USE OF CRISM, CTX, AND HIRISE DATA TO MAP BEDROCK SOURCES AND WIND-BLOWN RIPPLE FIELD MINERALOGY ON AND NEAR THE JEZERO CRATER DELTA. R. E. Arvidson and J. C. Christian, McDonnell Center for the Space Sciences, Department of Earth and Planetary Sciences, Washington University in Saint Louis, arvidson@wunder.wustl.edu.

Introduction: A number of validated mineral maps and highly processed hyperspectral image cubes are being generated as part of the MRO CRISM [1] Science Team's "Fandango". The intent is to deliver the products to the Mars 2020 Rover Project for their use in rover path planning and scientific analyses. This abstract focuses on an example of synergistic use of surface kinetic temperature and ferrous silicate spectral parameter "Fandango" products from CRISM hyperspectral image data (0.45-3.75 µm), together with HiRISE images, to distinguish outcrops from wind-blown ripple fields. This is for both scientific purposes and delineating possible rover mobility limitations [e.g., 2].

Approach: The DISORT radiative transfer code was used with a mildly backscattering Hapke function for the surface boundary condition, together with explicit inclusion of atmospheric dust and ice aerosols, CO_2, H_2O, and CO gases [3]. Additionally, a neural network approach was used to resolve the underdetermined nature of the mixed solar and emission terms for the longer wavelength data, and thus to solve simultaneously for surface kinetic temperatures and single scattering albedo spectra free of thermal effects [4]. A log maximum likelihood regularization with penalty functions was used to denoise and map project the CRISM data [3].

Results: A key question is the location and nature of the olivine-bearing materials within regions to be explored by the 2020 rover. Olivine-bearing bedrock should be relatively cool (high thermal inertia and mid-afternoon CRISM acquisition) and have a high olivine signature (spectral parameters from [5]), whereas olivine bearing ripples should be relatively warm. The derived CRISM products when compared to HiRISE data (Figs. 1-3) show that olivine is largely exposed as relatively bright, patchy bedrock, both within the deltaic complex, and on the crater floor, with some olivine locally dispersed into wind-blown ripple fields. Warm temperatures and the presence of high calcium pyroxene signatures, on the other hand, dominate most ripple fields. Low calcium pyroxene signatures are very limited in areal extent. The high calcium signature also extends as relatively featureless plains within and to the east of the delta.

The 2020 rover shares essentially the same mobility system and dynamics as the Curiosity rover. Curiosity has encountered deep wheel sinkage and high wheel and rover-based slip while traversing wind-blown sand ripple fields when the ripple wavelengths were approximately equivalent to the ~2.2 m wheel base [2]. Many of the ripple fields evident in Figs. 2-3 fall into that category and will require careful traverse planning to navigate and/or avoid. Future work will focus on using surface kinetic temperatures and albedos from CRISM data to retrieve thermal inertias and thus estimates of ripple material grain sizes and degree of induration [6]. This product will also be delivered as part of the "Fandango" to the 2020 rover project for use in traverse planning.

References: [1] Murchie S. L. et al. (2009) *JGR*, doi:10.1029/2009JE003344. [2] Arvidson R. E. et al. (2016) *J. Field Robotics*, doi:10.1002/rob.21647. [3] Kreisch C. D. et al. (2016) *Icarus*, doi:10.1016/j.icarus.2016.09.033. [4] He, L. et al. (2019) *IEEE*, doi:10.1109/JSTARS.2019.2900644. [5] Viviano-Beck C. E. et al. (2016) *JGR*, doi:10.1002/2014JE004627. [6] Christian, J. C. et al. (2020) *LPS LI*, this volume.

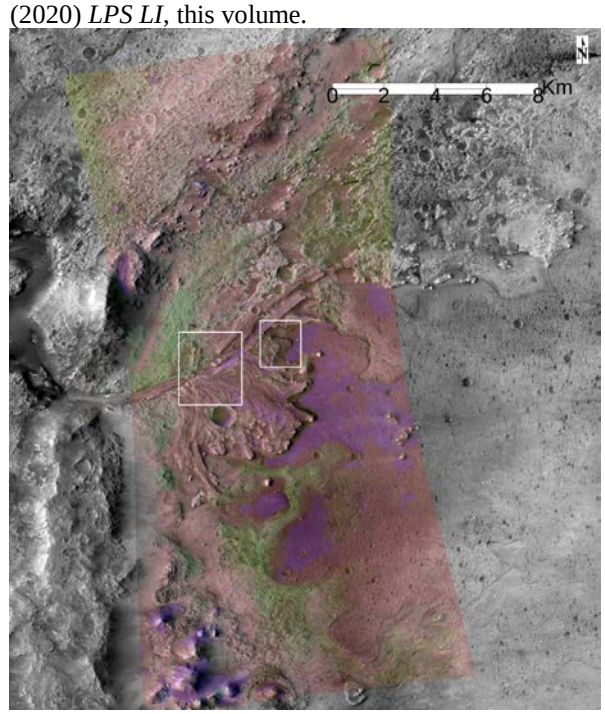

Figure 1: HRL000040FF overlain onto a CTX mosaic. RGB is combined as surface kinetic temperature, olivine, and high calcium pyroxene spectral parameters. The Jezero delta is the region beneath the white boxes. The boxes delineate areas show in Figs. 2-3. Green

areas are spectrally dominated by relatively cool olivine outcrops whereas purple areas are relatively warm deposits spectrally dominated by high calcium pyroxene. The 2020 Mars rover landing ellipse is centered just below of the middle of the scene.

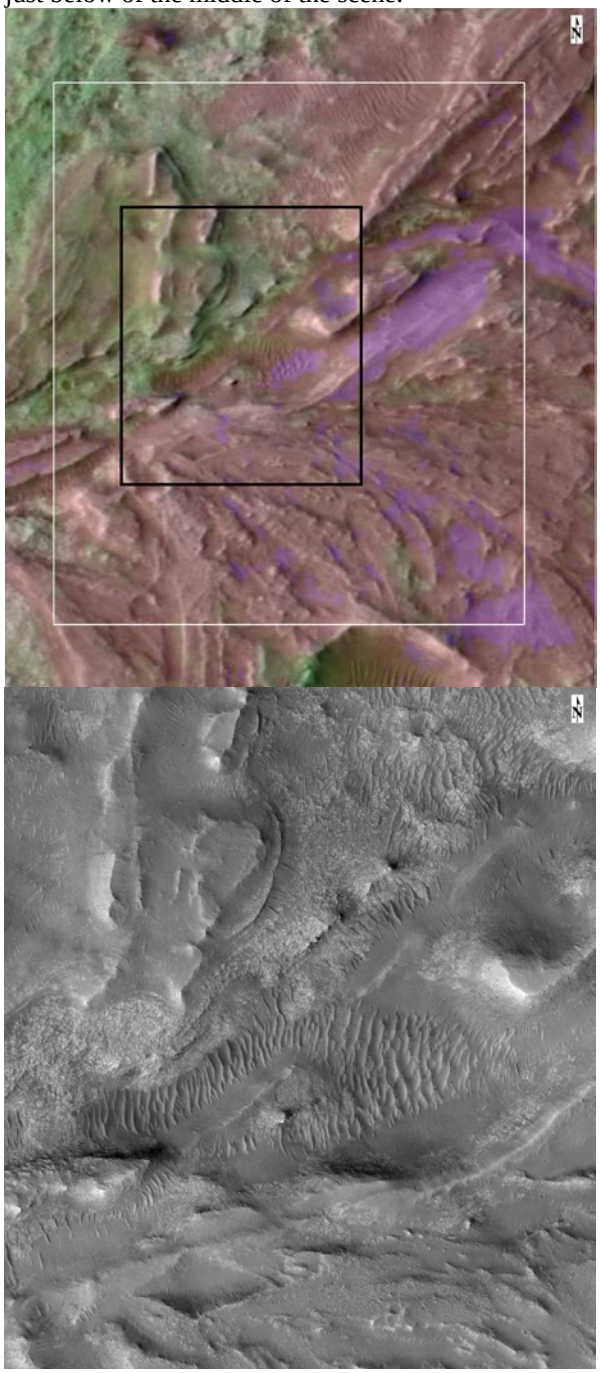

Figure 2: Area shown for left box in Fig. 1 enlarged for top image and HiRISE frame PSP_002387_1985_red shown on bottom, with interior black box showing the HIRISE image location in the CRISM scene. Note olivine-bearing outcrops to the north with locally adjacent olivine-bearing ripples. The more extensive ripple fields are dominated by high calcium pyroxene signatures.

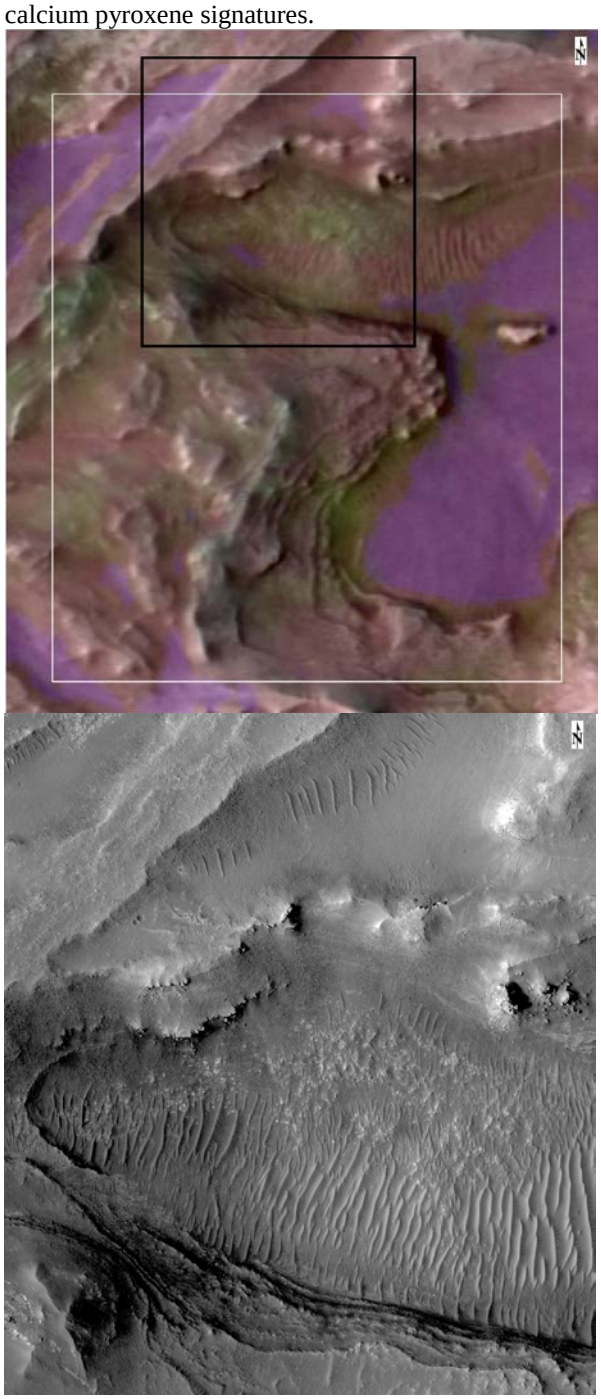

Figure 3: Area shown for right box in Fig. 1 enlarged for top image and HiRISE frame PSP_003798_1985_red shown on bottom, with interior black box showing location in the CRISM scene. Note olivine-bearing outcrops to the north with locally adjacent olivine-bearing ripples. The more extensive ripple fields are dominated by high calcium pyroxene signatures.