Evolved gas analyses of sedimentary rocks and eolian sediment in Gale Crater, Mars: Results of the Curiosity Rover's Sample Analysis at Mars instrument.

Brad Sutter[1]*, Amy McAdam*[2]*, Paul Mahaffy*[2]*, Douglas W. Ming*[3]*, Jennifer Eigenbrode*[2]*, Elizabeth Rampe*[3]*, Heather Franz*[2]*, Caroline Freissinet*[4]*, Andrew Steele*[5]*, Christopher House*[6]*, Doug Archer*[7]*, Charles Malespin*[2]*, Rafael Gonzalez*[8]*, Jennifer Stern*[2] *and Daniel Glavin*[2]*, (1)Jacobs Techology, Houston, TX, US, (2)NASA Goddard Space Flight Center, Greenbelt, MD, (3)NASA Johnson Space Center, Houston, TX, (4)Institut Pierre Simon Laplace, CNRS, Laboratoire Atmosphères, Milieux, Observations Spatiales, Guyancourt, France, (5)Carnegie Institution of Washington, Washington D.C., DC, (6)Department of Geosciences, Penn State, University Park, PA, (7)Jacobs, Houston, TX, (8)Laboratorio de Quimica de Plasmas y Estudios Planetarios, Instituto de Ciencias Nucleares, Universidad Nacional Autonoma de Mexico, Mexico D.F., Mexico*

The Sample Analysis at Mars instrument evolved gas analyzer (SAM-EGA) has detected evolved water, SO_2, NO, CO_2, CO, O_2, and HCl from two eolian sediments and nine sedimentary rocks from Gale Crater, Mars. The SAM-EGA heats samples to 870°C and measures evolved gas releases as function of temperature. These evolved gas detections indicate nitrates, organics, oxychlorine phase, and sulfates are widespread with phyllosilicates and carbonates occurring in select Gale Crater materials. CO_2 and CO evolved at similar temperatures suggesting that as much as 2373 ± 820 μgC/g may occur as organic carbon in the Gale Crater rock record while relatively higher temperature CO_2 detections are consistent with carbonate (<0.70 ± 0.1 wt % CO_3). Evolved NO amounts up to 0.06 ± 0.03 wt % NO_3 have been detected while O_2 detections suggests chlorates and/or perchlorates (0.05 to 1.05 wt % ClO_4) are present. Evolution of SO_2 indicated the presence of crystalline and/or poorly crystalline Fe and Mg sulfate and possibly sulfide. Evolved H_2O (0.9 - 2.5 wt% H_2O) was consistent with the presence of adsorbed water, hydrated salts, interlayer/structural water from phyllosilicates, and possible inclusion water in mineral/amorphous phases. Evolved H_2S detections suggest that reduced phases occur despite the presence of oxidized phases (nitrate, oxychlorine, sulfate, and carbonate). SAM results coupled with CheMin mineralogical and Alpha-Particle X-ray Spectrometer elemental analyses indicate that Gale Crater sedimentary rocks have experienced a complex authigenetic/diagenetic history involving fluids with varying pH, redox, and salt composition. The inferred geochemical conditions were favorable for microbial habitability and if life ever existed, there was likely sufficient organic C to support a small microbial population.