COMPOSITIONAL ANALYSIS OF NEAR-EARTH ASTEROID 2015 JD1

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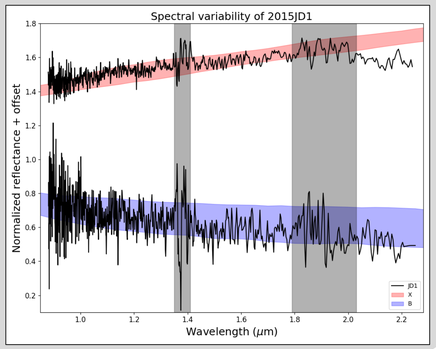
BACKGROUND

The surfaces of asteroids are exposed to many phenomena that can alter their geological properties. In November 2019, the near-Earth Asteroid (NEA) 2015 JD1 experienced a close flyby to the Earth. We performed an observational campaign to fully characterize this potentially hazardous asteroid using ground-based radar, spectroscopy, and photometry observations. In [1], we presented preliminary results on the physical characterization of 2015 JD1 (hereafter JD1) and rotational spectroscopy variability. **In this work, we utilized laboratory spectra from the Reflectance Experiment Laboratory (RELAB, [2]) to perform compositional analysis of the spectral variability.** Our observations suggest that **JD1 is an E-type** with a surface composition similar to aubrites, a class of differentiated enstatite meteorites [3].

NEAR-INFRARED VARIABILITY

The figure in the right shows the near-infrared (NIR) spectral variability of JD1 obtained at the Lowell Discovery Telescope (LDT). The spectral slope difference is ~40% μm^{-1}. Grey shaded area indicates the residual telluric features while red and blue are the X- and B-types average spectra [4].

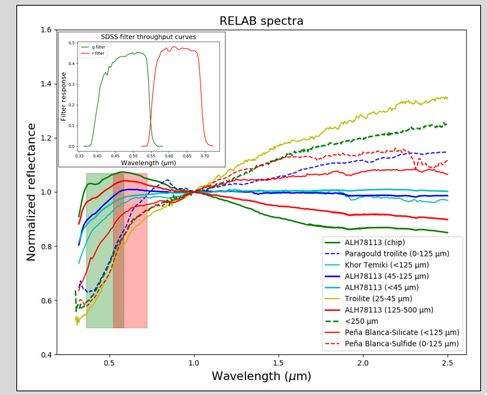


References: [1] López-Oquendo, A., Trilling, D., Gustafsson, A., et al. 2020, Vol. 52, AAS/Division for Planetary Sciences Meeting Abstracts, 415.01. [2] http://www.planetary.brown.edu/relabdata/ [3] Keil, K. 2010, Chemie der Erde / Geochemistry, 70, 295. [4] DeMeo, F. E., Binzel, R. P., Slivan, S. M., & Bus, S. J.2009, Icarus, 202, 160.

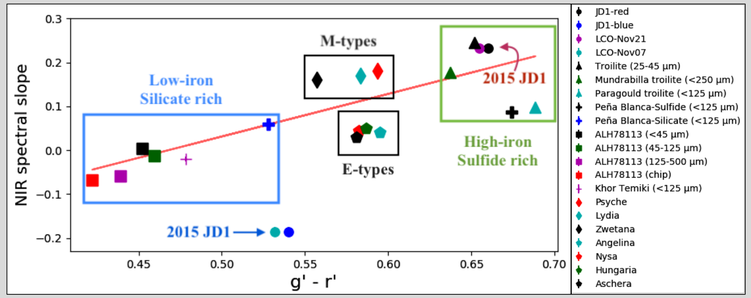
Acknowledgments: This work was supported in part by the Arizona Board of Regents and by NASA grant No. NNX15AF81G. This work was made possible in part through the State of Arizona Technology and Research Initiative Program. These results made use of the Lowell Discovery Telescope (LDT) at Lowell Observatory. LDT is localized on homelands sacred to Native Americans. We want to honor their past, present, and future generations, who have lived throughout the region.

METHODS

To explore the spectral variation of JD1, we developed a spectral slope and visible reflectance color study. We selected aubrites meteorites' spectra, as they are related to the E-type asteroids and minerals such as troilite from the RELAB spectral catalog. We retrieved the reflectance color using spectral convolution between Sloan filters response functions and the RELAB spectra sample. We derived the NIR spectral slope from 0.86 to 2.5 μm. The right figure shows the selected RELAB spectra and the Sloan g (green line) and r (red line) filters response functions (smaller panel in the top left).



RESULTS



The figure on the left shows the spectral slope as a function of the retrieved reflectance Sloan color. JD1 spectral measurements are shown in filled circles. This analysis shows both the effects of composition and grain sizes in the spectra. We find that silicate-rich samples (blue box) have bluer colors and spectral slopes than high-iron and sulfide-rich ones (samples in the green box). We find it unlikely to explain JD1's variability due to different grain sizes as they attribute a spectral slope change of ~10%. Thus, different compositions seem to be a feasible explanation of it.

CONCLUSIONS AND FUTURE WORKS

Our comprehensive analysis of the observed rotational spectral variability allows us to draw the following conclusion: **JD1 is an E-type asteroid rich in sulfides and iron with a surface patch richer in silicates and deficient in iron**, responsible for the spectral variability observed in this sub-kilometer NEA. These results show evidence that supports spectral heterogeneity across surfaces in the NEA population. We plan to continue this investigation in order to validate spectral inhomogeneity in the surface of JD1 using spectrophotometry and spectroscopy observations.