MAPPING UTOPIA PLANITIA: MORPHOMETRIC AND GEOMORPHOLOGIC MAPPING AT A REGIONAL SCALE. R. D. Capitan[1], G. R. Osinski[1,2], M. J. Van De Wiel[3], M. Kerrigan[3], N. Barry[2], S. Blain[2], [1]Centre for Planetary Science and Exploration University of Western Ontario, London, ON, Canada N6A 5B7 (rcapita@uwo.ca), [2] Dept. of Earth Sciences/Physics and Astronomy, University of Western Ontario, London, ON, Canada N6A 5B7, [3]Dept. of Geography, University of Western Ontario, London, ON, Canada N6A 5C2.

Introduction: Mapping planetary surfaces remains a challenge for planetary scientists. The actual mapping system based on delineation of broader geological units (e.g., Fig.1) needs to be reconciled with the most recent datasets that address local context surface morphologies. The interpretation of the former usually omits the most recent episodes of surface evolution, revealed by high-resolution satellite imagery provided by Mars Orbiter Camera (MOC), Mars Reconnaissance Orbiter Context Camera (CTX), High Resolution Imaging Science Experiment (HiRISE) and recent digital terrain models (DTMs). Neither mapping approaches take into consideration the altitudinal distribution of landforms or surface geologic deposits that have, in many cases, elevation coherence. The key to unite both interpretations is in a regional mapping approach and combination of both visual data and altimetry data into a united morphometrical and geomorphological interpretation of surface terrains. We present here the results of an ongoing campaign to remap the Utopia Planitia region of the northern plains of Mars.

Methodology: A regional computed relief map was created that can distinguish local differences in altitude up to 2 m and delineate with better precision the geologic structures than the existing geologic map [1]. This map is then used to differentiate for example the glacial and periglacial structures in centre of Utopia that superpose the original geologic structures, which has consequences when interpreting our final results (Fig. 2).

These initial datasets and preliminary interpretations will be used in an effort to compile a regional map of surface structures within the region, using GIS techniques and morphological interpretation of visual datasets. The focus will be in interpretation of both altitudinal and visual datasets and local correlations between the processes that can lead to a regional description of processes that acted in utopia and nearby regions. Our approach addresses also one of the most recent shifts in interpretation of broader scale geological units of Tanaka et al. [1], namely the interpretation of the existence of Vastitas Borealis Unit, covering most of the northern plains. In addition, this has implications for the most recent attempts to date these relatively young units as base for better definition of Amazonian epoch [2]. Our approach will lead to better constrain the upper morphologic units that will be defining grounds for better crater counting in this area besides the mapping aspects that already shows an improvement in delineation among surface morphologies [3]. Furthermore, a key to interpretation of the regional context rests in the spatial integration of diverse datasets such as Mars Recconaissance's Shallow Subsurface Radar SHARAD measurements, and CRISM geochemical datasets [4], that suggest the presence of water ice in upper deposits and different levels of mineral alterations in the area of study, which will be used, along with morphologic interpretation to the interpretation and mapping.

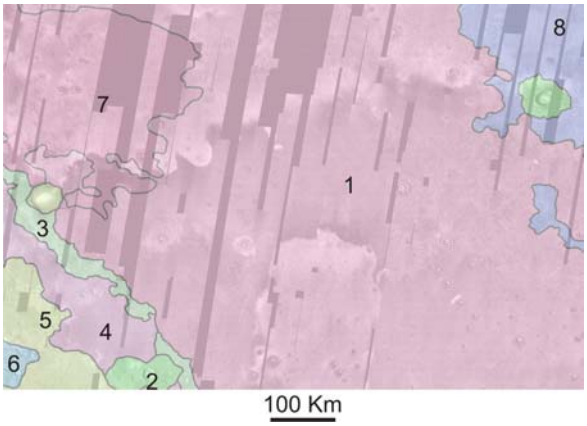

Fig.1 Current geologic map of Utopia Planitia and surrounding areas superposed on a THEMIS mosaic. The numbers represent geologic provinces [1]: 1. Vastitas Borealis interior unit; 2. Crater unit; 3.Vastitas Borealis marginal unit; 4.Utopia Planitia Plain unit 1; 5. Utopia Planitia Plain unit 2; 6. Nephensis Mensae Unit; 7. Astapus Coles Unit; 8. Elysium Rise Unit.

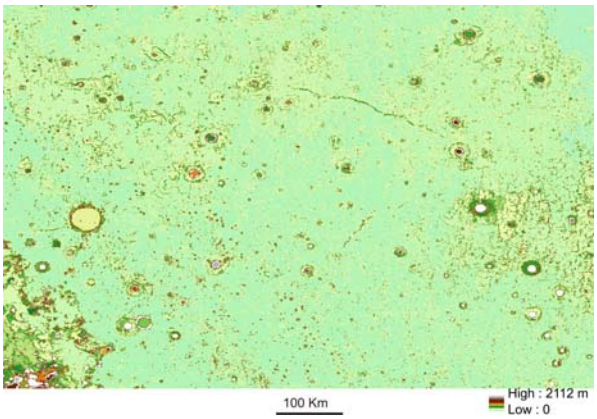

Fig.2 Relief map of the same units showing differences

in elevation among impact cratered, volcanic and plain units.

Results: The main focus of the mapping was to better differentiate the units comprising the Utopia Planitia region. A survey of CTX imagery revealed the presence of three characteristic landforms in western Utopia: glacial landforms, periglacial landforms and fluvial landforms (Figure 3); besides the three we also identified undifferentiated (mixed) contact units at the convergence of the three, formely described as marginal units [1].

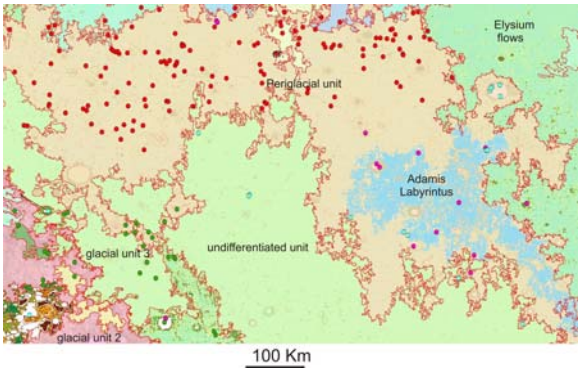

Fig.3 Surface processes identified on CTX imagery (dots) superposed on morphometric mapping of surface in Utopia Planitia region. The dots represent concentric crater fill (green), polygonal terrain (red), gullies (blue), and debris flows (purple).

At a regional scale our mapping results better identify limits among distict surface morphologies and show a succession of events that span through the entire Martian geologic time from cratered terrains in Arabia Terra and Terra Sabaea to much younger volcanic units of Elysium Mons and the youngest units that covers Utopia basin (Figure 3).

Based on our ongoing mapping, we have identifyed the following main morphologic units:

Elysium flows consist of several large volcanic basaltic lava flows towards Utopia basin and one of the major volcanic flows on Mars [1]. The new imagery confirms the original boundaries of Tanaka et al. [1], with a few minor modifications.

The *Glacial unit 2* is a distal glacial unit that consists of smooth thick materials deposited on top of an exisiting lightly cratered plains of undetermined age. See Osinski et al. [6, this conference] for further details and discussion of this unit.

The "Remnant" Glacial unit 3 consist of fretted terrain and represents modification of the upper glacial units [cf., 5] by mass movement, erosional and depositional processes that removed/ buried most of glacial effects. See Osinski et al. [6, this conference] for further details.

Adamis Labyrintus unit [1] is formed at the periphery of Elysium flows and consist of the so-called giant polygon terrain.

Undifferentiated unit is a mixture of impact cratering, volcanic and glacial and patchy periglacial landforms.

Periglacial unit is a unit that consists of polygonal terrains and scalloped depressions indicating a major ice buried component [7]. It's stratigraphy and origin is discussed by Kerrigan et al. [8, this conference].

Further mapping and crater counting to determine the age of these different units is ongoing.

Acknowledgements: GRO acknowledges funding from NSERC, the Canadian Space Agency, and MDA Space Missions, through the sponsorship of his Industrial Research Chair in Planetary Geology. RDC thanks the NSERC CREATE program for support.

References: [1] Tanaka, K.L., Skinner, J.A., Hare, T.M. (2005) USGS Map 2888. [2] Werner, S.C., Tanaka, K.L., (2011) Icarus, 215, 603-607. [3] Capitan, R.D., Van De Wiel., M., (2011) Computers & Geosciences, doi:10.1016/j.cageo.2011.11.030. [4] Fairen, A.C. et al. (2011) Nature Geoscience, 4, 667-670. [5] Head, J. W. et al. (2010) Earth and Planetary Science Letters, 294, 306-320. [6] Osinski, G. R. et al. (2012) LPSC XLIII, this conference. [7] Soare et al. (2007), Icarus, 191, 95-112. [8] Kerrigan, M. et al. (2012) LPSC XLIII, this conference.