

Historical earthquakes in Queensland

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Abstract On the basis of the past 50 years of recorded seismicity, Queensland does not appear to have as high a rate of earthquake occurrence per unit time and area (earthquake hazard) as Victoria or NSW yet it has suffered two large ($M \geq 6$) earthquakes in the short historical record, two more than Victoria and NSW combined. Records of many of Queensland's early earthquakes have been documented in the three volume *Isoseismal Atlas of Australia* but sources have not yet been exhausted as demonstrated with new information on 24 supposed earthquakes, most of them not catalogued. One of these in Torres Strait in 1907, previously unreported, was the first known damaging earthquake in the state, with a foreshock, a long-lasting aftershock sequence and an embedded mainshock/aftershock sequence. Puzzling and contradictory information has been investigated about the so-called Kilcoy earthquake of 1st May 1913 that may affect hazard estimates for Brisbane, and several other small earthquakes not previously catalogued or mis-identified as earthquakes have been put on record.

One of the interesting earthquakes discovered, in 1930, caused damage in Port Moresby and a tsunami which killed 12 Papua New Guinean fishermen.

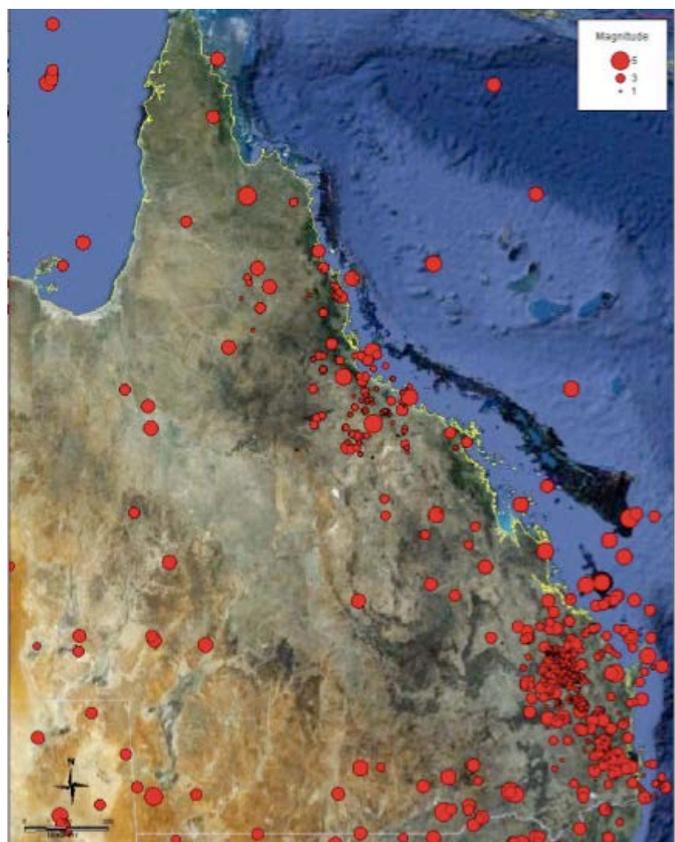
This new information has come about thanks to a courageous initiative of the Australian National Library, making scanned, searchable newspapers publicly available on the internet. These new data and their interpretation are important for better hazard assessments by improving early earthquake details and extending the earthquake database backwards, to better define source zones and lower the magnitude threshold of completeness intervals.

Introduction

Rynn (in Rynn & others, 1987) compiled a comprehensive atlas of the effects of early pre-instrumental earthquakes in Queensland, from 1875 until the first seismograph was established there in 1935 at Brisbane. Isoseismal maps for several interesting earthquakes post-1935 were also compiled and illustrated in this atlas.

Figure 1 A map of historical earthquakes in Queensland to the end of 2008 (from Payne, 2010) shows that most of them occurred in a broad swathe parallel to the coastline, with two broad clusters, the most extensive of them in the south-east of the state.

With the on-line publication of digitized copies of pre-1954 Queensland newspapers it was inevitable that new events would be found and more information about known events made available requiring revision of the previously catalogued epicentre and/or magnitude.



The pattern of seismicity in Figure 1 could be related to the poor seismograph coverage of Queensland until the 1980s. Aftershocks and swarms were not deleted from the catalogue prior to plotting, enhancing the clusters. The number of earthquakes per unit area and per unit time appears to be lower than in any other state or territory of Australia although the total energy release is higher than that in south-east mainland Australia where no large earthquakes have happened in post-colonial time.

Earthquakes identified in this report

1866 12 ?? Date and time unknown, Cape York

A brief summary of earthquakes observed worldwide and in Queensland was published in 1938 (*The Townsville Daily Bulletin* Saturday, February 5, 1938, page 6). It had the following to say about local events, including the earliest yet known in 1866:

So far as Queensland is concerned there are records of earth tremors from 1866. In December that year, Somerset, at the top of Cape York Peninsula, reported a slight shock, and other places have reported tremors at different times, among the latest being one in South Queensland in 1935. The most persistent series of tremors were experienced at Thursday Island, from June, 1907, at fairly frequent intervals up till the end of March the following year.

Perhaps new information will be uncovered to date this event and determine its approximate epicentral area and magnitude.

1867 05 12 23:00 UTC, Rockhampton

The *Sydney Morning Herald* Tuesday, 4 June 1867, page 2, carried the following story:

Earthquake.-A correspondent writes to the Rockhampton Bulletin that on Monday, 13th May, at about 9 a.m., we experienced a slight shock of earthquake on the Agricultural Reserve. For about two minutes, there was a rumbling subterranean sound not unlike a discharge of artillery, accompanied by a slight tremor of the ground. During this space of time our occupations were very naturally suspended, for we were at first perplexed to account for the mysterious sound. Our perplexity, however, was of short continuance; a residence of some years in New Zealand (where three shocks in the course of the day is not unusual) having familiarised us with these phenomena and their accompaniments. Should earthquakes become of frequent occurrence, it may necessitate the adoption of wooden in preference to stone structures which do not bear the twist and strain incidental to such commotions so well as those of wood.

Here the assigned magnitude is 3.5, subject to further information. There must have been newsworthy earthquakes in the following 30 years but only the the following 'slight earthquake' was discovered in the *Cairns Post* of Saturday, 22 March 1890, page 2.

1890 03 21 evening Redhill Brisbane, not an earthquake

Warwick Argus Tuesday, 25 March 1890

THE REDHILL "EARTHQUAKE."-In the Brisbane telegrams published in our issue of Saturday it was stated that a distinct shock of earthquake was felt at Red Hill, a suburb of the city, on Friday evenings ; It now turns out that the " earthquake" was caused by the explosion of damaged dynamite at Luggage Point, a mudbank in the river below Lytton. Eight or ten tons of explosive that had been damaged by the floods were thus destroyed by order of the authorities.

1894 01 22 Time unknown, Rockhampton, not an earthquake

The *Rockhampton Morning Bulletin* Thursday, 25 January 1894, page 6 reported an earthquake coincident with a violent thunderstorm and downpour. It is likely that the cause of the houses shaking was a thunder clap, not an earthquake.

1895 09 03 22:00 UTC, Tate River

A story in the *Warwick Examiner and Times* Saturday, 7 September 1895, page 5 states:

Earthquake in North Queensland.

TATE RIVER AND JUNCTION CREEK

The Weather Bureau has received advices to the effect that shocks of earthquake were experienced at Tate River and Junction Creek in North Queensland at 8 o'clock on Wednesday morning. A heavy rumbling sound like thunder and very loud, continued for a full minute, and made earth tremble for miles west of the Tate. No clouds were visible but miners state that a heavy fog all round the place on Tuesday night from about 11 o'clock till early on Wednesday morning, and the moon looked reddish in colour.

This is a remote area about 120km west of Atherton and a similar distance north of Undara National Park. The magnitude has been set at the default of 3.5, too small for damage and not widely felt but large enough for someone to bother reporting it.

1896 02 27 23:00 UTC, Cairns

Another 'new' event(s) documented here rated mention in the *Queenslander* newspaper of Saturday, 7 March 1896, page 47, about an earthquake or two felt in Cairns, Mareeba and Port Douglas. The date of origin was probably Thursday 28th February at 9am (27 February at 23:00 UTC), assuming 1896 was indeed a leap year.

Figure 2 Extracts from the *Queenslander* newspaper of Saturday 7th March 1896, column 1 above and column 2 below.

The first news item said there was no damage but in the second column of the same page of the newspaper there is a separate report about a crack in the Cairns railway tunnel attributed to the earthquake.

As late February is normally 'wet' season, the unfortunate drowning on Oakey Creek seeming to confirm this, it may be assumed that ground water may have contributed to the cracking, perhaps triggered or exacerbated by the shaking.

The felt area and 'damage' suggest that this earthquake had a magnitude of at least 3.7.

1907 10 27 20:40 UTC, Thursday Island

The account in the *Townsville Daily Bulletin* on Wednesday, 20 November 1907, page 7 that follows is interesting, not only because it describes a typical foreshock-mainshock-aftershock sequence, the largest Australian earthquake of 1907, but also because minor damage is reported, and lastly because there is apparently an expected association between earthquakes and ground rupture, perhaps learned following the great San Francisco earthquake the previous year.

The Chingtu, owned by the China Steam Navigation company, arrived at Cleveland Bay on Tuesday morning..... Mr R. D. Mackay, of the Bank of North Queensland at Thursday

Thursday.
The Chief Weather Bureau anticipate more rain over the Northern half of the colony, and fine weather in the interior.

Daniel Keene, underground manager at Torbanlea Colliery, died from injuries received from an explosion of gas.

A lad named Stemm was drowned on Thursday in Oakey Creek.

Two distinct shocks of earthquake were experienced at Cairns, Mareeba, and Port Douglas about 9 o'clock on Thursday week. The houses were slightly rocked by the tremor, but no damage was done.

The labour barquentine Rio Loge arrived at Bundaberg last week with thirty-five recruits. During the voyage Mr. Bergin was shot dead in the recruiting boat at Malayta.

The recent earthquake has caused a crack in the long tunnel on the Cairns Railway.

The Croydon Municipal Council has decided to obtain an estimate for lighting the town with electricity.

Island, was a through passenger to Brisbane. 'We have had several shocks of earthquake up there of late,' said Mr Mackay – In fact we had one last week. At Kyngdon one day we had two distinct shocks and one of them broke the glass in places some distance away. It is a peculiar sensation; it is a sort of an earth tremor. There are no apertures made in the ground, but the tremor is preceded by what seems to be an explosion and the people do not seem to be able to account for it. Some of the tremors appear to go in one direction and some in another. Mr Percy Hodel, nephew of Mr Joseph Hodel, of Townsville, and son of Mr Hodel, of Hodel's Limited, Thursday Island, was also a passenger by the Chingtu. With regard to the earthquakes he states that they are perplexing the people up there as there are no fissures created in the ground, and there is not the slightest indication of what causes them. The foundations around the island are particularly sound and it seemed improbable there would be anything bearing even the semblance of a landslide. It was true there were two volcanoes in islands some distance away, but neither of these had been in a state in any way approaching eruption.

Another story in *The Queenslander*, Saturday 2 November 1907, page 33.

EARTHQUAKE AT THURSDAY ISLAND.

SHARP AND SEVERE SHOCK. A LIGHTHOUSE DAMAGED. THURSDAY ISLAND, October 28.

A sharp and severe shock of earthquake occurred at 6.40 this morning, the noise accompanying it resembling the rattle of a number of Maxim guns being discharged.

Figure 3 The Goode Island Lighthouse Torres Strait in ca 1909 (State Library of Queensland).

The shock lasted about six seconds. The area of the earthquake apparently extended from Goode Island to Cape York, about twenty-four miles in a direct line. No damage was done here. At Goode Island it is reported that the earthquake was very severe, the foundations of the lighthouse being disturbed, necessitating immediate repairs. A slighter shock was felt at 7.30, and the movement seemed to travel from the north-west to the south-east.



The Portmaster (Captain J. Mackay) on Monday received a telegram from the harbour-master at Thursday Island, stating that a severe shock of earthquake was experienced at 7 a.m., followed by subterranean explosions. The lighthouse on Goode Island was badly shaken, and the reservoirs fell down and broke the concrete foundation and started all the light iron. The harbour-master further stated that he was repairing the damage, and would furnish more information after further examination. He would report Booby Island as soon as possible by means of heliograph. The Portmaster wired in reply, asking if the condition of the lighthouse was safe, and if the light would be exhibited as usual. The harbour-master at Thursday Island subsequently wired to the effect that he had got a flash (heliograph) from Booby Island to say that a severe "shake" had been experienced, but that no damage had been done. The reservoirs referred to, it may be mentioned, supplied the oil to the lighthouse at Goode Island.

The sequence at Thursday Island started at least as early as the evening of 28 June 1907 (*Clarence and Richmond Examiner*, Saturday, 29 June 1907) and continued until at least early 1909 as the following report from *The Brisbane Courier* of Tuesday, 5 January 1909, page 5 testifies:

EARTHQUAKE AT THURSDAY ISLAND.

A SHARP SHOCK.

THURSDAY ISLAND January 4.

A sharp shock of earthquake occurred here at 9.15 last evening.

It might be thought that earthquakes felt on York Peninsula may have originated to the north, in Papua New Guinea, but I have yet to find a PNG earthquake that was reported felt in Queensland (the large 1922 earthquake in the Southern Highlands of PNG was not reported felt on Thursday Island). The great 1938 earthquake in West New Guinea was felt quite distinctly in the Northern Territory so it is not impossible for a great earthquake on the Southern Highlands Seismic Zone section of Australia's northern plate boundary to be felt in Queensland

1907 11 10 14:05 UTC, Thursday Island embedded aftershock sequence

Late in 1907, the following item appeared in *The Queenslander* on Saturday, 16 November 1907, page 33, a good description of an embedded earthquake and its own aftershock sequence within the October sequence.

EARTHQUAKE AT THURSDAY ISLAND.

INHABITANTS ALARMED. NO DAMAGE DONE. THURSDAY ISLAND, November 11.

Consternation prevailed over the island about five minutes after midnight, caused by a further severe shock of earthquake, lasting about twelve seconds, followed by about eight slighter tremors at intervals until daylight. Though no damage was done, the sounds of subterranean explosions and rumblings have had a demoralising effect on the community, and it is felt that the slightest increase in the severity of the tremors must have a disastrous effect. The Japanese quarter of the town became very excited, and many speak of leaving the island. Information from Goode Island, where slight damage resulted to the lighthouse from last severe shocks, shows that no further injury was done.

The *Western Champion* of 29 December 1919, page 6, published a confused version of the 1907 earthquakes.

1908 12 07 Time unknown, Crow's Nest

Another previously uncatalogued earthquake was reported briefly in the *Adelaide Advertiser* of Wednesday, 9 December 1908 and *Singleton Argus* of 10 December but without a time of occurrence. Crow's Nest is about 100km northwest of Brisbane and 45km north of Toowoomba. Additional data will become available when more of the early newspapers, especially Brisbane papers, are digitised.

On the basis of the felt effects and limited felt area, its magnitude has been assigned as 3.5.

Figure 4 Report in the *Adelaide Advertiser*, Wednesday, 9 December 1908 of an earthquake at Crow's Nest, Brisbane.

This is an important earthquake occurring so close to a capital city.

AN EARTH TREMOR.

ALARMING EXPERIENCE.

Brisbane, December 8.

A distinct earth tremor, lasting about three seconds, was experienced at Crow's Nest yesterday. A number of buildings shook greatly, but no damage was done. The shock, which caused great consternation amongst residents, came from the south-east, travelling in a northerly direction. There was a loud report, as of thunder, which gradually led away towards the north.

SEVERE SHOCKS IN NEW ZEALAND.

Wellington, December 8.

Shortly before noon to-day a severe earthquake shock, lasting 19 seconds, was felt at Christchurch, following a less distinct earth tremor. No damage was reported. Two severe shocks were felt at Cheviot at 8.45 a.m. and 11.55 a.m., accompanied by a low rumbling noise. Much alarm was felt by residents at Hawkswood, where a chimney fell. Articles at the Medip Hills homestead were broken. Nelson, Timaru, and Honmerr also report two shocks.

The second story in Figure 4 about an earthquake causing damage in Christchurch just the day after the Crow's Nest event has been included here for interest to remind the reader what can happen when a large earthquake strikes an urban area. Christchurch Cathedral had been damaged by earthquakes on two occasions prior to the installation of seismographs in New Zealand so this earlier history is important and shouldn't be neglected in hazard studies, the warning signs were there for town planners in Christchurch.

1909 01 03 11:15 UTC, Thursday Island aftershock

See story above in discussion of the January 2007 mainshock. This is an extensive aftershock sequence with an embedded sequence indicating that the mainshock magnitude was substantial, perhaps somewhat larger than the magnitude 5 assigned.

1910 11 24 22:55 UTC, Childers

The *Sydney Morning Herald* of Saturday, 26 November, page 14 briefly reported that two earthquakes had been felt at Childers, the first at 8am Friday, the second (larger) at 8:55 was felt throughout the Bundaberg district. According to Rynn & others, (1987), the epicentre was near Mundubbera, about 150 km SW of Childers, this choice clearly influenced by the Roma report, but it could very well have been much closer to Childers and Bundaberg affecting hazard estimates there. *The Brisbane Courier*, Saturday, 26 November 1910, page 5 notes that it was distinctly felt in Maryborough which had a *not felt* designation on Rynn's isoseismal map, perhaps because it was not noticed on the ground floor of the telephone exchange building. There are no reports that it was felt anywhere between Gayndah and Brisbane.

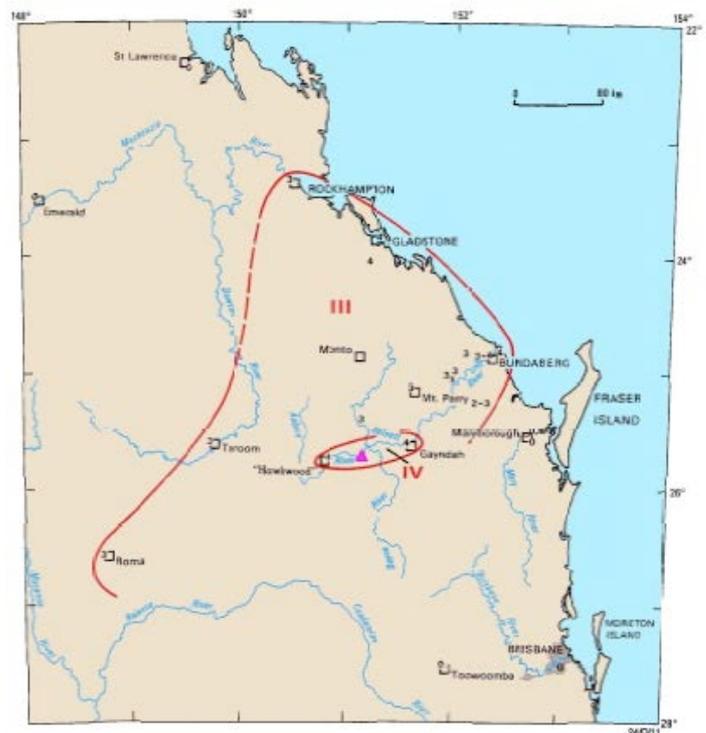


Figure 5 Isoseismal map of the 24 November 1910 earthquake, felt at Rockhampton and Roma but not Brisbane or Toowoomba, nor between Gayndah and Brisbane (Rynn & others, 1987).

The *Albany Advertiser* of Saturday, 26 November, page 3, comments that this earthquake was recorded on the Melbourne Observatory seismograph, the first Queensland earthquake recorded in Victoria and at Riverview.

The *Capricornian* of Saturday, 3 December, page 28 had a long story about the earthquake mentioning main towns where it was felt, including Rockhampton. The journalist noting *that it was more noticeable in brick buildings than those of wood*.

1912 12 06 17:00 UTC, Gladstone

The *Rockhampton Morning Bulletin* of Monday, 9 December 1912, reported that beds in the hospital was shaken by an earthquake at 3am on 7th December and that the earthquake was also felt 3 miles (5 km) away. This earthquake has been assigned a magnitude of 3.5 (± 0.5) until further information becomes available.

1913 May 01 16:20 UTC, Coalstoun Lakes - earthquake or sonic boom?

The more information one gathers about an earthquake the better the resulting isoseismal map is likely to be, so the fact that a map has been published shouldn't discourage further investigation. The isoseismal map of the early morning 1st May 1913 earthquake drawn up by Rynn and published by Rynn & others (1987) is a good example. Information for the original map was sparse but the epicentre from Riverview (Burke-Gaffney, 1951) was selected where the earthquake was strongly felt, near the southern end of the felt area. It is puzzling that a magnitude 4.8 earthquake at that location was not felt in Brisbane or Toowoomba.

The following newspaper extracts are interesting.

Townsville Daily Bulletin Thursday, 29 May 1913, page 7

Earth Tremors at Coalstoun Lakes. A correspondent of the 'Wide Bay and Burnett News' writes from Didcot (Maryborough), on May 9th.

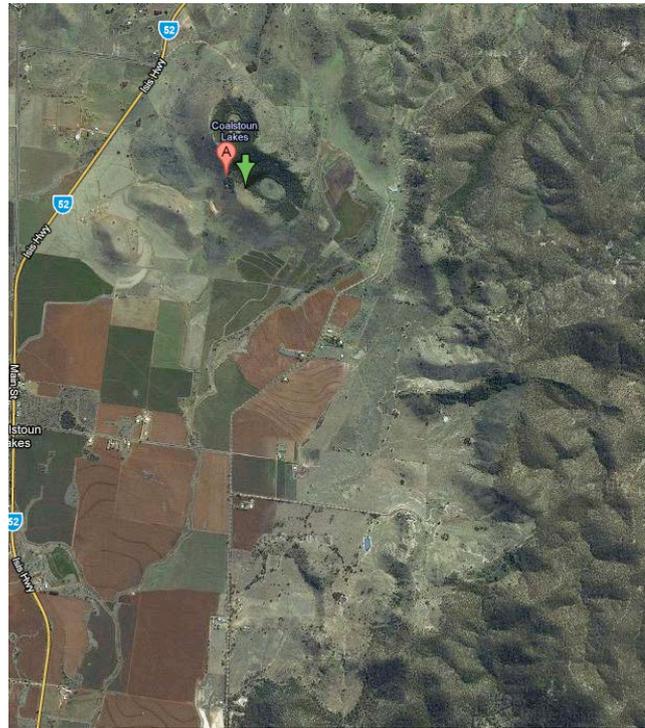
– *The Coalstoun scrub is situated on a kind of plateau, between ranges of picturesque conical - peaked mountains, several of the summits of which contain the craters of extinct volcanoes, and the Coalstoun Lakes themselves are simply large pools of water filling three of these craters. Since some time previous to the sharp earthquake shock of last week, which I believed was felt in Maryborough (although, as far as I can understand, you did not get it there half so violently as we did here) we have been experiencing, at Coalstoun, continually recurring subterranean rumblings and earth tremors, often as frequently as four times a day. Sometimes these rumblings have seemed to be right beneath us, and sometimes they seem to come from the heart of some of the extinct volcanic summits, at the foot of one of which my own lonely tent is pitched. Sometimes these rumblings begin with a heavy boom like that of a report of a distant cannon, which is, without a shadow of doubt, the noise of an explosion. Since the shock of Friday last, these rumblings have become increasingly frequent, and their noise louder. Some of them are felt and heard down here in Didcot, and only an hour ago we experienced a loud and long shock, accompanied by a distinct earth tremor – (I write at 12 noon on Friday) – which shook this hotel. Not having seen in the papers any mention of these continually recurring rumblings and earth tremours occurring elsewhere, we residents of the Coalstoun Plateau are beginning to get rather uneasy, and are commencing to eye the scrub clothed conical summits of the Seven Sisters, and the peaks whereon the water-filled craters are situated, with distrust, and the germ of a definite apprehension. Some of the ladies are distinctly upset about the matter. I think myself that these are circumstances which would justify a visit to the district by a Government geologist expert, both in the interests of science and those of the inhabitants of the district, who would become an authoritative reassurance from such a quarter on the subject of their growing apprehensions regarding the possibility of some volcanic disturbance ultimately taking place in their neighbourhood, believe that such continuance rumblings and tremors have never been experienced here before in the memory of the white man, although I have been told that the aborigines used to term the peaks containing the water-filled craters, for some reason or other, 'debbil-debbil,' and were afraid to go near them. All the facts I have described will be vouched for by all the residents of the Coalstoun Lakes district, at the request of many of whom I am communicating regarding them with you and your valuable paper.*

P.S. – I have just learned that a man reported to the party that assembled at Coalstoun yesterday, to greet the Minister for Railways that mud was bubbling up on the side of one of the mountains near the lakes.

Taken at face value this letter describes a classic foreshock, mainshock, aftershock sequence which would imply that the epicentre of the 1st May 1913 earthquake was near Coalstoun, about 40km east of Gayndah, a known source of past earthquakes, and about 140km further north than its currently accepted position. The published southern location (Rynn & others, 1987) is within 80km of Brisbane and Toowoomba where the earthquake was not felt. Many Kingaroy residents didn't feel it either. Equally our proposed northern location is about 100km south-east of Bundaberg where there are no reports it was felt.

The coincidence of Recent volcanoes (those less than about 10,000 yrs old) and current earthquakes should not be surprising, a similar scenario is apparent with the Recent volcanoes through central Victoria and south-east South Australia but most of Australia's earthquakes are not co-located with Recent volcanoes.

Figure 6 Revised epicentre (A) amongst a nest of Recent volcanic craters visible in the Google map.

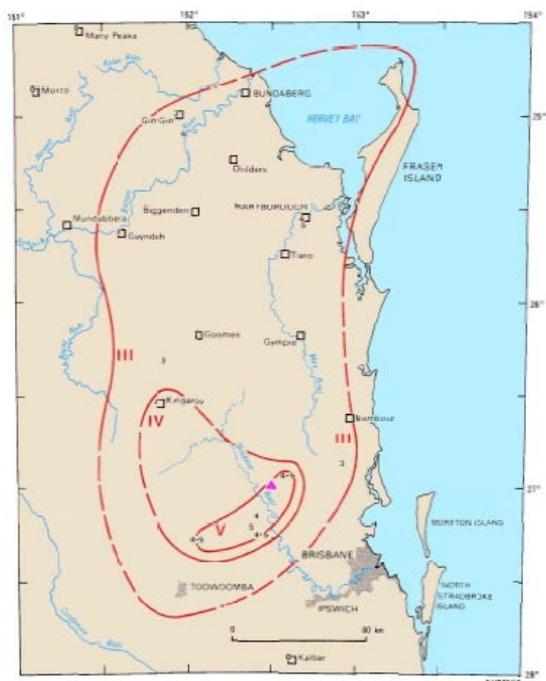


However, just as the new location became settled in this author's mind, further delving unveiled the following surprising article in a contemporary South Australian newspaper, *The Burra Record*:

A PAPER FOR THE NORTH AND NORTH EAST. Burra, Wednesday, May 7, 1913.

Several residents were awakened soon after 2 o'clock on Friday morning last by a slight earth shock which lasted several seconds. About the same time the residents of Brisbane and other places in Queensland also experienced a shock.

Figure 7 Isoseismal map from Rynn & others, (1987) of the 1st May 1913 Kilcoy earthquake showing the strange elongated shape with little variation in intensity and supposed epicentre in the south-east, yet not felt Brisbane or Toowoomba.



Perhaps there were simultaneous independent earthquakes in Queensland and South Australia - not impossible. Alternatively, the shaking may have been caused by a meteorite breaking up in the Earth's upper atmosphere spreading fragments to the mid-north of South Australia and to south-east Queensland where the sonic boom was noticed, rattling windows like an earthquake. This doesn't explain the observations near Coalstoun Lakes. It is surprising that Everingham & others (1987) didn't report on this event.

Undoubtedly this series of events needs more research once more newspapers are digitised and made available but the current location, size, even the cause, are uncertain.

1913 12 18 13:54 UTC, Townsville

An isoseismal map for this earthquake was drawn up by Rynn (Rynn & others, 1987) but the newspaper reports an earlier earthquake, one that dislodged rocks on Pilot Hill Station some 35 years earlier (the 35 years is in doubt, the scanned image of the number is difficult to decipher). More research is needed on this earlier event.

Townsville Daily Bulletin, Saturday, 20 December 1913, page 5

Earth Tremor of the North.

The severe earth tremor which was experienced in Townsville just before midnight on Thursday was the general subject of conversation on Friday. Though many people admittedly slept through it and some who were walking did not feel it, a majority of the folks in the houses evidently did, and considerable alarm was caused. In North Ward, where the houses were practically in darkness at the time, it was remarkable to see the number of lights which appeared in the windows directly after the shake, and the same thing doubtless occurred in all the suburbs. For the most part people did not realise the fact that they were experiencing a slight shock of earthquake and were out searching for the cause of their shaking beds and windows. A South Townsville resident states that the tremor lasted much longer than three seconds, as he was out of bed and lighted the lamp and walked round the house before the effect altogether died away. The tremor was felt at St. Heliers station and also at Ayr.

Advice was received by the General Traffic Manager yesterday from the stationmaster at Haughton Valley that a distinct earth shock was experienced shortly before midnight on Thursday. The tremor was felt by all in the neighborhood.

The earth tremor felt on Thursday night is not, it appears, the first experienced in Townsville, old residents recalling that an upheaval of a more pronounced type occurred about 35(?) years ago, when, rocks were dislodged from Pilot Station Hill.

AYR, December 19. A shock of earthquake was felt at Ayr and Brandon last night at 12 o'clock, its duration being some 15sec. The iron on the houses rattled and the houses rocked. Many people were frightened. No damage is reported.

1923 07 04 08:30 UTC, Brisbane

Earthquake risk is of greater concern for town planners and insurance companies than straight earthquake hazard so even small earthquakes near our cities need to be documented.

Figure 8 Demystifying a supposed earthquake in Brisbane, from Melbourne's *Argus* newspaper of Friday, 6 July 1923.

Attached is a newspaper report about a subway explosion that was originally ascribed to an earthquake near Brisbane on July 4th, 1923 at 6.30 pm. It was felt throughout the suburbs even beyond Mt Cootha. There was considerable debate over whether this was an explosion in the gas or electricity mains rather than an earthquake. The gas company denied it was a gas explosion.

SUBWAY EXPLOSION.

Mistaken for Earthquake.

BRISBANE, Wednesday.—At half past 6 o'clock this evening a distinct earth tremor was felt in the city and many of the suburbs. At first it was thought that a slight earthquake had occurred; but later it was ascertained that an explosion had occurred in one of the subways carrying electric light cables. It is surmised that the sound of the explosion was carried through the city and to the suburbs by the cables.

A pedestrian who was passing over a manhole above a subway opposite to the People's Palace, was thrown several feet into the air, but he escaped serious injury.

Some events described or headlined as earthquakes often later turn out to have been caused by some other phenomena; lightning and thunder, meteorite shockwave or man-made as in this example neatly summarised in the attached newspaper, Figure 8.

Many of the earlier newspapers did mistakenly ascribe the bang and rumble to an earthquake. It is mentioned here in the hope that it will be added to databases and tagged as man-made, otherwise future historians will 're-discover' this previously un-catalogued event.

1928 09 21 11:30 UTC, SW of Innisfail

The *Capricornia*, Thursday, 27 September 1928, page 44 ran the following story:

QUEENSLAND.

CAIRNS. September 21. About 9.30 to-night a distinct earth tremor was felt in Cairns, Gordonvale and Babinda. Wooden structures of two stories on high blocks were particularly affected. No damage was reported, but the vibration caused considerable alarm among the women and children.

Figure 9 Approximate felt area of the 21 September 1928 Atherton Tablelands earthquake felt Cairns to Ingham. The adopted epicentre is also shown.



ATHERTON, September 24. A strong earthquake shock was felt over the whole Tableland on Friday night about 9.25. Houses shook perceptibly, and roofs rattled for about 16 seconds. The shock was strong enough to crack concrete paths and shake cups from the tables at Malanda.

INGHAM, September 24. The most severe earth tremor for about 28 years was experienced in the district on Friday night. The shock was felt in many parts, rattling windows and iron on sheds. Many people heard an unusual noise but did not realise it was caused by the tremor.

The felt area and description are indicative of an earthquake of about magnitude 5 with an epicentre (17.8°S, 145.5°E) some 50km south of Malanda. It may have been nearer Ingham judging by the felt report there. The earthquake was not large but a reminder that an earthquake could occur anywhere in coastal Queensland and not just along the Brisbane/Gladstone stretch. More information would certainly tighten the location and improve the magnitude estimate. The earlier earthquake alluded to, felt at Ingham about 28 years earlier, may well have been the 1896 event discussed above.

1930 04 07 06:50 UTC, Evesham near Longreach

The *Townsville Daily Bulletin* of Thursday, 17 April 1930, page 5 included the following news item:

LONGREACH. April 12. Beautiful weather has been experienced here for the week, brought about by a few showers of rain in the early part. At one stage lightning and thunder was observed to the south and east, and the sky became overcast, but after a few spits this cleared off. A rather startling earth tremor occurred at Evesham station and adjoining holdings. Mr. H. Meires, the accountant at Evesham, was working at his desk, when the 'quake became so severe that he very nearly lost his balance. Doors slammed, pictures fell off the walls and for a few seconds things were a bit terrifying. It is said that a noise resembling thunder accompanied the disturbance.

The earth tremor was also felt at Greenhills, Breedon, Talleyrand, Manfred, Evesham, Darr River Downs, Hereward, Corona, and Mount Ryde stations. All persons agree that the disturbance lasted five or six seconds. The town of Longreach is not a name that springs readily to mind when discussing earthquakes in the period since monitoring commenced. The epicentre taken as the centre of the felt area is at 23.1°S, 143.7°E, near Evesham and the magnitude from the felt area is at least 4.1.

1930 06 Date and time unknown, Papua

The Perth *Daily News* published a brief news item on 20 June 1930, page 7 that is of interest in the context of Queensland hazard:

TOWNSVILLE. Thursday

Following an earth tremor which lasted a considerable time and caused damage to buildings and windows at Port Moresby, a huge tidal wave played havoc with natives out fishing.

Four were drowned at Hula and eight at Kerepuna when their canoes were swamped.

Port Moresby and Hula on the Papuan Gulf coast are on the Australian Plate, about 100km from the Australian - Solomon Sea Plate boundary (a similar tectonic situation to Christchurch New Zealand) but on the opposite side of the Papuan Gulf from Thursday Island. There are no reports that the earthquake was felt in Queensland or that a tsunami or irregular tide was observed on the western side of the Papuan Gulf. This is the one and only tsunami reported for the Papuan Gulf and one of only two known occasions on which damage has been reported in Port Moresby, the capital of PNG.

It is included here because of its proximity to Queensland and in the hope that more research in Queensland sources will unveil further news. Information is awaited from PNG.

1930 07 10 No time reported, Thursday Island

The *Cairns Post* of 12 July 1930, page 5 briefly reported without further details that a slight earthquake was felt in the night on Thursday Island and also on the mainland.

1932 08 05 03:50 & 06:00 UTC, Thursday Island

Yet another earthquake sequence in the Torres Strait as reported in the local newspaper *Townsville Daily Bulletin*, Monday, 12 September 1932, page 10. Still no seismograph in Queensland, nor in the Australian mandated territory of Papua.

THURSDAY ISLAND, August 29. A severe earth tremor was experienced about 1.50 p.m. on the 5th. inst. followed by another about 4 p.m. The first one was very severe and houses were shaken and most people rushed out of doors for safety, the shake lasting for about twenty five seconds. Several smaller ones have been felt since but none so intensive as the first one. Reports from neighbouring Islands state that the tremor was general throughout the Strait's islands.

By any reckoning these two earthquakes had to rate at least magnitude 3.5.

1935 04 12 01:32 UTC, Gayndah

An interesting footnote is added from a WA newspaper reporting the first Queensland earthquake ever recorded in WA, on the recently upgraded Perth seismograph. The earthquake was the magnitude ~5.2 event at Gayndah, south-east Queensland.

Geraldton Guardian and Express, Tuesday, 16 April 1935

Earth Tremors Recorded in Perth. – A seismograph sheet developed on Saturday showed that the earth tremor felt in Queensland between Brisbane and Rockhampton on Friday morning last was recorded at the Perth Observatory at 9.48 a.m. The Government Astronomer (Mr. H. B. Curlewis) said that the indications were that the tremor was deep-seated, and probably

originated on the edge of the Continental shelf, near the Great Barrier Reef. The seismograph sheet also disclosed that there had been a slight submarine disturbance in the Indian Ocean, about 2,100 miles from Perth. This was recorded at 3.30 a.m. on Saturday.

1937 10 07 01:25 UTC, Gayndah aftershock

Mt Perry and Gayndah residents were alarmed by an earthquake lasting about 3 seconds. Pictures swayed on the walls, wooden buildings trembled and cups and saucers rattled but there was no damage. Police reported that it was felt at the majority of outlying centres (*The Courier-Mail*, Friday, 8 October 1937, page 16).

It was not recorded on the Queensland University seismograph installed just 4 months earlier in Brisbane. According to the university's Dr. W.H. Bryan, dozens of tremors had occurred there between April and December 1935.

1950 04 05 20:00 UTC, Mackay

Many residents and patients in the hospital were awoken at about 6am local time, their beds creaking and building shaking. The tremor was reported to have also been felt at Pinnacle 32 miles (50km) away according to the *Townsville Daily Bulletin*, Monday, 10 April 1950, page 1. A magnitude of 4 has been assigned.

1950 06 19 09:45 UTC, Peeramom

Cairns Post, Wednesday, 21 June 1950, page 1

FELT IN INNISFAIL AREA.

INNISFAIL, June 20.-An Innisfail businessman claims that he felt the earth tremor in Innisfail last night about the same time as that which is reported to have happened on the Tableland. He is Mr. E.R. Westcott, who resides at the corner of Grace and Charles streets, Innisfail.

Mr. Westcott stated: "I was lying on my bunk after finishing dinner, and was reading a novel when I felt the bed shake, and then looking up from the book I saw that the mosquito net was also shaking. I stopped in bed and one of my sons in the next room shouted out to me and told me his bed also was being shaken. I would say the disturbance lasted about a quarter or half a minute.

"My other son, Ted, who was in the room adjoining his brother's, also lying down and reading, felt the disturbance and came running into the hallway asking what was wrong. When later we read the account of this earth tremor on the Tableland, we knew we had received some of the earth shock. I do not know whether any other persons in the neighbourhood felt the disturbance, but we certainly did."

Tremors were also reported to have been felt at South Johnstone.

REQUEST FOR REPORTS.

BRISBANE, June 20.- Headmasters, stationmasters and postmasters in the Lake Eacham area will be asked, to make reports on the earth tremor which occurred there on Monday night.

This was announced to-day by the officer in charge of the University seismological station (Dr. L. A. Jones).

He said that the tremor had not been big enough to register on the station's seismograph at Brisbane. There were only five previous recorded earth tremors in Queensland. One had been also at Lake Eacham before the world war.

The Biggenden area, together with the Mt Gambier district of South Australia, was the scene of Australia's most recent volcanic activity. This was a possible explanation for Monday's tremor.

Discussion

Two earthquake cycles have been observed at Thursday Island in the historical record, including the largest event on 28 October 1907, the first damaging earthquake in Queensland.

The Murray Islands of Torres Strait, the eastern group, are remnants of volcanoes that were active within the last 2 million years (Pleistocene age), overlapping the age of Victoria's Newer Volcanics and volcanoes in south-east (Coalstoun Lakes) and north-east Queensland (Undara). There is no sensible seismo-tectonic model that explains Recent features such as the intraplate earthquakes and volcanoes apart from one model (McCue & others, 1997).

The relocation of or different cause for the 1913 Queensland earthquake should improve any re-assessment of earthquake risk in the Brisbane region. The newspapers prior to the First World War were far more useful than subsequent newspapers as they include many country reports, whereas the later papers seem to be more focused on the cities and are more generally syndicated. The quality of the newspapers also suffered when wood chip and recycled paper replaced cloth which is obvious in the scanning quality.

Improvements in the isoseismal maps and epicentre locations may be made when more country newspapers are scanned by the ANL, or other sources such as diaries are made available.

Small earthquakes near the cities are as important as larger rural earthquakes to improve risk assessments to those cities, especially if the events can be associated with mapped faults, such as the 1954 earthquake near Adelaide which is one of a very few associated with a mapped fault in Australia.

Historical earthquakes along the Australian Plate boundaries should be better studied to assess their damage and tsunami risk potential. Mention is made of a small coastal earthquake in 1930 south of Port Moresby in PNG along the northern margin of the Australian Plate. Surprisingly 12 fatalities were caused by a reported tsunami which should have been detectable on the Australian coast almost due west of the epicentre across the Papuan Gulf.

Human activities are increasingly leading to earthquakes, whether pumping fluids underground for waste disposal or geothermal reservoir production, filling large reservoirs and mining. Historically, mining has shown a capacity to induce earthquakes. The coal mines of NSW and Queensland as well as the hard rock mines in NSW, SA and WA and more recently fracking operations in coal rich areas have all been associated with on-site 'earthquakes'. Such operations should be monitored closely with dense networks of seismographs and the data made publicly available.

More data will improve the parameters of events studied in this paper. No doubt this information will come to light in the future, there is always scope for improvement as Underwood (1972) pointed out 40 years ago.

Table Summary of earthquake details described in this paper

Date	Time UTC	Latitude °S	Longitude °E	ML	Place
1866 12 ??	??	10.7	142.2	3.5	Cape York (first reported Qld earthquake)
1867 05 12	23:00	23.4	150.5	3.5	Rockhampton
1890 03 21#	evening				Redhill explosion
1894 01 22#					Rockhampton Thunder storm
1895 09 03	22:30	17.6	145.0	3.5	Tate River
1896 02 27	23:00	16.7	145.5	3.7	Cairns
1907 06 28 ^f	??	10.6	142.2	3	Thursday Island
1907 10 27 ^m	20:40	10.57	142.21	~ 5.0	Thursday Island, minor structural damage
1907 11 10 ^m	14:05	10.6	142.2	4.0	Thursday Island
1908 12 07	??	27.3	152.0	3.5	Crow's Nest, Brisbane
1909 01 03 ^a	11:15	10.6	142.2	3.5	Thursday Island
1910 11 24	22:55	25.0	151.5	5.2	Childers
1912 12 06	17:00	23.8	151.2	3.5	Gladstone
1913 05 01	16:20	25.7	152.0	4.8	Coalstoun Lakes or possibly a meteorite (!)
1923 07 04#	08:00			-	Brisbane subway explosion
1928 09 21	11:30	17.6	145.7	> 4.3	SW of Innisfail
1930 04 07	06:50	23.1	143.7	> 4.1	Evesham, Longreach
1930 06 ??	??	9.5	147.2	~6	Port Moresby, PNG
1930 07 10	??	10.6	142.2	3	Thursday island
1932 08 05	03:50	10.6	142.2	> 3.5	Thursday Island
1932 08 05 ^a	06:00	10.6	142.2	3.5	Thursday Island
1937 10 07 ^a	01:25	25.5	151.7	3.5	Gayndah
1950 04 05	20:00	21.1	149.2	4.0	Mackay
1950 06 19	09:45	17.6	145.7	3.5	Peeramon, Lake Eacham

Note # not an earthquake, ^a aftershock, ^f foreshock, ^m mainshock

References

- AS1170.4-2007. Minimum Design Loads on Structures Part 4: Earthquake Loads. Standards Australia. 64pp.
- Burke-Gaffney, T.N., 1951. Seismicity of Australia. J and Proc. Roy. Soc., NSW, Vol LXXXV, pp. 47-52.
- Everingham, I.B., McEwin, A.J., and Denham, D., 1982. Atlas of isoseismal maps of Australian earthquakes. Bureau of Mineral Resources, Australia, Bulletin 214.
- Everingham, I. B., Denham, D, Greenhalgh, S.A., 1987. Surface-wave magnitudes of some early Australian earthquakes. BMR Journal of Australian Geology and Geophysics 10(3) 253-259.
- McCue, K.F., 1980. Magnitudes of some early earthquakes in south-eastern Australia. Search, 11(3), 78-80.
- McCue, K.F., 1978. Seismic Risk in Eastern Australia. University of South Australia, Report ADP 153 (unpubl.)
- McCue, K.F., 1996 (compiler) Atlas of Isoseismal Maps of Australian Earthquakes Part 3. AGSO Record 1996/19.
- McCue, K.F., Somerville, M., and Sinadinovski, C., 1996. Gshap etc. in Proceedings of the AEES Conference

McEwin, A.J., Underwood, R., Denham, D 1976. Earthquake risk in Australia. BMR Journal of Australian Geology and Geophysics 1(1), 15-21.

Payne, C., 2010 - ES&S Seismic Network Report, 2009.
http://www.aees.org.au/Articles/Payne_ESS-SNR_2009.pdf

Rynn, J.M.W., Denham, D., Grenhalgh, S., Jones, T., Gregson, P.J., McCue, K. and Smith, R.S., 1987. Atlas of isoseismal maps of Australian earthquakes. Bureau of Mineral Resources, Australia, Bulletin 222.

Underwood, R., 1973. Progress Report on Seismic Zoning in Australia. BMR Bulletin 164, 61-66.

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