Geophysical Research Abstracts
Vol. 19, EGU2017-17380, 2017
EGU General Assembly 2017

Understanding chemical and facies variability in the Murray Formation, Gale crater, from ChemCam data

Frances Rivera-Hernandez (1,2), Nicolas Mangold (2), Dawn Y. Sumner (1), Marion Nachon (1), Roger C. Wiens (3), Sylvestre Maurice (4), Olivier Forni (4), Jens Frydenvang (3), Horton Newsom (5), Erwin Dehouck (4), and Valerie Payre (6)

(1) Department of Earth and Planetary Sciences, University of California, Davis, CA, USA (friverah@ucdavis.edu), (2) Laboratoire de Planétologie et Géophysique de Nantes, Université de Nantes, Nantes, France, (3) Los Alamos National Laboratory, Los Alamos, New Mexico, USA, (4) IRAP, UPS-OMP, Université de Toulouse, Toulouse, France, (5) Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM, USA, (6) Laboratoire GeoRessources, Université de Lorraine, Nancy, France

The primary goal of the Mars Science Laboratory (MSL) mission is to determine if habitable environments existed on Mars [1]. To evaluate the potential for habitability, reconstructing the transport and depositional history of the sedimentary rocks at Gale Crater relies on the accurate interpretation of changes in depositional facies. This study uses ChemCam data to identify and characterize chemical variations that may be due to grain size and possibly facies changes within the Murray formation, a fluvio-lacustrine unit in Gale Crater dominated by interbedded mudstones and fine-grained sandstones [1]. These analyses compliment current efforts by APXS and ChemCam in reconstructing a chemostratigraphic record for the Curiosity rover traverse [e.g.,2,3].

Textural analyses from images taken by the Mars Hand Lens Imager (MAHLI), and the ChemCam Remote Micro Imager (RMI), and ChemCam chemical data were used to exclude targets with resolvable diagenetic features. Remaining targets were analyzed for chemical heterogeneity using the Gini Index (G), where G=0 indicates no point-to-point chemical variation and G=1 for a completely heterogeneous target [4]. Sandstones with grains larger than the laser beam diameter (~0.3-0.5 mm; medium sand) typically have G>0.25 [4]. Hence, heterogeneity in composition among closely spaced points on a single target may reflect variations in mineralogy among individual sand grains or concentrations of grains. In contrast, homogeneous rocks may have homogeneous grain compositions or only contain grains smaller than sand. Thus, even when the presence of sand grains cannot be demonstrated from images, their presence can be inferred using the Gini Index.

Preliminary analyses from sols 1400-1500 suggest that the abundances of FeOT, SiO_2, $Al2O_3$, and TiO_2 do not vary significantly in individual rock targets (G<0.1) or between targets. In contrast, CaO, MgO, K2O, and Na2O vary more from target to target (G>0.1). Most variations between targets are likely associated with resolvable diagenetic features [e.g.,5,6]. However, Murray bedrock targets with minimal diagenesis show variations in MgO and K2O, which may reflect variations in mineralogy and/or grain size. Some of these targets have resolvable clasts in RMI images, consistent with variable grain compositions larger than the ChemCam spot size. These targets are prime candidates for further analyses to characterize facies and provenance changes in the Murray formation.

References:

[1] Grotzinger et al. (2015), Science, 350, 6257.
[2] Siebach et al. (2016) GSA abstract, Vol. 47, No. 7, p.267
[3] Wiens et al. (2017) LPSC abstract
[4] Mangold et al. (2017) Icarus, 284, 1-17.
[5] L'Haridon et al. (2017) LPSC abstract
[6] Newsom et al. (2017) LPSC abstract