



A Calcium-rich Phase Observed with Chemcam

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The ChemCam instrument on the Curiosity rover consists of a remote Laser-Induced Breakdown Spectrometer (LIBS) and a remote micro-imager (RMI). The LIBS instrument is fundamentally an elemental analysis tool capable of probing samples up to 7 m from the mast of the rover. The ChemCam instrument probed locations on several samples that recorded relatively high calcium concentrations compared to other locations probed on the same rock or soil. These LIBS spectra contain the prominent 393 nm and 396 nm calcium lines as well as the 422 nm calcium line and the 404.5 nm Fe line. Inspection of 23 ChemCam LIBS spectra from Pearson, Epworth, and Rocknest_6a produced several instructive correlations between the major elements. For example, there is a clear negative correlation between the CaO against SiO₂, Fe₂O, MgO, Al₂O₃ showing that the high Calcium abundance is unlikely to be associated with aluminosilicates (like plagioclases) or pyroxenes. No sulfur or chlorine lines were detected, but given their low emission with LIBS, it would be difficult to conclude their absence. The visible spectral region contains a broad emission feature at 605 nm associated with CaO. When LIBS spectra contain elevated concentrations of certain elements, such as Ca, simple diatomic or triatomic species can form in an electronically excited state and are observed in the LIBS spectra. Alternatively, these lines fit Phosphorus lines and would reveal a strong enhancement in P. Carbon is visible but at the level of the atmospheric CO₂ contribution observed in all spectra acquired yet, thus discarding limestone as potential candidate. The lack of H present in the LIBS spectra, a signature for water, further suggests that these high calcium phases are not hydrated. Finally, three candidates emerge: Ca-sulfates (anhydrite), Ca-Phosphates (apatite) and Ca-perchlorates. SAM found perchlorates in low amount in soils, but those are Mg-perchlorates, not Ca-perchlorates. So, both apatite or anhydrite are plausible candidates for the origin of this Calcium rich material. These minerals would tell us the role of volatiles at Rocknest either as being due to fluid circulation or linked to igneous volatiles and fumarolic activity. More work on the context will help us to understand their origin better.