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Solid Earth
Discussions

Interactive comment on "From oil field to geothermal reservoir: First assessment for geothermal utilization of two regionally extensive Devonian carbonate aquifers in Alberta, Canada" *by* Leandra M. Weydt et al.

Anonymous Referee #3

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This paper examines Devonian reefs as potential geothermal reservoirs in the Hinton area of Alberta. There are critical flaws with this work though. Most important is a shocking lack of reference to previous work, including numerous papers on the Hinton Geothermal Potential and numerous papers of the hydrogeological properties of the same aquifers studied. As it stands this works is completely out of context of earlier work and its not clear that it adds much new information to what is already known. Another major concern is that the authors do not seem to know the study area well and make several false claims as well as some simply outrageous political comments

that have no place in a science journal. In the current form I really don't think the MS should be published. The authors need to do a major rewrite that includes some basic background research to place their work in context and to be able to demonstrate what new knowledge they are adding. Other issues are listed below.

1) Introduction: the reason why Alberta has such a high percapita CO2 emission is that it is developing the worlds second largest oil field, but with a very small population base (approximately 1o% of that of Saudi Arabia that is developing the worlds largest oil field). Most of Alberta oil is exported to the US, so its questionable CO2 accounting to log it all against the producer rather than the consumer. Therefore the introduction provides some misleading statistics that have questionable value in a science paper. 2) Introduction: The reason for such small hydro usage in Alberta is that southern Alberta is the driest part of Canada – there are very limited opportunities for hydro in the province. But as a nation Canada has over 70% of power production by renewable energy, one of the cleanest grids in the world. So again, the intro has very misleading information. 3) Introduction: To suggest that there is a political climate that favours business over environment, and its doubtful if Alberta will want to transition to a cleaner energy system is simply outrageous – politics does not belong in a science paper. Besides, Albertans have recently elected a government that has one of the most aggressive environmental programs in North America, including implementing the largest carbon tax in Canada. Such statements that speak to the politics of a place the authors do not live in, and to speculate about future decisions Albertan's will make, have absolutely no place in a science paper. 4) The authors make a false claim that there is no geothermal utilisation. For direct heat use Canada is about 7th in the world (see summary by Raymond 2015). Also, within Alberta the Leduc reef is already being used for direct heat. There are also cleaver thermal storage systems in southern Alberta as well as direct heat use of waters produced from the Western Canada Sedimentary Basin in Saskatchewan, as well as planned drilling this year for electrical production wells. The authors clearly need to do more research on the state of geothermal usage in their study area. 5) Page 3, line 9: what is Malm? 6) Page 3,

line 10. This gets very confusing,. Are you meaning that the overall project studies 3 aquifers or this paper? On line 12 you say there are only two aquifers in Alberta you study which is the subject of this paper. Its also not clear what is meant by two of four? What four? 7) Page 3, ln 17: This discussion on German aquifers seems out of place in a paper on Alberta, what is the relevance? I would remove this section. 8) Page 3, ln 23: It seems very odd to introduce looking at outcrops to understand the subsurface as some kind of new approach. Geologists in the petroleum and mining industry have been doing this pretty much ever since geology was invented – its pretty much the very foundation of geology in fact. This is nothing new and certainly not an original idea of Homuth et al 2015. 9) Page 4, ln 2: Delete 'literally' and also, use the Canadian spelling of "Centre" not 'Center' as that is the formal spelling of the Core Centre. 10) Page 4, ln 3 ".., results of drill stem test.." 11) Page 4, ln 6: There is a surprising lack of reference to numerous previous geothermal studies in the Hinton area, including some on the same reef systems. As well, since these units also produced major oil fields there has been extensive research conducted on the hydrogeology. A simple web search for terms like 'Hinton geothermal' or 'Nisku hydrogeology' will provide the authors with numerous papers of relevance that should be cited. Rather than 'superficially' I would say the area has been extensively studied. Try a bit of background research as part of your study! 12) Page 4, ln 9: here you say 3 aquifers and above it was two? 13) Page 4, ln 21: the formal name is 'Rocky Mountains' 14) Page 4, ln 25: closer to 2 million. 15) Page 5, ;n 32: how does this reef trend relate to the Leduc ? need more clear descriptions of everything, same for page 6, ln 9 and 26. Lots of various terms used with no clear description what they all are. 16) Page 9, ln 11: need ref for timing of larimide 17) Page 9, line 13: if there are similar fractures in both, isn't I more reasonable that they have the same origin, rather than invoking two different ones? 18) Section 5.2 this is not petrography

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