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Regional Geophysical Study for Geothermal Exploration in on Public Data in a Context of a Moratorium on NE Alberta Exploration

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Abstract

NE Alberta hosts many producing oil sand projects. These projects require large amounts of thermal energy to produce most of which is currently provided by burning natural gas; and this increases the greenhouse gas footprint to producing such hydrocarbons. One possible solution is to instead use geothermal heat directly with hot fluids produced using Engineered Geothermal Systems. Geothermal exploration always starts with broad geological structure reconnaissance of the area. Unfortunately, the larger geological context particularly beneath those relatively shallow depths (typically less than 400 m) of interest to hydrocarbon exploration is still poorly understood. As such, we have selected a rectangular area of 22,000 km^2 extending across 56.25˚ to 57.12˚N and 111.92˚ to 113.52˚W that we refer to as the Athabasca region. The main two categories of data which are in used consist of over 600 km seismic reflection profiles and 22,000 km^2 High Resolution Aeromagnetic data. Also there is a large amount of available well-logs from 1,000 boreholes in this area that have a key role in interpretation of seismic profiles. These integrated data sets are used for outlining sedimentary basin, mapping geological formation tops, locating fault zones and other structural lineaments, finding true depth of metamorphic basement, and finally building a detailed geological model of the region. To date all the seismic profiles are interpreted and HRAM data is successfully corrected and gridded through the area. The 3D geological model is constructed using these available data that reveals some detail about the gross structure of the region. This model shows that the Precambrian basement reflector is a smoothly undulating surface that could be consistent with minor faulting. The topography of this surface affects the structure of overlying sedimentary formations.