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Evidence of alteration of sediments from past habitable environments in Gale crater, Mars using the Mastcam imager.

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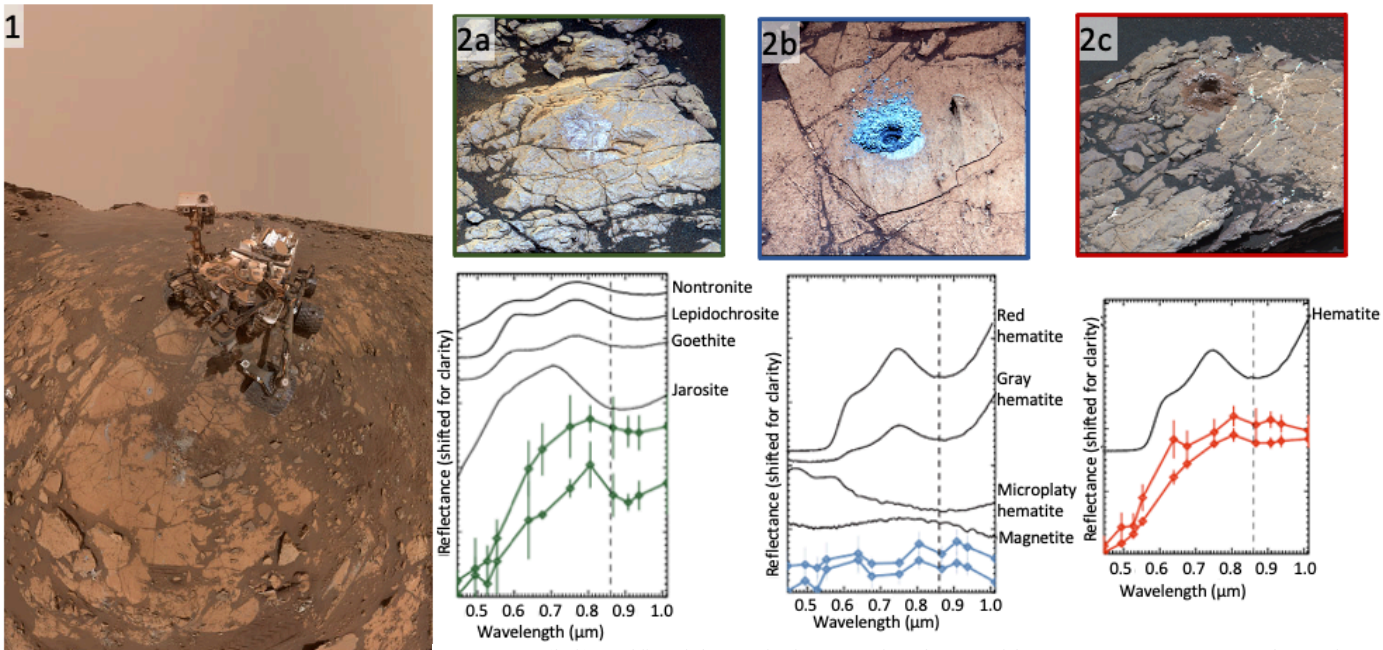

Figure 1 (left): Selfie of the Curiosity rover in Glen Torridon. **Figure 2:** Mastcam enhanced true color images of sites representative of major spectral groups and corresponding spectra (colored) with USGS lab spectra of relevant minerals (black). (a) 900 nm group, (b) flat light-toned group, and (c) 860 nm group.

Introduction: The Mars Science Laboratory (MSL) Curiosity rover (Fig. 1) has been exploring the ancient lake environment in Mt. Sharp, Gale crater, Mars since 2012. One area of interest that Curiosity has explored is the Murray formation, made up primarily of mudstones laid down in the bottom of the lake. Curiosity is currently exploring a region within the Murray formation called Glen Torridon where clay minerals were detected from orbit. This mineral detection is one reason that Gale crater was chosen as the landing site because they only form if water was present and can preserve signs of ancient life. Clay minerals form when rocks are altered by surface water and/or groundwater in a variety of environments.

The goal of this work is to determine what alteration minerals are present in Glen Torridon and what alteration process formed them.

Methodology: The Mastcam camera system on MSL is a 13-filter visible to near-infrared (0.4-1.1 μm) imager that collects color images and spectral data. Images were analyzed by manually defining regions of interest in color images to extract spectra that characterize mineralogical diversity.

Results: Three dominant spectral groups were observed in Glen Torridon (Fig. 2):

1. *0.9 μm absorption group*: Consistent with Fe-bearing clays and sulfates (i.e., nontronite, lepidochrosite, goethite, and jarosite).
2. *Flat light-toned group*: Consistent with coarse-grained Fe-oxides (e.g., hematite and magnetite).
3. *0.86 μm absorption group:* Consistent with fine-grained red hematite.

Each of these spectral groups are comprised of alteration minerals that can form from different types of alteration, and we are currently studying the relationship between the spectral properties and geologic context to determine the environment that they formed in.

FOR FURTHER READING:

Grotzinger J.P. et al., (2012) *Space Science Reviews.*
Grotzinger. J. P. et al., (2015) *Science*.
Milliken, R. et al., (2010) *Geophysical Research Letters*.