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MEX HRSC and MRO SHARAD synergic observations on Light-Toned Deposits (LTDs)

A. P. Rossi (1), R. Orosei (2) , M. Pondrelli (3) S. van Gasselt (4), , E. Hauber (5), A. Dumke (3), F. Russo (6), M. Cutugni (6) R. Seu (6), and G. Neukum (4)

(1) ISSI, Bern, Switzerland (2) IFSI, Rome, Italy (3) IRSPS, Pescara, Italy (4) Freie Universität, Berlin, Germany (5) DLR, Berlin, Germany (6) Infocom-La Sapienza, Rome, Italy. (arossi@issibern.ch)

Light-toned deposits

Light-toned deposits (LTDs) occur extensively on Mars [e.g. 1,2,3]. Several of them have been imaged by the Mars Express (MEX) High Resolution Stereo Camera (HRSC) [4], adding valuable 3-D information [5,6] to the available large extent of datasets from several missions. (e.g. MGS, Odyssey, MRO)

HRSC & SHARAD

Although LTDs are often located in steep and rough areas (e.g. Valles Marineris, chaotic terrains), the use of HRSC high-resolution Digital Elevation Models (DEMs) [6] greatly helps the analysis of ground penetrating radars such as Mars Reconnaissance Orbiter (MRO) Shallow Radar (SHARAD) [7].

We are concentrating on Crommelin crater and its neighbour as a starting point. Those 2 large structures host extensive LTDs.

We are building a Digital Elevation Model covering the entire area (preliminary DEM in Fig. 1) in order to better simulate the surface clutter: the resolution would be roughly 5 to 10 times better than MOLA, at these latitudes.

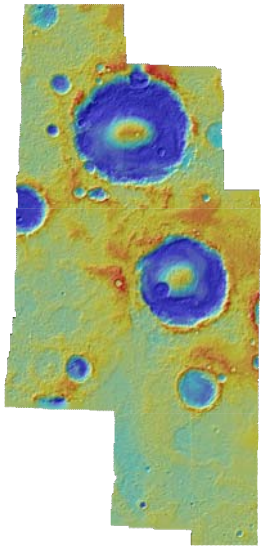

Fig. 1 Colour-coded HRSC stereo-derived shaded relief of Crommelin area, Mars. The width of the imaged area is around 300 km.

Crommelin crater LTDs

LTDs in Crommelin crater have a thickness ranging from 1.5 to 2 km, and the crater just south of Crommelin shows comparable thickness. The deposits are finely stratified and they are affected by a variable amount of erosion. The morphology and structure of the deposits cropping out within the craters show a complex interplay between primary deposition, possible deformation and erosion, increasing the spatial variability of LTDs surface expression. Therefore the surface geology of Crommelin is rather complex, which suggests, up to a certain extent, that its subsurface could be comparably complex as well. The relatively close distance between these LTDs and Meridiani Planum [3], which is characterized by the presence of LTDs that share several features with those in Crommelin offers the possibility of a comparison, not only on the surface geology and geomorphology of the two areas, but also on their subsurface radar expression, possibly useful to draw comparisons and distinctions between them.

Further areas

We plan to extend the synergic observation campaign to further areas where extensive (and relatively rough/steep) LTDs are present: this include other crater bulges, such as Gale, close to the dichotomy boundary, and few case studies of LTDs in the Valles Marineris canyon system.

Although the choice of targets is challenging, the use of high resolution DEMs will hopefully provide better chances to detect subsurface echoes.

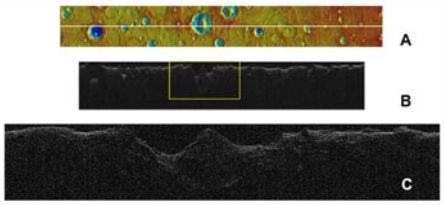

Fig. 2 Sample SHARAD radargram over Crommelin. A. ground track, over MOLA colour-coded shaded relief. B. Radargram r_0357001_001_ss19_700_a, the yellow outline indicates the extent of the enlarged portion of the radargram, as visible in C.

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