Shallow Geothermal Energy System in Fractured Basalt; A Case Study From Kollafjørður, Faroe Islands, NE-Atlantic Ocean

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Summary

A shallow (≈200 m) geothermal energy system is examined in the Faroe Islands, a 60-million-year-old volcanic archipelago in the Northeast Atlantic. The geothermal water has a heating capacity of approximately 150 individual households and consists of meteoric water approximately 3 years old. Water temperatures as high as 27°C in artesian wells are explained by a topography-driven vertical convection. The water flows into the boreholes from the north-northwest through fractures and flow tops and bases in the basalt exposed in surrounding high terrains. Of six influx zones, three are water carrying fractures that strike N – S and dip E.

A shallow (≈200 m) abnormally warm geothermal energy system has been examined in the 60-million-year-old volcanic archipelago the Faroe Islands which is located on the north-western flank of the Euroasian continental plate. In the Lygnnes area water temperatures in three artesian geothermal wells as high as 27°C flowing with varying flow rates is likely to be explained by a topography-driven vertical convection. Here, meteoric water infiltrate the fractured basalt possible not more than 3 years old before being discharged. The system has a heating capacity of approximately 150 individual households, if fully utilized.

In order to try to understand the geothermal system a serie of geophysical logging tools were applied to measure the fluid and rock parameters in the boreholes. The logging tools were; a 3-arm Caliper, a gamma ray (GR), a guard resistivity, fluid temperature and conductivity, a fluid flow, an optical televiewer and a sonic velocity log.

The results showed that the water flows into the boreholes from the N-NW through fractures, flow tops and flow bases in the basalt. Of six main influx zones, three contain open fractures. Two of them have an aperture of 7 cm. All three open fractures strike N and dip E. An additional open fracture was found and strikes W dips N, but does not appear to be transmissive. Therefore, it is suggested that it is the N – S striking fractures that are the water carriers in the Lygnnes area. To understand the geology of the inflow zones, the most essential logging tools were found to be the fluid flow log and the optical televiewer.