Testing correspondence between areas with hydrated minerals, as observed by CRISM onboard MRO, and spots of enhanced subsurface water content, as found by DAN along the traverse of Curiosity

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The Dynamic Albedo of Neutrons (DAN) instrument designed to detect neutrons in order to determine hydrogen abundance in the Martian subsurface (down to 1 m deep) is successfully working onboard Mars Science Laboratory (MSL) Curiosity rover for more than seven years. The Curiosity rover covered more than 20 km on the Martian surface and crossed a range of terrain types and geological structures of different mineralogical composition.

We investigate the possible correlation between the water equivalent hydrogen (WEH) value, as measured by DAN along the Curiosity traverse, and the presence of hydrated minerals, as observed from the orbit by Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) onboard Mars Reconnaissance Orbiter.

Our analysis of the WEH value from DAN measurements in Gale crater and the CRISM data, reflecting the distribution of hydrated/hydroxylated minerals on the surface of this crater, shows a confident increase of the average WEH values for the surface elements, containing certain types of minerals, in comparison with surface elements, that do not contain any of them. This increase is shown to become higher for surface with more prominent spectral features of hydrated/hydroxylated minerals on the surface. Thus, certain types of minerals being parts of the sedimentary deposits composing Gale crater, should have considerable thickness, which is sufficient for active neutron sensing in DAN measurements. To explain the correspondence, one may assume that large blocks of certain mineral composition are distributed over the traverse, the tops of which are observed by CRISM from the Martian orbit, and the volumes of which are detectable by DAN on the Martian surface.

The bottom of the crater is thought to be a composition of a uniform regolith and sedimentary blocks of minerals with different level of hydration. The fraction of the regolith contains a standard value of WEH, about 2.6 wt.% and the fraction of minerals, provided they are there, might contribute to some increase of the mean WEH values, up to 3.8 wt.%, as they are obtained at some spots from the DAN neutron sensing.