INTRODUCTION

Structural and stratigraphic features of Becquerel crater (Arabia Terra, Mars) suggest this area may be a possible methane release zone. The filling sequence of the crater shows a complex pattern of faults culminating on the top in a radial disposition: on Earth such a setting is often associated with methane seepage, thus further investigations may deepen this hypothesis, using also terrestrial analogues.

RESULTS & DISCUSSION

In the southern outcrop of Becquerel crater (Fig. 1) the stratigraphic analysis highlighted the occurrence of two main facies (Fig. 2):

- **P Facies:** light-toned deposits characterized by planar bedding. Interpreted as the result of possible lacustrine/evaporitic deposition. Locally these deposits assume also a wavy aspect with alternations of different beds.
- **T Facies:** dark deposits with trough-cross bedding, arranged in lenticular bodies. More resistant to aeolian erosion respect to the P Facies. Interpreted as cemented aeolian deposits.

The structural features within the outcrop are often complex and characterized by high variability in the attitude. Despite the complexity also due to the erosion, it is possible to infer an extensional kinematic based on the displacement observed in 3D view. On the depressed top the faults occur showing all the different attitudes detected in the other sectors and result in a radial pattern (Fig. 3).

We propose that the normal faults organized in a radial pattern, especially on the depressed top, may represent a surface collapse in correspondence over a buried salt diapir.

On Earth radial faults, over collapsed salt diapirs or uplifted fault blocks, are often associated with natural gas (methane) seepage.

In Fig. 4 a possible sequence of events is provided. During the early filling stage within the crater, groundwater table oscillations may have produced environments from playa-like to lacustrine, with deposition of salt and lacustrine/evaporitic deposits corresponding to the P Facies. Later, a groundwater table drop may have produced subaerial exposure and deposition of aeolian deposits corresponding to the T Facies. Before the final drying and the subsequent wind erosion, the estimated overburden of the salt might have been greater than 800 m, which is the current thickness after billions of years of aeolian erosion. The density contrast due to the lithostatic loading would have triggered the salt diapir rising. A depressed top with radial normal faults can be indicative of the reactive stage of the diapirism. A terrestrial analogue for reactive diapirism is in the Gulf of Mexico, where the salt diapirism causes normal radial faults and the collapse of the overburden rocks, thus developing intense natural gas seepage.

The Becquerel radial faults could then be the object of gas seepage investigations through orbital methane detection (e.g., Mars Express–Planetary Fourier Spectrometer, ExoMars-TGO). It will be interesting also to compare this hypothesis with other processes possibly responsible of such a radial pattern.

REFERENCES


