Eastern Victoria Geoscience Initiative – Southeast Lachlan Magnetotelluric Survey

The Geological Survey of Victoria, an agency of the Department of Jobs Precincts and Regions, and Geoscience Australia are conducting a magnetotelluric survey along the Southeast Lachlan Crustal Transect in eastern Victoria (Figure 1). The survey will measure variations in the Earth's natural ability to resist electrical currents. The data gathered will provide insights into the rocks and geological structures from near the surface to approximately 60 km deep within the Earth.

The survey is part of the Eastern Victoria Geoscience Initiative, a program to develop a greater understanding of Victoria's underlying "geological architecture". The new survey builds on existing knowledge gathered by the Geological Survey of Victoria, including a seismic survey that was undertaken across the Southeast Lachlan Crustal Transect in 2018.

The magnetotelluric survey will add to Victoria's geological knowledge base and contribute to future scientific research. It will also help government to make better informed earth resource and land management decisions.

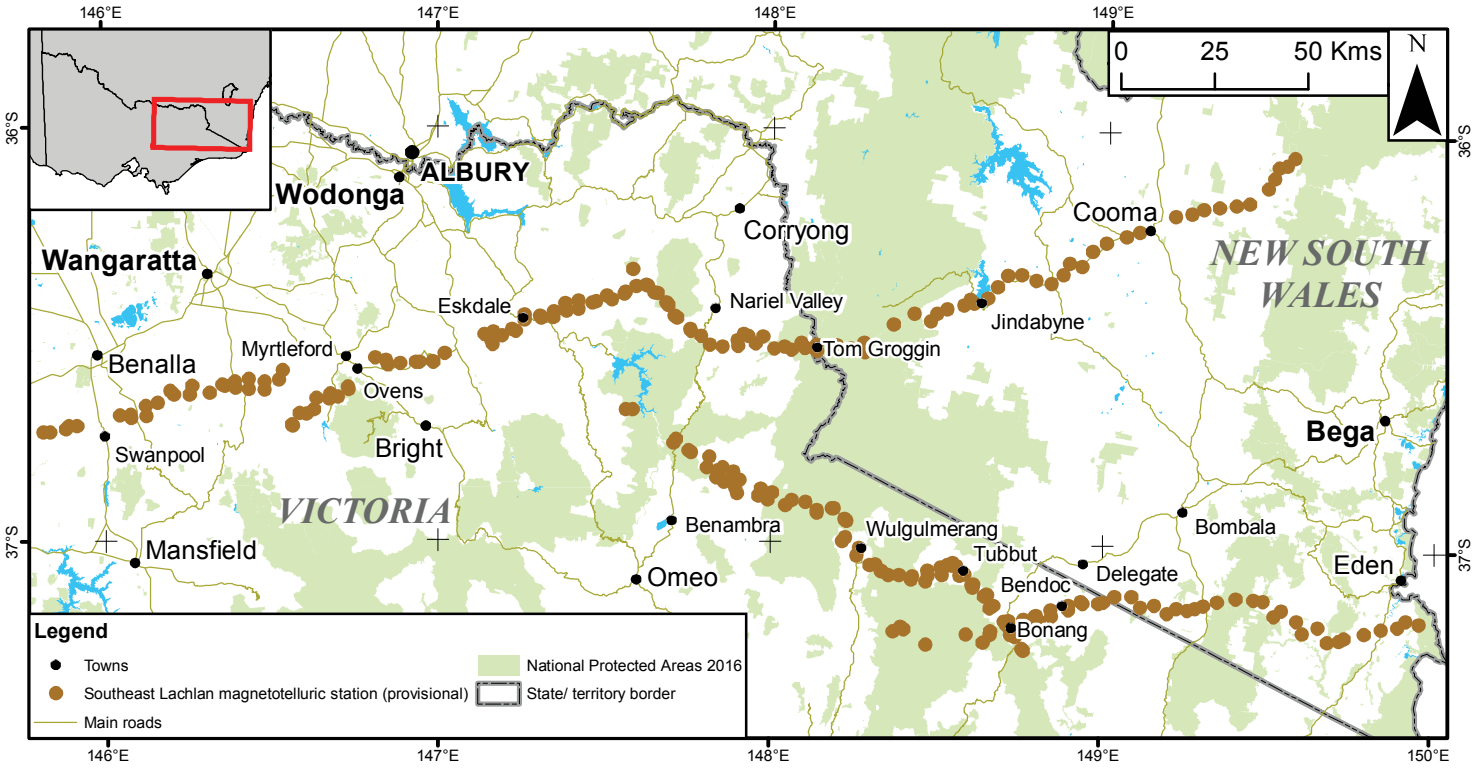

Figure 1. Map showing proposed magnetotelluric sites in Victoria.

THE SURVEY

The magnetotelluric survey consists of 95 pre-planned sites located approximately 4-6 km apart along the transect.

The survey will follow a route from Benalla in Victoria to east of Cooma in NSW and from Benambra in Victoria to Eden in NSW.

In Victoria the routes pass through Baddaginnie, Benalla, Tatong, Edi, Merriang South, Myrtleford, Ovens, Rosewhite, Kancoona, Running Creek, Eskdale, Bucheen Creek, Nariel Valley, Tom Groggin, Cobberas, Brumby, Wulgulmerang, Wulgulmerang East, Deddick Valley, Tubbut, Bonang West, Bonang and Bendoc.

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THE MAGNETOTELLURIC METHOD

The magnetotelluric method is a passive scientific technique that monitors natural variations in the Earth's magnetic and electrical fields over time. The survey instruments will measure the electrical resistivity of rocks from tens of metres to tens of kilometres below the surface.

Survey equipment is set up at each site to record for 20-30 hours.

By taking measurements at many locations in the survey area, geoscientists can map the differences in Earth's natural electrical resistivity from place to place. These differences in resistivity are related to the composition of the Earth's crust and mantle and will be used to interpret the position and relationship of rocks across the Southeast Lachlan Crustal Transect.

MAGNETOTELLURIC SURVEY EQUIPMENT

Magnetotelluric survey equipment typically consists of a data logger, solar panel and 12V battery, three magnetic sensors and two electric sensors (Figure 2).

Each electric sensor is comprised of a pair of electrodes which are separated by 50-100 m and buried in moistened ground (Figure 3). The electrode is housed in a (jam tin-sized) cylinder (13 cm-long, 7.5 cm diameter). The electric sensors are set up with both a north-south and east-west orientation.

The magnetic sensors are induction coils. Three induction coils are used, and they are oriented to measure the vertical and horizontal magnetic field components. The sensors are contained within 2 meter long PVC pipes. During the monitoring time, the horizontal sensors are buried approximately 20 cm deep (Figure 4) and the vertical sensor is installed up to 1 m deep in the ground and stabilised using an above-ground frame.

Wires connecting the sensors to the data logger will also be deployed, and these may need to be protected from potential damage.

Figure 2. Magnetotelluric survey equipment. Photo: Geological Survey of Finland.

Figure 3. Installation of electrode with wires ready for connection to data logger Photo: Geoscience Australia.

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Figure 4 . Installing a horizontal magnetic sensor in western Victoria. Photo: University of Adelaide.

SITE SELECTION AND PROPERTY ACCESS

Sites are nominated based on desktop GIS and satellite imagery analysis. The best locations are flat, clear ground covering an area of preferably 100 m by 100 m. Each site needs to be distant from man-made sources of electrical and magnetic noise such as power lines, gas pipelines, railway tracks, main roads, electric fences, rivers and large dams. Site selection is confirmed with a field visit to check the desktop assessment. The selection process also ensures that there is no potential conflict with farming or local activities.

The surveyors transport their equipment in 1 or 2 light 4WD diesel vehicles as some of the equipment is heavy (e.g. 12V batteries and coils of wire).

Public land managers and private property owners along the route are consulted as part of the survey planning process. Prior to the survey beginning, site access and entry conditions are negotiated with individual land owners and managers with permits from the relevant authority obtained where necessary.

SURVEY AUTHORISATION

Under Victorian laws, geological surveys can be authorised on behalf of the Department of Jobs Precincts and Regions under Section 112(1) of the Mineral Resources (Sustainable Development) Act 1990.

The survey will be carried out by an experienced magnetotelluric survey contractor under the supervision of Geoscience Australia and the Geological Survey of Victoria.

SAFETY AND ENVIRONMENT

A detailed risk assessment and mitigation plan will be prepared by the contractor to ensure the safety of the surveyors, the public and the environment.

The magnetotelluric survey equipment only receives readings of magnetic and electric fields, whether they occur naturally (e.g. lightening) or are man-made (e.g. electricity transmission). The equipment does not produce any emissions.

Biosecurity arrangements will be in place to avoid the transport of soil and organic material from site to site.

Some very minor site disturbance is necessary to install the monitoring equipment. All sites will be rehabilitated to the satisfaction of the land manager following the completion of works.

SURVEY RESULTS

The data gathered during the survey will be processed and then made publicly available through the Department of Jobs, Precincts and Regions' Earth Resources website and Geoscience Australia website.

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MORE INFORMATION

For more information on the Eastern Victoria Geoscience Initiative

Telephone the Customer Call Centre on 136 186
Email evgi.info@ecodev.vic.gov.au

Visit the Department of Jobs, Precincts and Regions' Earth Resources website at www.earthresources.vic.gov.au/evgi to download the Fact Sheets

- *Eastern Victoria Geoscience Initiative Project Overview*
- *The geology of eastern Victoria*
- *Understanding a deep crustal seismic reflection survey*
- *Southeast Lachlan Deep Crustal Seismic Reflection Survey*
- *Southeast Lachlan Ground Gravity Survey*
- *Southeast Lachlan Magnetotelluric Survey*

Visit the Geoscience Australia website for information on the magne totelluric scientific method including examples from previous projects across the nation.
www.ga.gov.au/scientific-topics/disciplines/geophysics/magnetotellurics