HYDRATED MINERALS IN AUREUM CHAOS, MARS. M. Sowe, L. Wendt, T. Kneissl, P. C. McGuire, and G. Neukum, Institute of Geosciences, Planetary Sciences & Remote Sensing, Freie Universitaet Berlin, Germany (mariam.sowe@fu-berlin.de).

Introduction: Aureum Chaos is a depression with a diameter of ~295 km (4.4°S/333°E) located east of Valles Marineris. Collapsed plateau material, chaotic terrain, and Interior Layered Deposits (ILDs) characterize the region. Its geologic units were classified by [1] into Hesperian floor material (Hcht) and Noachian plains (Npl1, Npl2). Polyhydrated sulfate (PHS) and hematite were detected with MEX-OMEGA and MGS-TES [2,3], as elsewhere on Mars in association with ILDs [4]. We utilized MRO-CRISM data and co-aligned MEX-HRSC, MRO-HiRISE and -CTX data in order to study the hydrated minerals (sulfates and phyllosilicate) detected in [5].

Datasets and Methodology: Minerals were identified based on CRISM-NIR observations as described in [5,6]. The datasets were combined in a GIS environment and the minerals were mapped. Layering attitudes were measured [7] to study their formation using HRSC-DTMs with resolutions of <100 m (Fig. 1, [8]). The extent of the hydrated deposits was determined, since it indicates where water was present in the past.

Vertical and spatial extent: ILDs are located in the central to northern part of Aureum Chaos; at elevations between -4900 m and -3300 m below datum. ILDs occur with their common eroded morphologies [6] and often crop out below dark mantle deposits of low thermal inertia. PHS is detected at elevations below -3600 m, monohydrated sulfate (kieserite) below -4100 m, and phyllosilicate (nontronite) below -4000 m. The hydrated area as shown by CRISM is ~70 km² and composed of mono- and PHS. The maximum vertical extent of the minerals is shown in Figure 1c. Local sulfate exposures were determined to 50 m on average for monohydrated sulfate and PHS, ranging from 20-90 m (outliers of ~360 m and ~240 m excluded). In contrast, phyllosilicate exposures are 20 m thick on average. Phyllosilicates only occur in minor amounts (<1 km²) and are not associated with ILDs but with collapsed Noachian plateau remnants (Fig. 1, 2c).

Stratigraphic relationship: A few outcrops show both sulfate types, where PHS overlies the cliff-forming monohydrated sulfate. Monohydrated sulfate is mainly ascribed to massive, eroded pitted outcrops of high albedo (Fig. 2a), while PHS forms distinct layers and has a lower albedo (Fig. 2b). Regions of high thermal inertia [6] are often near sulfate detections but do not necessarily coincide. The deposits mainly have low dipping values downslope. Phyllosilicate-rich outcrops are either low-albedo mounds with light-toned material cropping out underneath (Fig. 2c) or windblown deposits that are found close to the sulfate-rich outcrops. The TES-detected gray hematite [2] is present in low-albedo regions as shown in Fig. 1a, b.

Discussion and conclusions: Sulfates are either evaporites or alteration products that form at acidic pH values [9]. The status of hydration displayed by the detected minerals shows that different quantities of water were present through time. Hydration is observed at the maximum elevation of -3600 m. According to [10], the detected sulfates may convert into each other, either by dehydration (e.g. due to insolation) of PHS into monohydrated sulfate or water absorption of PHS into monohydrated sulfate. The fact that ILDs are mainly buried by mantle deposits or show a spectrally neutral rough-looking cap rock (comparable to Aram [6]), overlying most of the sulfate-rich ILDs, may explain why sulfates were not found in all CRISM observations shown in Fig. 1a. The low dip values and parallel bedding of ILDs indicate that they post-date the chaos formation in the Late Hesperian. In addition, sulfates overlie phyllosilicates (Fig. 2c). Since Aureum Chaos is a closed depression, water must have come from the subsurface e.g. as proposed by [11]. Further, we observe sulfates at different elevations bounded by collapsed ancient plateau material (e.g. to SE in Fig. 1a, 1b), and conclude that the formation of sulfates in a standing body of water is conceivable.

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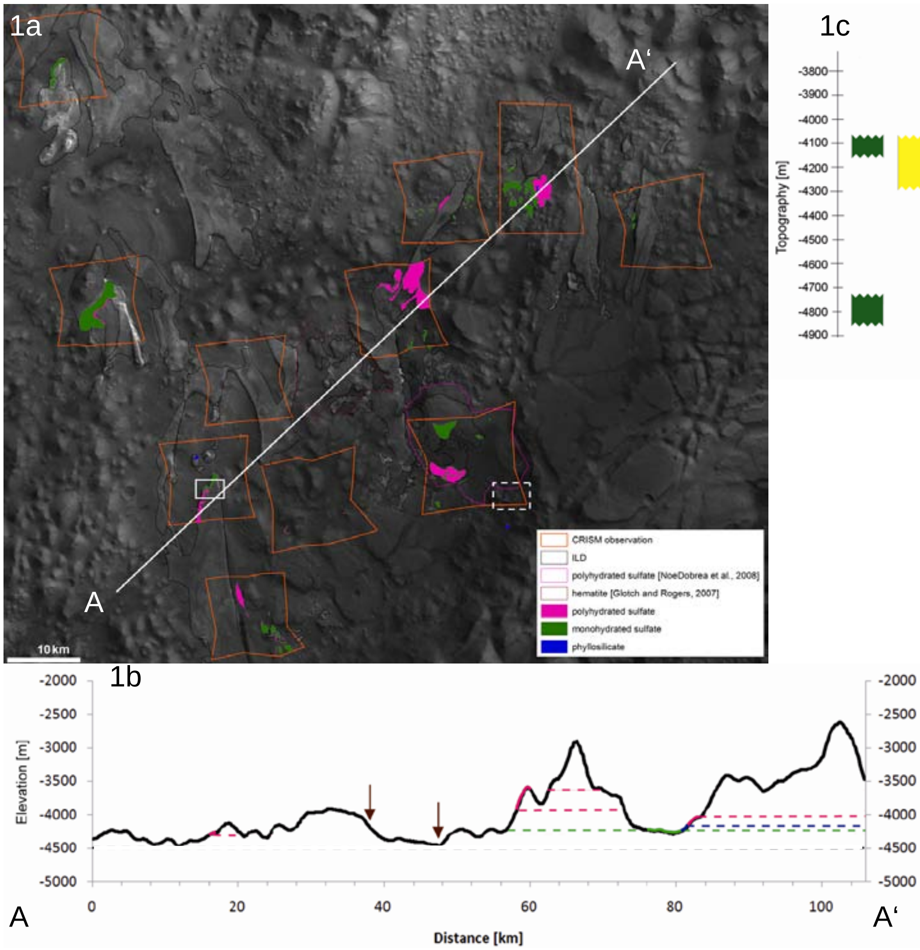


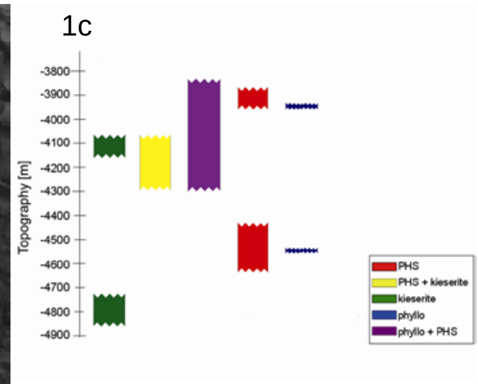
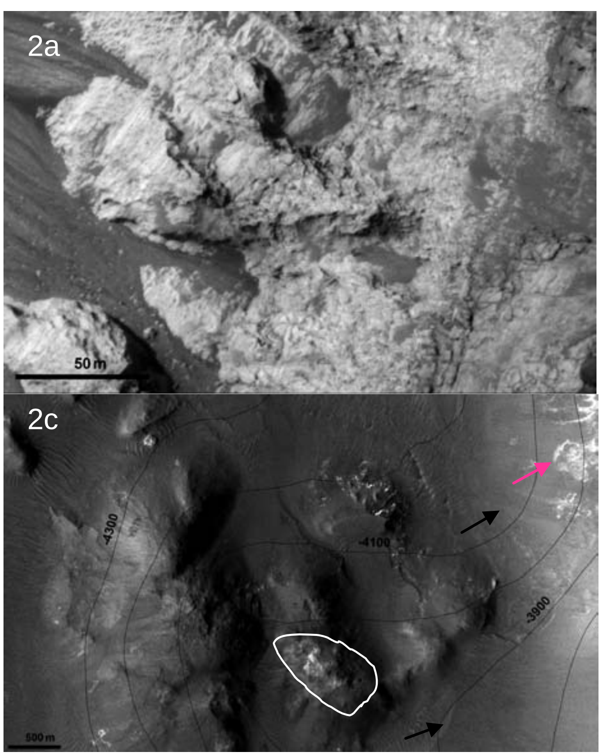


Figure 1: *(a)* Map of the mineral exposures (HRSC h0456_0000). Boxes show locations of Fig. 2a-c. *(b)* Solid line marks the profile AA' shown in Fig. 1a. Colored solid lines represent the mineral outcrops; arrows mark the region of the highest gray hematite concentration. 10x vertical exaggeration. *(c)* Maximum vertical extent of mineral exposures is based on HRSC-DTMs.



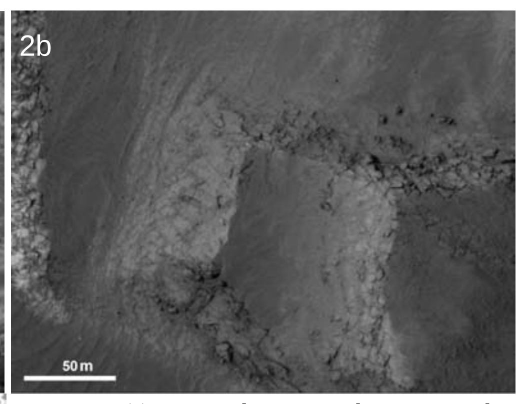


Figure 2: (a) Massive kieserite-rich outcrop with high albedo (HiRISE PSP_007217_1755). For context see solid white box in Fig. 1a. (b) PHS-rich material of low albedo is present above the kieserite-rich unit, which is shown in Fig. 2a (HiRISE PSP_007217_1755). (c) Phyllosilicate-rich mound (outlined white) and overlying (black arrows) PHS-rich layers indicated by pink arrow (CTX P04_002681_1761) with HRSC-DTM 100 m contours (h0456_0000). For context see dashed white box in Fig. 1a.