Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18688

Solubility of PGE in a Sodium Silicate Fluid

JACOB HUFFAKER[1], QI CHEN[1] AND CRAIG LUNDSTROM[2]

[1]University of Illinois - Urbana Champaign
[2]University of Illinois, USA

Presenting Author: Jacobwh3@illinois.edu

Platinum group elements (PGE), Platinum, Palladium, Ruthenium, Rhodium, Iridium, and Osmium, are vital in today's economy for their catalytic properties, high melting points, and corrosion resistance. While crustal concentrations of Pt are ~ 0.5 ppb, economic deposits of PGE in sulfide seams <1m thick (called PGE reefs) can have Pt concentrations up to 10 ppm. How these layers form in layered mafic intrusions remains debated. Commonly proposed ideas to explain formation process involve sulfide settling, magmatic mixing models, and secondary fluid models.

We have undertaken experiments exploring the possibility of PGE enrichment and concentration by low temperature water rich alkali silicate liquids. We ran experiments at a range of temperatures from 550°C - 760°C and 1 kbar pressure in a rapid quench cold seal system. Experiments were loaded in layers with 10mg of hydrous sodium disilicate, a 50/50 mixture of quartz and albite totaling ~ 10mg and ~0.5mg of Pt or Pd (as either oxides or chlorides). Initial experiments were run in gold capsules with intrinsic fO2 near Ni-NiO. We are currently running double capsule experiments buffered at Ru-RuO2 and MnO-MnO2. All experiments were weighed before and after a run to ensure capsule integrity. Experiments were mounted in epoxy and polished to reveal the glass layer juxtaposed with crystals including residual PGE sources. Major elements were analyzed using SEM while PGEs were measured using LA-ICP-MS to determine solubilities. These same capsules were analyzed for XANES and EXAFS at the Advanced Photon Source (APS) at Argonne National Laboratory to determine valence and nearest neighbor bonding. The Ni-NiO experiments yielded variably homogeneous Pt and Pd distributions with concentrations in the 10s of ppm in glass. XANES indicated these solubilities were for dominantly zero valent PGE. We will report PGE solubilities for new experiments under more oxidized double capsule conditions as well as for the effect of increasing Cl concentrations to better constrain possible transport and deposition of PGE.