



Jun 2023

## Information sheet

# GSWA deep crustal reflection seismic surveys

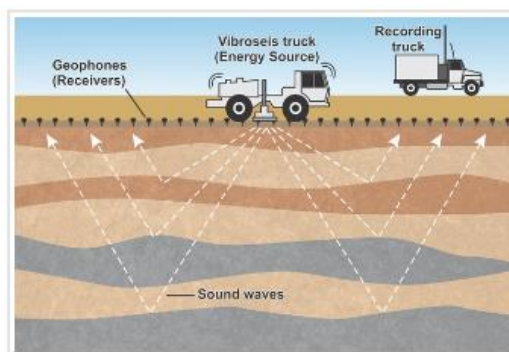
### Overview

Deep seismic reflection profiling enables geoscientists to make interpretations of geological features and structures as deep as 60 km with no impact on the environment. During the past 20 years, the Geological Survey of Western Australia (GSWA) and Geoscience Australia have undertaken more than 7000 line-km of deep crustal reflection seismic surveys across the state in order to investigate how the different components of the Western Australian landmass are configured and how they came together over the course of geological time. A [list of surveys](#) is on our website.

Reflection seismic surveying is a geophysical technique that uses artificially generated sound wave vibrations to make images of the rocks below Earth's surface. Specialized 'Vibroseis' trucks vibrate the ground to generate vibrations comparable in intensity to a road train passing by. The Vibroseis method was developed to allow seismic data to be acquired in urban and other sensitive environments by generating a controlled vibration that will not damage structures even in close proximity to the signal source.

The vibrations spread into the ground and are reflected from deep rocks and structures. The reflected waves return to the surface where they are recorded by geophones, small sensors that are similar to microphones. The recorded data are processed to make images of the crustal architecture in the project areas, and the structure, geometry, and relationships between the various geological domains.

Our seismic surveys complement our other geophysical, geological and geochemical surveys that enable us to make comprehensive maps and descriptions of the geology of Western Australia that are used by the government for land use policy and planning, and by many sectors of the State's economy.



### Survey process

The seismic surveys are conducted by experienced and professional contractors who follow strict operational guidelines. The surveys are non-invasive, and do not affect the environment, physical infrastructure, or heritage sites.

The seismic transects are usually sited along existing tracks and road verges to minimize any ground disturbance or the need to make new tracks. Road traffic management is used where required to ensure the safety of road users and the survey crew. A survey progresses at about 20 km per day.

A field crew lays out the sensors (geophones) on the surface every five or ten metres along the road verge. Once the geophones are in place, two or three vibrator trucks drive slowly along the line, stopping every 20 to 40 metres to vibrate the ground for about half a minute through a steel plate lowered onto the surface. If the truck has to vibrate on a bitumen road, a rubber mat is put on the bottom of the plate to protect the road surface. The force of the vibration is reduced as necessary near bridges, pipelines, buried services and culverts. Vibration points may be skipped near particularly vulnerable sites.

The seismic signal generated by the truck spreads into the ground, and the array of geophones records the time and strength of the seismic waves reflected back to the surface from the rocks and structures beneath.

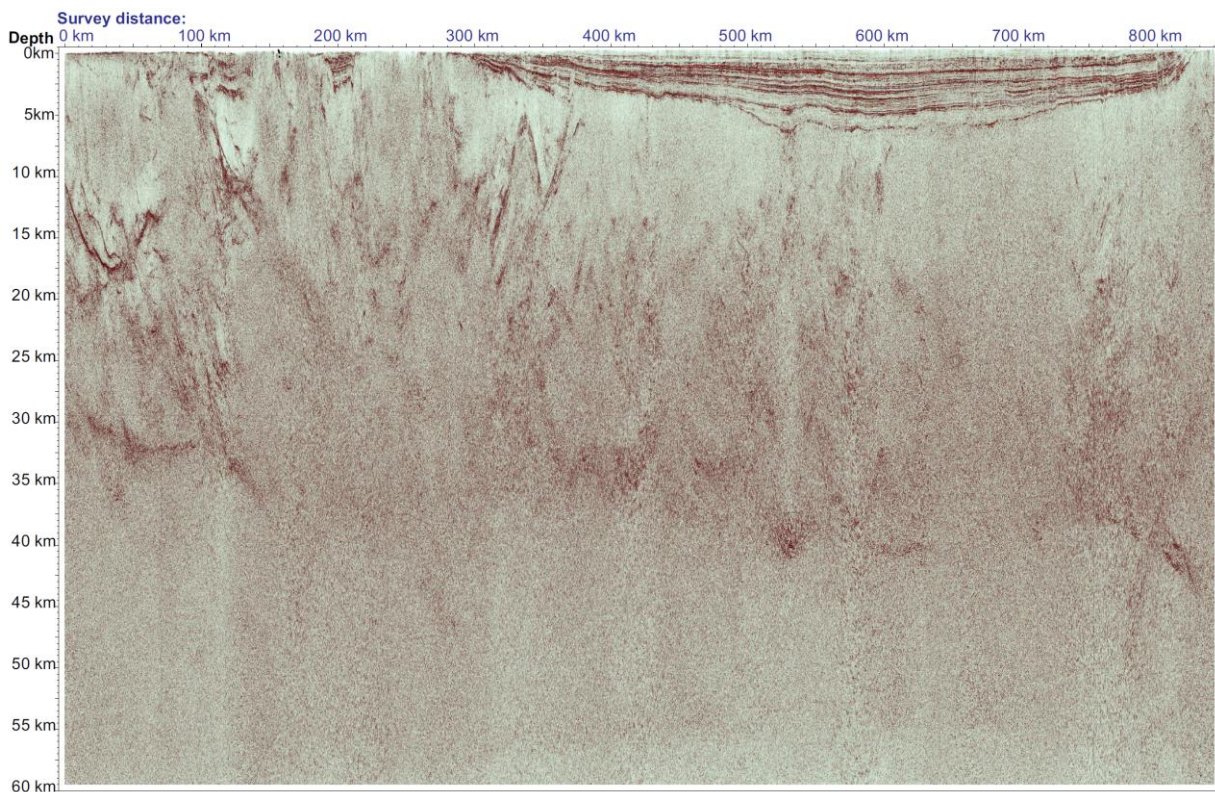
The spread of geophones can extend as much as 20 km or more along the path of the survey. As the survey progresses, geophones are collected from the rear of the line and taken to a large truck, where the data is downloaded and checked for quality, the geophones recharged, and fresh geophones moved to the front of the seismic line.



Seismic survey: a) Vibrator trucks with traffic control; b) a geophone in position; c) downloading data and recharging geophones. Photos: HiSeis Pty Ltd.

The survey is controlled and coordinated from a recording truck with long-range communications capability. Several support vehicles are required for laying out and retrieving geophones, carrying equipment, repairing equipment and processing data. There may be as many as 30 people or more in the survey crew.

At the end of the survey the large volumes of data that are produced are processed to produce images, in much the same way as a medical ultra-sound image is made.



Processed deep crustal seismic image (exaggerated vertical scale) across central Western Australia showing layers of shallow sedimentary rocks in the Canning Basin overlying the complex structure of basement rocks down to the base of the crust at approximately 40 km depth. Image: GSWA data archive.

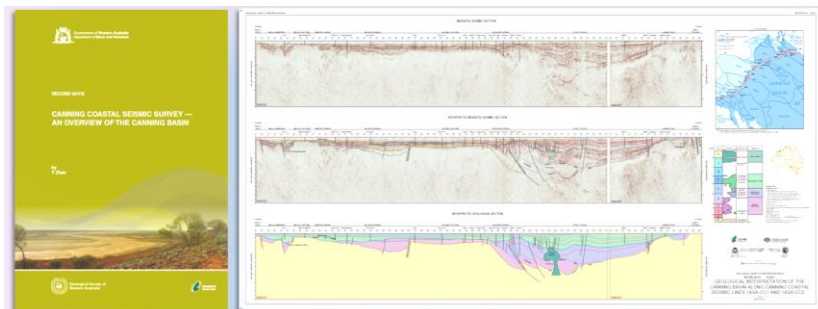
Scan the QR code to watch a Geoscience Australia [video](#) on YouTube about how seismic surveys are acquired.



## Survey data and results

GSWA makes all the data from a deep crustal seismic survey, together with an operations and processing report, available for public download without charge (although there may be a media charge for delivery of the data on a hard drive).

GSWA geoscientists use the seismic images to interpret the rock types, geometry and structures up to 60 km deep in the Earth's crust below the survey path. By incorporating the seismic data with other datasets and geological information, they are able to make maps and three-dimensional models of the subsurface geology, which are also made publicly available at no charge.



*Interpretation report of Canning Coastal deep crustal survey 2014.*

GSWA's interpretations, maps and models are used by other government agencies, private companies and landholders in general for various purposes including:

- planning for infrastructure projects or other land use activity;
- geohazard assessments;
- identification of areas with potential for groundwater reserves or geothermal sources, or that may be suitable for minerals or energy exploration.

## Community engagement

We send advance notification and continuing updates about GSWA's seismic surveys to landholders, infrastructure operators and local communities.

Information about a survey in progress will be updated regularly on our website at [www.dmirs.wa.gov.au/geophysics](http://www.dmirs.wa.gov.au/geophysics).

## More information

To learn more about GSWA projects and products:

- Email: [geological.survey@dmirs.wa.gov.au](mailto:geological.survey@dmirs.wa.gov.au)
- Website: [www.dmirs.wa.gov.au/gswa](http://www.dmirs.wa.gov.au/gswa)

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