GALE CRATER BULGE: A CANDIDATE MULTI-STAGE LARGE SPRING MOUND. A. P. Rossi[1,2], M. Pondrelli[3], S. van Gasselt[4], T. Zegers[1], E. Hauber[5], G. Neukum[4]. [1]RSSD of ESA. ESTEC, NL Noordwijk, The Netherlands, arossi@rssd.esa.int, [2]International Space Science Institute, Bern, Switzerland. [3]IRSPS, Università d'Annunzio, Pescara, Italy. [4]Institut für Geologische Wissenschaften, Freie Universität Berlin, Germany. [5]Institute of Planetary Research, DLR, Berlin, Germany.

Introduction: Light-toned deposits (LTDs) occur extensively at discrete locations on Mars (Fig. 1). A variety of interpretations have been proposed for these enigmatic sedimentary-like materials [1-3]. Despite the various genetic hypotheses proposed in the last decades, the process of formation of ILDs is still debated.

We have hypothesized that various LTDs could be large-scale spring deposits [4].

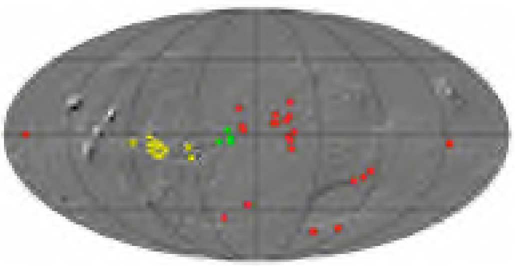

Figure 1: LTDs in Valles Marineris (yellow), chaotic terrains (green), crater bulges (red) over a MOLA-based shaded relief.

Spring deposits?: Several LTDs have common features: light color, association with hydrated minerals [5] or high H_2O content derived from Mars Odyssey GRS, topographic low setting, bulge-like morphologies, also in apparently flat and tabular bodies, such as LTD in Aram Chaos [5,6].

Gale crater bulge: In several cases, LTDs in crater bulges are sharing the lack of signs of relevant lacustrine activity in their respective basin. Also, there is no or little evidence of fluvial activity in the immediate surroundings of the craters hosting bulges and within their rim.

Gale crater is close to the equator on Mars, right at the crustal dichotomy boundary. It has a diameter of about 160 km and it is characterized by thick-layered deposits at its center (slightly off-centered northwards) of the structure. The thickness of these deposits is variable, with a maximum of about 2 km. The material in the bulge appears finely layered and light-toned, resembling sedimentary rocks.

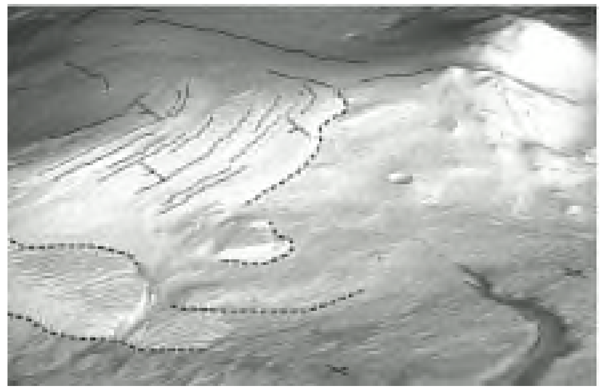

Figure 2: Perspective view of Gale central bulge. Some unconformities (dashed line) are highlighted. HRSC mosaic (orbits 1916, 1927, 1938) over HRSC stereo-derived DTM.

Figure 3: CTX and HRSC image mosaic over Gale crater bulge. Areas used for crater size-frequency dating are indicated in semi-opaque white.

Various hypotheses have been proposed in order to explain the genesis of Gale crater layered deposits [e.g. [7]. We suggest that the current appearance of bulge deposits inside Gale crater is mostly related to depositional processes rather than erosive [7].

Gale central bulge deposits can be subdivided in two main bodies with different architectural style: a slightly tabular crescent-shaped basal unit, which appears slightly eroded and characterized by few craters (possibly exhumed) and an upper mound-shaped unit unconformably overlaying the tabular unit. This upper mound has much fewer craters, respect to the basal unit.

Attitude measurements are showing layering dipping northwards up to few degrees [8].

For the central bulge a total volume of about 6000 km^3, has been measured. Within the bulge, its upper, steeper and apparently clinostratified portion contains approximately 700 km^3, as derived from both MOLA and HRSC DTM [9,10].

Internal unconformities (Fig. 2) and evidence of large temporal hiatus (e.g. in Gale crater bulge) are consistent with an intermittent or multistage process, e.g. supply of water from the subsurface. Differential erosion ages of around 5 Million years (Myr) and ~100 Myr have been measured respectively on the lower and upper portion of Gale crater bulge (Fig. 3,4).

Gale Crater [8] shows a possible hiatus in the formation/deposition of its central bulge. Different erosion and cratering levels suggest that these deposits, regardless their origin, have formed during a variable amount of time.

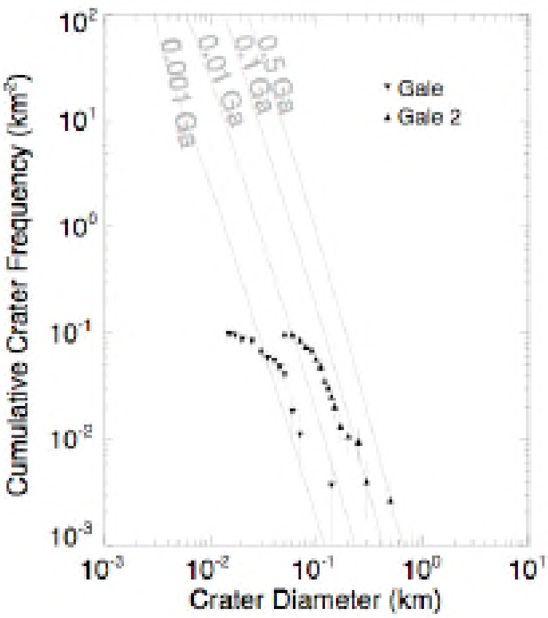

Figure 4: Crater size-frequency based ages over 2 selected areas on the LTDs of Gale Crater. Series on the left referred to the area on the left in Fig. 2.

Conclusions: LTDs in Gale crater show a complex internal architecture, with noticeable interruptions in the sedimentation. The lack of substantial fluvial features in the surroundings of the crater, together with the relative apparent young age of the deposits, points towards a local origin of the LTDs in the crater.

We suggest that an intermittent supply of material locally delivered from the subsurface in the form of precipitated spring deposits could be responsible for the formation of the of the bulge itself. In this hypothesis different architectures, styles and geometry would reflect environmental variations through time.

References: [1] Lucchitta, B.K., et al. (1992) *The canyon system on Mars*, in *Mars*. 1992. p. 453-492. [2] Malin, M.C. and K.S. Edgett (2000), Science, 290 1927-1937. [3] Chapman, M.G. and K.L. Tanaka (2001), JGR, 106: p. 10087-10100. [4] Rossi, A.P., et al. (2007) *LPS XXXVIII,* Abstract #1549. [5] Massé, M., et al. (2007), *EMSEC*, ESA ESTEC, Noordwijk, NL. [6] Oosthoek, J.H.P., et al (2007). *LPS XXXVIII,* Abstract #1577. [7] Edgett, K.S. and M.C. Malin (2001) *LPS XXXII,* Abstract #1005. [8] Rossi, A.P., et al. (2007) *LPS XXXVIII,* Abstract #1553. [9] Gwinner, K., et al. (2005) Photogrammetrie – Fernerkundung – Geoinformation, 2005. 5: p. 387-394. [10] Jaumann, R., et al., *PSS*, 2007. 55, 928-952.