The Mars Science Laboratory Mission: Early Results from Gale Crater

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The Mars Science Laboratory rover, Curiosity, landed within the 155-km Gale Crater on August 5th. The crater's interior Mount Sharp preserves a succession of flat-lying strata extending almost 5 km above the elevation of the landing site. The lower few hundred meters of the mound show a progression with relative age from clay-bearing to sulfate-bearing strata, separated by an unconformity from overlying likely anhydrous strata. The landing ellipse is characterized by a mixture of alluvial fan and high thermal inertia/high albedo stratified deposits, and a number of distinct fluvial features.

Curiosity's scientific payload was chosen primarily to allow a geologic and geochemical investigation of Mars' environmental history and habitability, as preserved in the layered sediments on the crater floor and mound. The mission at Gale Crater also places a number of highly capable atmospheric and environmental sensors within a dynamic setting next to a 5-km mountain within a 150-km diameter impact crater whose floor is 4.5 km below the Mars areoid. Atmospheric and environmental sensors will contribute by measuring the bulk atmospheric chemical and isotopic composition, the flux of high-energy particle and ultraviolet radiation after modification by the atmosphere, and modern processes related to meteorology and climate over at least one Mars year.

The MSL science payload includes a gas chromatograph-mass spectrometer and gas analyzer that will search for organic carbon in rocks, regolith fines, and the atmosphere (SAM); an x-ray diffractometer that will determine mineralogical diversity (CheMin); focusable cameras that can image landscapes and rock/regolith textures in natural color (MAHLI, Mastcam); an alpha-particle x-ray spectrometer for in situ determination of rock and soil chemistry (APXS); a laser-induced breakdown spectrometer to remotely sense the chemical composition of rocks and minerals (ChemCam); an active/passive neutron spectrometer designed to search for water in rocks/regolith (DAN); a weather station to measure modern-day environmental variables (REMS); and a sensor designed for continuous monitoring of background solar and cosmic radiation (RAD). A descent imager (MARDI) successfully operated during the landing. A sample acquisition and processing system includes a 2-m robotic arm, brush, scoop, drill, and sieves.

Early results to be discussed include: the bulk atmospheric composition and isotopic ratios of relevance to planetary evolution; high-precision measurements of atmospheric CH_4, CO_2, and H_2O, and key isotope ratios in H, C, and O; diurnal records of meteorology and high-energy radiation; imaging of the local geologic setting at multiple scales including aeolian and fluvial materials; chemical analyses of several rock and soil targets; and chemical, mineralogical, and isotopic measurements of a fine sand sample.