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Fluvial to Lacustrine Facies Transitions in Gale Crater, Mars

Dawn Y Sumner[1], Rebecca M. E. Williams[2], Juergen Schieber[3], Marisa C Palucis[4], Dorothy Z Oehler[5], Nicolas Mangold[6], Linda C Kah[7], Sanjeev Gupta[8], John P Grotzinger[4], John A Grant III[9], Lauren A Edgar[10] and William E Dietrich[11], (1)University of California, Davis, Davis, CA, United States, (2)Planetary Science Institute Tucson, Tucson, AZ, United States, (3)Indiana University Bloomington, Bloomington, IN, United States, (4)California Institute of Technology, Pasadena, CA, United States, (5)Johnson Space Center, Houston, TX, United States, (6)LPGN Laboratoire de Planétologie et Géodynamique de Nantes, Nantes Cedex 03, France, (7)University of Tennessee, Knoxville, TN, United States, (8)Imperial College London, London, United Kingdom, (9)Smithsonian National Air and Space Museum, Center for Earth and Planetary Studies, Washington, DC, United States, (10)Arizona State University, Tempe, AZ, United States, (11)University of California Berkeley, Berkeley, CA, United States

Abstract Text:

NASA's *Curiosity* rover has documented predominantly fluvial sedimentary rocks along its path from the landing site to the toe of the Peace Vallis alluvial fan (0.5 km to the east) and then along its 8 km traverse across Aeolis Palus to the base of Aeolis Mons (Mount Sharp). Lacustrine facies have been identified at the toe of the Peace Vallis fan and in the lowermost geological unit exposed on Aeolis Mons. These two depositional systems provide end members for martian fluvial/alluvial-lacustrine facies models. The Peace Vallis system consisted of an 80 km^2 alluvial fan with decimeter-thick, laterally continuous fluvial sandstones with few sedimentary structures. The thin lacustrine unit associated with the fan is interpreted as deposited in a small lake associated with fan runoff. In contrast, fluvial facies exposed over most of Curiosity's traverse to Aeolis Mons consist of sandstones with common dune-scale cross stratification (including trough cross stratification), interbedded conglomerates, and rare paleochannels. Along the southwest portion of the traverse, sandstone facies include south-dipping meter-scale clinoforms that are interbedded with finer-grained mudstone facies, interpreted as lacustrine. Sedimentary structures in these deposits are consistent with deltaic deposits. Deltaic deposition is also suggested by the scale of fluvial to lacustrine facies transitions, which occur over >100 m laterally and >10 m vertically. The large scale of the transitions and the predicted thickness of lacustrine deposits based on orbital mapping require deposition in a substantial river-lake system over an extended interval of time. Thus, the lowermost, and oldest, sedimentary rocks in Gale Crater suggest the presence of substantial fluvial flow into a long-lived lake. In contrast, the Peace Vallis alluvial fan onlaps these older deposits and overlies a major unconformity. It is one of the youngest deposits in the crater, and requires only short-lived, transient flows.

Topic Selection: Fluvial landforms and sedimentary deposits on planetary surfaces

Title: Fluvial to Lacustrine Facies Transitions in Gale Crater, Mars
Preferred Presentation Format: Assigned by Program Committee (Oral or Poster)
PreviouslyPublished?: Yes
Published?: The topographic profile and facies interpretations of the Peace Vallis fan have been published in Science and JGR. 2/3 of the abstract data have not been published.

First Presenting Author

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