MINERALOGICAL ANALYSIS OF EXOMARS ROVER LANDING SITES USING CRISM. S. M. R. Turner and J. C. Bridges. Space Research Centre, Leicester Institute for Space and Earth Observation, University of Leicester, UK (j.bridges@leicester.ac.uk).

Introduction: The ExoMars 2020 rover currently has three candidate landing sites: Oxia Planum, Aram Dorsum and Mawrth Vallis [1]. The purpose of this study is to highlight the mineralogical diversity of the proposed ExoMars landing sites with false-color hyperspectral imagery overlain on high-resolution imagery to amplify morphological context.

Method: Hyperspectral images <40 m/pixel resolution taken by the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) [2] were obtained from the NASA Planetary Data Sciences Geosciences Node and processed using the CRISM Analysis Toolkit v7.3.1 [3] extension to ENVI. Map-project flattened Viviano-Beck et al [4] summary parameters were exported into ArcMap and overlayed onto 25 cm/pixel imagery from the High-Resolution Imaging Science Experiment (HiRISE) and a 100 m/pixel Thermal Emission Imaging System (THEMIS) daytime infrared global mosaic, with landing ellipses taken from [1]. The summary parameters selected for this work were R2529, R1506 and R1080 in an RGB configuration to give enhanced false-color images, as outlined in [4]. Red usually represent olivines, blue may indicate pyroxene, blue/green mixtures often indicate clay, and blue/grey/brown often indicate basaltic material [4]. Due to mineral mixtures this RGB configuration was only be treated as a guide, with firm mineral indentification being undertaken using spectral extraction and library comparison techniques, like those used in other studies [e.g., 5].

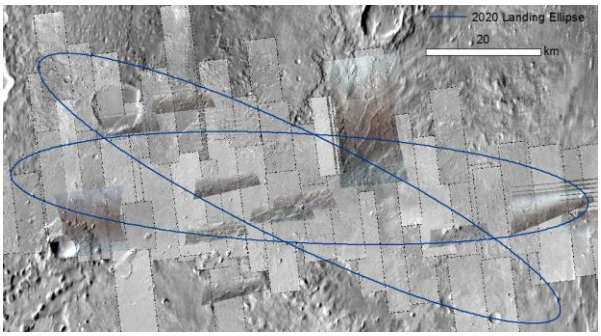

Fig. 1. CRISM false color images of the Aram Dorsum landing ellipses overlain on HiRISE and THEMIS imagery.

Aram Dorsum: The landing site proposed in Aram Dorsum contains an inverted channel system thought to be part of a regional alluvial system, which may represent a wider alluvial landscape [6,7,8]. This location has been shown to have potential for biosignature preservation [7]. As shown in Fig. 1, due to dust coverage the CRISM hyperspectral images within the landing ellipses there is no direct mineralogical information however, nearby dust-free regions have shown sulfates, Fe/Mg- and Al-phyllosilicates [8].

Oxia Planum: Oxia Planum has been described as a clay-rich, layered Noachian deposit that has subsequently undergone long-lived aqueous alteration as exhibited by a Hesperian-aged delta to the south-east, with remnants of an Amazonian-aged capping unit also identified [9,10,11]. The region includes an ancient, but recently exhumed clay-bearing unit with some phyllosilicate exposures as young as 100 Myr based on crater counts [10]. At the resolution of CRISM, Fe/Mg clay is mixed with olivine and pyroxene throughout the scene. Most notable spectral mixtures in Fig. 2 are located at the base of the delta to the south-east where the Fe/Mg clay and olivine are mixed resulting in an orange color, and also in the centre of the landing ellipses where Fe/Mg clay and olivine mixtures result in a beige color. Spectral analysis has shown that the Fe/Mg clay closely resembles vermiculite, which is consistent with other work [11].

Mawrth Vallis: The landing ellipses proposed for Mawrth Vallis are located adjacent to an eroded channel. CRISM scenes in Fig. 3 indicate diverse mineralogy with the presence of Fe/Mg- and Al- phyllosilicates mixed with olivines as exhibited in Fig. 3, and shown in other works that also identified nearby sulfates [12,13]. Unfortunately, there is currently a lack of CRISM coverage within the landing ellipses compared to Aram Dorsum (Fig. 1) and Mawrth Vallis (Fig. 3).

References: [1] Bridges, J. C., et al., (2017) LPSC 48, *this conference*. [2] Murchie, S., et al., (2007) JGR: Planets, 112(E5). [3] NASA PDS http://pds-geosciences.wustl.edu/missions/mro/crism.htm (accessed 3/10/16). [4] Viviano-Beck, C. E., et al., (2014) JGR: Planets, 119(6), 1403-1431. [5] Turner, S. M. R., et al., (2016) JGR: Planets, 121(4), 608-625. [6] Davis, J. M. et al., (2016) Geology 44(10) 847-850. [7] Balme, M. R., et al., (2016) LPSC 47, #2633. [8] Balme, M. R., et al., (2015) ExoMars LSSW#3. [9] Quantin, C., et al., (2015) ExoMars LSSW#3. [10] Quantin, C., et al., (2016) LPSC 47, #2863. [11] Carter, J., et al., (2016) LPSC 47, #2064. [12] Poulet, F., et al., (2015) ExoMars LSSW#3. [13] Gross, C., et al., (2016) LPSC #1421.

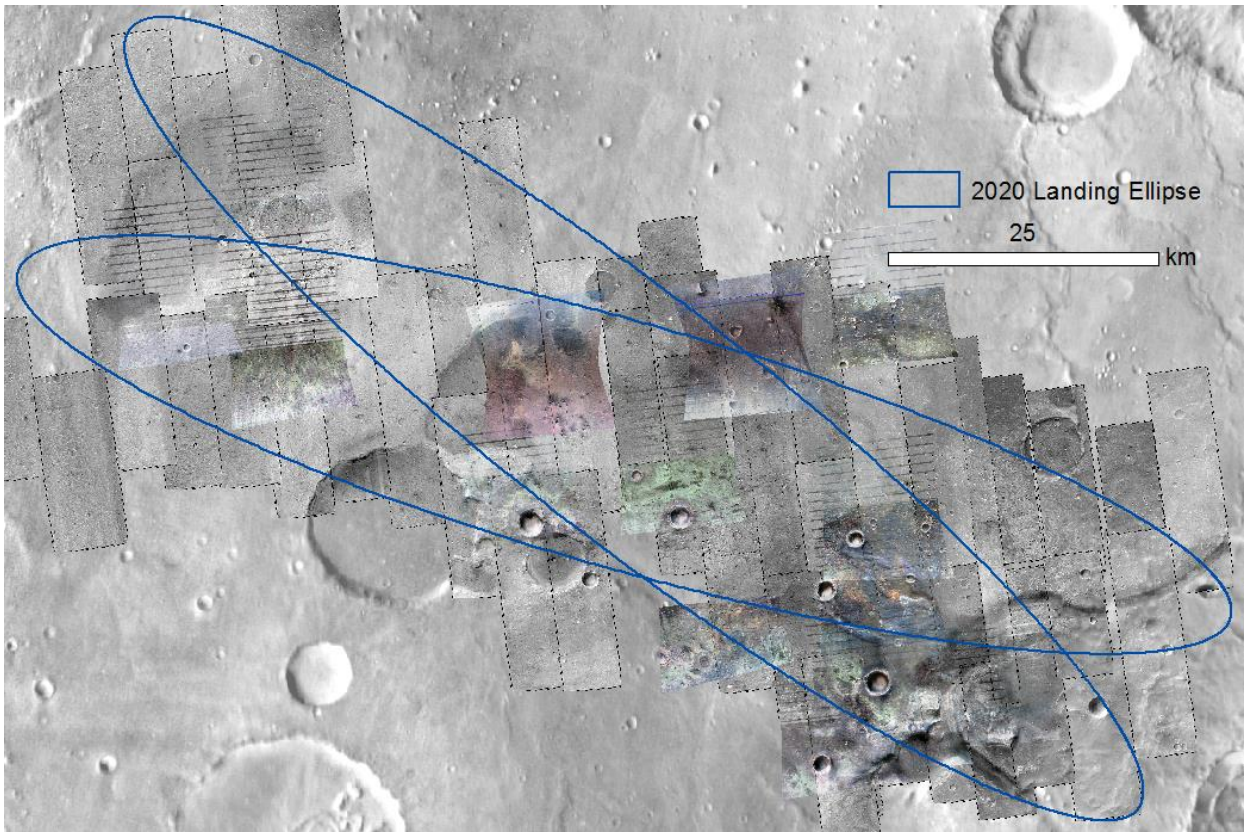

Fig. 2. CRISM false color images of the Oxia Planum landing ellipses overlain on HiRISE and THEMIS imagery.

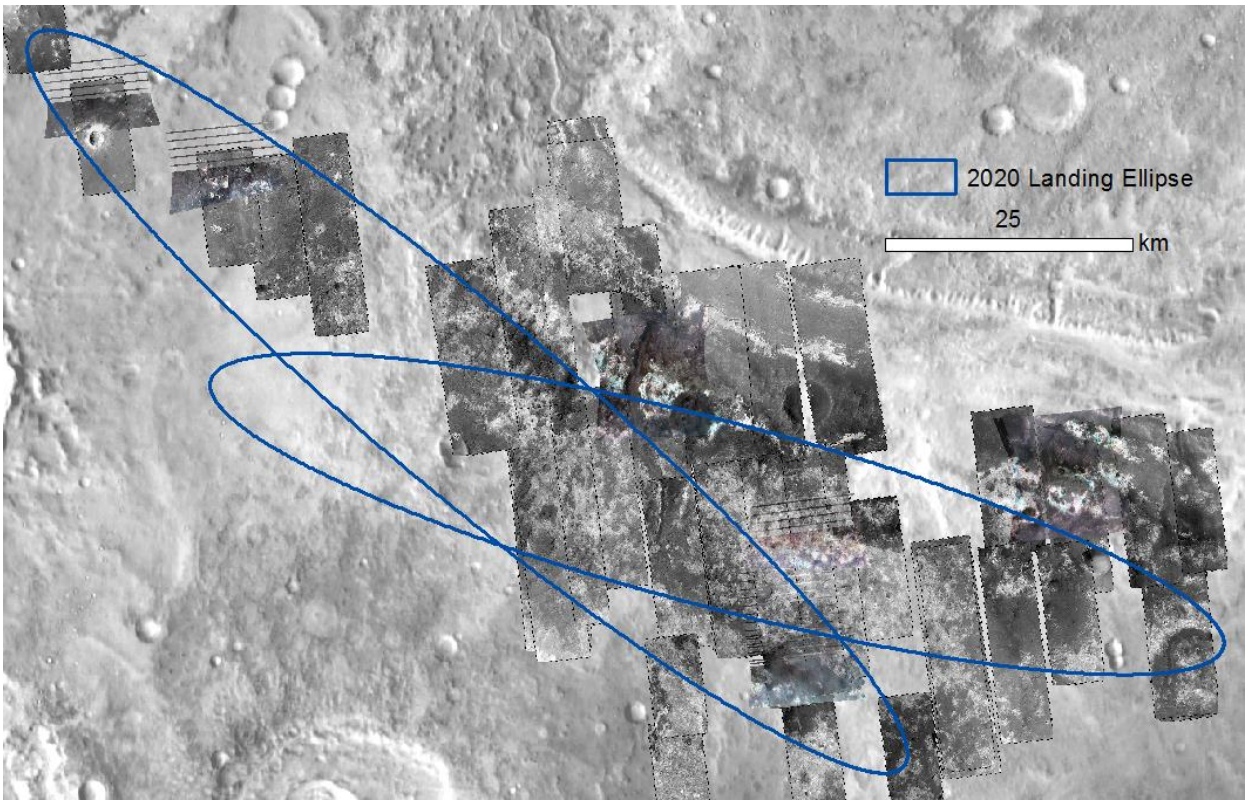

Fig. 3. CRISM false color images of the Mawrth Vallis landing ellipses overlain on HiRISE and THEMIS imagery.