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Sources of fluids and metals in the Krafla-Bjarnarflag magmato-hydrothermal system, NE Iceland

JÚLIA MATTIOLI ROLIM[1,2], PROF. DANIELE L. PINTI, PHD[3], KIM BERLO[4], ÁSGERÐUR K. SIGURÐARDÓTTIR[5] AND HELGI A. ALFREDSSON[6]

[1]GEOTOP & Université du Québec à Montréal
[2]Université du Québec à Montréal
[3]Geotop & Université du Québec à Montréal
[4]Geotop Research Centre, McGill University
[5]Landsvirkjun
[6]Geochemý Ltd.

Presenting Author: julia.mattioli8@gmail.com

Magmatic-hydrothermal fluids play a fundamental role in the formation of mineral deposits. These fluids are generated in the presence of magmas and are enriched in metals, the sources of which are still debated: exsolved from the magma itself or extracted by crustal rocks. To discriminate between these two sources, a clear picture of the fluid sources and circulation is needed. This project aims to investigate the origin of metals in the magmatic-hydrothermal system of Krafla, located NE Iceland, within the mid-ocean ridge. Krafla present bimodal (basaltic-rhyolitic) magmatic activity and shows a complex fluid circulation system. The sources of the fluids are constrained by using a multi-isotopic approach including $\delta^{18}O$, $\delta^{2}H$, $^{87}Sr/^{86}Sr$ and noble gas isotopes, sampled in 15 wells from Krafla and 3 from the nearby Bjarnarflag (Námafjall) fields. Raw $\delta^{2}H$ and $\delta^{18}O$ data from the wells range from -87.4 to –100.3‰ and -14.8 to -11.0‰ for Krafla, respectively, while Bjarnarflag fluids show more depleted values from -97.7 to 110.0‰ and -9.8 to -13.8‰, respectively. These values are within those of the present-day local and the southern Highlands recharges. The $^{87}Sr/^{86}Sr$ ratios from Krafla and Bjarnarflag are similar and range from 0.70315 to 0.70391 close to ones expected from interaction of fluids with local MORBs and rhyolites [1]. Wells K-38 and K-24 show higher values of 0.70436 and 0.70827, respectively. These high values could indicate the presence of seawater or seawater aerosols transported by glacial water from the southern Highlands, as suggested for the nearby Theistareykir field [1]. The $^{3}He/^{4}He$ ratios from K-20, K-21, K-34 and K-36, BJ-11 and BJ-12, normalized to the ratio of the atmosphere (Ra) and corrected for air component (Rc/Ra) ranges from 9.25 to 10.52. These values are higher than those of the depleted MORB-type mantle (7-9 Ra) suggesting a small contamination from the Icelandic mantle plume source, as in the nearby Theistareykir [2].

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