THE 2008 MARS PHOENIX LANDER THERMAL AND EVOLVED GAS ANALYZER (TEGA) DATASET: PLACING EASILY INTERPRETABLE EVOLVED GAS DATA ON THE PLANETARY DATA SYSTEM (PDS). A. H. Garcia[1,2], B. Sutter[1], P.D. Archer[1], P.B. Niles[3], T.C Stein[4], W.V. Boynton[5], D. Hamara[5]. [1]Jacobs, NASA Johnson Space Center, Houston, TX (brad.sutter@nasa.gov), [2]Idaho State Univ., Pocatello, ID, [3]NASA Johnson Space Center, Houston, TX, [4]Washington Univ. St. Louis, MO, [5]Univ. of Arizona, Tucson, AZ.

Introduction: The Phoenix Scout Lander mission investigated the north polar region of Mars in 2008 with the goal to study the history of water, assess the past/present martian climate, search for organics, and evaluate the potential for past/present microbial habitability on Mars [1-4]. To accomplish this goal, the Phoenix Lander's Thermal and Evolved-Gas Analyzer (TEGA) instrument assessed the gas composition of the martian atmosphere and evaluated the mineralogy of the martian regolith.

The TEGA instrument consisted of eight small ovens connected to a 4 channel magnetic sector mass spectrometer [5]. The ovens heated soil samples from ambient to 1000°C [1] where the gases (e.g., H_2O, CO_2, etc.) evolved from thermal decomposition of mineral phases were analyzed by the mass spectrometer. Minerals thermally decomposed at characteristic temperatures and the evolving gases indicated the presence of perchlorate, carbonate, and hydrated phases in the Phoenix landing site soils [1-4,6-7].

Problem: The Planetary Data System (PDS), unfortunately possesses TEGA evolved gas data that requires substantial further processing to be interpretable by the non-TEGA expert. The goal of this work was to provide the meaningful evolved gas data to the PDS so interested researchers could easily evaluate the evolved gas data without any further processing. The objectives of this work were to: 1) provide interpretable TEGA evolved gas data to the PDS 2) describe how the evolved gas data was processed 3) indicate what masses were measured for all samples.

The TEGA evolved gas measurements consist of 5 to 7 points of selected masses acquired as function of time (e.g., Fig 1 (blue +)). The 5 to 7 points were collected over a very short time frame (100s µs) and collected repeatedly because of the imprecise mass spectrometer tuning. This imprecision meant that TEGA was unable to consistently collect mass peak maximums at a predetermined voltage (Fig. 1). This is an issue for the general user because the user only needs the most intense point (not 5 to 7 points) or the mass peak maximum versus time to evaluate the evolved gas data (e.g., Fig. 1 (orange •)).

Solution: This work provided to the PDS single data (counts/s) points versus time for all collected masses (e.g., Fig. 1 (orange •)). The optimized points were derived from each set of 5 or 7 points via mathematic fitting functions (e.g., Gaussian). For example, in Fig.1b one optimized point (orange •) was calculated from 7 points (blue +) by using a fit function (green --). This was repeated for the next set of 5 or 7 data points until a single data point versus time was produced over the entire time frame for each analyzed mass (orange •, Fig 1a). The details of the coefficient values and equations used to initiate the optimized point calculation will become available for each selected mass on the PDS.

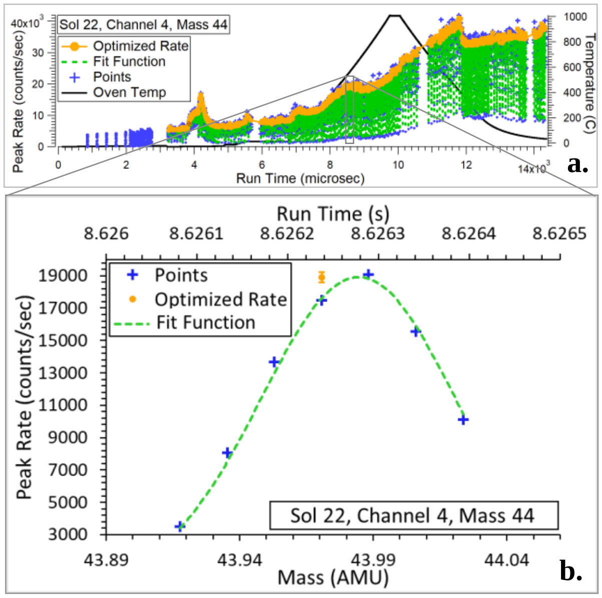

Figure 1. a) *Evolved CO_2 (m/z44) 5 or 7 –let data points (blue +) versus time from the Baby Bear soil acquired on sol 22 by channel 4 of the TEGA mass spectrometer. The bell curve function fitted to the collected mass 44 data (green ---), and the final optimized point (orange •) are indicated.* ***b)*** *An individual 7-let data (blue +) set highlighting the nature of peak fitting (green ---) required to calculate the single data point (orange •) versus experiment time.*

Another goal of this work was to indicate what masses were measured for a particular sample. Table 1 illustrates how this information will be presented on the PDS which, will allow users to quickly identify what masses were evaluated by TEGA for a particular sol. The green boxes indicate point values mostly greater than 25 counts/s which could yield useful data. Yellow boxes indicate point values less than 25 counts/s suggesting data may be questionable. Red boxes indicate

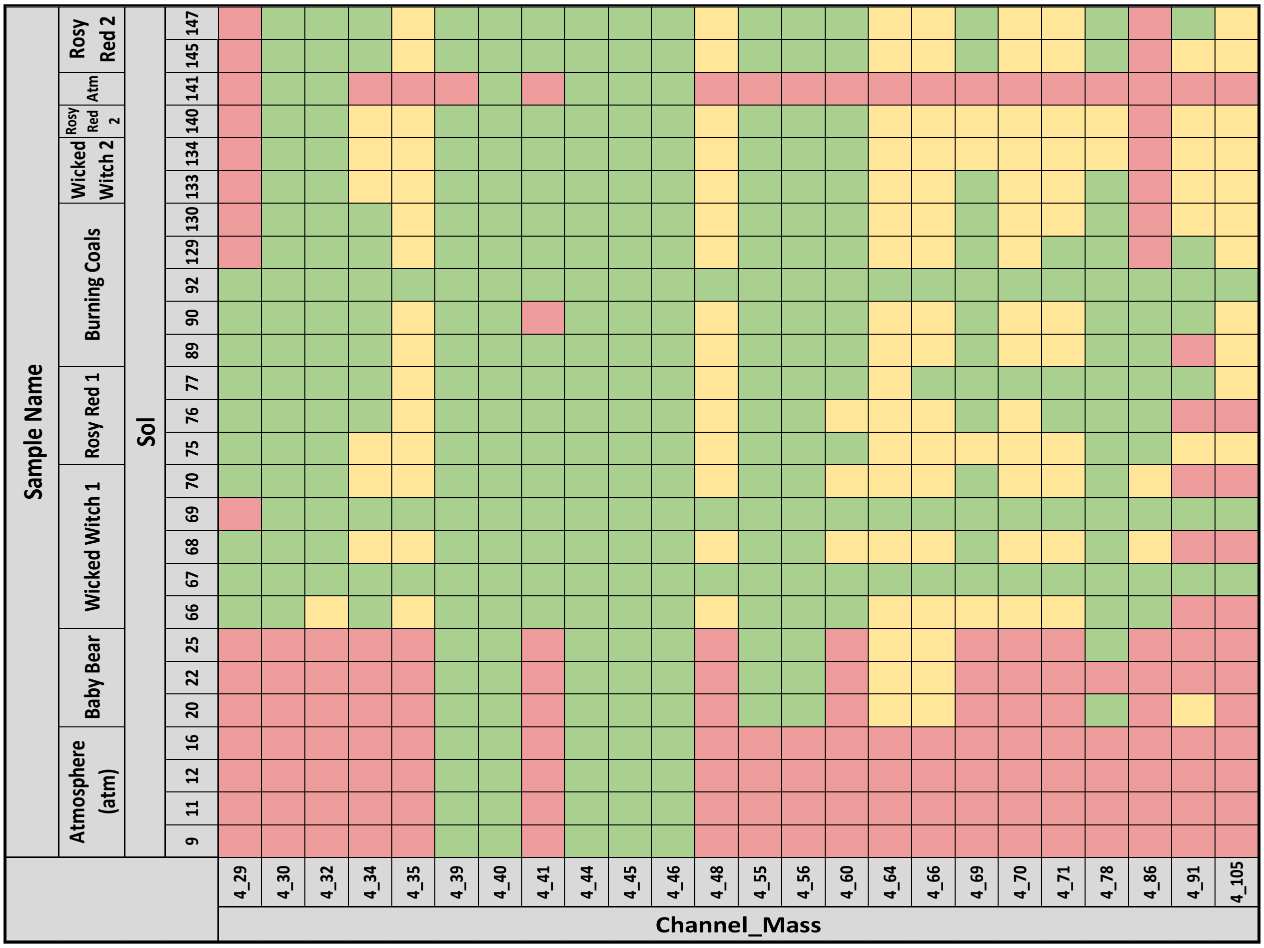

Table 1. *Description of atmospheric and soil evolved gas mass data collected on TEGA channel 4 during the Phoenix Mission. Data from channels 1, 2, and 3 will also be available. Green boxes indicate point values greater than 25 counts/s. Yellow boxes indicate point values less than 25 counts/s. Red boxes indicate that no 5 or 7-let data was collected and therefore no rate data was calculated.*

that no 5 or 7-let data was collected and therefore no rate data was calculated. This categorization is meant as rough guide and the perceived data quality will ultimately need to be determined by the user.

Conclusion: This work will result in an atmospheric/soil TEGA evolved gas data set placed on the PDS that the non-TEGA expert can begin to evaluate. The optimized data was based on calculations carried out by multiple TEGA team members and likely represents the highest quality data that could be derived from the raw TEGA data. This data set will be accompanied on the PDS by a tutorial document that describes the optimized point calculations and the files that contain the coefficient values and equations used to initiate the optimized point calculation. This will allow the interested users to modify calculations in order to reprocess raw TEGA data where they see fit. Furthermore, the PDS will contain a comprehensive table to facilitate rapid identification of masses and their corresponding sample that were measured by TEGA during the mission (e.g. Table 1).

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References: [1] Boynton et al. (2009) *Science, 325,* 61. [2] Smith et al. (2009) *Science, 325*, 58. [3] Hecht et al. (2009) *Science, 325*, 64. [4] Niles et al. (2010) *Science*, *329*, 1334. [5] Hoffman J. H. et al. (2008) *J Am Soc Mass Spectrom, 19*. [6] Cannon et al. (2012) *GRL*, *39*. [7] Sutter et al. (2012) *Icarus 218*, 290.