Geophysical Research Abstracts
Vol. 19, EGU2017-14147-1, 2017
EGU General Assembly 2017

ICDP supported coring in IDDP-2 at Reykjanes – the DEEPEGS demonstrator in Iceland – Supercritical conditions reached below 4.6 km depth.

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The Iceland Deep Drilling Project (IDDP) is exploring the technical and economic feasibility of producing supercritical geothermal resources. The IDDP-2 well is located in the Reykjanes saline geothermal system in SW Iceland, on the landward extension of the Mid-Atlantic Ridge, where we are probing the analog of the root zone of a black smoker.
In 2009, Phase 1 of the IDDP was unsuccessful in reaching supercritical conditions in the Krafla volcanic caldera in NE Iceland, when the IDDP-1 drill hole unexpectedly encountered 900°C rhyolite magma at only 2.1 km depth. The completed well produced superheated steam with a well head temperature of 453°C with an enthalpy and flow rate sufficient to generate ∼35 MWe.
Drilling the IDDP-2 began by deepening an existing 2.5 km deep production well (RN-15) to 3 km depth, casing it to 2941m depth and drilling it to 4626m. Total circulation losses which were encountered below 3 km depth, could not be cured by LCM and multiple cement jobs. Accordingly, drilling continued “blind” to total depth, without return of drill cuttings. We attempted 12 core runs below 3 km depth, half of which recovered some core. The cores are basalts and dolerites with alteration ranging from upper greenschist facies to amphibolite facies, suggesting formation temperatures >450°C. After a final report from the on-site science team, expected mid-year 2017, detailed petrological, petrophysical, and geochemical analyses of cores will be undertaken by the IDDP science team and collaborators and published in a special issue of a main-stream scientific journal.
The drilling of the IDDP-2 was funded by the field operator HS Orka, and by Statoil, and the IDDP industry consortium. The coring was funded by ICDP and the science program of the IDDP. Deepening the RN-15 began 11th August 2016, and was completed to 4626m, 17th December 2016. A perforated liner was inserted to 4,571m and the well subsequently logged for temperature, pressure and injectivity, after 6 days partial heating-up. The injectivity index proved to be 1.7 (kg/s)/bar. Supercritical conditions were measured at the bottom, 427°C at 340 bar pressure. The T-log showed the main permeable zones to be at around 3360m, 4200m, 4370m and 4550m depth. Estimates suggest that ∼30% of 40 L/s injected into the well are received by the three deepest feed zones. This can possibly be enhanced by massive soft stimulation, which is a part of the DEEPEGS plan to be executed later this year.
The DEEPEGS project is a demonstration project, supported by the European Commission, Horizon 2020. The goal is to demonstrate the feasibility of enhanced geothermal systems (EGS) for delivering energy from renewable resources in Europe. It is a four-year project coordinated by HS Orka, Iceland, in cooperation with partners from Iceland, France, Germany, Italy, and Norway. The project will demonstrate advanced technologies in three types of geothermal reservoirs, (i) in high enthalpy resource beneath existing hydrothermal field at Reykjanes with temperature up to 550°C, and (ii) in two very deep hydrothermal reservoirs in France with temperatures up to 220°C.