geoconvention
Calgary • Canada • May 15-17 2023

# "Act Naturally" – comparing natural and induced seismicity in west-central Alberta

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## Summary

Once considered a tectonically "quiet" province due to its intraplate tectonic setting, Alberta has experienced several large (>**M** 3.5) earthquakes in the past several years. Considerable public interest surrounds any mention of induced seismicity (human-caused earthquakes) in Alberta, due to the potential risk of environmental harm and community impacts; it remains controversial due to its association with oil and gas activity.

Alberta does occasionally experience natural earthquakes; most natural earthquakes recorded in Alberta occur on the eastern flank of the Rocky Mountains along thrust faults parallel to the mountain belt or deeper in the Precambrian basement. The Precambrian basement, which underlies the Alberta basin, is comprised of a complex "hodgepodge" of sutured metamorphic rocks that are relatively brittle; contacts between these units form zones of weakness and faults that are prone to seismicity in the present day. This is because optimally oriented faults and fractures are a crucial ingredient for earthquake generation.

Although earthquake monitoring stations exist throughout Alberta, a significant coverage gap in the provincial network is present in west-central Alberta. To address this, continuous seismic monitoring of the region has been completed using an array of four seismic monitoring stations (the EVR array; centered around a geothermal pilot well, Eavor-Lite) over a period of two years. Regional seismicity in this region has not been updated since the work of Stern et al. (2013), and new earthquake clusters are now both recognized in the literature and currently active.

The primary objective of this research is to better characterize earthquake activity (natural or induced) in west-central Alberta (113 to 117ºW and 51 to 53ºN). It is hypothesized that structural corridors like basement faults will delineate regions that are at a higher risk for induced seismicity, as has been shown in other parts of Alberta. When compared to natural earthquakes, induced earthquake clusters are expected to cluster differently in both space and time.

The data recorded by the EVR array has been captured and is currently being processed using REDPy, NonLinLoc, and Obspy, open-source software programs that are used to detect, locate, and cluster earthquakes into groups characteristic of their source. Template matching will be used to look for aftershocks associated with suspected natural events. The aim is to compare induced and natural earthquakes in the region, and provide guidance on the criteria for distinguishing them from each other similar to Verdon et al. (2019). This work, when complete, will aid in understanding seismicity risk in the region.