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Hydrated mineral stratigraphy of Aureum Chaos ILDs

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Introduction

Aureum Chaos is a crater with a diameter of ~295 km (Fig. 1) dominated by chaotic terrain. It is situated southwest of Aram Chaos and east of Valles Marineris. Its floor shows smooth, cliff-forming Interior Layered Deposits (ILDs) in the north to central part.

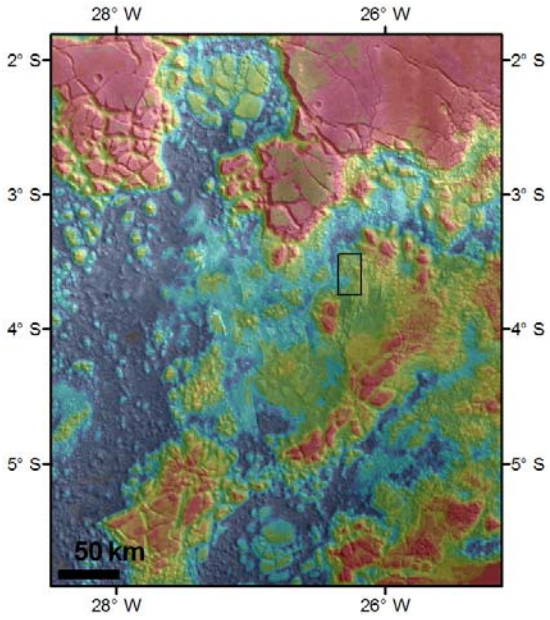

Fig. 1: HRSC DTM (h0456_0000) overlaid onto nadir image showing the research area. Box corresponds to CRISM observation in Fig. 2.

Background

Interior layered deposits (ILDs) have been reported from several regions of Valles Marineris bearing hydrated minerals and haematite [1-4]. Hydrated minerals indicate aqueous activity and give insights to environmental processes prevailing during mineral formation such as the abundance and permanence of water.

Datasets

We used MRO/CRISM IR-data combined with MEX/HRSC-DTMs in order to get information about the mineral stratigraphy. MRO/HiRISE and CTX data were used to find out whether there is a link between mineralogy and morphology [5].

Stratigraphic relationship

The ILDs are exposed at elevations from -4900 m to -3300 m. Identified minerals concentrate at elevation between -4900 and -3800 m. Kieserite occurs massive and cliff-forming on high albedo knobs (-4860 to -4740 m; -4190 to -4080 m) or intervening thick layered sequences of polyhydrated sulphates (PHS; -4300 to -4090 m). PHS is present on smooth, low albedo regions and apparently slope-forming [5]. Alike PHS is observed in a regional assemblage with phyllosilicates (-4300 to -3840 m; Fig. 3). PHS is also identified eroding out of steep bright mesa slopes (-4640 to -4420 m; -3960 to -3880 m). Isolated mounds of phyllosilicate (likely nontronite; at -4550 m) is located topographically below the sulphates. One outcrop of nontronite (-3950 m) is present on low albedo massive terrain amongst a unit which has a kieserite signature.

Conclusions

Aureum Chaos shows a diversity of minerals in light toned units and possibly in related loose debris. These minerals are arranged in a complex stratigraphic relationship. PHS apparently is located above kieserite but without a morphologic contact. The identified phyllosilicates are topographically located below as well as above the sulphates. Since water was involved in the formation of these minerals, the elevation at which they are found may represent the minimum water level (i.e. -3840 m). Further, the hydration state of these minerals is different and thus the water

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availability has been different. Besides, pH-values must have been alkaline when phyllosilicates were formed and rather acidic during the formation of sulphates.

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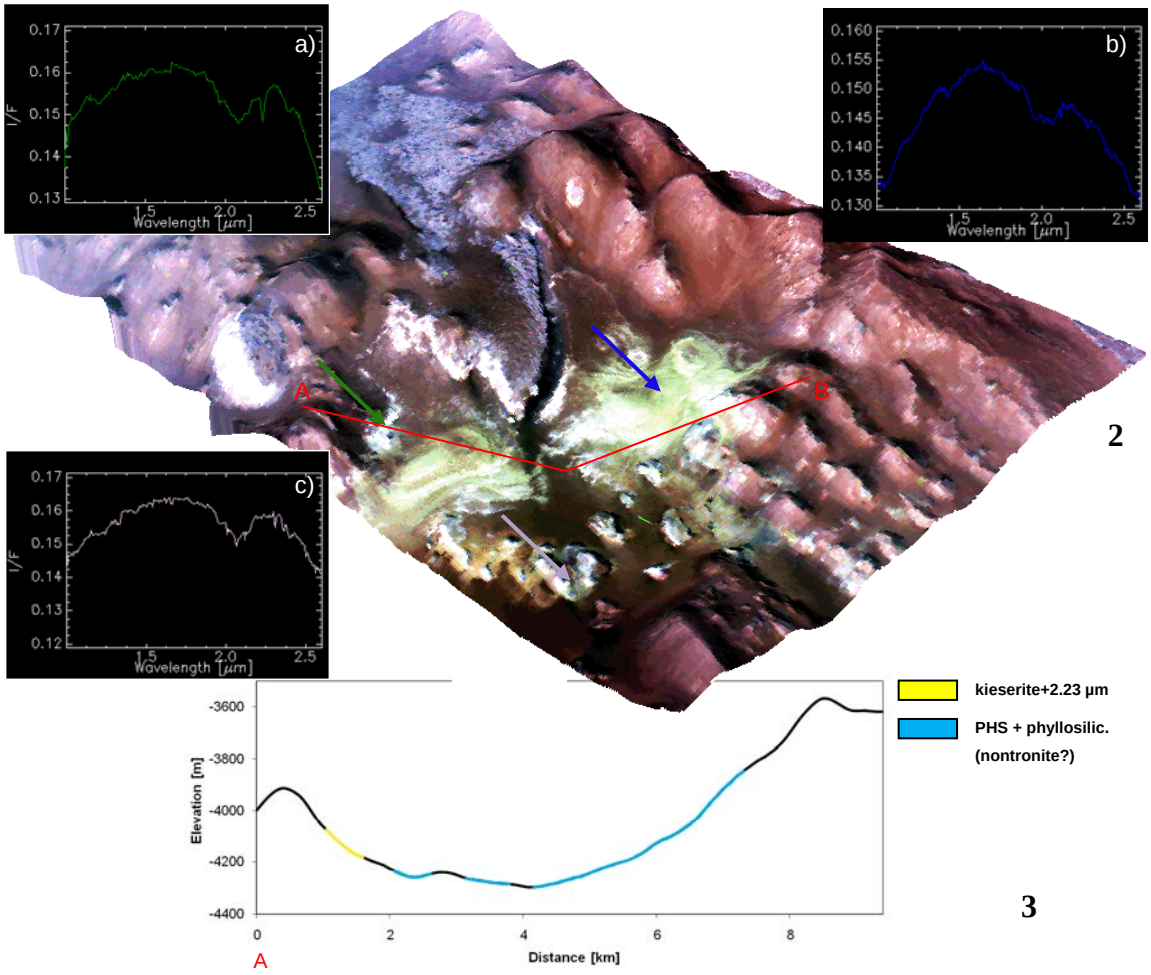

Fig. 2: CRISM false colour RGB (2.53, 1.51, 1.08 µm); HRL00006181 (location shown in Fig. 1) draped over HRSC topography (h0103_0009; 1x vertical exaggeration). Image is ~20 km across. Arrows correspond to spectra coincident with kieserite (a), phyllosilicate + PHS (b) and PHS + kieserite. Polyhydrated minerals (phyllosilicates, PHS) show absorptions at 1.4 and 1.9 µm. Kieserite –a monohydrated sulphate – has a characteristic absorption at 2.1 µm [1]. Phyllosilicates are identified by their typical absorptions between 2.2-2.3 µm [6]. Fig. 3: Profile covering sulphate- and phyllosilicate-rich regions shown in Fig. 2. Kieserite (yellow) is found at elevations between -4190 m and -4080 m, polyhydrated minerals like phyllosilicate and PHS between -4300 m and -3840 m. By measuring the dip of the layers we hope to get information of the lateral extent of these deposits.