FACTSHEETS

DOWNHOLE SAMPLER FOR HIGH-TEMPERATURE GEOTHERMAL WELLS

REFLECT: Redefining geothermal fluid properties at extreme conditions

In the REFLECT project a **downhole sampler and fluid transfer system for high-temperature geothermal wells (>200°C)** has been developed (Fig. 1). The sampler is designed to tolerate harsh environments at high pressures and elevated temperatures, capable to sample from individual feed zones at specific depths giving information that is otherwise lost once the fluid flashes and/or mixes with shallower feed zones while flowing up the well. The objective is to be able to use the sampler to sample various phases (liquid, steam and two-phase steam) at low to high temperatures using the same methodology on the surface as high-temperature geothermal wells using well logging slick-line equipment and a lubricator pipe (Fig.2).

When feed zones of deep wells at high temperatures blend with colder inflow zones in the upper sections of the well, the local fluid conditions can cause corrosion and/or scaling in the perforated liner and production casing (Fig. 3). Consequently, the lack of knowledge about fluid properties of distinct aquifers leads to long-term and high-cost geothermal utilisation problems. Downhole sampling of the fluid at depth provides information on the fluid composition that enables optimal design of downhole and surface installations to prevent operational problems.

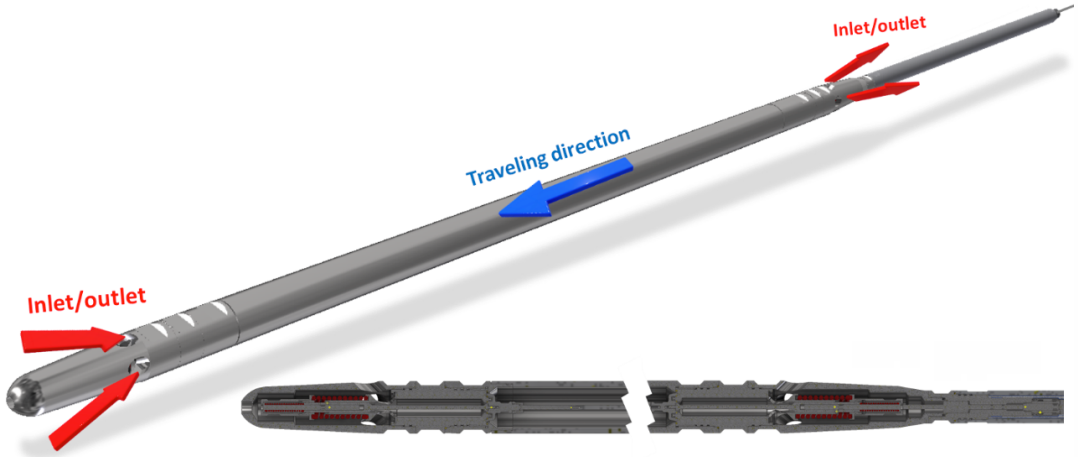

Figure 1: *REFLECT downhole sampler that has been developed to be able to sample various phases (liquid, two-phase, steam) at low to high temperature/high pressure superheated/supercritical conditions in geothermal wells.*

The fluid sampler developed in REFLECT will be able to sample high-temperature geothermal wells of 200-300°C, but **the more ambitious aim is to adapt the design even for higher temperatures (up to 400°C) and supercritical pressures**. A flow-through design has been selected as the most reliable principle (Fig.1). A special emphasis is put on the selection of corrosion resistant and leak-tight materials and parts suitable for construction of the downhole sampler.

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Since the sealing of the sampler will be one of the most crucial mechanisms, different materials for seals have been chosen, which can be adapted to the temperature/pressure conditions aimed for during sampling.

A first proof-of-principle sampling test will be performed by the REFLECT team at a low-temperature well in October 2022.

Figure 2: *The methodology of well sampling of high-temperature geothermal wells using well logging slick-line equipment and a lubricator pipe.*

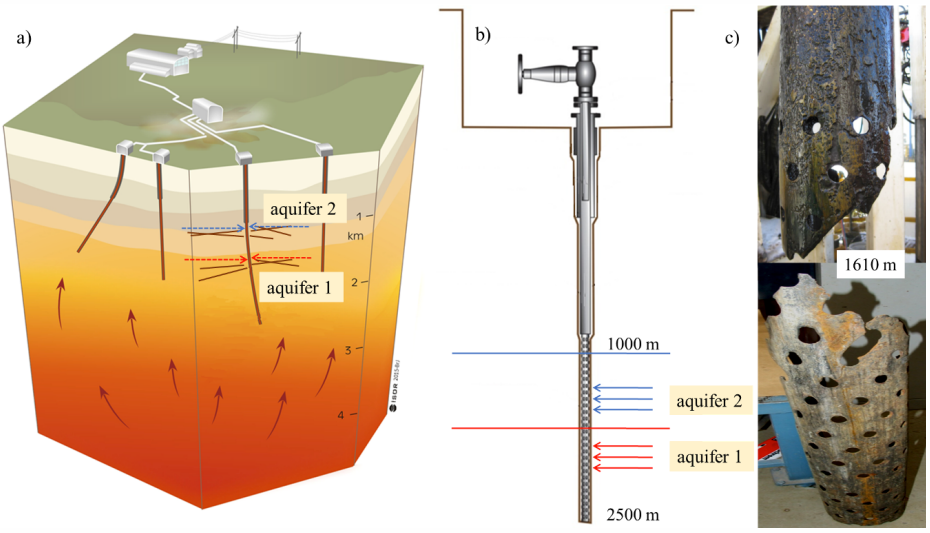

Figure 3: *Schematic drawing of a high temperature geothermal system (a) and a well bore with two feeding aquifers (b) for demonstration of a liner corrosion (c) at 1610 m depth within well KJ-39 (Krafla, Iceland). Extensive damage of the liner was caused by mixing between high temperature fluids from aquifer 1 (hot steam containing HCl gas) and aquifer 2 (colder instream) causing formation of HCl acid and corroding 12 mm liner down to 0 mm in few months. Surface samples showed no corrosive properties.*

Further information

Abstract EGU22 ERE2.4 Session: [Geochemical monitoring of the geothermal reservoirs using a high-temperature downhole sampler]

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