

## Copper diffusion in basaltic melts

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As an important source of world's Cu, Ni and PGE, magmatic sulfide deposits form by the oversaturation and separation of sulfide liquid from the host mafic/ultramafic magma. The sulfide drops sink in the magma chamber, scavenging chalcophile elements from surrounding silicate melts<sup>[1]</sup>. During this process, the ability of sulfide liquid to scavenge ore elements such as Cu is largely controlled by the diffusivity of Cu. However, no copper diffusion data are available at all in the literature. In this study, diffusion experiments have been carried out to study copper diffusion in basaltic melts.

Diffusion couple experiments were carried out at 1 GPa and 0.5 GPa through a temperature range from 1300°C to 1500°C in a piston-cylinder apparatus. The couple contained two dry glass cylinders juxtaposed together, one with ~100 ppm Cu and the other with ~1100 ppm Cu, both synthesized and having similar major element composition as the Etna basalt. Diffusion profiles in the quenched products were analyzed using an electron microprobe, with a 15 kV, 40 nA point beam, and a counting time of 240 s by three spectrometers at the same time.

Our preliminary results show that Cu diffusivity in basaltic melt is very high with small activation energy, similar to Na diffusivity in basaltic melt, 5-10 times that of Co<sup>[2]</sup> in 1-bar basaltic melt, and 10-40 times that of S in the similar Etna melt<sup>[3]</sup>. The rapid diffusion of Cu implies that incorporation of Cu in sulfide droplets is not kinetically limited. The large difference between diffusivities of Cu and other heavy metal elements may indicate a potential way to kinetically fractionate Cu from other metal elements (such as Au, Ni, PGE etc.).

[1] Naldrett, A. J. (2004). Springer. [2] Zhang, Y., Ni, H., & Chen, Y. (2010). *Reviews in Mineralogy and Geochemistry*, **72** (1), 311-408. [3] Freda, C., Baker, D. R., & Scarlato, P. (2005). *Geochimica et cosmochimica acta*, **69** (21), 5061-5069.