CO_2-fluxing crashes metal mobility in magmatic vapour

VINCENT J. VAN HINSBERG[1]*, KIM BERLO[1,2] AND ART. A MIGDISOV[1]

[1]Department of Earth and Planetary Sciences, McGill University, Montréal, Canada. (* correspondence: V.J.vanHinsberg@gmx.net; Artas65@gmail.com)

[2]Department of Earth Sciences, University of Oxford, Oxford, United Kingdom. (Kim_Berlo@inbox.com)

Magmatic systems host many types of ore deposits, including world-class deposits of copper and gold. It is now generally accepted that magmas are the source of metals and ore-forming fluids, although in some cases their input may be restricted to introducing thermal disturbances and associated hydrothermal circulation. In these magmatic-hydrothermal systems, low-density solutions, or vapours, are an important carrier of metals. Such vapours are water-dominated at low pressure, but CO_2 becomes a progressevely important conponent in vapours exsolved from magma at depth, especially for mafic magmas. Fluxing of these CO_2-rich vapours through the more shallow parts of the magmatic-hydrothermal plumbing system is now recognized as ubiquitous during open-system magma degassing.

In this contribution, we show that such CO_2-fluxing leads to a dramatic drop in element solubility in the previously water-dominated vapour, up to a factor of 10,000 for Cu. This drop in metal solubility far exceeds that which would be predicted for the temperature and pressure gradients expected in magmatic-hydrothermal systems. CO_2-fluxing thus represents a highly efficient, but as of yet unrecognised mechanism for metal deposition in magmas and host rocks.