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Drilling of nine high temperature wells in the Þeistareykir geothermal field, NE-Iceland, 2016-2017. Overview of the project, geology of the area and interpretation of the lithology and alteration of the sub-surface strata.

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Exploration drilling for electrical power production in the Þeistareykir geothermal area were first carried out in 2002 (Gautason et al., 2010). The area is one of three largest geothermal areas in NE-Iceland, 25 km north of lake Mývatn. The surface manifestations, consisting of steaming and altered ground, mud pools and fumaroles, cover an area of 11 km2. TEM- resistivity measurements, indicate a system size of 45 km2 (Karlsdóttir et al., 2006).
The geothermal system is the result of an active central volcano. The fissure swarm (NNE-SSW) is up to 15 km wide and 70-80 km long. The most recent volcanic activity, the formation of the Þeistareykjahraun lava, date to about 2400 BP (Sæmundsson et al., 2012).
During 2016-2017, 9 new wells were drilled in the area, ThG-10 to ThG-18, in order to fulfill the second phase of the power plant, 90 MW. First testing of the wells indicate that this is a success. A narrow zone of overpressure was encountered in some of the wells (at ∼100-300 m depth). Well ThG-10 had to be abandoned and cemented due to repeated blow-outs in the first phase of drilling. Therefore it was decided to use heavy drill mud and constant well cooling in the overpressure areas. Additionally, ThG-14, will likely not be used as a production well, where cementing of the production casing failed and signs of cooling were noticed. The cooling was confirmed with research of fluid inclusions (Guðjónsdóttir & Franzson., 2017).
The stratigraphy in the uppermost 1000-1500 m is composed of thick piles of subglacial formations of pillow basalt, tuffs and breccias with variously thick lava flows and intrusions in between. Below 1500 m basaltic lava flows are dominant, and in some of the wells, rocks of intermediate and silicic composition are seen below 2000 m depth, supported by geophysical logging and thin section analysis (Guðjónsdóttir, 2016). The alteration mineral assemblage, indicates rock temperatures up to >300°C. The main high temperature alteration minerals were quartz, epidote and chlorite. Wollastonite, prehnite, actinolite and garnet were also seen, in various amounts.

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