

Opportunity Title: Mineralogy and aqueous alteration of the martian surface

Opportunity Reference Code: 0012-NPP-NOV23-JSC-PlanetSci

Organization National Aeronautics and Space Administration (NASA)

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Application Deadline 11/1/2023 6:00:59 PM Eastern Time Zone

Description Surface mineralogy and geochemistry of Mars are key to characterizing geological processes on ancient and modern Mars. Mineralogical and geochemical measurements from Mars show that the ancient surface was altered by liquid water. The types of minerals and geochemical trends observed on the surface can help determine the characteristics of these ancient aqueous environments and whether or not they would have been habitable to microbial life. The goal of this research is to reconstruct the history of liquid water on Mars through mineralogical and geochemical measurements of the martian surface and analog materials. These analog materials can be synthesized in the laboratory or collected from Mars analog sites on Earth. Studies of phyllosilicate, iron oxide, sulfate, and carbonate minerals and amorphous or poorly crystalline phases are encouraged. Studies of mineral sorting and segregation in fluviolacustrine and aeolian environments on Earth as a means to interpret the mineralogy of martian surface deposits are also of great interest.

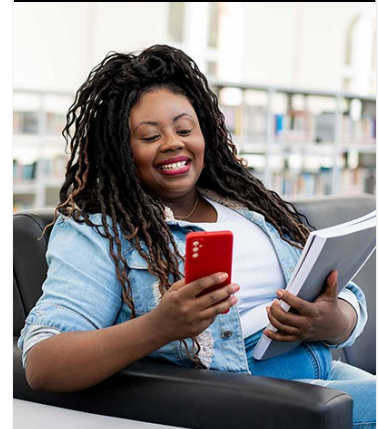
Analytical instruments available at JSC include X-ray diffraction, infrared spectroscopy, thermal and evolved gas analysis, laser-induced breakdown spectroscopy, ion chromatography, scanning electron microscopy, transmission electron microscopy, and electron microprobe. JSC also has test bed instruments for the CheMin X-ray diffractometer on the Mars Science Laboratory Curiosity rover, the Sample Analysis at Mars (SAM) instrument on Curiosity, the Thermal and Evolved Gas Analyzer (TEGA) on Phoenix, ChemCam on Curiosity, and the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on the Mars Reconnaissance Orbiter, and data collected on these instruments are directly comparable to those collected on Mars. Scientists with experience analyzing weathering products or amorphous materials using Synchrotron techniques are also encouraged to apply.

References:

Rampe, E. B., R. V. Morris, P. D. Archer Jr., D. G. Agresti, D. W. Ming (2016) Recognizing sulfate and phosphate complexes chemisorbed onto nanophase weathering products on Mars using in-situ and remote observations. *American Mineralogist*, 101(3), 678-689, doi:10.2138/am-2016-5408CCBYNCND.

Rampe, E. B., M. D. Kraft, T. G. Sharp, D. C. Golden, D. W. Ming, P. R. Christensen (2012) Allophane detection on Mars with Thermal Emission Spectrometer data and implications for regional-scale chemical weathering processes. *Geology*, 40(11), 995-998, doi:10.1130/G33215.1.

Rampe, E. B., D. W. Ming, J. P. Grotzinger, R. V. Morris, D. F. Blake, D. T. Vaniman, T. F. Bristow, S. M. Morrison, A. S. Yen, S. J. Chipera, R. T. Downs, C. N. Achilles, R. M. Hazen, T. S. Peretyazhko, B. Sutter, A. H.



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Treiman, P. I. Craig, J. D. Farmer, D. J. Des Marais, A. G. Fairén (2017)
Mineral trends in early Hesperian lacustrine mudstone at Gale crater, Mars.
LPS XLVII, 2821.

Rampe, E. B., B. Horgan, N. Scudder, R. J. Smith, A. M. Rutledge (2017)
Mineralogy of rock flour in glaciated volcanic terrains: An analog for a cold
and icy early Mars. LPS XLVII, 2437.

Bishop, J. L., E. B. Rampe (2016) Evidence for a changing martian climate
from the mineralogy at Mawrth Vallis. Earth and Planetary Science Letters,
448, 42-48, doi:10.1016/j.epsl.2016.04.031.

Location:

Johnson Space Center
Houston, Texas

Field of Science: Planetary Science

Advisors:

Elizabeth B. Rampe
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281-483-0216

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

**Eligibility
Requirements**

- **Degree:** Doctoral Degree.