GEOLOGICAL CHARACTERIZATION OF THE LAYERED DEPOSITS OF THE CROMMELIN CRATER (MARS). S. D'Arcangelo[1], , M. Pondrelli[1], A. P. Rossi[2] and G. Michael[3], [1]IRSPS, Università d'Annunzio, Pescara (Italy), (darcangelo@irsps.unich.it), [2]ISSI, Bern (CH). [3]Freie Universitaet, Berlin (DE).

Introduction: Crommelin impact crater is located in the south-west Arabia Terra zone, at 5°N latitude and 10°W longitude. It is characterized by an unusual infill and a singular central bulge; a detailed analysis of the deposits cropping out in this structure has been carried on using medium and high-resolution images, and the main resulting outcome has been a geological-geomorphological map. The Crommelin infill consists of layered deposits characterized principally by a sub-horizontal stratification and possibly displaying a cyclic depositional pattern [1], locally preferentially oriented along possible tectonic features.

Similar deposits have been discovered in many different geological context on Mars, such as Valles Marineris, Meridiani Planum and several crater bulges. The genetical interpretation of these deposits is still uncertain and debated. Nevertheless, a possible allogenic control on their deposition has been suggested by [1].

Aim of this work has been to characterize in detail Crommelin sedimentary fill and to infer its depositional evolution.

Deposits analysis: A detailed analysis on crater infill deposits has been possible with a dataset formed by: HRSC, CTX, MOC NA and HiRISE images. The several "units" reported on the geological-geomorphological map (Fig.1) have been defined on the base of parameters as: color, texture, morphology and presence or absence of erosive/depositional structures and are later on described in stratigraphic order from older to younger deposits.

The oldest units cropping out in the study area are *PL1*, *PL2* and *PL3*: plateau units showing rough textures on medium-resolution images, interpreted as thick layering of volcanites, eolian deposits and impact-related ejecta and breccias [2].

The *Rm* unit consists of impact-related breccias and ejecta that constitute the Crommelin's rim and are characterized by a variable roughness texture.

CT1, *CT2*, *CT3*, *CT4*, *CT5*, are the units cropping out on the central bulge; at medium and high-resolution images, they appear as layered deposits, characterized by a intensive aeolian erosion, emphasized by the presence of many knobs and yardangs which at places conceal the stratification. An interesting element, visible mainly on the highest zone of the central bulge (*CT4* and *CT5* units), is represented by erosion features interpreted as thermokarstic, probably related to a resurfacing event.

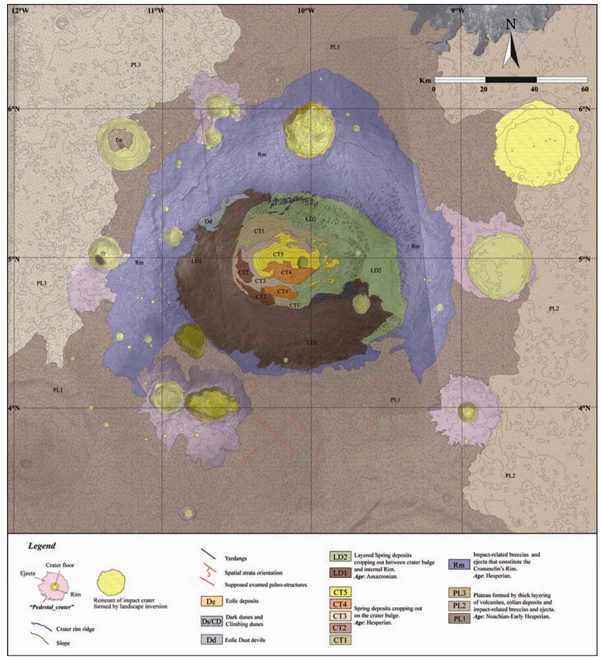

Fig.1: *Geological-geomorphological map of Crommelin.*

Into the crater depression, between external bulge and internal rim, the *LD1* and *LD2* units have been mapped; these deposits are clearly interested by a cyclic alternation of light/dark strata with a predominant sub-horizontal stratification, locally preferentially oriented along the main tectonic features (Fig.2).

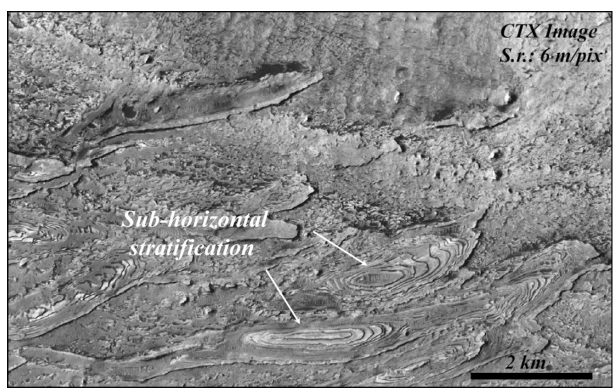

Fig.2: *CTX Image in which is represented the LD1 unit cropping out on the west-south sector of the crater depression .*

This alternation of light/dark strata correspond to layers with different mechanic behavior; dark deposits are subjected to aeolian erosion and reworking while, light strata appear to be more resistant to weathering and erosion (Fig. 3A). Moreover, at high-resolution images, light layers show a polygonal alteration pattern, with polygonal elements on average 3-7 meters wide (Fig. 3B). The same alteration pattern is present in the bulge's deposits too, but in this case the single elements size is smaller. *LD1* and *LD2* units stays stratigraphically on top of bulge's units.

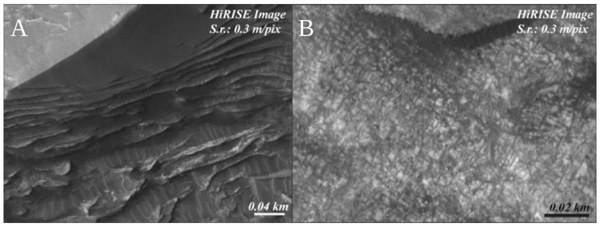

Fig.3: *A. LD2 interbedded deposits showing different mechanic behavior. B. Polygonal alteration pattern.*

Layered deposits' interpretation: The different hypothesis which have been proposed to explain layered deposits formation have been analyzed in order to assess the consistency with the reconstructed geological setting.

The lack of other related deposits and morphologies in the surrounding areas suggesting the presence of fluvio-lacustrine/volcanic processes, the distribution of these units confined within the impact crater depression, the absence of collapse-related structures, are not consistent with a formation of these layers as a result of lacustrine or volcanic activity.

The bulge's size (it's about 1.400 m higher than the theoretical value expected for a complex crater of the size of Crommelin [3]) and the cyclic organization of the layering allow a genesis solely related to the cratering process to be ruled out.

On the other hand, the described elements and especially their local preferential orientation along the main tectonic features and their polygonal alteration pattern are consistent with a genesis of these "units" as "Spring Deposits". These deposits cropping out into the Commelin crater would represent chemical precipitates which would form from emerging water carrying dissolved species which reach super-saturation upon emergence of water to the ambient atmospheric conditions [4]. The fractures that permitted the spring of these deposits are connected probably to the meteoric impact process that made the Crommelin's structure. CT and LD units would thus be related to different and successive impulses of the same spring process [5,6,7].

Reconstruction of the evolution of the depositional system: It's possible to outline the evolution of the depositional system of Crommelin zone in three main phases as schematized in Fig.4:

1) deposition, by fissural lavic eruption and successive deformation by meteoric impact processes and aeolian erosion, of *PL1*, *PL2* e *PL3* units;

2) formation of the Crommelin crater that after its origin probably showed a distinct rim sector but a central peak smaller than the bulge presently observed;

3) deposition of *CT1*-*CT5* units by a possible first impulse of spring processes that produced a large bulge growth; after that, deposition of *LD1* and *LD2* units into the crater depression. Later, all the infill deposits were subjected to alteration by thermokarstic and aeolian processes.

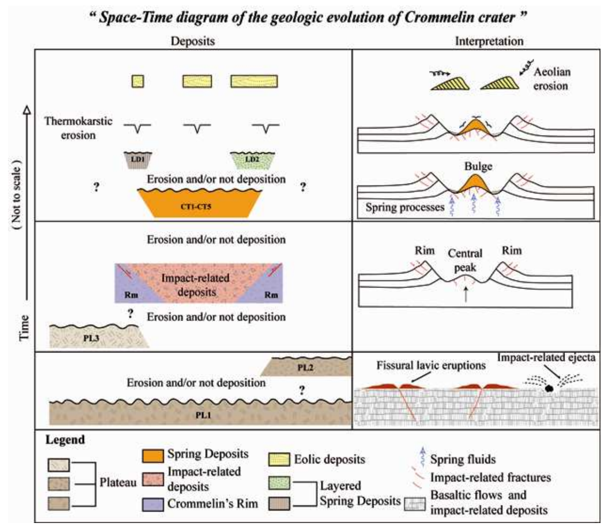

Fig.4: *Space-Time diagram .*

References: [1] Lewis K. W. et al. (2008) *Science, 5*, DOI: 10.1126/science.1161870. [2] Scott and Tanaka (1986) 1:15M, I-1802-A, USGS. [3] Garvin et al. (2003) 6th Int. Mars Conf.. #3277 [4] Pentecost A. (2005) *Travertine*, 445 pp., Springer-Verlag. [5] Rossi A. P. et al. (2008) JGR, *113*, E08016, doi: 10.1029/2007JE003062. [6] Rossi A. P., Neukum G. et al. (2007) LPS XXXVIII, #1549. [7] Rossi A. P., et al. (2006) AGU Fall Meeting Abstract, *13*, 05.