Different Phylloslicate-rich Materials on the Terra Sirenum Region, Mars. S. Adeli, E. Hauber, L. Le Deit and R. Jaumann, Institute of Planetary Research, German Aerospace Center (DLR), Rutherfordstr. 2, 12489 Berlin, Germany (Solmaz.Adeli@dlr.de).

Introduction: The evidence of ancient lakes on Mars is documented by both mineralogical and sedimentary records; however the volume and duration of the standing body of water in those paleolakes are still open questions. Lake basins capture the record of geological and environmental oscillations over a wide range of temporal and spatial scales, therefore they are prime candidates for in-situ exploration and can increas our knowledge about the Martian geology, climate and possible habitable sites on Early Mars.

The Terra Sirenum region, located in the cratered southern highlands, hosts a variety of enigmatic geological features including Ma'adim Vallis as one of the larger valleys on Mars [1]; and degraded basins that have been proposed to form isolated paleolakes [1-3]. These basins, probably of impact origin [4], might have been once part of the larger Eridania paleolake that existed during the late Noachian and early Hesperian Epochs [3]. In this study we focus on the 260 km Atlantis Basin (A.B.) centtered at 177°W-34°S, and on two unnamed basins located north and south of Atlantis (N.A.B. and S.A.B., respectively) (Fig. 1). Our aim is to investigate the mineralogical composition of bright materials, observed at the floor and on the rim of these basins, to understand their process of formation.

Data and methods: We used high resolution images of HRSC, CTX, MOC and HiRISE instruments, as well as MOLA topographic data to analyze the morphology and the stratigraphy of geological features of the A.B., N.A.B. and S.A.B..

CRISM hyperspectral data have been used to identify the mineralogical composition of light-toned materials. The CRISM data have been atmospherically [5] and photometrically [6] corrected via the CAT tool v6.7 under the ENVI software. We produced maps of absorption band depth at 1.9, 2.2 and 2.3 µm [8-10] to identify and localize the spectra with the diagnostic signatures of Al-phyllosilicates and Fe/Mg-phyllosilicates. These selected spectra have been ratioed by neutral spectra extracted from the same data cubes in order to reduce noise and emphasize the absorption bands in the spectra [7].

Morphology and stratigraphy: The floors of A.B. and S.A.B. are partly dominated morphologically by topographically hills (knobs) which are the oldest deposited unit in these basins [10] (elevation range: -500 to 0 m) (Fig. 2-a). They are composed of bright materials that have been interpreted as Fe/Mg-phyllosilicate-rich outcrops [11-14], possibly deposited during the

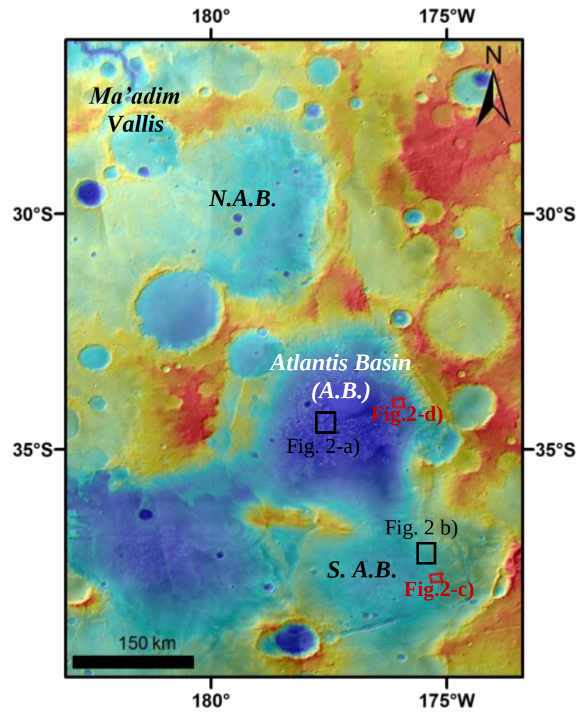

Fig. 1 Overview of the study area, MOLA topographic map overlaying the MOC global map. Location of CRISM cubes, shown in Fig. 2, has been represented as red boxes.

presence of a lake. These bright materials are also observed in the shallower peripheral parts of these basins, along the basin rims (Fig. 2-b). They form localized outcrops often situated close to fluvial channels. This type of outcrop is also ovbserved in N.A.B. which is not as deep as the two other basins and no chaotic material in form of knobs has been observed.

On basin rims, erosional features associated with fluvial channels are observed. These features may be related to one or several erosional events that would have occurred after and/or during the desiccation of the lake. The unit displaying the triangular facets is located stratigraphically above the bright chaotic material and may have been deposited in a lake and eroded later by water activity.

Mineralogical composition: The knobs observed at the floor of A.B. and S.A.B. have spectra with absorbtion bands at ~ 1.42 µm, ~ 1.92 µm and ~ 2.3 µm. They are consistent with spectra of Fe/Mg-phyllosilicates [9], which might be Fe/Mg-smectite (e.g., nontronite, saponite) and vermiculite (Fig. 2-e). This result is in agreement with previous authors [11-13]. Localized outcrops of brigth materials observed

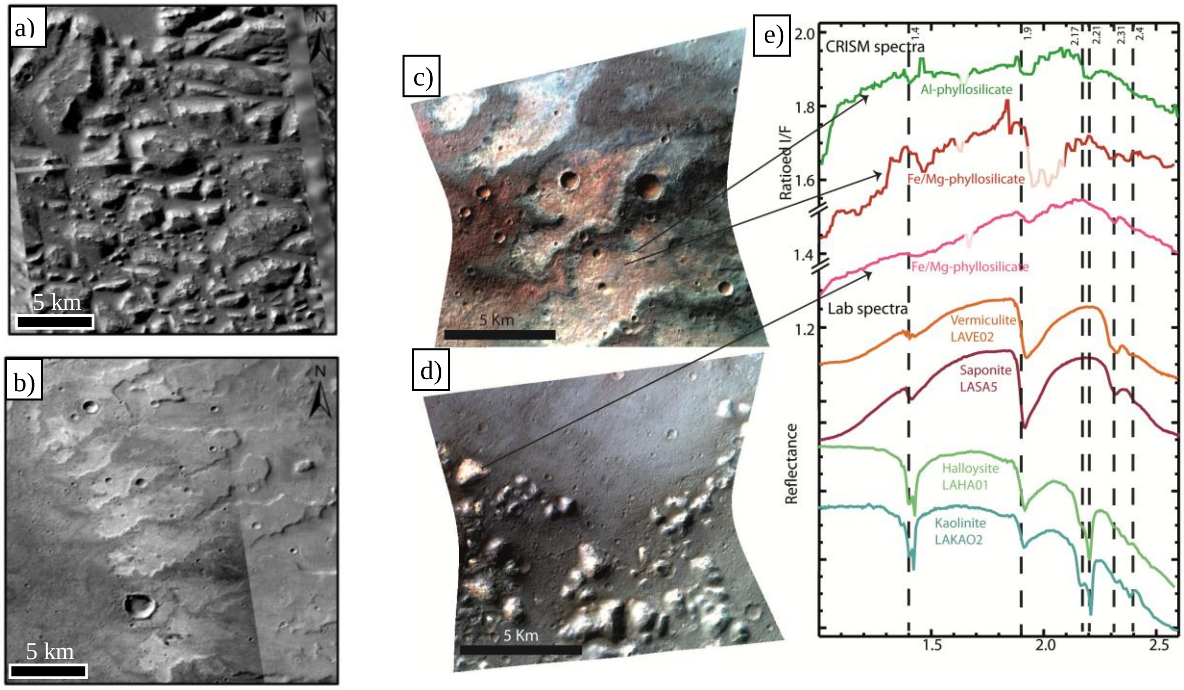

Fig. 2 a) A mosaic of CTX images from the knob field of Atlantis basin (A.B.). b) A mosaic of CTX images showing the localized outcrops where the sequence of Al-phyllosilicates on top of Fe/Mg-phyllosilicates has been observed. c) Image of the CRISM observation FRT 8A1C at 1.014 µm showing the localized outcrop of the sequence of Al-phyllosilicates overlying Fe/Mg-phyllosilicates. d) Image of the CRISM observation FRT 913-a at 1.0800 µm. Showing Fe/Mg-phyllosilicates in the knob field. d) CRISM spectra (ratioed I/F) averaged for a 3×3 pixel area compared to laboratory spectra. Locations of the averaged pixels are indicated by arrows toward Fig. 2-e). The location of the images and cubes is shown in Fig. 1, as black and red boxes respectively.

along the rims of A.B., N.A.B. and S.A.B. have spectra with absorption bands at ~ 1.4 µm,~ 1.9 µm and ~ 2.2 µm that are consistent with spectra of Al-phyllosilicates, including Al-smectites (e.g., montmorillonite, beidellite) and kaolinites (Fig. 2-e). Al-phyllosilicate has not been reported in Terra Sirenum before, and are stratigraphically on top of Fe/Mg-phylloslicates (Fig. 2-c). Additionally the presence of chloride salts in topographically lower areas has been reported in N.A.B. [15].

Discussion and conclusion: The bright materials currently forming knobs at floors of A.B. and S.A.B. may have been deposited in the lake. They might be the result of alteration of deposited sediment to Fe/Mg-phyllosilicates. The knobby shape of these materials may have been formed by erosion after the desiccation of the lake.

The sequence of Al-phylloslicates laying on top of Fe/Mg-phyllosilicates observed along the basin rims, has also been reported in other regions on Mars including the Marth Vallis region [16], Nili Fossae [9], and some sites around Valles Marineris [7]. In Terra Sirenum this sequence might be the result of bedrock alteration by pedogenesis [7]. Their outcrops may have been exposed by fluvial activity occurring in the upper parts of the basins, possibly related to melting of ice.

The two phyllosilicate-rich formations (knobs on the basin floor and localized outcrops along the basin rims) suggest that multiple aqueos episodes occurred in Terra Sirenum.

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