Soil-Moisture Interaction on the Present-Day Surface of Gale Crater, Mars

Priyabrata Das[1*], Sourabh Shubham[2], Amit Basu Sarbadhikari[1]
[1]Physical Research Laboratory, Ahmedabad-380058
[2]Indian Institute of Technology, Kharagpur-721302
*Email: priyabratapresi@gmail.com

Searching traces of present-day water activity on Mars is a prominent field of research with implications to understand the habitability and future explorations [1, 2]. The indirect shreds of evidences of hydrous activity, e.g. night-time brine and seasonal frost activity at the Gale crater have been provided based on the calculations of Mars Science Laboratory rover's (Curiosity) REMS weather data [2]. However, the newly calibrated data shows that the existence of liquid at Gale crater during MSL's traverse of first 1648 sols was unlikely, except the sols 1232 and 1311 [3]. Further, the remote visual observation of surficial signatures for examples, duricrusts, lobate shaped to spatially large grainflow deposits reveal the cohesiveness of the Gale's Bagnold dune surface [4].

We have used the data of Curiosity's LIBS to classify the soil types (i.e. loose and cohesive) in terms of hydrogen signal to determine the occurrence of water bearing phases. In order to understand the degree of hydration and possible reason for the enrichment, we estimated the hydrogen in some selected locations of the soil and the basement rocks along the rover track for one Martian year. The observation indicates a most likely occurrence of the of the hydrous soil patches at the top layer of Gale surface. Although, any direct evidence of liquid hydrous phases has not been established from the Gale surface till date, the entrapment of under-saturated fluid at the capillary fringes could be hypothesized as one of the potential scenario. The hydrogen counts measured during Martian autumn to winter are relatively more, indicating high abundance of water in comparison to the other seasons. There are possibilities of (1) super-imposition of the diurnal enrichment of near-surface atmospheric moisture over the broad seasonal range, or (2) the non-uniform distribution of salts and other hydrous minerals over the Gale surface due to wind sorting.

References: [1] Martínez, G. M. and Renno, N. O. (2013). *Sp. Sci. Rev.* 175, 29-51. [2] Martín-Torres, F. J., (2015). Nat. Geo. 8(5), 357. [3] Rivera-Valentín, E. G. et al. (2018). *JGR: Planets.* 123 (5), 1156-1167. [4] Cornwall, C. (2018). *Icarus.* 314, 311-326.