Fractional Vaporization of Hot Earth-like Exoplanets.

L. Schaefer and B. Fegley, Jr. Planetary Chemistry Laboratory, Department of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130. laura_s@wustl.edu, bfegley@wustl.edu.

Introduction: We discussed atmospheric chemistry of Earth-like exoplanets as a function of surface temperature (> 1500 K) in [1]. This work was inspired by the detection of an exoplanet (CoRot-exo-7b), which is very close to its star. This implies a T_{surf} of 1800 – 2600 K at the substellar point [2]. At these temperatures, the atmosphere is composed of rock-forming elements. The atmosphere generated on the day-side may be transported to the much cooler night-side and condensed, or perhaps be lost altogether.

Methods: We used the MAGMA code to model isothermal fractional vaporization of a silicate planet. Fractional vaporization occurs when vapor is continuously removed from the system, which simulates the transport from day to night on CoRot-exo-7b. The MAGMA code is described and validated against experimental studies in [3]. We discuss below results for the bulk silicate Earth (BSE) at 2200 K, shown in Fig. 1.

Results: The initial vapor is composed of Na gas, with O_2, monatomic O, and SiO gas. Sodium is completely lost at ~2.5% total vaporization. Then, SiO becomes the major gas. Magnesium gas becomes more abundant than SiO at ~28% vaporization. Silicon and Mg are lost at ~91-93% vaporization. Monatomic oxygen becomes the most abundant vapor species, followed by Ca and Al-bearing gases.

The total atmospheric pressure drops as fractional vaporization increases. When Na is present, $P_T \sim 10^{-3}$ bar. After Na is lost, $P_T \sim 10^{-4}$ bar, and decreases only slightly until Si and Mg are lost. Above 95% vaporization, P_T drops to $\sim 10^{-6.5}$ bar

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References: [1] Fegley, Jr., B. and Schaefer, L. 2009, *Meteoritics & Planetary Science*, this conference. [2] Léger, A. and 148 colleagues. 2009. *Astronomy & Astrophysics*, submitted. [3] Schaefer, L. and Fegley, Jr., B. 2004. *Icarus*, 169:216-241.

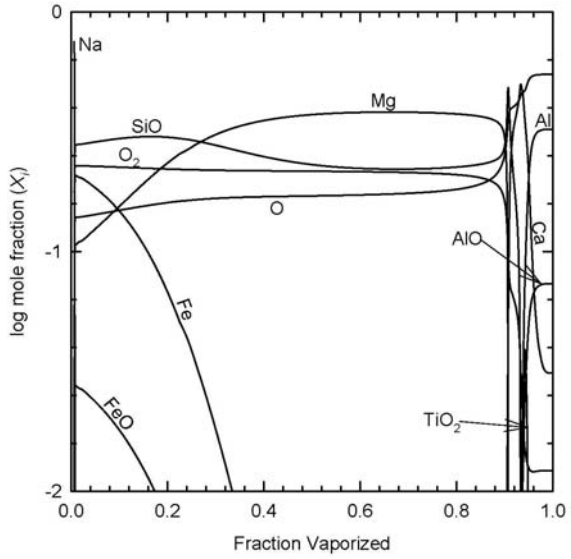

Fig. 1. Fractional vaporization of the BSE at 2200 K.