

Curiosity at Vera Rubin Ridge: Major Findings and Implications for Habitability

The Curiosity rover is finishing exploration of Vera Rubin Ridge (VRR), a topographic feature in lower Aeolis Mons (informally, Mt. Sharp). VRR is relatively resistant to erosion as compared with underlying strata and consists largely of finely laminated mudstones. Diagenetic features, including veins, concretions, and crystal molds, are variably present throughout. In situ data show the majority of the VRR rocks have ferric spectral signatures, as do the rocks in most of the underlying Murray formation previously investigated by Curiosity.

The sedimentary facies at VRR were deposited in a lacustrine environment, consistent with prior observations of the Murray formation. The reason for the ridge's erosional resistance is not yet clear, but variations in grain size, cement, porosity, or mineralogy of ridge rocks likely play a key role. The intimate association of ferric spectral signatures with the VRR and rocks below suggests that hematite or a precursor ferric phase formed either as a primary depositional phase at a redox interface in the lacustrine setting, or via pervasive and relatively uniform diagenetic oxidation. In situ spectral data are being used to model how dust and surface texture govern visibility of the hematite spectral signatures in CRISM orbital data.

One of the most surprising findings occurred at the top of VRR, when Curiosity explored areas that were visible as small (~10 m diameter) bright patches in HiRISE orbiter images. These patches are almost always found in local topographic depressions, and Curiosity discovered they contained gray rocks with no spectral evidence for ferric phases. The walls of these depressions expose a geological boundary between typical red ferric VRR rocks and gray rocks. This color change may mark a facies change within the Murray formation, but, based on their geologic settings, more likely records redox transformations caused by diagenetic fluids. Both the lake setting of the primary VRR rocks and evidence for redox-driven processes are favorable for habitability.

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