Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12474

Early magmatic evolution in the Angrite Parent Body: constraints from high-pressure phase equilibrium experiments.

SUSANA HOYOS AND TIMOTHY GROVE

Massachusetts Institute of Technology

Presenting Author: shoyos@mit.edu

Angrite meteorites are a small subgroup of basaltic achondrites characterized as mildly silica undersaturated, with unusually high Ca and Al contents [1]. The Angrite Parent Body (APB) may have been comparable in size to Vesta as it had a core dynamo [2], providing evidence of asteroid interior differentiation ~4.5 billion years ago, in the early stages of the Solar System [1,3]. The differentiation on the APB occurred at much lower gravity; was driven by early, intense heat sources; and operated over more reducing conditions [1,4] than in today's Earth interior. Nevertheless, the genesis of angrites is not well understood partly because of the small number of specimens available and their significant chemical variation. Our experimental study aims to constraint the petrogenesis of an MgO-rich group of angrites (Asuka881371, LEW87051, NWA1670 [5]) that possibly represents primary igneous activity produced by melting in the APB mantle.

We used a series of melting experiments conducted on two angrite primary compositions to constrain the oxygen fugacity (O2), temperature, extent of melting, and phase equilibrium conditions of this subset of plutonic angrites. Our preliminary results indicate that one group of angrites experienced crustal level Ol-Plag-Cpx fractional crystallization. We determined the near-liquidus phase relations and petrogenesis of the MgO-rich quench angrites by carrying out experiments over 2.4 GPa and >1350°C with an O2 similar to that calculated for LEW86010 (~IW+1, [4]). The melting conditions of this group of samples may represent an end member in our understanding of largescale igneous processes in the early Solar System. Using our experimental data, we will provide new estimations on the minimum size of the APB based on our temperature-pressure melting relations.

[1] Keil, K., (2012) Chemie der Erde, 72, 191-218. [2] Weiss, B.P. et al. (2008) Science, 322, 713-716. [3] Amelin, Y. (2008)GCA, 72,221-232. [4] Mckay, G. et al. (1994) GCA, 58, 2911-2919. [5] Tissot, F.L. H. et al. (2018) LPSC #2083