

## **Fractional degassing of trace elements during lava emplacement at Holuhraun, Bárðarbunga, Iceland**

**OLGEIR SIGMARSSON**

CNRS, Science Institut, University of Iceland

Presenting Author: [o.sigmarsson@opgc.fr](mailto:o.sigmarsson@opgc.fr)

Syn- and post-eruptive gas, emitted during the 2014-2015 Holuhraun basaltic fissure eruption, Iceland, and ten days after its termination, is of different composition. The syn-eruptive gas contributed approximately 10 Tg of SO<sub>2</sub>, little Cl and negligible F to the atmosphere (e.g. Gauthier et al., 2016, Bali et al., 2018). The post-eruptive gas phase has much lower S/Cl, S/F and Cl/F that is readily explained by progressive fractional degassing mechanism (Sigmarsson et al., 2020). Gauthier et al. (2016) observed elevated concentrations of several metal and metalloids in the syn-eruptive gas phase, which are known to be mobilized as sulphides (Edmonds et al., 2018) but the late volatilisation and degassing of halides led to enhanced element volatilities, especially as fluoride species. The halogen degassing after an eruption has ended and during the lava crystallization together with that of residual sulphur will thus generate haze enriched in metal-metalloid halogen and sulphide compounds all around and above the lava field.

Late degassing of the lava field produced by the Laki eruption (1783-84 CE) generated toxic haze that caused elimination of 1/5 of the Icelandic population and approximately 3/4 of the grazing animals. Sulphur haze around the lava field from late stage degassing corresponds to 1/5 of the total outgassing S (Thordarson et al., 1996). Toxic metal or metalloid vapour is also likely to have occurred after the Laki eruption ceased as inferred from analysis of the post-eruptive gas phase at Holuhraun. The fissure eruption at Holuhraun is an interesting analogue for the Laki event given that 1/10 of the magma volume of Laki (15 km<sup>3</sup>) was emitted by the eruption at Holuhraun (1.5 km<sup>3</sup>) and same proportions have been estimated for the SO<sub>2</sub> outgassing (10 Tg at Holuhraun vs 120 Tg for the Laki Fires). Trace element analysis of the syn-eruptive gas at Holuhraun reveal abundant emission of toxic metals such as cadmium and arsenic whereas the later gas phase is loaded with heavy metals and metalloides. Post-eruptive degassing of halogens thus amplifies emission of toxic elements.