Noble gas and stable isotope characteristics of hydrothermal fluid system, Krafla, Iceland

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The Krafla geothermal field is located in the neovolcanic zone in north-eastern Iceland, which has become a hotspot research area because of its massive geothermal resources. In this project, 10 fluid samples were collected in 2014 from either naturally occurring geothermal sites in the Krafla region or from commercial boreholes owned by the local geothermal company, Landsvirkjun. Noble gas isotopes (He, Ne, Ar, Kr, Xe) are currently being measured in the subsurface fluid isotope lab at the Lancaster University using NGX multi-collector noble gas mass spectrometer manufactured by Isotopx. Stable isotopes are being analysed at the GIG-CAS. Preliminary results show mantle dominated $^{3}He/^{4}He$ ratio of ~9Ra (Ra=air $^{3}He/^{4}He$) in samples. While there is a significant crustal radiogenic ^{40}Ar contribution, $^{20}Ne/^{22}Ne$ and $^{21}Ne/^{22}Ne$ ratios are air-like. The aims of using a wide range of tracers (noble gas and stable isotope geochemical tools) are to (1) determine the origin and mixing processes of the fluids, i.e. magmatic fluids and surface derived fluids. (2) investigate the subsurface fluid flow paths, fluid circulation and the role of various fluid sources, as well as quantify fluid-rock interaction (3) assess how main physical processes, such as boiling, steam separation influence the characteristics of geochemical processes in Krafla geothermal field.

We will present models that describe evolution, process of geothermal system and interactions between magma chamber and Krafla geothermal system, which can provide more information for geothermal exploration.