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From Grains to Landscapes: Reconstructing Martian Environments at Multiple Scales

03 November 2020 • 3:30 pm EDT • *Virtual Seminar*

Sedimentary deposits provide robust constraints on the global hydrosphere and climate of early Mars, fundamental aspects to determining whether Mars had conditions suitable for sustaining life. My research reconstructs the depositional environments of early Mars from interpretations of sedimentary deposits ranging from the scale of sediment grains to entire landscapes. At the sediment grain-scale, accurate measurement of the size and distribution of grains provides quantitative constraints on the energy available for sediment transport in ancient depositional environments. At the landscape scale, detailed mapping of landforms such as alluvial fans and deltaic deposits place important limits on the distribution, abundance, and relative timing of surface liquid water. In this talk, I will present results from two studies focused on characterizing the paleo-hydrology of the Gale crater region, the landing site for the Mars Science Laboratory Curiosity rover. The talk will focus on a grain size proxy I implemented that uses geochemical analyses from the ChemCam instrument on the Curiosity rover, and a detailed reconstruction of depositional environments we have surveyed in the Murray formation. To place this work in a wider context, I will also present results of geomorphic mapping of deltaic deposits that consider the hypothesis that Gale crater may have once been associated with a network of regional lakes, or a global ocean.