Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10952

Volatility of halogens during accretion of the telluric planets

LORRAINE RUZIE-HAMILTON[1], ANDREW MATZEN[2], PATRICIA CLAY[1], BERNARD J WOOD[2] AND RAY BURGESS[1]

[1]University of Manchester
[2]University of Oxford
Presenting Author: lorraine.ruzie@manchester.ac.uk

The present day highly volatile element (carbon, nitrogen, halogen, noble gas) distribution between the interior of the telluric planets and their exosphere reflects the integrated history of accretion and interaction between their different reservoirs [1]. Compositional heterogeneities of these elements in their respective mantle as well as their overall depletion [2] are difficult to reconcile with known accretionary or exosphere endmember sources. The process that caused these depletions is unclear: were volatiles added late in accretion to a largely volatile-free body [3] or was the process of partial melting and vaporization on proto-planets responsible for the depletion of volatile elements observed on the Earth [4]?

To look at this question we will compare our primitive halogen estimates with factors controlling their loss and retention during accretionary processes [5,6]. We are measuring the volatile behaviour of Cl, Br, and I by using the neutron irradiation noble gas mass spectrometry (NI-NGMS) method [7] from a silicate melt at fixed temperature and oxygen fugacity. Two types of experiments were performed in a one-atmosphere furnace: traditional wire-loop experiments (where a small bead of silicate melt is suspended on a platinum wire loop), and experiments where a crucible of melt was constantly stirred, thereby minimizing the role of diffusion. These mimic conditions relevant to accretion and global magma oceans on planetary surfaces during early stages of planet formation.

[1] Halliday, A. (2013) *Geochimica et Cosmochimica Acta* 105, 146-171 ; Dreibus G. and Wanke H. (1987), *Icarus* 71, 225-240; [3] Schönbächler M., Carlson R. W., Horan M. F., Mock T. D., and Hauri E. H. (2010), *Science* 328(5980), 884-887; [4] Norris C. A. and Wood B. J. (2017), *Nature* 549, 507-510; [5] Clay P. L., Burgess R., Busemann H., Ruzié-Hamilton L., Joachim B., Day J. M. D., and Ballentine C. J. (2017), *Nature* 551(7682), 614-618; [6] Clay, P. L., Joy, K. H., O'Driscoll, B., Busemann, H., Ruzié-Hamilton, L., Burgess, R., .Ballentine, C. J. (2020), *American Mineralogist, 105*(3), 289-306. [7] Ruzié-Hamilton, L., Clay, P. L., Burgess, R., Joachim, B., Ballentine, C. J., & Turner, G. (2016), *Chemical Geology*, 437C, 77-87.