Gaffey, M. J. et al. (1993) *Icarus*, 106, 573–602. [3] Sanchez, J. A. personal communication. [4] Rayner, J. T. et al. (2003) *PASP*, 115, 805. [5] Bus, S. J. et al. (2002) *Icarus*, 158, 106–145.