Tintina fault core analysis for potential geothermal development

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Keywords:

Abstract

A 500m exploratory well was drilled in the Ross River region in the Yukon to determine if the area warrants further geothermal research. The well is located along a laterally extensive dextral strike-slip fault, named the Tintina fault. Core analyses were conducted to evaluate the potential for development as a geothermal system. A geothermal gradient of 30.6°C/km was measured by a thermistor line. There is discussion of developing a greenhouse that can be heated by a direct use geothermal system, with the aim of reducing emissions from importing fresh produce, and to provide employment for the community.

1. Introduction

Canada currently generates no electricity from geothermal power, however there is some direct use for district heating applications (Raymond et al. 2015). Direct usage of geothermal energy in the Yukon is largely limited to simple systems to keep water from freezing, and for recreational hot springs. Yukon's energy is heavily based on hydroelectric power generation, and research being conducted is revealing large scale application and utilization of geothermal power. Many remote communities still exist as dependents on diesel as the only source of energy generation, and emissions could be mitigated by the substitution of geothermal power. Exploration along the Tintina fault through the Ross River test well has produced invaluable insight, and development of the area should be considered. The trench serves as a natural catchment for pre-glacial, glacial, and inter-glacial sediments spanning the late Pliocene to the late Pleistocene (Duk-Rodkin et al. 2010). These sediments are exposed and studied through land scars, but the regional geology is complex and generalized. The physical control on the sediments is limited, so geophysical information is utilized heavily. Acquiring data from core analyses of the Ross River test well gives insight into the hydrogeologic characteristics, and thermal properties at depth.

2. Methods and techniques

The well was drilled with a RC drill, to a depth of 500m. A thermistor line was lowered into the well with nodes at 10m intervals to measure temperature (Fraser, Colpron, & Relf 2019). A variety of analyses were conducted: core logging, qualitative XRD, thin section analysis, and helium pycnometry.

3. Results

In the results, we observed relatively high porosity values in the samples. The values ranging from 2.6-25%. The XRD results expressed common minerals such as quartz, plagioclase, k-feldspar, muscovite, and chlorite in nearly all samples. However, clays such as kaolinite and smectite were not present in the breccia and silty sand units. On the other hand, all the other lithologies contained clays. Thin section analysis revealed many natural fractures, and prevalent vuggy porosity. A thermal gradient of 30.6 °C/km was measured.

4. Discussion

The aim of this exploration project was to determine if the results warrant further geothermal research in the region. The geothermal gradient reflects it is indeed a region of elevated temperature and could be developed as a resource. The Ross River people have expressed interest in developing a geothermal system to sustain the heat requirements of a greenhouse. A greenhouse would provide fresh produce to the community and would reduce the emissions caused from importing food.

5. Conclusions

In conclusion, this study has proven the Ross River test well area to be a potential region for development as a geothermal resource. In collaboration with the Yukon Geological Survey, and the Ross River people, the project is moving forward.

Acknowledgments

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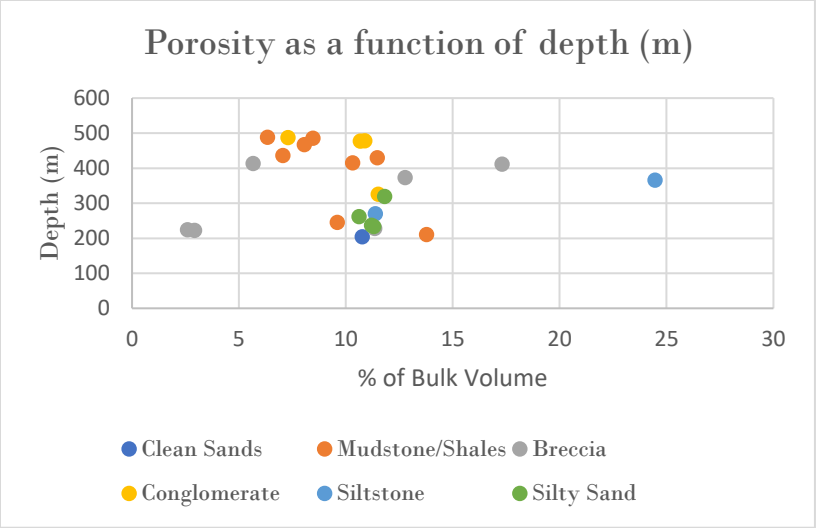

Fig. 1 Porosity of the Ross River well core samples as a function of depth, separated by lithology

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