
1Space Research Institute, RAS, Moscow, 117997, Russia, litvak@mx.iki.rssi.ru, 2University of Arizona, Tucson, AZ USA, 3Arizona State University, Tempe, AZ, USA, 4Jet Propulsion Laboratory, Pasadena, CA USA, 5Vernadsky Institute for Geochemistry and Analytical Chemistry, Moscow, Russia, 6Brown University, Providence, Rhode Island, USA, 7University of Tennessee, Knoxville, Tennessee, USA, 8Catholic University of America, Washington DC, USA.

Introduction: In September 2014, after more than two years of intensive surface operations and a long drive (about 9 km from the landing site) Curiosity rover finally arrived to the base of Mt Sharp named as Pahrump Hills. This study presents overview of DAN (Dynamic Albedo of Neutrons instrument) observations completed at different areas of Pahrump Hills outcrop in the attempt to test local variations of bulk distribution of subsurface water and compare it with observations at previous locations along Curiosity traverse, especially with results obtained during Yellowknife and Kimberley observational campaigns.

Instrumentation and Methods. The DAN instrument consists of a pair of neutron detectors and pulse neutron generator. The last one could emit short pulses of neutron emission (14 Mev neutrons within 2 microseconds) to irradiate the subsurface under the rover, while DAN neutron detectors are measuring delayed albedo of neutrons returned back from the subsurface [1]. This leakage of neutrons is the diffusion process, when neutrons make a large number of collisions with nuclei of the atoms of the substance encountered. It results in a moderation of the neutron’s energy, which strongly depends from the presence and distribution of Hydrogen nuclei. This method of active nuclear remote sensing is capable to retrieve (based on the analysis of shape of time response from the subsurface) a local distribution of Hydrogen (thought to be bound as part of H2O molecules) and bulk distribution of neutrons absorption elements (first of all such as chlorine and iron) within 3 m around the rover and to the the depth about 60 cm under the rover [2,3].

Observations. Pahrump layers are characterized by several sedimentary facies determined as Recessively-weathering Massive Mudstone (the most prevalent facies throughout the Pahrump Hills), Recessively-weathering Parallel Laminated Mudstone (fine-grained material exhibiting mm-scale parallel lamination, interbedded within the massive mudstone), Resistant Laminated to Massive Mudstone (Coarse cm- to mm-scale planar laminae), Resistant Cross-stratified Mudstone/Siltstones (parallel and low-angle mm-scale cross-laminae) and Cross-stratified Sandstone, see for details [4] and Figure 2. Our study summarises the results from more than 20 DAN active observations of bulk water distribution and bulk content of chlorine within the Pahrump Hills section, analyses possible correlation with local geological context and compare with DAN results encountered at previous observational campaigns completed along MSL traverse at Yellowknife and Kimberley areas. See on Figure 1 an illustration of DAN observations prior and after arriving to Pahrump Hillsing site.

Figure 1. The example of DAN measurements of bulk distribution of water and chlorine prior and after arriving to the base of Mt. Sharp.

Figure 2. Main outcrops visited by the Curiosity rover at the Pahrump Hills outcrop (Mastcam mosaic produced by MSSS, see also K. Stack et al., LPSC 2015).

References: