Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10267

Experimental Determination of H_2 Solubility in Primitive Melts

KARA BRUGMAN[1], ANAT SHAHAR[2], JAMES BADRO[3] AND GEORGE CODY[2]

[1]Earth & Planets Laboratory, Carnegie
[2]Carnegie Institution for Science
[3]Institut de Physique du Globe de Paris, Université Paris Cité, CNRS

Presenting Author: kbrugman@carnegiescience.edu

Exoplanet science is a flourishing field. Imminent new data from telescopes such as JWST require the development of models to interpret these data. Geochemical models, however, that are applied to exoplanets are based on Earth's chemistry and petrological relationships, many of which are still not well understood. Models of how solid planets and their atmospheres evolve depend on the solubility of volatile species in molten rock. But, studies of reduced volatiles in magma are not common. H_2 is the most abundant species in primary (nebula-derived) planetary atmospheres, which may be in direct contact with primitive magma oceans for extended durations of time [1]. The degree to which H_2 could be ingassed to, or degassed from, a magma ocean is important because this allocation sets the internal water budget of the planet and can affect future melting behavior and habitability. An increase in mantle H_2 may also lead to more H partitioned into the planet's metallic core.

Here we present the results of H_2 solubility experiments performed at high and near-ambient pressures. Previous work determined the solubility of H_2 in andesitic and basaltic compositions [2]; we extend this data to primitive and pyrolitic silicate compositions at multiple pressures and temperatures. Preliminary data suggest that H_2 is more soluble than previously suggested at all conditions currently probed. Implications of these data will be presented.

[1] Owen et al. (2020), *SpSciRev*, 216 (129).
[2] Hirschmann et al. (2012), *EPSL*, 345–348, 38–48.