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Water-related minerals in Aureum Chaos, Mars.

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Collapsed plateau material, chaotic terrain, and Interior Layered Deposits (ILDs) characterize Aureum Chaos that is located east of Valles Marineris. As elsewhere on Mars, spectrometers on Mars Express (MEX-OMEGA), Mars Reconnaissance Orbiter (MRO-CRISM) and Mars Global Surveyor (MGS-TES) detected water-related minerals (hydrated sulfates, hematite) in association with ILDs. We studied the hydrated minerals by utilizing MRO-CRISM data and co-aligned MEX-HRSC, MRO-HiRISE and MRO-CTX data since their extent indicates where water was present in the past.

Hydrated sulfates (mono- and polyhydrated sulfate) crop out below a spectrally neutral cap rock, whereas monohydrated sulfate underlies polyhydrated sulfate (PHS, e.g. epsomite MgSO4 x 7H2O). PHS is detected at elevations below -3600m, monohydrated sulfate (kieserite MgSO4 x H2O) below -4100m, and phyllosilicate below -4000m. In some regions, weathered PHS (e.g. debris fans on scarps) to some extent covers monohydrated sulfate exposures. These regions have a massive, high-albedo texture which otherwise is observed in outcrops that show a monohydrated sulfate signature. Phyllosilicate is present below sulfates or occurs as windblown material but is not associated with ILDs. Ferric oxide is found in both, bedrock and loose material down slope of sulfates. Local thicknesses of hydrated sulfate were determined to 50m on average, in contrast, phyllosilicate-rich knobs are 20m thick on average. The fact that ILDs are mainly buried by mantling deposits and show an abundant cap rock, overlying most of the sulfate-rich ILDs, may explain why sulfates were not found in all CRISM observations. However, the hydrated area as shown by CRISM is $\sim$70km^2.

Since ILDs are heavily eroded and hardly show impact craters on their surfaces, their indicated impact-cratering ages appear very young (Late Amazonian) and hence do not correspond to their formation ages. In order to define the age of the ILDs, we measured impact-cratering ages of materials underlying (chaotic terrain) and overlying (mantling deposits) ILDs. Accordingly, we approached the ILDs' age to between Late Hesperian and Late Amazonian.

Low dip values and parallel bedding of ILDs indicate that they were formed by periodic, low-energy sedimentation. Comparable mineralogies and morphologies were found in different regions of Valles Marineris -in chaos regions and chasmata- and may show that formation processes have been anyhow similar. Erosion within the basin apparently was not constant since angular, hardly affected and rounded materials are present. Consequently, we do not consider a huge water-filled basin in which material would be deposited, but local ponds within the basin. Since Aureum Chaos is a closed basin, and a region of high hydrostatic head, groundwater activity could have contributed to the formation of the detected hydrated minerals.