Integration of Seismic and Log Data of a Deep Borehole in the Basement Rocks of Northeastern Alberta

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Abstract

Existing heat flow and geothermal gradient studies suggest that deep drilling into the basement rocks is required for the extraction of geothermal heat for oil sands processing in Northern Alberta. The target temperature for the geothermal reservoir is 80°C in order to heat water for oil sands recovery. As an alternative to burning natural gas for hot water towards oil sands processing, a feasibility study on geothermal energy development in Alberta is currently being investigated under the research collaboration between the Helmholtz-Association of German Research Centers and the University of Alberta.

The extraction of geothermal heat from the crystalline basement rocks would require the use of Engineered Geothermal System (EGS) technology due to the low permeability of the granitic basement rocks. Hence, it is important to perform a detailed subsurface characterization of the basement rocks using a combination of geophysical logs and seismic methods. Part of the feasibility study for geothermal development in Northern Alberta consists of investigating the presence of subsurface fluid pathways in the Precambrian basement. A deep borehole located west of Fort McMurray has a depth of 2.36 km, where the largest oil sands deposit in Alberta is located (Figure 1). It is by far the deepest well drilled into the Precambrian basement below the sedimentary successions in Alberta, and can provide valuable information for geothermal investigations.

This presentation includes the processed and interpreted data sets from this deep borehole, with a focus on identifying any geological features such as zones of fractures in the crystalline basement rocks that could act as indicators of enhanced fluid potential – a necessary component for any geothermal systems to be viable.