**WATER AT THE PHOENIX LANDING SITE.** P. H. Smith[1], [1]The Lunar and Planetary Lab, University of Arizona, Tucson, AZ 85721 (psmith@lpl.arizona.edu).

**Introduction:** The Phoenix mission operated on the northern plains of Mars (68.2°N, 234.2°E) for 5 months starting on May 25, 2008. The season spanned $L_s$ 78° – 148° covering most of the northern summer. Water ice both under the lander and in trenches dug by the robotic arm was quickly discovered about 5 cm beneath a dry surface layer. The soil was analyzed by instruments that determined the microscopic structure as well as the chemistry and mineralogy. Initial conclusions were published in a series of papers that quantified the atmospheric water content [1], identified Ca-carbonate that buffers the soil chemistry [2], and discovered perchlorate as an important oxidant [3].

**Soil Properties:** The dry overburden is a good thermal insulator with the thermal conductivity on average 0.085 W $m^{-1}$ $K^{-1}$ [4]. Electrical conductivity is below 2 nS/cm; however, the dielectric permittivity shows overnight increases after $L_s$ 108°. This increase is likely a signature of regolith water adsorption. Significant water exchange between the regolith and atmosphere occurs each night with most of the daytime 1.8 Pa of water disappearing from the base of the atmosphere and a rapid increase toward saturation as temperatures drop [4]. Frost was observed to deposit on the surface early in the morning, see Fig. 1.

**Periodic Water:** Instabilities in Mars orbital dynamics and particularly the obliquity which on average is significantly larger than today's value causes large variations in the polar climate on 100K year time scales [5]. During these warmer and wetter seasons it is likely that thin films of water have moistened the soil Several lines of evidence show that liquid water has been a factor in modifying the soil chemistry [5]. First, the formation of Ca-carbonate at about 5% of the soil is most easily explained by dissolved $CO_2$ in the water films forming a weak acid that weathers the soil particles producing Ca-carbonate. Second, the cemented crust that produced the clods that are visible in the lower right of Fig. 1 is likely an evaporation crust. A variety of salts are seen in the wet chemistry experiment [3]. Finally, lenses of nearly pure ice were seen that are hard to explain from diffusive vapor deposition of the ice.

The combination of salts, periodic liquid water, and chemical energy sources are the ingredients of a habitable zone [7]. The perchlorate found at about 1% is used by Earth microbes as an electron acceptor and is likely to be commonly found in the northern plains. Future missions should drill deeper into this ice sheet to find actual evidence of life preserved in the ice.

**References:** [1] Whiteway, J. (2009) *Science*, **325**, 67. [2] Boynton, W. V. et al. (2009) *Science*, **325**, 61. [3] Hecht, M. (2009) *Science*, **325**, 64. [4] Zent. A. P. (2009) *J. Geophys. Res.,* in press. [5] Levrard, B. et al. (2007), *J. Geophys. Res.,* 112. [6] Smith, P. H. et al. (2009) *Science*, **325**, 58. [7] Stoker, C. et al. (2009) *J. Geophys. Res.,* in press.

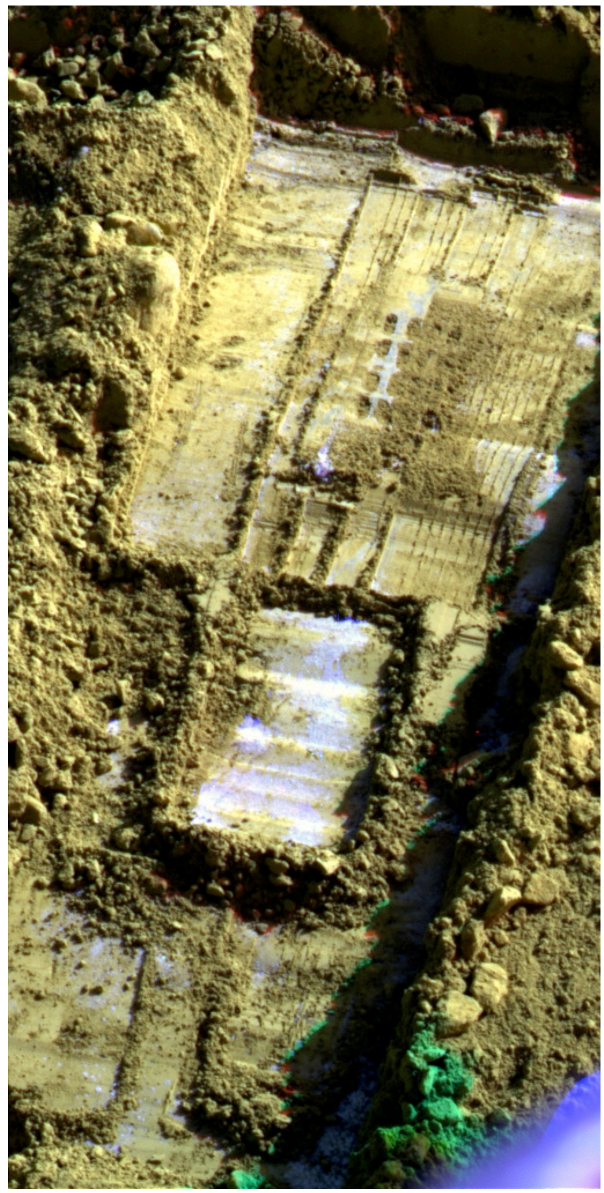

Figure 1. A false color image taken at 9 am LST on sol 118 showing the formation of frost at the bottom of a trench.