

Documenting Seismicity in Alberta

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Over 700 earthquakes have been recorded in Alberta by Earthquakes Canada from 1918 to the present. The majority are spatially correlated with the south-west trend of the Rocky Mountains and can be classified as micro-earthquakes (less than a magnitude 3). There are, however, three diffuse clusters of micro-earthquakes. One of these clusters, near Rocky Mountain House, has been the focus of several studies seeking to test the links between these events with hydrocarbon production. The motivation for these studies was due to the observation of a large increase in frequency of recorded micro-earthquakes during the late-seventies. Their assumption was that the increase was not entirely due to the addition of seismic monitoring stations in the early seventies or upgrading of stations in the early nineties.

The study by Wetmillar (1986) employed temporary seismographs with good spatial distribution in the Rocky Mountain House Seismic Zone (RMHSZ) to reliably locate micro-earthquakes. They were able to demonstrate that all of the earthquakes that they recorded were located within or beneath the Strachan D3-A gas reservoir. The study was, however, constrained by its short duration of less than one month which prevented them from comparing the frequency of recorded earthquakes to gas production. Baranova et al. (1999) attempted to link the RMHSZ earthquakes recorded on the Canadian National Seismic Network (CNSN) to volume production of the Strachan D3-A gas reservoir. Their study was inconclusive in that there was both a time lag in onset of seismic activity with the first peak in gas extraction and subsequent peaks were imperfectly correlated.

There is both a need for a denser network of seismic stations to lower the present threshold of detectable micro-earthquakes and a need to re-evaluate the existing database to search for previously undetected events. A larger database of seismic activity will help determine whether there is a more diffuse pattern to Alberta microseismicity.

Recently the Alberta Geological Survey participated in the selection of six sites for the University of Calgary's (U of C) new Alberta Telemetered Seismograph Network (ATSN). Five seismic stations were installed, by U of C, in the fall of 2009. Three of the five stations, are in northern Alberta. These include locations near the Wapiti River (Grande Prairie), Manning, and High Level. The two southern stations are located near Medicine Hat and Priddis. A site south of Fort Smith has been selected for installation in the early summer of 2010, as well as another southern site near Raymond. Two sites north of Edmonton and one north of Fort McMurray are in the planning stage.

In addition, the University of Alberta (Gu et al., 2009) has installed 11 semi-permanent seismic stations in the Canadian Rockies and Alberta Network (CRANE), in 2005 and 2006. Although

the stations are not telemetered, they provide a near continuous record with good spatial distribution of stations in central and southern Alberta. The compilation of the data from these sources with that from the Earthquakes Canada database is expected to lead to a better understanding the relationship between the clusters of micro-earthquakes and hydrocarbon production.

References

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