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Volcanic sequences as reservoir rocks. Importance of natural fracture systems - a case study from the Faroe Islands area - North Atlantic Igneous Province (NAIP)

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Volcanic rocks have been known to be reservoirs for more than a century but due to their often complex geological settings, they are commonly avoided.

The North Atlantic Igneous Province (NAIP) is one of the largest igneous provinces in the world. Large ranges of rock types comprise the NAIP, including tholeiitic and alkali basalts, nepheline- and quartz-syenites, nephelinites and carbonatites. The province is Paleocene in age and covers large parts of the North Atlantic region today. Parts of the NAIP outcrop onshore the Faroe Islands, on the western and the eastern side of Greenland, on Iceland and on the British islands.

In the Faroe Islands region volcanic settings serve as shallow geothermal energy systems, shallow groundwater aquifers and hydrocarbon reservoirs. These settings have been studied by core data and wire-line logs and examples will be presented. The aim of this study is to examine the key important parameters governing the reservoir properties and occurrences.

In all settings microfractures are important as porosity and permeability enhancers and are often linked to lava emplacement pathways and specific lava types such as subaqueous hyaloclastites and pillow lavas.

Studies on water movement from onshore the Faroe Islands on the islands of Streymoy have shown that the water in the volcanic settings in the area is being transported through large fractures and weathered flow tops and bases. This has also been seen in e.g. similar large igneous volcanic provinces such as the Columbia River Basalt Group, USA, and the Deccan Traps, India. Six influx zones were identified in the three approximately 200 meter deep geothermal holes on Streymoy, the Faroe Islands. Three with visible macrofractures striking north-south dipping east, two through weathered units, while the sixth influx zone did not show any visible fractures or weathered zones (Eidesgaard et al., 2019).

Reference: Eidesgaard, Ó.R., Schovsbo, N.H., Boldreel, L.O. and Ólavsdóttir, J. 2019 Shallow geothermal energy system in fractured basalt: a case study from Kollafjørður, Faroe Islands, NE-

Atlantic Ocean. Geothermic vol. 82, p. 296-314.