Sedimentary evolution of the Eridania paleolake in the Atlantis Chaos basin, Terra Sirenum. S. Adeli, E. Hauber, L. Le Deit, R. Jaumann. Institute of Planetary Research, German Aerospace Center (DLR), Rutherfordstr. 2, 12489 Berlin, Germany (Solmaz.Adeli@dlr.de).

Introduction: The Terra Sirenum region on Mars, located in the cratered Noachian Southern Highlands, hosts a variety of enigmatic features, including large, degraded basins that have been proposed to form isolated paleolakes. These basins, probably of impact origin [1], might have been part of the larger Eridania paleolake, during the late Noachian and early Hesperian Epochs [2-4]. The basins floors are partly occupied by knobs that are erosional remnants of a formerly contiguous unit, composed of light-toned materials, where hydrated minerals such as phyllosilicates have been identified [5-7]. In this study we focus on the 260 km diameter Atlantis Chaos basin, centered at 177°W-34°S, which presents well preserved sedimentary infill and chaotic terrains. Our aim is to constrain the sedimentary history of the former lake and the processes involved in the formation and erosion of the knob fields.

Data and Methods: HRSC and CTX images, as well as MOLA topographic data were used to analyze the geological features of the Atlantis basin. In addition we used high-resolution HiRISE images to better investigate the stratigraphic contacts between the different units. We performed crater counting on CTX images to determine the age of certain units.

Geologic mapping results: The elevated topographic massifs constituting the rim of the basin correspond to the Noachian cratered plateau unit (Npl) (Fig. 1) [8]. This Npl unit outcrops at an elevation between 1200 m and 3100 m (Fig. 1-c). The Modified basement unit (Mbt) is located along the rim of the basin (elevation range: 1200 m to 400 m). It has been eroded by fluvial channels and displays wrinkle ridges. The Mbt unit also displays faults (white arrows on Fig. 1-a) which may have facilitated the rise of groundwater to the surface.

The knob characterizing the chaotic terrain (Unit I), are found from -500 m to 0 m (except for the north-eastern and southern part of the basin) and they cover a large part of the basin floor. Chaotic terrains possibly formed a continuous deposit once, which has been later eroded into isolated knobs that seem to be separated by fractures [3]. The knobs at higher elevation are smaller in size (~80 m height, 1.5 km width) than those observed at lower elevation (~300 m height, 5 km width) close to the center of the basin floor. At the southern part of this unit, thin linear ridges, of different orientation, are visible within the knobs (Fig. 3-a). The features may be filled and cemented fractures resulting from fluid circulations in the subsurface.

Unit II is stratigraphically above units Npl and Mbt and partly covers the basin rim. It is exposed between 0 m and 400 m and may have been deposited during the existence of a lake in Atlantis basin. The sediments could have been transported into the Atlantis basin from the basin rims and partly from an unnamed basin, situated to the south. The lowest point in the division between the two basins is at an elevation of 350 m. Atlantis is linked at a spillover (pour point) elevation of 200 m to another basin to the south-west, which would have received the drainage from Atlantis. Morphologically, the two basins are connected by a small

Fig. 1: a) Geological map of Atlantis Chaos basin, superposed on MOLA topographic map overlapping a C1X mosaic. Black arrow represents the depositional fan. White arrows represent the channels sourced at the tectonic features. AB line shows the localization of the cross-section of Fig. 2. b) Zoom on the intersection of knobs, showing that Ampl filled the depression between them. c) MOLA contour lines (400 m) overlapped on HRSC images.
channel, which fed a depositional fan with ~50 m height and 12 km width, where it entered an impact crater (black arrow in Fig. 1). The Unit II has been eroded by fluvial erosion and it displays triangular facets (Fig. 3-a) at the contact with the Mbt unit that may resulted by erosional processes.

The north-eastern and southern parts of Unit I are covered by a smooth material, in which we distinguished two units according to their location in the basin and their ages (according to our crater counting result): the Hesperian plains (Hepl) to the north-eastern part of the basin and the Amazonian plains (Ampl) in the southern part. These units might be sediments deposited by aeolian activity such as volcanic air-fall deposits. It could also be volcanic lava flows, which would be consistent with reported volcanic activities [9]. Moreover, we observe scattered wrinkle ridges that would be consistent with both, a sedimentary and a volcanic, origin for the Unit I. The Hesperain and Amazonian plains have filled the depressions between the knobs (Fig. 1-b, Fig. 3-b). Hence, they were deposited after Unit I.

Hesperian Electris air-fall deposits described by [10] are found in high altitudes and have been eroded by fluvial activity. Regarding to its Hesperian age we propose that this layer is deposited after the desiccation of Atlantis Lake.

Discussion and conclusion: The initial shape of the basin resulted by its impact origin, makes it a suitable place for deposition of sediments in a standing water mass [2], where, the Unit I and II have been deposited (Fig. 2). The gradual desiccation of the Eridania Lake [2] caused the separation of individual basins to smaller lakes. However it is not clear that the materials have been deposited either before/after, or during the existence of the Eridania Lake. After the total desiccation of the Eridania Lake, an erosional phase started. The existence of an ice-cover lake is also supposed by [3] before its total drying out. During the erosional phase, Unit II was entirely eroded by fluvial and/or aeolian activities, and its remaining only crops out along the rim of the basin. As the erosion rate declined after early-Hesperian [11, 12], deposits of Unit I have been modified by water or melted ice. The remnant materials might have been more resistant to erosion, because of their cementation by fluid circulation, displaying as linear features in the knobs. Aeolian erosion also contributed to shape them in their current form and to transport the eroded material out of the basin. The Hepl and Ampl plains deposited between the knobs and may have contributed to their erosion.

The Atlantis basin and the other paleolakes, with their capacity of hosting a body of water during a certain period of time, could be promising sites for hosting life and preserving its evidence, if it ever existed during early Mars.

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