SAA Newsletter

#3/2026

From the Editors - Members are encouraged to submit articles with an earthquake connection of interest to members but accepting they may be edited or not published, at the discretion of the editors. Contributions to: mccue.kevin@gmail.com

Contents

Major Earthquakes Worldwide, April - June 2026, USGS

Date UTC	Time UTC	Latitude	Longitude	Depth km	Mww	Place
2026-04-01	22:48:13	1.12	126.30	35	7.4	Ternate Indonesia
2026-04-20	07:53:00	39.95	143.05	35	7.4	ENE Miyako Japan
2026-06-07	23:37:40	5.60	125.07	35	7.8	Mindanao Phillippines
2026-06-24.	22:05:11	10.40	68.32	10	7.2/7.5	Venezuela

Summary Unlike the previous quarter when the three major earthquakes were at intermediate depth or deep, all major earthquakes in this 2nd quarter of 2026 were shallow and all but that in Japan, killed people.

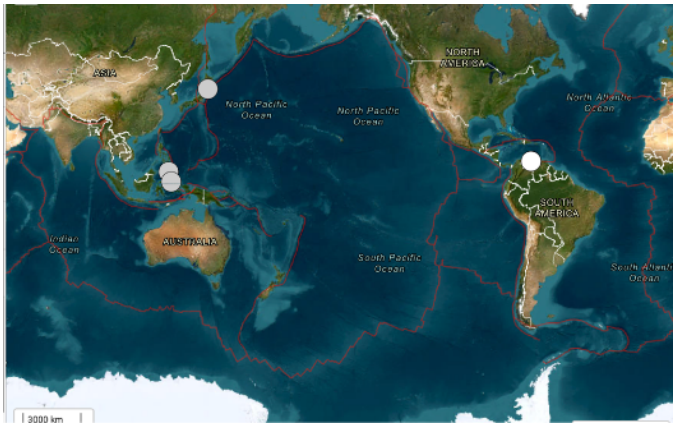


Figure 1 *Major, M≥7, World earthquakes in April - June 2026 (USGS)*

Japan

A magnitude 7.4 earthquake struck off the coast of northern Japan just before 5p.m. local time on Monday, according to the United States Geological Survey (USGS). Japan's government issued tsunami warnings for prefectures along the east coast of Japan's main island, Honshu, but no damaging tsunami waves were observed.

Molucca Sea, Indonesia

ABC News

On 1 April, a powerful magnitude 7.4 earthquake struck under the Molucca Sea region north-east of Indonesia, according to the USGS. The epicentre was 127km west-north-west of Ternate, Indonesia.

Indonesia's meteorology agency reported tsunami waves in West Halmahera at 0.3m and Bitung at 0.2m .

In the city of Manado on the fourth floor of a hotel one resident described the effects: "I felt a tremor … and it kept getting stronger, and that's when I realised it was an earthquake," I didn't think twice. I didn't take anything except my mobile phone and immediately ran. "In my entire life, this is the first time I've ever experienced an earthquake that strong and with such a long duration. "The damage I saw at the hotel — in the room, the ceiling at the front had completely collapsed."

The Head of Indonesia's National Disaster Management Agency (BNPB), Abdul Muhari, told ABC News that teams in Manado and Bitung, North Sulawesi, as well as Ternate, North Maluku, were still inspecting a number of buildings to assess the extent of the damage and to determine whether there had been any further fatalities.

"We are still collecting data to confirm the number of victims and the damage in each location," Mr Muhari told ABC News.

"There have indeed been earlier reports of casualties from the Regional Disaster Management Agency, but we will provide updated details later regarding the exact figures. . . our teams are still working in the field."

"One victim who died after being hit by debris has been taken to the hospital," said Nuriadin Gumeleng, spokesperson for the North Sulawesi National Search and Rescue Agency (Basarnas). Basarnas also reported one person with injuries was receiving treatment. "The other person broke his leg after jumping from a shop," the spokesperson said.

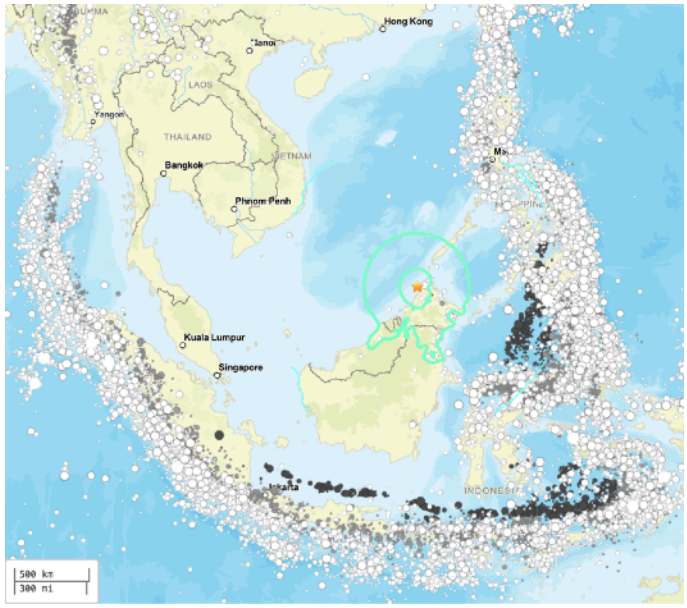


Figure 2 *The April 01 Indonesian earthquake, well away from the plate boundary.*

Indonesian broadcaster Metro TV reported one person had died from falling rubble in the Manado area, and video showed damaged buildings.

One person was killed, four were injured and over 450 structures were damaged or destroyed, the majority of them in the Batang Dua Islands.

Photo *A damaged building in Manado after the quake. (Reuters: Tonny Rarung).*

Regional governments in some cities, such as on Ternate and Tidore, the historic Spice Islands, were urged to prepare citizens for evacuation.

A hospital building was evacuated in Manado. (Reuters: Randy Karundeng)

The epicentre of the quake was roughly 580km south of the Philippine coast and 1,000km from Malaysia's Sabah.

The Philippines' seismology agency said there was "no destructive tsunami threat" to the country based on the latest data.

Waves of heights ranging from 0.3m to 1m above the tide level could hit some coastal areas of Indonesia, the Pacific Tsunami Warning Center said.

One person died after a sports centre collapsed and two others were injured in Manado. A Siloam Hospital was seriously damaged. Five government buildings and a hotel were also damaged in the city. In the Batang Dua Islands, near the rupture area, one person was injured, 1,966 others were displaced, 104 homes collapsed, 85 were moderately damaged and 79 were slightly damaged. In addition, six churches, a school and two public facilities were destroyed, with eight more churches damaged. At least 23 homes on Ternate Island, and 41 structures in Bitung were also affected. The kitchen of a house was destroyed by a landslide and the walls of a mosque and several government offices collapsed in the city. Across Halmahera, two homes collapsed, 12 others, a bridge and

a school were damaged. At least 27 homes collapsed, 25 others, five places of worship and a public facility were damaged on Tidore. In Minahasa Regency, one person was injured, 17 homes, three buildings and a road were damaged. Three churches were also damaged in the regency and in Tomohon. Several roads in Gorontalo were damaged or struck by landslides.

Tide Gauge Location	Lat	Long	UTC	Ht
Ofunato Honshu Japan	39.0N	141.8E	08:30	0.16m

Table Tsunami wave observation for Japan https://en.wikipedia.org/wiki/2026_North_Maluku_earthquake

Mindanao, Philippines At least 35 people died and 129 were injured in General Santos and Davao when a shallow magnitude 7.8 earthquake hit the Philippines at 07:37 am local time (23:37 GMT) on 7 June. The quake struck off the coast of General Santos City in Mindanao - the Philippines' main southern island.

A tsunami wave measuring a few centimetres was observed in the southern prefecture of Okinawa (Japan), and a 20cm wave was measured in the distant Ogasawara Islands, authorities said.

Waves were also detected at several locations along the coasts of Indonesia, Palau and the Philippines. The height of those waves ranged from a few centimetres to 1.4m, according to authorities.

Photo *Damage to a fast food restaurant in General Santos City in Mindanao. Parts of the city's St Elizabeth Hospital were severely damaged, forcing patients and medical personnel to evacuate and temporarily operate outside the main hospital building.*

Earthquake sequence in Venezuela

On 24 June a magnitude 7.2 earthquake with an epicentre some 130km west of Caracas morphed into a larger magnitude 7.5 earthquake, causing much destruction and loss of life in Venezuela. The editor has compiled information about this earthquake and its effects in an article on the SAA website.

Seismological aspects. Whether it was one or a doublet is not the issue. The sequence occurred on a series of transform faults along the boundary between the Caribbean and the South American Plates which move at about 30mm/year, a similar slip rate to the San Andreas in California or the Alpine Fault in New Zealand - not fast. Destructive earthquakes killing more than 10,000 people occurred in 1812 (M7.7) and 1875 (M7.5) and also in 1967 (M6.6) there were more than 300 deaths. The ground shaking may have been exacerbated by the fault rupture propagating through Caracas and other cities on the coast, where Doppler frequency shift caused pulse-like ground motion.

Engineering aspects. The 1967 Caracas earthquake alerted engineers to earthquake risk in Venezuela and ultimately led to the adoption of an earthquake building code recognising the importance of building foundations on deep, soft soils. The code did not apply retrospectively to pre-code buildings, nor is it clear how well the code was implemented in later buildings. In this earthquake sequence in 2026, hundreds of buildings have been severely damaged or collapsed.

Society aspects. The human catastrophe rolling out in Venezuela has risen to more than 4700 deaths, 16,740 injured, 17,907 homeless and still tens of thousands missing. The chaos and loss of life is made far worse by the political situation, crippling embargoes on trade especially oil, imposed by the US and Europe, and the freezing of billions of dollars of Venezuelan assets at a time when they are sorely needed. It is hard to understand the maintenance of these embargoes when these same countries are providing at least some on ground post-disaster support.

Australian earthquakes ML≥3, April-June 2026 (Maps by Clive Collins)

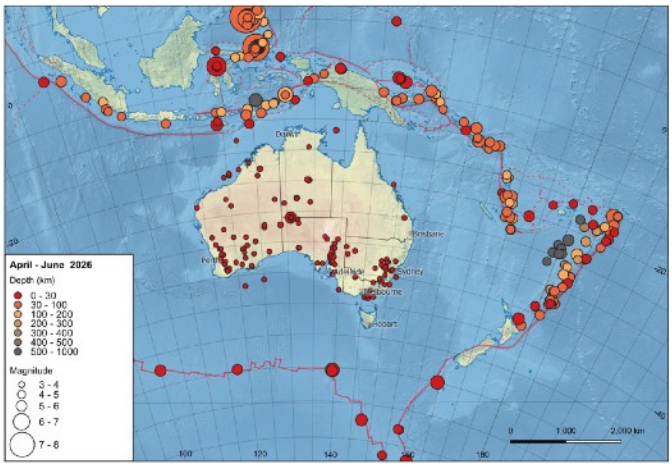


Figure 3 *Australia in its Plate Tectonic setting, marked by epicentres.*

The plate boundaries around continental Australia, the thin red solid lines in Figure 3, are the USGS version. We have plotted everything above ~M4.5 around the continent but above M3 within continental Australia in Figure 4, for April to June 2026. These limits are about what is practicable with the existing network.

The plate boundaries around Australia are marked by shallow earthquake epicentres. There were the usual earthquakes under compression in Papua New Guinea and Indonesia and enough on the Australian/ Antarctic plate boundary under tension or transform to mark it.

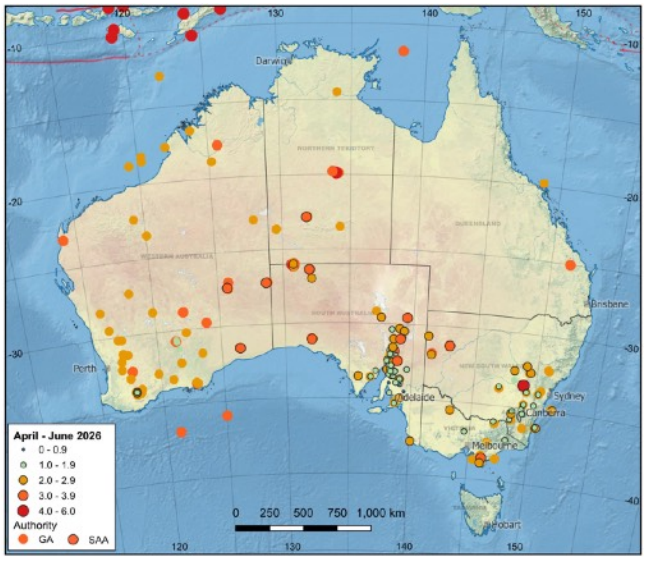


Figure 4 *Australian earthquakes, April- June 2026*

This was a very active quarter, at least in South Australia where on 4 April, a magnitude 5.6 earthquake struck the SA/NT border area causing surface faulting (see article below). It was followed by aftershocks to magnitude 4.1. Epicentres of the 49 earthquakes above magnitude 3 were located in all states and territories apart from Tasmania and the ACT.

South Australian seismicity April - June 2026

Fourteen of the many earthquakes recorded in South Australia in the quarter were of magnitude 3 or more and they ranged from the far northwest near Amata on the NT border (see article below) to Millicent in the southeast, leaving a big gap around Adelaide.

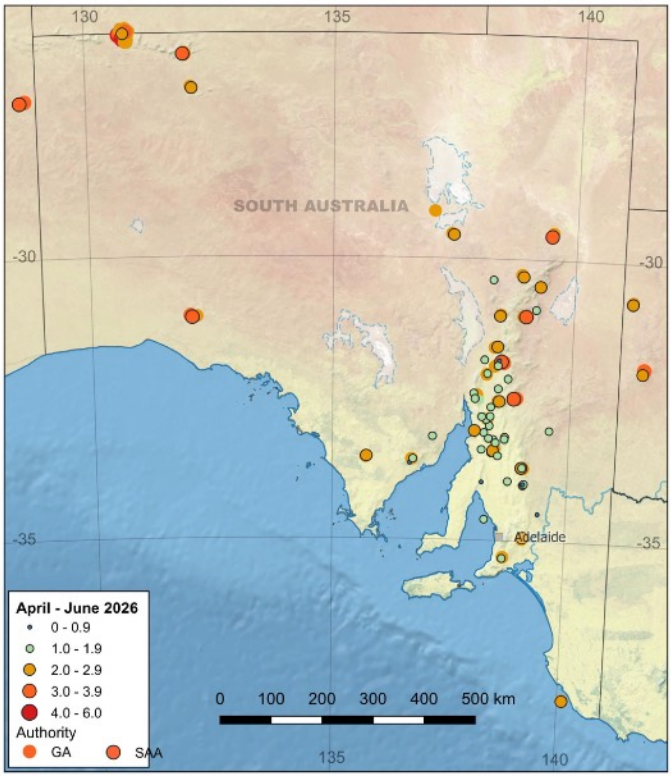


Figure 5 *SA earthquakes, April - June 2026*

Amata, SA earthquake - a changed landscape

ABC
https://www.abc.net.au/news/2026-05-20/outback-earthquake-apy-lands-south-australia/106666992

Amata, a remote community in the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands near the border of South Australia and the Northern Territory, felt the earthquake at the start of April.
"The rocks on the western side have been lifted up about half a metre or so relative to the rocks on the eastern side," University of Melbourne professor Mark Quigley told ABC North & West Breakfast's Tom Mann.
"It's permanently changed the landscape there."
Professor Quigley said the obvious rupture was "maybe 3 or 4 kilometres long", with more subtle cracking also visible. "It's extended right through

areas of bedrock into areas of younger sediment on either side of the bedrock knob," he said.

Photo *A rupture caused by the earthquake in the APY Lands last month. (Supplied: Quinn McNab)*

“Cracks in the ground in outback Australia caused by a recent magnitude 5.5 earthquake could help researchers predict future earthquakes. “

Photo *The research team saw extensional cracking from the earthquake "stretching" the land surface. (Supplied: Quinn McNab). Shortly after, University of Melbourne researchers attended the scene and were met by a several-kilometre-long rupture in the ground.*

"It allows us to do detailed geological analyses of the ground surface rupture … to understand how the geology influences the patterns of earthquake damage.”

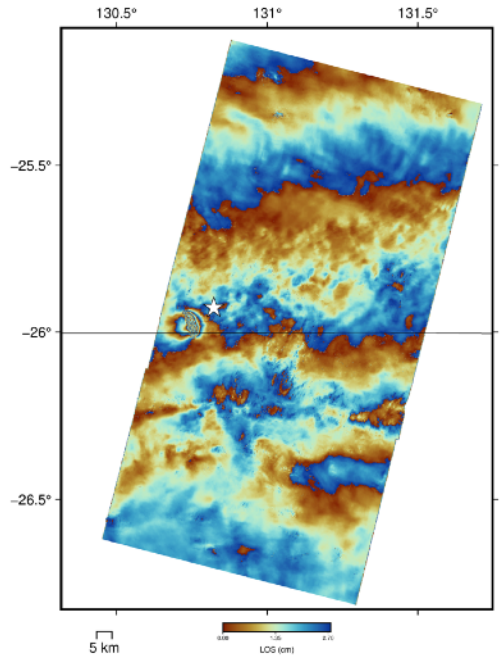
Geoscience Australia senior seismologist Jonathan Bathgate said that on April 5, the agency had received about 30 reports from people who felt the quake that morning.

He said the magnitude was equivalent to the devastating 1989 Newcastle earthquake that killed and injured dozens, and created a $4 billion damage bill. "It's the same size earthquake, it just happens to be in quite a remote part of the country rather than near a populated centre," he said.

Lessons from the land

Remarkably, **e**leven surface-rupturing earthquakes have occurred in Australia since the 14 October 1968 Meckering WA earthquake.

“There are seismometers across the country, but very rarely are they right on top of earthquake ruptures. So we have to use other means to try to understand those ground motions," Professor Quigley said. "What we're able to do here is go out immediately after the earthquake and look at, for example, the way rockfalls have occurred, or individual rock fragments have flown in the air."



InSar photo *Ground displacement due to the AMATA SA/NT border earthquakes. The star is one estimate of the epicentre.*

The rupture from this earthquake is now the topic of ongoing research at the University of Melbourne and Geoscience Australia. Observations from the ground have already proven interesting for Professor Quigley. "There's this really distinct and interesting characteristic of the earthquake that tells us the motions were dominated by motions perpendicular to

the fault, which is quite cool," he said. "In other words, for a roughly north-south striking fault, the predominant motions are more east-west. The rocks were moving towards and away from the fault."

The research into this quake should provide lessons that could then be applied to the same type of fault mapped elsewhere, Professor Quigley said. "Including proximal to urban centres like in Adelaide, for example, to try to understand … what the patterns of shaking might look like and therefore what potential impacts they might have on infrastructure," he said. "I think it's going to reveal some really tremendous insights about the physics of earthquakes, not just in Australia, but applicable to geologically analogous regions worldwide."

NSW seismicity April - June 2026

There were six earthquakes in the State during the quarter, the largest at M4.5 was a mining induced seismic event within the Cadia Mine, SW Orange. A subsequent aftershock M3.4 occurred 2 months later on 18 June.

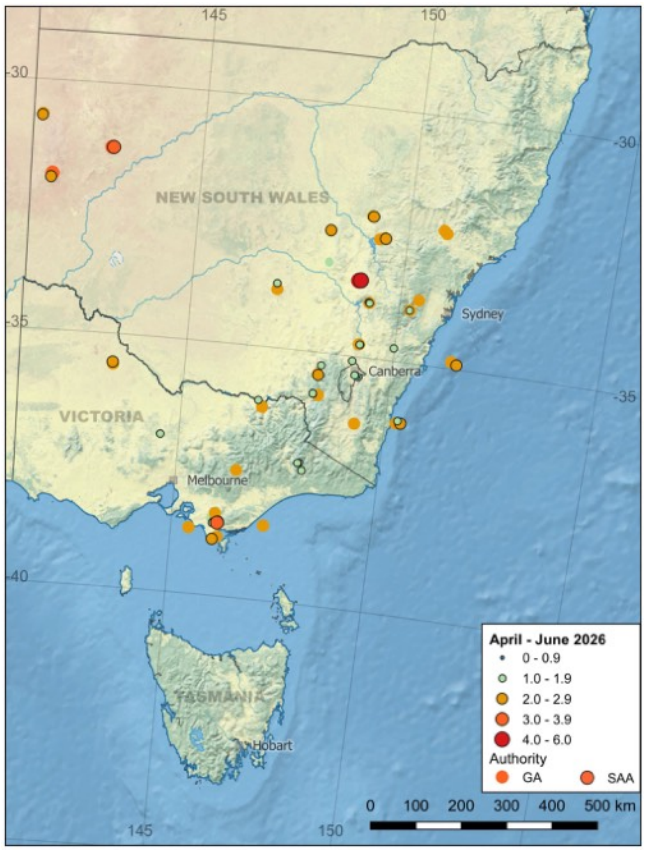


Figure 6 Seismicity of SE Australia, April - June 2026

Earthquakes shut Cadia Gold Mine NSW – again, 14 April 2026

According to the ABC News, 153 gold miners took refuge in underground chambers for up to 10 hours following a magnitude 4.5 earthquake in the workings. The Cadia gold mine near Orange NSW operated by the US Newmont Corporation has been closed following a moderate earthquake until underground damage has been repaired and the workings made safe. The earthquake occurred on Tuesday at 10:20 UTC, 14 April. Geoscience Australia received more than 2,000 reports of the earthquakes being felt throughout the region and Sydney, Canberra and as far as three hundred kilometres south-east in Batemans Bay.

Two small aftershocks were recorded at the nearest seismographs Young and Dalton. This was the second magnitude 4+ earthquake in the last 9 years with many smaller ones in between.
The earlier earthquake was a magnitude 4.3 event on 14 April 2017 that led to the evacuation of the Cadia site and closure of underground mining for about 3 months.

Newmont's Cadia goldmine tailings dam partially collapsed in 2018.

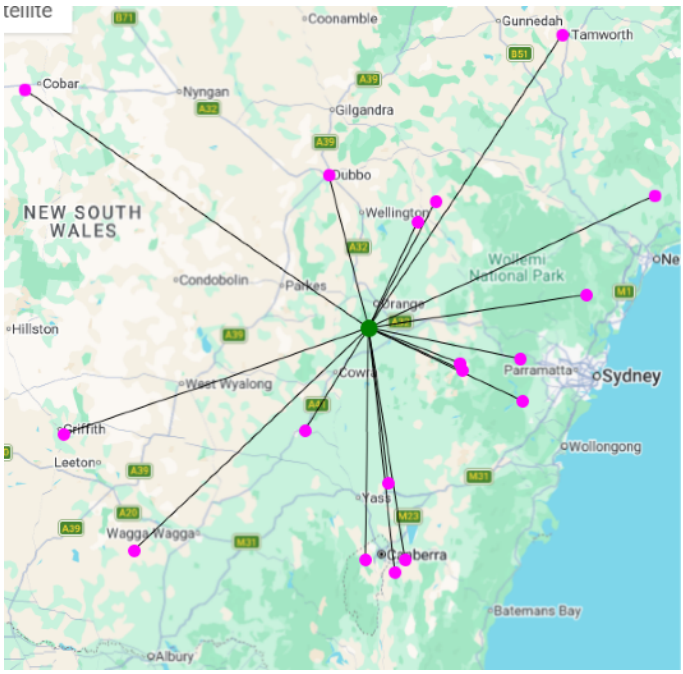


Figure 7 Only close and well distributed seismographs were used to locate the epicentre and depth by SAA seismologists. A local crustal model was used in the computation.

Seismic events are not uncommon across Australia's mining regions. Who could forget the Tasmanian mine disaster 20 years ago at Beaconsfield after a small mine-induced earthquake. Kalgoorlie WA and Broken Hill NSW had many mining induced earthquakes and some deaths dating back to the 1960s. In February 2015, the Mount Rawdon Qld open cut gold mine had a magnitude 5.2 earthquake and magnitude 4.0 aftershock, causing two rockfalls.

GA's Dr Phil Cummins said five quakes of a similar scale had been recorded within 50km of Cadia since 1977.

Figure 8 *Using just the closest seismograph data, SAA seismologists computed an epicentre below the mine and marked with a red tear. The computed focal depth was between the surface and 2km.*

GA reported the epicentre several km to the SSW and at 5km depth using IASPEI travel times and arrival times from seismographs as far away as Western Australia. Their location of two aftershocks using just local data is at the same location as the SAA mainshock solution, under the mine.

John Clemens, the owner of the Forest Reefs Tavern about a 20 minute drive from the mine site, said they had just closed for the evening when they felt the quake. “We’d just closed the tavern and were counting the takings and the place just shook like a truck was coming through it,” he said. “It was crazy. Windows rattling, wine glasses rattling in the hotel. “We had one once before out near the mine but that one last night was crazy.” He said everyone at the tavern was alright and there had been no damage. “The force coming from the mine side, the western side, it was like the pub leant one way and then came back the other,” he said.

The NSW premier Chris Minns said the government had no information to suggest the earthquake was linked to mining activity. “We don’t believe it’s linked, or I’ve been given no information that it has been linked,” he said.

[Ed. I have written to the NSW Premier’s office to ensure he has the relevant information.]

ABC News
https://www.abc.net.au/news/2026-04-24/newmont-cadia-gold-mine-to-fix-earthquake-damage-in-weeks/106600726

Newmont's Cadia gold mine aims to fix earthquake damage in five weeks.

One of the country's largest gold mines expects to reopen its underground facility in five weeks after an earthquake rattled the New South Wales Central West. Below ground operations at Newmont's Cadia site have been suspended since a magnitude 4.5 quake hit earlier this month, the region's biggest on record.

The company today released its first quarterly update for the year, stating that investigations about the impact of the tremor were still ongoing, but initial findings suggested damage was limited. "The operation is currently processing surface stockpiles and expects underground rehabilitation to be completed in the next five weeks, enabling a return to 80 per cent capacity," the report said. Newmont said it expected to return to full operational capacity at the end of the second quarter.

The update projected production at the site to be lower due to a "short gap" in mill feed, but predicted return to normal levels at the start of the third quarter.

Newmont operates seismographs at the mine but have seen no need to release this critical data and the NSW premier has apparently not asked that it be made public.

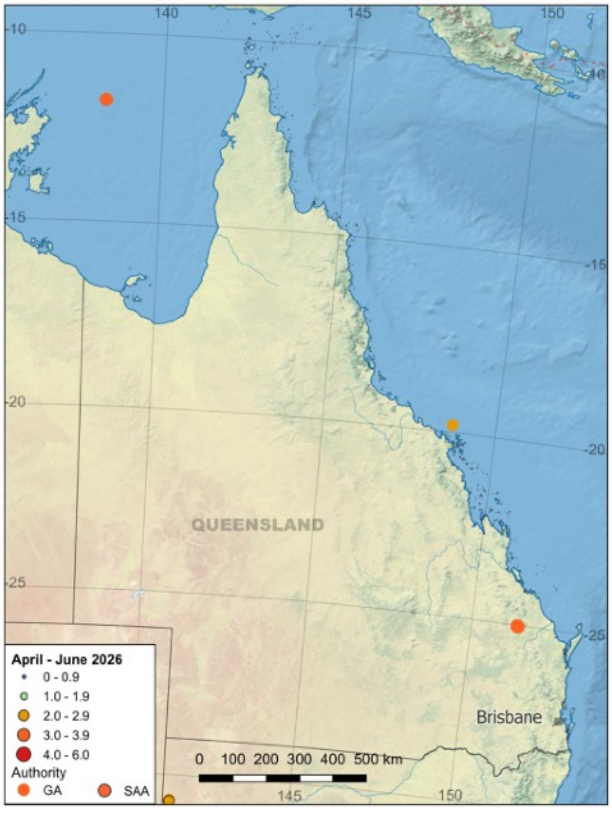


Figure 9 *Epicentre locations in Queensland in the quarter - three of them.*

Queensland seismicity April - June 2026

Four earthquakes of magnitude M≥3 were detected in the quarter, two of them 35km SE Monto in the southeast, another offshore Bowen and the fourth in the Gulf of Carpentaria in the far northwest of the State. The two earthquakes in four days near Monto were felt locally but no damage was reported. In all seventeen aftershocks were large enough to be recorded.

Report on the May 2026 Yarrol Block Earthquakes and Aftershocks, Queensland

by Mike Turnbull

On 2026-05-17 at 21:51 UTC an ML 3.5 earthquake (Event 1) occurred in the Yarrol Block, about 35 km southeast of Monto in Central Queensland. This was followed by an ML 3.6 in the same place on 2026-05-20 at 18:06 (Event 2).

(Refer to Figure 2) Event 1 was followed over four days by 31 small aftershock events from ML 0.6 to ML 0.8. Event 2 was followed over 22 days by 16 aftershocks ranging from ML 0.6 to ML 0.9. These aftershocks were only recorded on the Eidsvold (EIDS) station operated by Geoscience Australia and assumed aftershock events continue for an extended period it may be that they have not been generated by these recent ML3.5 and 3.6 events. However, this suggested more distant association could go back to the 1935-04-12 ML 6.1; or even to the 1918 06-07 ML 6.0 to 6.3. Using that reasoning, we could further go back hundreds, thousands, hundreds of thousands etcetera of years to the great earthquakes of unknown event times that shattered the Yarrol Block to the complex of faults it now displays. At some stage we need to draw a line in the sand; or, in this case, in the admittedly very long event timelines, and determine that one aftershock sequence has been terminated by the occurrence of a subsequent generational event; and that is what I have chosen to do.

The Yarrol Block (see Figure 1) is located between Mt Perry and Monto and is the head waters of the Burnett River. It is heavily mineralized and contains the Monto (Goondicum) open cut Titanium Mine (see the aspherical truncated pluton feature in the top middle of Figure 1). In the southeast the historical Mt Perry Mine (a large source of gold, silver, copper, and other polymetallic ores), and the operational Mt Rawdon open cut gold/silver mine.

The whole of the Yarrol Block consists of a complex of earthquake faults. It presents a continuous seismically active zone and is notable for having

Figure 1: The Yarrol Block showing the locations of Events 1 and 2.

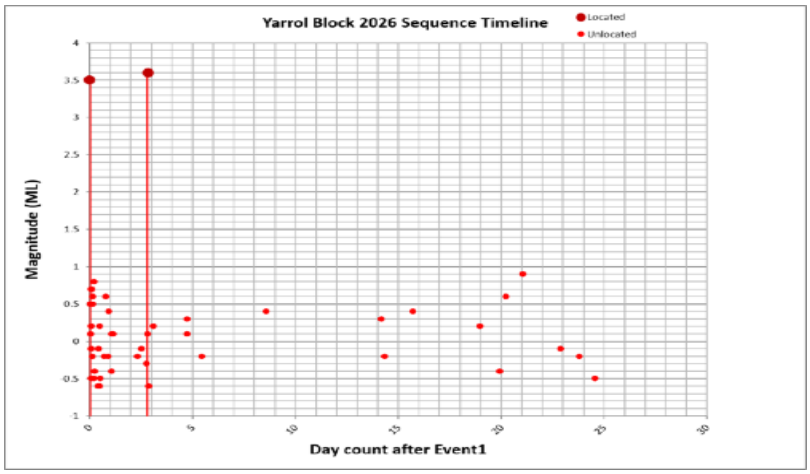


Figure 2: Timeline of the Yarrol 2026 Sequence

were not located. A noticeable feature of the sequence is the distinct separation between the magnitudes of Events 1 and 2, and the assumed aftershocks. Their associations with Events 1 and 2 were implied by their coincidental S-P times; however, it may be that they represent the long-term background seismicity of the Yarrol Block and have not been triggered by either Event 1 or 2, but (a) previous much larger event(s). The sequence is ongoing.

It has been suggested that Events 1 and 2 should be considered aftershocks of the 2015-02-15 ML 5.0; and this could certainly be true. Under normal circumstances it would not be expected that earthquakes of the order of ML 3.5 could generate an extended aftershock sequence, and if these small, generated the 2015-02-15 ML 5.0, and the April 1935 ML 6.1 earthquakes. It has been recently speculated that the "Great Queensland Earthquake" (somewhere between ML 6.1 to 6.3) in June 1918 occurred in this area, not offshore from Gladstone as previously thought. The fractured condition of the geology suggests seismic activity of very large earthquakes over geological time.

Victorian seismicity April - June 2026

A magnitude M3.2 earthquake struck northwest of Foster in Southeast Victoria on 9 May at 08:12 UTC.

This was the largest of ten Victorian earthquakes located by SAA seismologists, Figure 6, most of them in the southeast of the state.

Seismicity in the Northern Territory April - June 2026

Five of the nine recorded earthquakes over magnitude 3 occurred SW of Tennant Ck, still active since the three large earthquakes ruptured the crust there in 1988. One of the Tennant Ck aftershocks was the largest earthquake in the Territory in the quarter, its magnitude M4.2.

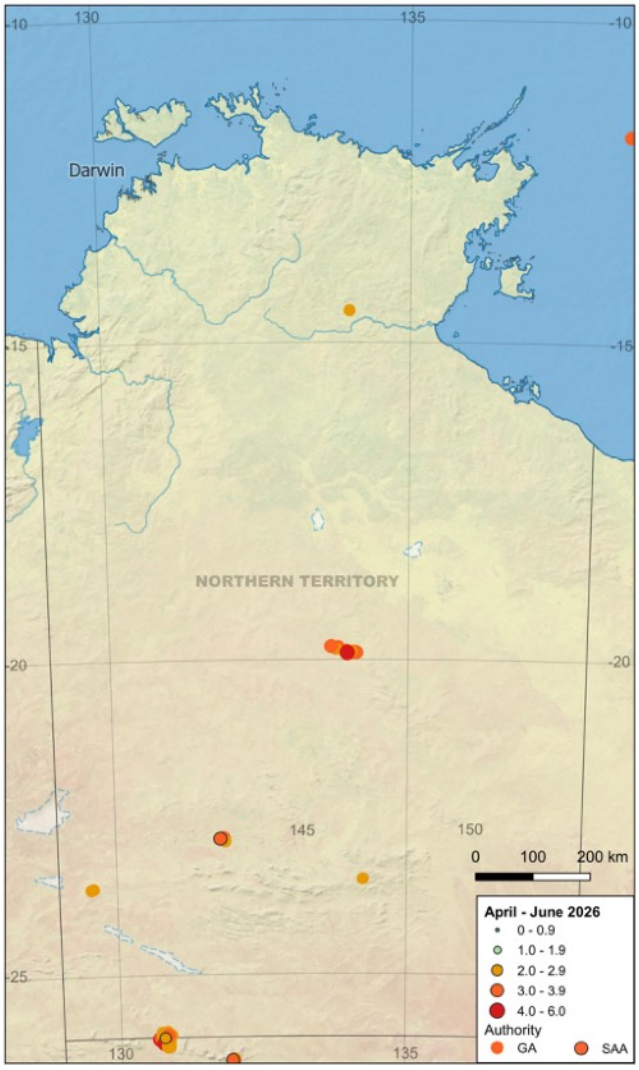


Figure 10 *Epicentre locations in the Northern Territory April - June 2026.*

Three aftershocks of the Amata SA earthquake seem to have drifted over the border into NT.

Seismicity in WA April - June 2026

As you can see from the map most of the sixteen M≥3 earthquakes in the quarter were in southern WA, the largest at magnitude M4.0 was near the SA border in the Great Victorian Desert. The early morning earthquake on Friday 22 May (local time) near Kalgoorlie woke many residents of the mining town, some of whom attributed these events to mining activity.

Note: Details and maps of Australian region earthquakes can be downloaded from the Geoscience Australia website.

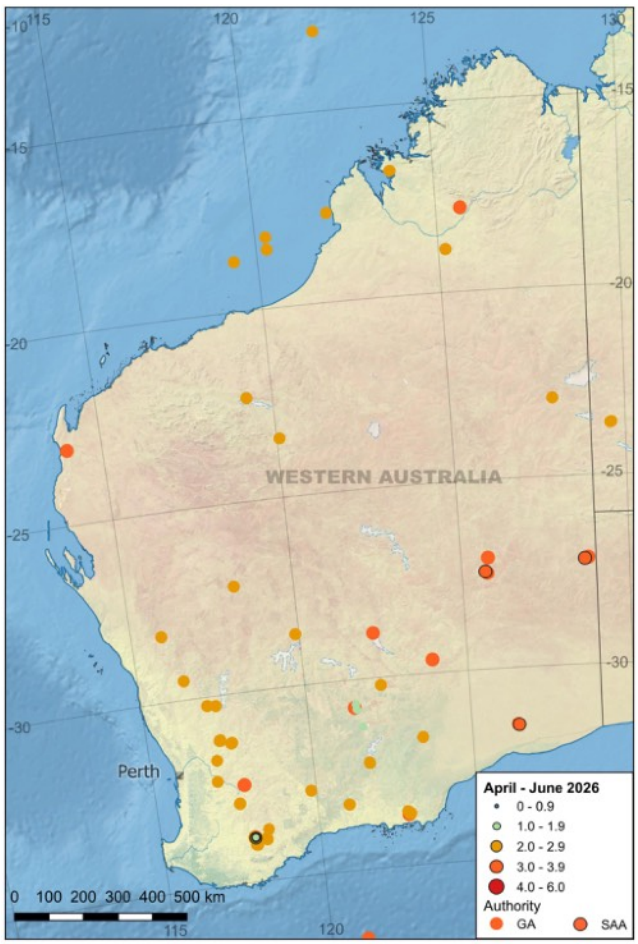


Figure 11 *Epicentres in Western Australia computed by GA for the 2nd quarter of 2026.*

Sydney Morning Herald

WA town shaken but not stirred by mystery earthquake swarm (Michael Philipps April 18, 2026).

Eleven earthquakes in the space of seven days may seem like a lot, but it has become the norm for the small West Australian town of Gnowangerup – although the cause of the tremors remains a mystery.

Gnowangerup has recorded almost 200 earthquakes since the start of 2026, most localised to an area about 10 kilometres to the north-east of the town near several farms. They follow a significant magnitude M5 earthquake in the area in 2023 which lasted about 30 seconds and caused damage to several homes.

Peismo News In the ACT, problems with data dropouts were related to poor internet (CLIL) and/or poor power connection to the Peismo via ill-fitting barrel power connectors and lightning (PFLO). The first 3-component Peismo, designed and built by John Millard using ChatGPT was installed at BEGA to replace an ancient EchoPro. John Millard has subsequently designed and built a new smaller triaxial model as shown on the front page of this newsletter. All but one of the eight ACT Peismos are now recording on Seismosphere. There are ten Peismos in the Sydney Network and four in South Australia with the recent installation by David Love at PENW. Paul Desteno has added VPN capability to remotely access the Peismo.

Collecting earthquake data in NZ

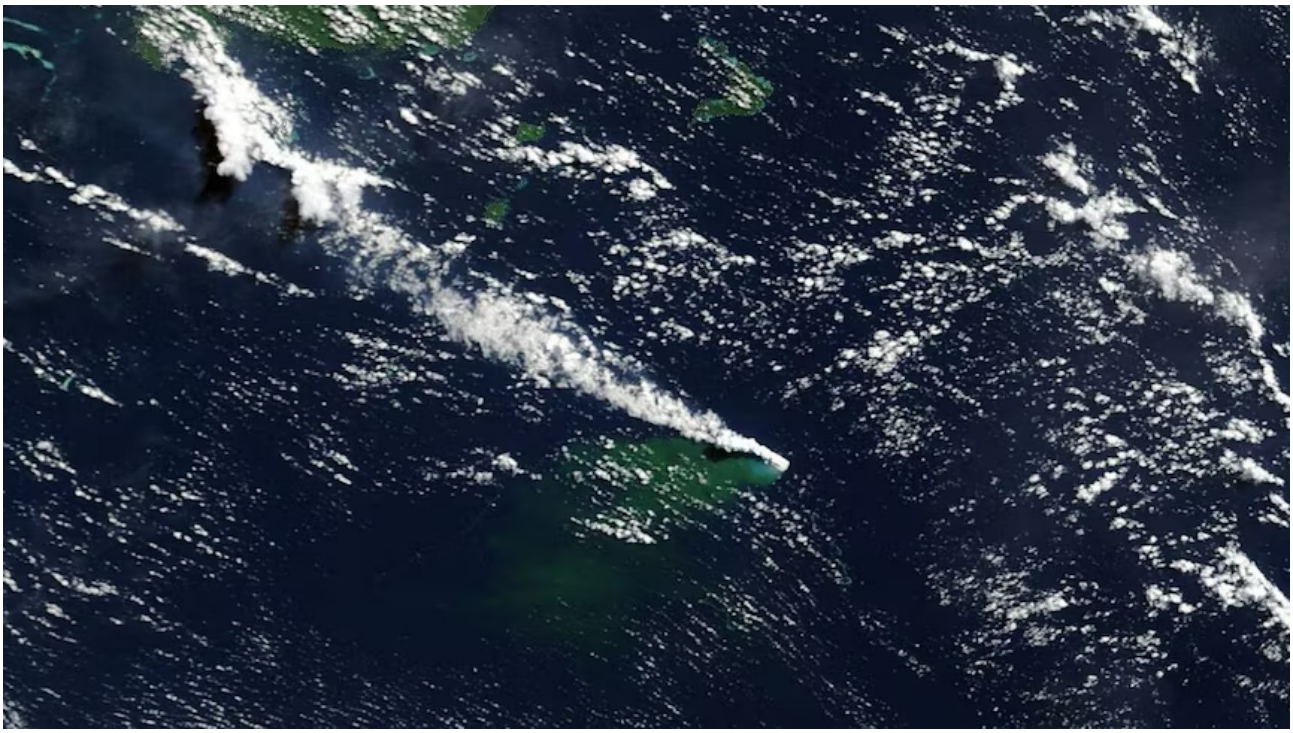
In an article about the earthquake hazard faced by the population of Auckland, one of the researchers, Dr Jennifer Eccles, said: "It's always better to plan based on evidence rather than on our best hopes or worst fears." How true!

News release Victoria University of Wellington

Major earthquakes stop with a jolt, causing whiplash for buildings
Publicly released: Fri 24 Apr 2026 at 0400 AEST | Fri 24 Apr 2026 at 0600 NZST
NZ-led research into large earthquakes shows that they stop fast, with a sharp backwards movement. Scientists studied 12 major earthquakes where movement was mainly along the ground rather than up and down, using shaking data recorded within several kilometres of the faults. They found that the whiplash-type stop was a common feature of the earthquakes, which included the 2010 Darfield and 2016 Kaikōura quakes, and say it should be included in hazard assessments.
Ed - I can't say I have ever seen evidence of earthquake whiplash.

Undersea volcano eruption in Papua New Guinea's Bismarck Sea - prompted tsunami concerns

By Patrick Martin and Dana Kirimof



https://www.abc.net.au/news/2026-05-19/papua-new-guinea-volcanic-eruption-bismarck-sea/106697688

Photo *The eruption seen from space (with a sou-easter blowing - Supplied: NASA Worldview).*

The Titan Ridge Volcano is active across a 5 kilometre area and is visible from space. A volcano is erupting under the ocean in the Bismarck Sea, southeast of Manus Island prompting warnings of possible tsunamis from authorities as ash and smoke billow into the sky.
Papua New Guinea authorities warned of falling pumice, ash, unpredictable swells and turbulent currents in the area near the eruption of the provisionally-named Titan Ridge Volcano.
Satellites have captured the event unfold from space, while seafarers in the area have seen it.

Photo *Kennedy Masis took in the spectacle from the fishing boat he was working on (photo supplied).*

One fisherman, Kennedy Masis, was searching for tuna when he "saw smoke coming out of the sea", he told the ABC (Ed. too close for comfort),

“Twelve years as a fisherman I've never seen anything like that … it's scary. It sounds like thunder and the sea smells like metal burning."He said the next day he saw plenty of dead fish near the reef which was like a "boiling spring”. He warned other fishermen in the region to be cautious in the area as the eruption continued.

Steve Saunders, the principal geodetic surveyor at the Rabaul Volcano Observatory, told ABC's Pacific Beat localised tsunami activity was possible. "We could have some more intense explosive activity, in which case we may get just small tsunamis," Mr Saunders said. "That would cause just small tsunamis because it's 100 kilometres at least to the nearest land.” He added that the ocean in the area is about 500 to 800 metres deep.

He said that while undersea eruptions had happened before, this one was showing some unique characteristics. "What's unusual about this is that it's much more energetic, it looks as though ... a cone is probably building underneath," he said. "We are getting pumice actually reaching the surface ... so it looks as though we may have a vent at, or very near the surface."

PNG's Mineral Resources Authority (MRA) said that the volcano was active along a 5km stretch of ocean, but regular satellite monitoring had been hampered by cloud cover in recent days. A magnitude 5.5 earthquake was recorded near the site on Monday.
Before the eruption authorities recorded a number of quakes in the area, including six on May 8.

Mr Saunders said that any toxic fumes from the eruption were not blowing toward populated areas.

In a totally different tectonic environment the SA/NT border earthquake near Amata discussed elsewhere in this Newsletter was about the same size as that in the Bismarck Sea and was also very shallow, rupturing to the surface. The obvious displacement on the fault is akin to what happened on the floor of the Bismarck Sea releasing gases and fluids at high temperature along the ground break into the atmosphere and ocean. Dead fish were reportedly observed as far away as the east coast of New Ireland, the incident causing considerable unrest in PNG, especially the threat of tsunami.

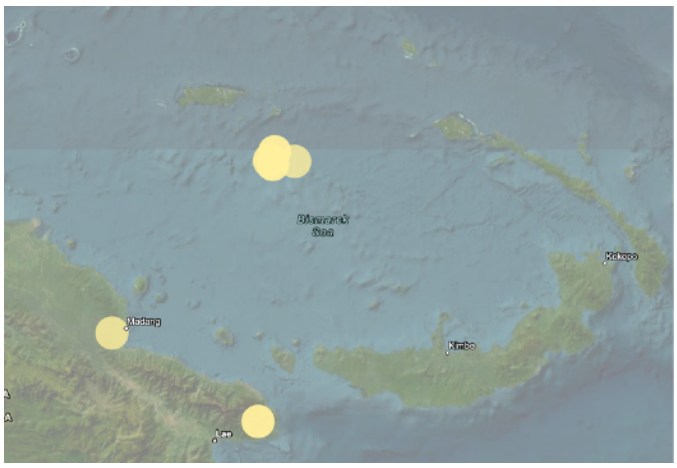


Figure 12 *Earthquakes located in the Bismarck Sea PNG (GA) from 01 May 2026 to 20 May 2026.*

It is conjectured that the cluster of earthquakes in the Bismarck Sea (listed from GA), southeast of Manus Island, may be associated with the eruption.

Physics World – The hidden mechanics behind earthquakes

27 May 2026 Lorna Brigham
https://physicsworld.com/a/the-hidden-mechanics-behind-earthquakes/

Adhesive asperities, not abrasion, dominate fault friction and reshape our understanding of stick-slip behaviour.

Earthquakes occur when tectonic plates rub against each other, become temporarily stuck, and then suddenly release accumulated stress as they slip. Although earthquakes have been studied for decades, the microscopic mechanics that cause faults to stick, slip, and generate friction are still not fully understood.

In this research, scientists use a granite-on-granite system to investigate these processes. Granite is common in continental crust and mechanically similar to many fault rocks, making it a strong laboratory analogue.

Photo *Earthquake boundary (Courtesy: Shutterstock/ Karen Grigoryan)*

The researchers used three complementary approaches. First, they performed controlled experiments measuring friction, wear, and surface roughness as two granite surfaces slid past each other, including tests with water, different temperatures, and different sliding speeds. Second, they ran molecular dynamics simulations of a silica (amorphous SiO_2) tip sliding on quartz (crystalline SiO_2), the dominant mineral in granite, to observe how atomic bonds break, phases transform, heat builds up, and friction emerges. Third, they applied theoretical models of contact mechanics (how surfaces actually touch through tiny asperities) and flash heating (how much local heating occurs and whether it weakens the material).

Traditionally, earthquake models assume that friction comes from mechanical processes such as asperity interlocking (high points locking together), plowing (hard grains digging into the opposite surface), and gouge grinding (crushed particles resisting motion). However, this study shows the opposite of what those models predict: more wear leads to less friction, and less wear leads to more friction. Instead of friction coming from grains digging or grinding, it arises from tiny asperities that plastically flatten, cold-weld together, and resist sliding because their welded atomic bonds must be broken. This represents a major shift in how fault friction is understood.

The study also finds that friction is largely insensitive to temperature, sliding speed, and hold time, suggesting that classic rate-state friction laws may not scale to real faults. The simulations identify three main energy dissipation mechanisms which are bond breaking, plastic deformation, and stress-induced phase changes. This shows that flash heating at laboratory speeds is too small to weaken quartz, whereas earthquake level slip speeds would generate much stronger thermal weakening. They also reveal that certain quartz polymorphs can form purely from stress, meaning their presence in natural faults does not necessarily indicate high temperatures.

Taken together, these results suggest that fault friction is dominated by adhesive bonding at asperities rather than mechanical grinding, and that tectonic motion may be governed more by creep-slip than classic stick-slip behaviour.

Reference Sergey V Sukhomlinov et al 2026 Rep. Prog. Phys. 89 038301

The Seismological Association of Australia Inc.

PO Box 682, Mylor SA 5153
website: https://earthquake.net.au/

Membership of the SAA is open to anyone interested in earthquakes and applies for the calendar year (January through to December)

A Note on the Great Earthquake North of Macquarie Island, 23 May 1989

by Kevin McCue

Introduction Clearing out years of paperwork I came across some nostalgic telexes of seismograms of the great earthquake north of Macquarie Island on 23 May 1989. I spent a year there as geophysicist in 1968 during which time I rebuilt the tide gauge and have maintained an interest in the seismicity ever since. We felt a few sharp small earthquakes in 1968/9; nothing compared with this one which was the first great earthquake known on this right-lateral transform fault plate boundary south of New Zealand (Figure 11).

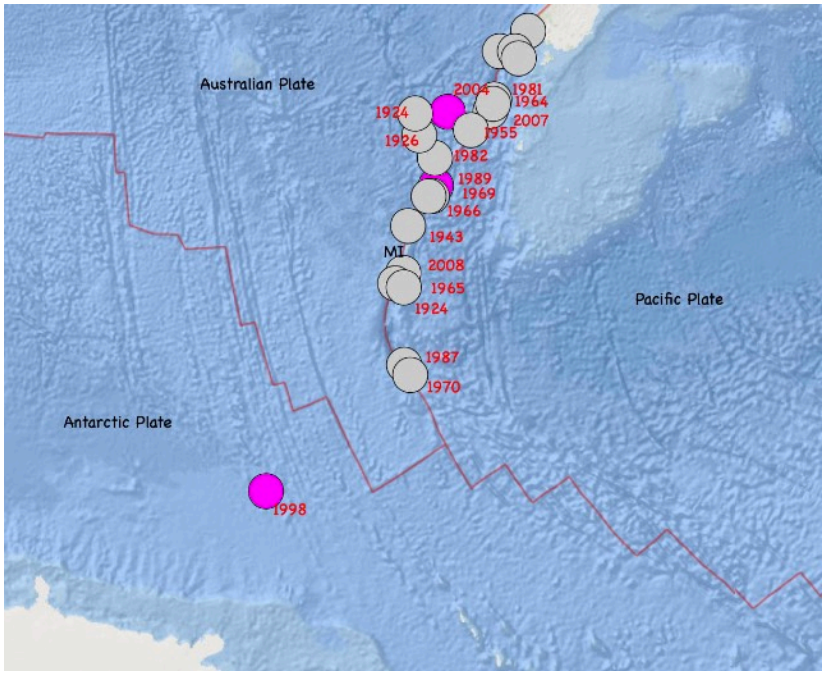


Figure 13 Major earthquakes (pink dots) on the Macquarie Ridge, 1901-2022 (from McCue and others, 2026). The island is marked as MI.

My copies are only facsimile copies of the MCQ seismogram but show that an old Helicorder record can be useful. The focus of the mainshock was north of the island where it was strongly felt and MCQ was the closest seismograph (Table below). According to the ISC, shaking was felt I=VI to VII MM Macquarie Island, V Campbell Island, II South Island of New Zealand and Hobart, Tasmania).

Satake and Kanamori's (1990) modelling indicated that this earthquake was the largest strike-slip earthquake ever recorded till then; the moment magnitude Mw 8.1, the fault length 150km (from the distribution of aftershocks), the average slip about 9m. Das (1993) on the other hand found that Mw was 8.2, the fault was 220km long with a centroid depth of 19.5km and with a bilateral rupture.

Jones and McCue (1988) wrote about earthquakes on the ridge extending from south of New Zealand 1500km to the triple junction of the Pacific, Antarctic and Australian Plates, a year too early to learn from this remarkable earthquake. They postulated that a M 8.2 earthquake was about the one in 100 year earthquake. With the benefit of not one but two great earthquakes on the ridge, both of them north of Macquarie Island in 1989 and 2004, McCue (2008) confirmed the estimated size of the 100 yr event as magnitude 8.0 so the probability of another great earthquake in the 100 years since 1989 is quite high, given the known clustering of earthquakes.

The seismogram copies covered the previous day and two following days. Notably there were no foreshocks in the 24 hours prior to the mainshock, five aftershocks within the coda of the mainshock but surprisingly few aftershocks in the next 2 days.

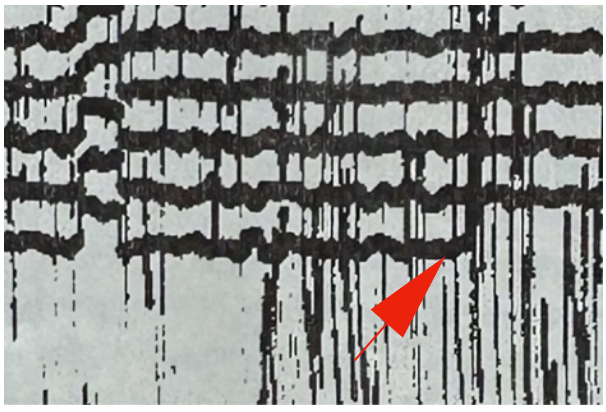
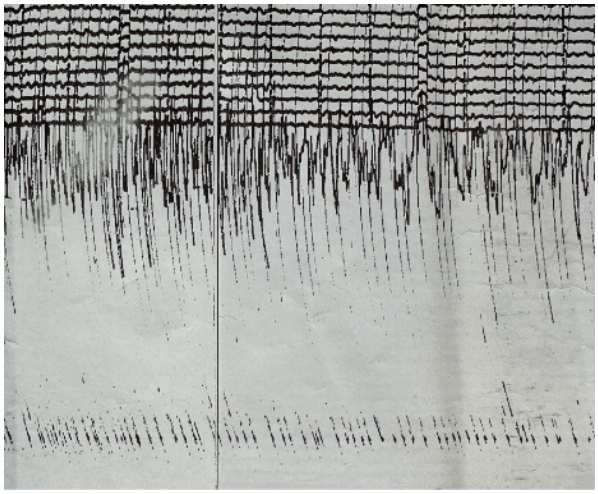


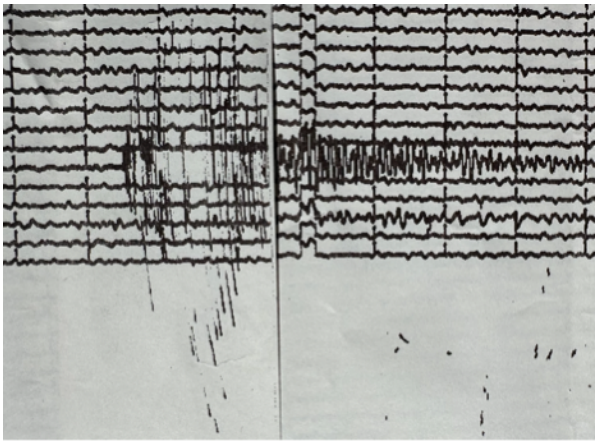
Figure 14 *The mainshock first arrival (arrowed) coincided with a 10s time mark so the first motion is difficult to pick accurately, not a problem with modern digital Peismo records.*

Analogue records also saturate when the earthquake is too close, the pen can only move so far and as you can see in Figure 15 the maximum movement was reached for several minutes so - no magnitude assessment can be made and the S arrival is obscured.

Figure 15 *The pen on the recorder is moving too fast to record on the paper except when it slows and stops to change direction. The short lines near the bottom of the seismogram record those turning points at the pen's extreme mechanical range limit.*



Figures 16 and 17 *show sample aftershocks recorded at MCQ in the first 2 days, 20 minutes apart. The S-P times are quite different, about 5s on one and 25s on the other corresponding to about 40km and 200km distance from MCQ respectively.*

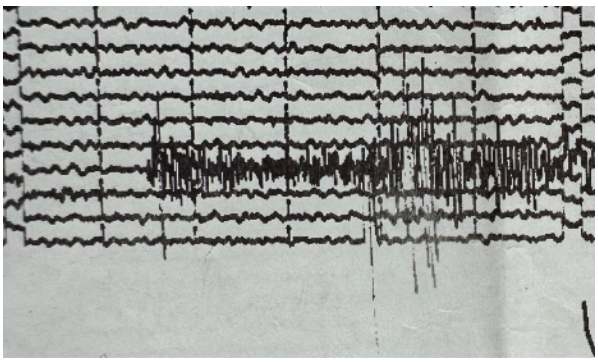


The difference in distance agrees with Satake and Kanamori's (1990) estimated length of faulting if these two events were at or near the ends of the faulted region.

Neither of these aftershocks would have been recorded at sufficient seismographs to have been located, but they indicate how close the rupture came to the northern tip of Macquarie Island where the base is located on an isthmus barely a metre above high water mark.

The actual records were not returned to BMR Canberra until the relief boat exchanged personnel in December 1989. The Newcastle NSW earthquake that same December changed the focus of interest so not much Australian effort was directed to this great earthquake on the Macquarie Ridge. Trevor Jones (dec.) made the Macquarie Ridge seismicity the focus of his masters thesis from Macquarie University whilst stationed in Fiji and the telexes were addressed to him.

A selected part of the ISC solution is summarised in the table below illustrating the problem caused by using an inappropriate model, and constraining the depth to 10km. The nearest stations; Macquarie Island MCQ to the south, Campbell island CBZ to the east and Tasmania University TAU to the northwest all have substantial negative residuals. The distance of 2.29° (250km) is a lot further than other published estimates of 150km which would indicate that rupture proceeded to the south from initiation rather than bilaterally.



Coincidently, Paul Hutchinson had just installed his homemade seismograph in SA when the quake hit.

Table *Distance, azimuth and arrival times extracted from the ISC world earthquake database for the May 1989 Macquarie Ridge earthquake. Only the closest stations are shown.*

Station	Dist	EvAz	Phase	Time	TRes
MCQ	2.29	205.0	Pn	10:55:19.8	-6.2
CBZ	5.22	94.6	Pn	10:56:02.0	-4.3
BRZ	8.06	37.0	Pn	10:56:43.0	-2.3
MSZ	9.15	34.8	Pn	10:56:58.0	-2.3
TMP	10.29	41.6	Pn	10:57:12.0	-3.9
CMZ	11.96	46.9	Pn	10:57:35.9	-2.7
TAU	13.06	311.6	Pn	10:57:49.0	-4.7

The tsunami in Tasmania

A Tasmanian tide gauge recording (Figure 16) from Recherche Bay (Figure 17) was folded up with these seismograms. So though the earthquake mechanism was strike slip i.e. no vertical movement on the fault in theory, the earthquake still generated a tsunami, apparently well recorded on coastal tide gauges in southeastern Australia. Had the mechanism been a thrust, which Jones and McCue (1988) showed was possible given the tectonics, then damage from the tsunami could have been severe in southern Australia.

As it was, the tsunami was small compared with the normal tide range and of similar period to waves in the bay prior to the tsunami.

The tide range p-p is about 0.8m, the wave height p-p about 10cm and the initial tsunami waves p-p about 30cm. The tsunami wave period, an average of the first 3 waves, is about 25 minutes, about the same as the period of the pre-tsunami waves. The tsunami duration was more than 24 hours at Recherche Bay.

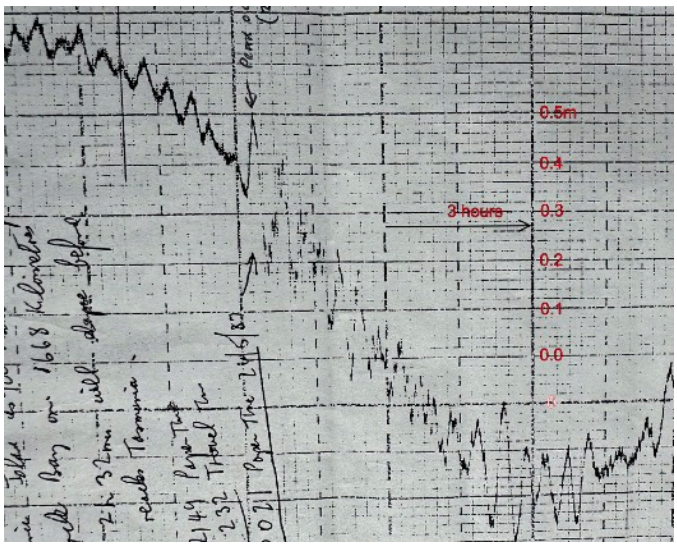


Figure 18 *Annotated Recherche Bay tide gauge record.*

Discussion A note addressed to Trevor Jones was attached to the telexed seismograms indicating that an SMA-1 analogue strong motion instrument in the seismic vault on the island triggered, and the film was changed, but I have never seen the film.

There is an inexplicable M8 earthquake in the Balleny Islands south of the plate boundary (Figure 13).

Figure 19 The Recherche Bay tide gauge location (green arrow) is open to the Southern Ocean to the east so it is unlikely the waves are a seiche generated by the tsunami.

It is a pity that the December 1989 Newcastle earthquake activity diverted attention from this earthquake, and prevented studies of the aftershocks, strong motion record and tide gauge records.

Obviously a better crustal model could have been developed to reduce the residual travel times on regional seismographs.

Two great earthquakes have now ruptured the plate boundary north of Macquarie Island. Surely it is the turn of the southern part of the boundary to the triple junction, encompassing Macquarie Island.

The Australian base on Macquarie Island is very exposed to tsunamis. During storms, large waves crash from one side (usually the eastern side) to the other, across the isthmus.

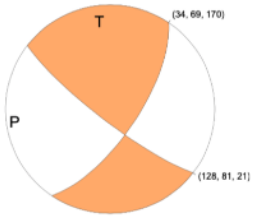


Figure 20 *The focal mechanism published by the USGS is almost pure strike-slip, the probable rupture plane strikes at 34.degrees.*

Photo *Macquarie Island is located about 1,600 kilometres south-east of Tasmania. The base shown here was built almost at sea level on an isthmus. This view looks south from the seismograph site MCQ across the narrow isthmus to the plateau. (Photo Australian Antarctic Division).*

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Obituary - Kim Beven

Jeong-Bok Kim Beven Seismologist/Analyst
BMR/AGSO/GA 20/08/1951 - 12/05/2026

Kim trained to look up as an astronomer but retrained to look down into the Earth to detect the conspicuous waveforms of nuclear explosions. She died suddenly in New York on Mother's Day visiting family, far too young for someone so engaged with family, her garden, with life.

I met her at the Bureau of Mineral Resources when she was hired into the newly formed Nuclear Monitoring Group alongside the new Earthquake Monitoring Group. The Department of Foreign Affairs was charged with overseeing the Australian contribution to the UN's Strategic Arms Limitation Treaty or SALT. It made no sense for nuclear monitoring to be in DFAT, as it was known, so they outsourced this function to BMR to do the monitoring.

Kim and Peter Everson were the first new members of the team and later Lesley Hodgson (dec) and Willie Penders joined the group from the ANU Earth Science Department. These well-trained analysts were mentors for Kim. At various times analysts were seconded to Vienna to join the nuclear monitoring staff there. Earthquake Monitoring was quite a sociable group and would celebrate at lunchtime. One of the more memorable times was when Kim brought along a delicious array of Korean food. She was a very popular member of the group.

It would be fair to say that family and gardening came well ahead of work. She particularly loved growing tree peonies, some grown from seed given by Kim survive today in Clive Collins' garden (pictured). She was given leave to join her husband Terry when he was posted overseas with DFAT on several occasions, a right in the public service despite opposition within BMR management. We missed her. Sonja and I caught up with her in Vienna and she generously spent the day chauffeuring us around, looking at historic sites.

Her husband Terry survives her along with their children David, Hannah and Michael, and their families.