PRO3D®: A TOOL FOR HIGH RESOLUTION RENDERING AND GEOLOGICAL ANALYSIS OF MARTIAN ROVER-DERIVED DIGITAL OUTCROP MODELS

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NASA's Mars Exploration Rovers (MER) and Mars Science Laboratory Curiosity Rover (MSL) are proxies for field geologists on Mars, taking high resolution imagery of rock formations and landscapes which is digitally analysed in detail on Earth. Panoramic digital cameras (Pancam on MER and Mastcam on MSL) are used for characterising the geology of rock outcrops along rover traverses. A key focus is on sedimentary rocks that have the potential to contain evidence for ancient life on Mars. Clues to determine ancient sedimentary environments are preserved in layer geometries, sedimentary structures and grain size distribution. The panoramic camera systems take stereo images which are co-registered to create 3D point clouds of rock outcrops to be quantitatively analysed much like geologists would do on Earth.

The EU FP7 PRoViDE project is compiling all Mars rover vision data into a database accessible through a web-GIS (PRoGIS) and 3D viewer (PRo3D). Stereo-imagery selected in PRoGIS can be rendered in PRo3D, enabling the user to zoom, rotate and translate the 3D outcrop model. Interpretations can be digitised directly onto the 3D surface, and simple measurements can be taken of the dimensions of the outcrop and sedimentary features. Dip and strike is calculated within PRo3D from mapped bedding contacts and fracture traces. Results from multiple outcrops can be integrated in PRoGIS to gain a detailed understanding of the geological features within an area.

These tools have been tested on three case studies; Victoria Crater, Yellowknife Bay and Shaler. Victoria Crater, in the Meridiani Planum region of Mars, was visited by the MER-B Opportunity Rover. Erosional widening of the crater produced <15 m high outcrops which expose ancient Martian eolian bedforms. Yellowknife Bay and Shaler were visited in the early stages of the MSL mission, and provide excellent opportunities to characterise Martian fluvio-lacustrine sedimentary features. Development of these tools is crucial to exploitation of vision data from future missions, such as the 2018 ExoMars Rover and the NASA Mars 2020 mission.

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