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Geochemical monitoring of the geothermal reservoirs using a high-temperature downhole sampler

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The monitoring of a geothermal reservoir during its development and production stage is crucial for sustainable and long-lasting utilization. Production wells can cut through several feeding aquifers resulting in discharging of a mixture of fluids originating from these different zones. As such, a sample obtained from a well head during conventional sampling represents an average chemical composition of the subsurface fluids. In contrast, a downhole sampler can collect fluids at precise depths and therefore providing an information about fluid properties at individual feed zones. As it has been observed in high temperature geothermal fields, lack of such a knowledge can lead to a decreased production efficiency and high cost of utilization. For example, extreme corrosion rates of perforated liners have been observed at specific depths due to localized mixing of fluids characterized by distinct compositions. Such damages could be avoided by identifying of such mixing depths before well flow test and by casing off these mis-matching feed zones through cement plugs or tiebacks. Similarly, scaling induced by fluid mixing, could be reduced by assessing appropriate casing depth, and therefore preventing the inflow of problematic fluids into the well.

The aim of this study is to design the downhole sampler that is capable of collecting fluids from high temperature wells at up to 300-400 °C during every stage of the geothermal utilization. The chemical data obtained from fluids at different depths will not only help to select the most energy efficient discharge fluids for improved productivity of the well. It will also contribute to the conceptual models of the reservoirs, hence, to better understanding of hydrothermal reservoirs through their production lifetime.