# Chemical equilibrium models of the redox state of Earth's earliest atmosphere

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The Earth's present day atmosphere is the product of secondary outgassing of accreted volatiles and impact degassing of planetesimals. The Earth can be modeled as a mixture of primitive materials, such as carbonaceous (C), ordinary (O), or enstatite (E) chondrites. In previous work, we calculated the composition of the outgassed atmospheres of large planetesimals and the early Earth [1,2] and the impact-degassed atmospheres [3] of these primitive materials. We found that outgassing of O-chondrites produces a reducing atmosphere rich in $CH_4$ (see Fig. 1) [1,2]. In contrast, impact degassing of C-chondrites produces oxidized, water- & $CO_2$-rich atmospheres, whereas impact degassing of O- & E-chondrites produced $H_2$-rich atmospheres with large amounts of CO and water vapor [3]. Here, we will further explore the oxidation states of these atmospheres. We will explore the effect of a range of temperatures and pressures on the results.

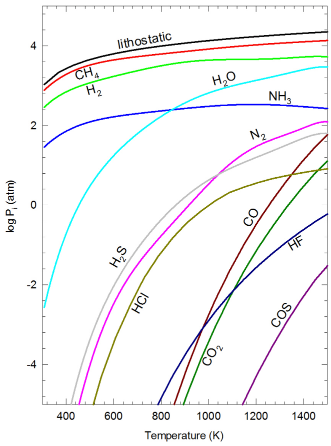


**Fig. 1**. Outgassed atmosphere from an Earth-like planet composed of ordinary chondritic material. From [4]

[1] Schaefer, L. and Fegley, B., Jr. (2005) *BAAS*, **37**, 67. [2] Schaefer, L. and Fegley, B., Jr. (2007). *Icarus*, **186**, 462-483. [3] Schaefer, L. and Fegley, B. Jr. (2010) *Icarus*, **208**, 438-448. [4] Fegley, B., Jr., and L. Schaefer, L. (2013) *Treatise on Geochemistry*, 2nd ed, Ch. 6.3.