Eastern Victoria Geoscience Initiative – Geology of eastern Victoria

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 https://earthresources.vic.gov.au/projects/eastern-victoria-geoscience-initiative

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 Geoscience Australia's Onshore Seismic and Magnetotelluric project webpage for information about deep crustal seismic surveys across Australia and gravity as a geophysical technique.
www.ga.gov.au/about/projects/resources/seismic
www.ga.gov.au/scientific-topics/disciplines/geophysics/magnetotellurics
www.ga.gov.au/scientific-topics/disciplines/geophysics/gravity

The bedrock geology of Victoria is described in detail in the book:

VandenBerg, A.H.M., Willman, C.E., Maher, S., Simons, B.A., Cayley, R.A., Taylor, D.H., Morand, V.J., Moore, D.H. & Radojkovic, A., 2000. The Tasman Fold Belt System in Victoria. Geological Survey of Victoria Special Publication.

This publication can be can be downloaded for free from the Earth Resources online store:
http://earthresources.efirst.com.au/product.asp?pID=8&cID=6

An exciting 'big science' research project is investigating how the geology of Victoria and southeast Australia evolved from its humble beginnings as ocean floor crust over 500 million years ago to the uplifted mountain landscapes of today. The research project includes using deep seismic surveying, gravity and magnetotellurics to image the Earth in a near-continuous line from near Benalla in central northeast Victoria to the east coast near Eden in New South Wales.

The surveys will help interpret the types of rock that lie up to 60 kilometres below the Earth's surface. The techniques to be used cannot directly detect mineral deposits or energy resources. Instead, it's the large-scale 'geological architecture' that is being investigated, for a number of important reasons that are summarised below.

GEOLOGICAL HISTORY

The mountains of eastern Victoria form part of the Great Dividing Range, a series of hills, ranges, mountains, plateaus and escarpments that extends 3,500 kilometres from North Queensland south through eastern Australia and eastern Victoria and across to western Victoria. The Australian Alps reside within the Great Dividing Range and represent the highest mountains in Australia (Figure 1).

Bedrock is exposed along the whole of the Great Dividing Range in Victoria. This provides a unique natural research laboratory, which can help geoscientists understand the geological evolution of eastern Victoria and southeast Australia.

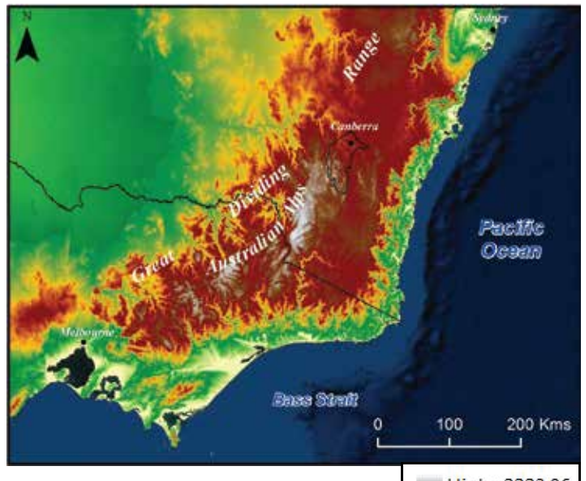

Figure 1. Elevation image of southeast Australia showing the Great Dividing Range and the Australian Alps.

Age dating of rocks, fossils and textures from the bedrock indicate that that the rock types at surface in southeast Australia today were formed in an ancient ocean between 530 and 400 million years ago (Figure. 2). This ocean was probably a direct ancestor of today's Tasman Sea and the modern line of volcanic 'arc' islands that stretches from New Zealand to Vanuatu.

Figure 2. Exposed bedrock in the Genoa River. These beds were originally deposited as horizontal sediments by turbidity currents in the deep ocean 485 – 458 million years ago. They have since become upturned rock (the 'Pinnak Sandstone') and can be found at surface across a significant portion of eastern Victoria. Source: The Tasman Fold Belt System in Victoria (Geological Survey of Victoria).

In geology, present Earth behaviour is an important key to past Earth behaviour. Geoscientists infer that the plate-tectonic processes of subduction, volcanic arc magmatism and continental collision observed along the Australia-Pacific plate boundary in New Zealand and Vanuatu today, measurable at centimetres per year, were likely operating in similar ways and rates within southeast Australia 530 to 400 million years ago resulting in the formation of very similar rocks. These processes have gradually built the continental crust of southeast Australia over a period of more than 100 million years. Understanding exactly how that occurred requires gaining a deeper insight into the legacies such processes might have left behind in the deeply buried rocks of Victoria and New South Wales.

Eastern Victoria Geoscience Initiative – Geology of eastern Victoria

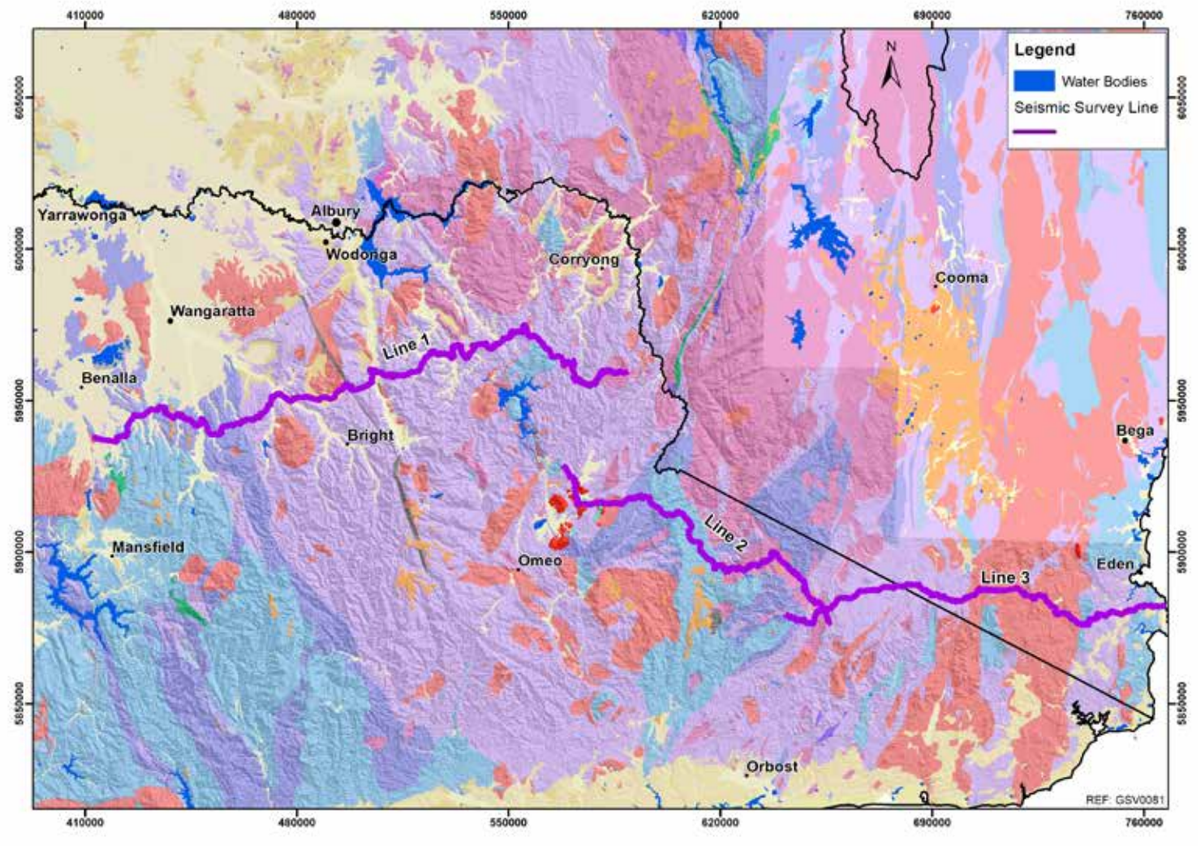

Figure 3. The geology of southeast Australia (source: Geoscience Australia). Colours correspond to different rock-types. Purple, blue and red rocks form the ancient 'bedrock'. Yellow rocks are younger sedimentary basins. Proposed transect is the dark purple lines.

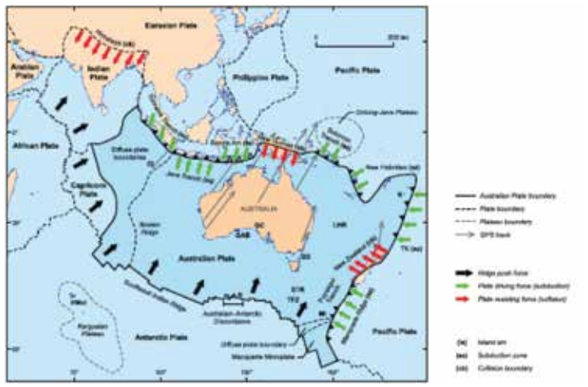

Figure 4. Map of the crustal plates and their key boundaries surrounding the Australian (continental) plate. Red arrows are the plate motion vectors and velocity. High precision GPS measurements show that Australia is moving to the north-northeast at a rate of around 7 cm per year. BS = Bass Strait; CI = Cook Islands; GAB = Great Australian Bight; GC = Gawler Craton; LHR = Lord Howe Rise; HMcI = Heard and McDonald Islands; MI = Macquarie Island; STR = South Tasman Rise; TFZ = Tasman Fault Zone. Source: Shaping a nation: A geology of Australia (Geoscience Australia).

Geological mapping shows that the overall 'grain' of Victoria's bedrock geology trends in a north-south direction, most likely a legacy of the ancient geological plate-tectonic processes that once operated. For this reason, the transect and geological surveys are aligned east-west. The deep geology is best investigated at right angles (Figure 3).

The modern Australia-Pacific plate boundary is still aligned north-south. It appears that over the last 400 million years, the plate boundary has slowly migrated east for thousands of kilometres to its present position in the western Pacific Ocean (Figure 4).

Figure 5. Mount Bogong, Victoria's highest peak, seen from Tawonga Gap. The Tawonga Fault scarp forms the slope between the cleared paddocks and the summit. With a vertical uplift of about 700 metres, most apparently happening in just the last few million years, this is one of the highest active fault scarps in Australia. Photo: Geological Survey of Victoria.

CURRENT DAY

Eastern Victoria is a region of ongoing geological evolution. Uplift of the current rugged topography of the Australian Alps continues apace, courtesy of stresses imparted into the rocks of southeast Australia from the intense and ongoing mountain-building activity of New Zealand. It is now thought that the Australian Alps aren't the eroded stumps of an 'ancient mountain range' as previously assumed. Rather they are a dynamic new mountain range still thrusting skywards along old fault lines which have re-awoken in the last 6 to 10 million years (Figure 5).

Some of the bedrock, such as some exposed granites of eastern Victoria, are known to have formed approximately 420 million years ago at a depth of 15 to 25 kilometres below the Earth's surface. Some of the older seafloor rocks have been buried and heated to temperatures approaching 600 degrees Celsius. These high temperatures must also have occurred at a significant depth below the Earth's surface. Key questions for geoscientists to answer include understanding exactly how and why these ancient rocks from deep in the Earth's crust came to be exposed at the present day surface in the Great Dividing Range and Australian Alps.

EARTH RESOURCES

Victoria's inland geology is the source of soils and the host for ground water and other resources. It is also the foundation support for buildings, roads, dam walls, and most other infrastructure. Developing our geological understanding is important for future planning, since geology forms the foundation upon which everything else in the State is built. The results of the Eastern Victoria Geoscience Initiative will help geoscientists gain a deeper understanding of the geology of eastern Victoria, for better informed and safer land management, including for ground stability, earthquake hazard, infrastructure planning and resource assessments.

The ancient bedrock of the Great Dividing Range and Australian Alps has been heated in the past. The high temperatures would not have allowed any oil or gas to be preserved. The sedimentary rocks are too old for coal. Igneous and metamorphic rocks do not host coal.

Future research will not alter these scientific facts.

Gold and other metals have been discovered and mined from the region in the past, but none of these deposits proved to be as s ignificant as the world-famous goldfields of central and western Victoria. The deep seismic reflection survey cannot directly detect more metals, but it is possible that the results might help geoscientists understand, in broad terms, how minerals such as gold have formed over time.