Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37893

Hydrology of the Vaðlaheiði moor as revealed by the construction of a 7 km long road tunnel in N-Iceland

BJARNI GAUTASON[1], FINNBOGI ÓSKARSSON[2], VINCENT DROUIN[3], ÞORSTEINN EGILSON[2], BENEDIKT N BJARNASON[4], ANETT BLISCHKE[2] AND SIGURVEIG ÁRNADÓTTIR[5]

[1]University of Iceland
[2]Iceland GeoSurvey
[3]Icelandic Met Office
[4]Efla Consulting Engineers
[5]Norðurorka

The Vaðlaheiði moor separates the Eyjafjörður fjord from the Fnjóskadalur valley in North Iceland. The moor is flat-topped at an elevation of more than 600 m and elongated north-south, with steep western slopes and more gentle eastern slopes.

Construction of a 7 km long road tunnel through Vaðlaheiði commenced in 2013 and was completed in 2018. The construction encountered several challenges, some foreseen and others unexpected. During excavation from the west, rapidly rising bedrock temperatures were recorded, and several aquifers with modest flow of warm water were intersected. At roughly 2 km into the tunnel, an aquifer associated with a fault-breccia was intersected, delivering an estimated 350-400 L/s of hot water (~ 43°C) into the tunnel. Several smaller aquifers were subsequently intersected and the maximum bedrock temperature in the tunnel exceeded 60°C. Efforts to contain the hot water were partially successful, reducing the flow to ~80 L/s. A portion of this “excess” flow is now used for a health spa.

Excavation from the east intersected another fault breccia, which eventually collapsed into the tunnel, releasing substantial amounts of cold water with an initial flow of 500 L/s, which decreased over time. The flow was eventually contained and now represents a source of potable water.

The chemical and isotopic composition of the thermal water resembles that of geothermal waters exploited in the region, whereas the cold water resembles water from local mountain springs. Both are ultimately derived from precipitation. The geothermal system occurs stratigraphically below a relatively thick sedimentary horizon, whereas the cold-water resource was intersected above this horizon. The location of natural springs on the moor, groundwater level in boreholes, and notable ground deformation associated with fluid extraction on the east side, but not the west, all support a conceptual hydrological model where the sedimentary horizon acts as an aquitard that effectively separates two hydrological domains. This has implications for the exploration of low-temperature geothermal resources, suggesting that such systems may be completely masked by shallow cold groundwater flow.