Understanding a deep seismic reflection survey

HOW A SEISMIC SURVEY WORKS

A seismic survey is a low-impact method that enables geoscientists to interpret geological features up to 50 kilometres beneath the earth's surface.

To conduct a survey, seismic waves are sent deep into the earth from Vibroseis trucks. The process is similar to using sound waves for an ultrasound. The Vibroseis trucks travel slowly across the landscape approximately 8 to 10 kilometres per day, stopping at frequent intervals to send down seismic waves from vibrators mounted on the trucks.

The seismic waves are reflected (echoed) off rock formations and recorded by sensitive microphones on the surface called geophones. This enables geoscientists to gather data to build knowledge of the underlying geology (Fig. 1).

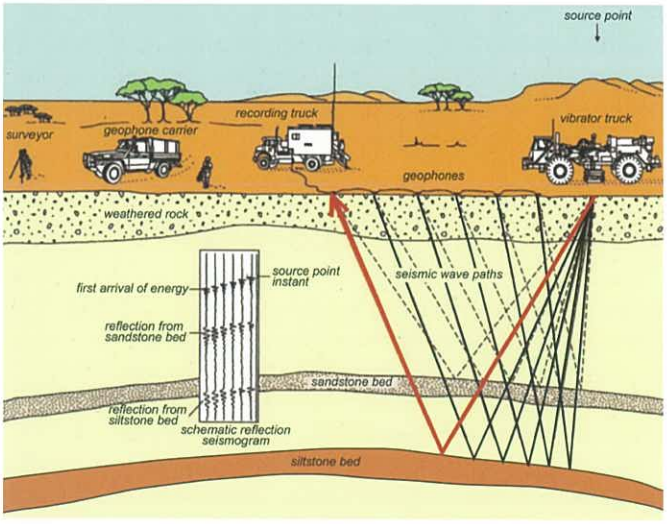

Fig 1. How a seismic survey works

Fig 2. Three Vibroseis trucks are used for a seismic survey

SURVEY TRUCKS AND SUPPORT VEHICLES

A seismic survey involves 10 to 15 vehicles. These include three Vibroseis trucks (Fig. 2), a recording truck and a number of 4WD vehicles for moving the geophones. A survey crew consists of approximately 40 people.

Support vehicles are part of a survey team but may travel separately to the survey vehicles. These may include 10 to 15 caravans, a water tanker, trucks and other support vehicles.

PROCESS OF THE SURVEY

1. PRE-SURVEY CONSULTATION

While a seismic survey is low impact, the Geological Survey of Victoria (GSV) engages early with communities and other stakeholders to ensure the research does not interfere with regional activities.

2. PEGGING THE ROUTE

A qualified experienced surveyor sets the route for the survey. Surveyors peg the route about a week before the survey starts. This involves placing pin markers and/or wooden pegs at regular intervals (every 40 metres) along the survey line . These markers show where the Vibroseis trucks will send down seismic waves, and where geophones (Fig. 3) will be placed to record the echoes. These pegs are removed as the survey team moves along the route.

Care is taken to protect roadside plants and animals. If required, procedures will be implemented to avoid the transport of soil and plants.

The field crew set down geophones (Fig. 4.) set down every 40 metres along the survey route.

Fig 3. Geophone

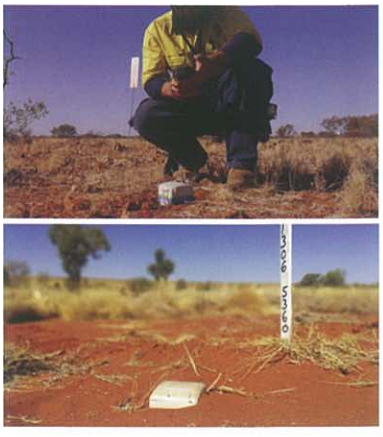

Fig 4. Geophone in place & survey peg

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3. RECORDING

Once the geophones are in place, the three Vibroseis trucks drive slowly in convoy along the survey route, stopping at frequent intervals to generate the seismic signal by synchronously vibrating the ground beneath them for 10 to 15 seconds. The size and noise of the trucks are similar to a garbage truck. The vibrations are about the same as those generated by a large truck driving past.

Three trucks are required to generate sufficient seismic energy to see deep into the earth. The trucks are pre-programmed so that vibrations are only generated at the pre-determined points. The vibrations are generated clear of buildings and significant infrastructure.

Vibrations that could potentially damage infrastructure would also damage the survey equipment and generate unwanted 'noise' in the data. In this situation the Vibroseis trucks will automatically shut down.

The survey is controlled from the recording truck (Fig. 5) where the signals from the geophones are recorded for later analysis. The survey crew works 7 days a week, 12 hours per day, moving 10 to 15 kilometres per day along the survey line. The crew stays in local towns, or in mobile camps when working in more remote areas.

The marking pegs and geophones are removed as the survey team moves along the route.

Fig 5. The recording truck

4. GRAVITY SURVEYING

A gravity survey is often conducted along the route at the same time as a seismic survey. The gravity survey involves one person travelling in a single 4WD vehicle, stopping every 400 metres to the side of the road and using a sensitive instrument, approximately the size of a large shoebox, to measure and record the earth's gravity at that location (Fig. 6). The measurement and recording time takes approximately 5 minutes and has no direct impact.

Fig 6. Gravity meter

5. LINE CHECKING AFTER RECORDING

After recording is completed, an audit is conducted along the survey route to check it is clear of rubbish and survey pegs. Any restoration work required is undertaken. Stakeholders and landowners are contacted to make sure land and infrastructure is left in a satisfactory state.

WORKING WITH THE COMMUNITY

Property owners and public land managers are consulted months before a deep seismic survey is undertaken. Access to properties may require the temporary removal of infrastructure such as fences to allow the Vibroseis trucks to travel along the survey route.

Land Access Agreements are in place with individual landowners, leaseholders and public agencies before a survey starts. Any fencing or other infrastructure removed for a survey is replaced once the survey is complete.

Partial road closures and traffic management may be in place during the course of a survey. Road traffic measures are communicated before and during a survey.

MORE INFORMATION

Fact Sheet: Eastern Victorian Geoscience Initiative

Fact Sheet: Geology of Eastern Victoria

For further information visit earthresources.vic.gov.au/evgi

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GEOLOGICAL SURVEY OF VICTORIA