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# Diversity of Iron in Meridianum Planum and Gusev Crater

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Chemical compositions of soils and rocks at Gusev crater and Meridiani Planum measured by the APXS (Alpha Proton X-Ray Spectrometer) [1, 2] distinguish between basaltic rocks, evaporite-rich rocks, basaltic soils, hematite-rich soils, and sulphur-rich subsurface layers. Although top surface soils of Gusev and Meridiani are compositionally similar to those at previous landing sites, differences in iron and some minor element concentrations suggest the addition of local components.

At the Meridiani Planum all soils and outcrops have a higher Fe/Si ratio (mean Fe/Si = 0.75) compared to rocks and soils in Gusev crater (mean Fe/Si = 0.57). The enrichment of Fe derived from an admixture of hematite ($Fe_2O_3$) as measured in-situ by the Mössbauer spectrometer [3]. Hematite was also detected at Meridiani Planum from the orbit by the TES of the Mars Global Surveyor (MGS) [4]. The formation of hematite is an indicator for aqueous activities under oxidizing conditions. The highest portion of this mineral was found in spherical grains, called 'Blueberries', which cover the landing site. These spherules were found in rock exposures in Eagle crater to about 2 % by volume and were interpreted as concretions that formed by precipitation from aqueous fluids inside sedimentary rocks [5]. At Gusev crater no hematite was observed until sol 90 except for some coating on a rock.

Our investigations of hematite bearing materials, measured by the Alpha Particle X-ray Spectrometer (APXS), Mössbauer Spectrometer (MB), and Microscopic Imager (MI) [6], provide a more integrated view of different occurrences of hematite on the Martian surface. Here, we report an alternative view that also is consistent with the data and observations. We interpret the hematite as a surface coating similar to terrestrial surface coatings. Ratios of Fe to Mn are compared with Fe concentrations (in

weight %) for various soils and outcrop samples in Meridiani Planum. Most samples cluster at a mean Fe/Mn ratio of about 50 and range in Fe from 13 to 17 wt. %. Exceptions are samples with very high Fe contents, such as soils dubbed 'JackRussell', and 'FredRipple', and an outcrop depression filled with spherules named 'Berry Bowl full' that have Fe/Mn ratios of about 110. All high hematite bearing soils are top surface samples, while corresponding subsurface soil samples and soils disturbed by rover wheels have low hematite contents. In outcrop samples with the same Fe/Mn ratio as found for the soil samples the formation of the main portion of fine dispersed hematite must be an isochemical re-crystallization process under strongly oxidizing conditions. Based on APXS measurements we cannot distinguish whether spherules consist of pure hematite or carry a thin layer of hematite. However, the very high Fe/Mn ratios of three undisturbed samples together with very high hematite contents suggest the presence of a hematite-rich top layer irrespectively of shape and area coverage of spherules or fragments.

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