SUMMARY OF RESULTS FROM THE MARS PHOENIX LANDER'S THERMAL EVOLVED GAS ANALYZER. B. Sutter[1], D.W. Ming[2], W. V. Boynton[3] P B. Niles[2], J. Hoffman[4], H. V. Lauer[5], and D. C. Golden[6] [1]Jacobs/ESCG, Houston TX, 77058, *brad.sutter-2@nasa.gov*. [2]NASA Johnson Space Center, Houston, TX 77058. [3]University of Arizona, Tucson, AZ 85721 [4] Department of Physics, University of Texas at Dallas, Richardson, TX 75083 [5]ESCG/Barrios Tech., Houston, TX 77058. [6]ESCG/Hamilton Sundstrand, Houston, TX 77058.

Introduction: The Mars Phoenix Scout Mission with its diverse instrument suite successfully examined several soils on the Northern plains of Mars. The Thermal and Evolved Gas Analyzer (TEGA) was employed to detect evolved volatiles and organic and inorganic materials by coupling a differential scanning calorimeter (DSC) with a magnetic-sector mass spectrometer (MS) that can detect masses in the 2 to 140 dalton range [1]. Five Martian soils were individually heated to 1000°C in the DSC ovens where evolved gases from mineral decompostion products were examined with the MS. TEGA's DSC has the capability to detect endothermic and exothermic reactions during heating that are characteristic of minerals present in the Martian soil.

The EGA detected water in the Phoenix soil. There was a low temperature water release beginning at 295°C that gradually rose to 735°C which was followed by a higher temperature water release [2] (Fig. 1). The initial water release could be attributed decomposition of hydrous carbonate or sulfate phases (e.g., hydrous magnesite, jarosite) or dehydroxylation of Fe-oxyhydroxides or phyllosilicates. The higher temperature water release could be attributed to dehydroxylation of phyllosilicates or serpentine or other rock forming minerals [2].

The higher temperture data indicated the presence an endothermic peak with an onset temperature at 730°C with corresponding CO_2 release. The most logical candidate material that exhibits these properties at this high temperature is calcite ($CaCO_3 \rightarrow CaO + CO_2$) [3]. TEGA enthalpy determinations suggest that calcite, may occur in the Martian soil in concentrations of ~3 to 5 wt.% [3]

One of the main goals of the TEGA instrument was to detect the presence of organics in the Martian soil. Unfortunately no organic fragments were detected by TEGA's mass spectrometer. The Wet Chemistry Laboratory (WCL) did detect perchlorate in the soil [4]. TEGA's MS detected a mass 32 peak between 325 and 625°C in the soil Baby Bear which was presumed to be oxygen (O_2) derived from perchlorate decomposition [4]. Organics if present would decompose at these same temperatues and would unfortunately be oxidized to CO_2 by the O_2 [5] The Phoenix soil exhibited a low temperture (200 to 600) CO_2 release which could be attributed to oxidized organic material, decomposiotn of Fe- or Mg-carbonates, and/or desorption of adsorbed CO_2 [3].

The Phoenix Lander TEGA instrument detected water at temperatures that may indicate the presence of phyllosilictes, Fe-oxyhydroxides, and possibly hydrous carbonates, and/or hydrous sulfates. TEGA along with WCL detected calcite with a high degree of confidence. O_2 release from perchlorate decomposition may be why organics were not detected by the Viking GC/MS [5]. The release of O_2 from perchlorate decomposition will have implications on how future misstions will conduct the search for organics on Mars. If perchlorates are ubiquidous on Mars and if organic detection techniques require heating then leaching of the soil will be required to remove soluble perchlorate. Solution techniques (e.g., super critical water extraction) [6] that extract organics without heating may provid an alternative way to obtain organics for analysis without organic destruction.

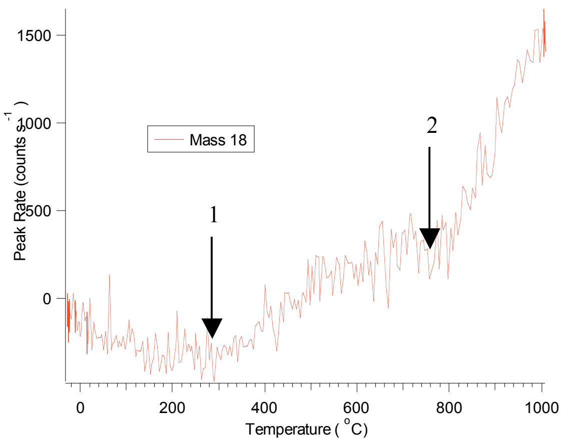

Fig. 1. Water release from the Phoenix surface soil, Baby Bear. Initial release occurred at 295°C (arrow 1) followed by significant water release at 735°C (arrow 2).

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