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Sulfates and Ferric Oxides in Ophir Chasma, Mars

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Introduction: We present results of our study of the sulfates and iron oxides in Ophir Chasma, Mars, using visible to short wave infrared data (SWIR) from the imaging spectrometers OMEGA and CRISM in conjunction with panchromatic and color imagery, digital elevation models and anaglyphs. Similar studies of the mineralogy of the light-toned deposits (LTD) in Valles Marineris on Mars have been presented by [1-12].

Results: The southern slope of Ophir Mensa shows kieserite and partly polyhydrated sulfates (PHS). The slope is heavily eroded. The upper boundary of detection of the sulfate signature follows a prominent horizon that bends up and down the slope of Ophir Mensa's southern flank. The southern wall of Ophir Chasma shows a complex juxtaposition of Monohydrated sulfates (MHS), PHS sulfates and iron oxides. MHS overlay the basaltic rocks of the southern chasma wall. It is discordantly overlain by redeposited MHS material, PHS, and thin deposits of jarosite and mineral phases with absorptions at 1.4, 1.93 and 2.21 or 2.23 μm, partly consistent with ferric oxy-hydroxides or mixtures containing amorphous silica found elsewhere on Mars [e. g. 10,11].The chasm floor north of Ophir Mensa shows a sulfate signature where not covered by landslides. This sulfate-rich material appears to stratigraphically overlay the sulfate-free LTDs on the northern side of Ophir Mensa.
In the flat central valley, PHS are constrained to topographically low regions below -4400 m; MHS is found between -4400 m and -4300 m. No evidence is found for a discordance between the two groups. suggesting a succession of MHS on top of PHS, "inverted" compared to sulfate occurrences in other chasmata [7,9-12]. Locally, absorption bands at 1.4, 1.93 and 2.21 μm as in the "mineral bowl" are observed.

Discussion and conclusions: Our observations imply that at least two sulfate-forming events: One forming the sulfates within Ophir Mensa, and a second one forming those in the central valley and those on the southern wall of the "mineral bowl", with the first being possibly the intrusion of groundwater into previously deposited LTD material of unknown origin. For the flat central valley deposits, an interdune playa-like facies caused by ground water upwelling as suggested for Merdiani Planum [13] is conceivable. In contrast, the sulfate deposits in the "mineral bowl" valley south of Ophir Mensa with varying, but high topographic elevation compared to the central valley and a steep inclination of layering suggests a drape deposit neither formed by a standing body of water, nor by groundwater upwelling, but might indicate the presence of meteoric water in the form of rain, frost or snow.

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