**STRATIGRAPHIC ARCHITECTURE AND STRUCTURAL CONTROL ON SEDIMENT EMPLACEMENT IN BECQUEREL CRATER (MARS).** A. P. Rossi[1], M. Pondrelli[2], E. Hauber[3], A. Baliva[2], G. Michael[4], G. G. Ori[2], L. Pompilio[5], M. Parente[6], A. Ivanov[7], G. Neukum[4]. [1]ISSI, CH (arossi@issibern.ch). [2]IRSPS, IT. [3]DLR, DE. [4]FU Berlin, DE. [5]Univ. Parma, IT. [6]Stanford/SETI, USA. [7]EPFL, CH.

**Introduction:** Becquerel crater (352° E, 22° N) is among the several craters in Arabia Terra hosting unusual sedimentary-looking light-toned deposits (LTDs) [e.g. 1]. We are investigating the possible interplay between sedimentation and deformation [2], trying to link the local structures (fractures, faults) with the regional tectonic trends.

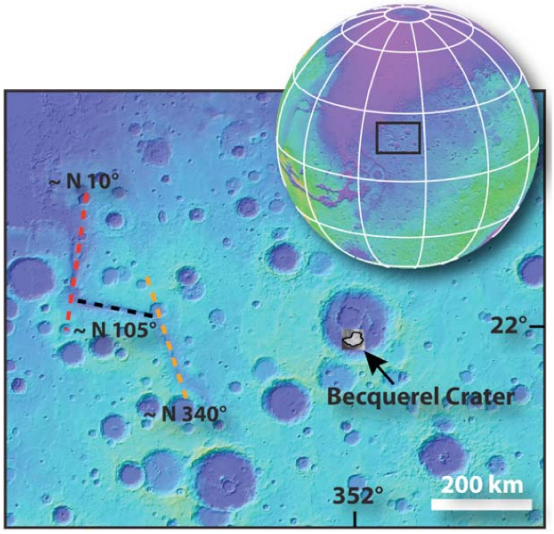


**Figure 1:** Location of Becquerel crater, with indication of some of the regional structural trends (shown for the three main legs of Marwth Vallis).

**Stratigraphy and architecture:** The layered mound in Becquerel crater shows a complex structure. Bedding can be traced over large portions of the bulge, frequently bounded by exposed or possibly buried structures (Fig. 2). The faulting subdivides the bulge in various domains characterized by different stratigraphic architecture (Fig. 2, 3).

Thin, regular [1], parallel and sub-horizontal beds characterize the northern central portion of the bulge. Outward dipping strata are present in its northwestern and southwestern portion.

Intraformational unconformities are visible in various portions of the bulge, separating sequences with different stacking pattern styles.

**Deformation and Structures:** Several deformation features are visible within Becquerel bulge [e.g. 2]. They include faults with offset suggesting at least transcurrent movements as well as fractures at places filled with exotic material. Faults and fractures, when well exposed, show that they are affecting the stratification, suggesting synsedimentary activity. Also, some lineaments are appearing as preferential alignment of geomorphological features or boundaries between domains with different stratigraphic architecture. Those lineaments (Fig. 2) are interpreted as buried structures (e.g. faults), active at different times during the emplacement of the different portions of Becquerel bulge LTDs. The comparison between the structural trends in Becquerel and some of the regional ones, are visible in Fig. 1, 2, 3.

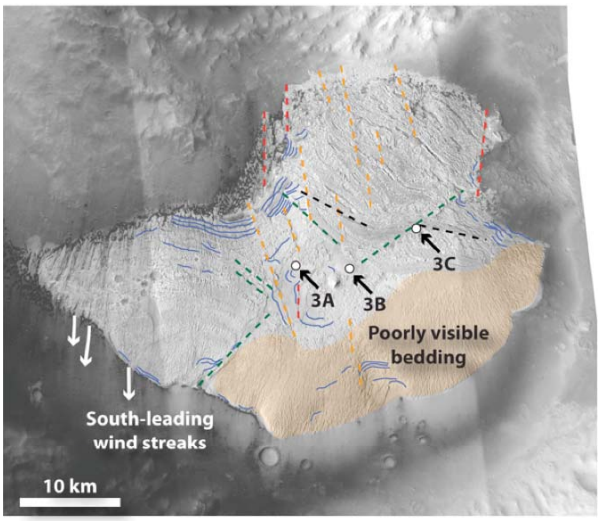


**Figure 2:** Sketch of Becquerel crater bedding, structures and main geomorphological features. The color code of lineament azimuth is similar to Fig. 1, except various green coded lineaments, not shown in previous figure (CTX mosaic).

**Geomorphological aspects:** Landforms related to erosion, such as yardangs, mesas or knobs can be found throughout the bulge. Some of these features show a clear structural control in their location and development. Also, the apparent lack of visible bedding in extensive portions of the south-east area of the bulge (although layers are sporadically cropping out, e.g. Fig. 2) might be related to both: a) lower lateral continuity of beds (more knobby terrain), b. higher level of mantling (Fig. 2) due to differential exposition and exhumation. The well-stratified northern portion and the poorly stratified southern area are separated by a topographic divide. Moreover, south-leading wind streaks are visible just south of the LTDs, consistently with stronger erosion on the north side of the bulge and a lower, with possibly deposition, mantling in the south-facing slope (in light orange, Fig. 2).

**Regional structures:** The regional structural trends are largely compressional [3, 4] but significant extensional structures are present and can be traced into Arabia Terra [4]. Some of them could also be responsible for the preferential lines of erosion and collapse at the dichotomy boundary [5]. The timing of this activity likely dates back to Noachian [3], but local reactivations cannot be ruled out, given the fact that tectonic structures cut different portions of the possibly post-Noachian Becquerel sedimentary fill.

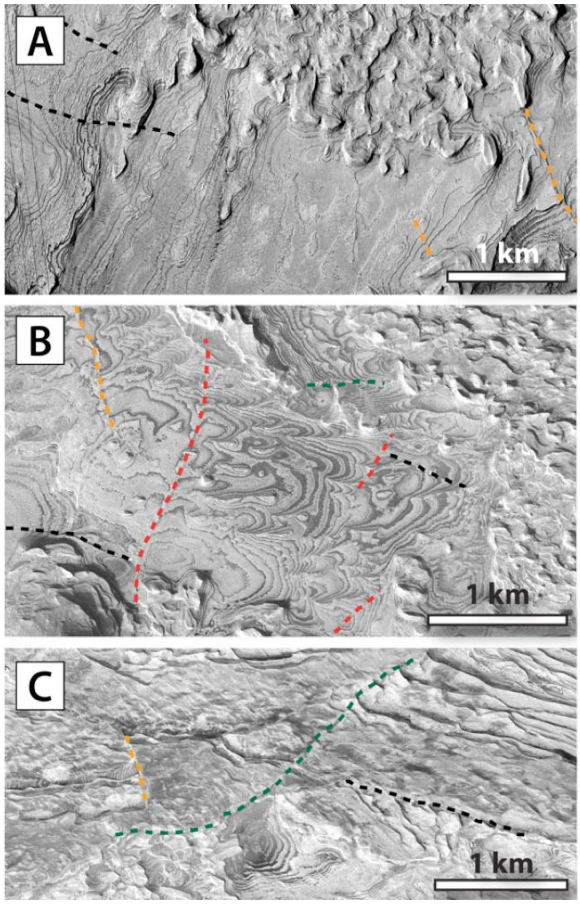


**Figure 3:** HiRISE views of different portions of the bulge. A. Regular layering just south of knobby layered terrain (PSP_001955_2015) B. (possibly synsedimentary) deformation of sub-horizontal beds (PSP_004078_2015) C. Complex deformed sediments (PSP_005845_2015). Across the entire structure, a limited set of orientations of both faults, fractures are visible.

**Significance for LTDs formation**: The internal architecture of layered sedimentary-like deposits in Becquerel crater is complex. An interaction between deposition and deformation [2] is likely. We interpret the deposits to be formed after the emergence of subsurface fluids leading to large travertine-like deposits, possibly during discrete multiple phases, recorded by angular unconformities. Pre-existing structures, possibly re-activated, could provide a pathway for subsurface fluids to the surface [6]. Arabia Terra appears to be a suitable area on Mars for such subsurface fluid emergence [7, 8, 9]

Allogenic control on the sediment emplacement seems likely at some stage to some extent [1]. Nevertheless both vertically and horizontally the stratigraphic complexity of the deposits in Becquerel appears to be very high; therefore an extrapolation over the entire LTD assemblage is difficult.

We are also trying to obtain insights on the local and regional paleo-stress field.

**References:** [1] Lewis, K. et al. (2008) Science 322 1532-1535. [2] Bridges, J., et al. (2008) *LPS XXXIX, #1913*. [3] Scott, D.H. and Dohm, J.M. (1990) *LPS XX proceedings*, 487-501. [4] R.C. Anderson et al. (2008) *Icarus* 195, 537-546. [5] McGill, G. (2002) USGS Geologic Investigations Series I-2746. [6] Okubo, C.H., et al. (2008), *GSA Bulletin*, doi: 10.1130/B26421.1. [7] Andrews-Hanna et al (2007) *Nature*, 2007. 446(7132): p. 163-166. [8] Rossi et al. (2008) *J. Geophys. Res*., 2008. 113(E8),1-17. [9] Allen, C. and Oehler, D. (2008) *Astrobiology*, 8, 6, 2008 doi: 10.1089/ast.2008.0239