THE RECONCILIATION OF HiRISE SCALE MAPPING AT OXIA PLANUM: THE LANDING SITE FOR THE EXOMARS ROSALIND FRANKLIN ROVER. P. Fawdon[1], C. Orgel[2], E. Sefton-Nash[2], S. Adeli[3], M. Balme[1], J. Davis[4], A. Frigeri[5], P. Grindrod[4], E. Hauber[3], L. Le Deit[6], D. Loizeau[7], A. Nass[3], C. Quantin-Nataf[8], M. Volat[8], S. de Witte[2], J. L. Vago[2] & the ExoMars RSOWG 'Macro' group. [1]The Open University, Walton Hall, Milton Keynes, United Kingdom (peter.fawdon@open.ac.uk), [2]European Space Research and Technology Centre (ESTEC), European Space Agency, Noordwijk, The Netherlands, [3]Institut für Planetenforschung, Deutsches Zentrum für Luft und Raumfahrt (DLR), Berlin, Germany, [4]Natural History Museum, London, UK, [5]Istituto di Astrofisica e Planetologia Spaziali (INAF-IAPS), Via del Fosso del Cavaliere, Roma, Italy, [6]Laboratoire de Planétologie et Géodynamique, Université de Nantes, France, [7]Université Paris Saclay, France, [8]Laboratoire de Géologie de Lyon, Université de Lyon, Lyon, France

Introduction: In June 2023 the ESA-Roscosmos ExoMars Rover will land in Oxia Planum (OP) on Mars (*Figure 1*). The Mission's main goal is to search for signs of past and present life. During its 218-sol nominal mission [1], this goal will be met by investigating the geochemical environment in the shallow subsurface using *Kazachock,* the instrumented lander and the *Rosalind Franklin* (RF) Rover.

In preparation for the surface mission, The ExoMars mission team performed a detailed group mapping exercise of the OP landing site [2, 3]. The work prioritizes the 1-sigma landing ellipses, but incorporates interpretations from elsewhere in the 3-sigma envelope and beyond. The goal of this effort was to develop a thorough understanding of the OP landing site's geography, stratigraphy, and geological history prior to operations, and to provide testable hypotheses to facilitate interpretation of results and further the mission's science objectives.

Here we present an update on the reconciliation phase of mapping, including the completed sections of the HiRISE scale map, the stratigraphy and a summary of our interpretations of the major geological units.

Completed sections of the Map: The mapping effort is nearing the end of the *reconciliation phase*, in which a smaller team consolidated features digitized by a large team over a grid of 1x1km map quads [2, 3]. We used HiRISE, HiRISE DEM and CASSIS NPB (Near IR, Pan and Blue) data products to produce a morphostratigraphic map suitable for publication to help formulate the rover mission's strategic science plan. The full map includes bedrock geological units, surficial overlays, geomorphic and structural elements such as ridges and fractures. The map, data and geographic nomenclature will be available through ESA [4 and 5]

A preliminary reconciliation of the *Pannonia* [5] and *Aquitania* [5] mapping areas have been completed (*Figure 1*). Work to complete the Dalmatia [5] region is ongoing, although observations from this region have already been incorporated into our understanding of stratigraphy (*Figure 1*).

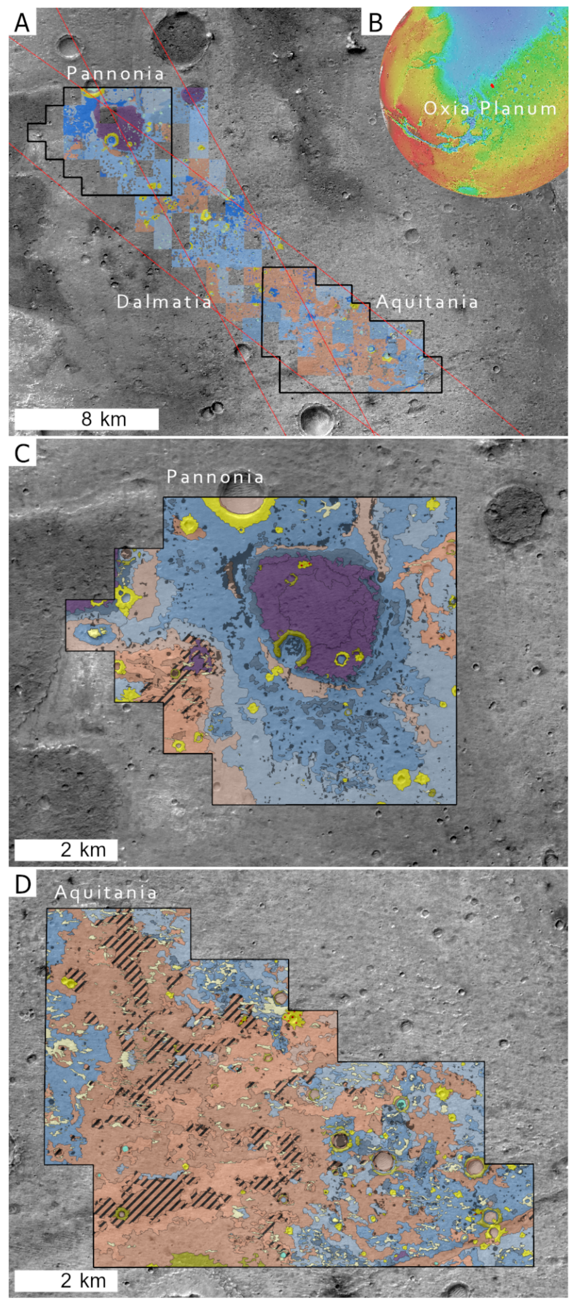

Figure 1: *(A) The location of Oxia Planum (B) The area of Mapped quads. The reconciled map of the (C) Pannonia region and (D) Aquitania region.*

Geological units and stratigraphy: We created a stratigraphic framework based upon 17 units divided into six groups (Ejecta, Surfical, Dark, Yellow, Bright, and Orange; *Figure* 2) based on their appearance in CaSSIS NPB data. Within the stratigraphy we identify four possible stratigraphic discontinuities (D 1 – 4).

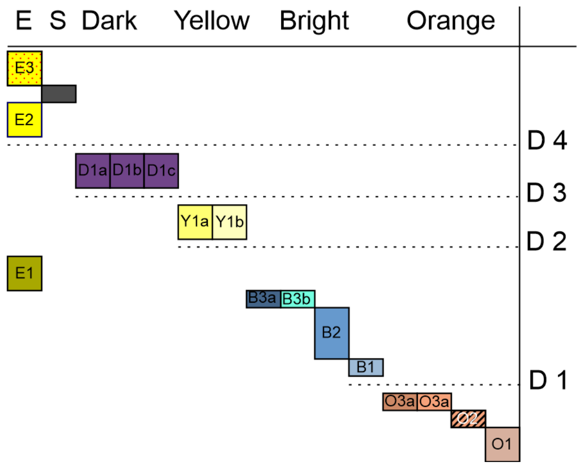

Figure 2: *Correlation of photogeological units identified in Oxia Planum. Units are identified by their texture in HiRISE and color in CaSSIS data and organized by superposition relationships.*

We have taken a conservative approach to preserve fidelity, retaining divisions identified during the group mapping, rather than combining units. We expect that observations by RF will develop our understanding of how meaningful these divisions are.

For each geological unit we observe in remote sensing data, we incorporate additional contextual observations [6 – 12] and consider a range of possible interpretations and associated confidences. Here we summarize some notable findings.

Impact group (E1-3) – includes numerous small (<200m) impact craters with a wide variety of degradation states. Some impact ejecta units appear to have been overlain by younger units. This demonstrates a substantial time gap in the stratigraphy.

Surficial group (S) – includes dark patches infilling topographic lows, and accumulations of aeolian material. The dark patches display variable induration; some appear to be regolith, others friable bedrock.

Dark group (D1a-c) – thin (~1 m), low albedo units, often associated with local topographic highs. Often contain windows to underlying units.

Yellow group (Y1a, Y1b) – includes larger yellow (in CaSSIS NPB) mounds (*Y1a*) with round planview shape that overlie a resistant layer, and smaller yellow, more linear mounds (*Y1b*) that transition into Periodic Bedrock Ridges. Yellow mounds predate the dark group and appear to represent remnants of a once more extensive layer of variable thickness.

Bright group (B3a) – The upper unit forms a thin resistant layer directly underlying either the Yellow or Dark units. It is not associated with phyllosilicate spectral signatures and contains a crisp layer with wide fractures representing a paleo surface.

Bright group (B1, B2) – The middle and lower units host a boxwork of upstanding ridges associated with high relief areas such as scarps and large ridges. Regionally extensive, this unit crops out as a mantling layer, and contains exhumed fluvial channel bodies, so an origin related to fluvial and groundwater processes is possible, but awaits in-situ confirmation.

Orange (O3a, O3b and O2) – includes materials with distinct orange CaSSIS NPB color that contain 5-10 m spaced fractures. Also includes brighter 'knobby' materials, if these are stratigraphically distinct layers or lateral variation is unclear.

Orange (O1) – These units have smaller (<5 m spacing) fractures than the upper orange units, and have the strongest phyllosilicate spectral signatures. The origin of this group is uncertain, but contextual observation suggests this may be the upper part of a lacustrine to alluvial succession. Alternatively, they could be sediments altered by later aqueous activity.

Outcomes and Ongoing work: Thus far in this project we have completed the group mapping, used the first part of the reconciled map in ExoMars strategic simulations and published the Geography of Oxia Planum [5]. Future work includes production of the mapping report for the ExoMars team, publication of the final map sheet and formulation of science questions uncovered during map reconciliation.

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