WHAT WOULD MER SOIL DO IN THE PHOENIX WCL? J.A. Hurowitz[1], [1]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109 joel.a.hurowitz@jpl.nasa.gov.

Introduction: The Phoenix Wet Chemistry Laboratory (WCL) has yielded fascinating new information on the nature of soluble minerals present in soils at the northern latitudes of Mars. Put simply, the WCL was designed to soak a soil sample in water and analyze the chemistry of the soil leachate using sensors and electrodes mounted in the walls of the WCL sample cell [1]. Perhaps one of the most interesting results of this experiment was the finding that the soil leachate has a mildly alkaline pH [2].

In contrast to Phoenix soil, it might be expected that immersing a Martian soil from an equatorial latitude landing site (Mars Exploration Rover (MER), Pathfinder, Viking 1), all of which have very similar chemical properties [e.g., 3], would result in a relatively acidic pH. This expectation is borne of the high sulfur abundances in equatorial soil and dust, which have been assumed to be the product of interactions between the Martian soil and sulfuric acid-rich solutions [e.g., 4]. The influence of acidic, S-rich fluids has been confirmed by MER Mössbauer results, which indicate the presence of a variety of ferric sulfate minerals, which are diagnostic of low-pH (pH < ca.4.0) formation conditions [e.g., 5], and have the ability to acidify dilute fluids when dissolved [e.g., 6].

In order to test the hypothesis that the immersion of soil from an equatorial latitude landing site in water would result in a low-pH solution, a series of reaction path simulations will be presented in which the minerals present in MER soils are subjected to Phoenix WCL experimental conditions. These simulations will be carried out using *The Geochemist's Workbench*. The results of these simulations will provide insight into the aqueous chemistry of liquids in contact with soils at Martian equatorial latitudes, and provide a basis for comparison of Phoenix WCL results to soil chemistry from other landing sites on Mars.

Predicting the Behavior of an MER Soil Sample: For the initial simulations, the mineral abundances of MER soils will be taken from the work of [7], with igneous mineral compositions taken from [8]. Because the results from [7] do not uniquely identify chloride minerals, 0.75 wt. % Cl (generally consistent with abundances from all landing sites) will be added as a variety of chloride salts, including $Mg(ClO_4)_2$.

In an initial simulation (**Fig. 1**) a fluid composition identical to the WCL leaching fluid was used (TS21 from Table 2 of [1]) to evaluate how a soil from MER would behave in the Phoenix WCL. A pH of 5.6, also consistent with [1], was set at the beginning of the simulation. Following determination of the equilibrium speciation in the initial solution, 1 cm^3 of "soil", whose mineral abundances and compositions are derived from [7] and [8], was reacted with the solution.

In the simulation shown on **Fig. 1**, all of the sulfate in the soil was assumed to be present as the Fe^{3+} hydroxy-sulfate schwertmannite, and no minerals were allowed to precipitate. Redox disequilibrium was assumed between Fe^{2+} and Fe^{3+}, and NO_3^- and NH_3, and the igneous mineral phases were allowed to react with the solution kinetically using known laboratory dissolution rates (thereby minimizing their impact on solution chemistry). The simulation was conducted at 25°C.

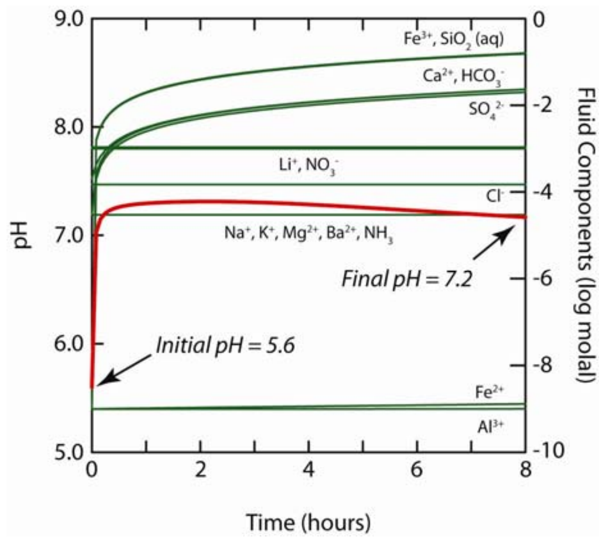

Figure 1: pH and fluid composition as a function of time following addition of soil to WCL leaching fluid.

The results of this simulation indicate that pH evolves from a value of 5.6 to 7.2 after 8 hours of MER soil - WCL solution interaction. Much work remains to be done to understand the implications of this interesting initial simulation, but this work provides a useful proof of concept for a new means of evaluating and comparing the aqueous chemistry of soluble soil minerals at different landing sites on Mars.

References: [1] Kounaves, S.P., et al. (2009) *JGR 114*, E00a19 10.1029/2008je003084. [2] Kounaves, S., et al. (2009) *40th LPSC,* Abstract #2489 (CD-ROM). [3] Yen, A.S., et al. (2005) *Nature 436,* doi:10.1038/nature03637. [4] Settle, M. (1979) *JGR 84,* 8343-8354. [5] Morris, R.V., et al. (2006) *JGR 111,* doi:10.1029/2005JE002584. [6] Jerz, J.K. and J.D. Rimstidt (2003) *Amer. Min. 88,* 1919-1932. [7] Rogers, A.D. and O. Aharonson (2008) *JGR 113*, E06s14 10.1029/2007je002995. [8] McSween, H.Y., et al. (2008) *JGR 113*, 14.