Mineralogy of Fluvio-Lacustrine Sediments Investigated by Curiosity during the Prime Mission: Implications for Diagenesis

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The Mars Science Laboratory rover *Curiosity* investigated sedimentary rocks that were deposited in a diversity of fluvio-lacustrine settings. The entire science payload was employed to characterize the mineralogy and chemistry of the Sheepbed mudstone at Yellowknife Bay and the Windjana sandstone at the Kimberley. Data from the CheMin instrument, a transmission X-ray diffractometer, were used to determine the quantitative mineralogy of both samples. The Sheepbed mudstone contains detrital basaltic minerals, calcium sulfates, iron oxides or hydroxides, iron sulfides, trioctahedral smectite, and amorphous material. The mineral assemblage and chemical data from APXS suggest that the trioctahedral smectite and magnetite formed authigenically as a result of alteration of olivine. The apparent lack of higher-grade phyllosilicates (e.g., illite and chlorite) and the presence of anhydrite indicate diagenesis at ~50-80 ºC. The mineralogy of the Windjana sandstone is different than the Sheepbed mudstone. Windjana contains significant abundances of K-feldspar, low- and high-Ca pyroxenes, magnetite, phyllosilicates, and amorphous material. At least two distinct phyllosilicate phases exist: a 10 Å phase and a component that is expanded with a peak at ~11.8 Å. The identity of the expanded phase is currently unknown, but could be a smectite with interlayer H_2O, and the 10 Å phase could be illite or collapsed smectite. Further work is necessary to characterize the phyllosilicates, but the presence of illite could suggest that Windjana experienced burial diagenesis. Candidates for the cementing agents include fine-grained phyllosilicates, Fe-oxides, and/or amorphous material. Interpretations of CheMin data from the Windjana sandstone are ongoing at the time of writing, but we will present an estimate of the composition of the amorphous material from mass balance calculations using the APXS bulk chemistry and quantitative mineralogy from CheMin.