Assessing Source Region Characteristics from Gale crater Lacustrine mudstone

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ASSESSING SOURCE REGION CHARACTERISTICS FROM GALE CRATER LACUSTRINE MUDSTONE.

C. C. Bedford¹, J. C. Bridges², S. P. Schwenzer¹, R. C. Wiens³, E. B. Rampe⁴, J. Frydenvang⁴, P. J. Gasda³.

¹ The Open University (Candice.bedford@open.ac.uk)
² University of Leicester
³ Los Alamos National Laboratory
⁴ NASA Johnson Space Centre
⁵ University of Copenhagen

The NASA Curiosity rover has encountered mudstones deposited in a lake environment within the respective Yellowknife Bay¹ (YKB) [Bradbury Group] and Murray² [Mt Sharp Group] formations of Gale crater, Mars. Chemical and mineralogical studies conducted on YKB mudstones show a habitable lake environment at the time of deposition¹. The Chemistry and Camera (ChemCam) instrument suite has acquired major, minor and trace element compositions through Laser-Induced Breakdown Spectroscopy³,⁴ generating an extensive dataset of ~9500 observation points (where one observation point is the average of 30 – 50 spectral analyses). This study has excluded targets that have not hit in situ host rock to assess host rock geochemical variation between stratigraphic groups⁵.

Our results show that Murray is enriched in SiO₂, Al₂O₃, and K₂O, but depleted in CaO and MgO compared to YKB mudstone. Despite Murray demonstrating higher Chemical Indices of Alteration than YKB⁶,⁷, Murray’s dominant basaltic mineralogy and secondary mineralogy infers that open system alteration has not masked source characteristics⁸. Hence, we hypothesise that Murray’s geochemical difference is related to a change towards a more silica-rich, tholeiitic provenance from the regional, subalkaline basalt that was initially eroded and deposited at YKB⁹,¹⁰.