

Multi-disciplinary approaches to studying volcanic plumbing systems – a Nordic case study

STEFFI BURCHARDT¹, VALENTIN TROLL¹, FRANCES DEEGAN¹, HARRI GEIGER¹,
TOBIAS MATTSSON¹, OLIVIER GALLAND²

¹ CEMPEG, Department of Earth Sciences, Uppsala University, Villavägen 16, 75236 Uppsala, Sweden

² PGP, Geosciences, University of Oslo, Sem Selandervei 24, Blindern, 0316 Oslo, Norway

Magma transport and storage in volcanically active regions involves a multitude of complexly interacting physical and chemical processes. The study of magma channels and reservoirs, so-called volcanic plumbing systems, is therefore intrinsically multidisciplinary, commonly involving e.g. igneous petrology, volcano seismology and geodesy, and volcano-tectonics. Unfortunately, research efforts traditionally remain within disciplinary boundaries, which has thus far hindered a more holistic understanding of processes in active volcanoes.

In order to overcome these traditional boundaries and facilitate multi-disciplinary research, it is essential to be aware of the capabilities and limitations of individual approaches. Here we give an overview of the most common methods in volcanic plumbing system research and discuss how these can be combined to complement each other, using the 2014-2015 Holuhraun eruption on Iceland as an example. We also highlight the potential for closer Nordic collaboration in the future.

The recent fissure eruption was well monitored with geodetic and geophysical methods that indicated shallow magma storage beneath, and lateral magma transport from, the neighbouring Bárðarbunga volcano (Riel et al., 2015; Sigmundsson et al., 2015). We investigated the link between Bardarbunga and Holuhraun through mineral textures, thermobarometry, and major-, trace element-, and oxygen isotope geochemistry of the Holuhraun lavas. Combined with existing geophysical data, our results support a model of initial vertical magma ascent within the Bárðarbunga plumbing system followed by lateral transport of aggregated magma batches to the Holuhraun eruption site.

References:

- Riel, B., et al. (2015). The collapse of Bárðarbunga caldera, Iceland. *Geophysical Journal International*, **202**, 446-453, doi: 10.1093/gji/ggv157.
- Sigmundsson, F., et al. (2015). Segmented lateral dyke growth in a rifting event at Bárðarbunga volcanic system, Iceland. *Nature*, **517**, 191-195, doi:10.1038/nature14111.