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September 21-23
2020
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Magnetotelluric exploration in the southeastern Canadian Cordillera: Regional-scale crustal structures associated with geothermal systems

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Summary

The development of geothermal energy requires information about subsurface structure that can be obtained from geophysical exploration. This reduces the risks associated with subsequent drilling programs. The magnetotelluric (MT) method is an electromagnetic geophysical method that is widely used in geothermal exploration. MT is effective in this application because it can sense subsurface electrical resistivity, a parameter that is sensitive to the presence of fluids. MT has been widely used on the prospect-scale of geothermal resources. It can also be used in regional-scale exploration that provides information about the origin of geothermal fluids at depth.

This regional MT approach to geothermal exploration is being applied to southeastern British Columbia. Since 2002, the University of Alberta has collected MT data on a grid to allow the 3-D resistivity structure to be determined. A fully 3-D resistivity model of the region 48-54^{o}N and 112-122^{o}W, obtained from 336 MT stations with a typical spacing of 22 km, gives an overview of the resistivity structure and shows that crustal fluid distribution can be mapped. Zones of low resistivity are observed throughout the southern Omineca and southwestern Foreland belts; and they are shallowest near the Southern Rocky Mountain Trench, with some extending to depths of more than 50 km. There are low-resistivity zones that connect the low-resistivity crustal layer and the surface along a number of faults. Implications for future geothermal research and development will be discussed.