A COMPARISON OF ORDINARY CHONDRITES WITH 243 IDA AND DACTYL. J. C. Granahan[1], [1]Science Application International Corporation (10932 Blake Lane, Bealeton, VA 22712. E-mail: james.c.granahan@saic.com).

Introduction: Infrared spectra of asteroid 243 Ida and its satellite Dactyl have features that are similar to those of L6 and LL4 chondrite meteorites. The 243 Ida and Dactyl data are from Galileo spacecraft Near Infrared Mapping Spectrometer (NIMS) observations obtained on August 28, 1993.[1] This NIMS data has been radiometrically calibrated during an effort to create spectral data products for the NASA Planetary Data System (PDS) and now can be compared to existing meteorite measurements. A comparison of one- and two-micrometer band centers and band areas of these recently calibrated 243 Ida and Dactyl data correspond to measurements of ordinary chondrite meteorite spectra.[2] This abstract describes the effort to create 243 Ida and Dactyl radiance spectral archive products and their comparison with known meteorite measurements.

Abstract: The archive product effort is processing NIMS data from the Galileo 243 Ida encounter archived as uncalibrated data number values in the NASA PDS Imaging Node. The NIMS imaging spectrometer possessed 2 silicon and 15 indium antimonide detectors that could acquire spectra ranging from 17 to 408 spectral channels.[3] The sensor had a grating that could move into 24 different positions. Different sequences of grating positions produced 17, 102, and 408 spectral channel observations of the 243 Ida system. A combination of the NIMS scan mirror and Galileo Orbiter scan platform motion worked to keep the sensor on target while the multiple components of the spectral data were acquired.

Radiance spectra were created by an application of NIMS calibration factors that were calculated for the Jovian portion of the Galileo mission. The NIMS sensor used a solar illuminated aluminum plate and a blackbody radiation source inflight to determine sensitivity values for radiance calibration.[3] NIMS had four gain states that could be used to optimize the spectral signal to the amount of light detected from a target. The 243 Ida NIMS observations were collected in gain state 3 and 4. Calibration values derived for the Jovian tour Ganymede 1, Ganymede 2, and Callisto 3 orbits were used to convert the 243 Ida data into quantities of radiance.

The current work has assembled spatially rectified radiance spectral image products and radiance point spectra products for submission to the NASA PDS Small Bodies Node. The spectral image products are configured as Flexible Image Transport System (FITS) [4] formatted files. The point spectra products are assembled as ASCII text table files. These data files are part of a data volume that includes support documentation. This documentation describes the sensor, spacecraft, mission, observations, navigation, and data processing used to create the data products. This data volume will be peer reviewed and revised prior to archival in the NASA PDS system.

The comparison of this data with those of meteorites was conducted as part of a data quality check. Previous asteroid 243 Ida NIMS and NASA Infrared Telescope Facility measurements (not including Dactyl) found values consistent with those of LL chondrites.[5] The NIMS 243 Ida and Dactyl data were converted into reflectance through a ratio with a solar radiance spectrum from "The Infrared Handbook".[6] The resultant reflectance spectra band centers and areas were measured for comparison with S type asteroids and meteorites as described by Gaffey et al.[7]

Figure 1 is a band I center versus band II/band I area ratio plot. Band I refers to measurements of the spectral band in the vicinity of one micrometer in wavelength. Band II refers to measurements in the neighborhood of two micrometers. The plotted values of 243 Ida and Dactyl overlap the SIV subclass field of S type asteroids.[7] The SIV subclass field corresponds to ordinary chondrite meteorite values as measured by Gaffey et al.[7]

Figure 2 is another band I center versus band II/band I area ratio plot. It compares 243 Ida and Dactyl values to ordinary chondrite meteorite values as measured by Dunn et al.[2] The bulk of the 243 Ida values are consistent with the measurements of L6 chondrite meteorites. Other portions of 243 Ida are similar to those of LL5 chondrite meteorites. The Dactyl values correspond to those of LL4 chondrites.

This work was made possible by funding from the NASA Planetary Mission Data Analysis Program.

References: [1] Carlson, R. W., et al. (1994), Bulletin of the American Astronomical Society, 26, 1156. [2] Dunn, T. L., et al. (2010), Icarus, 208, 789-797. [3] Carlson, R. W., et al. (1992), Space Science Reviews, 60, 457-502. [4] Pence, et al. (2010), Astronomy and Astrophysics, 524(A42), 1-40. [5] Granahan, J. C. (2002), Journal of Geophysical Research Planets, 107(E10), 5090-5100. [6] Wolfe, W. L., and G. J. Zissus (1985), The Infrared Handbook, General Dynamics. [7] Gaffey, M. J., et al. (1993), Icarus, 106, 573-602.

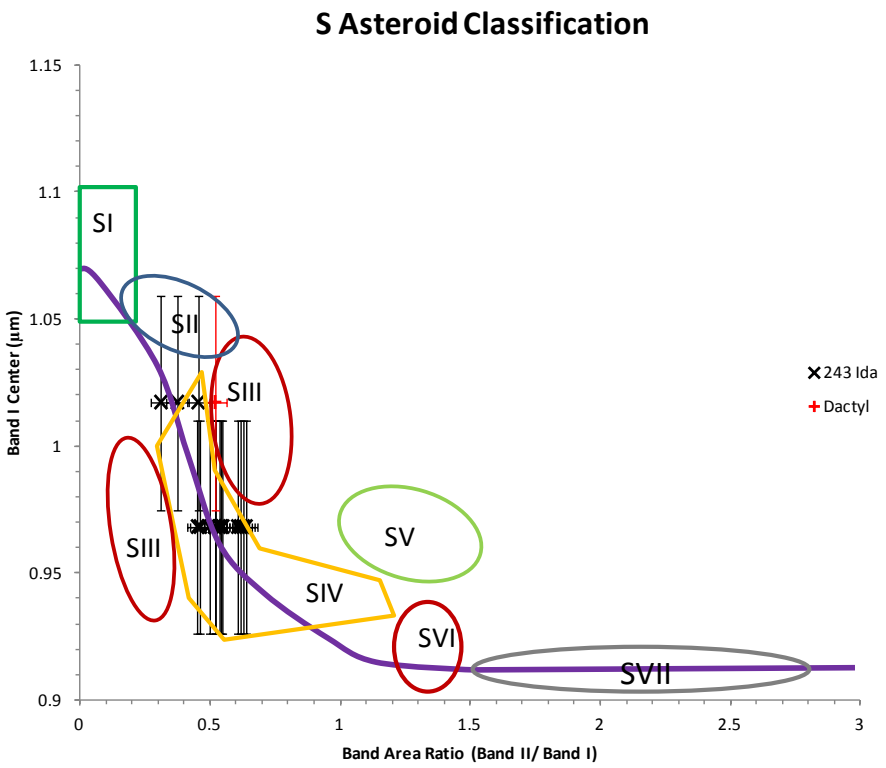

Figure 1. 243 Ida and Dactyl S type asteroid comparison plot

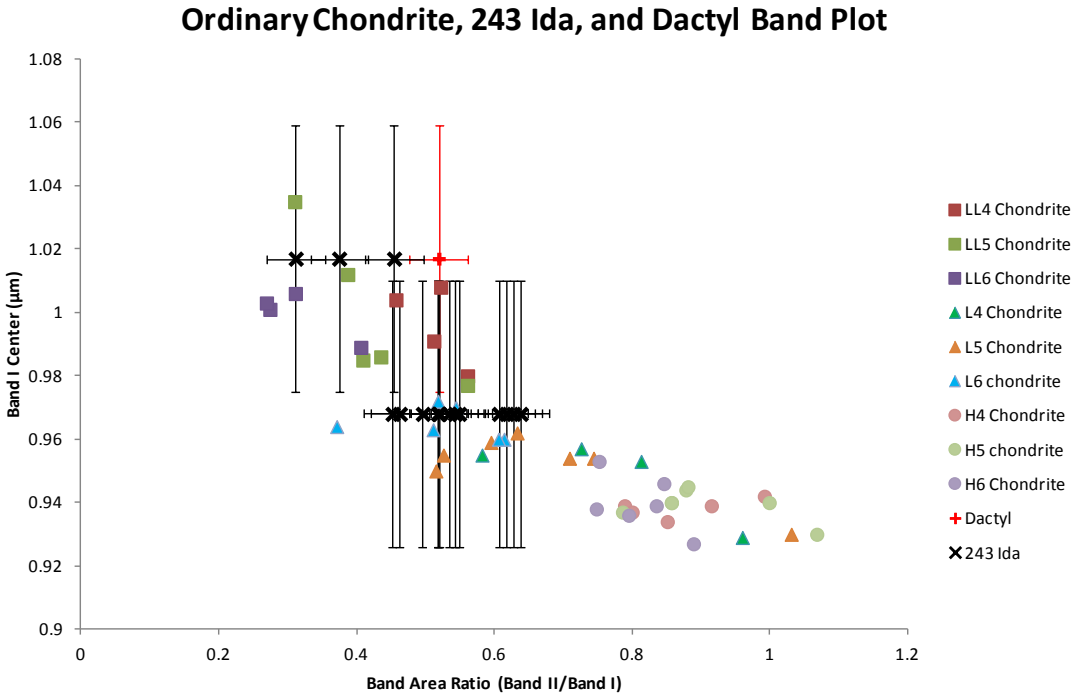

Figure 2. 243 Ida and Dactyl ordinary chondrite comparison plot