Mineralogical Changes in a Predominantly Fluviolacustrine Succession at Gale Crater, Mars

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The Mars Science Laboratory *Curiosity* rover landed in Gale crater in August 2012 to investigate the strata of lower Aeolis Mons (i.e., Mount Sharp) and characterize their depositional and diagenetic environments. Visible/short-wave infrared spectra from orbit of these strata show variations in phyllosilicate, sulfate, and Fe-oxide minerals, suggesting these units record environmental changes that occurred during the early Hesperian. *Curiosity* has traversed over 15 km and has climbed through ~200 m of stratigraphic section, made up of predominantly fluviolacustrine (i.e., the Bradbury group and the Murray formation) and aeolian (i.e., the Stimson formation) units. Multiple geochemical and mineralogical instruments are onboard *Curiosity* to study these ancient rocks, including the Chemistry and Mineralogy (CheMin) instrument, which is an X-ray diffractometer (XRD) and X-ray fluorescence spectrometer, and the Alpha Particle X-ray Spectrometer (APXS).

Geochemical and mineralogical variability in the Murray formation point toward changes in depositional and diagenetic environments and sediment sources over time. The base of the Murray formation, represented by the Pahrump Hills and Marias Pass localities, was deposited in a lacustrine environment and displays incredible mineralogical and geochemical variability over ~15 m of section. CheMin data show a change from samples with abundant pyroxene, phyllosilicate, and hematite with minor jarosite at the base of the Pahrump Hills to a sample in Marias Pass that lacks these minerals and instead is dominated by feldspar and amorphous and crystalline SiO_2 with minor magnetite and Ca-sulfate. This variability may represent a change in the sediment source region, in addition to a change in depositional and/or diagenetic environment. The most recent CheMin measurements of the Murray formation show remarkable consistency in mineralogy over ~50 m of section. These samples contain abundant phyllosilicate, hematite, Ca-sulfate, and feldspar, with minor pyroxene. The observation of significant Ca-sulfate is consistent with geomorphological and geochemical evidence for desiccation of the lake environment in this interval. Furthermore, the abundance of hematite suggests the fluids at the time of deposition and/or diagenesis were oxidizing.