**Spectral Constraints on the Nature and Formation Mechanism of Recurring Slope Lineae** L. Ojha[1], J. J. Wray[1], A. S. McEwen[2], S. L. Murchie[3]; [1]Earth and Atmospheric Sciences, Georgia Institute of Technology, [2]Lunar and Planetary Laboratory, University of Arizona, [3]Applied Physics Laboratory, John Hopkins University.

**Introduction:** Recurring Slope Lineae (RSL) are dark, narrow features that extend downslope on steep, equator-facing, mid-latitude and equatorial rocky slopes of Mars [1-3]. They exhibit progressive growth over time in the downslope direction. They are observed to form and grow during multiple warm seasons (peak surface temperature ranging from 250 to 300 K) and are observed to fade and completely disappear during colder seasons. Due to their distinct seasonality, incremental growth, and observed surface temperatures, their formation has been attributed to brines.

Spectroscopic evidence for brines is now being sought through intensive monitoring of RSL with the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM). Here we describe results from our preliminary analysis of CRISM data over RSL slopes.

**Methodology:** RSL sites with the most temporal coverage by CRISM were selected for analysis. CRISM cooler conservation prevents acquisition of useful IR (1–4 μm) data during some observations, so we concentrated mostly on the VNIR region (0.4–1 μm) due to its greater availability, although IR wavelength data were also analyzed where available. CRISM I/F images were downloaded and pre-processed using ENVI's CRISM Analysis Toolkit to reduce atmospheric effects, map-project the images, and map parameters indicative of mineralogy [e.g., 4].

Spectral plots were produced from slopes with RSL activity. Individual RSL are smaller than the spatial resolution of CRISM (~18m/pixel), so we averaged data over RSL slopes and their associated bright fans (Figure 1). The spectrum derived from this region of interest (ROI) was divided by an average from a spectrally neutral region in the same scene. The ratio of the same numerator to the same denominator was plotted for all CRISM observations available at each site.

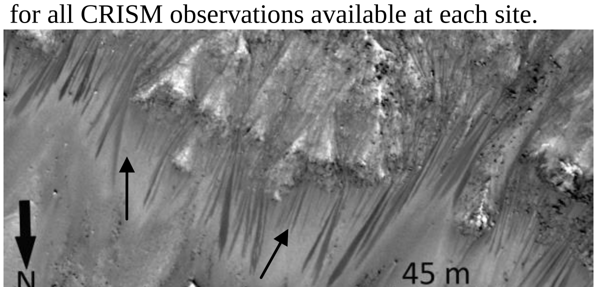


Figure 1. RSL at Palikir Crater. Arrows point at the bright fans chosen as the numerator ROI for Figure 2.

**Results:** At Palikir Crater we defined an ROI dominated by bright fans (Figure 1), which are inferred to be deposits from past RSL activity. These fans have a distinct color in both HiRISE and CRISM images. A broad absorption edge at 530 nm was observed along with a band centered near 950 nm, with the depth of both bands varying over time (Figure 2). Specifically, the absorption bands are weakest prior to the onset of RSL activity (Ls 247) and strongest at the time when HiRISE observed peak RSL activity (Ls 302). A similar pattern has been observed in other locations, including Tivat Crater, where a 530 nm absorption is observed to strengthen and a 930 nm band appears late in the RSL activity season. Maps of the relevant CRISM parameters (BD530, BD860, BD920) [4] show that these absorptions are a distinct feature of RSL slopes.

**Discussion:** The 950 nm absorption band from the VNIR data along with broad shallow band centered around 2.1 μm (Figure 2) could be attributed to pyroxene with small amounts of red hematite. The red hematite would also account for absorption at 530 nm band, the 600 nm shoulder and a 100 nm pyroxene absorption shifted to a slightly shorter than expected wavelength. The inferred fluctuation in pyroxene signature on RSL slopes (relative to the surrounding terrain) seems most readily explained as due to grain size sorting within the fans. However, the 530 nm band may be due to an additional ferric component that changes in abundance over the RSL season.

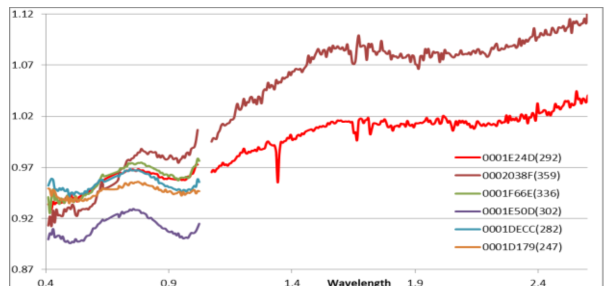


Figure 2. Seasonal variability in spectra of Palikir Crater RSL fans.

Alternatively, the 950 nm absorption band can be attributed to ferric sulfate such as botryogen [5] or ferric oxyhydroxide such as lepidocrocite [6]. An alternative possibility is ferrous sulfate[5], but $Fe^{2+}$ sulfates alone would neither explain the 530 nm band (attributed to $Fe^{3+}$) nor provide substantial freezing point depression for brine formation. In addition, we observe no OH or $H_2O$-related absorptions in the IR that should be present for these secondary phases. We are now studying additional sites to better understand these trends.

**References:** [1] McEwen A. S. et al. (2011) *Science, 333,* 740–743. [2] Ojha L. et al. (2012) *LPS XLIII,* Abstract #2591. [3] McEwen A. et al. (2012) *AGU Fall Meeting,* Abstract #P21C-1857. [4] Pelkey S. M. et al. (2007) *JGR, 112,* E08S14. [5] Bishop J. L. et al. (2009) *JGR, 114,* E00D09. [6] Morris R. V. et al. (2000) *JGR, 105*(E1), 1757–1817.