GEOLOGIC CONTEXT OF HIGH-SILICA DEPOSITS ON MARS FROM *IN SITU* FIELD MAPPING, COLUMBIA HILLS, GUSE V CRATER, MARS . L. S. Crumpler [1], and the Athena Sc ience Team. [1]New Mexico Museum of Natural His tory and Science, Alb uquerque, NM 87104 (larry.crumpler@state.nm.us)

Introduction: Silica-enriched soils encountered by Spirit within the Columbia Hills near Home Plate ***[1,3,4]*** repre sent a record of poten tially hab itable envi-ronments on Mars at the time of their formation re-gardless of whether they formed as re sidua from leac h-ing of silica rocks or a deposits from silica-enriched fluids ***[2].*** During the third Martian year "field sea son", the geologic setting of the these deposits was exa mined in detail by the MER Spirit rover during a series of traverses up and down the "East Valley" between Home Plate and Mitcheltree Ridge. Correlative map-ping of out crop layers examined by the Athena in-struments around the margins of the East Valley en-abled the construction a true field-based ge ologic map. The resulting contacts are constrained in three dimen-sions and support both stratigraphic and structural in-terpretations. Mitcheltree Ridge and Low Ridge oc-cupy structural synclines that merge to the west and northwest (respe ctively) with the margins of Home Plate along a monoclinal to ant iclinal axis. The floor of the East Valley where the silica-enriched materials occur is a stru ctural hinge line along which the lowest stratigraphic materials yet vis ited by Spirit are ex-posed. Confinement to the lowest stratigraphic la yers indicates that the silica-enriched deposits are among the oldest materials examined. Alternately, the appar-ent stratigraphic position is spurious and the deposits are laterally discontinuous and uncon formable (local hydrothermal or recently formed under current relief conditions).

Mapping Analysis Methods: The thorough and deli b-erate series of outcrop examinations by Spirit enabled the use of standard field geologic pro cedures and ul-timately the con struction of a well-constrained geo-logic map. The position of boundaries between dis-tinctive layers and marker units were mapped along the entire trav erse of East Valley using Navcam stereo ranging from multiple positions . The results were plo t-ted in planimetric pe rspective and co-registered within the corresponding HiRISE image (PSP_001513_1655) ***[5].*** Following standard field mapping methods, field determined contacts segments were then combined with the continu ation of the con tacts as detected in the high resolution, over head image data, Based on in situ results at several outcrops (**1, WinterHaven2; 2, Troll; 3, Bellin gshausen; 4, Madeline English; 5, Clara Zap; 6, Torquas; 7, Nancy Warren; 8, Pes a-pallo**) **(Fig. 1)**, including Mi croscopic Imager results at the actual out crops, inter pretations of litho l ogy and corresponding correl ations from location to location were established, resulting in an *in situ*, observation-based geo logic map.

Observation Summary: Spirit traversed the valley ("East Val ley") and examined outcrops b etween Home Plate, Mitcheltree Ridge, and Low Ridge b etween sols 772 and 1304. Distinctive light-toned, lumpy soils, some silica en riched, were ident ified in the central axis of the valley; m ore platey materials similar to the loose plate "Halley" may be stratigraphically lower. RAT brushing of one outcrop of the immediately overlying material (Montalva) was also ex ceptionally light toned and anoma lously potassic. The lumpy, light-toned, silica-enriched soils appear stratigraphically conform-able in that within the East Valley they always occur at least be low a prominent layer several centim eters thick that rims the valley on the lower flanks of Low Ridge and Mitcheltree Ridge, and the e ast margin of Home Plate. But their location on the valley floor could be because they collected in the lo cal topographic trough of the valley. The west dip on the east margin of Home Plate, eastward dip along the base of Mitcheltree Ridge imply a anticlinal structure for the valley floor in agreement with the ap parent strat igraphically lower position and narrow distribution of the valley floor deposits. The bedding on the ma rgins of Mitcheltree Ridge and Low Ridge southward are likewise evidence for synclinal structures underl ying these ridges and im-ply significant inversion of topography. MI data for outcrops on the south (Graham Land, Troll), east (Tor-quas) and west (Madeline English) sides of the valley are all char acterized by equant spherical grains inter-preted to be an unusually fluid type of lapilli (pyro-clastic "droplets").

Discussion. At least three alternative models for the geologic setting of the silica-enriched deposits can be considered based on field-based geo logic ma pping: (1) the deposits are a distinct layer or paleo surface re-cording a period of silica deposition or leaching prior to deposit of the overlying units, in cluding Home Plate lithologies, (2) the deposits formed as precipitates or residua along vertical discontinuities occupied by hy-drothermal fluids associ ated with local volcanism along Mitcheltree Ridge, or (3) the deposits are rel a-tively recent and developed in soils filling local de-pressions in the cu rrent topography.

In addition to the above results, the complexity of the local geology as captured in the mapping over an area a few tens of meters across, is evidence that the surface of Mars (1) retains detailed contact and unit boundary rela tionships, espe cially where deflation has uncovered the substrate, (2) is geologically complex at human and rover scales, implying that numerous unique geologic events are likely to be captured in isolated outcrops across the planet, and (3) records at

even modest scales significant stratigraphic unconformities and variations in environment through geologic time.

References: [1] Squyres et al, Science 316, 738-742, 2007. [2] Squyres et al, EOS Transactions AGU, 88(52), P21C-01, 2008. [3] Ruff et al, EOS Transactions AGU, 88(52), P23A-1097, 2008; [4] Yen et al., EOS Transactions AGU, 88(52), P23A-1095, 2008; [5] McEwen et al, JGR 2006.

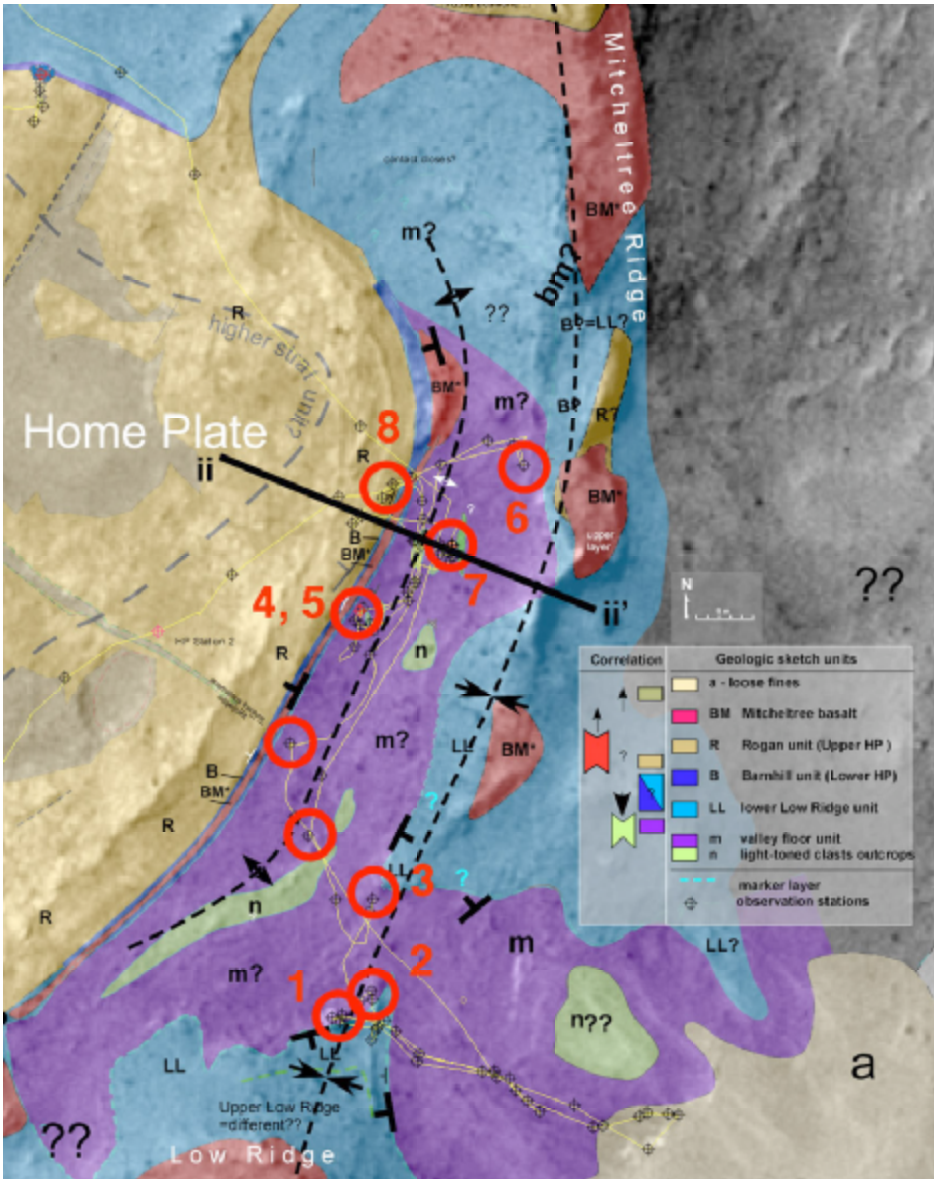

Figure *1.* *Field based geologic sketch map* of "East Valley" between Home Plate and Mitcheltree ridge. Note that silica enriched deposits ("n") occur principally along an anticlinal structural axis. The silica-enriched materials are either a deep layer exposed along shallow structure contours of the antiform, or loose materials trapped in the valley floor subsequent to development of the current relief. Red circles indicate locations of in situ observation stations discussed in "Observation Summary". Location of cross section (**Fig.2**) indicated by line end-labeled ii-ii'. Map width, 80 m.

Figure 2. East valley crosses section based on *in situ* observations of outcrops. Silica enriched materials tend to occur along the anticlinal axis defining the valley centerline or where low-lying units are more deeply dissected.