Geophysical Research Abstracts
Vol. 17, EGU2015-6247, 2015
EGU General Assembly 2015

From Kimberley to Pahrump_Hills: toward a working sedimentary model for Curiosity's exploration of strata from Aeolis Palus to lower Mount Sharp in Gale crater

Sanjeev Gupta (1), David Rubin (2), Katie Stack (3), John Grotzinger (4), Rebecca Williams (5), Lauren Edgar (6), Dawn Sumner (7), Melissa Rice (8), Kevin Lewis (9), Michelle Minitti (5), Juergen Schieber (10), Ken Edgett (11), Ashwin Vasawada (3), Marie McBride (11), Mike Malin (11), and the MSL Science Team

(1) Imperial College London, London, United Kingdom (s.gupta@imperial.ac.uk), (2) UC, Santa Cruz, CA, USA, (3) Jet Propulsion Laboratory, Pasadena, CA, USA, (4) California Institute of Technology, Pasadena, CA, USA, (5) Planetary Science INstitute, Tucson, AZ, USA, (6) USGS, Flagstaff, AZ, USA, (7) UC, Davis, CA, USA, (8) Western Washington University, Bellingham, WA, USA, (9) Johns Hopkins University, Baltimore, Maryland, USA, (10) Indiana University, Bloomington, Indiana, USA, (11) Malin Space Science Systems, San Diego, CA, USA

In September 2014, NASA's Curiosity rover crossed the transition from sedimentary rocks of Aeolis Palus to those interpreted to be basal sedimentary rocks of lower Aeolis Mons (Mount Sharp) at the Pahrump Hills outcrop. This transition records a change from strata dominated by coarse clastic deposits comprising sandstones and conglomerate facies to a succession at Pahrump Hills that is dominantly fine-grained mudstones and siltstones with interstratified sandstone beds. Here we explore the sedimentary characteristics of the deposits, develop depositional models in the light of observed physical characteristics and develop a working stratigraphic model to explain stratal relationships.

During her crossing of Aeolis Palus, the plains region between the Gale crater rim and Aeolis Mons, Curiosity encountered a remarkably rich array of clastic sedimentary rocks primarily of fluvial origin. Initially isolated outcrops of pebble conglomerates and cross-bedded sandstones were observed. However, in the vicinity of the Kimberley waypoint a distinct facies - the 'Striated Unit' showing ENE-WSW banding in orbital images was identified. In situ observations by Curiosity showed that this facies comprises primarily south-dipping decimeter-thick bedsets of sandstones. The alongstrike continuity of these bedsets for 100's of meters in a southward-dipping direction, with little trace of curvature, precludes a fluvial barform interpretation. We interpret the inclined beds as clinoforms representing deposition at the mouth of rivers where they enter a standing body of water. The southward direction of dip indicates systematic accretion of clinoforms and their growth to the south likely from drainage systems draining the north Gale crater rim.

In Curiosity's traverse southward and westward from Kimberley, similar southward inclined facies were encountered but at higher elevations suggesting the possibility that we are observing multiple cycles of clinoform growth.

Finally, at the Pahrump Hills section, we observe a sedimentary succession characterized by massive and finely laminated mudstones which contain interstratified cross-bedded sandstones and are capped by a resistant cross-bedded sandstone. Cross-bedding shows dominantly southward flow directions. Our observations suggest stratigraphic continuity between Aeolis Palus and the Pahrump Hills succession that records a facies transition from fluvio-deltaic sediments to facies deposited in a lacustrine succession.