# BOREHOLE SEISMOLOGY AND NEW DIRECTIONS IN MICROSEISMOTECTONIC STUDIES

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This presentation is intended to give an overview of the emerging science and technology of borehole seismology as applied to microearthquake and tectonic studies - "microseismotectonics.". The uses of these techniques can include:

* Passive and active imaging of subvertical structures, such as strike-slip faults, caldera walls, and dykes
* Tracing a hazardous fault with the more the more frequent M<0 microearthquakes a la Gutenberg-Richter
* Detecting subsurface volcanic and fluid movements before they appear on surface instruments
* Monitoring and locating very low magnitude volcanic and non-volcanic tremor
* Researching new seismic phases such as the different types of fault zone guided waves

In all of these cases, the borehole seismic monitoring technique offers many advantages in terms of signal detection and processing for both natural and active seismic sources. Advantages include improvements in signal-to-noise, increased bandwidth, and greater sensitivity to small changes in underground conditions.

In this presentation the basic technology of borehole seismology will be reviewed.
Results from applying them to the San Andreas fault, Long Valley Caldera, the Hot/Dry Rock experiment in Basel, Switzerland, and the geothermal fields in Iceland and Hawaii will be shown. The presentation will conclude with the borehole-based observation of a new seismic phase that has been recorded on a borehole seismograph in the San Andreas fault.

**Biography**
Professor Peter Malin is Director of the Institute for Earth Science and Engineering at the University of Auckland. Professor Malin is an expert in imaging activity below the Earth's surface, and was one of the leading scientists on the San Andreas Fault Observatory at Depth project, which monitors activity in the fault line at a depth of three kilometres below the surface.
The Institute aims to study volcanic and seismic activity in New Zealand and is closely involved with the Borehole Instrument Centre for Eden Park (BICEP) project. This comprises installing an array of seismographs to provide a three-dimensional view of the movements directly below Eden Park - New Zealand's famous rugby ground. It will be a permanent installation incorporated into the stadium infrastructure providing continuous data.
The IESE has also installed seismic monitoring equipment at the Basel HDR before the critical events there, and monitored the deepest borehole seismographs in Australia (1.7km) at Paralana.
Peter Malin received a BSc in Geophysics and a MSc in Marine Geophysics from Stanford University, and a PhD in Geophysics from Princeton University. His experience lies in seismic propagation in planetary crusts, borehole investigation of seismic sources and signals, and environmental geology.