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Nature and origin of RSL: Spectroscopy and detectability of liquid brines in the near-infrared

Marion Masse (1), Pierre Beck (2), Bernard Schmitt (2), Antoine Pommerol (3), Alfred McEwen (4), Vincent Chevrier (5), and Olivier Brissaud (2)

(1) Polish Academy of Sciences, WROONA group, Poland (marion.masse@twarda.pan.pl), (2) IPAG, Université de Grenoble, St Martin d'Hères, France, (3) Physikalisches Institut, Universität Bern, Bern, Switzerland, (4) Lunar and Planetary Laboratory, University of Arizona, Tucson, USA, (5) Keck Laboratory for Space an Planetary Simulation, University of Arkansas, Fayetteville, USA

If water has likely flowed on Mars in its early history, the current presence of liquid water is debatable. However, some recently discovered fea-tures named "Recurrent Slope Lineae" (RSL) suggest that superficial liquid can occur on present day Mars in a transient state [McEwen et al., 2011]. RSL are dark (up to 40% darker than the surrounding areas), narrow (0.5-5 m) and are mostly found in the southern mid-latitudes. Repeated MRO/HiRISE images reveal that they appear and grow during warm seasons and fade and disappear during cold seasons. They develop on steep slopes (25°-40°), favoring equator-facing slopes, times and places with peak temperatures of ∼250-300K.

The most likely formation process of RSL involves the presence of liquid brines near the surface. Brines are more stable on Mars than pure water [e.g. Chevrier et al., 2009] because salts can depress the freezing point of water by up to 70 K. However, this hypothesis suffers from the lack of clear identification of brines with the high resolution CRISM spectra. The mineralogical characterization of RSL is challenging because RSL are much smaller than the ∼18 m pixel scale of CRISM data but spectral features diagnostic of water or brines [Hanley et al., 2010] are not observable even on the largest RSL.

The goal of our study is to reproduce with laboratory experiments some hydration and dehydration cycles of different kind of brines mixed with basaltic soil. These experiments aim to understand the spectroscopic behavior of brines during these processes and to determine the diagnostic spectral features that we can expected to find for Martian RSL. We found that, if the surface displays a low albedo from the beginning of the hydration to the end of the dehydration, diagnostic brines absorption bands are only observed when the liquid film is formed. This is consistent with our current RSL observations. In the future, we need to acquire some new CRISM data when the formation of liquid brines is the most likely (early morning and late evening [Gough et al., 2011]) and to compare these data to our experimental spectra.