

# High geothermal temperatures found deep below the Southern Alps

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The Alpine Fault is one of the world's major geological features and its tectonic movements have created the more than three-kilometre-high Southern Alps.

But it's a discovery just half a kilometre deep that has scientists stirring.

A collaboration by a team that drilled into the fault revealed water at 630 metres that was hot enough to boil. Similar geothermal temperatures are found normally at depths greater than three kilometres, or in association with active volcanoes.

"The conditions we've uncovered are extreme by global standards and comparable to those in major volcanic centres like Taupo—but there are no volcanoes in Westland," says Victoria's Professor Rupert Sutherland.

"Nobody on our team, or any of the scientists who reviewed our plans, predicted that it would be so hot down there."

Rupert worked with more than 100 scientists from 12 countries as part of the Deep Fault Drilling Project, jointly led by Victoria, GNS Science and the University of Otago.

In 2014, the team drilled into the Alpine Fault at a site near Whataroa, a small township north of Franz Josef Glacier.

The team identified the Whataroa site as the best place in the world to

understand what a [fault](#) looks, feels and sounds like just before an earthquake occurs. The Alpine Fault is known to rupture in magnitude 8 earthquakes approximately every 300 years and last ruptured in AD 1717.

Engineering challenges meant the project fell short of achieving all its technical goals, but the borehole continues to provide interesting data for scientists.

The team hadn't expected to find such extreme temperatures and the potential for large geothermal resources in the area.

"The geothermal environment is created by a combination of tectonic movement and groundwater flow. Slippage during earthquakes has uplifted hot rocks from about 30 kilometres deep, and the rocks are coming up so fast that they don't get a chance to cool properly," explains Rupert.

"Earthquakes fracture the rocks so extensively that water is able to infiltrate deep beneath the mountains and heat becomes concentrated in upwelling geothermal fluids beneath valleys. River gravels that are flushed by abundant West Coast rain and snow dilute this geothermal activity before it reaches the surface.

"This geothermal activity may sound alarming but it is a wonderful scientific finding that could be commercially very significant for New Zealand."

Warren Gilbertson, chief operating officer of Development West Coast, says the discovery has the potential to transform the economy and resilience of Westland, and provide a significant and sustainable clean energy resource that could be developed using local people and equipment.

"The location of geothermal activity and its possible benefit and association to the dairy and tourism sectors provide real opportunities from an economic perspective."

It is still too early to say just how big and how hot the geothermal resource might be, adds Rupert, and further exploration and drilling will be needed to assess the economic potential.

Provided by Victoria University

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