COMPARISONS OF SOILS AND ROCKS AT THE VIKING LANDER 1 AND PATHFINDER LANDING SITES. K. Larsen[1], R. E. Arvidson[1], B. L. Jolliff[1], and B. C. Clark[2], [1]Department of Earth and Planetary Sciences, Washington University, St. Louis, Missouri, 63130, larsen@wunder.wustl.edu, [2] Lockheed Martin Aerospace, Denver, Colorado.

Earth-based and orbital images show that the Viking Lander 1 site (Mutch Memorial Station, MMS), Chryse Planitia, is located in a bright red area, whereas the Pathfinder site (Sagan Memorial Station, SMS), Ares Vallis, is on the border between brighter, red and darker, grayer areas (Figure 1 and [1, 2]). Examination of Viking Lander and IMP images acquired under similar conditions shows that both sites exhibit bright red soils that vary from crusted to loose, with some deposits shaped by wind into drifts and tails (Figure 2). Soil-covered rocks are also found at both sites as are dark gray areas that may be dunes. The bright red soils probably formed from fine-grained (i.e., loess) materials mixed by aeolian processes on at least regional scales. Cementation of soils to form duricrust has also occurred at both sites.

A major difference between the Viking and Pathfinder sites is that the Pathfinder site (Figure 2, right) has a greater abundance of dark cobbles and granules (presumably from local rocks) within the soils as compared to the Viking site (Figure 2, left). This greater abundance is consistent with a greater areal abundance of dark gray materials inferred from Earth-based and orbital data and suggests that the soils at the Pathfinder site have a greater contribution of local materials than the deposits exposed at the Viking 1 site. The question then becomes whether the XRFS and APXS elemental data for the two sites support this hypothesis.

Correspondence analysis (CA) is a relatively new technique in the planetary sciences and is a way to reduce the dimensionality of complex data by conducting a joint Q- and R-Mode factor analysis [3]. Correspondence analysis applied to a normalized set of seven Viking XRFS soil measurements [4], eleven Pathfinder APXS rock and soil measurements [5], and a shergottite basalt (average composition of Shergotty, EETA79001, and Zagami [6]) for eight common elements shows that 85% of the variance is explained by two factors (Figure 3). Pathfinder rocks form a trend toward enriched Al, Si, whereas Viking soils form a mixing line with the shergottite basalt as an endmember. Pathfinder soils lie close to the mixing line, displaced toward the Pathfinder rock compositions, implying local rock contributions to these soils.

The combined data imply that the bulk of the soils (i.e., bright, red) formed from sources with mafic composition. Corrosion, cementation, or linear mixing with other materials produce a linear trend in CA space toward Cl, S enrichment. Duricrust lies off this trend, toward even further Cl, S enrichment. Pathfinder rocks show varying amounts of soil contamination, defined by a trend away from the Shergottite-Viking soil line toward Si, Al enrichment. The greater abundance of local rock materials inferred from CA for Pathfinder soils is consistent with a greater abundance of dark fragments. Results also suggest that

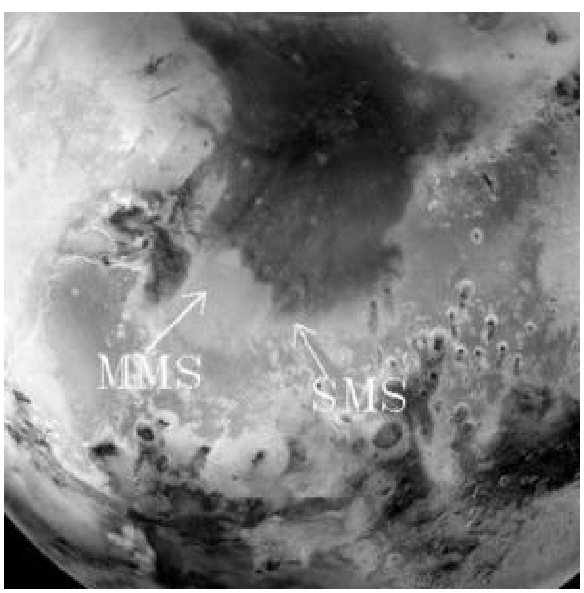

Figure 1. MDIM red wavelength mosaic with landing sites shown.

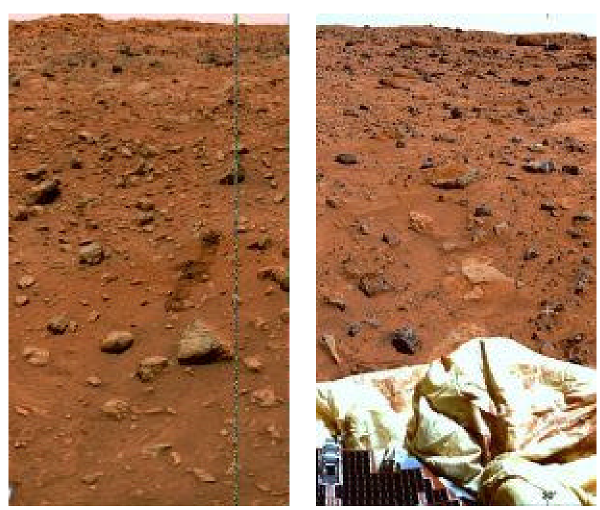

Figure 2. Viking (left) and IMP (right) color images acquired under similar lighting conditions.

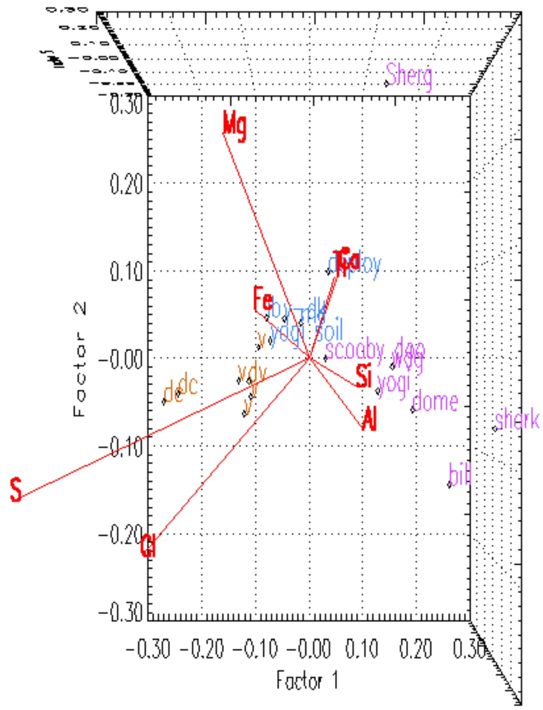

Figure 3. Plot of factor loadings on first two factors for elemental data. Brown symbols correspond to Viking soils, blue symbols correspond to Pathfinder soils, and purple to rocks. Position of model soil-free rock is located in very lower right of diagram. This soil-free rock composition was computed by removing typical soil oxides until sulfur content was reduced to zero. dc = *Viking duricrust;* v = *Viking soils, Sherg = Shergottite basalt.*

detailed surface observations at given sites, particularly dark areas, will allow us to identify and characterize local materials, even within a matrix of regionally-homogenized aeolian materials.

References: [1] Arvidson et al. (1989) *JGR*, *94*, 1573-1587. [2] Golombek et al. (1997) *Science*, *278*, 1743-1748. [3] David et al. (1974) *Can. J. Earth Sci.*, *11*, 131-146. [4] Clark (1982) *JGR*, *87*, 10,059-10,067. [5] Rieder et al. (1997) *Science*, *278*, 1771-1774. [6] Lodders (1998) *Met. Planet. Sci.*, *33*, A183–A190.