PERVASIVELY ALTERED HEMATITE-RICH DEPOSITS SOUTHEAST OF HOME PLATE, GUSEV CRATER, MARS. C. Schröder[1,2], R.E. Arvidson[3], M.E. Schmidt[4], R. Gellert[5], G. Klingelhöfer[6], D.W. Ming[2], R.V. Morris[2], J.W. Rice[7], A.S. Yen[8], P.A. de Souza Jr.[9] and the Athena Science Team, [1]NASA Postdoctoral Program Fellow, christian.schroeder-1@nasa.gov, [2]NASA Johnson Space Center, Houston, TX, [3]Washington University, St. Louis, MO, [4]Smithsonian Institution, Washington D.C., [5]University of Guelph, Canada, [6]Johannes Gutenberg-Universität, Mainz, Germany, [7]Arizona State University, Tempe, AZ, [8]NASA JPL, CalTech, Pasadena, CA, [9]CEV, Aulnoye-Aymeries, France.

Introduction: The investigation of Home Plate and its surroundings in the Inner Basin of the Columbia Hills in Gusev Crater has added substantially to the water story on Mars. Textural, morphological, and geochemical evidence from Home Plate point towards an explosive origin, probably a hydrovolcanic explosion [1]. High silica deposits in the immediate vicinity of Home Plate suggest hydrothermal alteration [e.g. 2,3]. Pervasively altered deposits rich in hematite were investigated to the southeast of Home Plate. Of these, the target Halley, the target KingGeorgeIsland on the GrahamLand outcrop, and the targets Montalva and Riquelme on the Troll outcrop were investigated in situ with the Alpha Particle X-ray spectrometer (APXS), the Microscopic Imager (MI), and the Mössbauer (MB) spectrometer (Fig. 1).

Geologic Setting: KingGeorgeIsland and Riquelme may be within the same stratigraphic layer. Montalva and Halley are lower in the stratigraphy, with Halley below Montalva (Fig.1). Whereas Halley and Montalva show a fine-grained texture, KingGeorgeIsland and Riquelme contain spheroidal clasts, possibly lapilli (Fig. 2). Spirit dislodged some plates while driving over the layers (Fig. 1). Rover imagery suggests that the target Halley is part of an extensive set of buff colored platy outcrops in Eastern Valley. These platy outcrops appear to be in direct contact with the high silica deposits in several locations (Fig. 4).

Mineralogy: A high hematite signature was first identified in Mössbauer spectra of the target Enderbyland_Halley in the robotic arm's workvolume of Spirit's Winter Haven 2 location on Low Ridge, Southeast of Home Plate (Fig. 4). The target was mostly covered by soil with a soil-free spot barely large enough to cover the ~1.4 cm diameter footprint of the Mössbauer instrument and was not brushed or abraded with the Rock Abrasion Tool. A spectrum of the cleanest surface showed 72 % of the iron to be in hematite, 15 % in magnetite, 8 % in nanophase ferric oxides, 3 % in pyroxene, and 2 % in olivine [4]. Py-

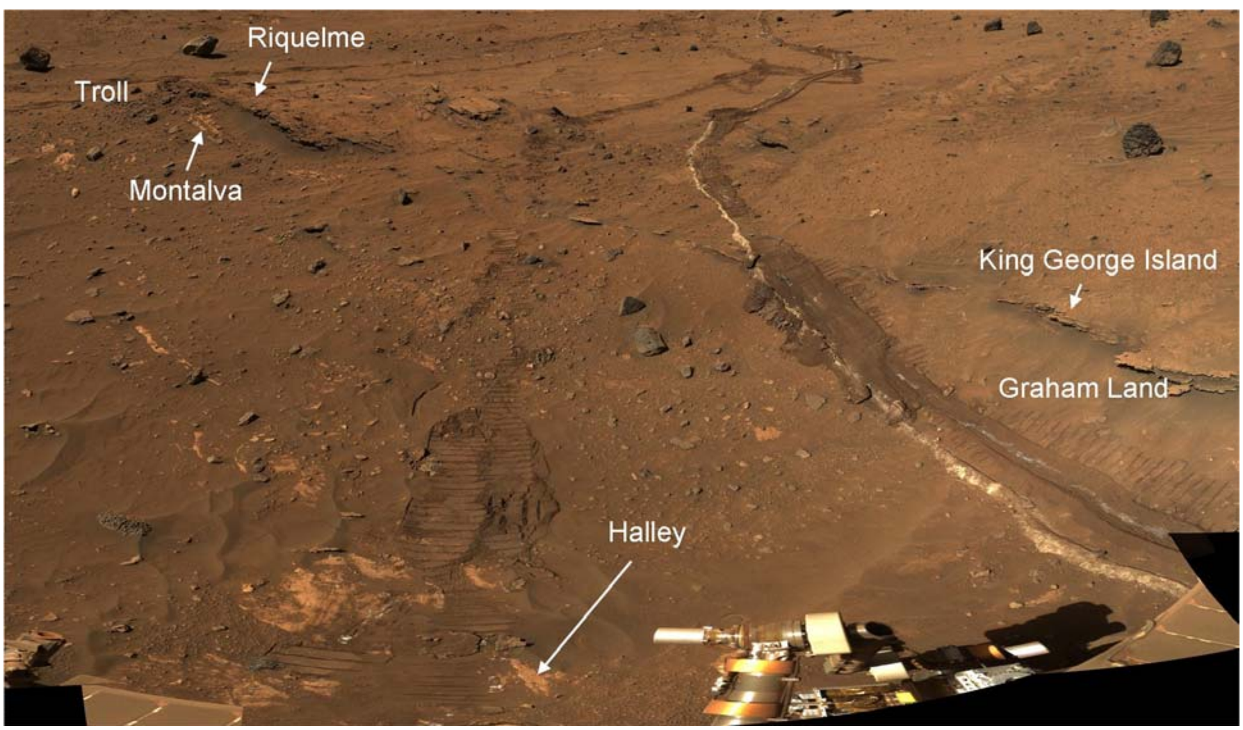

Figure 1. Cutout from the Pancam McMurdo Panorama obtained at Spirit's Winter Haven 2 loaction on Low Ridge (**http://marswatch.astro.cornell.edu/pancam_instrument/images/mcmurdo_atc.jpg**).

Abbildung 2. This MI image of Riquelme shows spheroidal clasts, possibly lapilli.

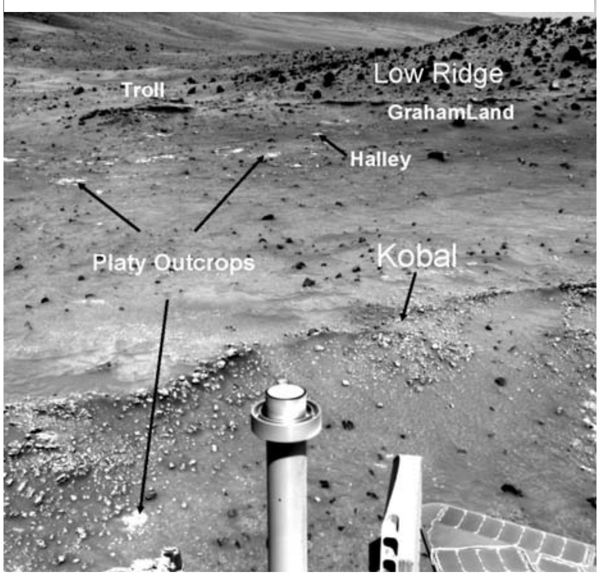

Abbildung 3. Navcam frame acquired on sol 776 within East Valley looking to the southeast. Nodular outcrop Kobal has a Mini-TES Si-rich signature.

roxene and olivine are probably a contamination from the surrounding basaltic soil as suggested by a sharp increase in these phases in spectra taken from targets with more soil in the field of view of the instrument. Magnetite and the nanophase iron oxide phase did not increase and are therefore likely a part of the Halley mineralogy. The target KingGeorge on the Graham-Land outcrop and one target on the Troll outcrop, Riquelme, are also hematite-rich, but have ~20 % of iron in pyroxene which is not from contamination by soil. Montalva has 78 % of the iron in hematite, the highest hematite content of any rock investigated by Spirit to date. The Mössbauer spectrum of Montalva is similar to the spectrum of Halley. Fe^{3+}/Fe_{Total} ratios range from 0.67 in KingGeorge to 0.93 in Montalva [4].

Composition: APXS elemental compositions show very high K, enrichment in P, Cl, Zn and Br, and depletion in Ca and S in KingGeorgeIsland and Riquelme compared to Halley [5]. Montalva holds the record for highest K of all targets investigated by Spirit, and it is distinct from Halley as well as King-GeorgeIsland and Riquelme by its very low Mn. A series of APXS measurements on Halley with different rock/soil ratios in the field of view of the instrument revealed a positive correlation between Ca and S (R^2=0.9986), suggesting the presence of Ca-sulfates [5,6]. Zn and Cl are also positively correlated in Halley [6].

Discussion: The hematite-rich deposits are related to and seem to lie stratigraphically below Home Plate (compare [7]). Similar bedding thicknesses and variable grain sizes are consistent with deposition during a volcanic eruption.

Hematite, high Fe^{3+}/Fe_{Total} ratios, Ca-sulfates, and Zn-Cl correlation all indicate extensive alteration of these materials. Although these materials have high hematite content, the total Fe content is similar to the Fe contents in other materials. Therefore, the hematite does not appear to be the result of dissolution, mobilization and reprecipitation of Fe from elsewhere, but instead the Fe was altered within the Halley class materials [5]. Volatile elements are relatively high in these materials, similar to some of the volatile compositions of materials around Home Plate suggesting, these outcrops were altered/oxidized by solutions rich in these elements [5]. Geochemical differences between Halley (highest Zn), Montalva (highest K, very low Mn), and KingeGeorgeIsland/Riquelme suggest vertical differences in redox conditions.

Laterally discontinuous alteration regimes are implied because rover imagery suggests that platy outcrops containing Halley seem to lie in direct contact below Si-rich deposits in Silica Valley whereas they appear to be below the Montalva and KingGoergeIsland/Montalva layers at LowRidge.

References: [1] Squyres S.W. (2008) *Science, 316*, 738-742. [2] Morris R.V. et al. (2008) *LPS XXXIX*, this issue. [3] Ming D.W. (2008) *LPS XXXIX*, this issue. [4] Morris R.V. et al. (2008) *JGR*, to be submitted. [5] Ming et al. (2008) *JGR*, to be submitted. [6] Yen A.S. et al. (2007) 7th International Conference on Mars, 3335. [7] Crumpler L.S. (2008) *LPS XXXIX*, this issue.