A SIMPLIFIED VIEW OF THE GEOCHEMICAL DIVERSITY SURROUNDING HOME PLATE.

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Introduction: The Home Plate feature (Fig. 1) within the Inner Basin of the Columbia Hills consists of layered rocks and has been interpreted as an accumulation of pyroclastic deposits [1]. Samples analyzed by the Alpha Particle X-ray Spectrometer within ~25 meters of the eastern margin of Home Plate exhibit a strikingly diverse range of geochemical compositions, including the highest levels of Mg, Si, K, Zn, and Ni measured at Gusev Crater. This wide range of chemical variability across the 40+ samples analyzed on and near Home Plate can be represented by contributions from only six primary components. This reconstruction is not reflected in the Mössbauer mineralogy suggesting that significant alteration of the contributing components has occurred.

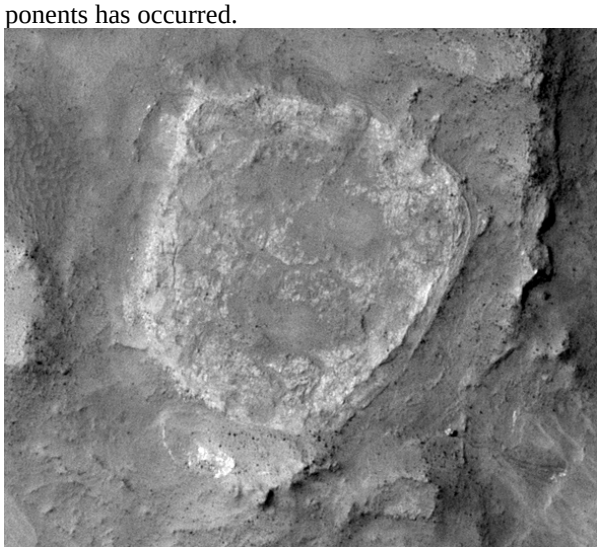

Fig. 1. HiRISE image of Home Plate.

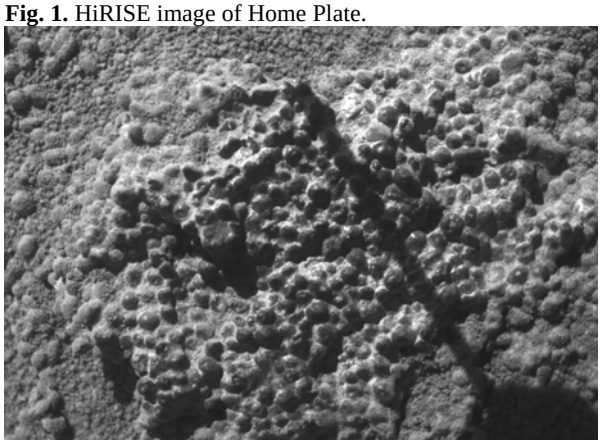

Fig. 2. Example Microsopic Imager image of a sample in the vicinity of Home Plate (granules are ~1 mm dia.)

Geochemical Components: The chemical compostions of the clastic rocks (Fig. 2) which form Home Plate and surrounding deposits can be represented by mixtures of a small number of distinct components:

Wishstone/Watchtower. APXS analyses of samples at the summit and on the northwest flank of Husband Hill are characterized by elevated Ti and P with depleted Cr. This signature is clearly reflected in analyses of Home Plate and its surroundings (Fig. 3).

Algonquin Class. Several of the samples near Home Plate exhibit the ultramafic signature (high Mg, low Al, and elevated Cr) of Algonquin Class rocks found on the southern slopes of Husband Hill (Fig. 4).

Alkali-rich basalt. Samples analyzed in the vicinty of Home Plate are rich in Na and K, suggesting that alkali-rich basalts are likely components.

Silica. The highest concentration of SiO_2 (>90 wt%) measured at the surface of Mars is located in the valley immediately east of Home Plate. Other samples in this area also exhibit elevated Si. Hydrothermal processes are likely responsible for these enhancements [2, 3].

Martian dust. Due to surface roughness, dust and sand distributed by aeolian processes are difficult to completely remove from the analyzed samples by brushing with the Rock Abration Tool. Fortunately, the composition of martian dust is relatively uniform [4] and can be used in this mixing model.

K, Ni, and Zn. Significant enhancements in K, Ni, and Zn are found in certain samples surrounding Home Plate. In several cases, there is a clear association with Cl, suggesting that these elements may have been mobilized in fluids or through high-temperature volcanic emissions.

These listed constituents of the samples surrounding Home Plate are not true endmembers, as several are themselves composed of multiple components. However, organizing the wide compositional diversity into mixtures of several known samples (Table I) results in a simpler view of the geochemistry.

Results: Samples on Home Plate are well represented by a dust-like composition, an alkali basalt, and a combination of Watchtower and Algonquin class rocks. The Mg-rich samples, which may represent the lowest stratigraphic unit sampled near Home Plate, are largely dominated by the ultramafic composition of Algonquin class rocks. An intermediate stratigraphic unit between the platy deposits of Home Plate itself and the Mg-rich samples in the valley floor exhibits a

strong K, Ni, Zn signature. This layer is tracable from the edge of Home Plate to Mitcheltree and Low Ridges to the east (across the valley). Finally, the silica-rich deposits do not appear as a contiguous layer in the stratigraphy and may be a product of hydrothermal processes which occurred more recently.

Fe-Mineralogy: This model of chemical components does not reliably extend to the iron mineralogy established by the Mössbauer spectrometer. The Mg-rich samples, for example, are dominated by magnetite, while the ultramafic rocks identified as chemically-related are dominated by olivine. One possible scenario for reconciling this discrepancy involves the aqueous alteration of olivine to silica and magnetite. The available data, however, does not provide an indication of phyllosilicates (e.g., serpentine) that would have resulted in this process. Nonetheless, Mg-rich weathering products (talc, chrysotile, etc.) could be present but remain undetectable by the Mössbauer spectrometer.

Conclusions: Samples analyzed on and near Home Plate can be represented by a small number of distinct components. These samples can be grouped into a defined statigraphy consisting of the light-toned deposits of Home Plate itself, an intermediate layer rich in volcanic volatiles, and a lower layer which is consistent with aqueously altered ultramafic rocks.

References: [1] Squyres, S. W. et al (2007) *Science*, *316*, 738-742. [2] Morris, R. V. et al (2008) *39th LPSC*. [3] Ruff, S. et al (2008) *39th LPSC*. [4] Yen, A. S. et al. (2005), *Nature*, *436*, 49-54.

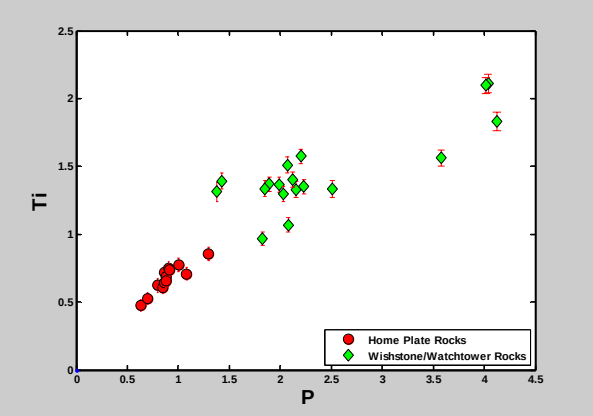

Fig. 3. Ti versus P for Home Plate rocks (red) and for the related Ti- and P-rich Wishstone/Watchtower class rocks (green).

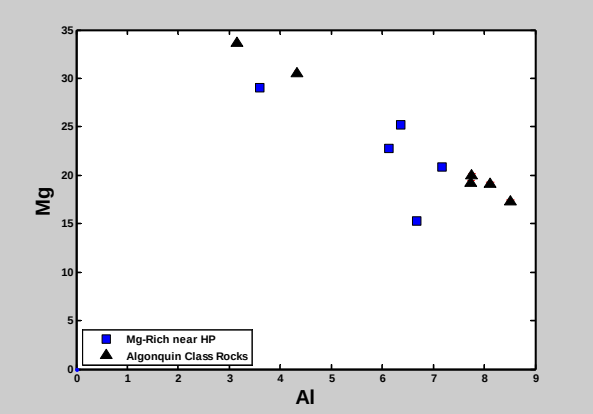

Fig. 4. Mg versus Al for the Mg-rich samples near Home Plate (blue) and the related Algonquin Class rocks (black).

Table I. Mixing model results indicating that chemically diverse samples on and near Home Plate can be represented by a small number of distinct components.

Sample		Wish/Watch (Watchtower)	Algonquin Class (Palomino)	Alkali Basalt (Humbolt Peak)	Silica (Kenosha Comets)	Martian Dust (average of 20)	K, Ni, Zn (Torquas)	K, Ni, Zn (Montalva)	Residual (wt%)
On Home Plate	Barnhill (NW)	0	4	1	0	79	0	15	1.8
	Posey (NW)	12	5	12	1	68	0	0	1.6
	Papa Bell (NW)	24	6	49	3	18	0	0	1.3
	Pesapallo (East)	21	3	31	3	42	0	0	0.4
	Superpesis (East)	2	1	0	0	95	0	2	0.4
	June Emerson (East)	4	6	42	1	48	0	0	0.5
	Elizabeth Emery (East)	0	3	18	0	74	0	5	0.7
	Texas Chili (South)	1	3	13	0	74	7	0	1.4
	Pecan Pie (West)	1	7	25	1	64	0	3	1.3
	Chanute (North)	0	0	0	0	89	0	9	2.0
Intermediate Layer	Madeline English	15	0	18	7	41	20	0	0.9
	King George Island	17	0	7	6	53	17	0	1.0
	Riquelme	8	0	0	2	70	5	14	0.6
Mg-Rich	Everett	1	51	1	5	3	39	0	0.6
	Slide	0	76	0	10	0	6	6	1.7
	GoodQuestion	0	18	0	20	43	0	18	1.2
	Eileen Dean	11	36	6	13	9	24	0	1.1
Silica-Rich	Nancy Warren	6	0	0	61	32	0	0	1.6
	Elizabeth Mahon	0	1	0	60	31	7	0	1.2
	Innocent Bystander	0	36	0	41	0	0	24	1.4
	Nora Luker	0	6	0	53	39	2	0	0.6