

Geomatics applications in planetary science: an investigation into the geological environment of the Nili Fossae region of Mars using remote sensing data and GIS

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The Nili Fossae trough is an early-mid Noachian graben structure northwest of the Isidis Impact Basin and north of the volcanic Syrtis Major Planum on Mars. This site has been presented as a candidate for the Mars 2020 sample return mission because it has a geological environment with diverse mineralogy (clay minerals, carbonates, and ultramafic minerals), and origin (impact, volcanic, and sedimentary). ArcGIS has been used to create detailed geological maps of the area near the landing ellipse, based on HiRISE and CTX imagery from the Mars Reconnaissance Orbiter. Our preliminary results include numerous structural and sedimentary features: faults and fractures; a possible hydrothermal alteration system characterized by polygonal surface cracks; breccia and potential melt ridges associated with the ejecta blanket of nearby Hargraves Crater; zones of debris flow and mass wasting; and erosional surfaces indicative of past aeolian and fluvial activity. This study also involves the use of multi-spectral data from HiRISE and CRISM in order to characterize the mineralogical environment in more detail. As well, we are currently developing stratigraphic relationships between geological units using cross-cutting relationships, alteration products, and crater-counting methods. Future work may examine the potential for this environment to contain biologically relevant materials and be used to help decide on its suitability for the Mars 2020 rover.