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Groundwater circulation between volcanic fissure systems evidenced by water stable isotopes

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The divergent boundary between the European and American plates in Iceland, generally called the Neovolcanic zone, is characterized by well defined volcanic systems, each consisting of a central volcano, fissure swarm and a high temperature hydrothermal activity.

Isotopic studies within the Northern part of the Neovolcanic zone, where five NNE striking left-stepping en echelon volcanic systems have been identified indicate both a very complex groundwater inflow and geological structure of the thermal areas.

The isotopic values of the thermal waters vary considerably both within and between systems. The fluids are a mixture of precipitation, either local or from far away, and older groundwater with a pre-Holocene component. Observed oxygen shift is highly variable from less than 1‰ to about 7‰.

On surface the volcanic systems and fissure swarms are very distinct and well separated. Groundwater flow is mainly fissure/fracture controlled and thus assumed to be only along the fissure swarms with little or no flow connection between the volcanic systems. However recent isotopic studies have shown some evidence that at depth the thermal water can flow from one volcanic fissure system to the next. This is in accordance with recent observations of a segmented dyke intrusion in one of the volcanic system (Bárdarbunga) that grew laterally for more than 45 km at a relatively shallow depth (5-8 km) and ended in an effusive fissure eruption within the nearby Askja volcanic system (Sigmundsson et al., 2015).

Isotopic data on the thermal waters within the Northern part of the Neovolcanic zone will be presented and fluid circulation within the volcanic systems constructed.