EGU23-15216, updated on 21 Feb 2024
https://doi.org/10.5194/egusphere-egu23-15216
EGU General Assembly 2023

Trace element transport processes in volcanic gases

Celine Mandon[1] and Andri Stefansson[2]
[1]Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland, Reykjavik, Iceland (celine@hi.is)
[2]Faculty of Earth Sciences, University of Iceland, Reykjavik, Iceland (as@hi.is)

Despite our perception of gold as a shiny precious metal, a small amount of gold is actually transported by magmatic gases and emitted in the atmosphere at most volcanoes on Earth. This gaseous transport is made possible by the very nature of volcanic gases: high-temperature non-ideal water vapor-dominated mixture of gases, also containing other major constituents such as sulfur, carbon dioxide and halogens. This combination allows for volatile transport of virtually all elements from the periodic table, through the formation of gaseous compounds between trace elements and major gas species. However, the complexity of volcanic gases also makes them difficult to apprehend; little is known on the solubility and behavior of trace elements. Moreover, the gas composition varies from one volcano to another, while changes in pressure and temperature occur between gas exsolution from the magma and emission at the surface. Interactions between the gas phase and surrounding rocks and fluids can furthermore affect volcanic gases on their way to the surface. In this work, we explore the transport processes controlling the abundance of trace elements in volcanic gases. We use major and trace element composition from fumarolic gases from Vulcano, Italy sampled over a 14-year period and during both background emissions and unrest. We also work with a compilation of high-temperature gas compositions, from fumaroles and volcanic plumes, from various tectonic settings. This data is then used for thermochemical calculations using the HSC Chemistry software. We will explore the factors that affect the trace element transport in volcanic gases, such as 1) cooling of the gas from the exsolution temperature to the emission temperature at the surface, 2) pressure decrease from the depth of exsolution to atmospheric pressure, 3) composition of the gas and therefore ligand availability, 4) transport rate and its effect on mineral deposition from the gas.