SEARCH FOR IRON OXIDE AND IRON SULFIDE ON ASTEROID (101955) BENNU FROM OSIRIS-REX VISIBLE AND INFRARED SPECTROMETER PRELIMINARY SURVEY DATA. B. E. Clark[1], X. D. Zou[2], H. H. Kaplan[3], S. Ferrone[1], E. S. Howell[4], V. E. Hamilton[3], A. Praet[5], J.Y. Li[2], M. A. Barucci[5], J. R. Brucato[6], G. Poggiali[6], D. S. Lauretta[3], and the OSIRIS-REx Team. [1]Ithaca College, Ithaca, NY (bclark@ithaca.edu), [2]Planetary Science Institute, Tucson, AZ, [3]Southwest Research Institute, Boulder, CO, [4]University of Arizona, Tucson, AZ, [5]Paris Observatory, Paris, France, [6]INAF - Arcetri Astrophysical Observatory, Florence, Italy.

Introduction: There is evidence for an absorber near 0.55 µm in the OSIRIS-REx camera color imaging data of asteroid (101955) Bennu [1], and iron oxides, which absorb light near 0.55 µm, have been found in meteorites that are spectral analogs for Bennu [2]. Thus, the imaging evidence has sparked a search: can we confirm this discovery and characterize the absorption with the spectrometer data? In response, we compile data from the Preliminary Survey of Bennu (December 3 – 26, 2018), obtained by the OSIRIS-REx Visible and Infrared Spectrometer (OVIRS), and use them to generate maps of the surface using a suite of spectral indices that are designed for measurements of iron oxide band depths.

Methods: The OVIRS spectrometer is described in [3]. The wavelengths and band index algorithms for iron oxides are tested and presented in [4]. Map generation processes are presented in [5], spectral super-resolution for the OVIRS spectrometer is discussed in [6], and projection effects due to the registration of the OVIRS data to a triangularly tessellated shape model of Bennu are discussed in [6]. Validation of the spectral index and mapping processes are presented in [7]. Iron oxides that exhibit absorption features in the wavelength range over which the OVIRS spectrometer is sensitive include the following:

- **Fe^{3+} at 0.5 µm**
- **Fe^{3+} at 0.624 µm**
- **Fe^{3+} at 0.86 µm**

These features are common in hematite, magnetite, spinel ($MgAl_2O_4$), hercynite, and chromite (see **Figure 1**).

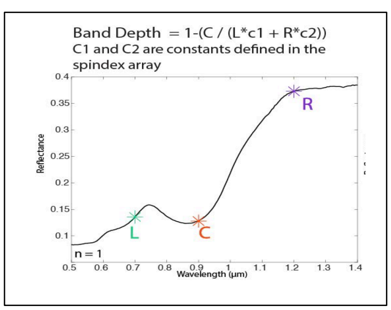

Figure 1: A spectral index algorithm is shown for the iron oxide hematite.

Iron sulfides, such as pyrite, exhibit a broad shoulder just beyond 1 µm, and the OVIRS spectrometer may also detect this feature.

To first order, no large 0.55-µm absorption features have yet been found in the early OVIRS data. However, it is possible that very minor 1- or 2-sigma bands can still be detected if there is spatial coherence to boost the signal-to-noise ratio, and correlation with surface features to add context. In the Preliminary Survey data, the distribution of incidence, emission, and phase angles obtained is sufficient for a preliminary photometric analysis [8] and subsequent photometric correction. The lowest phase angle in the data set, 37 degrees, was obtained for part of the surface on day of year 346. The spatial resolution of these data is approximately 30 meters/spectrum. Our first spectral maps of Bennu will cover mostly the southern hemisphere and equatorial regions. For context, iron oxide/sulfide maps of the surface of Bennu will be shown overlain on the global base map image mosaic obtained by the high-spatial-resolution camera PolyCam for comparison with albedo [1].

Context: Understanding the iron oxide/sulfide distribution on Bennu's surface will be key to our understanding of this tiny world. Detection of magnetite may allow us to determine if Bennu is more CI-like or CM-like. Iron oxides/sulfides are also interesting due to their potential for creation at the surfaces of carbonaceous asteroids via space weathering processes [9]. Iron oxides are seen in meteorites, where they tend to be very low albedo components, contributing to the overall darkness of carbonaceous chondrite meteorites [2].

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References: [1] LeCorre et al. (2018) *AGU* #P22A-03. [2] Kiddell et al. (2018) *JGR Planets* 10.1029, 2018JE005600. [3] Reuter et al. (2018) *Space Sci. Rev.* 214:54. [4] Kaplan et al. (2019a), *submitted.* [5] Clark et al. (2019), *in preparation.* [6] Ferrone et al. (2019) *submitted.* [7] Kaplan, H. et al., 2019b, *LPSC 50.* [8] Zou, X-D. et al., 2019, *LPSC 50*. [9] Thompson et al. (2017) *LPSC 48*, #2799.