THE MICA FILES: A COMPILATION AND REFERENCE DOCUMENT FOR MINERALS IDENTIFIED THROUGH CRISM ANALYSIS. K. D. Seelos[1], C. E. Viviano[1], S. E. Ackiss[2], C. H. Kremer[3], S. L. Murchie[1], [1]JHU Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723 (CRISM-MICA@jhuapl.edu), [2]University of Idaho, Moscow, ID; [3]Brown University, Providence, RI.

Introduction: The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) [1], onboard the Mars Reconnaissance Orbiter (MRO), has been acquiring visible-near infrared hyperspectral observations of the surface and atmosphere of Mars since 2006. CRISM data have greatly broadened our knowledge of the mineralogy of Mars, providing a basis for understanding the geologic and climatologic history of the planet.

To date, over 1,060 scientific studies have been published that utilize CRISM data, including several documenting new mineral discoveries. Using these published detections, Viviano-Beck et al. [2] compiled a set of relatively pure mineral endmember spectra, or type spectra, in order to test the efficacy of reformulated CRISM summary parameters – calculations of absorption strength (i.e., band depth), slope, albedo and other spectral characteristics that assist with spectral analysis. This collection of CRISM type spectra became known as the Minerals Identified through CRISM Analysis (MICA) library, and is available for download at the Planetary Data System (PDS) at http://crismtypespectra.rsl.wustl.edu/.

MICA library spectra are useful for comparison to and validation of other putative mineral identifications on Mars since spectra from Mars sometimes do not exhibit exactly the same spectral features as those acquired in a controlled laboratory setting. To expand upon the utility of the MICA library, we have now created a companion guidebook comprising two-page descriptions for each of the MICA type spectra, called "The MICA Files".

Background: *CRISM Data and Processing.* CRISM acquires visible-near infrared (0.4-4μm) hyperspectral (544 channels at 10 nm sampling) observations of Mars in two primary modes: mapping and targeted. Mapping observing modes are generally multispectral with reduced spatial resolution (90 or 180 m/pix) but have increased along-track spatial coverage, whereas targeted data are hyperspectral, typically 18 or 36 m/pix, and with data coverage focused on a smaller areal footprint. Both mapping and targeted CRISM data are calibrated and delivered to the PDS as Targeted Reduced Data Records (TRDRs). However, targeted images that meet certain data quality thresholds (e.g., data completeness, IR detector temperature, atmospheric opacity) are further pipeline-processed to include standard photometric and atmospheric corrections, empirical corrections to mitigate spectral smile and gimbal motion effects, and map projection [3,4]. These advanced products, which also include summary parameter cubes and 3-color parameter composites, or browse products, make up the Map-projected Targeted Reduced Data Record (MTRDR) product suite. All CRISM spectra discussed in The MICA Files are derived from PDS-delivered MTRDR collections.

Selection of MICA Spectra. Typically, spectra are extracted from the same CRISM scenes referenced in the published literature. In some cases an image that was acquired after the publication date or a similar outcrop elsewhere provided a better match to the laboratory spectrum, in which case the cleaner spectrum is shown. The MICA Files utilize in-column ratios of spectra from regions of interest to spectrally neutral material in the same scene. This technique standardizes the way spectra are presented in The MICA Files, emphasizes diagnostic absorption features, and simplifies comparison to laboratory spectra.

The MICA Files Content: The MICA Files document contains a synopsis of each mineral, mineraloid, or ice that has been identified on Mars using CRISM data. In addition, there is a brief primer on CRISM and

Table 1. Phases included in The MICA Files

Nesosilicates	***Oxides***
Fe-Olivine	Hematite
Mg-Olivine	***Halides***
Sorosilicates	Chloride
Epidote	***Carbonates***
Inosilicates	Fe/Ca-Carbonate
High-Calcium Pyroxene	Mg-Carbonate
Low-Calcium Pyroxene	***Sulfates***
Phyllosilicates	Alunite
Al-Smectite	Bassanite
Chlorite	Gypsum
Fe-Smectite	Hydrated Fe-Sulfate
Illite/muscovite	Jarosite
Kaolinite	Monohydated Sulfate
Margarite	Polyhydrated Sulfate
Mg-Smectite	***Mineraloids***
Serpentine	Hydrated Silica
Talc	***Ices***
Tectosilicates	CO_2 Ice
Analcime	H_2O Ice
Plagioclase	

spectral variability at Mars, as well as reference tables from [2]. At present, there are 31 type spectra included in the guidebook, organized by mineral group, or sets of minerals that share related molecular structures (Table 1). Each two-page mineral overview (see Fig 1. for example) offers a standardized set of information that includes:

- *CRISM type locality image,* rendered as both an enhanced visible color composite and a browse product that highlights the mineral of interest.

- *Mineral description/identification*, summarizing key criteria for how to recognize and distinguish the mineral's spectral features.

- *CRISM spectrum of type locality*, as compared to a laboratory-derived spectrum.

- *Absorption details* provides absorption positions in both plot and table form.

- *Type locality description and morphologic overview* describes and illustrates the geologic and textural properties of the specific type locality, includes a HiRISE or CTX image.

- *Other occurrences* describes where the mineral has generally been identified elsewhere on Mars in published literature.

- *Key reference* is the scientific paper that describes the primary occurrence of the mineral of interest in its type location.

- *Other resources* lists related papers on the mineral of interest for further information.

Intended Audience: The MICA Files is designed to be an introduction to the visible-near infrared spectra variability observed at Mars as well a user's guide and reference document accessible for all CRISM data users, Mars researchers, or planetary spectroscopists.

Online Access and Updates: The MICA Files is available for browsing and download on the CRISM website at https://crism.jhuapl.edu/. There will be two PDF versions for download, one optimized for electronic viewing and one formatted for printing.

We anticipate that updates to The MICA Files will occur as needed to incorporate new information and discoveries. For suggested additions or other feedback, please contact us at CRISM-MICA@jhuapl.edu.

References: [1] Murchie, S. L., et al. (2007) *JGR, 112*, E5, S03. [2] Viviano-Beck, C. E., et al., (2014) *JGR, 119*, 1403-1431. [3] Seelos, F. P., et al. (2012) *Plan. Data Users Wksp.* [4] Seelos, F. P., et al. [2016] *47th LPSC*, Abstract 1783.

Acknowledgements: The MICA Files would not have been possible without Frank Seelos, Kelley Taylor, Shannon McKenzie, Debra Buczkowski, Samuel Cartwright and many others on the CRISM Team and beyond who have helped create, review, and provide inspiration over the years.

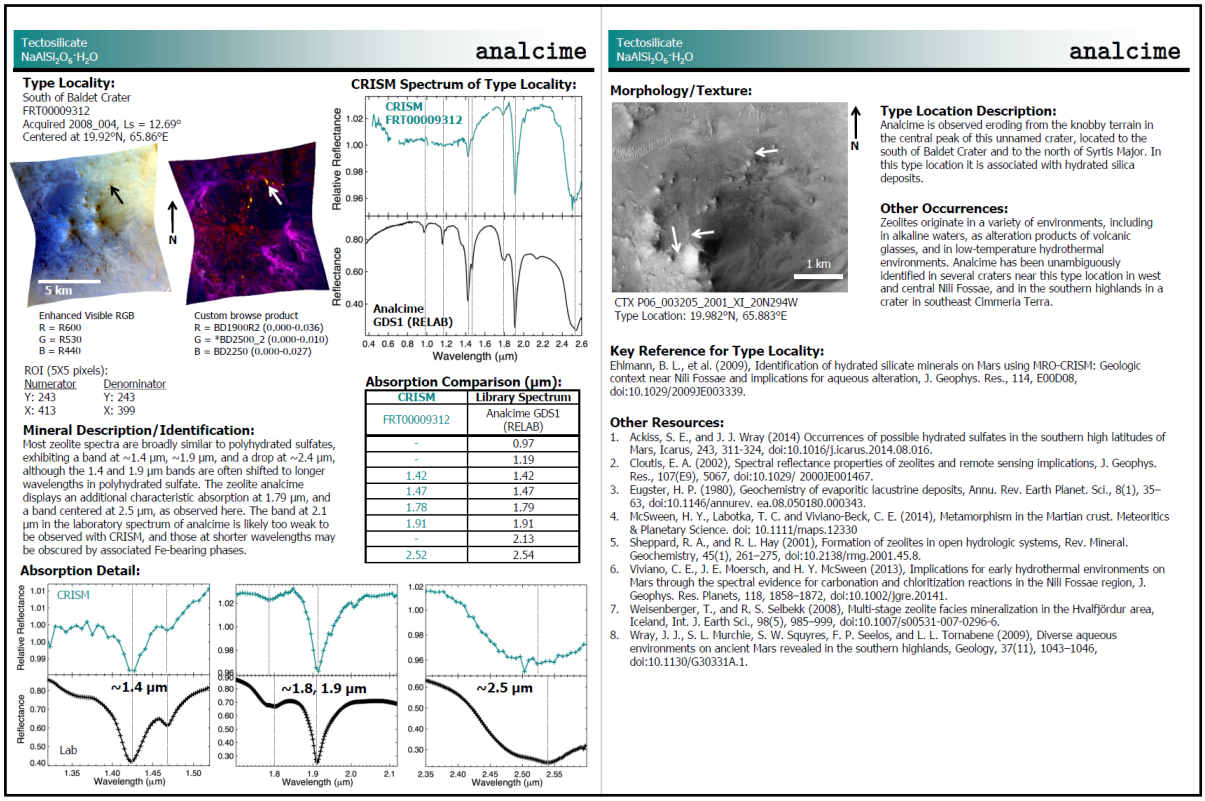

Figure 1. Example two-page layout of The MICA Files displaying information for the tectosilicate analcime.