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Mapping and characterisation of the Oxia Planum clay-bearing unit using CaSSIS imagery

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Current knowledge of the clay unit at Oxia Planum, the Rosalind Franklin rovers landing site, is based in large part on spectroscopy data from the OMEGA and CRISM instruments. While these instruments have proved useful for creating a broad map of this unit, along with identifying candidates for the clay making up the unit, their usefulness is limited by their spatial resolution. Mapping at Oxia has primarily been carried out using 1200-300m/pixel OMEGA or 200-100m/pixel CRISM data and, even accounting for the intermittent 18m/pixel CRISM hyperspectral data available, existing clay maps are insufficient for the purposes of rover traverse planning.

Images from the Colour and Stereo Surface Imaging System[1] (CaSSIS), which has a resolution of 4m/pixel, can improve upon this. Work done by members of the CaSSIS science team identified certain CaSSIS band ratios which can aid in identifying the presence of ferric/ferrous minerals[2]. In a more recent study CRISM, HiRISE colour and CaSSIS data were used to identify that at least two spectrally and morphologically distinct subunits make up the Oxia clay unit[3]. These sub units are divided into a lower and upper member. The lower member appears orange in CaSSIS/HiRISE VNIR images, shows extensive metre-scale fracturing and possesses CRISM spectral signatures consistent with the presence of a Fe/Mg-rich clay mineral. The upper member, blue in CaSSIS/HiRISE VNIR images, shows metre-decametre scale fracturing along with CRISM spectral signatures consistent with a mix of a Fe/Mg-rich clay mineral and olivine.

This work demonstrates that ferric detections within CaSSIS band ratios correlate well with CRISM, and that the lower clay member appears to have a higher ferric content than the upper member. Given this a new, higher resolution clay map is being created using CaSSIS band ratios in conjunction with HiRISE greyscale imagery to observe fracture size. This map, currently being constructed over the 1-sigma landing ellipses, delineates between the two subunits well in addition to revealing those areas where the two subunits are too intermixed to reliably differentiate at CaSSIS's resolution. Given that CaSSIS has higher resolution in comparison to the CRISM/OMEGA instruments, that it can differentiate between the clay sub-units, and that it

provides higher landing site coverage compared to CRISM hyperspectral data, means this map will provide a significant improvement over what is currently available for the sites clay unit.

References; 1; Thomas N. et al. (2017). "The Colour and Stereo Surface Imaging System (CaSSIS) for the ExoMars Trace Gas Orbiter." Space Science Reviews 212(3-4): 1897-1944. 2; Tornabene L. L. et al. (2017). "Image Simulation and Assessment of the Colour and Spatial Capabilities of the Colour and Stereo Surface Imaging System (CaSSIS) on the ExoMars Trace Gas Orbiter." Space Science Reviews 214(1). 3; Mandon L. et al. (in review). "Spectral Diversity and Stratigraphy of the Clay-Bearing Unit at the Exomars 2020 Landing Site Oxia Planum." Astrobiology

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