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Data from the Mars Science Laboratory CheMin XRD/XRF instrument

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The CheMin instrument on the Mars Science Laboratory (MSL) rover Curiosity uses a Co tube source and a CCD detector to acquire mineralogy from diffracted primary X-rays and chemical information from fluoresced X-rays. CheMin has been operating at the MSL Gale Crater field site since August 5, 2012 and has provided the first X-ray diffraction (XRD) analyses in situ on a body beyond Earth. Data from the first sample collected, the Rocknest eolian soil, identify a basaltic mineral suite, predominantly plagioclase ($\sim$An50), forsteritic olivine ($\sim$Fo58), augite and pigeonite, consistent with expectation that detrital grains on Mars would reflect widespread basaltic sources. Minor phases (each <2 wt% of the crystalline component) include sanidine, magnetite, quartz, anhydrite, hematite and ilmenite. Significantly, about a third of the sample is amorphous or poorly ordered in XRD. This amorphous component is attested to by a broad rise in background centered at $\sim$27° 2θ (Co Kα) and may include volcanic glass, impact glass, and poorly crystalline phases including iron oxyhydroxides; a rise at lower 2θ may indicate allophane or hisingerite. Constraints from phase chemistry of the crystalline components, compared with a Rocknest bulk composition from the APXS instrument on Curiosity, indicate that in sum the amorphous or poorly crystalline components are relatively Si, Al, Mg-poor and enriched in Ti, Cr, Fe, K, P, S, and Cl. All of the identified crystalline phases are volatile-free; H_2O, SO_2 and CO_2 volatile releases from a split of this sample analyzed by the SAM instrument on Curiosity are associated with the amorphous or poorly ordered materials. The Rocknest eolian soil may be a mixture of local detritus, mostly crystalline, with a regional or global set of dominantly amorphous or poorly ordered components.
The Rocknest sample was targeted by MSL for “first time analysis” to demonstrate that a loose deposit could be scooped, sieved to <150 μm, and delivered to instruments in the body of the rover. A drilled sample of sediment in outcrop is anticipated. At the time of writing this abstract, promising outcrops are in range and this talk will provide an update on data collected with the CheMin instrument.