

Sedimentary petrography and facies analysis at the Shaler Outcrop, Gale Crater, Mars

L.A. Edgar¹, S. Gupta², D.M. Rubin³, K.W. Lewis⁴, G. Kocurek⁵, R. Anderson⁶, J.F. Bell III¹, G. Dromart⁷, K.S. Edgett⁸, J.P. Grotzinger⁹, C. Hardgrove⁸, L.C. Kah¹⁰, R. Leveille¹¹, M.C. Malin⁸, N. Mangold¹², R. Milliken¹³, M. Minitti¹, M. Rice⁹, S. Rowland¹⁴, J. Schieber¹⁵, K.M. Stack⁹, D.Y. Sumner¹⁶, and the MSL Science Team.

¹Arizona State University, Tempe, AZ, 85287, ledgar1@asu.edu, ²Imperial College London, London, UK, ³UC, Santa Cruz, CA, ⁴Princeton University, Princeton, NJ, ⁵University of Texas at Austin, Austin, TX, ⁶USGS, Flagstaff, AZ, ⁷Universite de Lyon, France, ⁸Malin Space Science Systems, San Diego, CA, ⁹California Institute of Technology, Pasadena, CA, ¹⁰University of Tennessee, Knoxville, TN, ¹¹Canadian Space Agency, Montreal, Canada, ¹²Laboratoire de Planétologie et Géodynamique de Nantes, France, ¹³Brown University, Providence, RI, ¹⁴University of Hawaii at Manoa, Honolulu, HI, ¹⁵Indiana University, Bloomington, IN, ¹⁶UC Davis, Davis, CA.

The Mars Science Laboratory Curiosity rover has recently completed an investigation of a large fluvial deposit known informally as the Shaler outcrop (~1 m thick). Curiosity acquired data at the Shaler outcrop during sols 120-121 and 309-324. The Shaler outcrop is comprised of cross-bedded coarse-grained sandstones and recessive finer-grained intervals. Shaler is distinguished from the surrounding units by the presence of resistant beds exhibiting decimeter scale trough cross-bedding. Observations using the Mast Cameras, Mars Hand Lens Imager (MAHLI) and ChemCam Remote Micro Imager (RMI) enable the recognition of several distinct facies. MAHLI images were acquired on five distinct rock targets, and RMI images were acquired at 33 different locations. On the basis of grain size, erosional resistance, color, and sedimentary structures, we identify four facies: 1) resistant cross-stratified facies, 2) smooth, fine-grained cross-stratified facies, 3) dark gray, pitted facies, and 4) recessive, vertically fractured facies. Panoramic Mastcam observations reveal facies distributions and associations, and show cross-bedded facies that are similar to those observed at the Rocknest and Bathurst_Inlet locations. MAHLI and RMI images are used to determine the grain size, sorting, rounding and sedimentary fabric of the different facies. High-resolution images also reveal small-scale diagenetic features and sedimentary structures that are used to reconstruct the depositional and diagenetic history.