Geophysical Research Abstracts
Vol. 15, EGU2013-2470, 2013
EGU General Assembly 2013


# Early Results from the Curiosity Rover's SAM Investigation at Gale Crater

Paul Mahaffy (1), Chris Webster (2), Michael Cabane (3), and Patrice Coll (4)

(1) NASA Goddard, Laboratory for Atmospheres, Greenbelt, MD, 20771 United States (paul.r.mahaffy@nasa.gov), (2) Jet Propulsion Laboratory, Pasadena, CA 91109 United States, (3) LATMOS, Univ. Pierre et Marie Curie, Univ., 75005 Paris, France, (4) LISA, Univ. Paris-Est Créteil, Univ. Denis Diderot & CNRS, 94000 Créteil, France

The goals of the Mars Science Laboratory Mission (1, 2) are to explore the potential of the Gale Crater landing site to support life either in the distant past or the present. The contribution of the Sample Analysis at Mars (SAM) instrument suite (3) in this exploration of habitability is (A) to search for organic compounds in rocks and soils, (B) to determine the composition of inorganic volatiles compounds in the atmosphere or extracted from solid materials, and (C) to measure the isotopic composition of several of these volatiles. While prime exploration targets of MSL's Curiosity Rover are the layers in the central mound (Mt. Sharp) of Gale crater the initial exploration of region near the landing point has revealed a diverse geology and the early part of the mission has been spent both commissioning the 10 Curiosity instruments and the Rover subsystems and making first time measurements of both atmospheric and solid samples.

SAM is located in the interior of MSL's Curiosity rover next to the XRD/XRF CheMin instrument. A variety of imaging, laser induced breakdown spectroscopy, and elemental analysis instrumentation serves to locate sampling sites and interogate candidate materials before solid sample is collected either with a drill or a scoop for delivery to SAM and CheMin. SAM's instruments are a quadrupole mass spectrometer (QMS), a tunable laser spectrometer (TLS), and a 6-column gas chromatograph (GC). These are coupled through a solid sample transport system and a gas processing and enrichment system. The SAM suite is able to measure a suite of light isotopes and to analyze volatiles directly from the atmosphere or thermally released from solid samples.

Early results from SAM atmospheric runs include a determination of: new volume mixing ratios for the 5 major isotopic constituents showing Ar approximately equal to N2; an upper limit of 3.5 ppb for the volume mixing ratio of methane; C and O isotope ratios showing both heavier than terrestrial averages; D/H in water $\sim$5 times terrestrial; and the 40Ar/36Ar ratio in good agreement with gases trapped in glasses of EETA79001 Mars meteorite values. Major evolved gases from fines scooped from an eolian drift were $H_2O$, $CO_2$, $O_2$, $SO_2$, and a number of minor species. Chlorine containing compounds in this material were tentatively identified as perchlorates.

References:
1. J. P. Grotzinger et al., Mars Science Laboratory Mission and Science Investigation. Space Sci Rev 170, 5 (2012).
2. J. Grotzinger, Beyond water on Mars. Nat Geosci 2, 231 (2009).
3. P. R. Mahaffy et al., The Sample Analysis at Mars Investigation and Instrument Suite. Space Sci Rev 170, 401 (2012)