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# Inverted channels and chloride-rich deposits in the highlands of Terra Sirenum: Formation mechanism and timescale

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Chloride-bearing deposits have been widely identified on the southern highlands of Mars, mostly within Noachian-aged terrains (e.g., Osterloo et al., 2010). The salt deposits offer a paleo-environmental record of their formation and subsequent modification. Understanding their history is crucial for the investigation of liquid surface water and the past geochemical environment on Mars, as well as for the search for biosignatures. Here, we present the preliminary results of our study focused on chloride-rich material in Terra Sirenum. We used imagery (HRSC, CTX, HiRISE), topographic (HRSC, HiRISE), and spectroscopic (THEMIS, CRISM) data to investigate the origin, formation mechanism, and chronology of these deposits at three sites. The chloride-bearing materials are found in local depressions and appear within light-toned deposits ranging in width from a few tens of meters to a few kilometers with polygonal fractures that are a few tens of meters wide with an irregular plan-view shape that does not follow a regular geometrical pattern. The deposits rich in chloride are found in proximity to phyllosilicate-bearing deposits. The stratigraphic relationships indicate that the phyllosilicates are part of the ancient highland crust and that the salts were deposited at a later time. Thus, the formation of chloride-bearing deposits is likely caused by a later water activity. This relation between chloride-bearing and phyllosilicate-rich deposits has also been observed in other areas in Terra Sirenum and been interpreted as result of water accumulation in ponds, brine concentration by water evaporation, and chemical precipitation of salts.
In the study areas, the light-toned material is exposed due to erosion and degradation of a wide-spread low-albedo upper layer. Several inverted channels are observable within these areas where the dark upper layer has been removed and the light-toned material is present. These inverted channels are generally composed of darker material, but where higher resolution images (CTX or HiRISE) are available, we can observe, on the floor and walls of these inverted channels, locally exposed thin layers of bright material with CRISM signature of chloride salts. The presence of chloride-rich deposits on the floor and walls of inverted channels, which formed later than the deposition of phyllosilicate-bearing material, would point to precipitation of salts as a result of a late aqueous activity. The phyllosilicates-rich material were most likely deposited during late Noachian-early Hesperian period, but the timescale for the precipitation of chlorides is unclear. Since chloride salt formation requires aqueous activities and different chemical conditions than phyllosilicates, constraining the timescale of their formation would have a valuable implication on understanding the past chemical condition of the Martian surface, its climatic conditions, and astrobiological research.