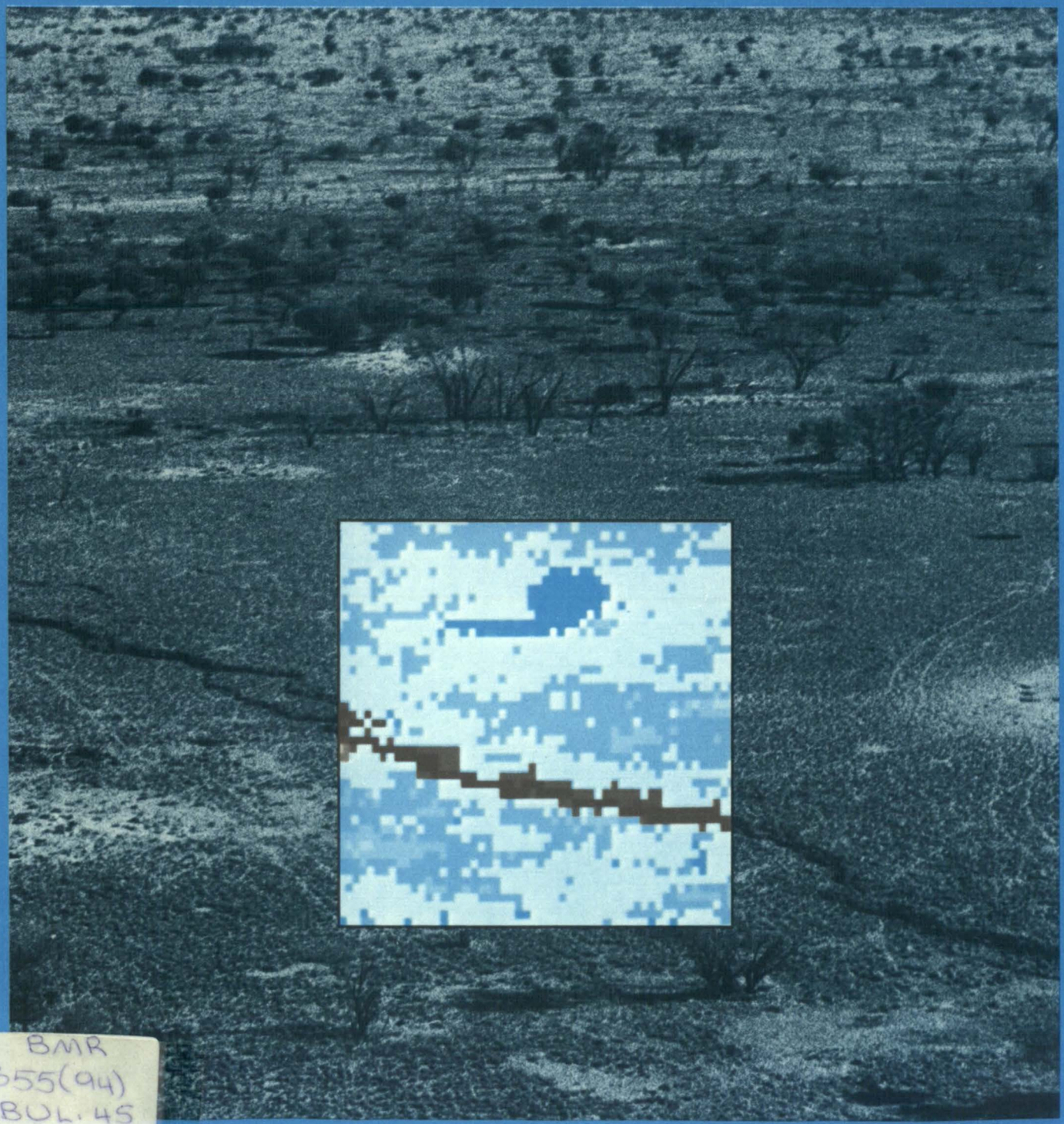
Atlas of isoseismal maps of Australian earthquakes, part 2

BMR Bulletin
222

J.M.W. Rynn & others



DEPARTMENT OF RESOURCES AND ENERGY
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

BULLETIN 222

Atlas of isoseismal maps of Australian earthquakes

Part 2

Compiled by

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The cover illustration shows the fault scarp associated with the Marryat Creek earthquake of March 1986. This took place approximately 350 km south of Alice Springs and had a Richter magnitude of 5.7. Although the effects of this earthquake are not described in this Bulletin, the illustration shows surface faulting that is typical of large intraplate earthquakes caused by compressive stresses in the crust. The fault scarp was 13 km long and had a maximum throw of 0.5 m. The photograph was taken looking to the southwest. The fault scarp strikes north-south, and the western block overrides the eastern block.

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Erratum: Note that the isoseismal maps accompanying the two Bundaberg earthquake aftershocks of 6 June 1918 have been transposed.

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ABSTRACT

This atlas of isoseismal maps of Australian earthquakes documents the ground intensity effects of 79 earthquakes. Most of these earthquakes originated in Queensland, northern New South Wales, and South Australia before 1982, and were not documented in the first atlas (*BMR Bulletin* 214) because their maps were not available at the time of publication; the remainder occurred in 1982 and 1983. The earliest map is for the November 1875 Mackay (Qld) earthquake and the most recent for the 1983 Beltana (SA) earthquake.

This *Bulletin* and *Bulletin* 214 incorporate 163 maps from 149 earthquakes felt on the Australian continent, and provide a comprehensive database for earthquake risk assessments.

Although the largest Australian earthquakes were included in *Bulletin* 214, this atlas contains maps of several early earthquakes of significance. These include the 1883 Gayndah (Qld), the 1886 Yass (NSW), and the 1913 Ravenswood (Qld) earthquakes, which had Richter magnitudes of 5.9, 5.5, and 5.7 respectively.

The atlas is arranged in the same format as *Bulletin* 214: the isoseismal maps are presented in chronological order, each facing a page containing a brief description of the earthquake and the methods used to obtain the intensity data.

1. INTRODUCTION

Isoseismal maps show the distribution of the shaking effects of earthquakes, and provide valuable information for estimates of earthquake risk. They are of particular significance in Australia, where instrumental strong-motion data are scarce and difficult to obtain.

Isoseismal maps for Australian earthquakes have appeared in a large variety of publications, and some maps have been republished in small groups when used in specific earthquake risk studies (e.g. Bubb, 1971; McCue, 1973, 1975).

In BMR *Bulletin* 214 (Everingham & others, 1982) 83 maps from 70 earthquakes were compiled to provide a convenient medium for the assembly of intensity maps for Australian earthquakes—i.e., a basic macroseismic data source. No attempt has been made to analyse the results in terms of attenuation studies or earthquake risk assessment, but any such analyses must be consistent with the records presented not only in *Bulletin* 214 but also in this supplement, in which a further 79 maps are presented.

Terminology used in the text, maps, table, and map descriptions is defined in Appendix 1.

The Modified Mercalli (MM) scale, the basis of modern intensity estimates, is described in Appendix 2.

In the text, reference is frequently made to 'BMR' although 'BMR' does not appear in the list of references. In these instances the results have been obtained from the unpublished files and computer data lists of the Bureau of Mineral Resources, Geology and Geophysics, Canberra. BMR maintains the Australian National Earthquake Data Centre, where information on all located earthquakes occurring in the Australian region is recorded and updated.

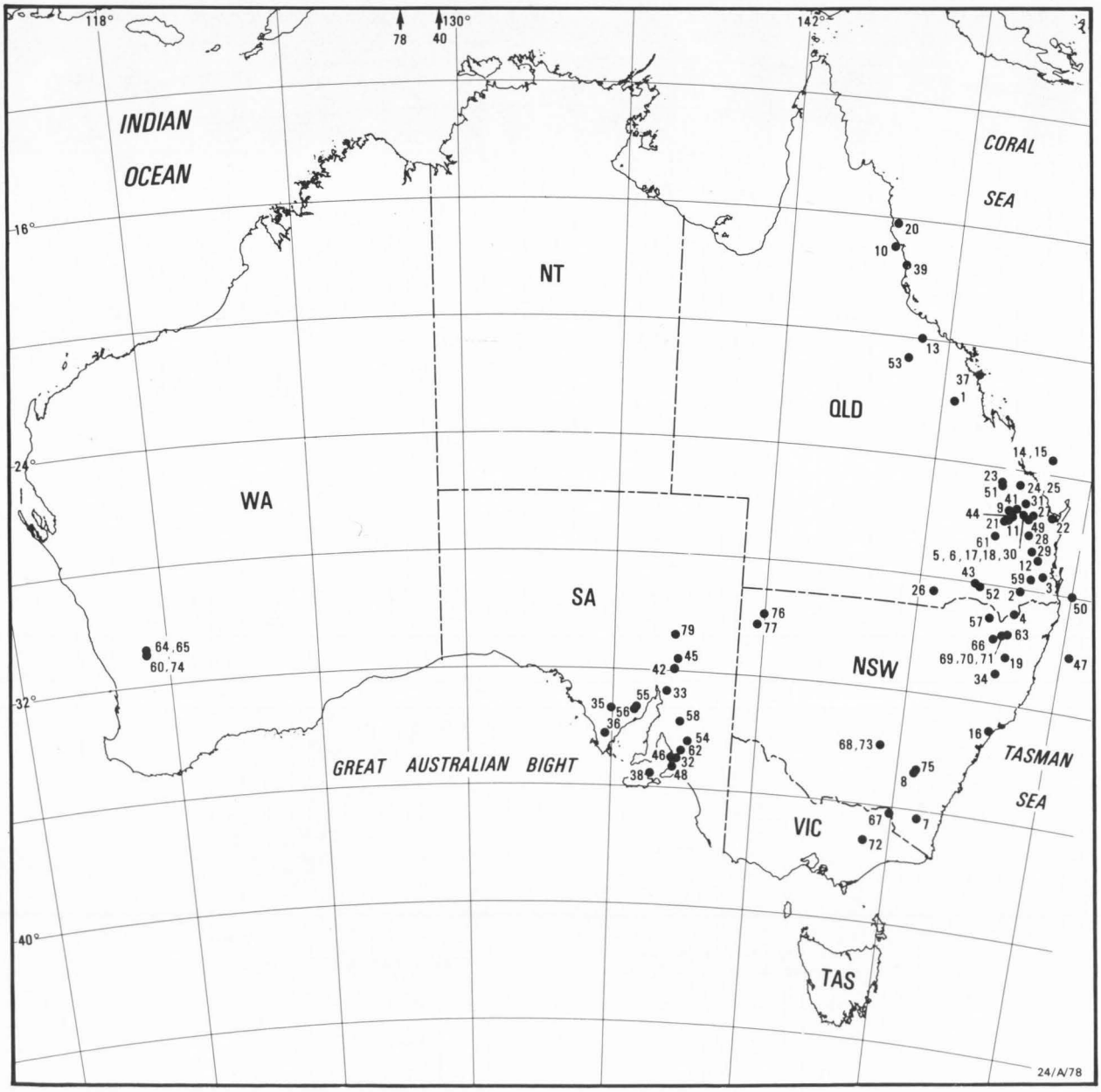

Fig. 1. Index map of the Atlas earthquakes (for key to numbers, see Table 1).

2. EARTHQUAKE DATA

Table 1 lists details of earthquakes for which isoseismal maps are shown—the location of each earthquake is shown in Figure 1. These details were taken from BMR's earthquake data file, which contains earthquake parameters obtained from all sources. The selection of hypocentres and magnitudes for the atlas earthquakes is based on a careful examination of all available data and an appraisal of published information on the earthquakes.

HYPOCENTRES

For earthquakes that occurred before 1958, instrumentally determined hypocentres are either not available or have been inaccurately determined because instrumental recordings were rare and timing was inaccurate by modern standards. In fact, until the mid-1950s ony five recording stations (Brisbane, Adelaide, Perth, Melbourne, and Sydney) were in continuous operation on the Australian continent. Hence, most of the early earthquake maps show epicentres that have been determined from macroseismic observations; the epicentres are plotted in the zones of highest intensities.

Determinations of epicentres and depths for earthquakes after the late 1950s are more accurate than for earlier earthquakes, but their accuracy can vary within this set. By the end of 1983, many more seismographic stations had been installed but there were still significant gaps in the coverage of Queensland, Western Australia, and northern New South Wales (see Fig. 2). The most accurate results have been obtained for those earthquakes with epicentres located within networks of stations, and those which have been closely studied because they were felt over a wide area.

The focal depths of some earthquakes have been determined by using local network results or reliable depth phases recorded as teleseisms; these focal depths have been included in Table 1.

MAGNITUDES

The magnitudes of each earthquake, and the source (Appendix 3) of each determination, are listed in Table 1. Each magnitude was investigated to ensure that it was reliably

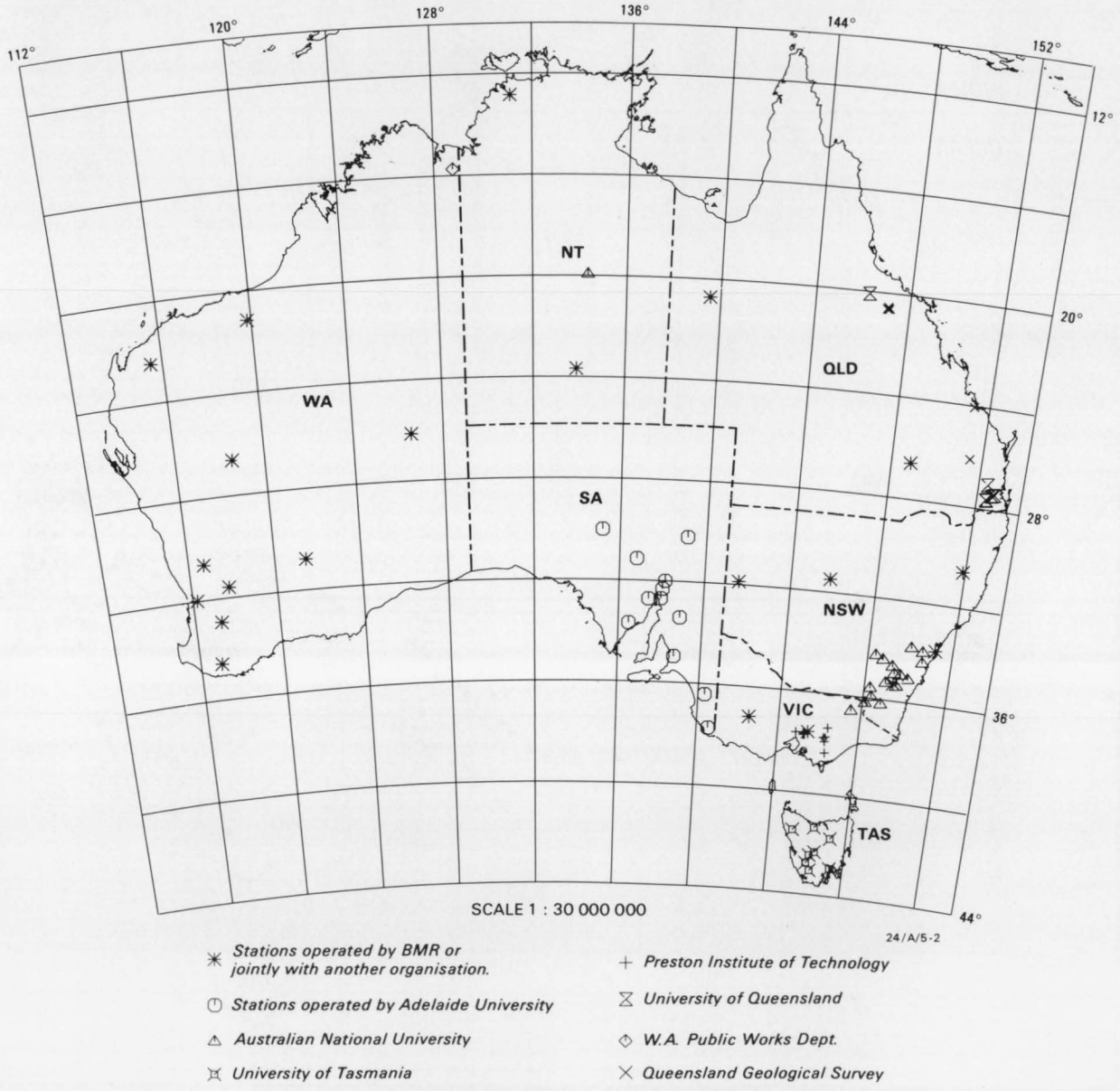

Fig. 2. Australian seismographic stations 1983.

TABLE 1. HYPOCENTRAL PARAMETERS

No.	Locality	Origin time (UT)						Epicentre		Focal depth	Magnitude		
		yr	m	d	h	m	s	lat. °S	long. °E	(km)	ML	MS	MB
1.	Mackay (Qld)	1875	Nov	11	10	50		22.0	148.5		4.3 I		
2.	Warwick (Qld)	1875	Nov	24	11	00		28.1	152.0		3.8 I		
3.	Ipswich (Qld)	1877	Feb	26	21	45		27.5	152.8		4.5 I		
4.	Warwick (Qld)	1880	Aug	10	19	00		28.9	151.9		3.6 I		
5.	Gayndah (Qld)	1883	Aug	28	16	55		25.5	151.7		5.9 I		
6.	Gayndah (Qld)	1883	Aug	28	18	20		25.5	151.7		5.2 I		
7.	Berridale (NSW)	1885	Jan	21	01	10		36.3	149.1	<25	4.6 I		
8.	Yass (NSW)	1886	Nov	29	17	00		34.75	148.8		5.5 I		
9.	Eidsvold (Qld)	1891	Jan	05	03	34		25.4	151.1		4.0 I		
10.	Cairns (Qld)	1896	Feb	27	10	58		17.0	145.7		4.3 I		
11.	Mundubbera (Qld)	1910	Nov	24	23	00		25.7	151.2		5.2 I		
12.	Kilcoy (Qld)	1913	May	01	16	20		27.0	152.5		4.8 I		
13.	Ravenswood (Qld)	1913	Dec	18	13	54		20.0	147.0		5.7 I	4.7 E	5.8 GR
14.	Bundaberg (Qld)	1918	Jun	06	18	23		23.5	152.5		5.5 I		
15.	Bundaberg (Qld)	1918	Jun	06	19	20		23.5	152.5		5.7 I		
16.	Boolaroo (NSW)	1925	Dec	18	10	47	10	33.0	151.6		5.0 BMR		
17.	Gayndah (Qld)	1935	Jun	01	12	12		25.5	151.67		4.3 I		
18.	Gayndah (Qld)	1935	Jul	18	19	30		25.5	151.67		4.1 I		
19.	Armidale/Guyra (NSW)	1938	Jun	27	22	38	47	30.1	151.6	33	4.7 RIV		
20.	Daintree (Qld)	1942	Apr	10	03	00		16.2	145.7		3.8 I		
21.	Delubra (Qld)	1951	Dec	30	20	34	03	25.8	151.0		4.0 I		
22.	Maryborough (Qld)	1952	Jun	24	01	44	04	25.5	152.8		4.8 RIV	4.4 E	
23.	Dawes (Qld)	1953	Feb	06	17	49	31	24.7	150.7		3.7 I		
24.	Many Peaks (Qld)	1953	Dec	03	15	42	49	24.5	151.4		4.4 I		
25.	Many Peaks (Qld)	1953	Dec	03	15	58		24.6	151.3		3.8 I		
26.	St George (Qld)	1954	Sep	19	10	37	06	28.5	148.6	10	5.3 RIV	4.1 E	
27.	Biggenden (Qld)	1954	Sep	21	20	29	22	25.3	152.0		3.8 I		
28.	Murgon (Qld)	1955	Feb	01	11	09	30	26.15	151.80		3.6 I		
29.	Mt Stanley (Qld)	1955	Apr	10	22	36	15	26.7	152.2		3.2 I		
30.	Gayndah (Qld)	1955	Sep	10	06	12	54	25.5	151.6		3.4 I		
31.	Mt Perry (Qld)	1955	Dec	01	05	33	51	25.1	151.7		3.2 I		
32.	Adelaide (SA)	1959	Mar	02	12	22		34.98	138.73		2.6 I		
33.	Melrose (SA)	1959	Sep	09	04	17	30	32.7	138.2	10	4.2 ADE		
34.	Uralla/Tamworth (NSW)	1959	Oct	12	21	23	40	30.95	151.75		4.7 RIV		
35.	Mamblin (SA)	1959	Nov	02	01	17	57	33.36	135.98		5.2 ADE		
36.	Cummins (SA)	1960	Aug	30	21	23	50	34.20	135.75		4.2 ADE		
37.	Mackay (Qld)	1960	Oct	19	11	37	07	21.0	149.3		4.3 CTA		
38.	Kingscote (SA)	1962	May	16	21	41	36	35.51	137.66	25	4.4 ADE		
39.	Innisfail (Qld)	1963	Mar	28	04	29	52	17.6	146.2		3.2 I		
40.	Banda Sea	1963	Nov	04	01	17	13	6.94	129.53	108			7.8 ISC
41.	Mundubbera (Qld)	1964	Mar	25	06	14	38	25.3	151.4		4.1 CTA		
42.	Hawker (SA)	1965	Jan	25	20	22	54	31.93	138.50	0	4.6 ADE		
43.	Goondiwindi (Qld)	1965	Jun	03	21	59	57	28.08	150.22		5.3 CTA		4.4 ISC
44.	Mundubbera (Qld)	1967	Jul	18	07	48	04	25.65	151.15		4.0 I		
45.	Wilpena (SA)	1972	Apr	18	22	20	40	31.58	138.62	12	5.3 ADE		
46.	Adelaide (SA)	1972	Oct	17	12	40	07	35.00	138.51	6	3.4 ADE		
47.	Dorrigo (NSW)	1973	Jul	29	13	58	04	30.09	154.37	10	4.5 RIV		
48.	Willunga (SA)	1975	Jul	14	18	02	23	35.25	138.58	24	3.4 ADE		
49.	Coalstoun Lakes (Qld)	1975	Nov	12	10	29	47	25.6	151.9		3.2 I		
50.	Gold Coast (Qld)	1976	Sep	22	04	33	09	28.0	154.0		3.4 COO		
51.	Dawes (Qld)	1976	Oct	01	00	46	40	24.8	150.7		3.2 I		
52.	Inglewood (Qld)	1977	Mar	05	06	04	11	28.14	150.35	33	4.5 BMR		
53.	Scartwater (Qld)	1978	May	24	17	38	00	20.7	146.6		3.2 CTA		
54.	Truro (SA)	1979	Jul	04	09	18	45	34.39	139.19	4	3.5 ADE		
55.	Kimba (SA)	1979	Oct	22	11	13	40	33.31	136.95	34	3.5 ADE		
56.	Kimba (SA)	1980	Apr	15	00	38	05	33.26	137.03	31	4.3 ADE		
57.	Ashford (NSW)	1980	Sep	04	21	05	45	29.13	150.94		4.0 CAN, WIV		
58.	Clare Valley (SA)	1980	Nov	13	08	56	16	33.74	138.83	19	3.7 ADE		
59.	Tenthill (Qld)	1981	Mar	24	18	34	16	27.67	152.24	10	2.7 COO		
60.	Cadoux	1981	Apr	07	20	15	58	30.74	117.16	0	4.5 MUN		
61.	Monogorilby (Qld)	1981	May	10	14	39	38	26.33	150.73	19	4.1 CTA		
62.	Mt Pleasant (SA)	1981	Aug	31	19	35	17	34.71	139.04	25	2.8 ADE		
63.	Glen Innes (NSW)	1981	Oct	11	09	26	35	29.64	151.75		3.2 WIV		
64.	Cadoux (WA)	1982	Jan	24	04	06	19	30.90	117.12	5	4.3 MUN		3.5 GS
65.	Cadoux (WA)	1982	Feb	06	15	24	38	30.88	117.15	7	4.9 MUN		4.7 GS
66.	Inverell (NSW)	1982	Mar	04	10	02	43	29.82	151.20	20	3.6 RIV, WIV		
67.	Corryong (NSW)	1982	Mar	09	00	09	26	36.24	147.92	13	3.4 BMR		
68.	West Wyalong (NSW)	1982	May	20	07	36	18	33.96	147.24	2	3.6 BMR		
69.	Glen Innes (NSW)	1982	Jun	08	03	13	24	29.66	151.63		2.9 WIV		
70.	Glen Innes (NSW)	1982	Jun	09	04	32	47	29.66	151.63		3.5 WIV		
71.	Glen Innes (NSW)	1982	Jul	05	09	02	29	29.67	151.63		2.2 WIV, COO		
72.	Wonnangatta (Vic)	1982	Nov	21	11	34	19	37.20	146.96	17	5.4 BMR	3.8 BMR	4.8 BMR
73.	West Wyalong (NSW)	1982	Nov	26	00	11	17	33.94	147.25	4	4.6 BMR		5.4 BMR
74.	Cadoux (WA)	1983	Jan	26	06	16	15	30.73	117.13	10	4.8 MUN		5.1 GS
75.	Bowning (NSW)	1983	Mar	07	23	26	01	34.69	148.88	17	3.8 BMR		
76.	Milparinka (NSW)	1983	Apr	08	19	33	18	29.85	142.01	45	4.5 BMR		4.9 GS
77.	Milparinka (NSW)	1983	Jun	20	17	33	00	30.22	141.74	60	4.7 BMR		
78.	Timor	1983	Nov	24	05	30	34	7.57	128.19	180	7.5 MUN	7.1 GS	6.4 GS
79.	Beltana (SA)	1983	Dec	29	17	42	02	30.79	138.40	20	4.8 ADE		5.3 GS

determined from instrumental data because earthquake lists frequently record magnitudes that have been determined from intensity data (e.g., those of McCue, 1980) or have been determined by non-standard methods. Local magnitude (ML) was the most commonly determined magnitude, and therefore will generally be referred to by researchers when analysing results. Where more than one value of ML is available for any given earthquake, then the ML determinations listed by Drake (1976) or McCue (1975) are preferred for eastern and southern Australian earthquakes respectively. In Western Australia, all the listed ML values were determined by BMR Mundaring Geophysical Observatory.

Reliable magnitude values for several of the earlier earthquakes could not be determined instrumentally (from seismograms), so their magnitudes were calculated—according to McCue's (1980) formula—from macroseismic data:

$$M = 1.01\ln(Rp) + 0.13$$

where Rp is the radius of perceptibility in kilometres of the MM(III) isoseismal and ln is the natural logarithm. Magnitudes determined by this method should be treated as approximate values which may be revised as a result of further research.

The surface-wave magnitudes for the 1913 Ravenswood (Qld), the 1952 Maryborough (Qld), and the 1954 St George (Qld) earthquakes were taken from an unpublished report by I. B. Everingham, in which MS magnitudes were determined from the Riverview, Melbourne, and Perth seismograms.

Where the sources of the magnitudes listed in the table are not specifically identified, the values have been taken from the appropriate reference.

3. ISOSEISMAL MAPS

Maps that have been published elsewhere are reproduced here without major modifications to the overall shape of the isoseismals; however, some minor modifications have been made to standardise the presentation. Isoseismals drawn over the sea have been eliminated but their trend is indicated by a single dash. The isoseismals on each map are drawn to enclose all intensity observations equal to or greater than a given intensity, but isolated intensity reports which do not fit the general pattern have been ignored; thus, the isoseismals are smoothed to some extent.

4. THE FUTURE

Because of the sparseness of instruments to record strong ground motion in Australia we will have to rely for many years on the careful analysis of felt intensities to assess earthquake risk. Therefore it is essential that a comprehensive and reliable source of these data is maintained. New isoseismal maps of past and future earthquakes, and possible revisions of existing isoseismal maps, will be included in annual BMR seismological reports (e.g., Denham & Gregson, 1984, 1985).

5. ACKNOWLEDGEMENTS

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APPENDIX 1: TERMINOLOGY

ACCELEROMETER. A seismograph for measuring ground acceleration as a function of time.

ACTIVE FAULT. A fault along which slip has occurred in historical (or Holocene) time, or on which earthquake foci are located.

AFTERSHOCKS. Smaller earthquakes following the largest earthquake of a series concentrated in a restricted crustal volume.

EARTHQUAKE. The vibrations of the Earth caused by the passage of seismic waves radiating from a source of elastic energy.

EPICENTRE. The point on the Earth's surface directly above the focus (or hypocentre) of an earthquake.

FAULT. A fracture or zone of fractures in rock along which the two sides have been displaced relative to each other. The total fault offset may range from one millimetre for very small earthquakes to ten metres for the Earth's largest shock.

FOCAL DEPTH (OF EARTHQUAKES). The depth of the focus (hypocentre) below the surface of the Earth.

FOCUS (HYPOCENTRE). The place at which rupture commences.

FORESHOCKS. Smaller earthquakes preceding the largest earthquake of a series concentrated in a restricted crustal volume.

HYPOCENTRE (FOCUS). The place at which rupture commences.

INTENSITY (OF EARTHQUAKES). A measure of ground shaking obtained from the damage done to structures built by man, changes in the Earth's surface , and felt reports (see Appendix 2).

INTENSITY QUESTIONNAIRE. Special form or card (designed about the Modified Mercalli scale of intensity) listing questions to which simple answers indicate the intensity of an earthquake. The answers to these questionnaires gathered from an area around a felt earthquake can be integrated with field observations and other reports in drawing isoseismal maps (see Appendix 4).

ISOSEISMALS. Contour lines drawn to separate one level of seismic intensity from another.

MACROSEISMIC EFFECTS (OF EARTHQUAKES). Those effects that can be observed on a large scale in the field without instrument aid.

MAGNITUDE. A quantity that is characteristic of the total energy released by an earthquake, in contrast to 'intensity', which subjectively describes earthquake effects at a particular place. Richter (1935) devised the logarithmic magnitude scale in current use to define local magnitude (ML) in terms of the motion that would be measured by a standard type of seismograph located 100 km from the epicentre of an earthquake. Several other magnitude scales are also in use; for example, the body-wave magnitude (MB) and the surface-wave magnitude (MS), which use body-waves and surface-waves respectively, and the duration magnitude (MD), which is based on the length of time that the seismogram is disturbed. Magnitude scales are open-ended, but the largest known earthquake magnitudes are about MS 8.5. For magnitude relations, see McGregor & Ripper (1976) or Båth (1981).

MEIZOSEISMAL REGION. The area of strong shaking and significant damage by an earthquake.

MODIFIED MERCALLI (MM) SCALE. A numerical index describing the effects of an earthquake. The scale in common use today is the Modified Mercalli scale of 1931, in which intensity values are indicated by capital Roman numerals from I to XII. The narrative descriptions of each intensity value are given in Appendix 2.

RISK (SEISMIC). The relative risk is the comparative earthquake hazard from one site to another. The probabilistic risk is the odds of earthquake occurrence within a given time interval and region.

ROSSI-FOREL (RF) SCALE. A numerical index describing the effects of an earthquake (in common use before the adoption of the MM scale in about 1931).

SCARP (FAULT). A cliff or steep slope formed by displacement of the ground surface.

SEICHE OSCILLATION. Resonant oscillation in closed or semiclosed bodies of water.

SEISMICITY. The distribution of earthquakes in space and time.

SEISMOGRAPH. An instrument for recording, as a function of time, the motions of the Earth's surface that are caused by seismic waves.

SEISMOLOGY. The study of earthquakes, seismic sources, and wave propagation through the Earth.

STRONG GROUND MOTION. The shaking of the ground near an earthquake source made up of large-amplitude seismic waves of various types.

TELESEISM. An earthquake recorded by a seismograph at a great distance from the source (over 1000 km).

APPENDIX 2: MODIFIED MERCALLI (MM) SCALE OF EARTHQUAKE INTENSITY (New Zealand version, 1965, after Eiby, 1966)

MM I	Not felt by humans, except in especially favourable circumstances, but birds and animals may be disturbed. Reported mainly from the upper floors of buildings more than ten storeys high. Dizziness or nausea may be experienced. Branches of trees, chandeliers, doors, and other suspended systems of long natural period may be seen to move slowly. Water in ponds, lakes, reservoirs, etc., may be set into seiche oscillation.
MM II	Felt by a few persons at rest indoors, especially by those on upper floors or otherwise favourably placed. The long-period effects listed under MM I may be more noticeable.
MM III	Felt indoors, but not identified as an earthquake by everyone. Vibrations may be likened to the passing of light traffic. It may be possible to estimate the duration, but not the direction. Hanging objects may swing slightly. Standing motorcars may rock slightly.
M IV	Generally noticed indoors, but not outside. Very light sleepers may be awakened. Vibration may be likened to the passing of heavy traffic, or to the jolt of a heavy object falling or striking the building. Walls and frame of buildings are heard to creak. Doors and windows rattle. Glassware and crockery rattle. Liquids in open vessels may be slightly disturbed. Standing motorcars may rock, and the shock can be felt by their occupants.
MM V	Generally felt outside, and by almost everyone indoors. Most sleepers awakened. A few people frightened. Direction of motion can be estimated. Small unstable objects are displaced or upset. Some glassware and crockery may be broken. Some windows cracked. A few earthware toilet fixtures cracked. Hanging pictures move. Doors and shutters swing. Pendulum clocks stop, start, or change rate.
MM VI	Felt by all. People and animals alarmed. Many run outside. Difficulty experienced in walking steadily. Slight damage to Masonry D. Some plaster cracks or falls. Isolated cases of chimney damage. Windows, glassware, and crockery broken. Objects fall from shelves, and pictures from walls. Heavy furniture moves. Unstable furniture overturned. Small church and school bells ring. Trees and bushes shake, or are heard to rustle. Loose material may be dislodged from existing slips, talus slopes, or shingle slides.
MM VII	General alarm. Difficulty experienced in standing. Noticed by drivers of motorcars. Trees and bushes strongly shaken. Large bells ring. Masonry D cracked and damaged. A few instances of damage to Masonry C. Loose brickwork and tiles dislodged. Unbraced parapets and architectural ornaments may fall. Stone walls cracked. Weak chimneys broken, usually at the roofline. Domestic water tanks burst. Concrete irrigation ditches damaged. Waves seen on ponds and lakes. Water made turbid by stirred-up mud. Small slips, and caving-in of sand and gravel banks.
MM VIII	Alarm may approach panic. Steering of motorcars affected. Masonry C damaged, with partial collapse. Masonry B damaged in some cases. Masonry A undamaged. Chimneys, factory stacks, monuments, towers, and elevated tanks twisted or brought down. Panel walls thrown out of frame structures. Some brick veneers damaged. Decayed wooden piles broken. Frame houses not secured to the foundation may move. Cracks appear on steep slopes and in wet ground. Landslips in roadside cuttings and unsupported excavations. Some tree branches may be broken off.
MM IX	General panic. Masonry D destroyed. Masonry C heavily damaged, sometimes collapsing completely. Masonry B seriously damaged. Frame structures racked and distorted. Damage to foundations general. Frame houses not secured to the foundations shifted off. Brick veneers fall and expose frames. Cracking of the ground conspicuous. Minor damage to paths and roadways. Sand and mud ejected in alluviated areas, with the formation of earthquake fountains and sand craters. Underground pipes broken. Serious damage to reservoirs.
MM X	Most masonry structures destroyed, together with their foundations. Some well-built wooden buildings and bridges seriously damaged. Dams, dykes, and embankments seriously damaged. Railway lines slightly bent. Cement and asphalt roads and pavements badly cracked or thrown into waves. Large landslides on river banks and steep coasts. Sand and mud on beaches and flat land moved horizontally. Large spectacular sand and mud fountains. Water from rivers, lakes, and canals thrown up on the banks.
MM XI	Wooden frame structures destroyed. Great damage to railway lines. Great damage to underground pipes.
MM XII	Damage virtually total. Practically all works of construction destroyed or greatly damaged. Large rock masses displaced. Lines of sight and level distorted. Visible wave-motion of the ground surface reported. Objects thrown upwards into the air.

Categories of non-wooden construction

Masonry A. Structures designed to resist lateral forces of about 0.1 g, such as those satisfying the New Zealand Model Building Bylaw, 1955. Typical buildings of this kind are well reinforced by means of steel or ferro-concrete bands, or are wholly of ferro-concrete construction. All mortar is of good quality, and the design and workmanship are good. Few buildings erected prior to 1935 can be regarded as Masonry A.

Masonry B. Reinforced buildings of good workmanship and with sound mortar, but not designed in detail to resist lateral forces.

Masonry C. Buildings of ordinary workmanship, with mortar of average quality. No extreme weakness, such as inadequate bonding of the corners, but neither designed nor reinforced to resist lateral forces.

Masonry D. Building with low standards of workmanship, poor mortar, or constructed of weak materials like mud brick and rammed earth. Weak horizontally.

Windows. Window breakage depends greatly upon the nature of the frame and its orientation with respect to the earthquake source. Windows cracked at MM V are usually either large display windows, or windows tightly fitted to metal frames.

Chimneys. The 'weak chimneys' listed under MM VII are unreinforced domestic chimneys of brick, concrete block, or poured concrete.

Water tanks. The 'domestic water tanks' listed under MM VII are of the cylindrical corrugated-iron type common in New Zealand rural areas. If these are only partly full, movement of the water may burst soldered and riveted seams. Hot-water cylinders constrained only by supply and delivery pipes may move sufficiently to break pipes at about the same intensity.

APPENDIX 3: MAGNITUDE SOURCES

Estimates of earthquake magnitudes have been obtained from several sources. The table below identifies the codes on the atlas maps and in Table 1 with the agencies that provided the estimates. 'I' indicates that the magnitude has been estimated from intensity results as per McCue (1980).

ADE — University of Adelaide, Adelaide (SA)
BMR — Bureau of Mineral Resources, Geology and Geophysics, Canberra (ACT)
CAN — Australian National University, Canberra (ACT)
COO — Cooney Observatory, Armidale (NSW)
CTA — Charters Towers Observatory (Qld)
E — I. B. Everingham, personal communication, from the Riverview, Perth, and Melbourne seismograms
GR — Gutenberg & Richter (1954)
GS — United States Geological Survey—National Earthquake Information Service (NEIS), (USA)
I — Magnitude determined from intensity data
ISC — International Seismological Centre (UK)
MUN — BMR Mundaring Geophysical Observatory, Perth (WA)
RIV — Riverview Observatory, Sydney (NSW)
WIV — Wivenhoe Dam Network, southeastern Qld.

APPENDIX 4: EARTHQUAKE QUESTIONNNAIRE FORM

GEOPHYSICAL OBSERVATORY GROUP,
BUREAU OF MINERAL RESOURCES,
P.O. BOX 378,
CANBERRA CITY, A.C.T. 2601

EARTHQUAKE REPORT

We are investigating the effects of the earthquake that took place on and would be grateful if you would complete this report and return it in the pre-paid envelope.

If you did not feel the earthquake, please complete section 1 of the report, because this will help to fix limits of the area affected by the shock.

Please underline appropriate words or fill in spaces.

Name of Person reporting (block letters)	An earthquake was felt ☐ Not felt ☐	Time.....a.m. .....p.m.

1. YOUR LOCATION DURING EARTHQUAKE

(a) Address at time of earthquake.....
and nearest large town.....

(b) Ground: Rocky, gravelly, loose, compact, marshy, filled-in or.....
Level, sloping, steep or.....

(c) If indoors, type of building construction: Wood, brick, brick veneer, masonry, concrete or.....

(d) Quality of construction: New, old, well built, poorly built, or.....

(e) No. of floors in building.....

(f) Observer's floor.....

(g) Activity when earthquake occurred: Walking, sitting, lying down, sleeping, or.....

(h) If out of doors, you, others were: Quiet, active, or.....

2. EFFECTS ON POPULATION

(a) Felt by: Very few, several, many, all (in your home) (in community)

(b) Awakened: No one, few, many, all (in your home) (in community)

(c) Frightened: No one, few, many, all (in your home) (in community); general panic

3. RELATED SOUNDS

(a) Rattling of windows, doors, dishes, etc. .....

(b) Creaking of building (describe).....

(c) Earth noises: Faint, moderate, loud.....

4. PHYSICAL EFFECTS AND DAMAGE

(a) Outside:

1. Trees and bushes shaken, vehicles rocked, etc. .....
2. Ground cracked, landslides, water disturbed, etc. .....
3. Columns, monuments, elevated water tanks, etc., cracked, twisted, overturned.....
4. Other effects.....

(b) Buildings:

1. Hanging objects swung moderately, violently. Direction of movement.....
2. Small objects shifted, overturned, fell.....
3. Furniture shifted, overturned, broken.....
4. Plaster cracked, broken, fell.....
5. Windows cracked.....
6. Structural elements of brick, wood, or..... were damaged slightly, moderately, greatly.....

Additional information will be appreciated. Use space on reverse side.

G82/4-124A

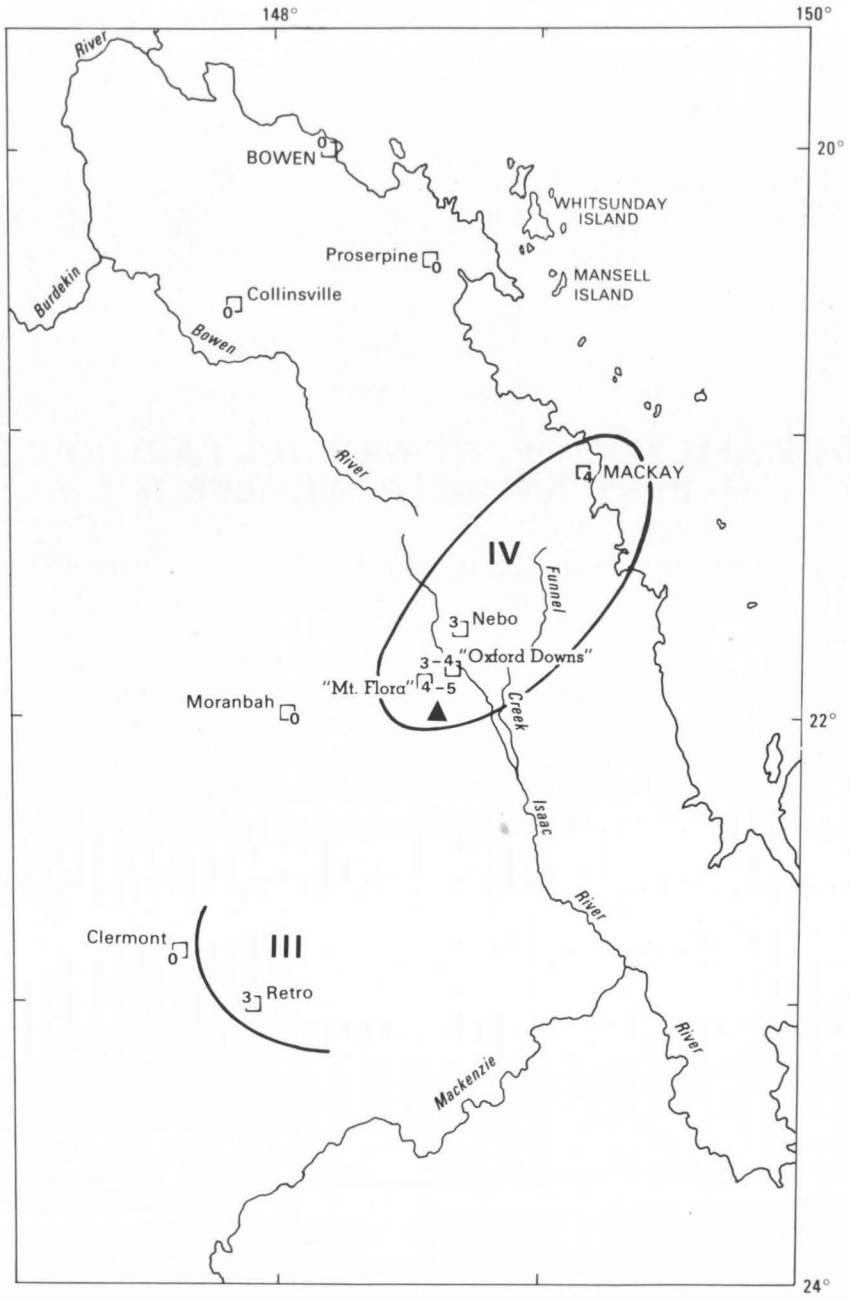
ISOSEISMAL MAPS
(in chronological order)

ISOSEISMAL MAP OF THE MACKAY EARTHQUAKE, QUEENSLAND—11 NOVEMBER 1875

At about 8:50 p.m. local time on 11 November 1875 (10:50 hours UT) the township of Mackay and several settlements in its hinterland experienced the effects of an earthquake. According to articles in the *Mackay Mercury* and *Brisbane Courier*, felt reports from eight centres indicated that the epicentral zone (area of maximum intensity—MM IV-V) was near Mount Flora, about 100 km southwest of Mackay. An approximate magnitude calculated from the radius of perceptibility (MM III isoseismal) was ML(I) = 4.3.

This is the first known widely felt earthquake to be reported in Queensland. The epicentre on the map was estimated from the felt reports.

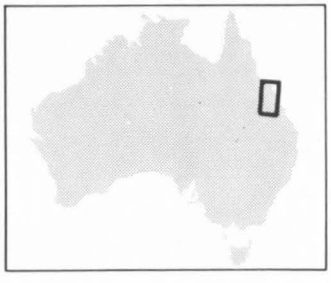
ISOSEISMAL MAP OF THE MACKAY EARTHQUAKE, QUEENSLAND, 11 NOVEMBER 1875



0 80 km

DATE : 11 NOVEMBER 1875
TIME : 10:50 UT
MAGNITUDE : 4.3 ML (I)
EPICENTRE : 22.0°S 148.5°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



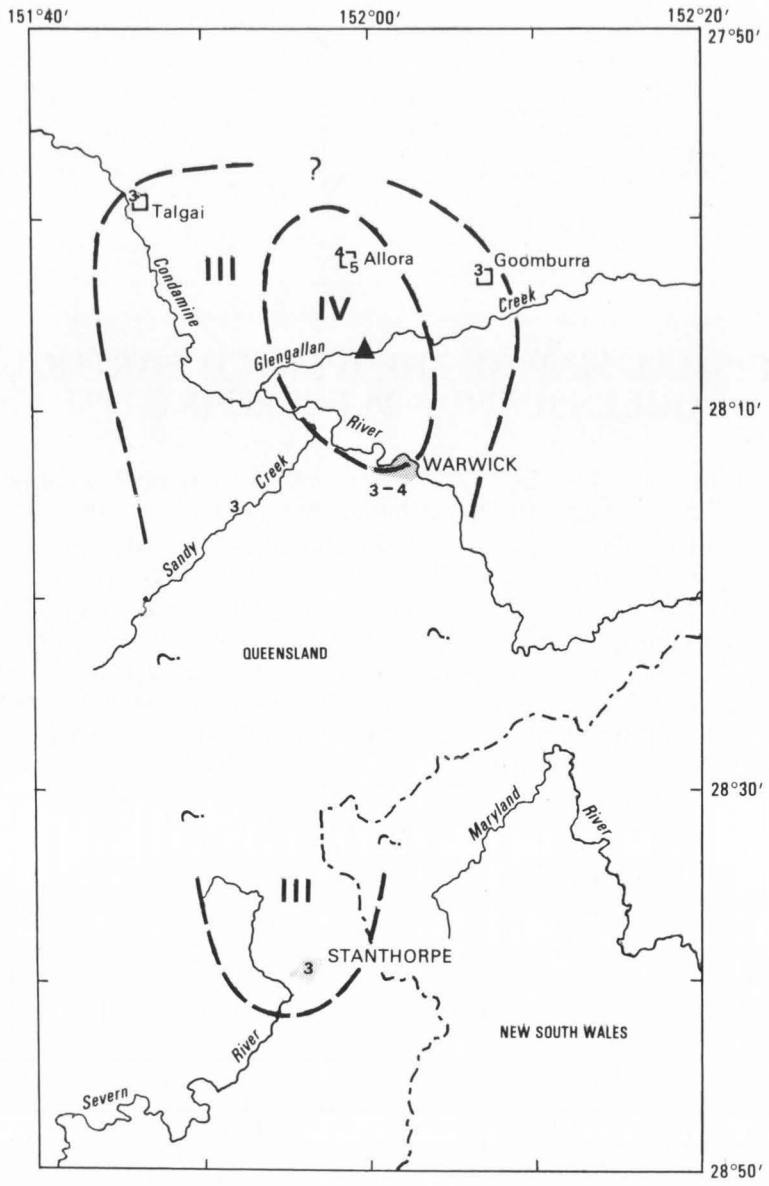
24/F55/2

ISOSEISMAL MAP OF THE WARWICK EARTHQUAKE, QUEENSLAND—24 NOVEMBER 1875

On 24 November 1875, at about 11:00 hours UT (9:00 p.m. local time) Warwick and the surrounding district experienced an earthquake, the first ever known to have occurred in this area since its settlement. Reports from the *Stanthorpe Border Post and Stannum Miner* and the *Warwick Examiner and Times* indicated that the effects were felt in six settlements; the maximum intensity—MM IV-V—was assigned to reports from Allora. The few felt reports belie the size of the felt area of 1500 km^2, in which many of the townships and farms today had not been settled in 1875. An approximate magnitude—ML(I) = 3.8—was calculated from the radius of perceptibility of the MM III isoseismal.

The epicentre shown on the map was estimated from the felt reports.

ISOSEISMAL MAP OF THE WARWICK EARTHQUAKE, QUEENSLAND, 24 NOVEMBER 1875



0 20 km

DATE : 24 NOVEMBER 1875
TIME : 11:00 UT
MAGNITUDE : 3.8 ML (I)
EPICENTRE : 28.1°S 152.0°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

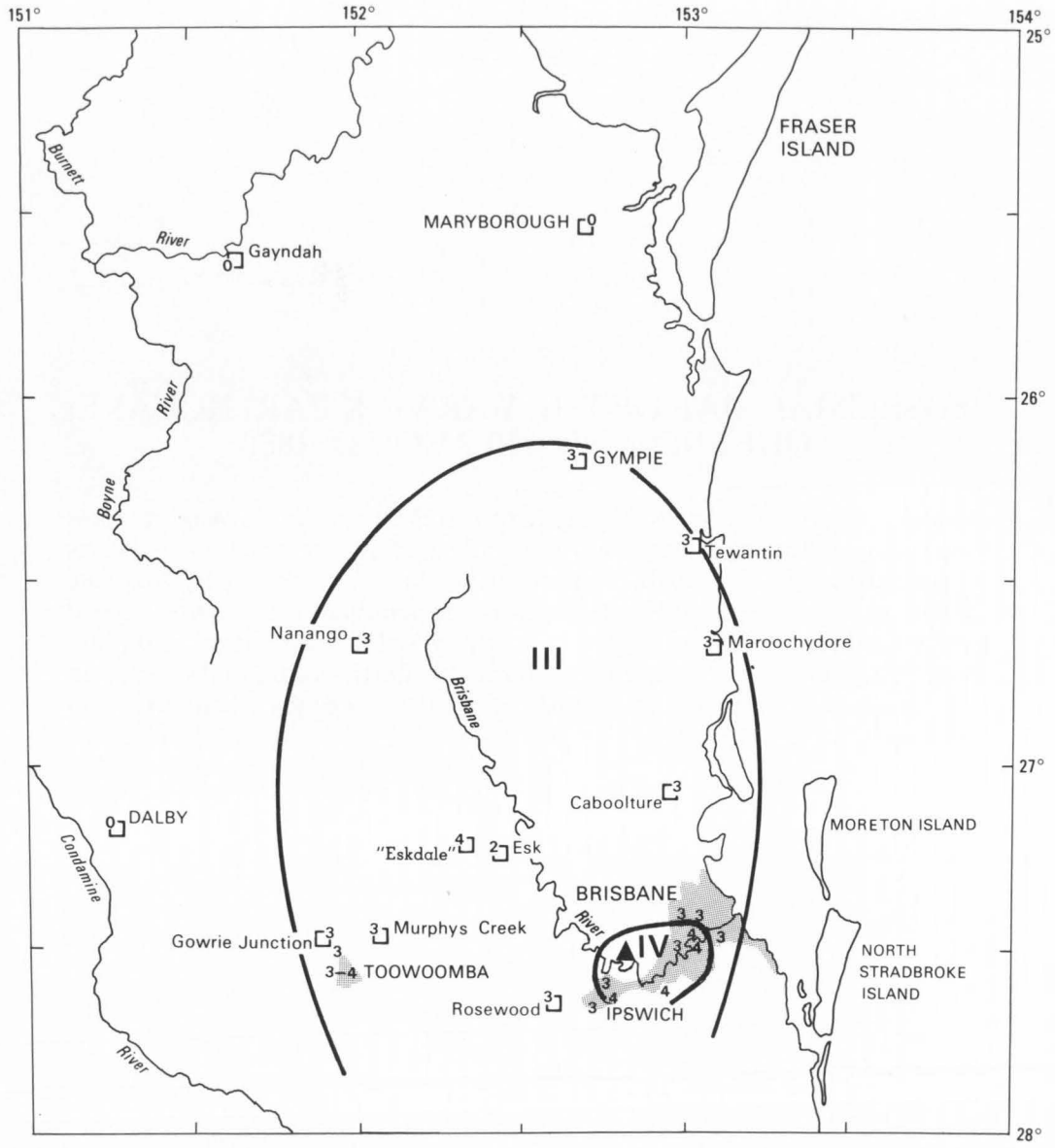
24/H56-2/1

ISOSEISMAL MAP OF THE IPSWICH EARTHQUAKE, QUEENSLAND—26 FEBRUARY 1877

At 21:45 hours on 26 February 1877 UT (about 7:45 a.m. on 27 February, local time), much of southeastern Queensland around Brisbane, and up to 150 km west and north of the city, experienced the effects of an earthquake. Reports from the *Ipswich Observer and West Moreton Advocate*, *Brisbane Courier*, *Brisbane Telegraph*, *The Week*, *Gympie Times and Mary River Mining Gazette*, *Toowoomba Chronicle and Darling Downs Adviser*, and *Stanthorpe Border Post and Stannum Miner* indicated that the effects were felt in 18 towns and farms, and that a maximum intensity of MM IV was assigned to the Ipswich area. In addition, Brisbane and Toowoomba were assigned intensities of MM III–IV. The extent of the felt area was about 17 500 km^2. A magnitude of ML(I) = 4.5 was calculated from the radius of the MM III isoseismal.

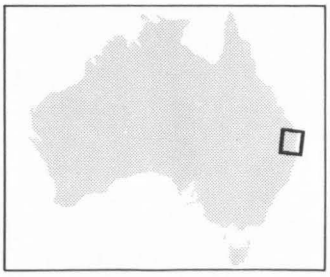
The epicentre on the map was estimated from the felt reports.

ISOSEISMAL MAP OF THE IPSWICH EARTHQUAKE, QUEENSLAND, 26 FEBRUARY 1877



DATE : 26 FEBRUARY 1877
TIME : 21:45 UT
MAGNITUDE : 4.5 ML (I)
EPICENTRE : 27.5°S 152.8°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

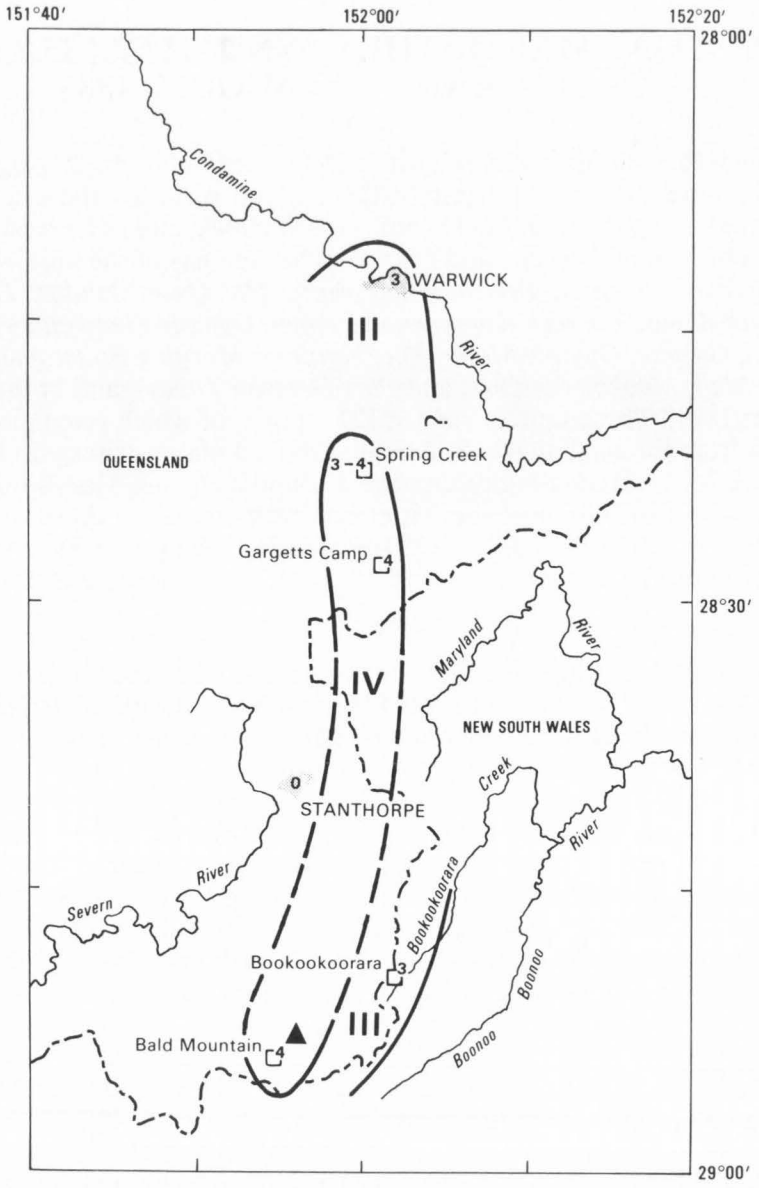


24/G56/10

ISOSEISMAL MAP OF THE WARWICK EARTHQUAKE, QUEENSLAND—10 AUGUST 1880

At about 19:00 hours on 10 August 1880 UT (5:00 a.m. on 11 August, local time) many settlements between Warwick and Stanthorpe experienced the effects of an earthquake. Newspaper reports from the *Warwick Argus*, *Brisbane Telegraph*, *The Week*, and *The Queensland Agriculturist and Family Journal* indicated that the area of highest intensity, MM IV, was centred near Bald Mountain. The felt zone was elongated roughly north-south, and covered an area of about 800 km^2. A magnitude of ML(I) = 3.6 was calculated from the isoseismal data.

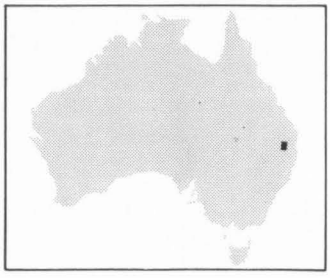
ISOSEISMAL MAP OF THE WARWICK EARTHQUAKE, QUEENSLAND, 10 AUGUST 1880



0 20 km

DATE : 10 AUGUST 1880
TIME : 19:00 UT
MAGNITUDE : 3.6 ML (I)
EPICENTRE : 28.9°S 151.9°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H56-2/2

ISOSEISMAL MAP OF THE GAYNDAH EARTHQUAKE, QUEENSLAND—28 AUGUST 1883

At about 16:55 hours on 28 August 1883 UT (2:55 a.m. on 29 August, local time) a large area in southeastern Queensland recorded the effects of an earthquake. Reports from Rockhampton to Warwick, and as far west as Roma, were published in most city and provincial newspapers of the time—including the *Brisbane Courier*, *Brisbane Telegraph*, *The Queenslander*, *The Week*, *Warwick Argus*, *Warwick Examiner and Times*, *Gympie Times and Mary River Mining Gazette*, *Gympie Miner*, *Rockhampton Morning Bulletin and Mount Perry Mail*, *Mackay Mercury*, and *Port Denison Times*—and in the book by Walker(1890). These sources yielded 127 reports, of which seven disclosed no effects from the earthquake. Buildings sustained major damage in Gayndah, assigned MM VII, and minor damage in Bundaberg and Maryborough. The nature and distribution of the felt effects were similar to those of the well-known Gayndah earthquake of 1935 (Bryan & Whitehouse, 1938). On this basis, the epicentre is assumed to be at 25.5°S, 151.7°E—the same as for the 1935 event.

The area experiencing the effects of this earthquake covered about 140 000 km^2. Based on the radius of the MM III isoseismal, the calculated magnitude ML(I) is about 5.9. One severe aftershock at about 4:20 a.m. on the same morning was widely felt (see over the page).

This earthquake was of great interest at the time, provoking attempts to define some causal relationships with the great Krakatoa volcanic eruption of 26 August 1883, to which many contemporary reports linked it. Such a premise is entirely false because there are no geological grounds or time relationships to sustain such an idea. Thus, this Gayndah earthquake was a singular local earthquake as significant as its later counterpart in 1935.

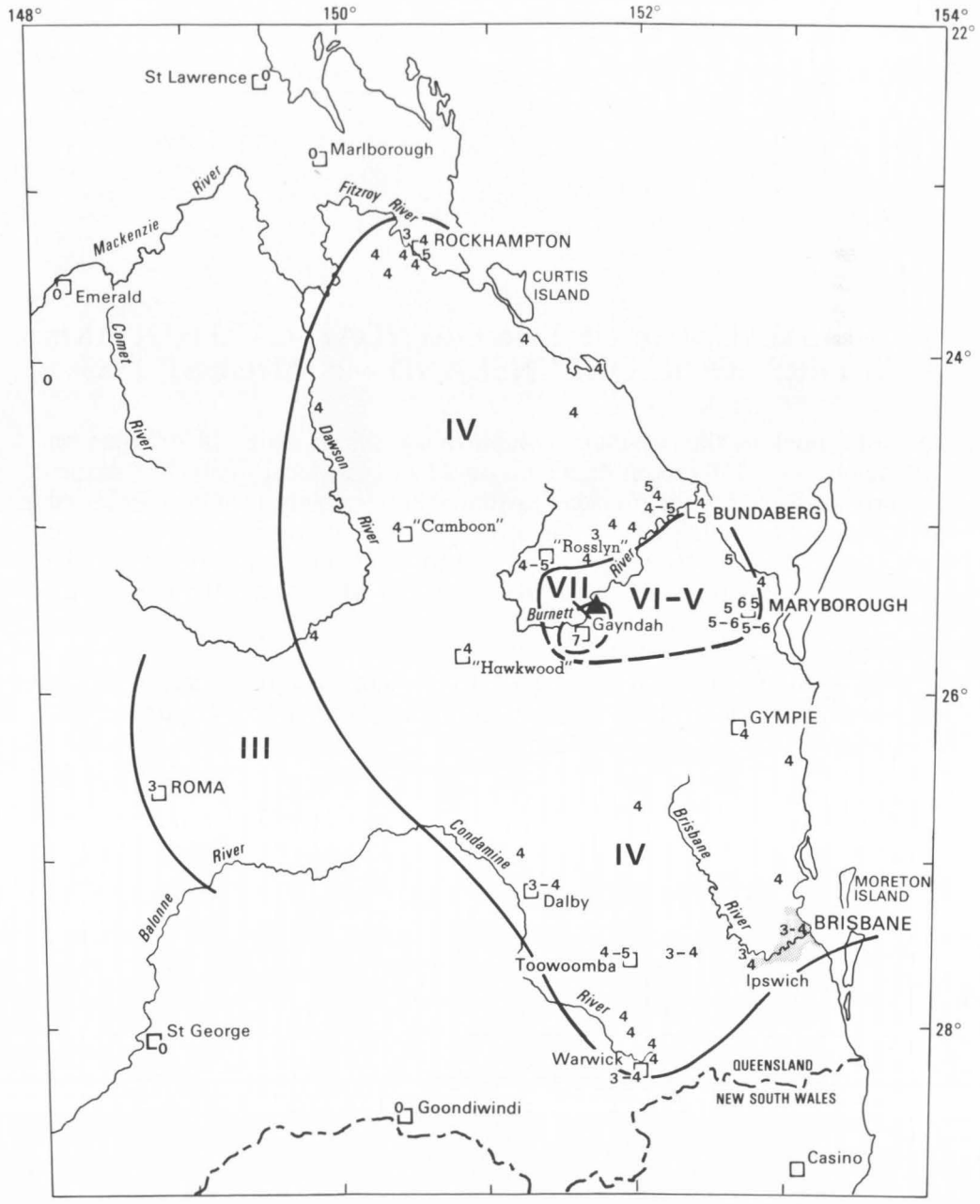
References

BRYAN, W. H., & WHITEHOUSE, F. W., 1938—The Gayndah earthquake of 1935. *Proceedings of the Royal Society of Queensland*, 49(10), 106-119.

RYNN, J. M. W., in press a—The 1883 Gayndah earthquake and its 'non-relationship' to the Krakatoa volcanic eruption. *Papers of the Department of Geology, University of Queensland.*

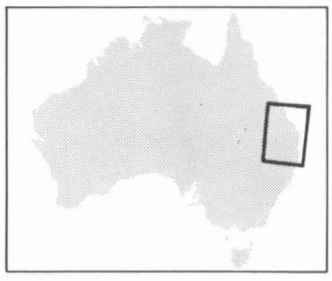
WALKER, J. Y., 1890—THE HISTORY OF BUNDABERG. *Gordon and Gotch, Sydney.*

ISOSEISMAL MAP OF THE GAYNDAH EARTHQUAKE, QUEENSLAND, 28 AUGUST 1883



DATE : 28 AUGUST 1883
TIME : 16:55 UT
MAGNITUDE : 5.9 ML (I)
EPICENTRE : 25.5°S 151.7°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/Q/9

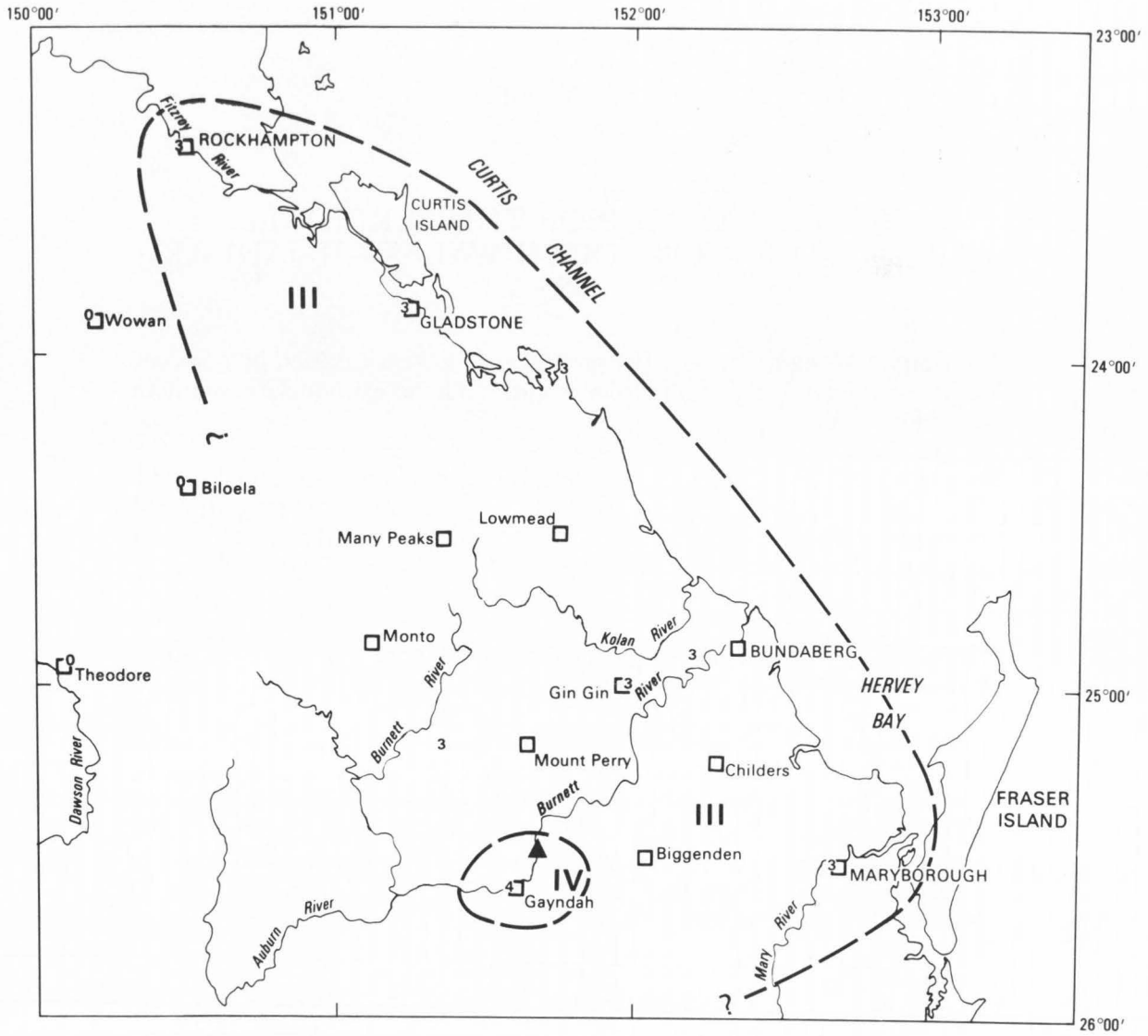
ISOSEISMAL MAP OF THE GAYNDAH EARTHQUAKE AFTERSHOCK, QUEENSLAND—28 AUGUST 1883

An aftershock of the previous earthquake was felt at about 18:20 hours on 28 August 1883 UT (about 4:20 a.m. on 29 August, local time). Newspaper reports (as listed for the previous earthquake) from eight localities indicated that the event was felt over an area of at least 20 000 km^2. The maximum intensity, MM IV, was again reported from Gayndah. An estimate of the magnitude is ML(I) = 5.2 based on the radius of the MM III isoseismal.

Reference

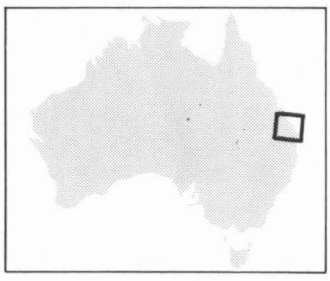
RYNN, J. M. W., in press a—The 1883 Gayndah earthquake and its 'non-relationship' to the Krakatoa volcanic eruption. *Papers of the Department of Geology, University of Queensland.*

ISOSEISMAL MAP OF THE GAYNDAH AFTERSHOCK, QUEENSLAND, 28 AUGUST 1883



DATE : 28 AUGUST 1883
TIME : 18: 20 UT
MAGNITUDE : 5.2 ML(I)
EPICENTRE : 25.5°S 151.7°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/Q/10

ISOSEISMAL MAP OF THE BERRIDALE EARTHQUAKE, NEW SOUTH WALES—21 JANUARY 1885

The *Cooma Monaro Express, Illawarra Mercury, Yass Courier*, and *Sydney Morning Herald* newspapers all carried stories about this earthquake in southern New South Wales.

The earthquake did no damage, was felt over a small area—of about 21 000 km^2—and was of short duration, commensurate with the low magnitude of the ML(I) = 4.6 derived from the radius of perceptibility. The location was near that of the much larger earthquake of 18 May 1959 (Everingham & others, 1982).

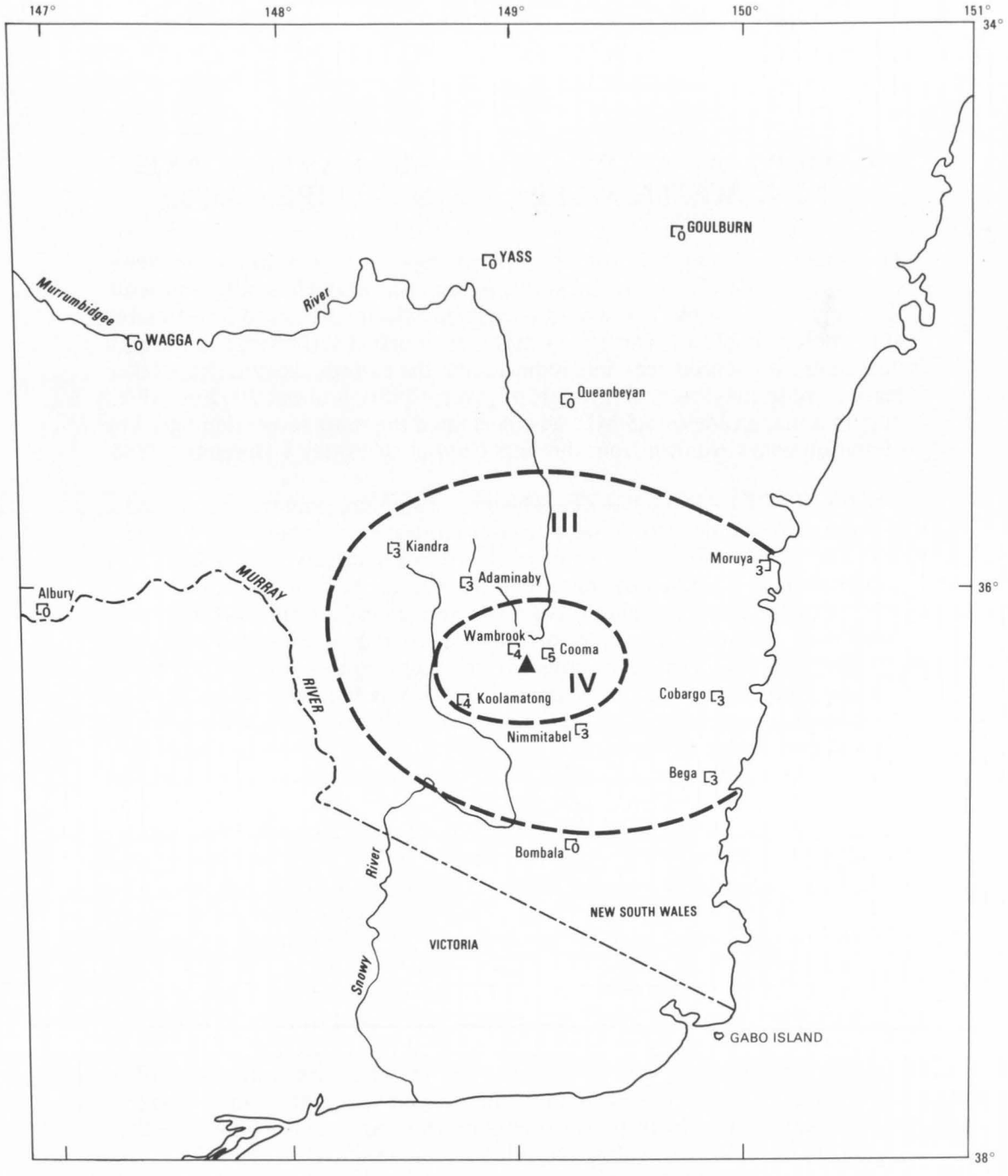
The following excerpt appeared in the *Cooma Monaro Express* of Saturday 24 January 1885:

> *'SHOCK EARTHQUAKE*—On Wednesday morning between 11 o'clock and noon, a sharp shock of an earthquake was felt in Cooma, accompanied by a rumbling noise which lasted some 10 or 15 seconds at least. In the hotels and chemists shops, the bottles on the shelves shook, several of them being knocked off their perches. The shock travelled in an easterly and westerly direction and we learn that it was simultaneously felt at Wambrook, Adaminaby and Kiandra.'

Reference

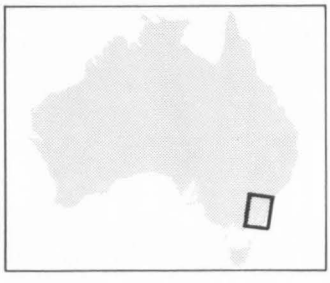
EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

ISOSEISMAL MAP OF THE BERRIDALE EARTHQUAKE, NEW SOUTH WALES, 21 JANUARY 1885



DATE : 21 January 1885
TIME : 01:10 UT
MAGNITUDE : 4.6 ML (I)
EPICENTRE : 36.3°S 149.1°E
DEPTH : < 25 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



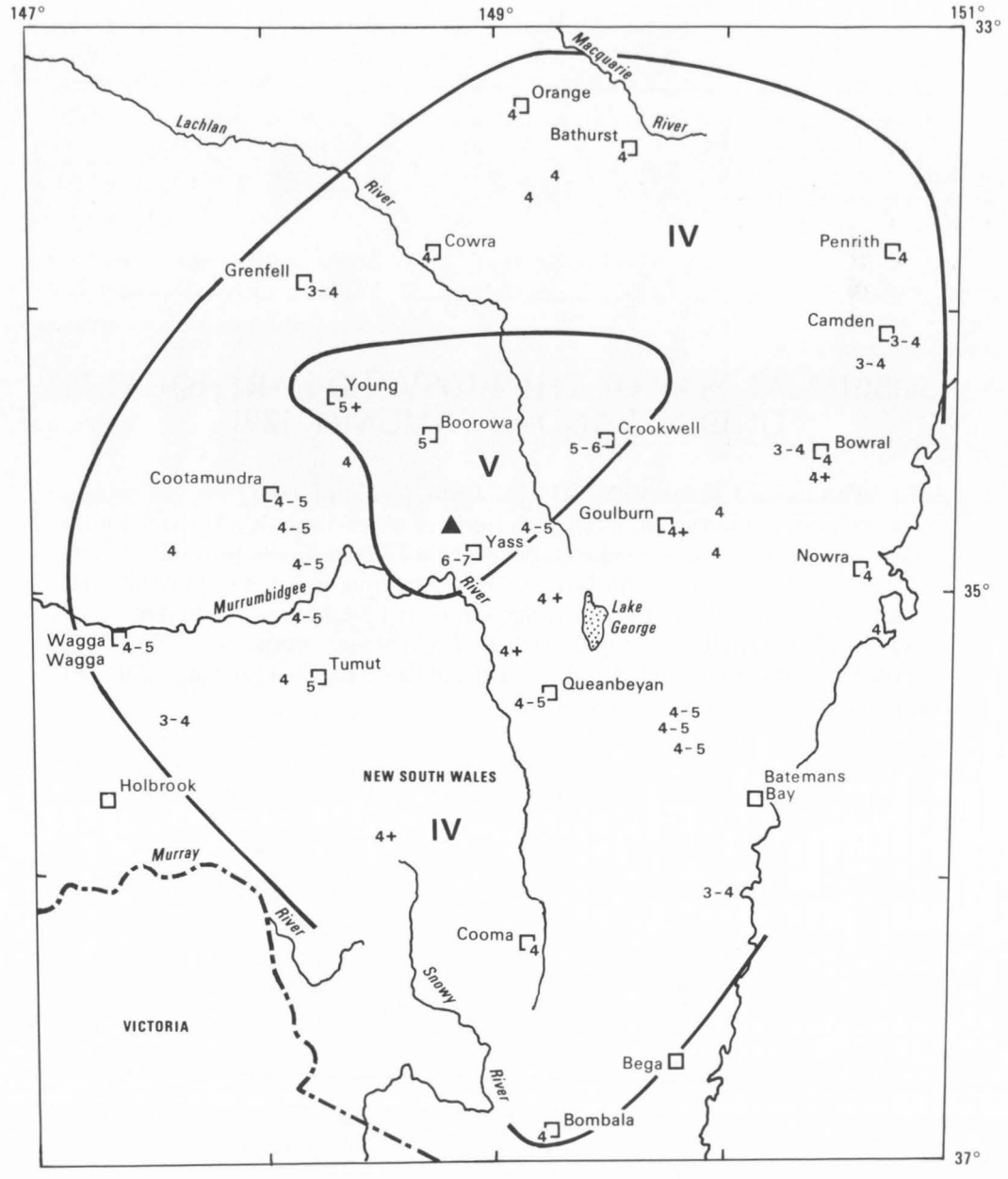
24/N/17

ISOSEISMAL MAP OF THE YASS EARTHQUAKE, NEW SOUTH WALES—29 NOVEMBER 1886

This map was compiled from newspaper reports in the *Boorowa News, Goulburn Herald, The Daily Telegraph, Sydney Morning Herald, Queanbeyan Age*, and *Yass Courier.* These reports enabled MM intensities to be estimated at more than 40 places. The epicentre is very poorly determined, but the high intensities experienced near Yass indicate that the earthquake must have taken place close to that town. The radius of perceptibility is about 200 km, which implies a magnitude of 5.5 ML. Yass sustained the most severe damage. The quotation below is taken from the *Yass Courier* of Friday 3 December 1886.

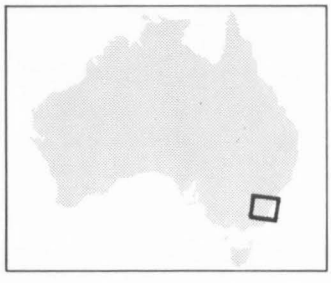
'SHOCKS OF EARTHQUAKE—The residents of Yass, and we can add those of the surrounding district, were aroused from their slumbers shortly before three o'clock on Tuesday morning last, from the effects of two shocks of earthquake. It is stated by those who were up at the time that there was a shock of earthquake at about half-past two o'clock, but this was not heard by many; but at a few minutes before three o'clock, there were two shocks of earthquake following each other in rapid succession, of which there cannot be any doubt. A few seconds before the shocks were felt, there was an unusual rumbling noise heard, then came the shocks one after the other, the two lasting about twelve seconds, during which short interval, houses in the town shook to their foundations, and were for the time entirely at the mercy of the wave. By the effect of the phenomena the walls in some of the houses in Cooma Street were cracked, ceilings fell down, parcels were displaced from shelves and pictures thrown from walls. The shock travelled from west to east, and the report of it lasted for nearly two minutes. Many of the residents were terror stricken. It was not until several minutes afterwards that they could realise that the shock was an earthquake. In the Mechanics Institute, the large lamps rattled, and the sound they made was similar to that of a peal of bells. Several houses in O'Connell Town have been more or less injured, and a wall in Mr James Buckland's house was cracked from floor to ceiling. Lower down Cooma Street the shock was felt more severely, the bricks in some of the chimneys of Mr Mote's Yass Hotel fell in, while the police barracks, and the quarters of Inspector Brennan, shook to such a degree that it was thought by Inspector Brennan (who was up at the time) that they were about to fall down. Two walls in Dr Thane's house were cracked from top to bottom, and the aperture in one of them is large enough to admit a man's hand, while the verandah of his house, which is formed of concrete was cracked in several places.'

ISOSEISMAL MAP OF THE YASS EARTHQUAKE, NEW SOUTH WALES, 29 NOVEMBER 1886



DATE : 29 NOVEMBER 1886
TIME : 17:00:00 UT
MAGNITUDE : 5.5 ML (I)
EPICENTRE : 34.75°S 148.8°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



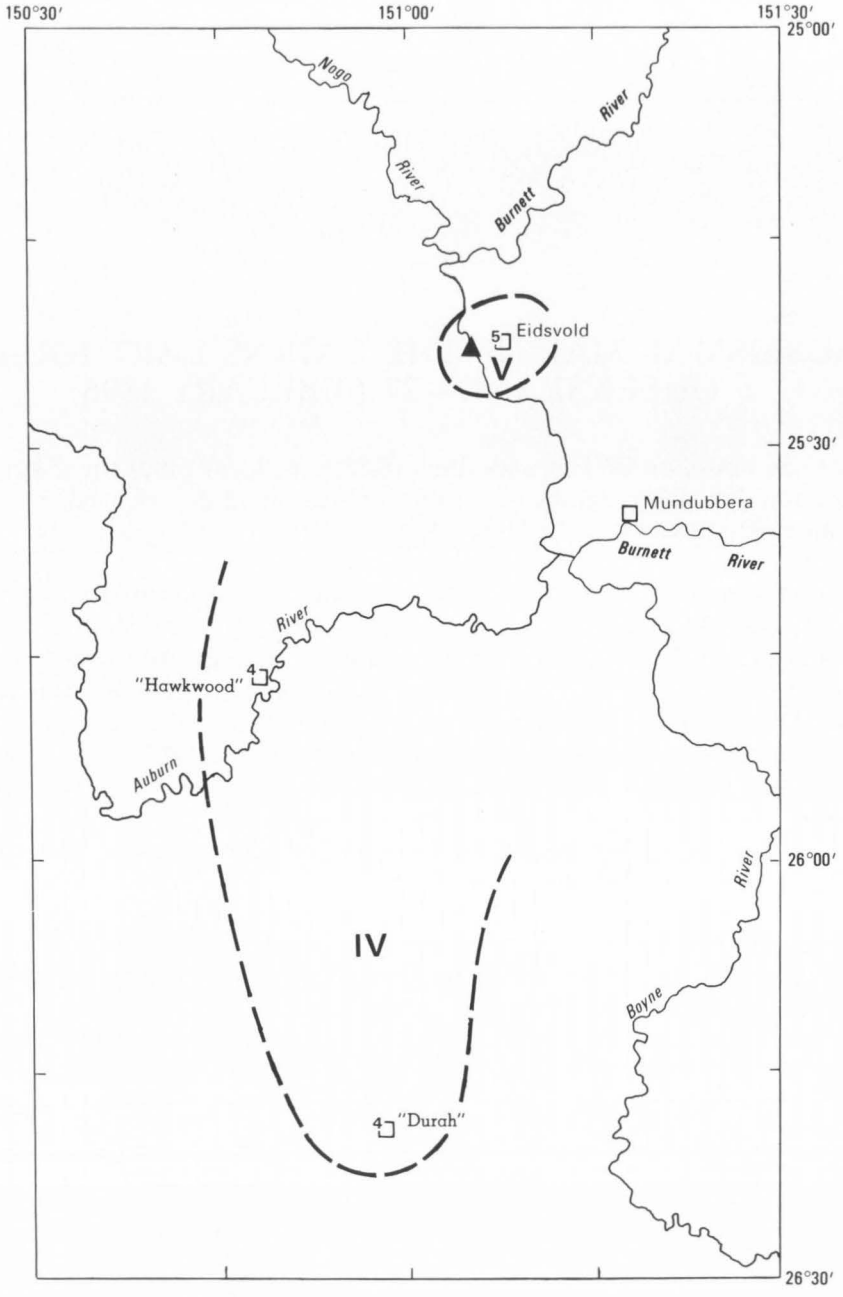
24/N/11

ISOSEISMAL MAP OF THE EIDSVOLD EARTHQUAKE, QUEENSLAND—5 JANUARY 1891

At 03:34 hours on 5 January 1891 UT (1:34 p.m. local time) the Eidsvold region, in central eastern Queensland, felt the effects of an earthquake. The maximum intensity, MM V, was assigned to reports from Eidsvold, where small objects were thrown from shelves and broken. This earthquake was the most intense in a series, which consisted of six events between 1:00 p.m. and 2:00 p.m. local time, experienced in a small region around Eidsvold (as reported in *The Week*, and the *Wide Bay and Burnett News*). The epicentre on the map was estimated from the evidence of the felt reports.

Although only three districts reported the event, the instances of damage indicate its importance. A magnitude of ML(I) = 4.0 has been estimated from the isoseismal data.

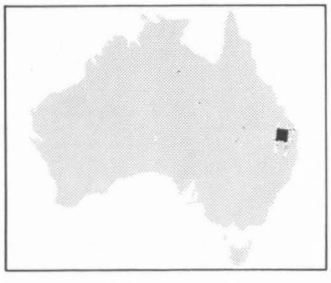
ISOSEISMAL MAP OF THE EIDSVOLD EARTHQUAKE, QUEENSLAND, 5 JANUARY 1891



0 20 km

DATE : 5 JANUARY 1891
TIME : 03:34 UT
MAGNITUDE : 4.0 ML (I)
EPICENTRE : 25.4°S 151.1°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/G56/11

ISOSEISMAL MAP OF THE CAIRNS EARTHQUAKE, QUEENSLAND—27 FEBRUARY 1896

At 10:58 hours on 27 February 1896 (8:58 p.m. local time) the Cairns and Atherton Tableland regions of northern Queensland experienced the effects of an earthquake.

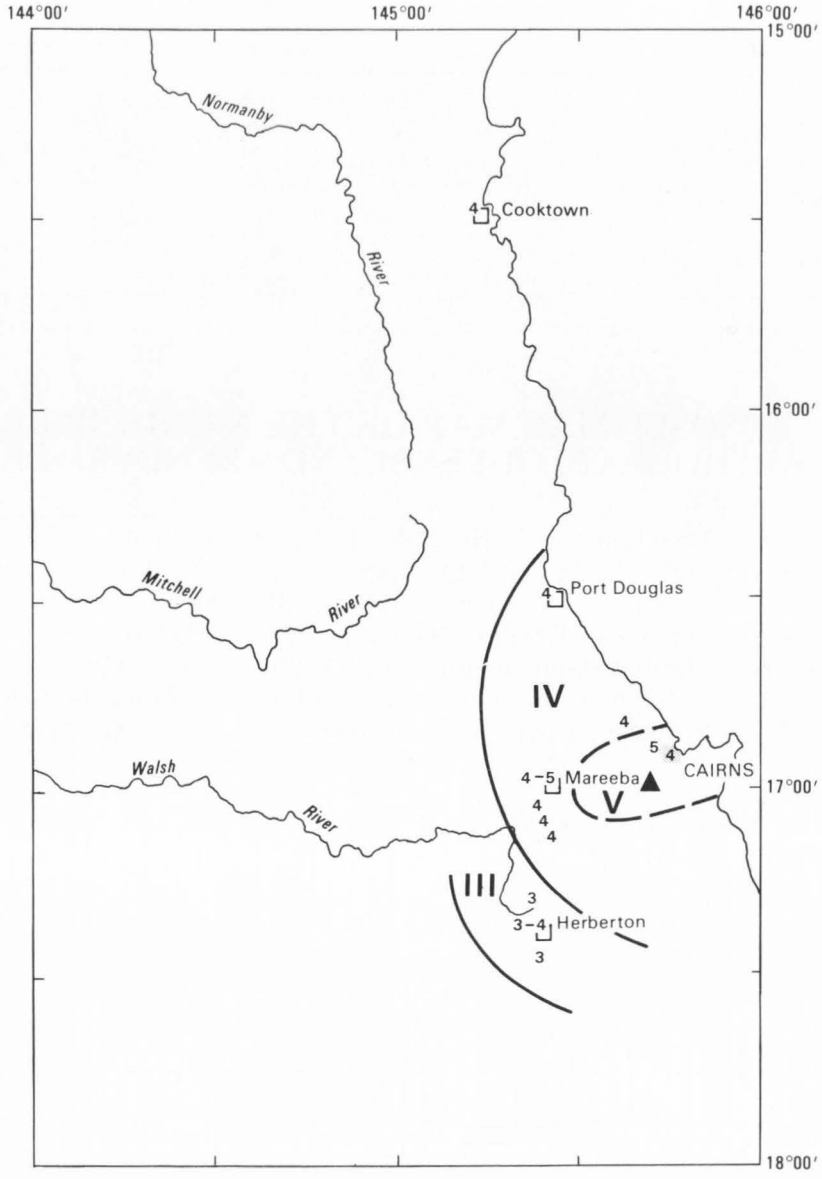
Reports from newspapers (*Cairns Argus, Townsville Northern Mining Register, Cairns Wild River Times*, and *The Queenslander*) and an historical account (Collinson, 1942, p. 143) were used to compile the map. An intensity of MM V was assigned to both Cairns, where cracks formed in a concrete road tunnel, and Mareeba, where small objects were thrown off shelves. An area of about 20 000 km^2 was affected. Based on the radius of the MM III isoseismal, a magnitude of ML(I) = 4.3 was calculated.

The newspaper reports also stated that an aftershock occurred at about 9:00 p.m., closely following the main shock.

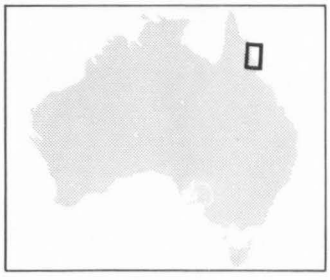
Reference

COLLINSON, J. W., 1942—MORE ABOUT CAIRNS—THE SECOND DECADE. *W.R. Smith & Patterson, Brisbane.*

ISOSEISMAL MAP OF THE CAIRNS EARTHQUAKE, QUEENSLAND, 27 FEBRUARY 1896



0 60 km



DATE : 27 FEBRUARY 1896
TIME : 10:58 UT
MAGNITUDE : 4.3 ML (I)
EPICENTRE : 17.0°S 145.7°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/E55/4

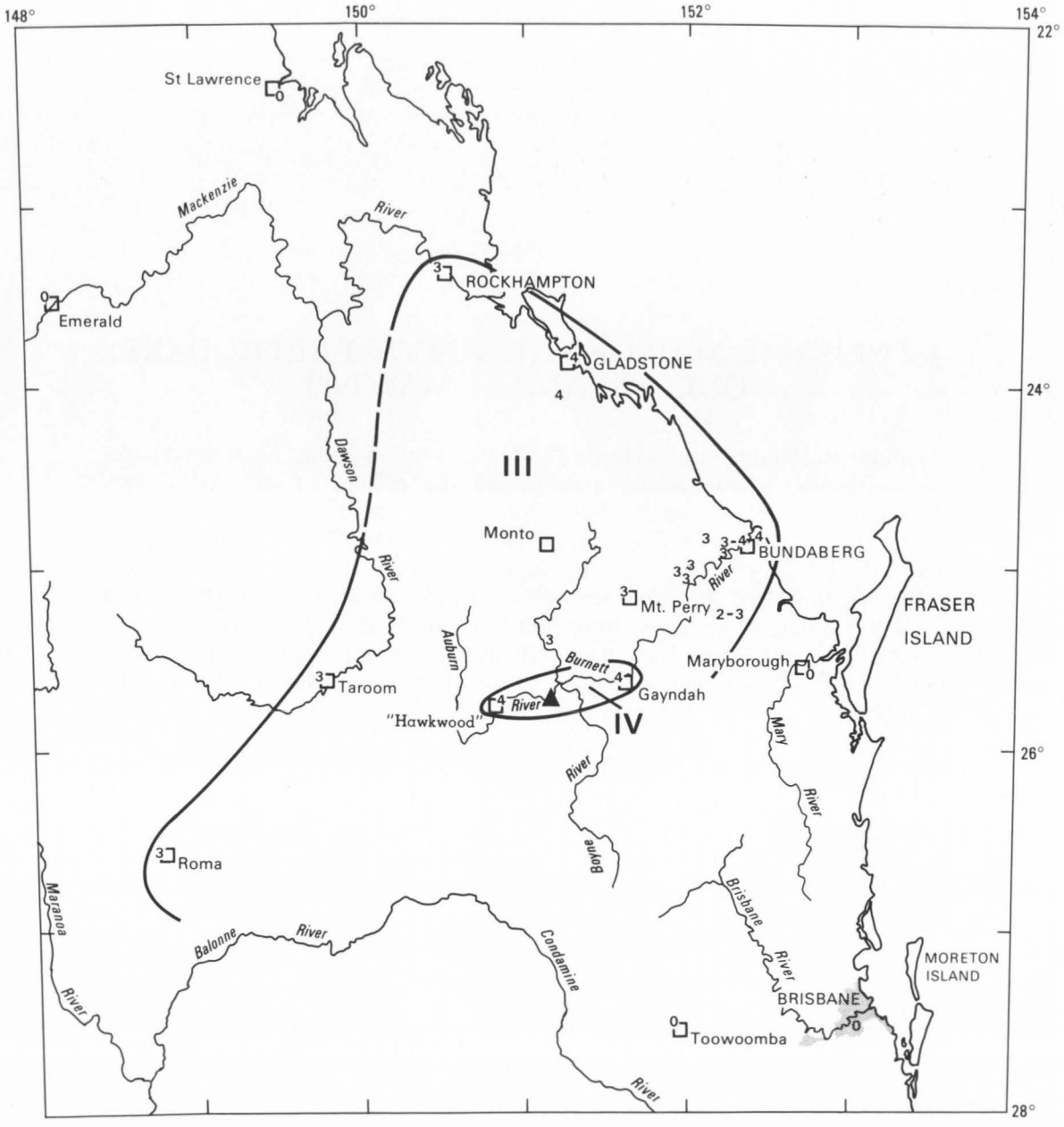
ISOSEISMAL MAP OF THE MUNDUBBERA EARTHQUAKE, QUEENSLAND—24 NOVEMBER 1910

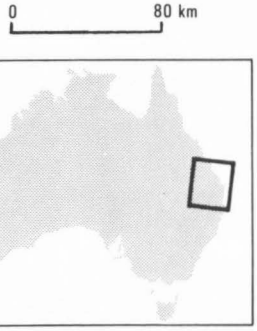
At about 23:00 hours on 24 November UT (about 9:00 a.m. on 25 November, local time) the central eastern region of Queensland was shaken by an earthquake. Reports of felt effects in the *Bundaberg Mail*, private correspondence, and Turner's (1955) book allowed MM intensity values to be assigned. The maximum intensity, MM IV, was felt in the Gayndah area. The effects were felt over an area of about 30 000 km^2. From the radius of the MM III isoseismal, a magnitude of ML(I) = 5.2 was calculated.

Reference

TURNER, H., 1955—RURAL LIFE IN SUNNY QUEENSLAND. *Glovers Printing Works, Bundaberg.*

ISOSEISMAL MAP OF THE MUNDUBBERA EARTHQUAKE, QUEENSLAND, 24 NOVEMBER 1910





DATE : 24 NOVEMBER 1910
TIME : 23:00 UT
MAGNITUDE : 5.2 ML (I)
EPICENTRE : 25.7° S 151.2° E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
o EARTHQUAKE NOT FELT

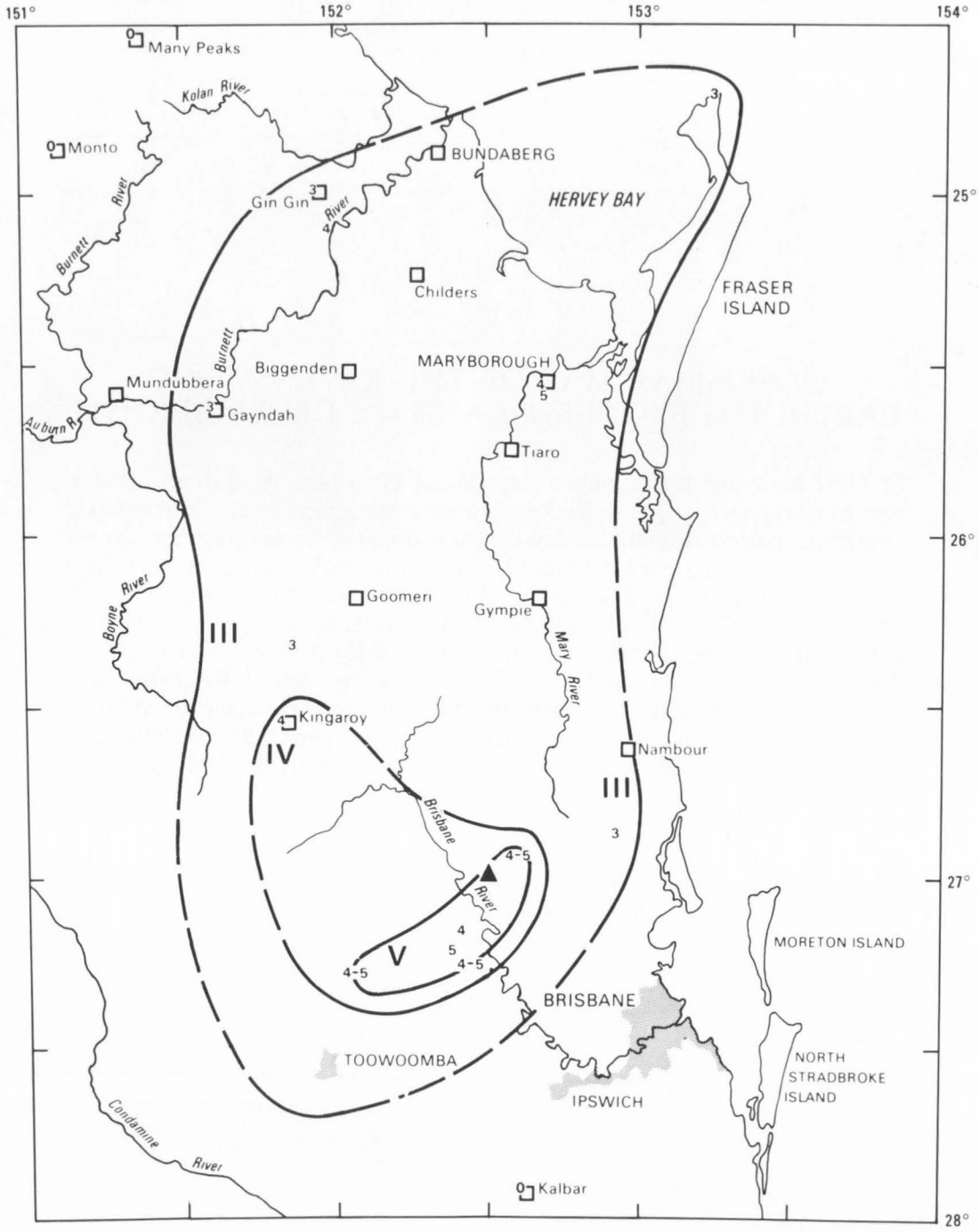
24/Q/11

ISOSEISMAL MAP OF THE KILCOY EARTHQUAKE, QUEENSLAND—1 MAY 1913

At about 16:20 hours on 1 May 1913 UT (2:20 a.m. on 2 May, local time) parts of southeastern Queensland experienced the effects of an earthquake. Newspaper reports in the *Brisbane Courier, The Daily Standard and Daily Mail, The Queenslander, The Gympie Times and Mary River Mining Gazette, Bundaberg Mail, and Kingaroy Herald*, and subsequent comments from local residents, indicated that the most strongly affected area was in the central Brisbane valley, where a maximum intensity of MM V was assigned to the Kilcoy, Esk, and Crows Nest areas. Of interest was a report of a permanent creek in the Crows Nest area going dry immediately after the earthquake. The affected area covered about 50 000 km^2.

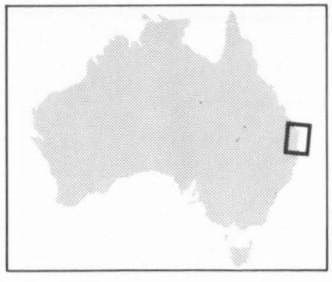
From the radius of the MM III isoseismal a magnitude of ML(I) = 4.8 was calculated.

ISOSEISMAL MAP OF THE KILCOY EARTHQUAKE, QUEENSLAND, 1 MAY 1913



DATE : 1 MAY 1913
TIME : 16:20 UT
MAGNITUDE : 4.8 ML (I) 4.0 ML (RIV)
EPICENTRE : 27.0° S 152.5° E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/G56/12

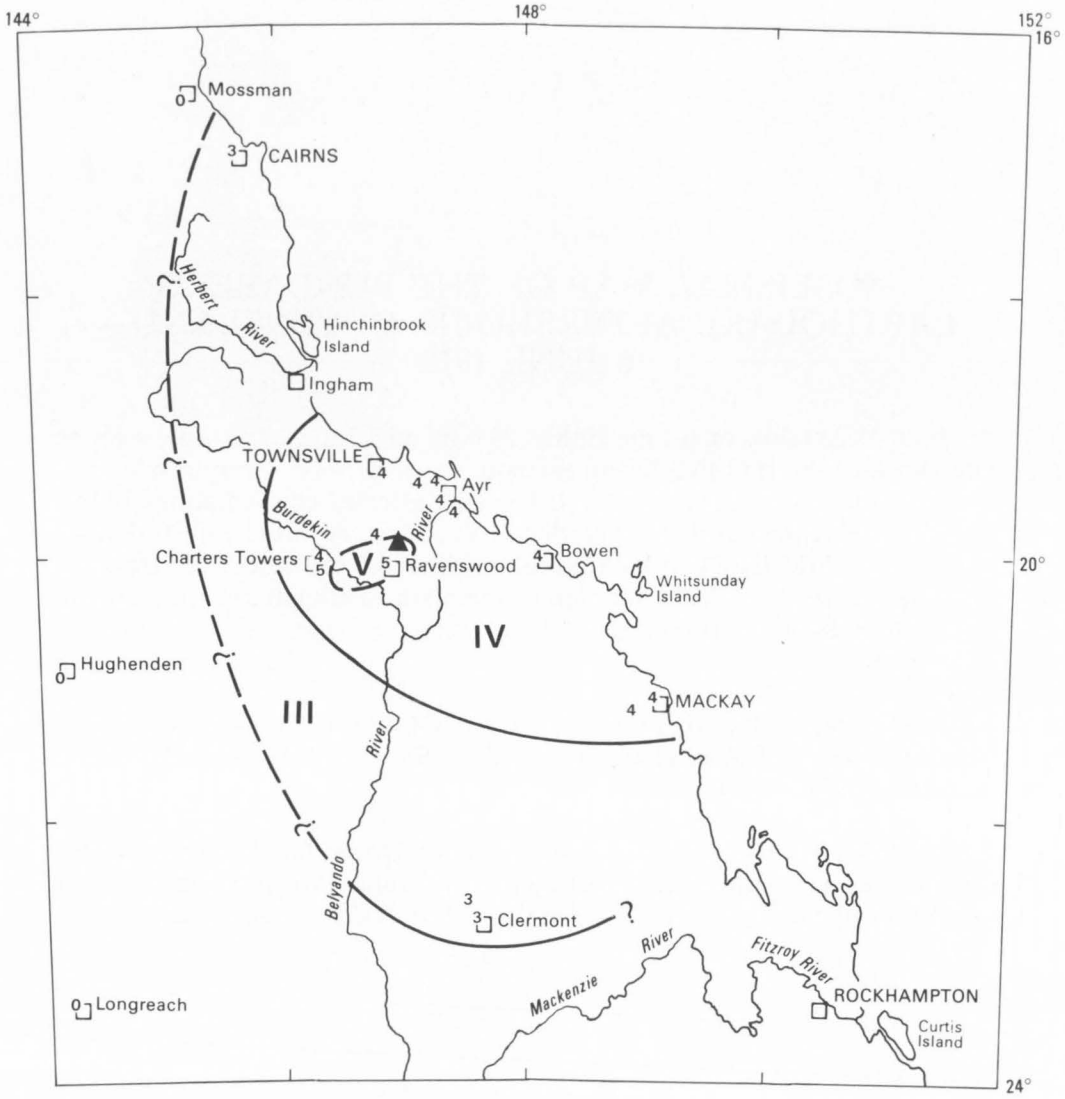
ISOSEISMAL MAP OF THE RAVENSWOOD EARTHQUAKE, QUEENSLAND—18 DECEMBER 1913

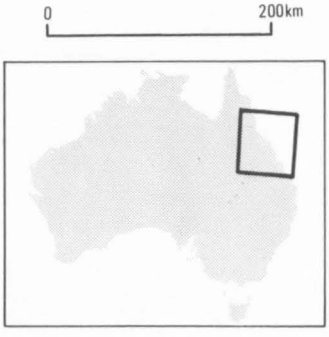
At 13:54 hours on 18 December 1913 (about 11:54 p.m. local time), a large part of northeastern Queensland experienced the effects of this earthquake. Newspaper reports from the *Townsville Daily Bulletin, Evening Star and North Queensland Register, Mackay Daily Mercury, Bowen Independent*, and *Brisbane Courier*, and personal experiences reported in the *Home Hill Observer* newspaper in 1977, indicated that isoseismal effects extended over an area of about 110 000 km^2. A maximum intensity of MM V was assigned to the Ravenswood area. This earthquake, which was recorded at Riverview, was located by Gutenberg & Richter (1954), who determined the epicentre at 20°S, 147°E, and assigned a magnitude (MB) of between 5.3 and 5.9 (their 'd' value). Based on the radius of the MM III isoseismal, a magnitude of ML(I) = 5.7 was calculated.

Reference

GUTENBERG, B., & RICHTER, C. F., 1954—SEISMICITY OF THE EARTH. *Princeton University Press, New Jersey.*

ISOSEISMAL MAP OF THE RAVENSWOOD EARTHQUAKE, QUEENSLAND, 18 DECEMBER 1913





DATE : 18 DECEMBER 1913
TIME : 13:54 UT
MAGNITUDE : 5.7 ML (I), 4.7 MS 5.8 MB
EPICENTRE : 20.0° S 147.0° E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/Q/12

ISOSEISMAL MAP OF THE BUNDABERG EARTHQUAKE AFTERSHOCK, QUEENSLAND—6 JUNE 1918

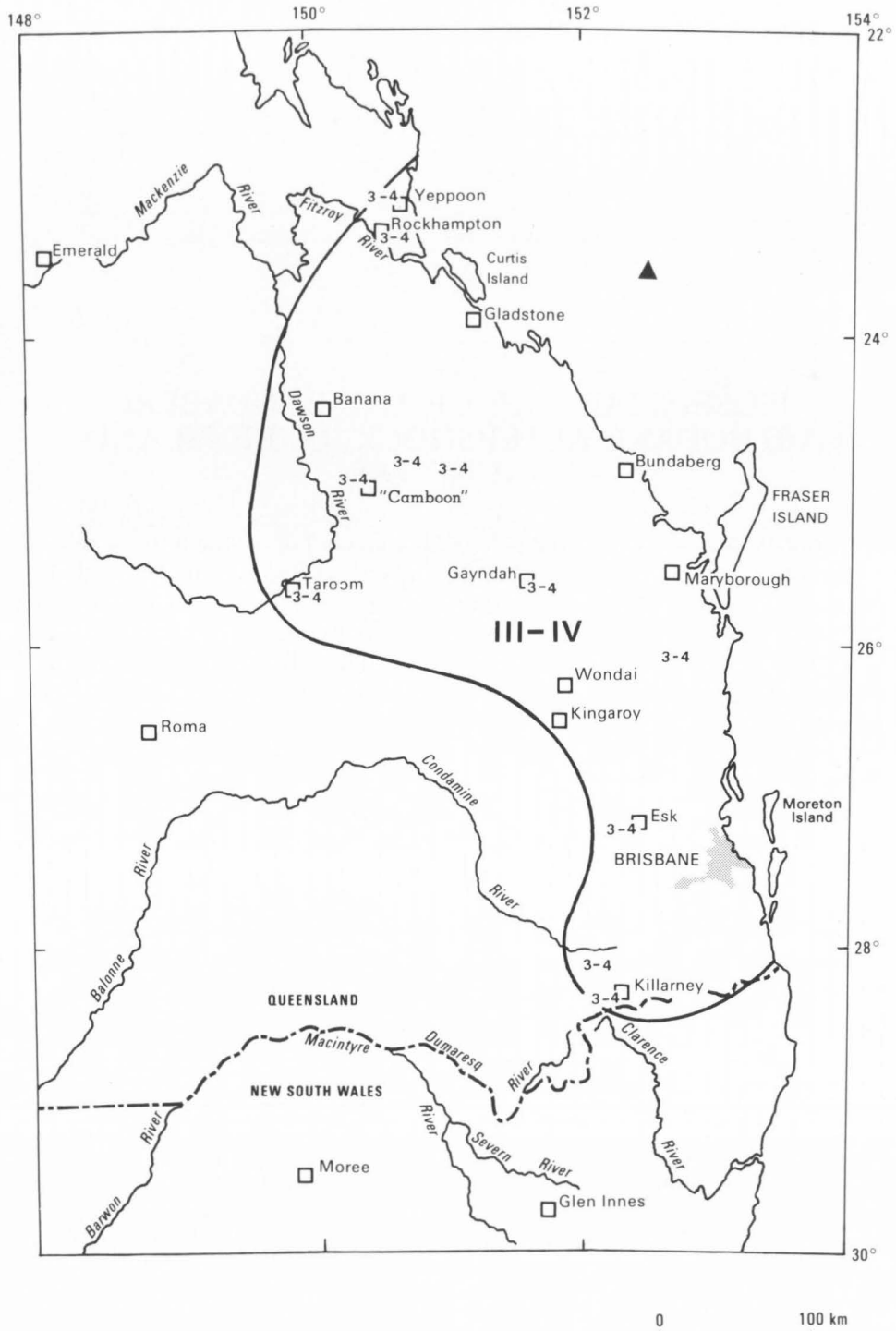
At about 18:23 hours on 6 June 1918 (4:23 a.m. on 7 June, local time) a severe aftershock of the 1918 Bundaberg earthquake was reported from residents in the area who experienced its effects. The area affected covered about 70 000 km^2 from Rockhampton to Warwick. All centres reported effects having intensities of MM III–IV. A magnitude ML(I) = 5.5 was calculated from the isoseismal data. The isoseismal map of the main earthquake is illustrated in Everingham & others (1982).

References

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

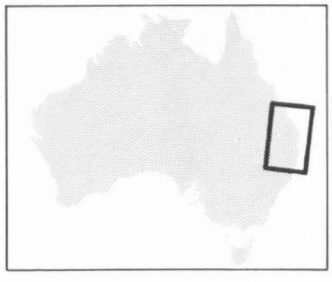
RYNN, J. M. W., in press b—A reappraisal of Queensland's largest known earthquake—The 'Queensland' earthquake of 6 June, 1918 (magnitude about 6). *Papers of the Department of Geology, University of Queensland.*

ISOSEISMAL MAP OF THE BUNDABERG AFTERSHOCK, QUEENSLAND, 6 JUNE 1918



DATE : 6 JUNE 1918
TIME : 19:20 UT
MAGNITUDE : 5.7 ML (I)
EPICENTRE : 23.5°S 152.5°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/Q/14

ISOSEISMAL MAP OF THE BUNDABERG EARTHQUAKE AFTERSHOCK, QUEENSLAND—6 JUNE 1918

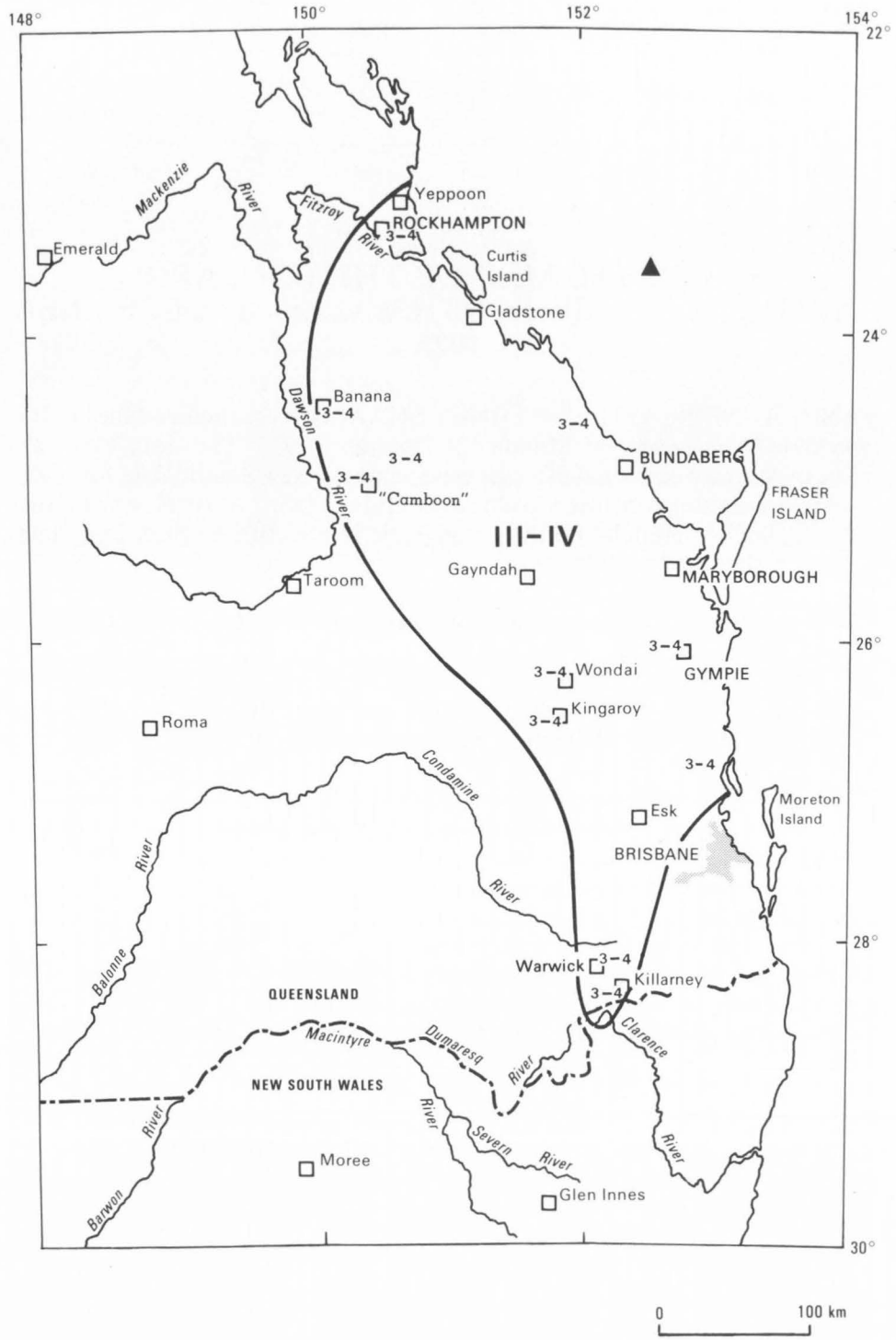
At about 19:20 hours on 6 June 1918 (5:20 a.m. on 7 June, local time) another severe aftershock associated with the Bundaberg earthquake was reported. This was considered to be the strongest aftershock of the sequence. An area of about 100 000 km^2 was affected, and all felt reports were assigned values of MM III to IV. A magnitude ML (I) = 5.7 was calculated from the isoseismal data. The isoseismal map of the main earthquake is illustrated in Everingham & others (1982).

References

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

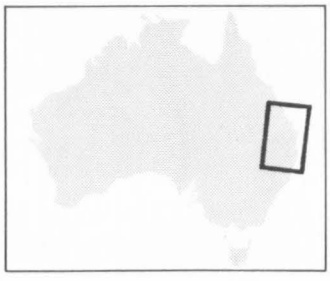
RYNN, J. M. W., in press b—A reappraisal of Queensland's largest known earthquake—The 'Queensland' earthquake of 6 June, 1918 (magnitude about 6). *Papers of the Department of Geology, University of Queensland.*

ISOSEISMAL MAP OF THE BUNDABERG AFTERSHOCK, QUEENSLAND, 6 JUNE 1918



DATE : 6 JUNE 1918
TIME : 18:23 UT
MAGNITUDE : 5.5 ML (I)
EPICENTRE : 23.5°S 152.5°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/Q/13

ISOSEISMAL MAP OF THE BOOLAROO EARTHQUAKE, NEW SOUTH WALES—18 DECEMBER 1925

'PANIC AT NEWCASTLE', 'SYDNEY SHAKEN' were the headlines in the *Northern Daily Leader* of Monday 21 December 1925. The story went on:

> 'the most severe earthquake tremor experienced in New South Wales for many years occurred just before 9 o'clock on Friday night . . . At Newcastle two severe shocks were felt and there was panic in a picture theatre. In Sydney a sharp shock was felt.'

There follows the report of an interview with Dr Pigot of Riverview Observatory:

> '. . . he considered that there was strong evidence to support the conclusion that the origin of the disturbance was a spot approximately 80 miles NNE of Sydney on what is known to geologists as the continental shelf.'

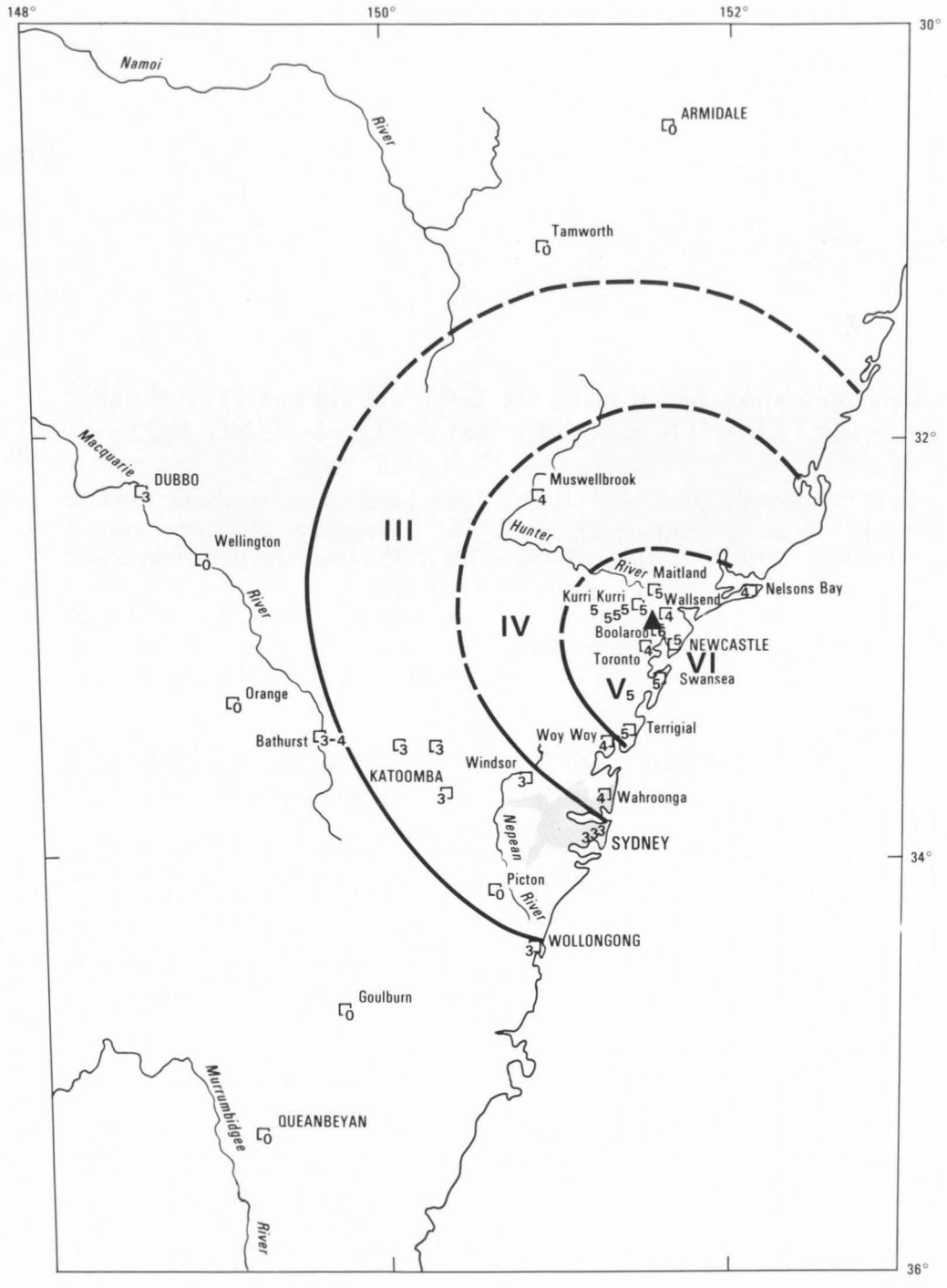
The earthquake was felt by a miner 600 feet below the surface at West Maitland:

> '. . . thought I was seeing things when the hauling engine jumped out of its bed and dropped back again as soon as the tremor ceased . . . The boom seemed to come up from under my feet . . .'

The isoseismal map was compiled from newspaper reports in the *Sydney Morning Herald, Northern Daily Leader, Lithgow Mercury, Queanbeyan Age*, and *Goulburn Herald*. Pigot's location of the epicentre is remarkably close to that in the isoseismal map, considering he had only a single station to work with.

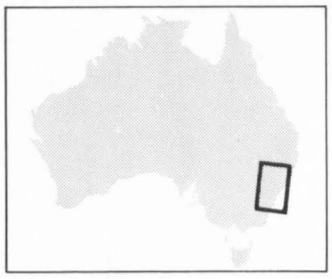
A magnitude of ML 5.0 was determined from the Mainka seismograms recorded at St. Ignatius College, Riverview, whilst that derived from the radius of perceptibility was ML(I) = 5.3.

ISOSEISMAL MAP OF THE BOOLAROO EARTHQUAKE, NEW SOUTH WALES, 18 DECEMBER 1925



DATE : 18 December 1925
TIME : 10:47:10 UT
MAGNITUDE : 5.0 ML (BMR), 5.3 ML (I)
EPICENTRE : 33.0°S 151.6°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/N/18

ISOSEISMAL MAP OF THE GAYNDAH EARTHQUAKE AFTERSHOCK, QUEENSLAND—1 JUNE 1935

At 12:12 hours on 1 June 1935 UT (10:12 p.m. local time) a strong earthquake was felt in the epicentral area of the 1935 Gayndah earthquake (Bryan & Whitehouse, 1938; Everingham & others, 1982). This event was one of the major aftershocks of the Gayndah earthquake sequence. The effects were felt over an area of about 11 000 km^2. A maximum intensity of MM V was assigned to Bymingo, where small objects such as lamps were thrown off shelves. A magnitude ML(I) = 4.3 was calculated from the isoseismal data.

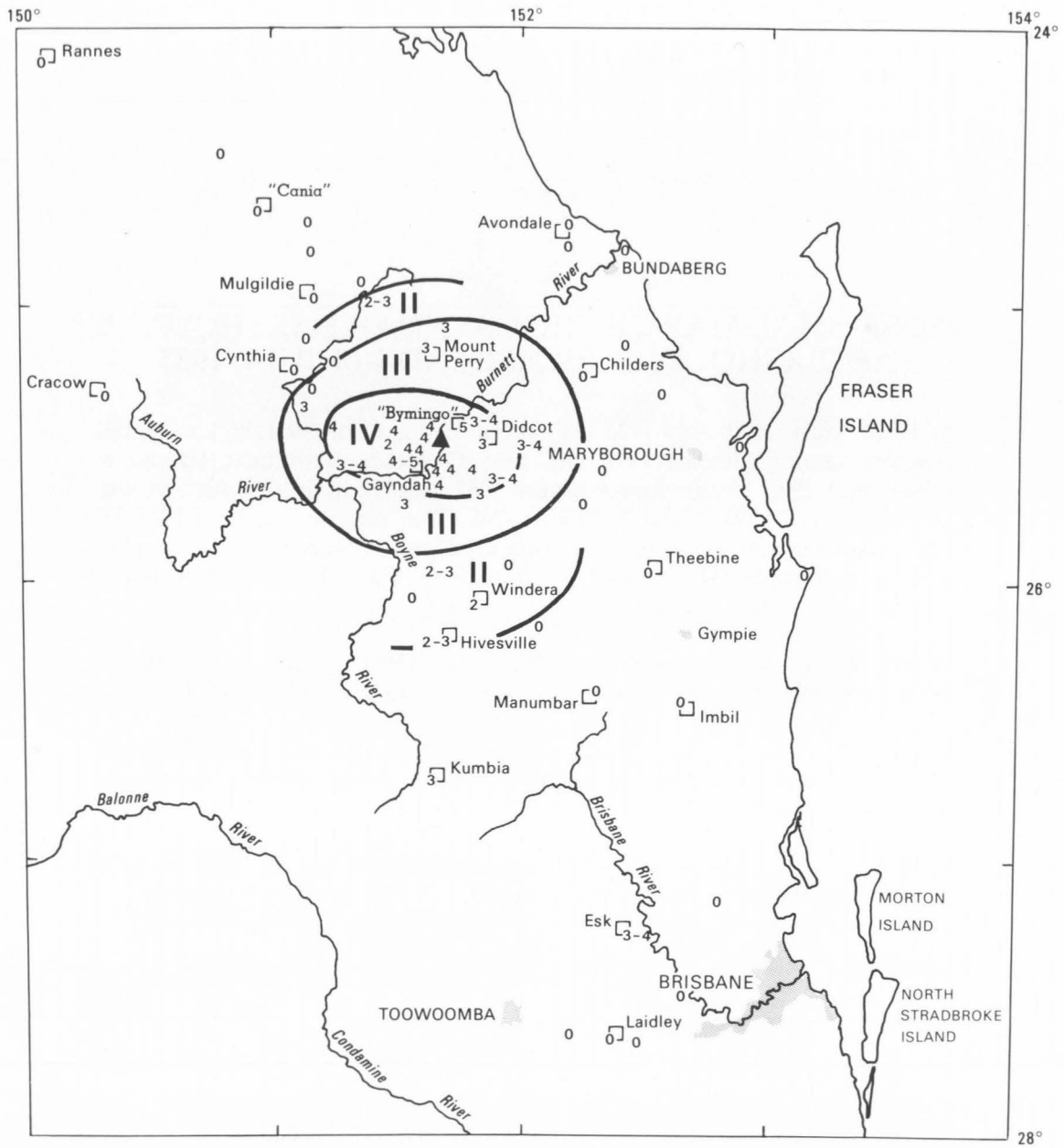
References

BRYAN, W. H., & WHITEHOUSE, F. W., 1938—The Gayndah earthquake of 1935. *Proceedings of the Royal Society of Queensland*, 49, 106-119.

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

RYNN, J. M. W., in press c—The aftershock sequence associated with the 1935 Gayndah earthquake. *Papers of the Department of Geology, University of Queensland.*

ISOSEISMAL MAP OF THE GAYNDAH AFTERSHOCK, QUEENSLAND, 1 JUNE 1935



DATE : 1 JUNE 1935
TIME : 12:12 UT
MAGNITUDE : 4.3 ML(I)
EPICENTRE : 25.50°S 151.67°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/G56/15

ISOSEISMAL MAP OF THE GAYNDAH EARTHQUAKE AFTERSHOCK, QUEENSLAND—18 JULY 1935

At 19:30 hours on 18 July 1935 UT (about 5:30 a.m. on 19 July, local time) a second major aftershock of the 1935 Gayndah earthquake (Bryan & Whitehouse, 1938; Everingham & others, 1982) was felt in the Gayndah region. The area affected was about 7500 km^2 and a maximum intensity of MM IV was assigned to several reports from properties in the Mundubbera–Gayndah area. A magnitude ML(I) = 4.1 was calculated from the isoseismal data.

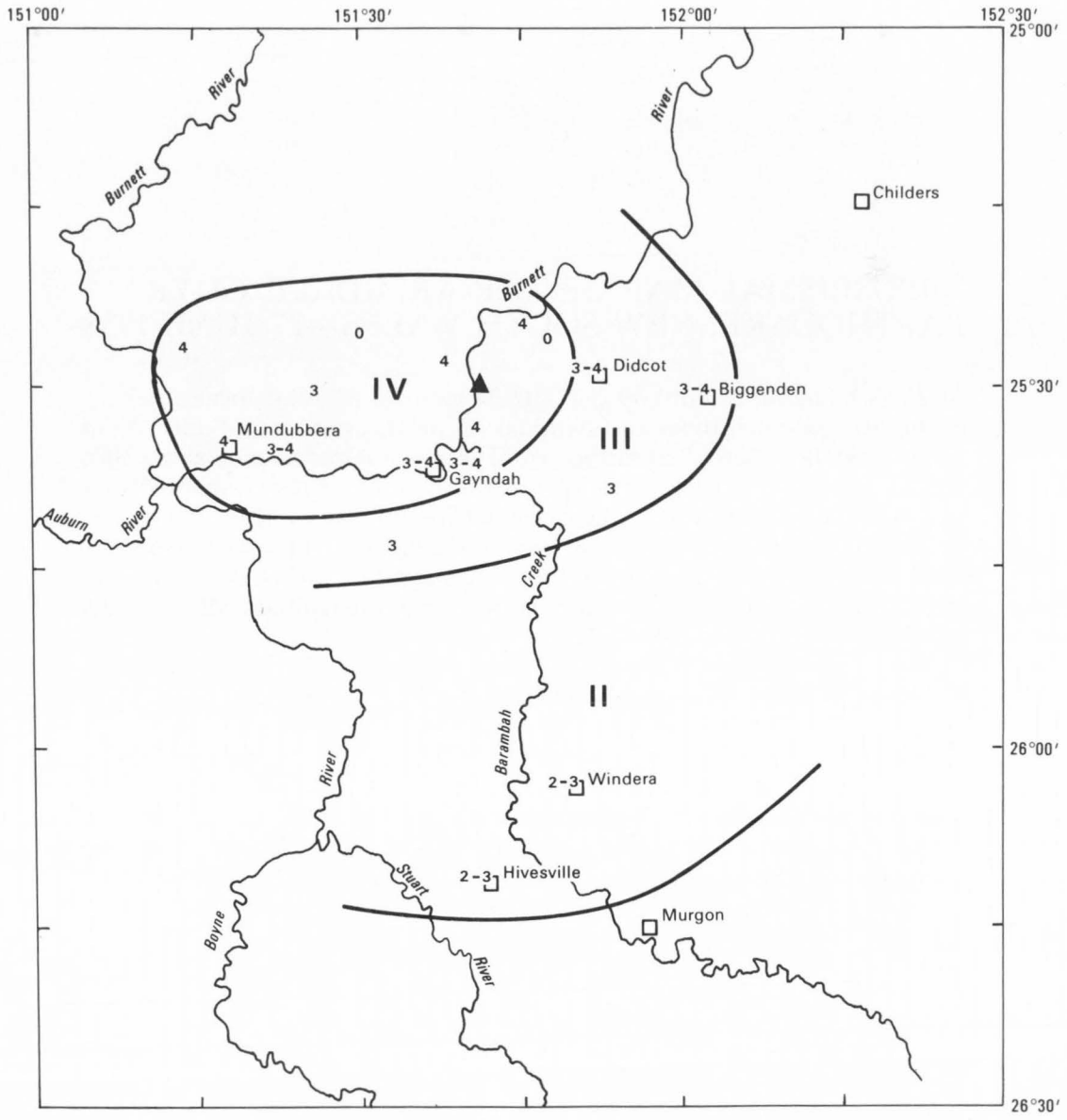
References

BRYAN, W. H., & WHITEHOUSE, F. W., 1938—The Gayndah earthquake of 1935. *Proceedings of the Royal Society of Queensland*, 49, 106–119.

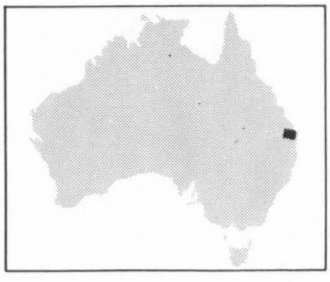
EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

RYNN, J. M. W., in press c—The aftershock sequence associated with the 1935 Gayndah earthquake. *Papers of the Department of Geology, University of Queensland.*

ISOSEISMAL MAP OF THE GAYNDAH AFTERSHOCK, QUEENSLAND, 18 JULY 1935



0 20 km



DATE : 18 JULY 1935
TIME : 19:30 UT
MAGNITUDE : 4.1 ML (I)
EPICENTRE : 25.50°S 151.67°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/G56/16

ISOSEISMAL MAP OF THE ARMIDALE/GUYRA EARTHQUAKE, NEW SOUTH WALES—27 JUNE 1938

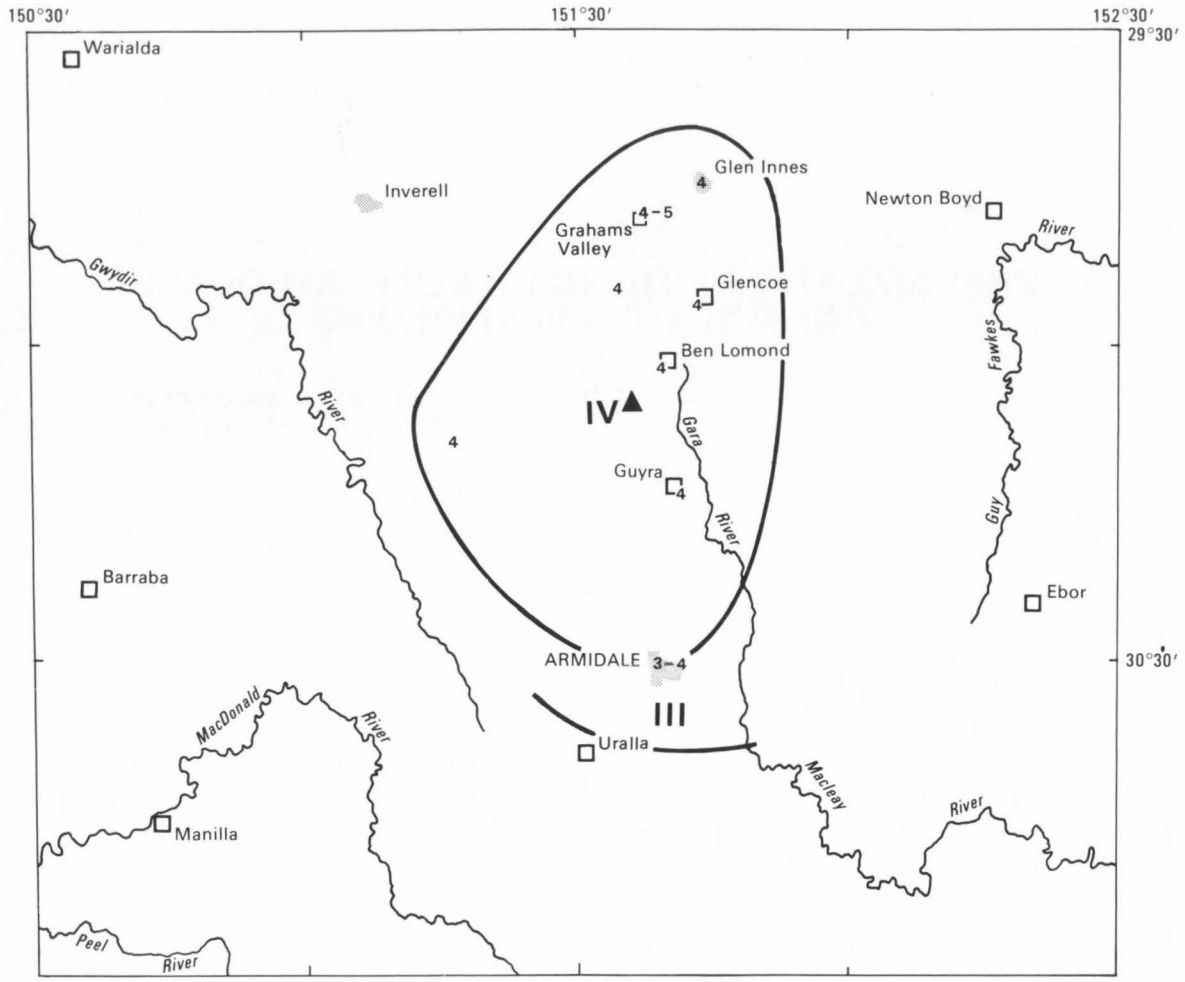
At 22:38 hours on 27 June 1938 UT (8:38 a.m. on 28 June, local time) the region between Glen Innes and Armidale in northeastern New South Wales experienced the effects of an earthquake. The area affected covered about 5000 km^2. A maximum intensity of MM IV-V was reported in the Grahams Valley area, southwest of Glen Innes, where cupboard drawers were shaken onto floors. All isoseismal data were taken from local New England Tableland newspapers, the *Armidale Express* and *Uralla Times*. A magnitude ML(RIV) = 4.7 was calculated from the Riverview seismograms, and a magnitude ML(I) = 3.9 calculated from the isoseismal data.

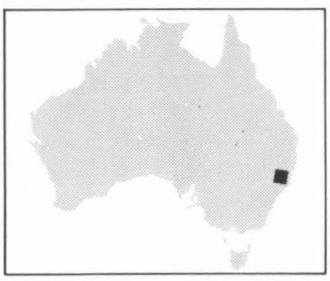
A resident of Ben Lomond reported a foreshock at about 2 a.m. on 28 June.

Reference

RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanthorpe-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30-42.

ISOSEISMAL MAP OF THE ARMIDALE/GUYRA EARTHQUAKE, NEW SOUTH WALES, 27 JUNE 1938





DATE : 27 JUNE 1938
TIME : 22:38:47 UT
MAGNITUDE : 4.7 ML (RIV), 3.9 ML (I)
EPICENTRE : 30.1°S 151.6°E
DEPTH : 33 km

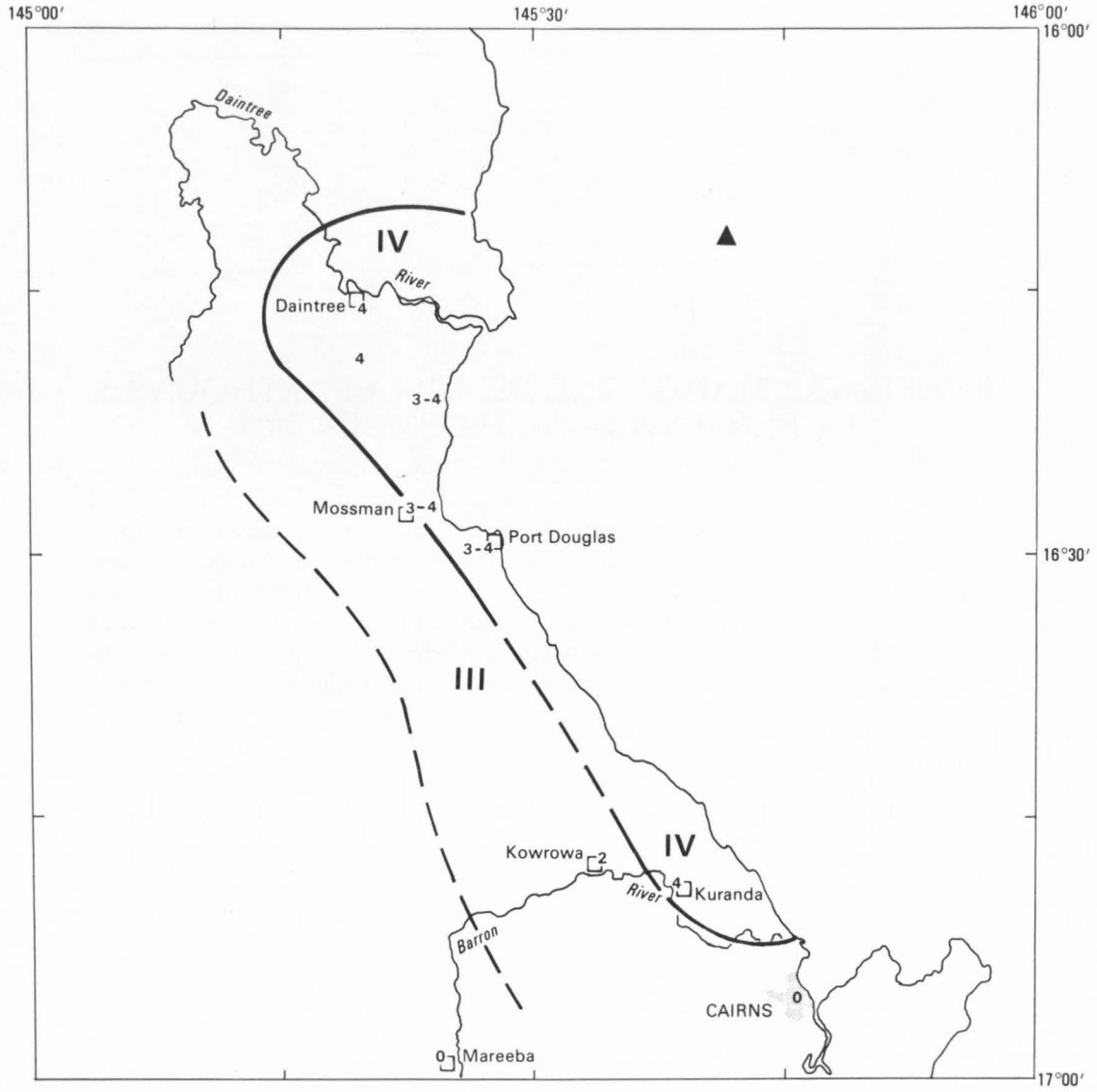
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/H56/1

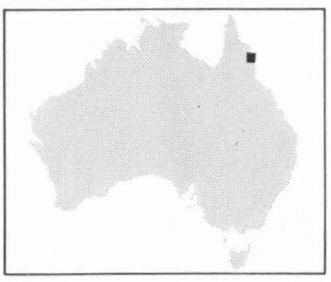
ISOSEISMAL MAP OF THE DAINTREE EARTHQUAKE, QUEENSLAND—10 APRIL 1942

At 03:00 hours on 10 April 1942 UT (1:00 p.m. local time) the effects of an earthquake were felt along a 100-km-long coastal belt just north of Cairns. Reports published in the *Cairns Post*, and those received from a macroseismic survey conducted by the University of Queensland, indicated that the felt area was about 2000 km^2. The most intense effects were reported from Daintree and Kuranda, both of which were assigned intensities of MM IV. A magnitude ML(I) = 3.8 was estimated from the isoseismal data. The earthquake is assumed to have occurred offshore because of the distribution of the felt reports.

ISOSEISMAL MAP OF THE DAINTREE EARTHQUAKE, QUEENSLAND, 10 APRIL 1942



0 20 km



DATE : 10 APRIL 1942
TIME : 03:00 UT
MAGNITUDE : 3.8 ML (I)
EPICENTRE : 16.2 ° S 145.7° E
DEPTH : Crustal

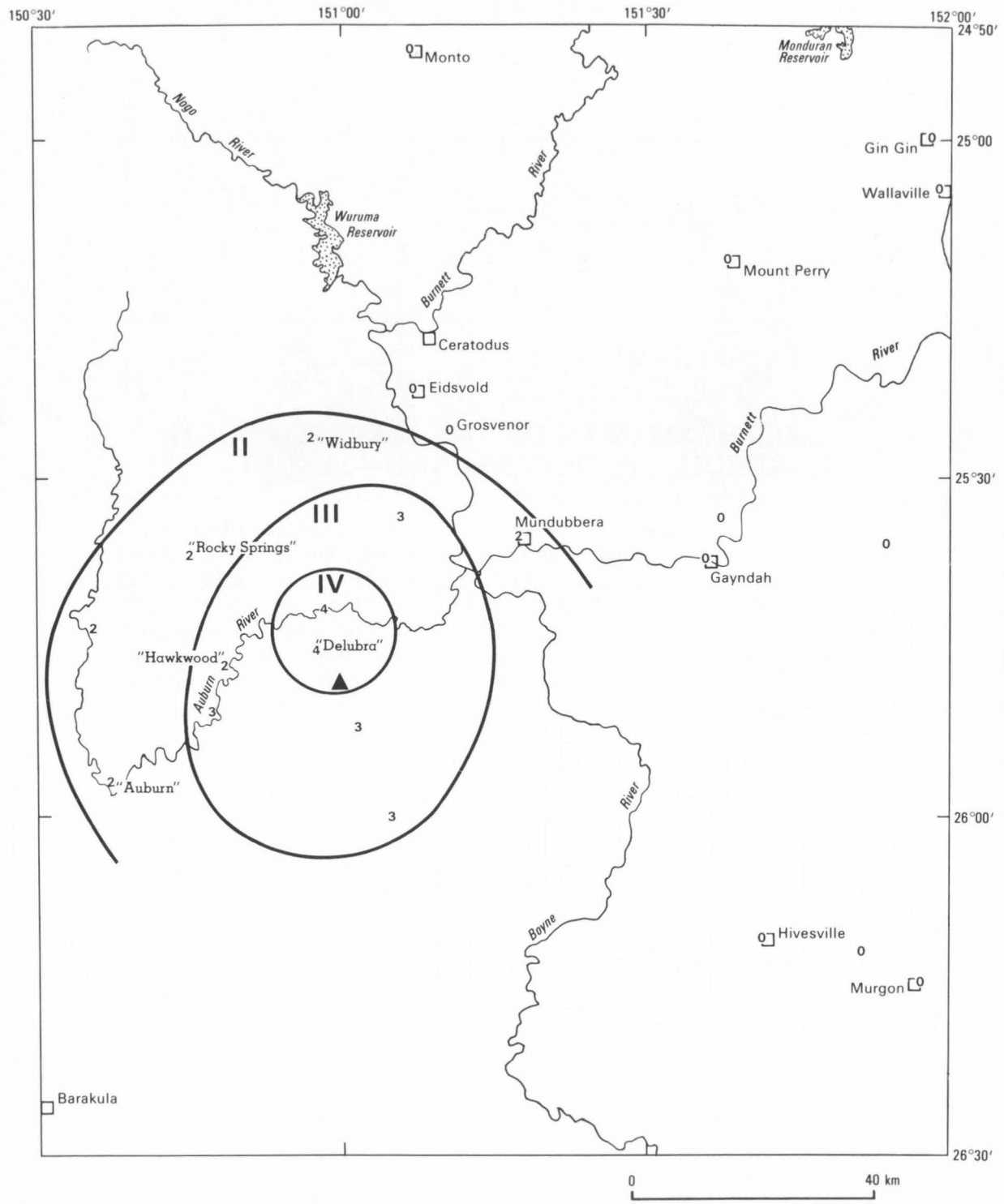
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/E55/5

ISOSEISMAL MAP OF THE DELUBRA EARTHQUAKE, QUEENSLAND—30 DECEMBER 1951

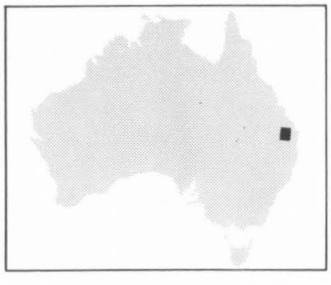
At 20:34 hours on 30 December 1951 UT (6:34 a.m. on 31 December, local time) the effects of a magnitude MB 4.5 earthquake were experienced in the farming district about 40 km southeast of Mundubbera in central eastern Queensland. The earthquake was felt over an area of about 5000 km^2, in which the maximum intensity, MM IV, was assigned to the felt report from Delubra homestead. Of 50 earthquake questionnaires returned, 35 reported that the event was not felt. Several of the properties near Delubra reported three aftershocks occurring within one hour after the main shock. A magnitude of ML(I) = 4.0 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE DELUBRA EARTHQUAKE, QUEENSLAND, 30 DECEMBER 1951



DATE : 30 DECEMBER 1951
TIME : 20:34:03 UT
MAGNITUDE : 4.0 ML (I)
EPICENTRE : 25.8°S 151.0°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

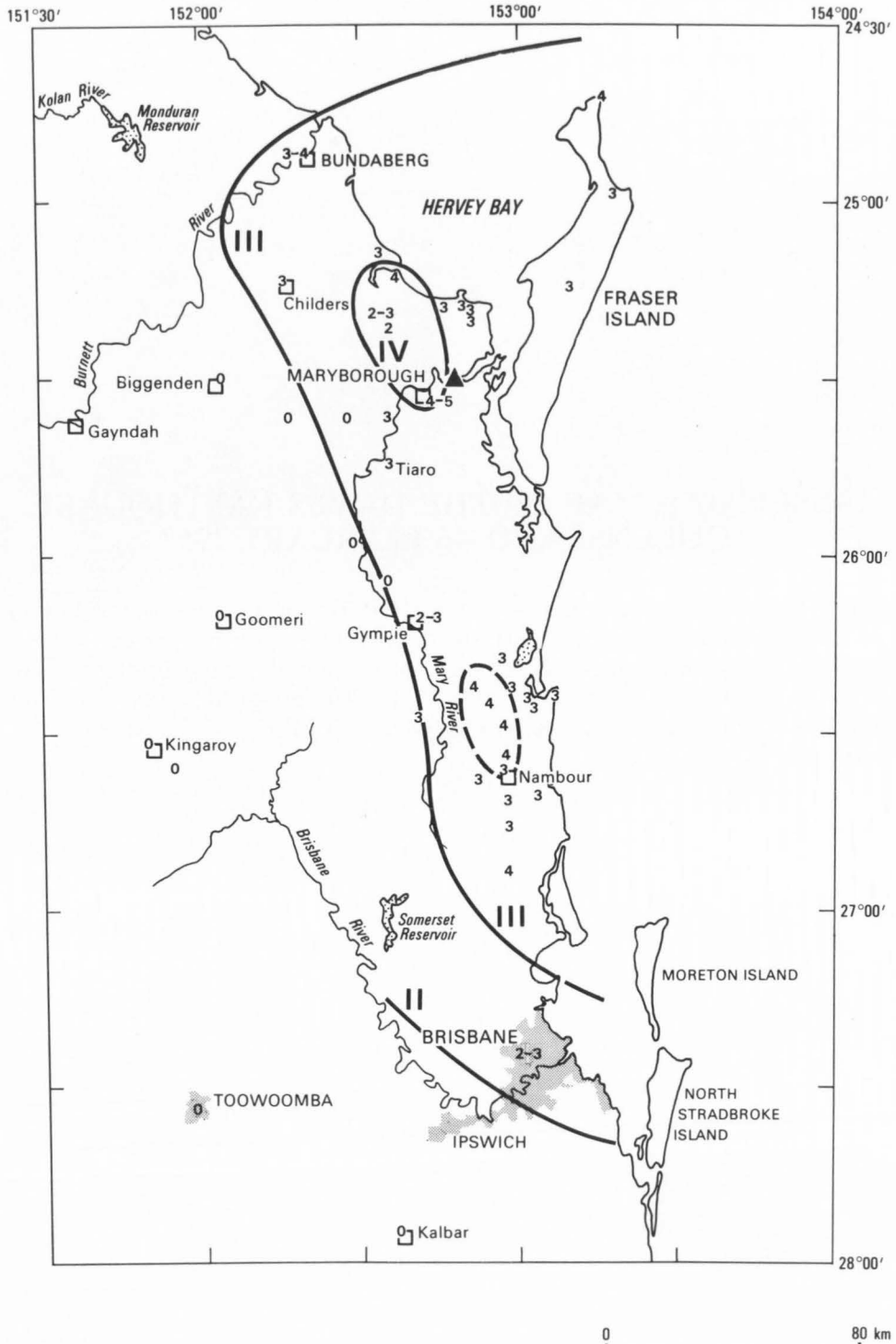


24/G56-5/1

ISOSEISMAL MAP OF THE MARYBOROUGH EARTHQUAKE, QUEENSLAND—24 JUNE 1952

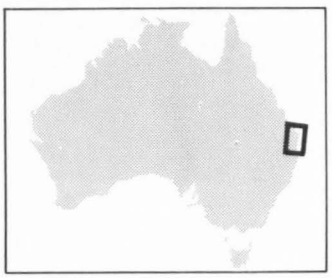
On 24 June 1952 at 01:44 UT (11:44 a.m. local time) an earthquake of magnitude ML 4.8 was felt along the southeast Queensland coast. The epicentre was near Maryborough, where the maximum intensity of MM IV-V was assigned. Felt effects covered an area of about 19 000 km^2, extending from Bundaberg in the north to Brisbane in the south and west to the ranges. Reports from Maryborough indicated that slight damage, in the form of cracks in plaster walls and ceilings of several buildings, was sustained. Of 105 earthquake questionnaires returned, 67 reported some effects due to the earthquake. A magnitude of ML(I) = 4.8 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE MARYBOROUGH EARTHQUAKE, QUEENSLAND, 24 JUNE 1952



DATE : 24 JUNE 1952
TIME : 01:44:04 UT
MAGNITUDE : 4.8 ML (I), 4.8 ML (RIV), 4.4 MS
EPICENTRE : 25.5°S 152.8°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

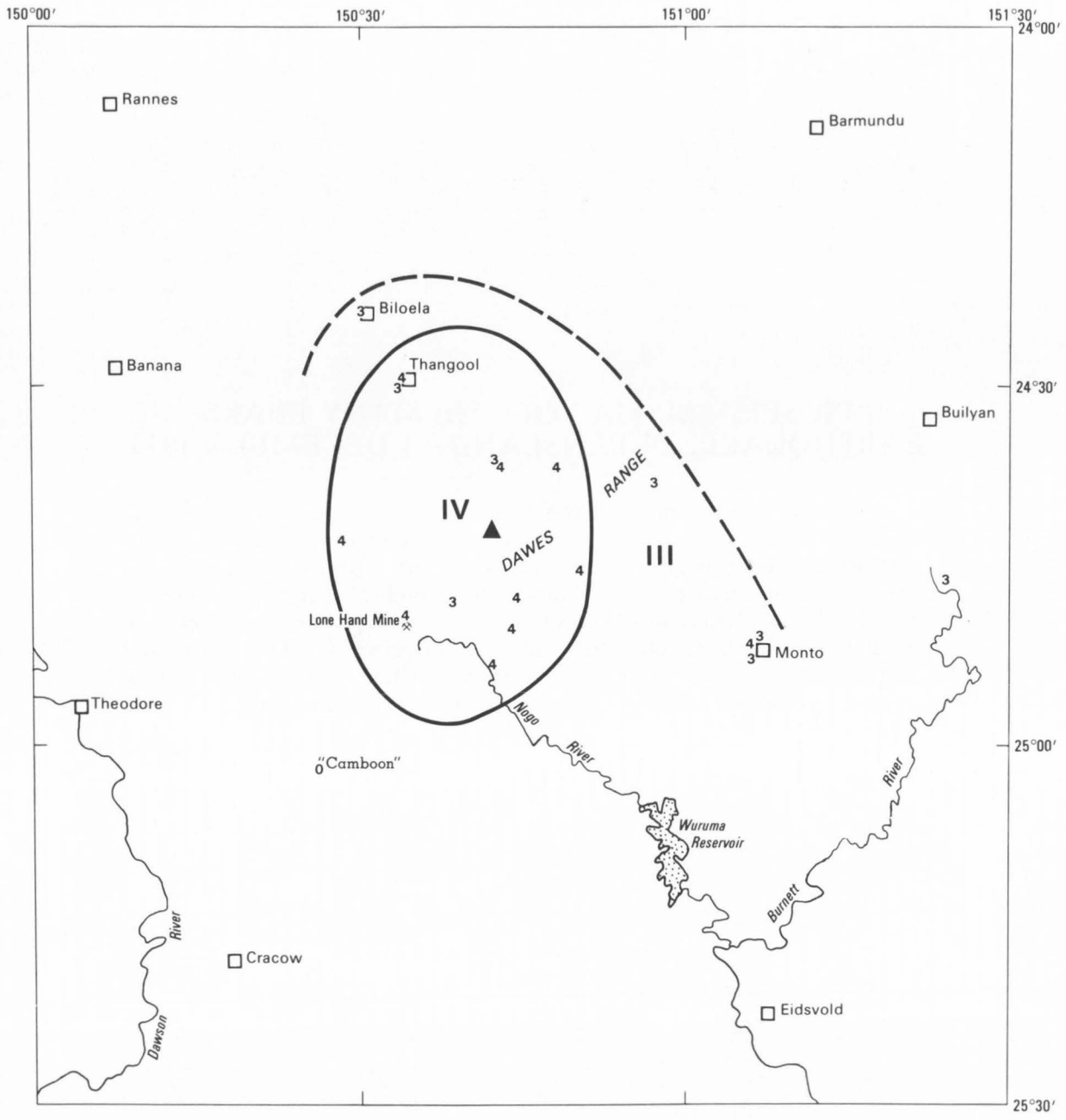


24/G56/4

ISOSEISMAL MAP OF THE DAWES EARTHQUAKE, QUEENSLAND—6 FEBRUARY 1953

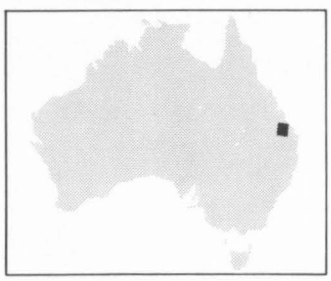
On 6 February 1953 at about 17:49 hours UT (7 February, 3:49 a.m. local time) a small area in central eastern Queensland reported the effects of an earthquake felt over an area of about 2800 km^2; 24 earthquake questionnaires were received. A maximum intensity of MM IV was assigned to reports from homesteads in the Dawes Range area. A magnitude ML(I) = 3.7 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE DAWES EARTHQUAKE, QUEENSLAND, 6 FEBRUARY 1953



DATE : 6 FEBRUARY 1953
TIME : 17:49:31 UT
MAGNITUDE : 3.7 ML(I)
EPICENTRE : 24.7°S 150.7°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

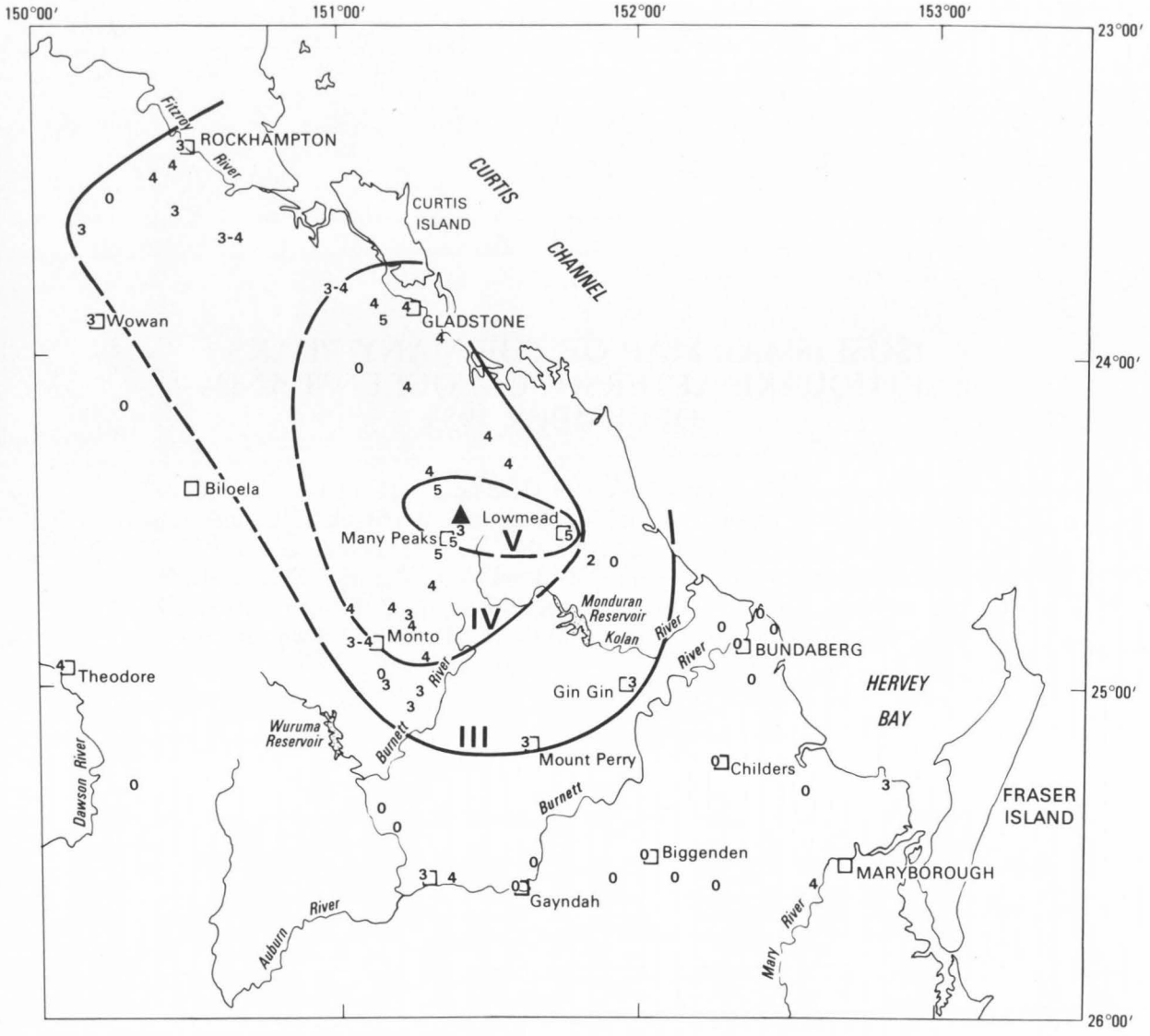


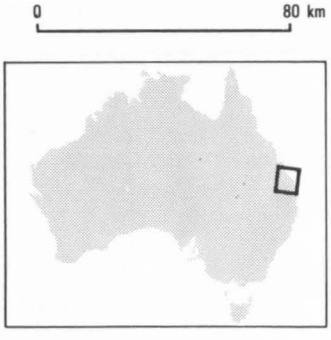
24/G56-1/1

ISOSEISMAL MAP OF THE MANY PEAKS EARTHQUAKE, QUEENSLAND—3 DECEMBER 1953

At 15:43 hours on 3 December 1953 UT (1:43 a.m. on 4 December, local time) the effects of an earthquake of magnitude ML(I) about 4.4 were felt in the Many Peaks region of central eastern Queensland. The maximum intensity, MM V, was assigned to the Many Peaks township and several nearby properties, where crockery and other small items fell of shelves and pictures were displaced. An area of approximately 5500 km^2 was affected. Of 132 earthquake questionnaires received, 58 reported that the earthquake was not felt. One aftershock, at about 1:58 a.m., was reported (see over the page).

ISOSEISMAL MAP OF THE MANY PEAKS EARTHQUAKE, QUEENSLAND, 3 DECEMBER 1953





DATE : 3 DECEMBER 1953
TIME : 15:42:49 UT
MAGNITUDE : 4.4 ML (I)
EPICENTRE : 24.5°S 151.4°E
DEPTH : Crustal

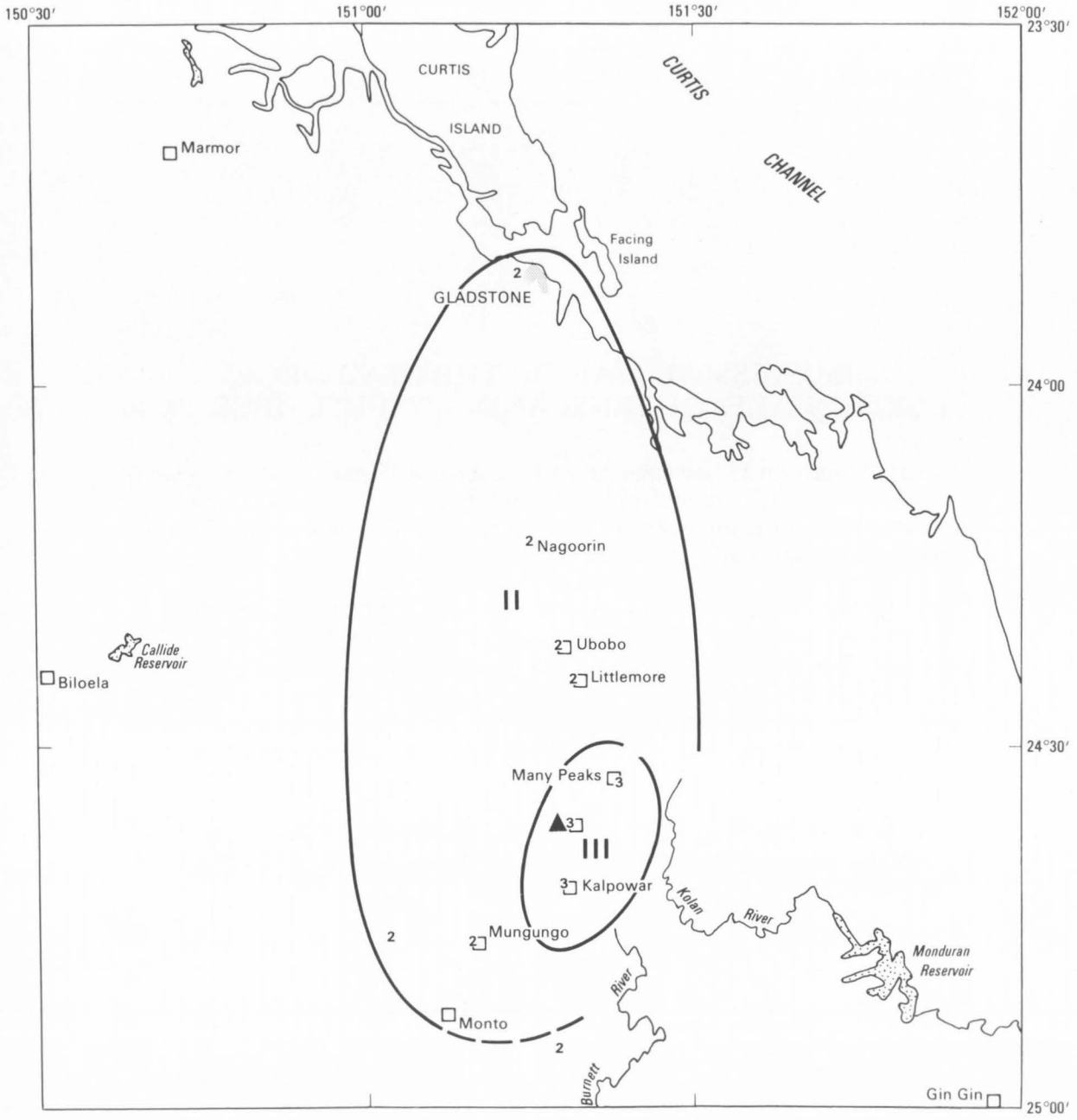
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/Q/5

ISOSEISMAL MAP OF THE MANY PEAKS EARTHQUAKE AFTERSHOCK, QUEENSLAND—3 DECEMBER 1953

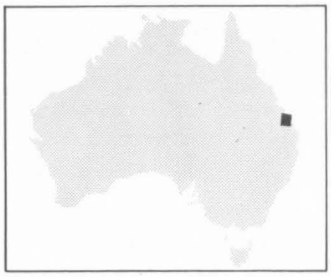
This earthquake, which occurred at about 15:58 hours UT on 3 December 1953 (about 1:58 a.m. 4 December, local time) was an aftershock of the previous event (at 15:43 hours UT). It occurred in the Many Peaks area and its effects were reported over an area of about 2500 km^2. A maximum intensity of MM III was assigned to the Many Peaks–Kalpowar area. Fifteen earthquake questionnaires were returned. A magnitude of ML(I) = 3.8 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE MANY PEAKS AFTERSHOCK, QUEENSLAND, 3 DECEMBER 1953



DATE : 3 DECEMBER 1953
TIME : 15:58 UT
MAGNITUDE : 3.8 ML (I)
EPICENTRE : 24.6°S 151.3°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/Q/6

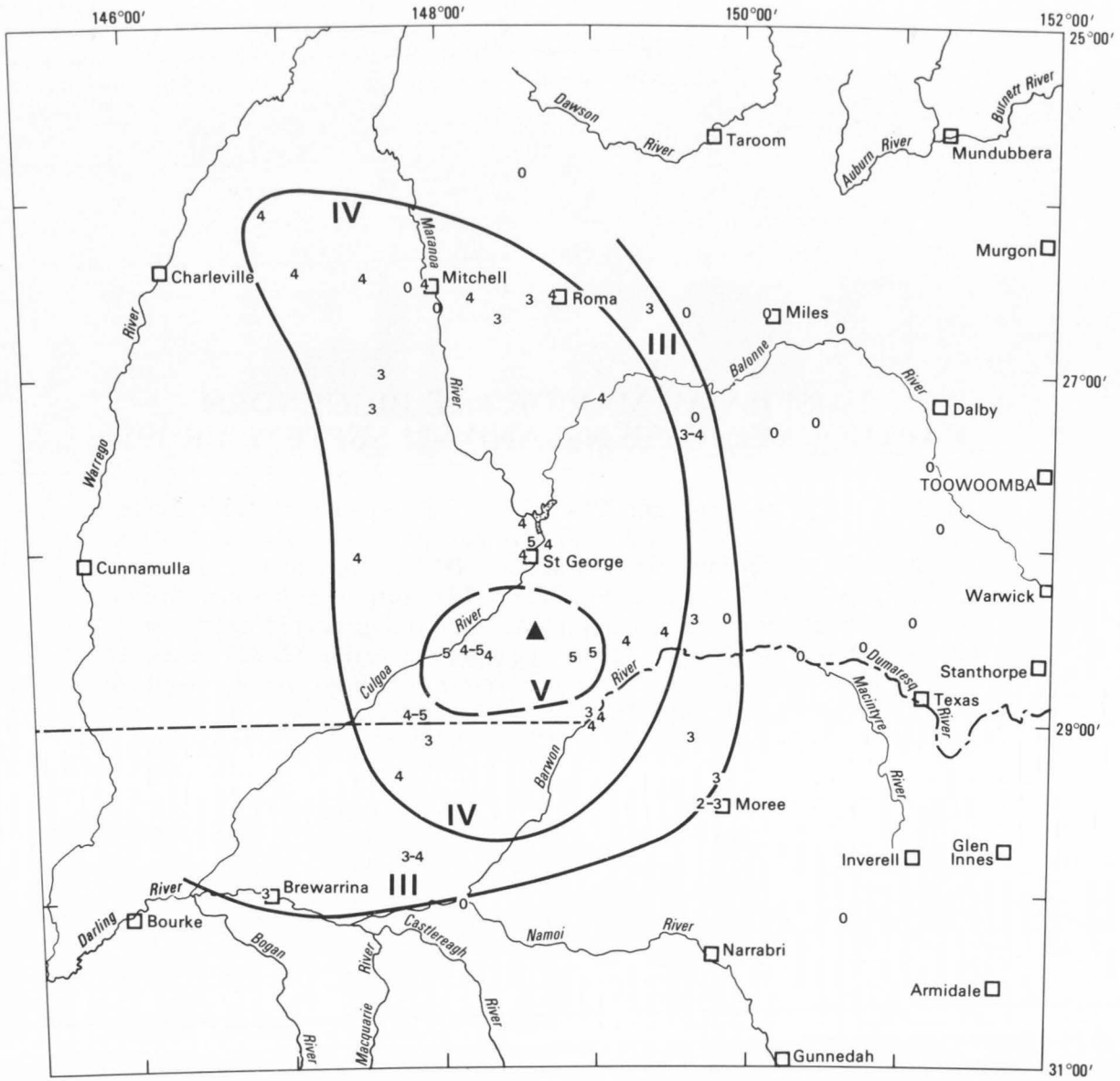
ISOSEISMAL MAP OF THE ST GEORGE EARTHQUAKE, QUEENSLAND—19 SEPTEMBER 1954

At 10:37 hours on 19 September 1954 UT (about 8:37 p.m. local time) parts of southwestern Queensland and north central New South Wales experienced the effects of a magnitude ML (RIV) 5.3 earthquake. The epicentre was located about 50 km south of St George.

The earthquake was felt over an area of about 120 000 km^2, in which a maximum intensity of MM V was assigned to reports from the farming community south of St George. Of 122 earthquake questionnaires received, 27 reported that crockery and other articles fell off shelves, and cracks in concrete were noted at several places. There were additional reports of the effects being felt in moving cars, and in one instance a 5000-gallon water tank was 'turned over'.

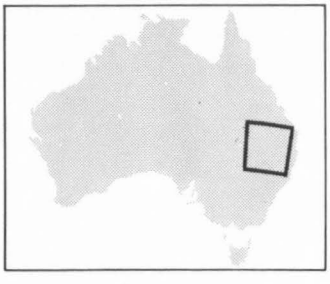
Two reports of aftershocks were received from the epicentral region—one about 3 minutes after the main shock and the other shortly after midnight on 20 September 1954 (local time).

ISOSEISMAL MAP OF THE ST GEORGE EARTHQUAKE, QUEENSLAND, 19 SEPTEMBER 1954



DATE : 19 SEPTEMBER 1954
TIME : 10:37:06 UT
MAGNITUDE : 5.3 ML (RIV), 5.5 ML (I) , 4.1 MS
EPICENTRE : 28.5°S 148.6°E
DEPTH : 10 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

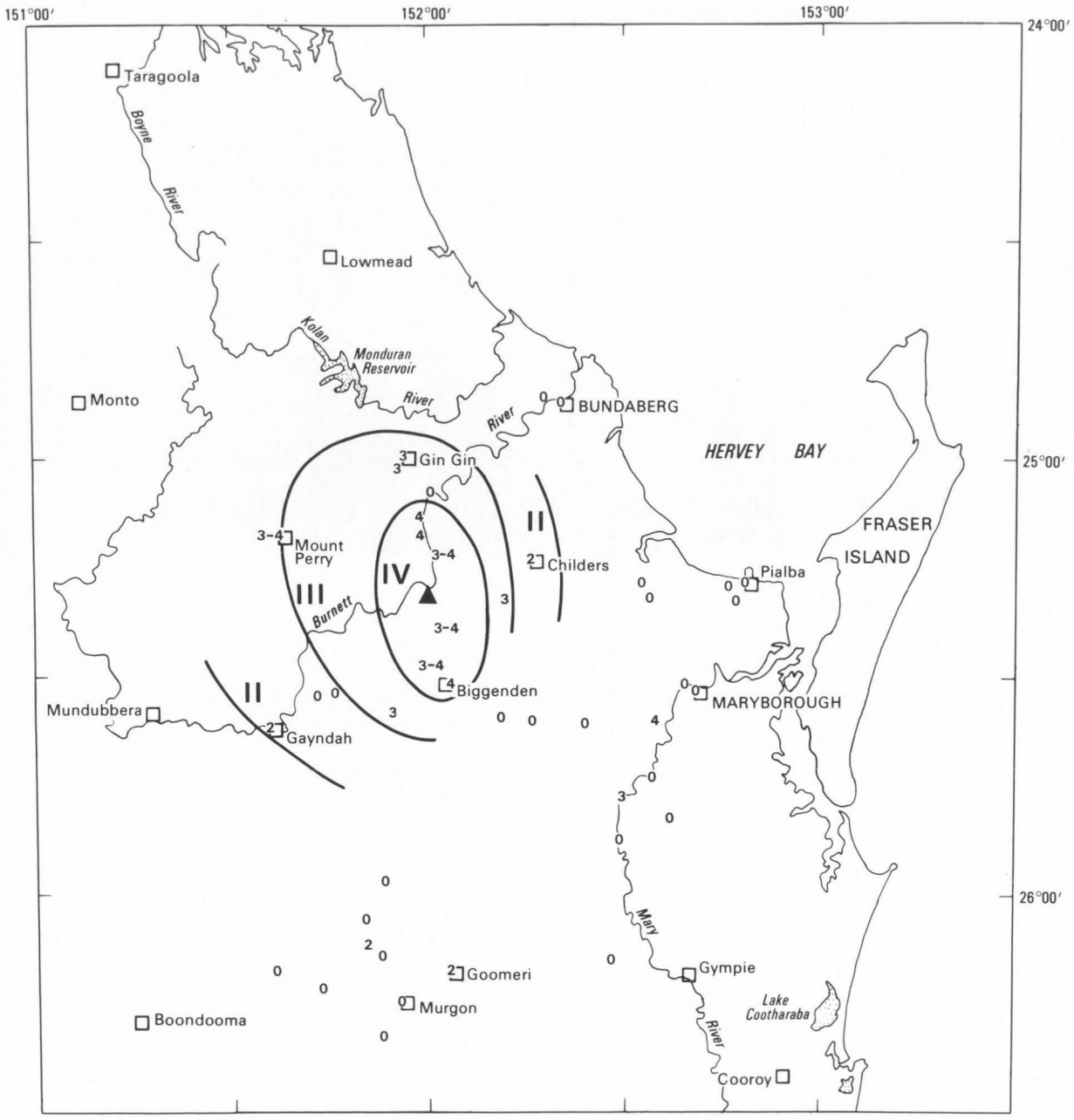


24/Q/7

ISOSEISMAL MAP OF THE BIGGENDEN EARTHQUAKE, QUEENSLAND—21 SEPTEMBER 1954

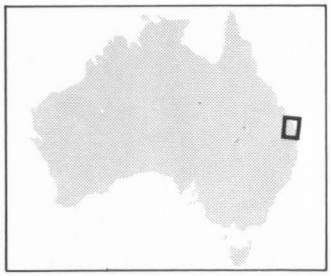
At 20:29 UT on 21 September 1954 (6:29 a.m. 22 September, local time) the Biggenden area of central eastern Queensland experienced the effects of an earthquake. The felt area covered about 5600 km^2, in which a maximum intensity of MM IV was assigned to the region north of Biggenden. Several isolated felt reports were received from the Maryborough and Murgon districts to the east and south, respectively, of the epicentral region. Of 82 earthquake questionnaires received, 46 reported no effects of the earthquake. A magnitude ML(I) = 3.8 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE BIGGENDEN EARTHQUAKE, QUEENSLAND, 21 SEPTEMBER 1954



DATE : 21 SEPTEMBER 1954
TIME : 20:29:22 UT
MAGNITUDE : 3.8 ML (I)
EPICENTRE : 25.3°S 152.0°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



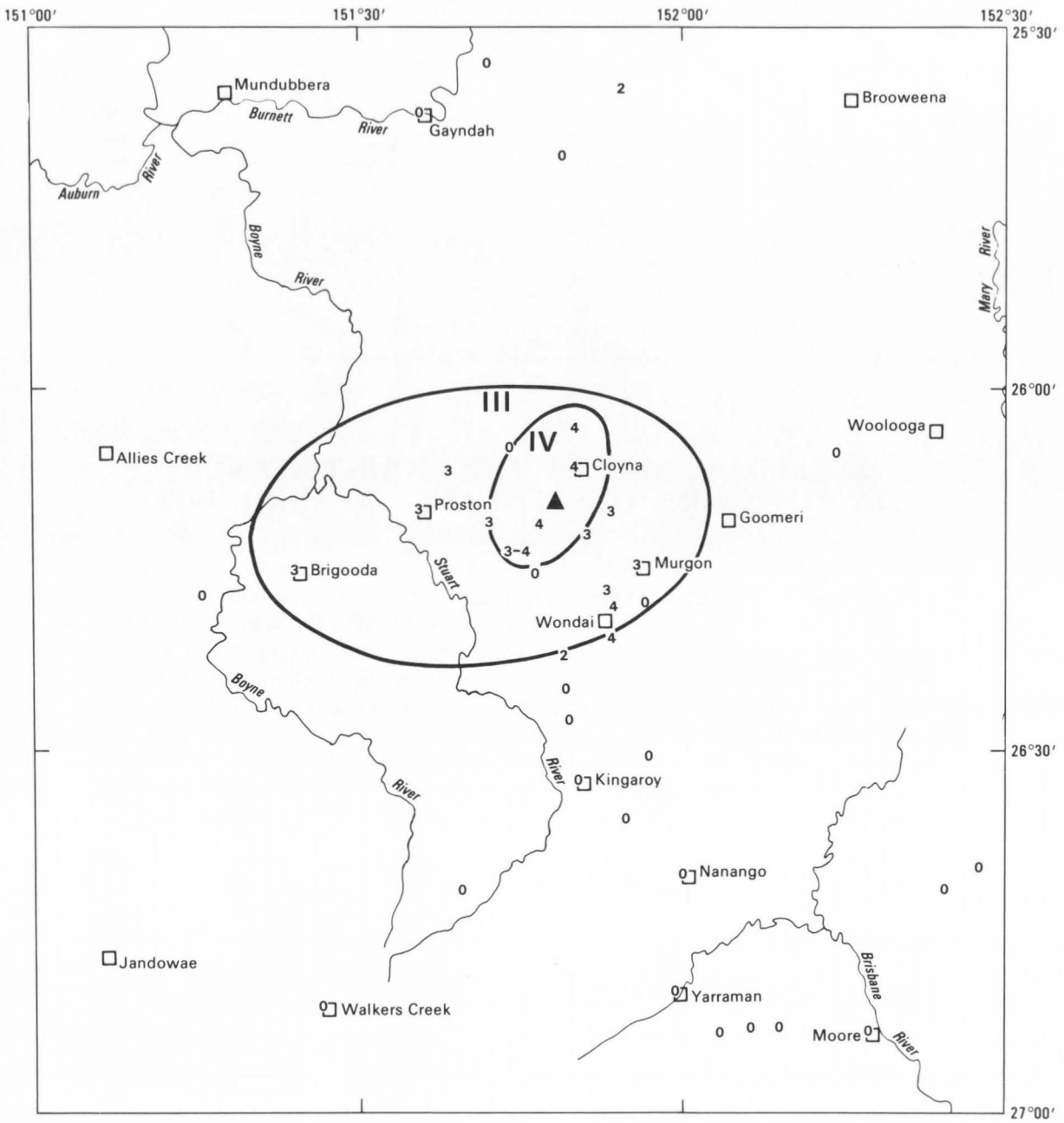
24/G56/5

ISOSEISMAL MAP OF THE MURGON EARTHQUAKE, QUEENSLAND—1 FEBRUARY 1955

On 1 February 1955 at 11:09 UT (9:09 p.m. local time) the Murgon area of southern Queensland experienced an earthquake of magnitude ML(I) = 3.6. The area affected covered about 2200 km^2, in which a maximum intensity of MM IV was assigned to Cloyna. Eighty-eight earthquake questionnaires were returned; 57 of them reported that the earthquake was not felt.

One aftershock was reported to have occurred at about 16:00 UT (about 2 a.m. on 3 February, local time).

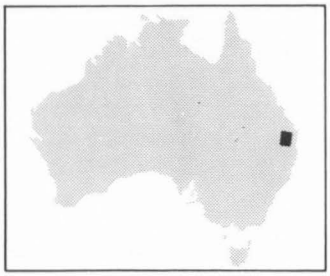
ISOSEISMAL MAP OF THE MURGON EARTHQUAKE, QUEENSLAND, 1 FEBRUARY 1955



0 40 km

DATE : 1 FEBRUARY 1955
TIME : 11:09:30 UT
MAGNITUDE : 3.6 ML (I)
EPICENTRE : 26.15°S 151.80°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

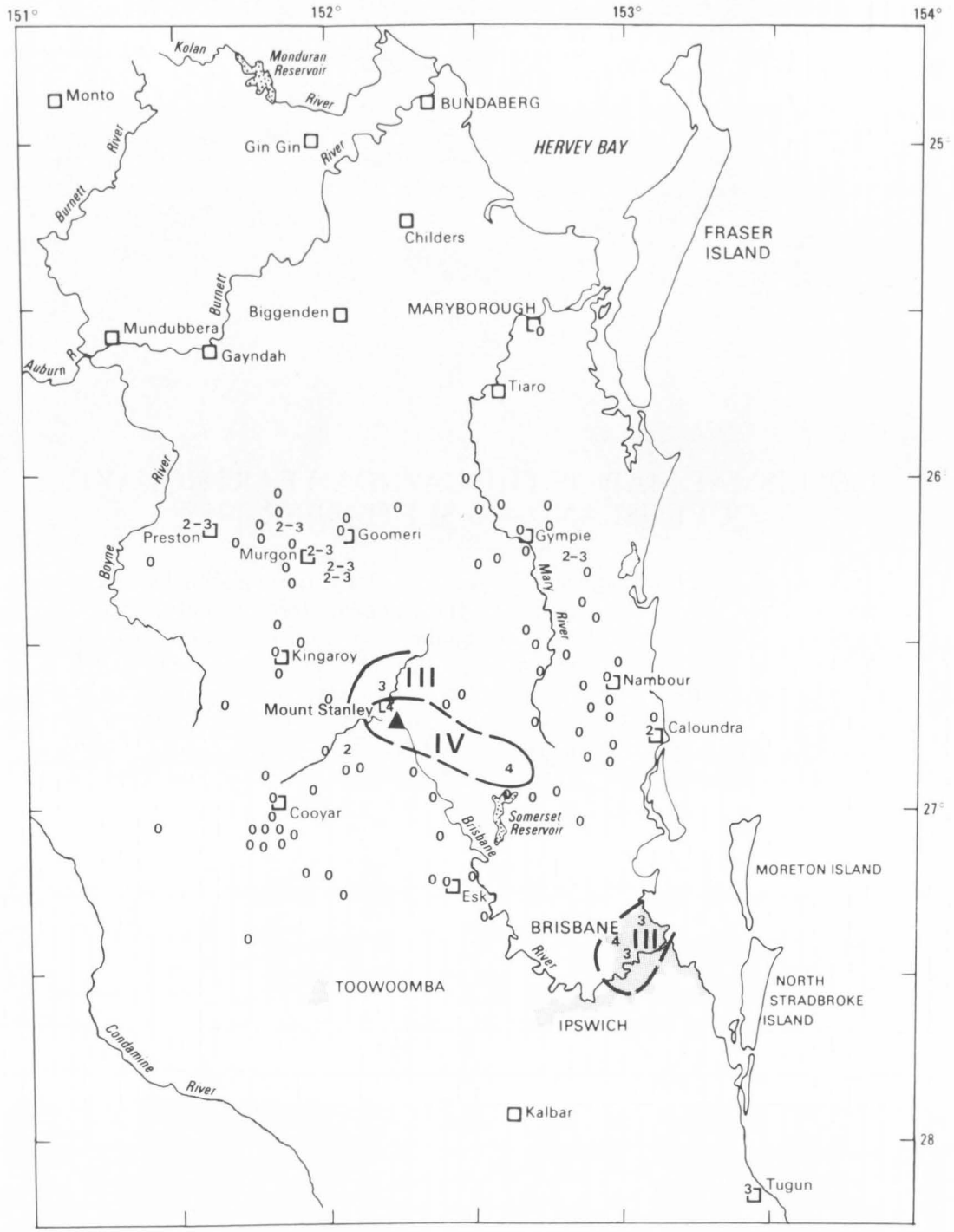


24/G56/6

ISOSEISMAL MAP OF THE MOUNT STANLEY EARTHQUAKE, QUEENSLAND—10 APRIL 1955

At about 22:36 hours on 10 April 1955 (about 8:36 a.m. on 11 April, local time) an area of about 1000 km^2 in the upper Brisbane River valley felt the effects of an earthquake. The maximum intensity, MM IV, was assigned to the Mount Stanley area. A very intensive isoseismal survey conducted by the University of Queensland showed that, apart from the small epicentral zone, most of southeastern Queensland did not experience the effects of the earthquake; indeed, of 119 earthquake questionnaires returned, 100 reported that the effects of this earthquake were not felt. Isolated reports of the event came from the Murgon, Gympie, Brisbane city, and Gold Coast areas (all MM II to III). A magnitude ML(I) = 3.2 was estimated from the isoseismal data.

ISOSEISMAL MAP OF THE MOUNT STANLEY EARTHQUAKE, QUEENSLAND, 10 APRIL 1955



DATE : 10 APRIL 1955
TIME : 22:36:15 UT
MAGNITUDE : 3.2 ML (I)
EPICENTRE : 26.7° S 152.2° E
DEPTH : Crustal

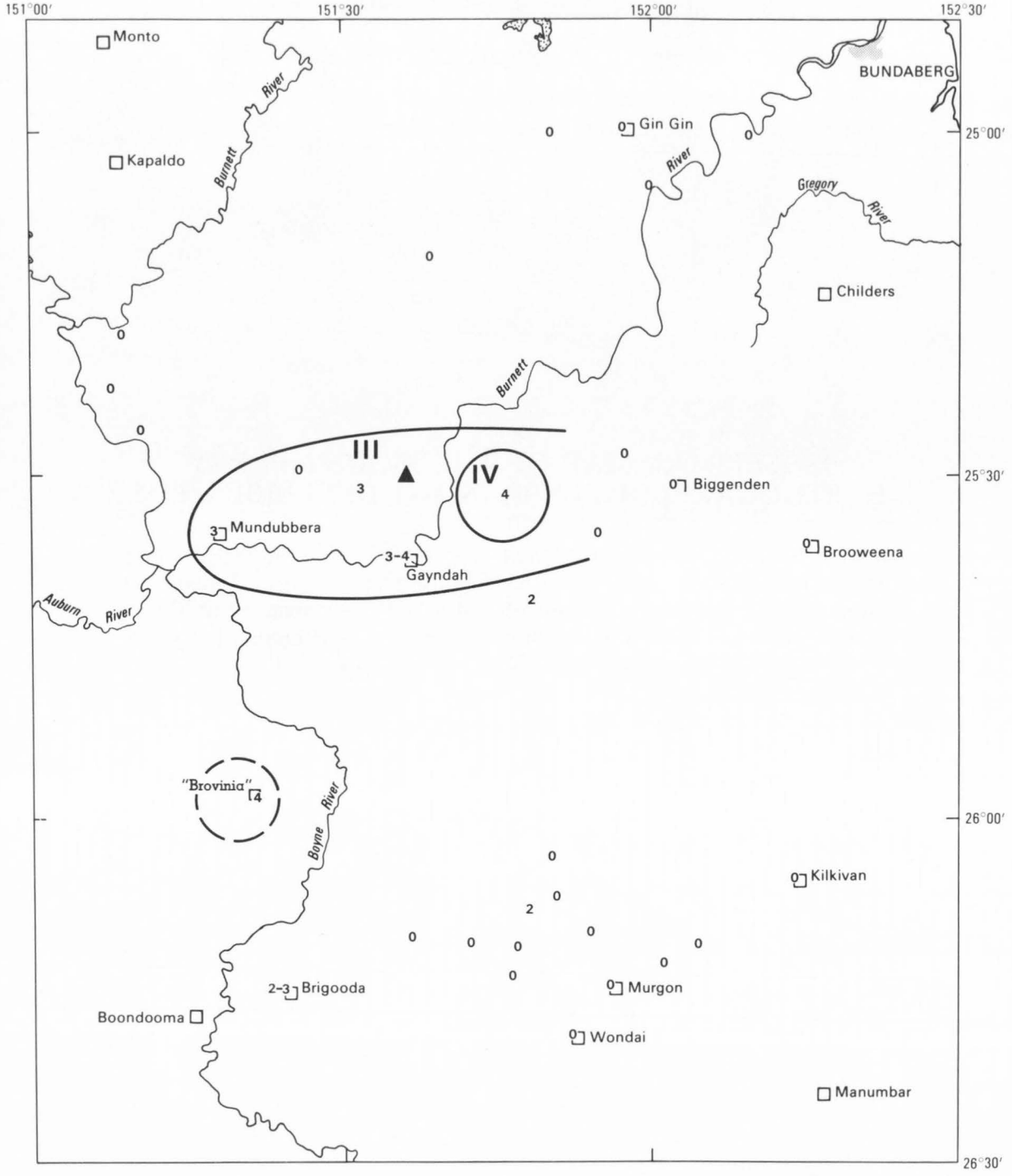
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/G56/13

ISOSEISMAL MAP OF THE GAYNDAH EARTHQUAKE, QUEENSLAND—10 SEPTEMBER 1955

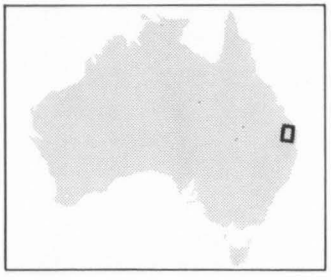
At 06:13 UT on 10 September 1955 (4:13 p.m. local time) an earthquake of magnitude ML(I) = 3.4 occurred in the Gayndah area of central eastern Queensland. The effects of this earthquake were felt over an area of about 1300 km^2, in which a maximum intensity of MM IV was assigned to Gayndah. Isolated felt reports were also received from two areas south of Gayndah. One of these—from near Brovinia homestead, about 70 km southwest of Gayndah—appeared to have experienced the most severe effects. Of 65 earthquake questionnaires returned, 49 reported that the earthquake was not felt.

ISOSEISMAL MAP OF THE GAYNDAH EARTHQUAKE, QUEENSLAND, 10 SEPTEMBER 1955



DATE : 10 SEPTEMBER 1955
TIME : 06:12:54 UT
MAGNITUDE : 3.4 ML (I)
EPICENTRE : 25.5°S 151.6°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

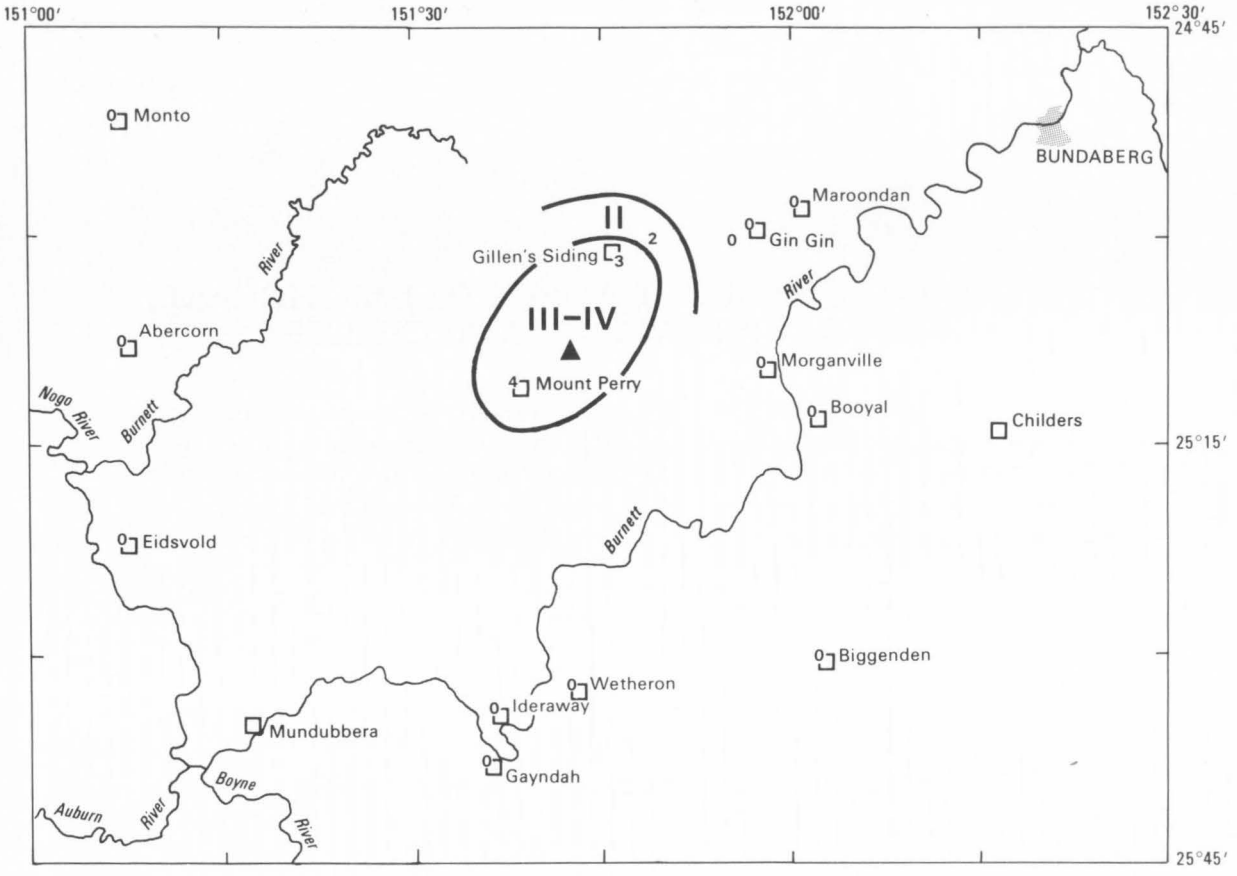


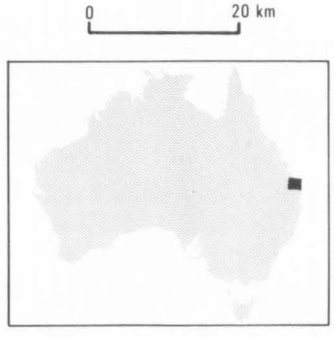
24/G56/7

ISOSEISMAL MAP OF THE MOUNT PERRY EARTHQUAKE, QUEENSLAND—1 DECEMBER 1955

At 05:34 hours on 1 December 1955 (3:34 p.m. local time) the Mount Perry district experienced the effects of an earthquake. The area affected was about 700 km^2, in which a maximum intensity of MM IV was assigned to Mount Perry. Of 18 earthquake questionnaires returned, seven reported that the earthquake was felt. A magnitude ML(I) = 3.2 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE MOUNT PERRY EARTHQUAKE, QUEENSLAND, 1 DECEMBER 1955





DATE : 1 DECEMBER 1955
TIME : 05:33:51 UT
MAGNITUDE : 3.2 ML (I)
EPICENTRE : 25.1° S 151.7° E
DEPTH : Crustal

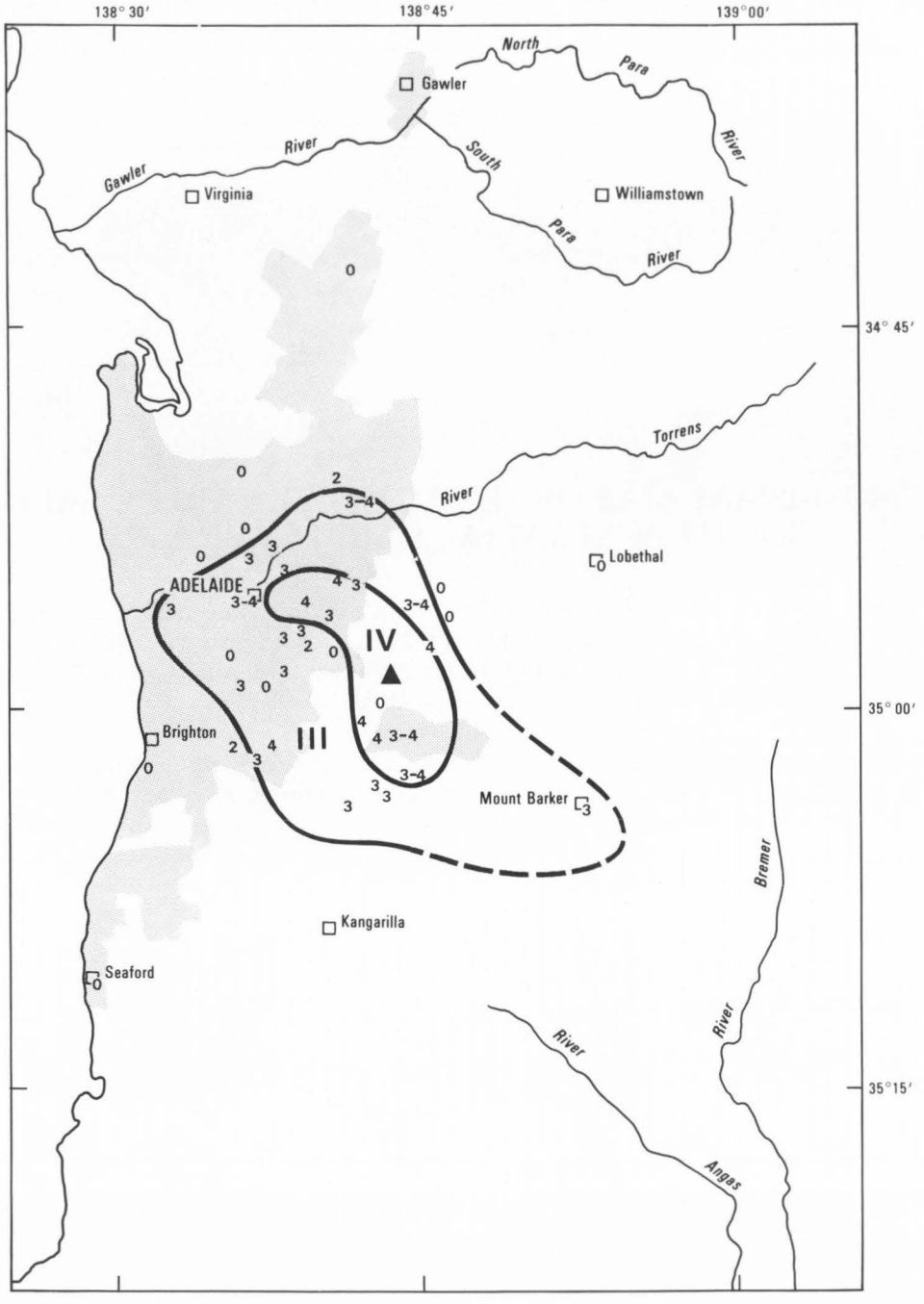
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

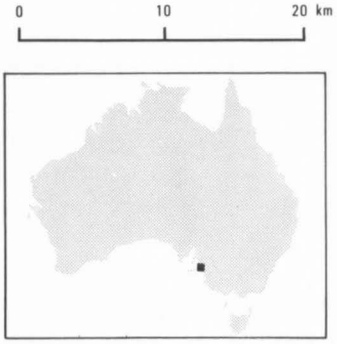
24/G56/14

ISOSEISMAL MAP OF THE ADELAIDE EARTHQUAKE, SOUTH AUSTRALIA—2 MARCH 1959

At 12:22 UT on 2 March 1959 (9:52 p.m. local time) a slight earth tremor was experienced in the Adelaide metropolitan area. The felt area extended over only 500 km^2. The maximum intensity was MM IV, and no damage was reported. Many observers likened the sound of the earthquake to a combination of thunder and noise from a passing heavy vehicle. The duration of the ground shaking was 3 to 5 seconds.

ISOSEISMAL MAP OF THE ADELAIDE EARTHQUAKE, SOUTH AUSTRALIA, 2 MARCH 1959





DATE : 2 March 1959
TIME : 12 : 22 UT
MAGNITUDE : 2.6 ML(I)
EPICENTRE : 34.98°S 138.73°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

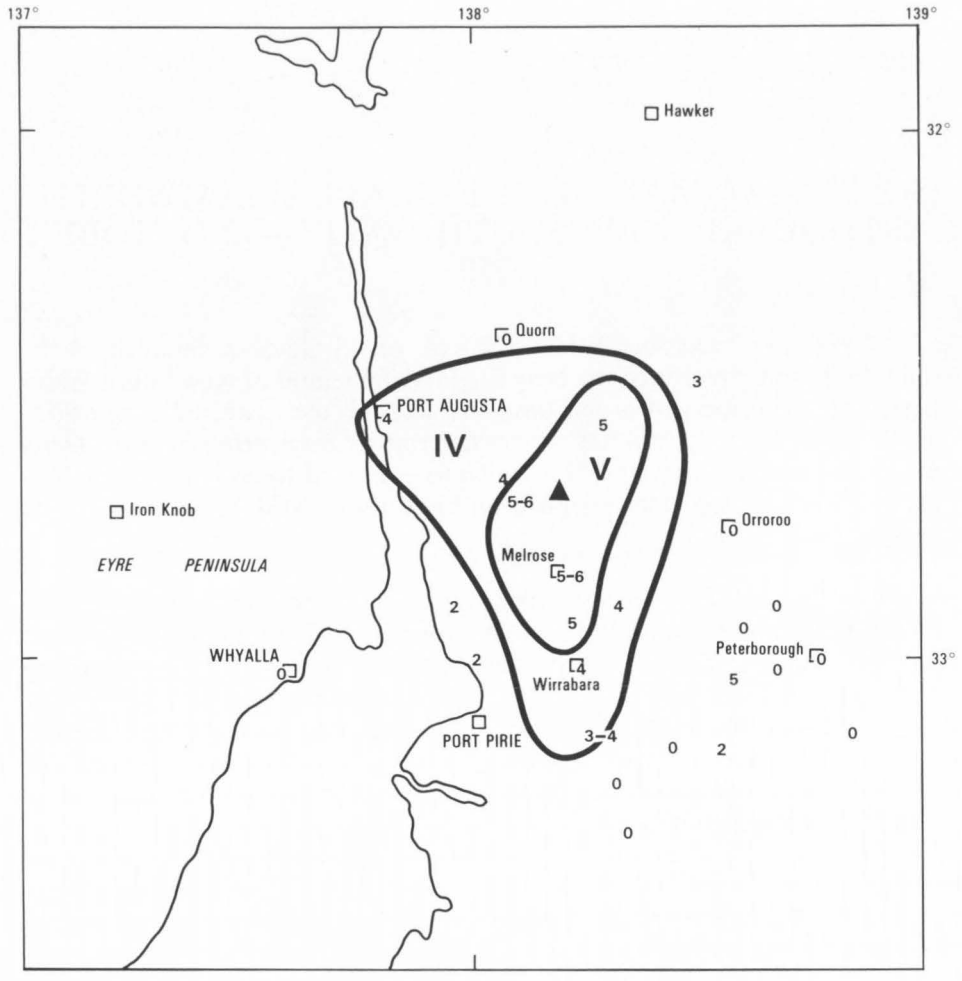
24/154/5

ISOSEISMAL MAP OF THE MELROSE EARTHQUAKE, SOUTH AUSTRALIA—9 SEPTEMBER 1959

An earthquake centred near Melrose in the Flinders Ranges caused minor damage over an area of about 1000 km^2. The shock occurred at 04:17 UT on 9 September (1:47 p.m. local time). It was felt from Port Augusta in the north to Port Pirie in the south, a distance of 60 km.

The magnitude of the earthquake determined from the Adelaide seismograph record was ML = 4.2. The maximum reported intensity was assigned a value of MM VI. In Wirrabara the walls of one house were cracked, and extensive plaster falls were reported from other dwellings. Similar reports were received from Melrose and adjoining towns.

ISOSEISMAL MAP OF THE MELROSE EARTHQUAKE, SOUTH AUSTRALIA, 9 SEPTEMBER 1959



DATE : 9 September 1959
TIME : 04:17:30 UT
MAGNITUDE : 4.2 ML (ADE)
EPICENTRE : 32.7°S 138.2°E
DEPTH : 10 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

ISOSEISMAL MAP OF THE URALLA/TAMWORTH EARTHQUAKE, NEW SOUTH WALES—12 OCTOBER 1959

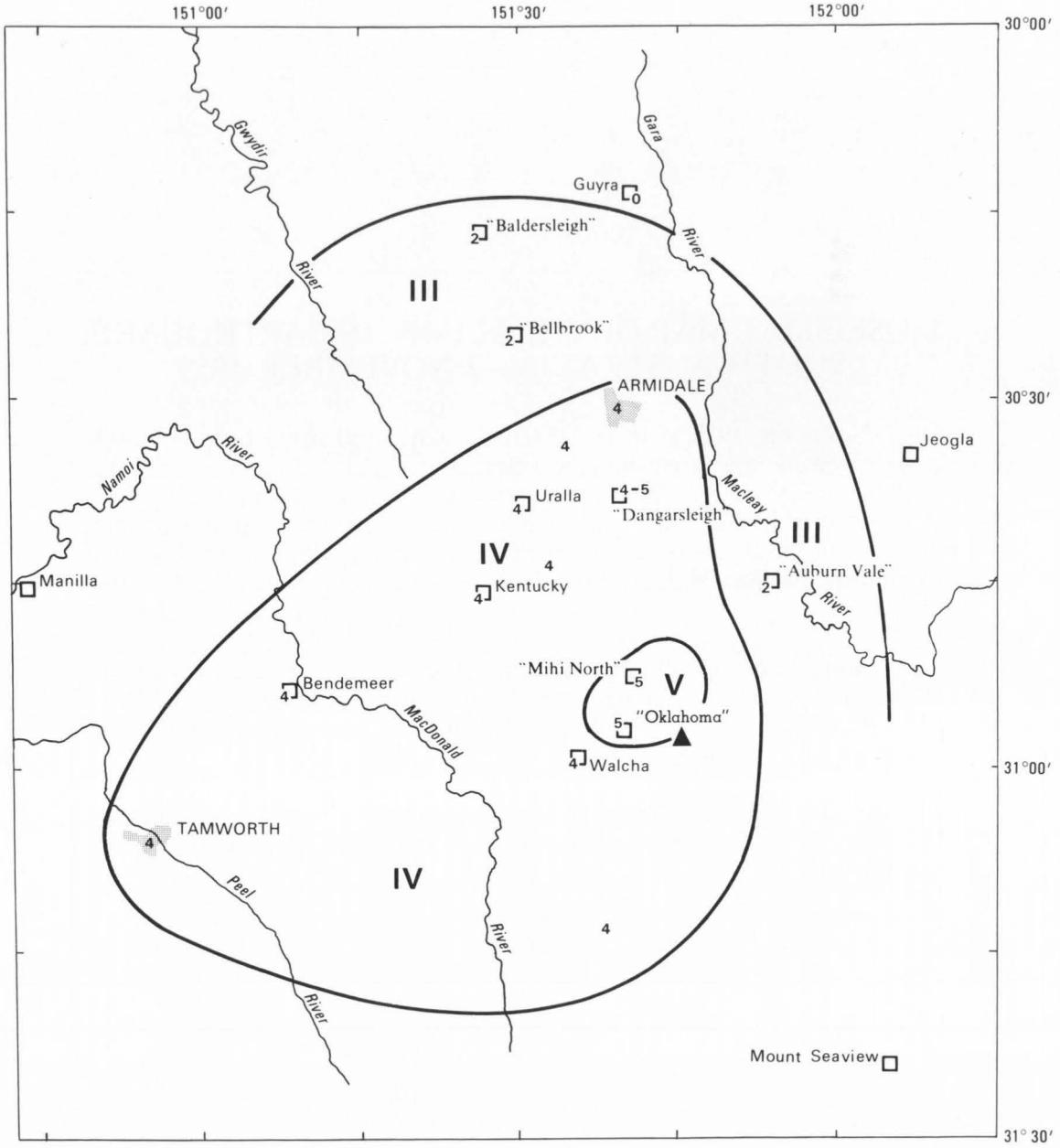
At 21:24 UT on 12 October 1959 (7:24 a.m. on 13 October, local time) the Armidale/Tamworth area of the New England Tableland of New South Wales experienced the effects of an earthquake. The felt area covered about 8000 km^2. Regional newspapers—the *Armidale Express*, *Tamworth Northern Daily Leader*, and *Uralla Times and Walcha News*—alluded to 56 felt reports. The most severely affected area, assigned an intensity of MM V, was just to the northeast of Walcha.

Reports of damage were received from Oklahoma homestead, where cracks were reported in the foundations of the house, and from Dangarsleigh and Mihi North homesteads, where bottles were knocked from shelves. A magnitude ML (RIV) = 4.7 was calculated from the seismograms, and a magnitude of ML(I) = 4.1 was obtained from the isoseismal data. Reports from Dangarsleigh indicated that tremors were felt there during the three days before the earthquake, and that an aftershock was experienced at about 8:15 a.m. on 13 October 1959 (local time).

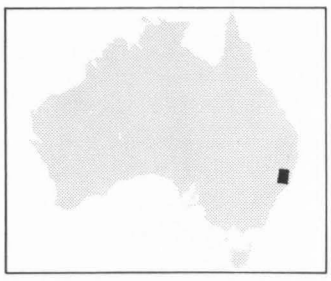
Reference

RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanthorpe-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30–42.

ISOSEISMAL MAP OF THE URALLA/TAMWORTH EARTHQUAKE, NEW SOUTH WALES, 12 OCTOBER 1959



0 20km



DATE : 12 OCTOBER 1959
TIME : 21:23:40 UT
MAGNITUDE : 4.7 ML (RIV) 4.1 ML (I)
EPICENTRE : 30.95°S 151.75°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/H56/2

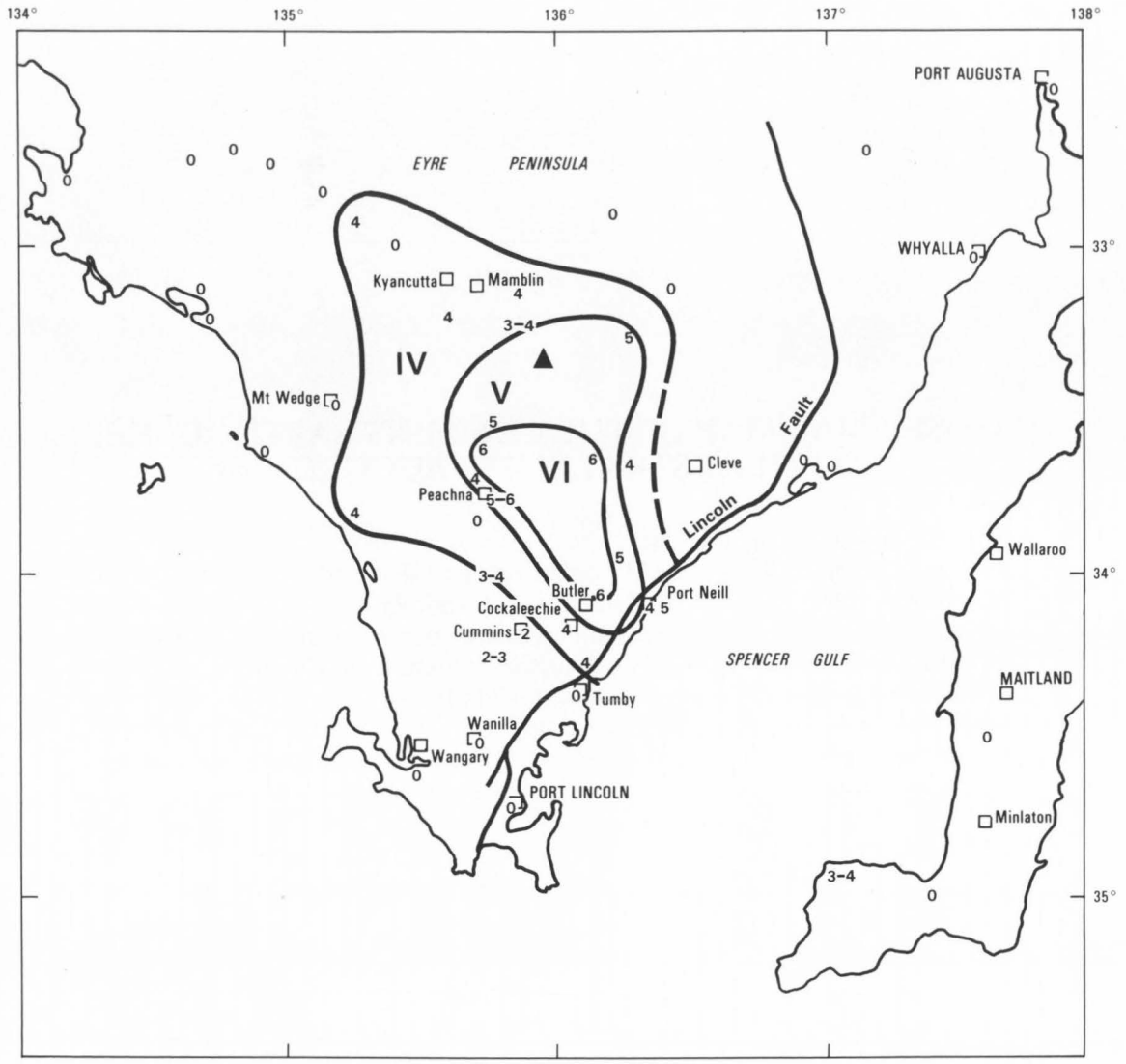
ISOSEISMAL MAP OF THE MAMBLIN EARTHQUAKE, SOUTH AUSTRALIA—2 NOVEMBER 1959

On 2 November 1959 at 01:18 UT (10:48 a.m. local time) Eyre Peninsula experienced its largest earthquake—magnitude ML = 5.2. The shock was reported at Port Neill, Cummins, Tumby Bay, and Kyancutta. The felt area extended over 24 000 km^2. There were numerous reports of minor damage in the epicentral area. Effects included plaster cracking, small objects overturned, furniture shifted, and falls of pictures, books, and ornaments from shelves.

The earthquake triggered five aftershocks between ML = 4.0 and 4.5 occurring along two branches extending northwest and southwest to Cleve. The southern fork straddles the Lincoln Fault, which marks the western boundary of the Spencer Gulf Graben.

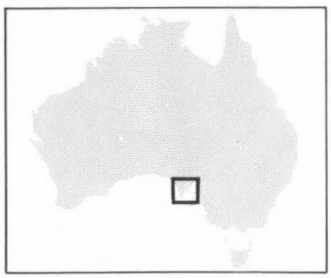
The University of Adelaide distributed questionnaires to assess the intensity variation. Of the 64 questionnaires returned, 34 reported that the earthquake was not felt.

ISOSEISMAL MAP OF THE MAMBLIN EARTHQUAKE, SOUTH AUSTRALIA, 2 NOVEMBER 1959



DATE : 2 November 1959
TIME : 01:17:57 UT
MAGNITUDE : 5.2 ML (ADE)
EPICENTRE : 33.36°S 135.98°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
o EARTHQUAKE NOT FELT

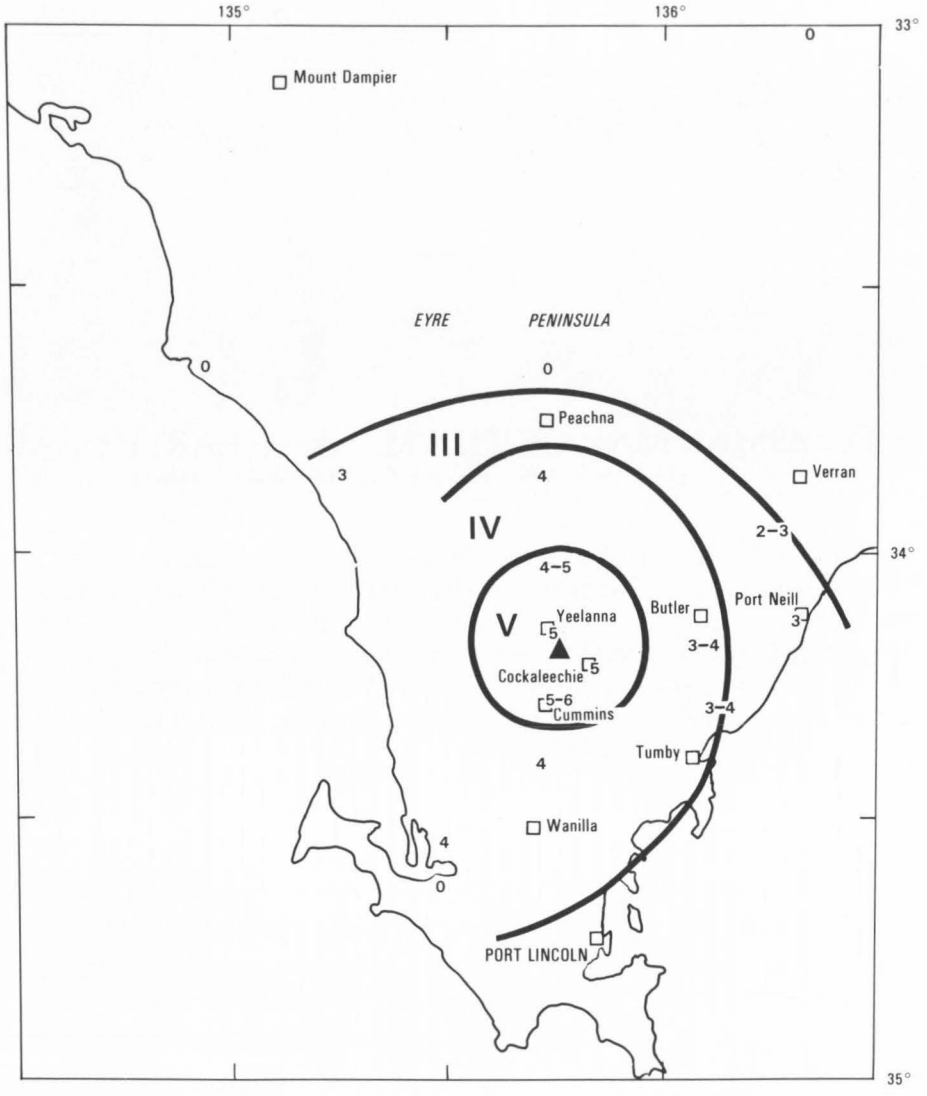


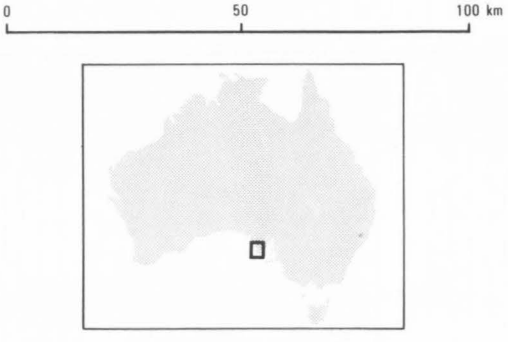
24/153/2

ISOSEISMAL MAP OF THE CUMMINS EARTHQUAKE, SOUTH AUSTRALIA—30 AUGUST 1960

An earthquake of magnitude ML = 4.2 was reported from a number of centres on the Eyre Peninsula at 21:24 UT on 30 August 1960 (6:54 a.m. on 31 August local time). It was followed five hours later by another widely felt tremor. Both were recorded at towns betweeen Tumby Bay, Cummins, Yeelanna, Butler, and Port Lincoln. The township of Cockaleechie, 18 km from Cummins, reported six aftershocks that day and continuous mild tremors throughout the following week. The maximum intensity was assessed as MM V-VI in the Cummins area, where minor plaster-cracking occurred. At Cockaleechie, a chimney was cracked and a pendulum clock was stopped by the main shock.

ISOSEISMAL MAP OF THE CUMMINS EARTHQUAKE, SOUTH AUSTRALIA, 30 AUGUST 1960





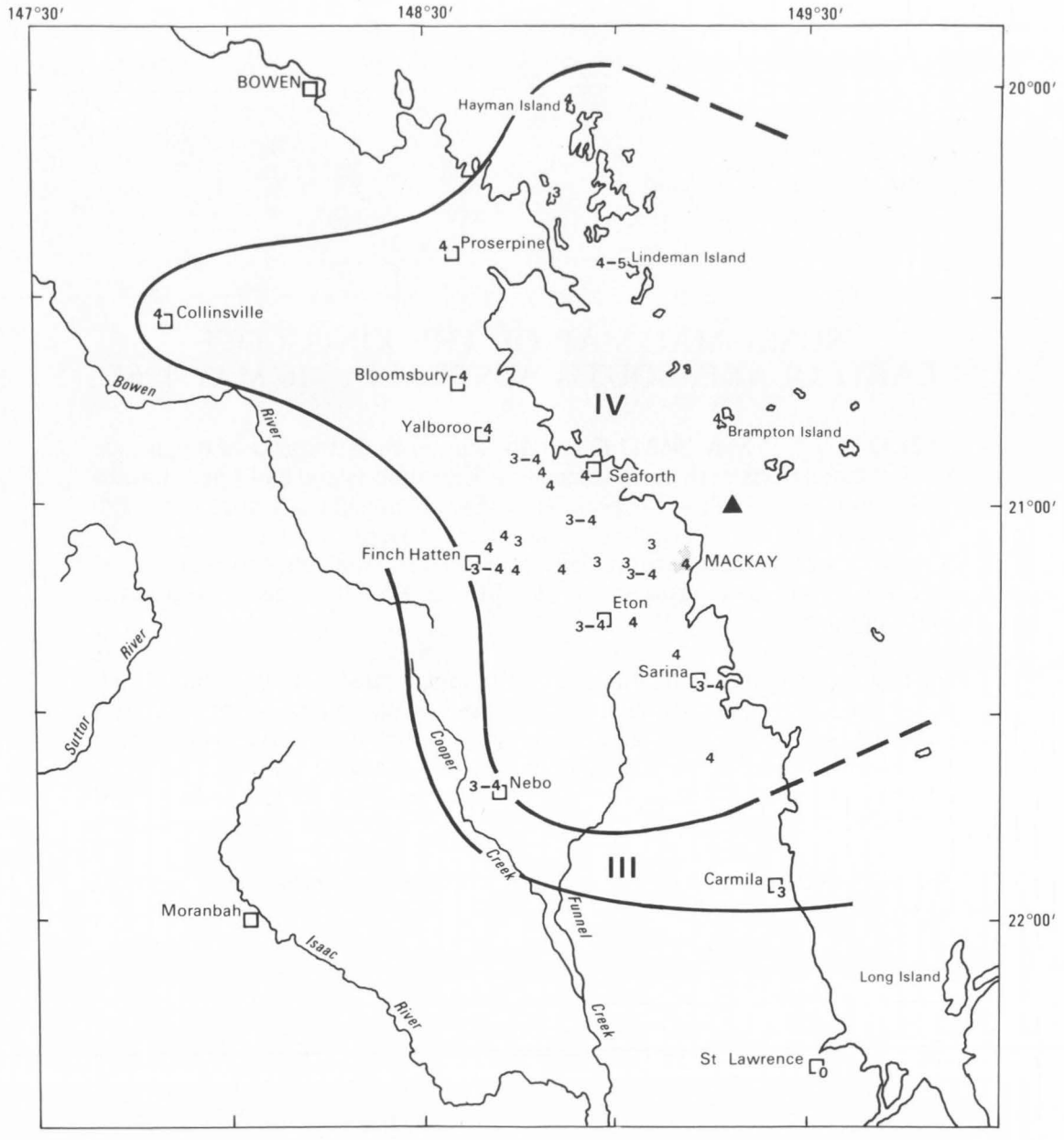
DATE : 30 August 1960
TIME : 21:23:50 UT
MAGNITUDE : 4.2 ML (ADE)
EPICENTRE : 34.2°S 135.75°E
DEPTH :

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

ISOSEISMAL MAP OF THE MACKAY EARTHQUAKE, QUEENSLAND—19 OCTOBER 1960

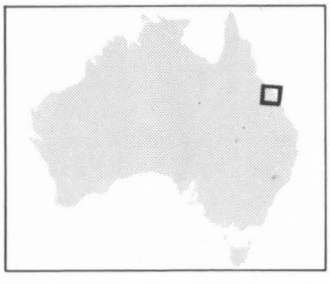
At 11:36 UT on 19 October 1960 (9:36 p.m. local time) an area of about 45 000 km^2 surrounding Mackay experienced the effects of an earthquake. Of 66 earthquake questionnaires returned, only four reported that the event was not noticed. Most reports were assigned intensities of MM IV; the maximum intensity, MM V, was experienced at Lindeman Island. A magnitude ML(I) = 5.0 was calculated from the intensity data. One aftershock, at 12:11 UT on 19 October, was recorded.

ISOSEISMAL MAP OF THE MACKAY EARTHQUAKE, QUEENSLAND, 19 OCTOBER 1960



DATE : 19 OCTOBER 1960
TIME : 11:37:07 UT
MAGNITUDE : 5.0 ML (I), 4.3 ML (CTA)
EPICENTRE : 21.0°S 149.3°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/F55/3

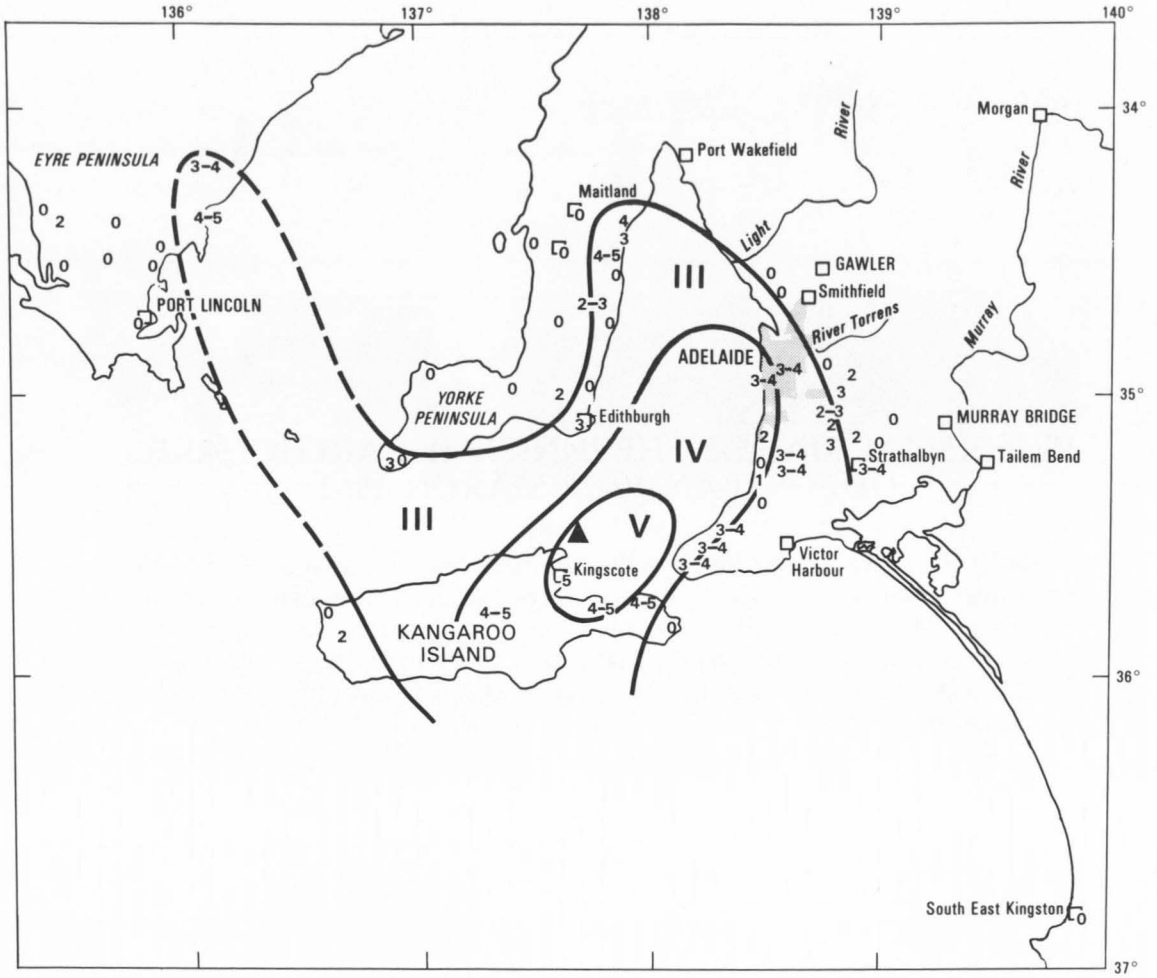
ISOSEISMAL MAP OF THE KINGSCOTE EARTHQUAKE, SOUTH AUSTRALIA—16 MAY 1962

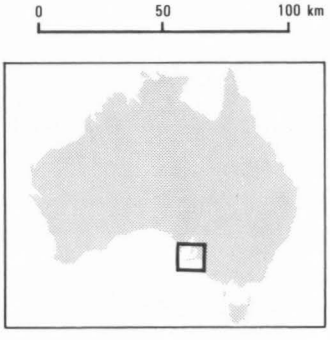
At 21:42 UT on 16 May 1962 (7:12 a.m. local time) an earthquake of magnitude ML 4.4 shook parts of the country areas of Kangaroo Island and some suburbs of Adelaide. It was felt as far away as the Eyre Peninsula at a distance of 190 km from the epicentre. The tremor was felt for periods of two to five seconds. It was the largest local earthquake experienced in Adelaide for many years. One aftershock was recorded on the Mount Bonython seismograph the following day.

No damage was reported, but the earthquake rattled windows and shook houses, swayed lights, vibrated mirrors, and awoke many people. Reports indicated that most people remained calm, but switchboards in country post offices were busy dealing with enquiry calls to Adelaide for about an hour after the earthquake. The tremor was felt most intensely on Kangaroo Island and Yorke Peninsula, where intensities assessed at MM V were reported.

The isoseismal map was constructed from information furnished in 56 returned intensity questionnaires.

ISOSEISMAL MAP OF THE KINGSCOTE EARTHQUAKE, SOUTH AUSTRALIA, 16 MAY 1962





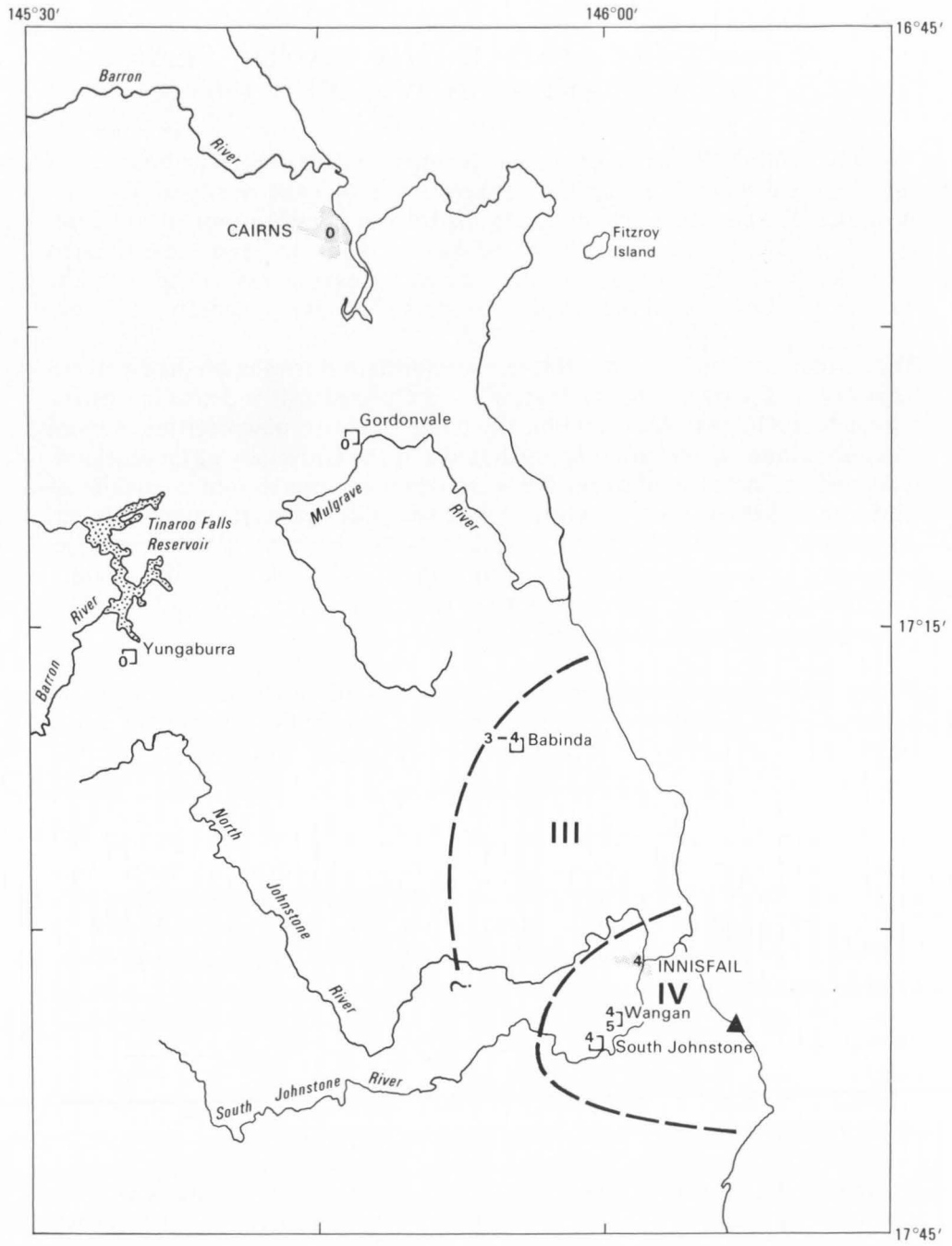
DATE : 16 May 1962
TIME : 21:41:36 UT
MAGNITUDE : 4.4 ML (ADE)
EPICENTRE : 35.51°S 137.66°E
DEPTH : 25 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

ISOSEISMAL MAP OF THE INNISFAIL EARTHQUAKE, QUEENSLAND—28 MARCH 1963

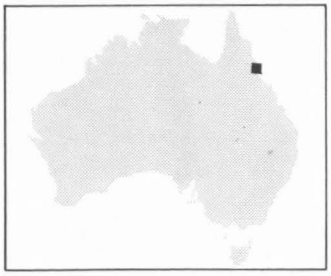
At 04:29 UT on 28 March 1963 (2:29 p.m. local time) an area of about 300 km^2 near Innisfail, north Queensland, experienced the effects of an earthquake. Although reports, primarily from the *Cairns Post* newspaper, were quite sparse, it is interesting to note that people in moving vehicles at Wangan felt the earthquake. A magnitude ML(I) = 3.2 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE INNISFAIL EARTHQUAKE, QUEENSLAND, 28 MARCH 1963



DATE : 28 MARCH 1963
TIME : 04:29:52 UT
MAGNITUDE : 3.2 ML (I)
EPICENTRE : 17.6° S 146.2° E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/E55/6

ISOSEISMAL MAP OF THE BANDA SEA EARTHQUAKE—4 NOVEMBER 1963

'On 4 November 1963, one of the largest intermediate-depth earthquakes of the century occurred in the Banda Sea, some 600 km north of Darwin, Australia. The epicenter determined by the International Seismological Center is 6.94°S, 129.53°E, at the eastern end of the Banda arc, and the estimated focal depth of 108 km indicates that the earthquake is associated with the northward subduction of the Indian-Australian plate taking place in the region.

The earthquake was widely felt throughout northern Australia (in the Northern Territory, and parts of eastern Australia and Queensland) and also in western Papua New Guinea. A geographically comprehensive macroseismic survey, conducted immediately after the earthquake by the University of Queensland, indicated the large extent of the felt region, and gave maximum intensities of MM V in and about Darwin, where typical effects included cracking of plaster, displacement of small objects, and breakage of crockery. At the other extreme, swaying of tall buildings was reported from Perth and Adelaide in the far south of the continent. The isoseismal map was produced from analysis of some 300 questionnaires.' (Hearn & Webb, 1984).

The wide coverage of the intensity data for the 1963 earthquake provides an opportunity to examine the continental-scale distribution of macroseismic effects with reference to the broad geological structure of Australia. This analysis was carried out by Hearn & Webb (1984).

Very large earthquakes from the Sunda Arc/Banda Sea region are often felt over the Australian continent. In 1974, a Banda Sea earthquake of similar focal depth was felt throughout the north of Western Australia and the Northern Territory (Everingham & others, 1982), and in 1977 a shallow earthquake in the Sunda Arc was felt throughout most of Western Australia, including Albany on the south coast (Gregson & others, 1979).

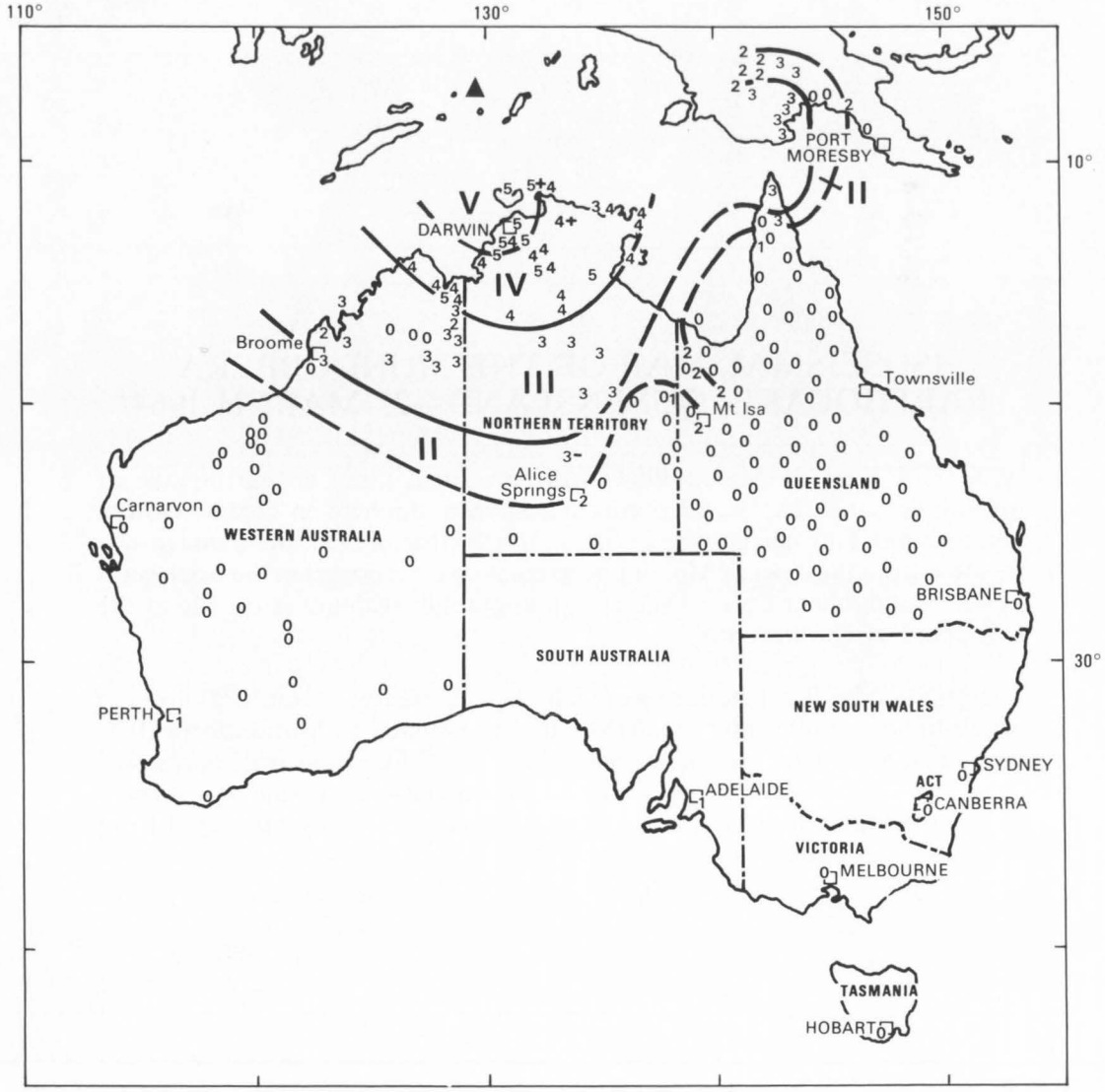
References

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

GREGSON, P. J., PAULL, E. P., & GAULL, B. A., 1979—The effects in Western Australia of a major earthquake in Indonesia on 19 August 1977. *BMR Journal of Australian Geology & Geophysics*, 4, 135–140.

HEARN, S. J., & WEBB, J. P., 1984—Continental-scale felt effects of the large Banda Sea earthquake of 4 November 1963. *Bulletin of the Seismological Society of America*, 74(1), 349–351.

ISOSEISMAL MAP OF THE BANDA SEA EARTHQUAKE, 4 NOVEMBER 1963



DATE : 4 NOVEMBER 1963
TIME : 01:17:13 UTC
MAGNITUDE : 7.8 MB
EPICENTRE : 6.9°S 129.5°E
DEPTH : 108 km

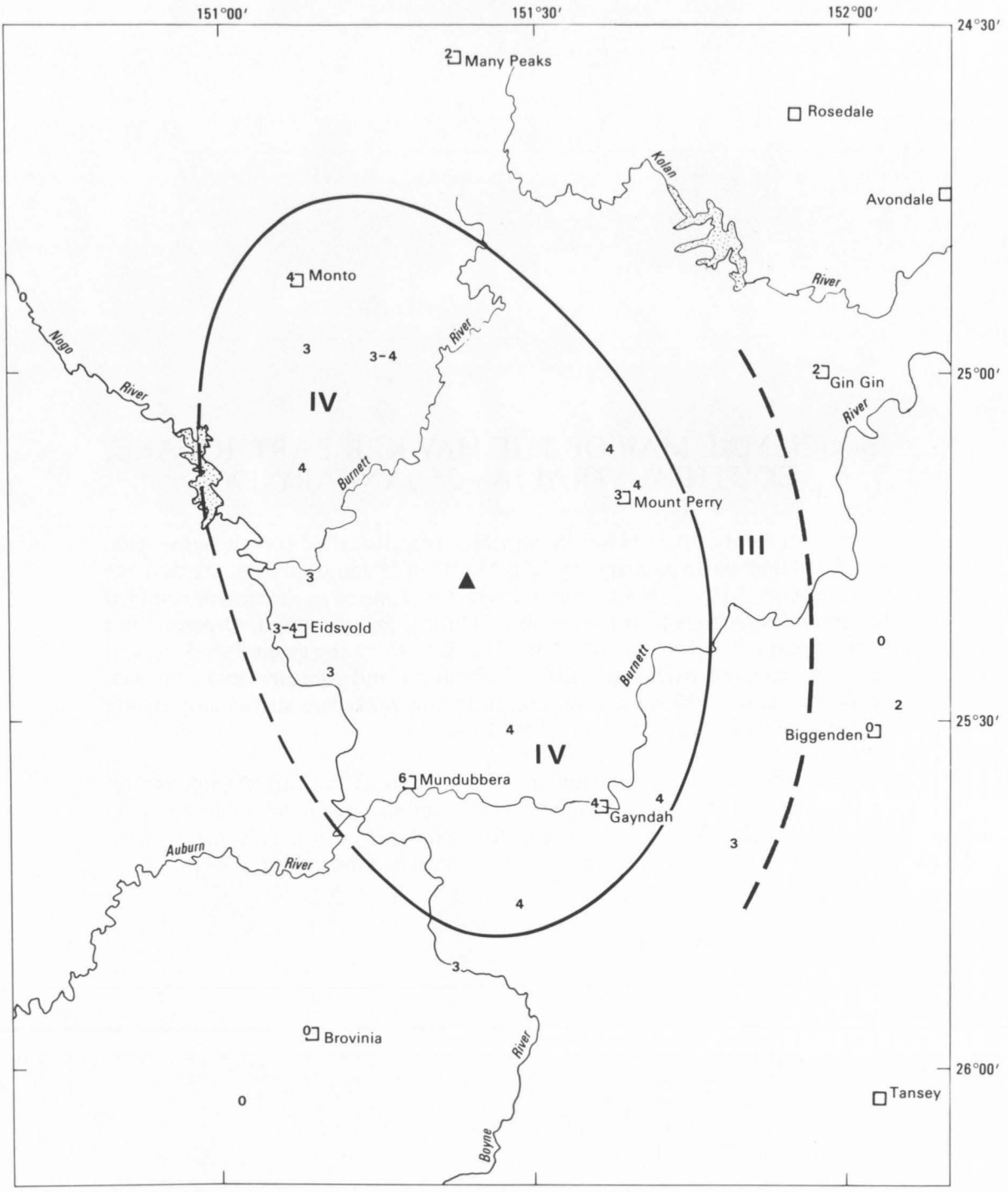
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

ISOSEISMAL MAP OF THE MUNDUBBERA EARTHQUAKE, QUEENSLAND—25 MARCH 1964

At 06:15 UT on 25 March 1964 (4:15 p.m. local time) an earthquake of magnitude ML(CTA) = 4.1 occurred near Mundubbera in central eastern Queensland. This earthquake is of interest in that significant damage was reported from the town of Mundubbera: cracks were reported in the brick walls of the Mundubbera Butter Factory (photographic evidence is on file at the University of Queensland).

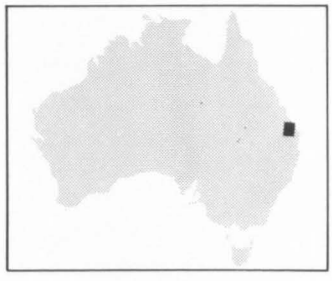
The effects of this earthquake were felt over an area of about 9500 km^2, in which the maximum intensity, MM VI, was assigned to Mundubbera. It is interesting to note that the area enclosed by the MM IV isoseismal accounted for a large proportion of the felt area. Of 60 earthquake questionnaires returned, 50 recorded the felt effects. A magnitude ML(I) = 4.5 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE MUNDUBBERA EARTHQUAKE, QUEENSLAND, 25 MARCH 1964



DATE : 25 MARCH 1964
TIME : 06:14:38 UT
MAGNITUDE : 4.5 ML(I), 4.1 ML(CTA)
EPICENTRE : 25.3°S 151.4°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



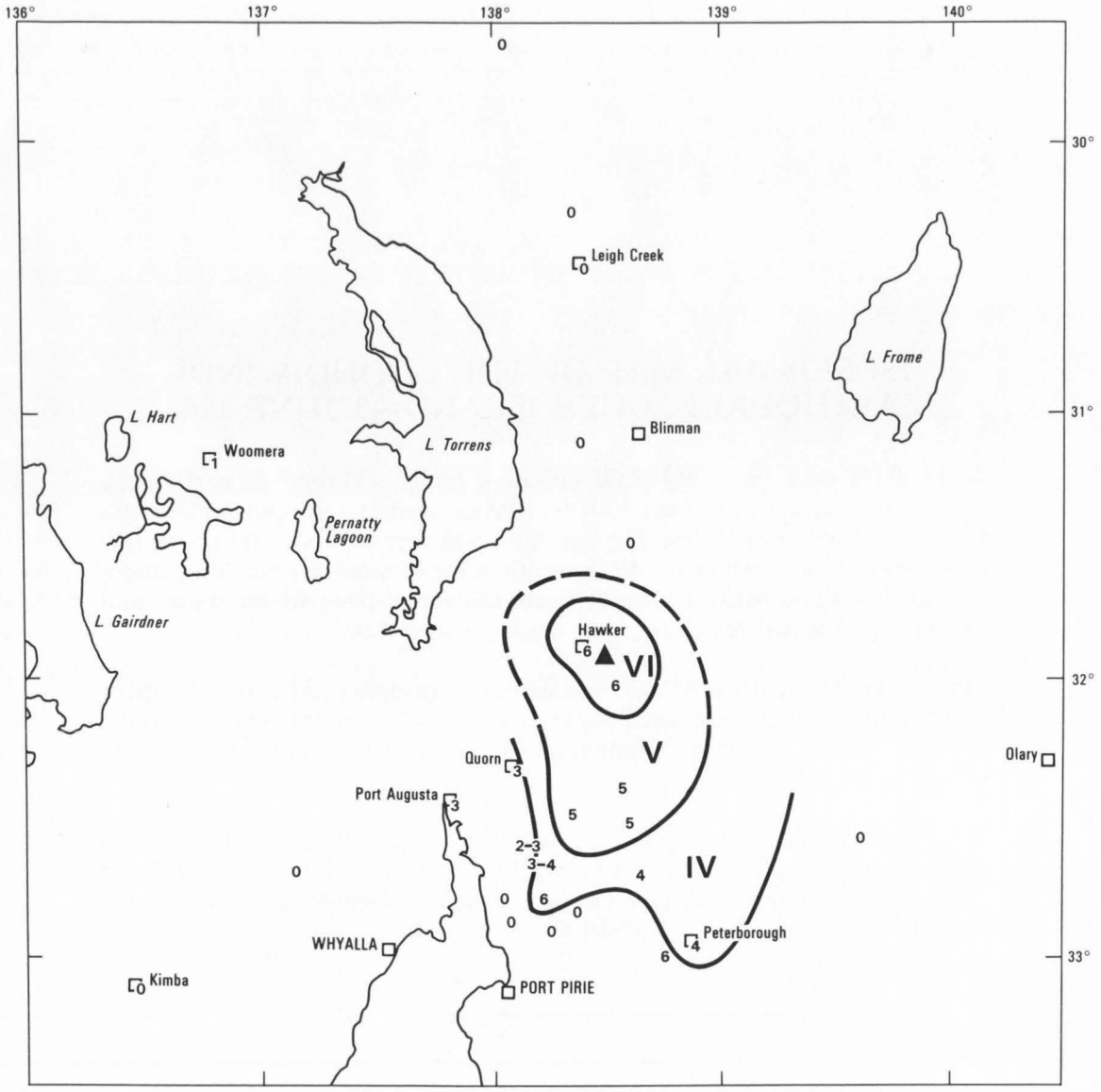
24/G56/8

ISOSEISMAL MAP OF THE HAWKER EARTHQUAKE, SOUTH AUSTRALIA—25 JANUARY 1965

Several northern centres of South Australia were disturbed shortly before 6:00 a.m. local time on 26 January 1965 (20:23 UT on 25 January) by an earthquake that registered ML 4.6. No serious damage was reported as the tremor rumbled for about 20 seconds near the towns of Quorn, Peterborough, Orroroo, and Port Augusta. The worst affected was Hawker, where the ground shaking was sufficient to open cracks in walls and chimneys and overturn small objects. At Port Augusta, 90 km from the epicentre, the quake was sufficiently strong to rattle windows and cause crockery to rattle.

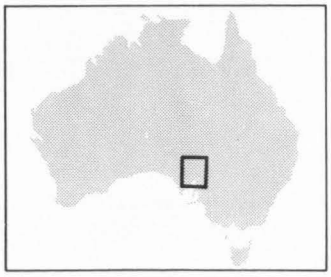
Thirty-seven isoseismal questionnaires were returned and used to construct the accompanying map. Unfortunately it was not possible to define the contours adequately below MM IV because of the remoteness of the epicentral region and the time of the occurrence of the shock, when most people were asleep.

ISOSEISMAL MAP OF THE HAWKER EARTHQUAKE, SOUTH AUSTRALIA, 25 JANUARY 1965



DATE : 25 January 1965
TIME : 20:22:54 UT
MAGNITUDE : 4.6 ML (ADE)
EPICENTRE : 31.93°S 138.50°E
DEPTH : 0 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/SA/9

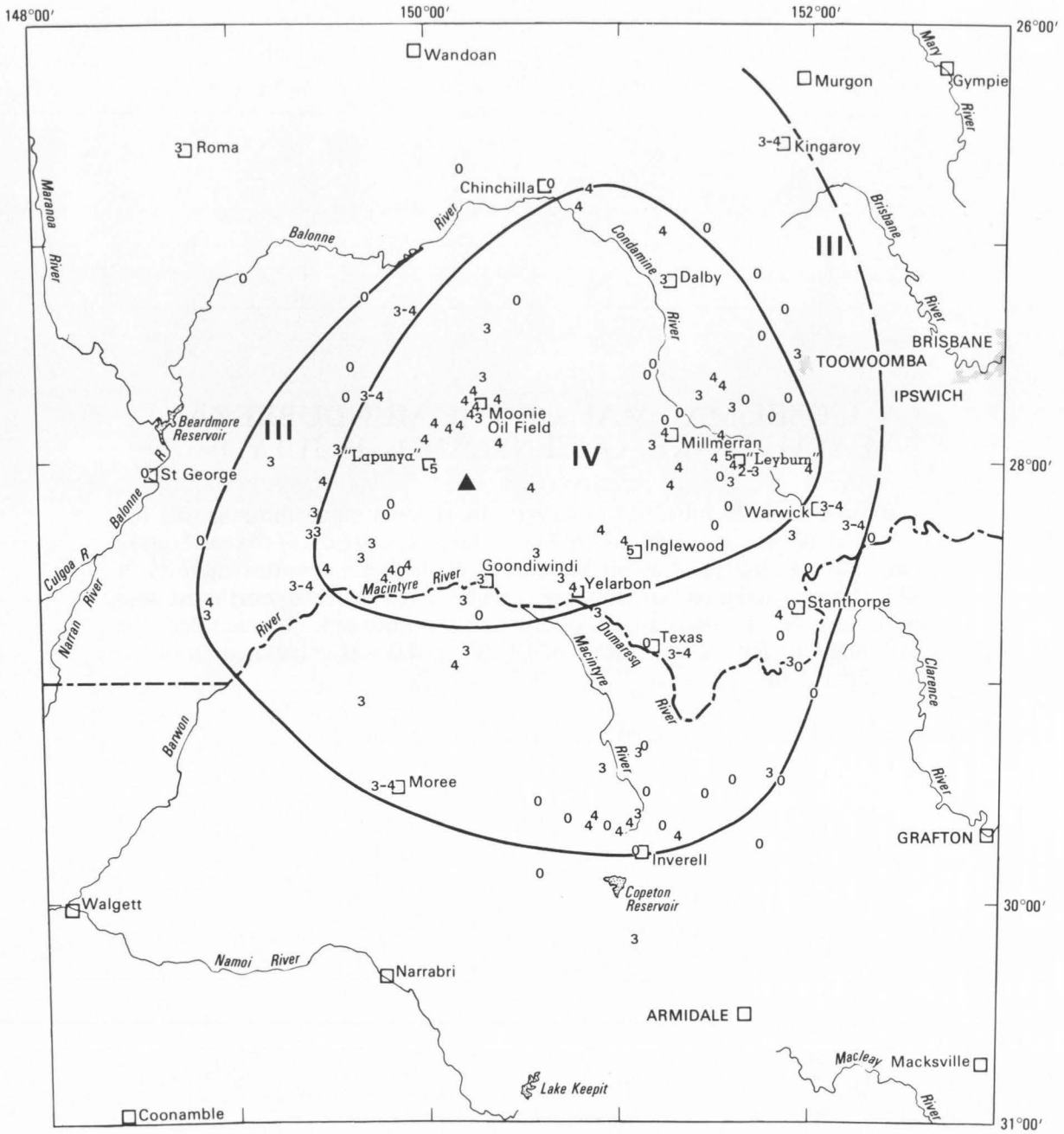
ISOSEISMAL MAP OF THE GOONDIWINDI EARTHQUAKE, QUEENSLAND—3 JUNE 1965

At 22:00 UT on 3 June 1965 (8:00 a.m. on 4 June, local time) an earthquake was felt over an area of about 100 000 km^2 in southeastern Queensland and northern New South Wales. The epicentre was located about 60 km north-northwest of Goondiwindi and 40 km south of the Moonie oil field. Magnitudes of MB = 4.4 and ML(CTA) = 5.3 were calculated from seismograms, and ML(I) = 5.3 was determined from the isoseismal data.

The maximum intensity, MM V, was assigned to Inglewood and to Leyburn and Lapunya homesteads, where many articles on shelves were knocked to the floor. Of 185 earthquake questionnaires, 63 reported having not felt any effects of the earthquake.

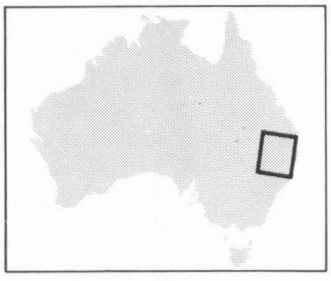
Two probable foreshocks were reported from several residents at Yelarbon (between 10:00 and 11:00 p.m. on 3 June, local time) and at Leyburn (at about 7:45 a.m. on 4 June, local time). One aftershock at about 9:00 a.m. on 4 June 1965 was felt in the Leyburn district.

ISOSEISMAL MAP OF THE GOONDIWINDI EARTHQUAKE, QUEENSLAND, 3 JUNE 1965



DATE : 3 JUNE 1965
TIME : 21:59:56·9 UT
MAGNITUDE : 5.3 ML (CTA), 4·4 MB, 5·3 ML (I)
EPICENTRE : 28·08°S 150·22°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



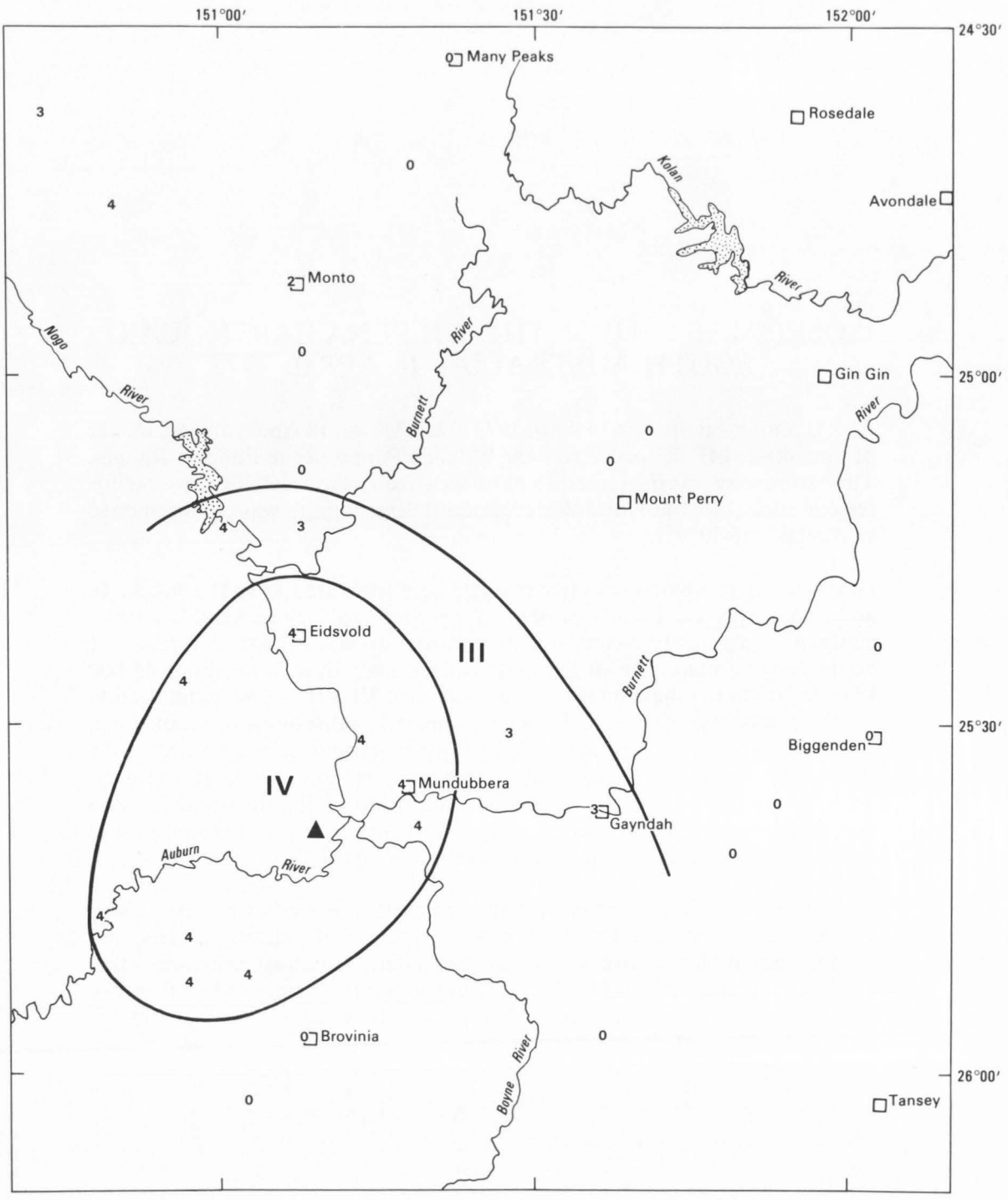
24/Q/8

ISOSEISMAL MAP OF THE MUNDUBBERA EARTHQUAKE, QUEENSLAND—18 JULY 1967

At 07:48 UT on 18 July 1967 (5:48 p.m. local time) an earthquake was felt near Mundubbera in central eastern Queensland. The effects of the earthquake were felt over an area of about 4000 km^2, in which a maximum intensity of MM IV was assigned to Mundubbera and places to the northwest and southwest. Of 54 earthquake questionnaires returned, 31 recorded the earthquake as felt. A magnitude of ML(I) = 4.0 was calculated from the isoseismal data.

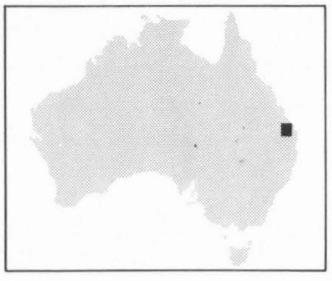
One aftershock was recorded at 07:57 UT on 18 July 1967.

ISOSEISMAL MAP OF THE MUNDUBBERA EARTHQUAKE, QUEENSLAND, 18 JULY 1967



DATE : 18 JULY 1967
TIME : 07:48:04 UT
MAGNITUDE : 4.0 ML (I)
EPICENTRE : 25.65°S 151.15°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/G56/9

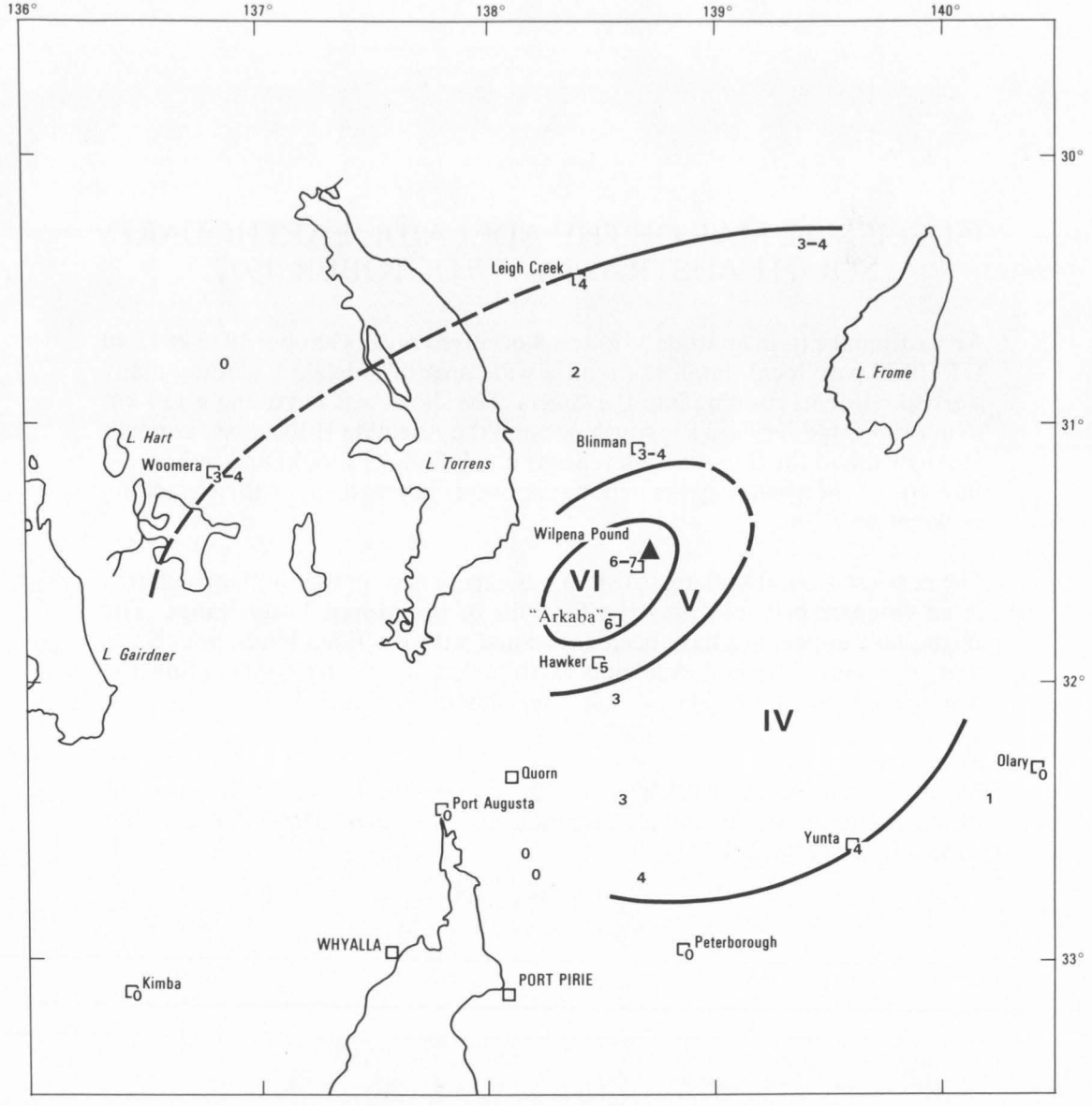
ISOSEISMAL MAP OF THE WILPENA EARTHQUAKE, SOUTH AUSTRALIA—18 APRIL 1972

At 7:51 a.m. local time on 19 April 1972 (22:21 UT on 18 April) an earthquake of magnitude ML 5.3 occurred near Wilpena Pound in the Flinders Ranges. The earthquake was the largest to have occurred in the Adelaide Geosyncline seismic zone since the World-Wide Standard Seismograph was commissioned at Adelaide in 1959.

Isoseismal questionnaires were circulated to a wide area after the shock. In addition, inspection reports of damage were received from several insurance companies investigating claims. This information was used to construct the accompanying map. The earthquake was felt over an area of about 45 000 km^2, in which the maximum intensity was MM VI–VII. At Wilpena Station the shock was so severe that rocks weighing more than one tonne were dislodged, and crashed down the mountainside of Wilpena Pound, causing a fire on the side of the range. At Arkaba and Wilpena homesteads, cracks in the walls appeared at right-angles to the apparent direction of the disturbance; trees and bushes were strongly shaken; plaster was shaken from the ceilings; and small objects bounced from side to side in cupboards.

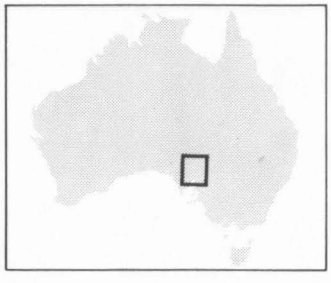
At Hawker, residents reported two disturbances, the second rather violent. Cracking occurred in several buildings constructed of concrete blocks, and several areas of plaster were moved. Some dwellings sustained numerous small cracks in the plasterwork in all rooms, as though the house had shaken like jelly. Damage in Hawker appeared to occur along a lineament across the southeast corner of the township.

ISOSEISMAL MAP OF THE WILPENA EARTHQUAKE, SOUTH AUSTRALIA, 18 APRIL 1972



DATE : 18 April 1972
TIME : 22:20:40 UT
MAGNITUDE : 5.3 ML (ADE)
EPICENTRE : 31.58°S 138.62°E
DEPTH : 11.9 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/SA/10

ISOSEISMAL MAP OF THE ADELAIDE EARTHQUAKE, SOUTH AUSTRALIA—17 OCTOBER 1972

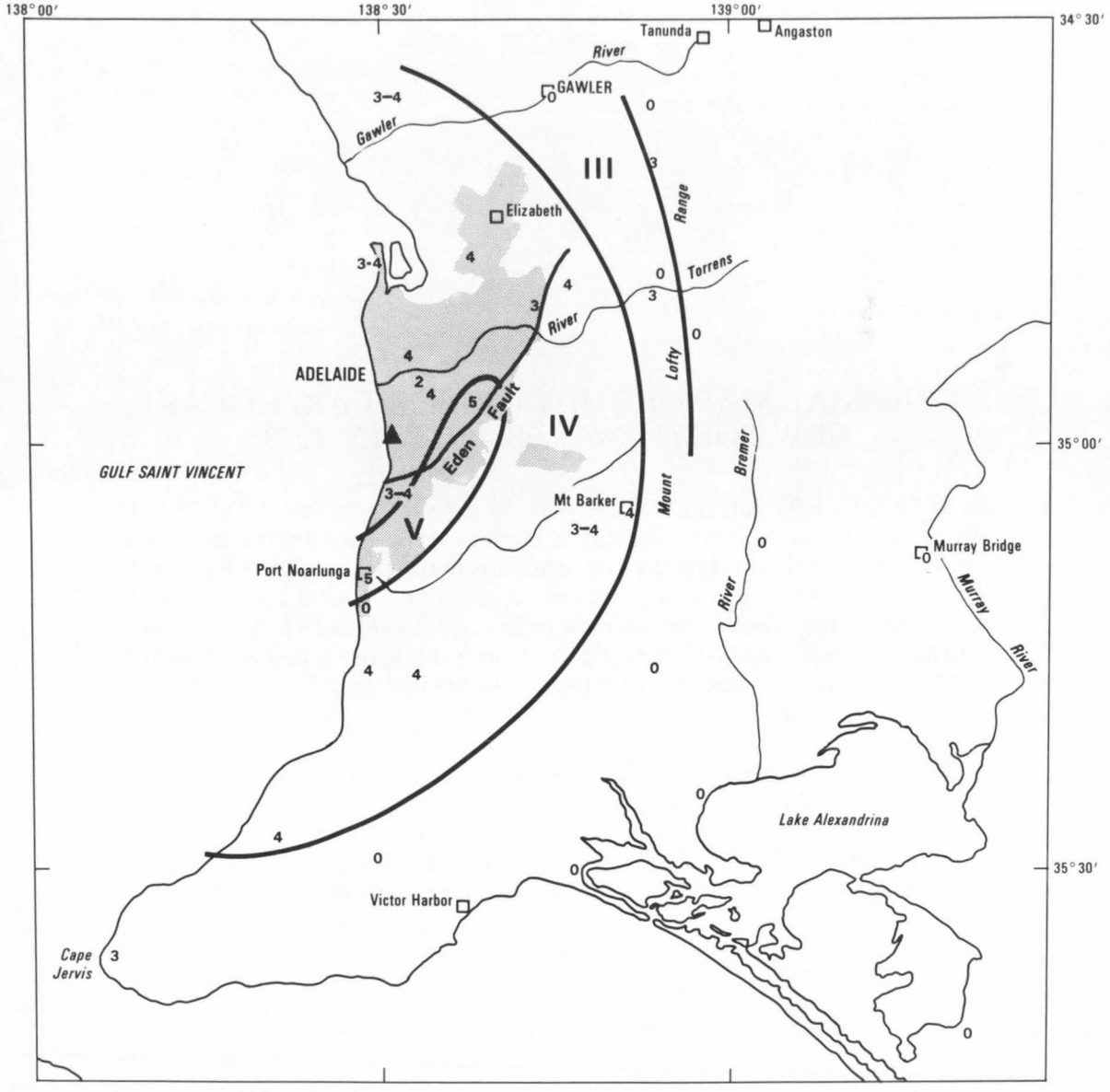
An earthquake of magnitude ML = 3.4 occurred on 17 October 1972 at 12:40 UT (10:10 p.m. local time). It shook a wide area of Adelaide, sending many startled residents running into the streets. The shock was felt along a 150-km strip from Cape Jervis in the south, around the Adelaide Hills, to as far north as Angaston in the Barossa Valley. Some city buildings shook, and police and Bureau of Meteorology switchboards were jammed by callers seeking explanation.

The heaviest ground shaking (MM V) was experienced in the southern suburbs in an elongate belt following the foothills of the Mount Lofty Range. The earthquake appears to have been associated with the Eden Fault, which has been the site of several Adelaide earthquakes in the past—including the damaging 1954 shock (ML = 5.4; Everingham & others, 1982).

Reference

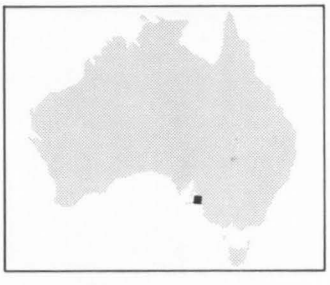
EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

ISOSEISMAL MAP OF THE ADELAIDE EARTHQUAKE, SOUTH AUSTRALIA, 17 OCTOBER 1972



DATE : 17 October 1972
TIME : 12:40:07 UT
MAGNITUDE : 3.4 ML (ADE)
EPICENTRE : 35.00°S 138.51°E
DEPTH : 6 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/154/7

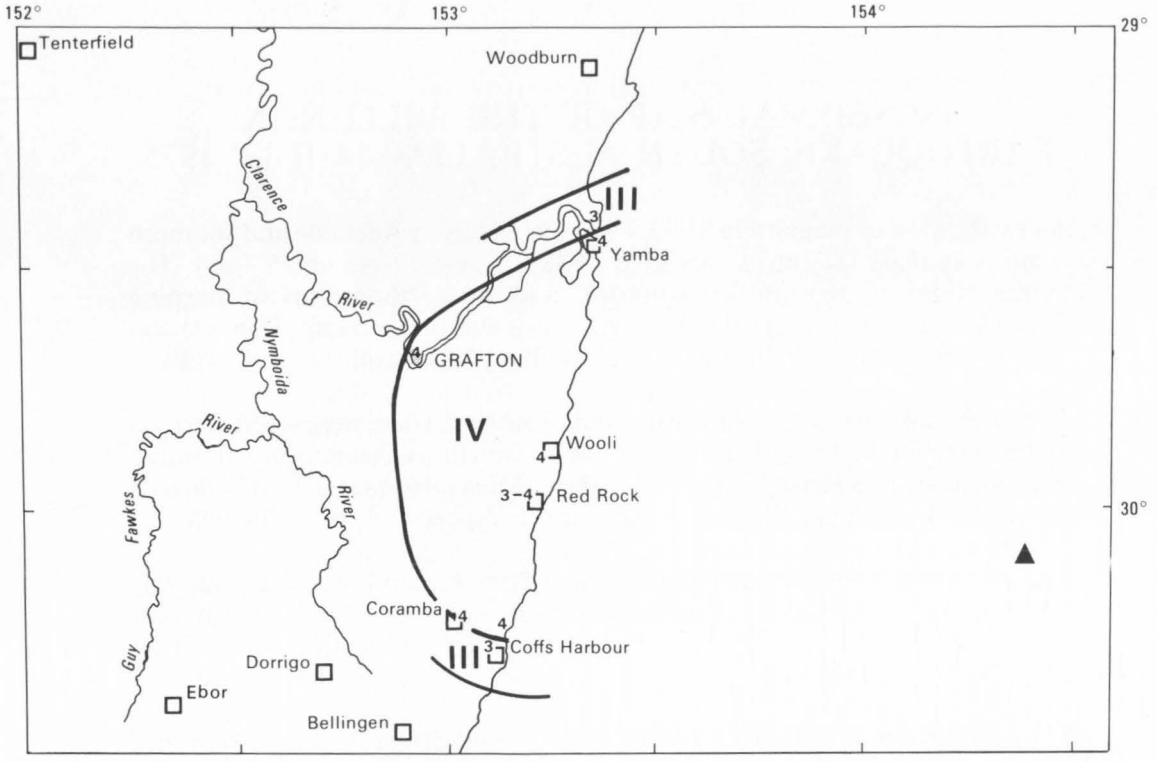
ISOSEISMAL MAP OF THE DORRIGO EARTHQUAKE, NEW SOUTH WALES—29 JULY 1973

At 13:58 UT on 29 July 1973 (11:58 p.m. local time) the central New South Wales coast between Yamba and Coffs Harbour experienced the effects of a small earthquake. From eighteen witness reports in the *Grafton Daily Examiner*, it was determined that the affected area covered about 4000 km^2, in which the Wooli district experienced the most intense effects (MM IV). A magnitude ML(RIV) 4.5 was calculated from the Riverview seismograms, and a magnitude of ML(I) = 4.1 was determined from the isoseismal data.

Reference

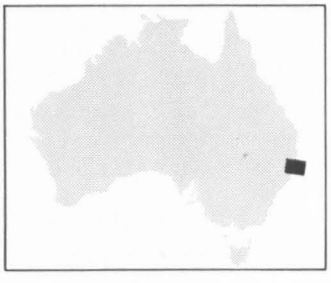
RYNN, J. M. W., & LYNAM, C. T., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanhope-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book,* 30–42.

ISOSEISMAL MAP OF THE DORRIGO EARTHQUAKE, NEW SOUTH WALES, 29 JULY 1973



DATE : 29 JULY 1973
TIME : 13:58:03.5 UT
MAGNITUDE : 4.5 ML (RIV) 4.1 ML (I)
EPICENTRE : 30.09°S 154.37°E
DEPTH : 10 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H56/3

ISOSEISMAL MAP OF THE WILLUNGA EARTHQUAKE, SOUTH AUSTRALIA—14 JULY 1975

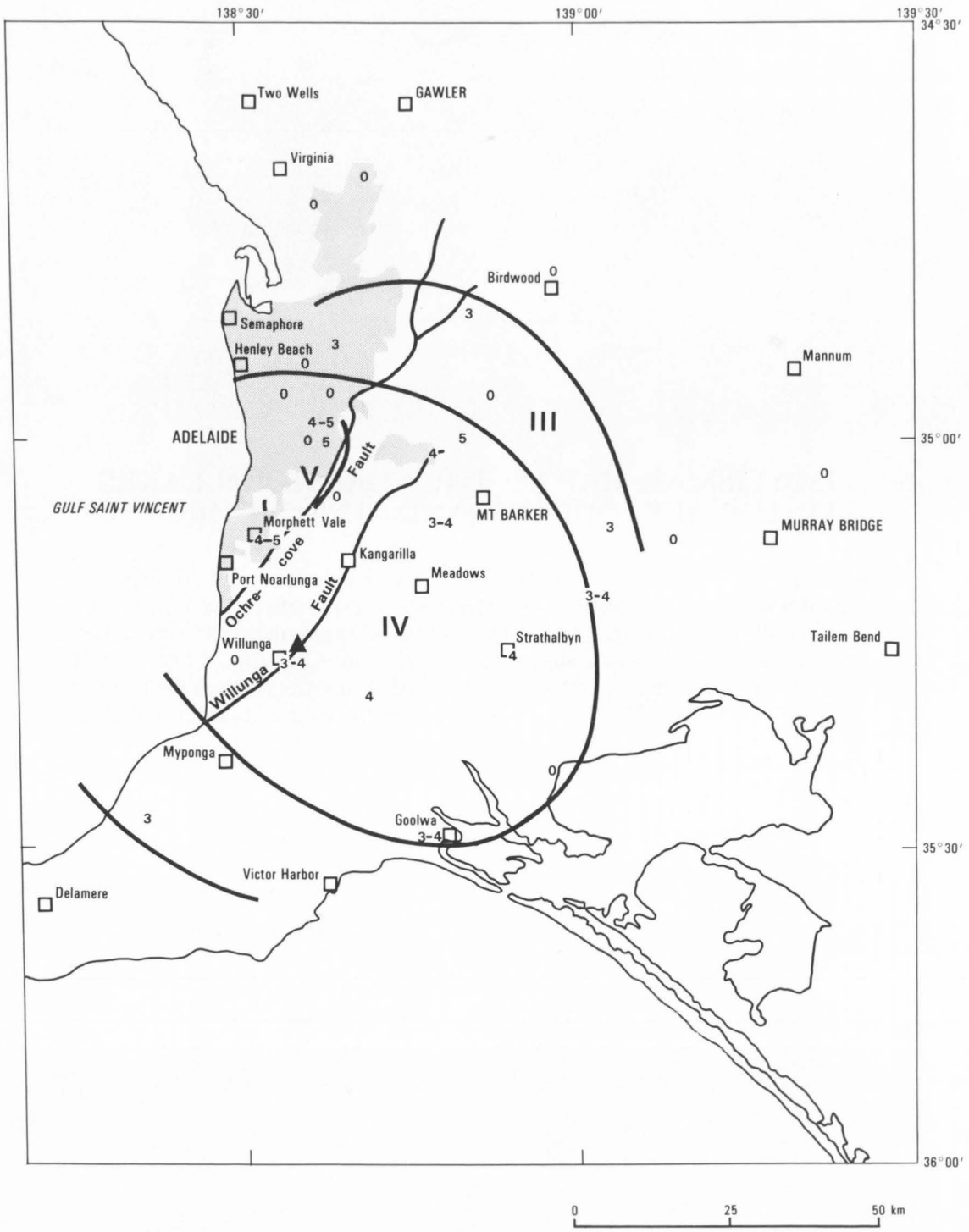
An earthquake of magnitude ML 3.4 was felt widely in Adelaide and southern suburbs at 18:02 UT on 14 July 1975 (3:32 a.m. local time on 15 July). The tremor shook houses, rattled windows, and awoke thousands of sleeping families. Many people reported feeling a sharp and severe bump. Damage was only minor, such as slight cracking of ceiling plaster and masonry walls.

The earthquake was felt at Kangarilla and Meadows. There were several reports of the earthquake being heard or felt as far north as Semaphore, although other areas such as Henley Beach felt nothing. Most areas northeast of Adelaide did not feel anything. The southernmost felt report was from Goolwa.

Reports indicated that the felt duration lasted from three to 20 seconds. Flagstaff Hill and Morphett Vale experienced the highest intensities (MM V). Many were frightened, and likened the earthquake sound to rolling thunder with an ominous thud at the end.

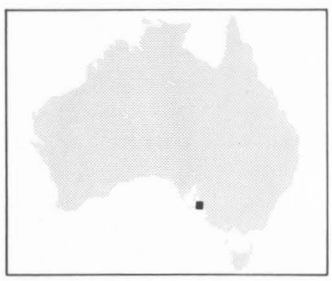
The isoseismal map indicates a possible association with the Ochre–Cove Fault. However, the instrumental epicentre is displaced 55 km to the south, and lies close to the Willunga Fault.

ISOSEISMAL MAP OF THE WILLUNGA EARTHQUAKE, SOUTH AUSTRALIA, 14 JULY 1975



DATE : 14 July 1975
TIME : 18:02:22.9 UT
MAGNITUDE : 3.4 ML (ADE)
EPICENTRE : 35.25°S 138.58°E
DEPTH : 24 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

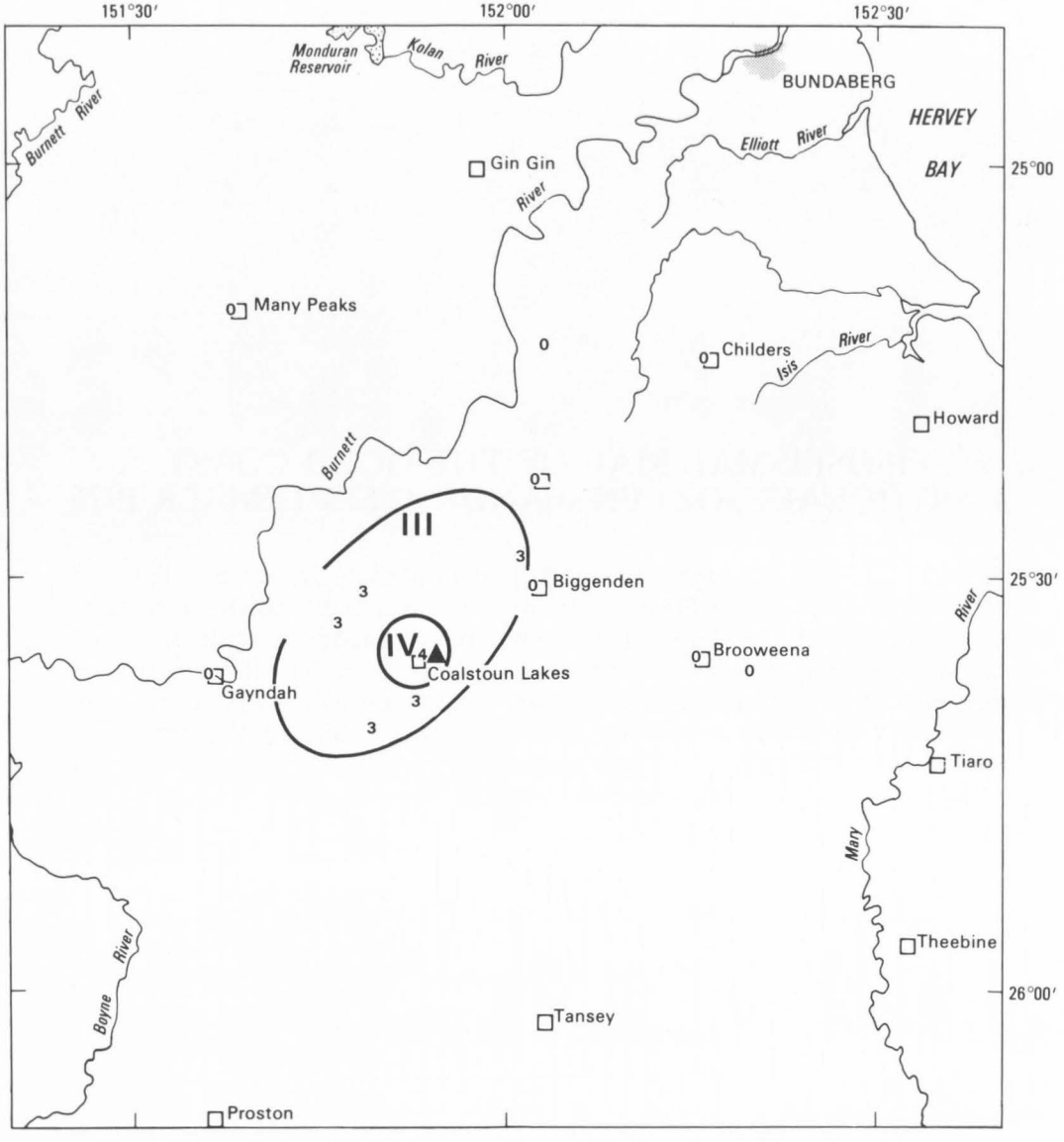


24/154/8

ISOSEISMAL MAP OF THE COALSTOUN LAKES EARTHQUAKE, QUEENSLAND—12 NOVEMBER 1975

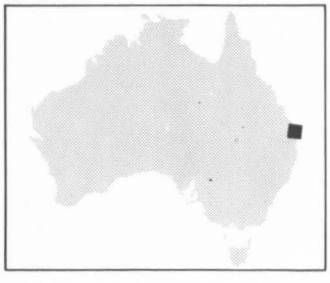
At 10:30 UT on 12 November 1975 (8:30 p.m. local time) a small area near Coalstoun Lakes in central eastern Queensland experienced the effects of a small earthquake. The area affected was about 800 km^2, in which a maximum intensity of MM IV was assigned to reports from Coalstoun Lakes. Of 31 earthquake questionnaires returned, 14 recorded that the earthquake was not felt. A magnitude of ML(I) = 3.2 was determined from the isoseismal data.

ISOSEISMAL MAP OF THE COALSTOUN LAKES EARTHQUAKE, QUEENSLAND, 12 NOVEMBER 1975



DATE : 12 NOVEMBER 1975
TIME : 10:29:47 UT
MAGNITUDE : 3.2 ML (I)
EPICENTRE : 25.6°S 151.9°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

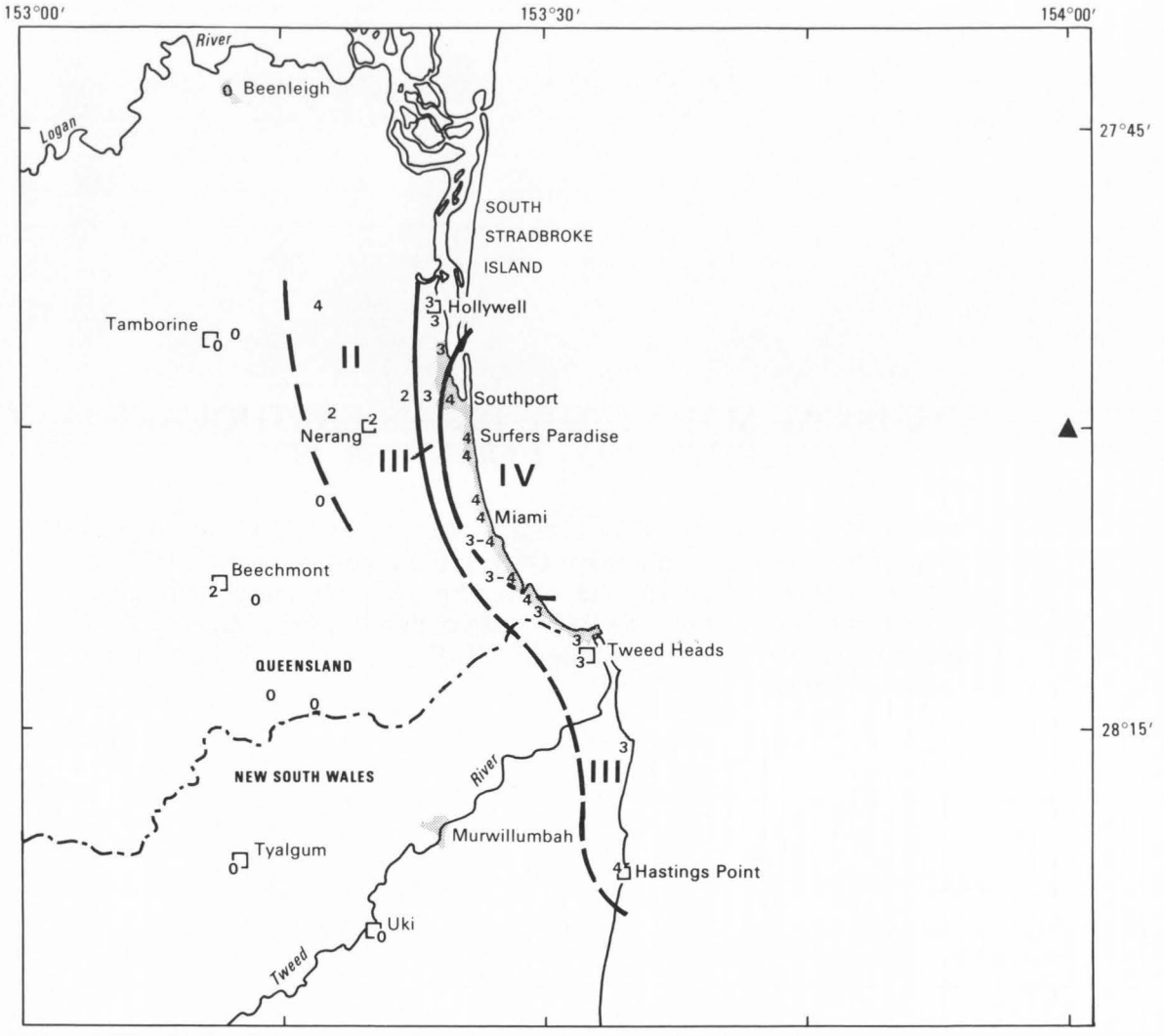


24/G56-6/1

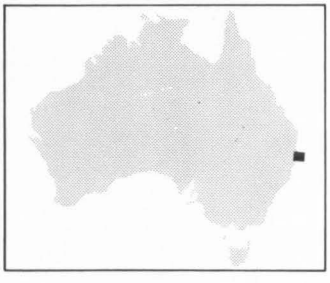
ISOSEISMAL MAP OF THE GOLD COAST EARTHQUAKE, QUEENSLAND—22 SEPTEMBER 1976

At 04:33 UT on 22 September 1976 (2:33 p.m. local time) the entire Gold Coast strip from Hollywell to Hastings Point, and around the town of Nerang, experienced the effects of an earthquake which originated beneath the sea about 60 km off Surfers Paradise. The affected area was about 300 km^2. Felt reports describing the most intense effects, assigned an intensity MM IV, came from the area between Southport and Miami in the middle of the region. A magnitude ML(COO) = 3.4 was calculated from the Cooney Observatory seismogram, and the isoseismal data yielded an approximate magnitude ML(I) = 3.8.

ISOSEISMAL MAP OF THE GOLD COAST EARTHQUAKE, QUEENSLAND, 22 SEPTEMBER 1976



0 20 km



DATE : 22 SEPTEMBER 1976
TIME : 04:33:09 UT
MAGNITUDE : 3.4 ML (COO), 3.8 ML (I)
EPICENTRE : 28.0°S 154.0°E
DEPTH : Crustal

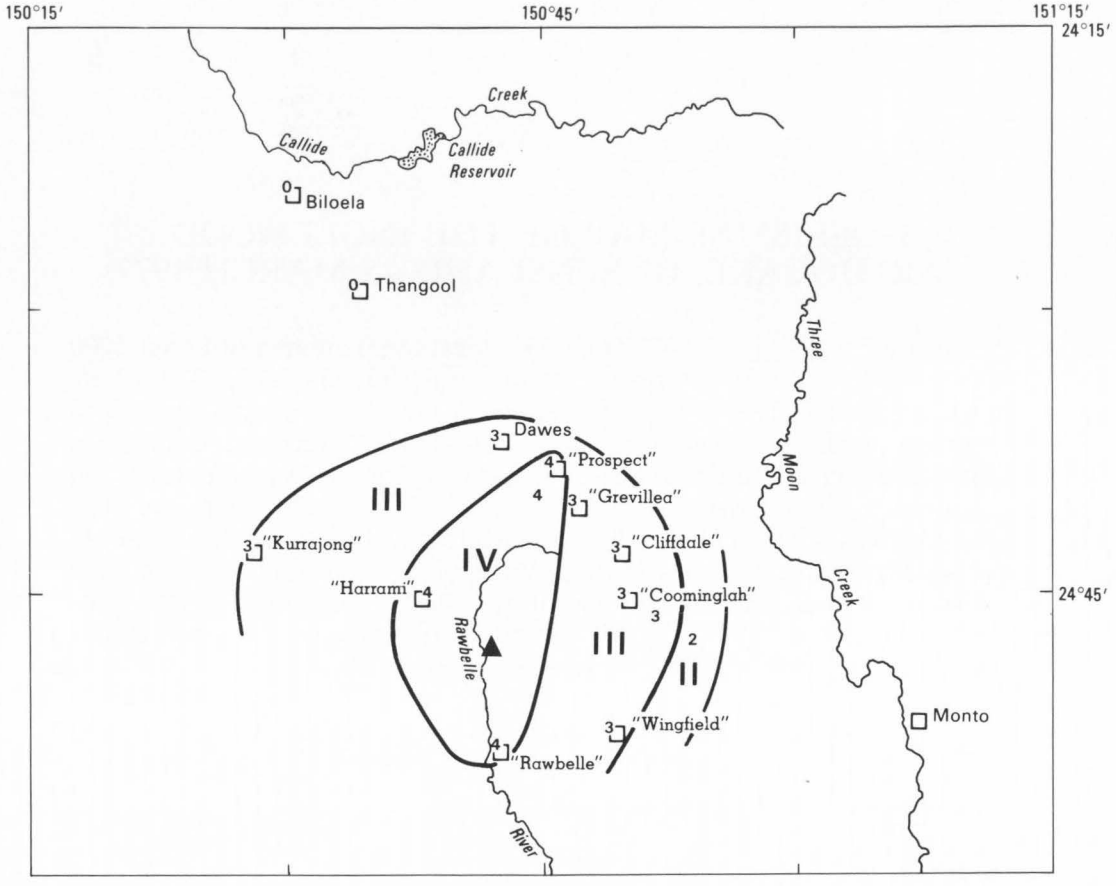
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/G56-15/1

ISOSEISMAL MAP OF THE DAWES EARTHQUAKE, QUEENSLAND—1 OCTOBER 1976

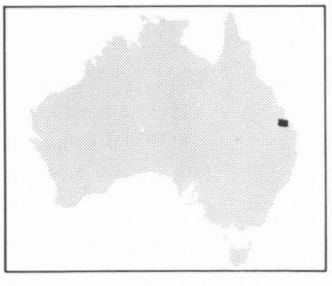
At 00:47 UT on 1 October 1976 (10:47 a.m. local time) a 1200-km^2 area to the west of Monto in central eastern Queensland experienced the effects of a small earthquake. Felt reports were received from 12 farm-houses in the area, in which a maximum intensity of MM IV was assigned to several places between Rawbelle and Prospect. A magnitude of ML(I) = 3.2 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE DAWES EARTHQUAKE, QUEENSLAND, 1 OCTOBER 1976



DATE : 1 OCTOBER 1976
TIME : 00:46:40 UT
MAGNITUDE : 3.2 ML (I)
EPICENTRE : 24.8° S 150.7° E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

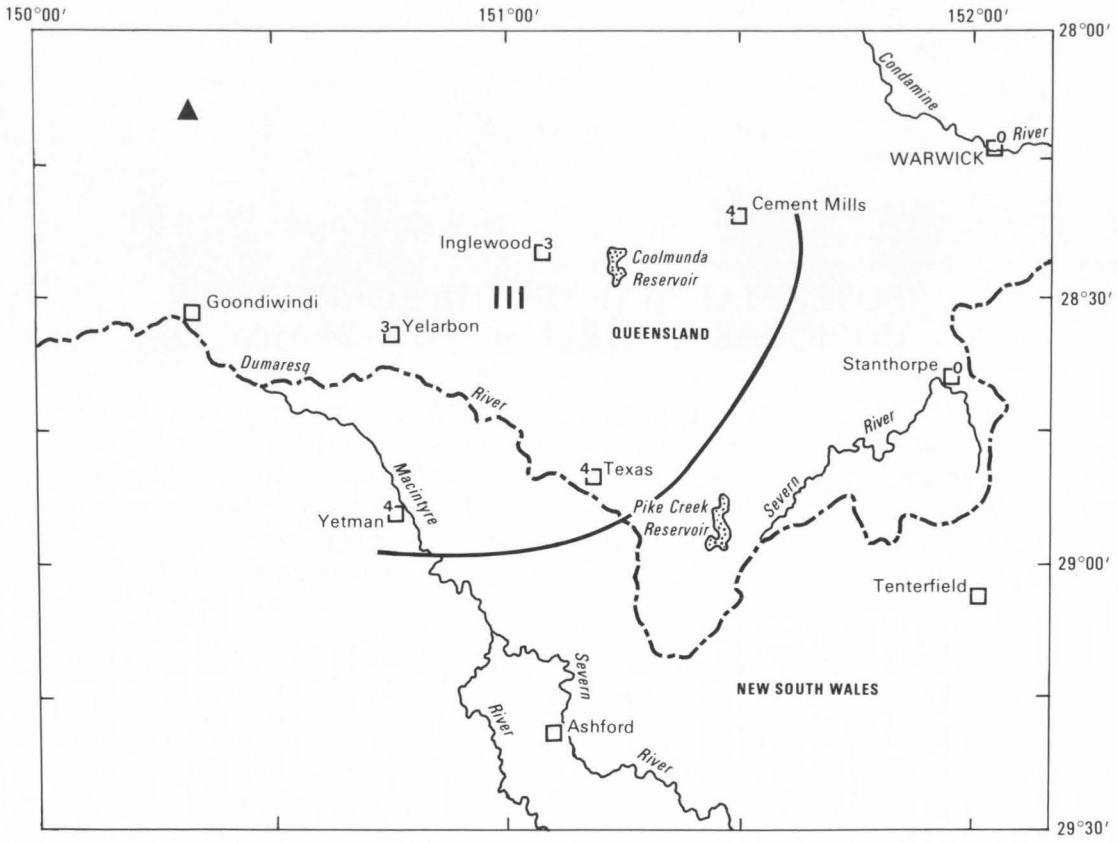


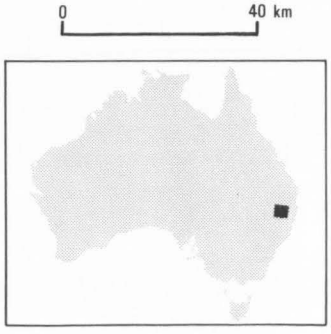
24/G56-1/2

ISOSEISMAL MAP OF THE INGLEWOOD EARTHQUAKE, QUEENSLAND—5 MARCH 1977

At 06:04 UT on 5 March 1977 (4:04 p.m. local time) an area of about 5000 km^2 southwest of Warwick in southern Queensland experienced the effects of an earthquake. The maximum intensity of MM IV was assigned to three sites in the area. The epicentre was located by the International Seismological Centre using eight Australian seismographic stations; it was about 100 km northwest of the isoseismal zone, but the solution is well constrained. The epicentral location is similar to that obtained for the 3 June 1965 Goondiwindi earthquake (loc. cit.). The poor coverage of the questionnaires and the sparseness of the population precluded the preparation of a complete isoseismal map. A magnitude of ML = 4.5 was adopted, based on the seismograms obtained from BMR's eastern Australian network.

ISOSEISMAL MAP OF THE INGLEWOOD EARTHQUAKE, QUEENSLAND, 5 MARCH 1977





DATE : 5 MARCH 1977
TIME : 06:04:11 UT
MAGNITUDE : 4.5 ML (BMR)
EPICENTRE : 28.14°S 150.35°E
DEPTH : 33 km (R)

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

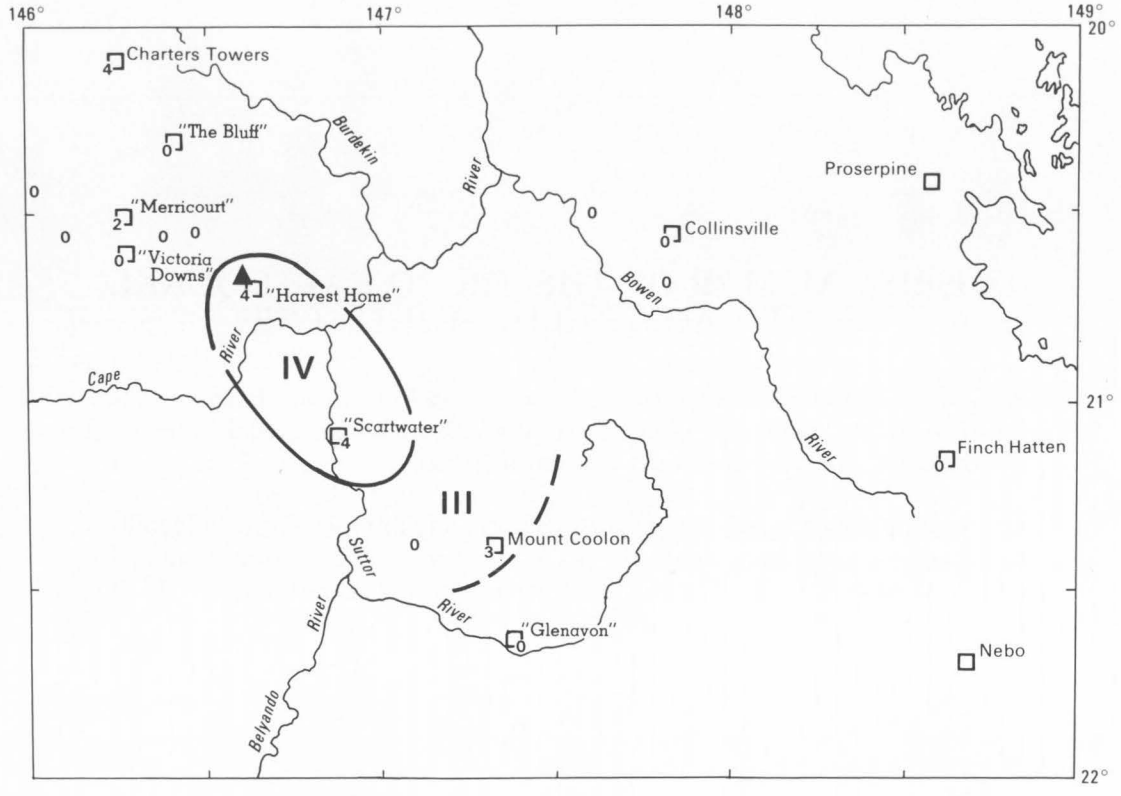
24/H56/4

ISOSEISMAL MAP OF THE SCARTWATER EARTHQUAKE, QUEENSLAND—24 MAY 1978

At 17:38 UT on 24 May 1978 (3:38 a.m. on 25 May, local time) the area to the south of Charters Towers in northern Queensland experienced the effects of an earthquake. The felt area was about 7000 km^2, in which felt reports describing the most intense effects—assigned intensities of MM IV—came from the Scartwater and Harvest Home homesteads. A magnitude of ML = 3.2 was calculated from the Charters Towers (CTA) seismograms, and ML(I) = 3.8 was derived from the isoseismal data.

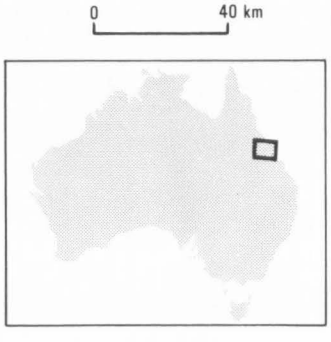
An aftershock with magnitude ML(CTA) = 3.0 was recorded at 23:45 UT on 24 May 1978.

ISOSEISMAL MAP OF THE SCARTWATER EARTHQUAKE, QUEENSLAND, 24 MAY 1978



DATE : 24 MAY 1978
TIME : 17:37:59.5 UT
MAGNITUDE : 3.2 ML (CTA) 3.8 ML (I)
EPICENTRE : 20.7°S 146.6°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



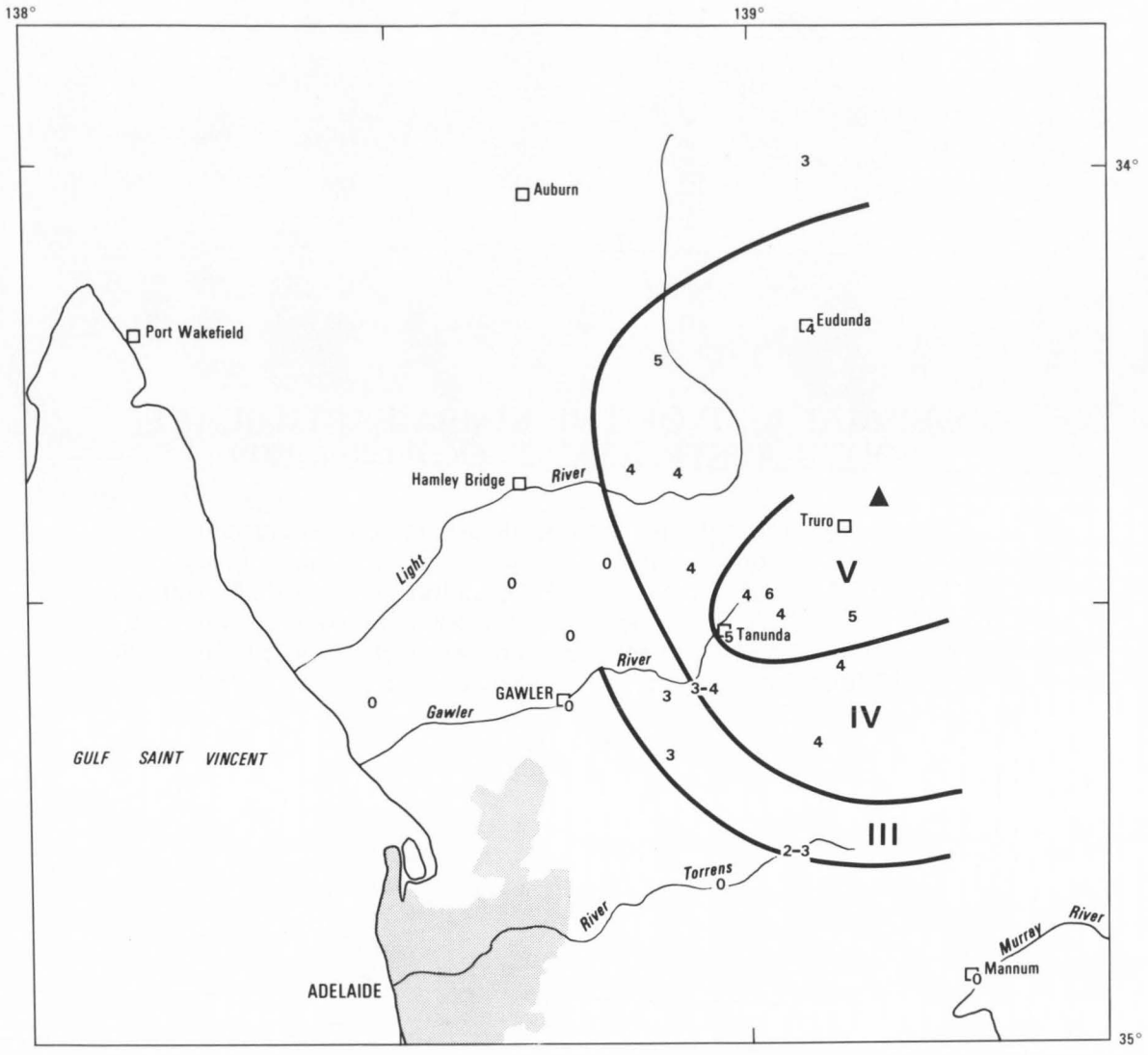
24/F55/4

ISOSEISMAL MAP OF THE TRURO EARTHQUAKE, SOUTH AUSTRALIA—4 JULY 1979

A small earthquake of magnitude ML = 3.5 was felt in the Barossa Valley northeast of Adelaide at 9:19 UT on 4 July 1979 (6:49 p.m. local time). The epicentre was located close to the town of Truro.

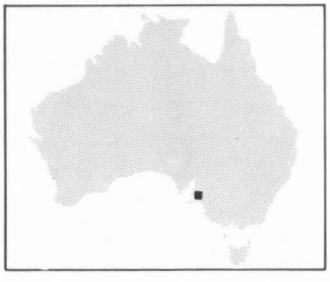
The accompanying isoseismal map was based on felt reports from 26 localities collected by the Adelaide Seismological Observatory. The maximum intensity was assessed as MM VI. The radius of perceptibility was estimated as 40 km.

ISOSEISMAL MAP OF THE TRURO EARTHQUAKE, SOUTH AUSTRALIA, 4 JULY 1979



DATE : 4 July 1979
TIME : 09:18:45 UT
MAGNITUDE : 3.5 ML (ADE)
EPICENTRE : 34.39°S 139.19°E
DEPTH : 4 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

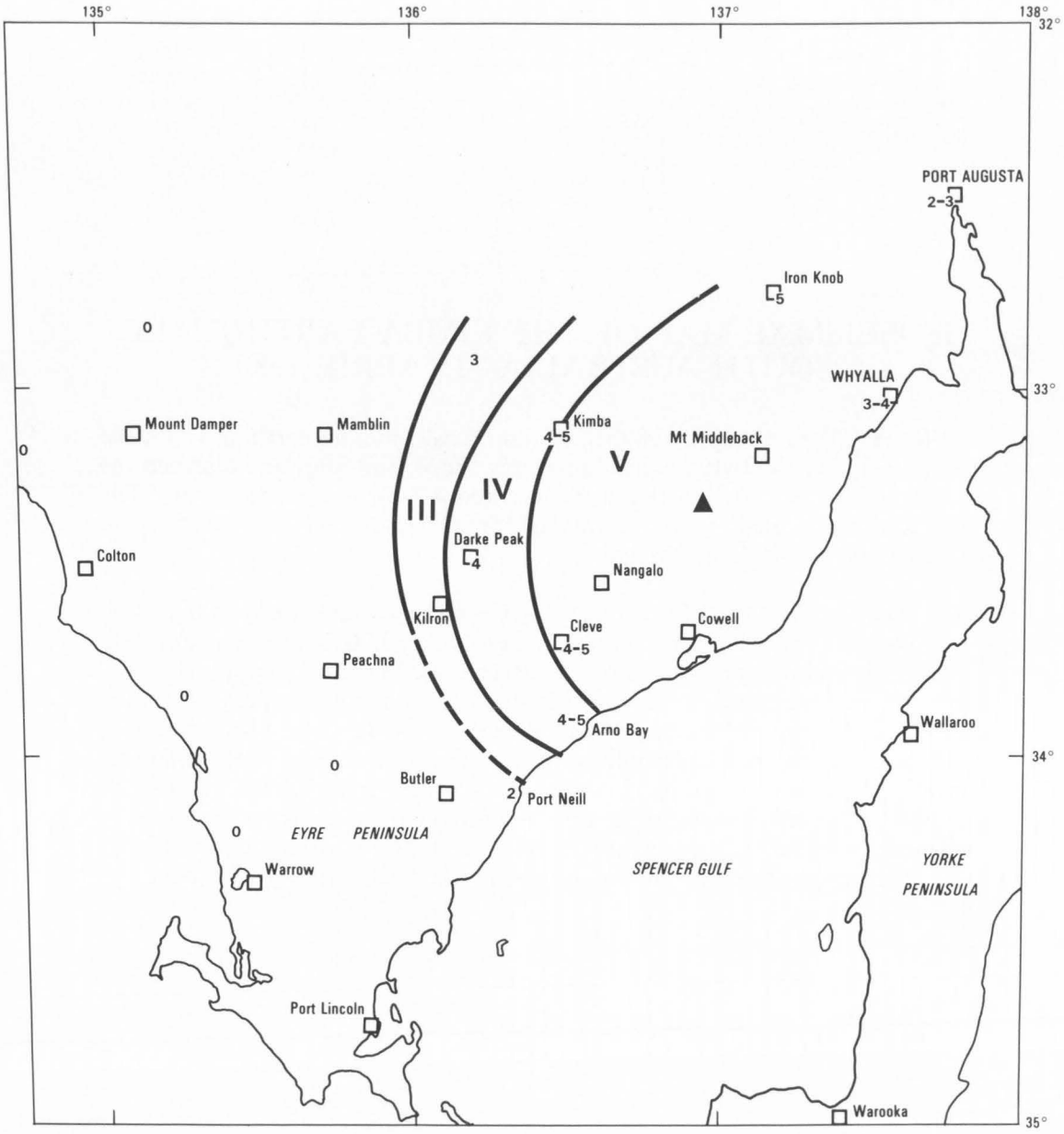


24/154-9/2

ISOSEISMAL MAP OF THE KIMBA EARTHQUAKE, SOUTH AUSTRALIA—22 OCTOBER 1979

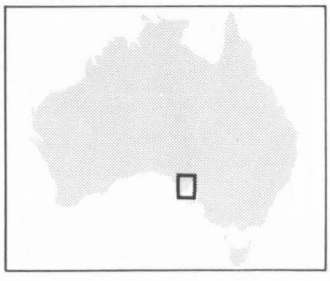
The northeastern part of the Eyre Peninsula experienced an earthquake of magnitude ML = 3.5 on 22 October 1979 at 11:14 UT (8:44 p.m. local time). It was felt from Port Neill in the south to Port Augusta in the north. No serious damage was reported. The strongest shaking was felt in the towns of Iron Knob, Kimba, and Cleve. The instrumental epicentre was located 24 km southwest of Mount Middleback. The focal depth, although not well constrained, was calculated to be 34 km.

ISOSEISMAL MAP OF THE KIMBA EARTHQUAKE, SOUTH AUSTRALIA, 22 OCTOBER 1979



DATE : 22 October 1979
TIME : 11:13:40.3 UT
MAGNITUDE : 3.5 ML (ADE)
EPICENTRE : 33.31°S 136.95°E
DEPTH : 34.3 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



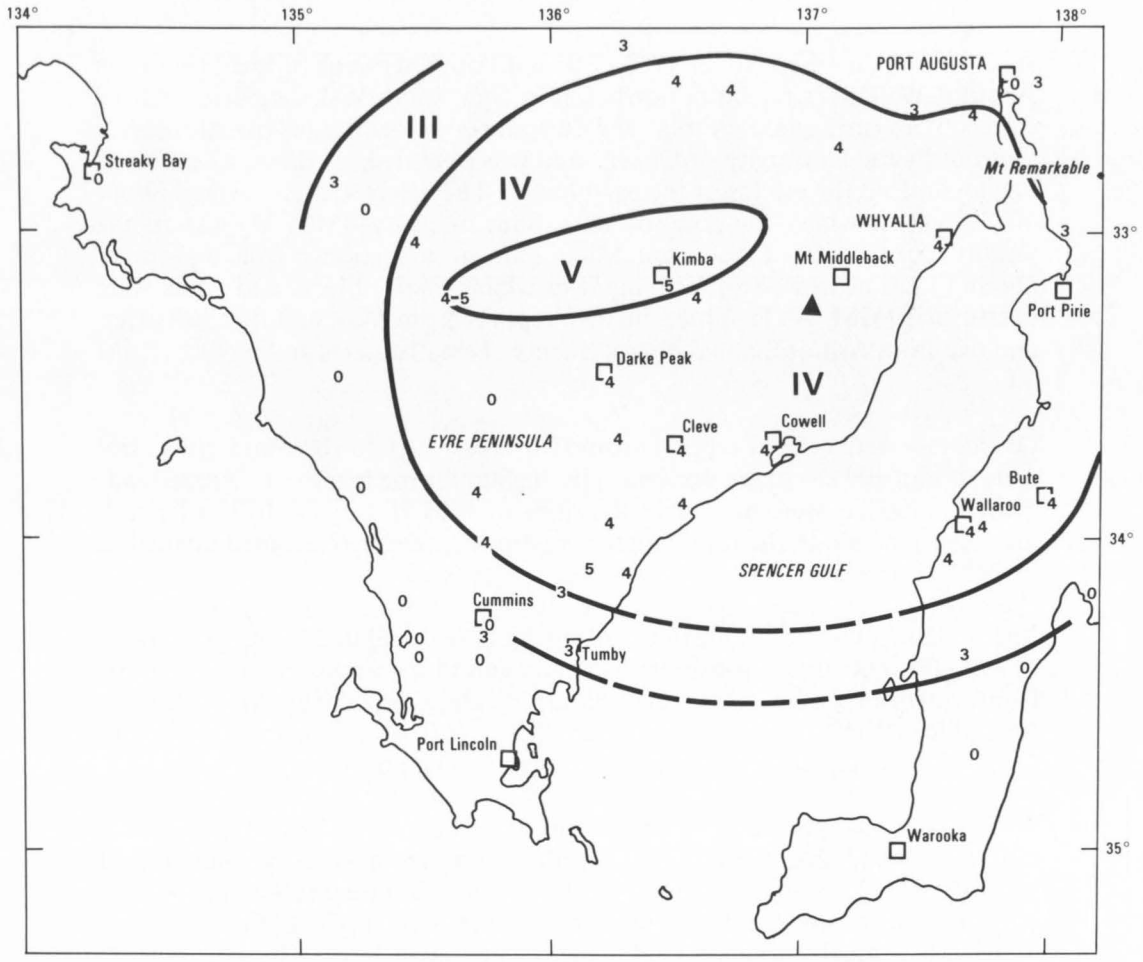
24/SA/11

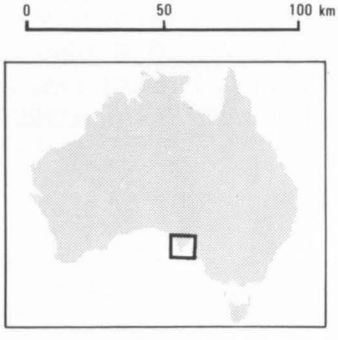
ISOSEISMAL MAP OF THE KIMBA EARTHQUAKE, SOUTH AUSTRALIA—15 APRIL 1980

At 00:38 UT on 15 April 1980 (10:08 a.m. local time) an earthquake on the eastern side of the Eyre Peninsula severely shook buildings and alarmed the local population. The earthquake measured 4.3 on the Richter scale. The epicentre was located 15 km southwest of Mount Middleback, the site of several other Eyre Peninsula earthquakes.

The shock was felt from Port Augusta in the north to Tumby Bay in the south and Bute in the east. The perceptible area was over 55 000 km^2. The duration of the felt shaking varied from five to 20 seconds. There were no injuries, and the only damage reported was cracks in the walls of a public building at Kimba and in some farm-houses. However, there were many reports of wall-hangings falling off walls, and household wares crashing to the floor. The maximum intensity was MM V at Kimba. Many observers reported hearing the tremor as well. At Cowell there was one report of a person in bed being moved violently around the room 'as if something was under it, trying to heave me off'. Of the 51 returned isoseismal questionnaires, 18 recorded that the earthquake was not felt.

ISOSEISMAL MAP OF THE KIMBA EARTHQUAKE, SOUTH AUSTRALIA, 15 APRIL 1980





DATE : 15 April 1980
TIME : 00:38:05 UT
MAGNITUDE : 4.3 ML (ADE)
EPICENTRE : 33.26°S 137.03°E
DEPTH : 31 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

ISOSEISMAL MAP OF THE ASHFORD EARTHQUAKE, NEW SOUTH WALES—4 SEPTEMBER 1980

At 21:05 UT on 4 September 1980 (7:05 a.m. on 5 September, local time) the Ashford-Wallangra region in northeastern New South Wales experienced the effects of an earthquake. A total of 69 responses to earthquake questionnaires sent out by the University of Queensland was obtained; of these, 42 reported having noticed the effects of the earthquake. The affected area covered about 4000 km^2, in which the zone of maximum intensity—MM V—was in the vicinity (northwards) of Wallangra. Minor damage was reported from a property about 10 km northwest of Wallangra in which small objects and vases were overturned (MM V-VI). Three further reports from Wallangra and district, and two from Ashford, noted displacements of small objects and pictures (MM V).

Of interest were several reports from two areas outside the main epicentral zone. About 100 km to the northeast, in the Stanthorpe (southern Queensland) area, felt reports were assigned intensities of MM II and IV. In the Inverell area, about 60 km to the south-southeast, reports were also assigned intensities of MM II and IV.

Instrumental magnitudes for this earthquake were calculated from five stations of the ANU network in southeast Australia and four stations of the Wivenhoe Dam network (southeastern Queensland), yielding respectively ML(CAN) = 4.5 and ML(WIV) = 3.5. Thus a value of ML = 4.0 was adopted as the Richter magnitude. A magnitude of ML(I) = 3.7 was obtained from the isoseismal data.

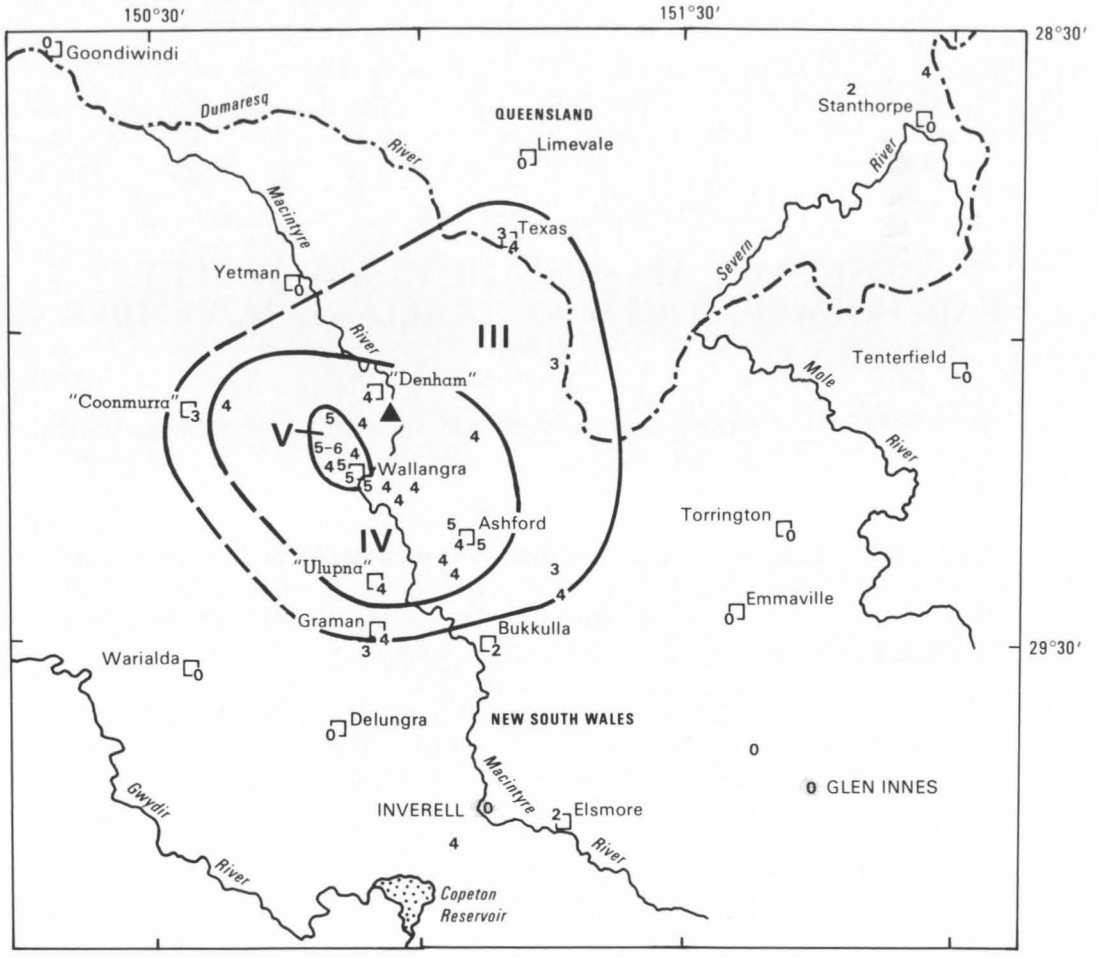
This earthquake generated a significant aftershock sequence. Through the month of September 1980 after the main shock, 26 felt reports that related to 15 aftershocks were received. Of these 15 events, five were able to be located. An additional seven aftershocks were recorded instrumentally but not reported as being felt. In all, a total of 22 aftershocks are known to have been associated with this earthquake. The magnitudes of located aftershocks, based on the Wivenhoe seismograms, were in the range ML (WIV) = 2.5 to 2.9.

References

RYNN, J. M. W., & LYNAM, C. J., 1982—The seismicity of northeastern New South Wales (New England Fold Belt and southern portion of Clarence-Moreton Basin)—a preliminary study. *In* Proceedings of a symposium in honour of Emeritus Professor A. H. Voisey, University of New England, Armidale, 5-8 July 1982, 149-165.

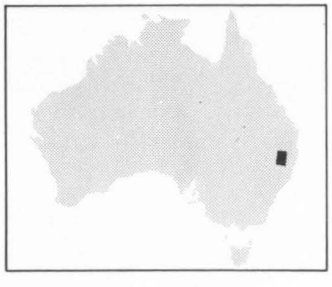
RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanhope-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30-42.

ISOSEISMAL MAP OF THE ASHFORD EARTHQUAKE, NEW SOUTH WALES, 4 SEPTEMBER 1980



DATE : 4 SEPTEMBER 1980
TIME : 21:05:44.79 UT
MAGNITUDE : 4.5 ML (CAN), 3.5 ML (WIV), 3.7 ML (I)
EPICENTRE : 29.13 °S 150.94°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H56/7

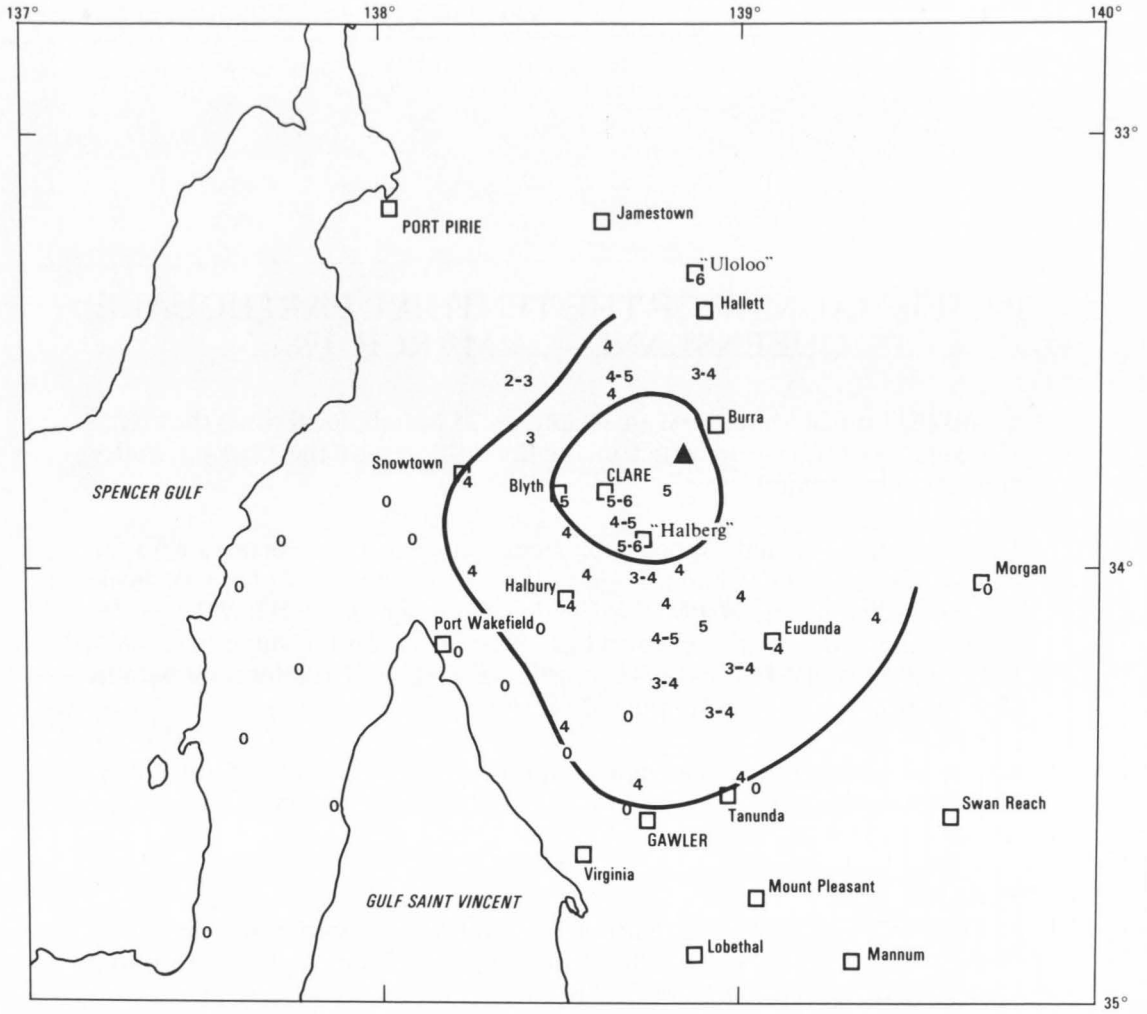
ISOSEISMAL MAP OF THE CLARE VALLEY EARTHQUAKE, SOUTH AUSTRALIA—13 NOVEMBER 1980

At 08:56 UT on 13 November 1980 (7:26 p.m. local time) an earthquake of magnitude ML 3.7 centred on Clare Valley was felt over a wide area of the mid-north of South Australia.

Returned earthquake report questionnaires were used to plot an isoseismal map, on which each felt intensity is from a single observer. The map indicates that the tremor was felt from Jamestown in the north to Gawler in the south, Eudunda in the east, and Snowtown in the west.

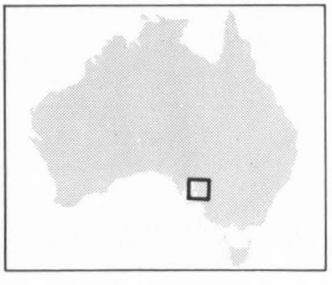
The only damage reported was minor cracking of plaster in old buildings at Clare, Halberg, and Ulooloo Station, north of Hallett. There were several reports of families fleeing their homes as they began to shake.

ISOSEISMAL MAP OF THE CLARE VALLEY EARTHQUAKE, SOUTH AUSTRALIA, 13 NOVEMBER 1980



DATE : 13 November 1980
TIME : 08:56:16 UT
MAGNITUDE : 3.7 ML (ADE)
EPICENTRE : 33.74°S 138.83°E
DEPTH : 19 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/SA/13

ISOSEISMAL MAP OF THE TENTHILL EARTHQUAKE, QUEENSLAND—24 MARCH 1981

At 18:34 UT on 24 March 1981 (4:34 a.m. on 25 March, local time) the effects of a small earthquake were felt in the Tenthill area of the Lockyer Valley, southeast Queensland.

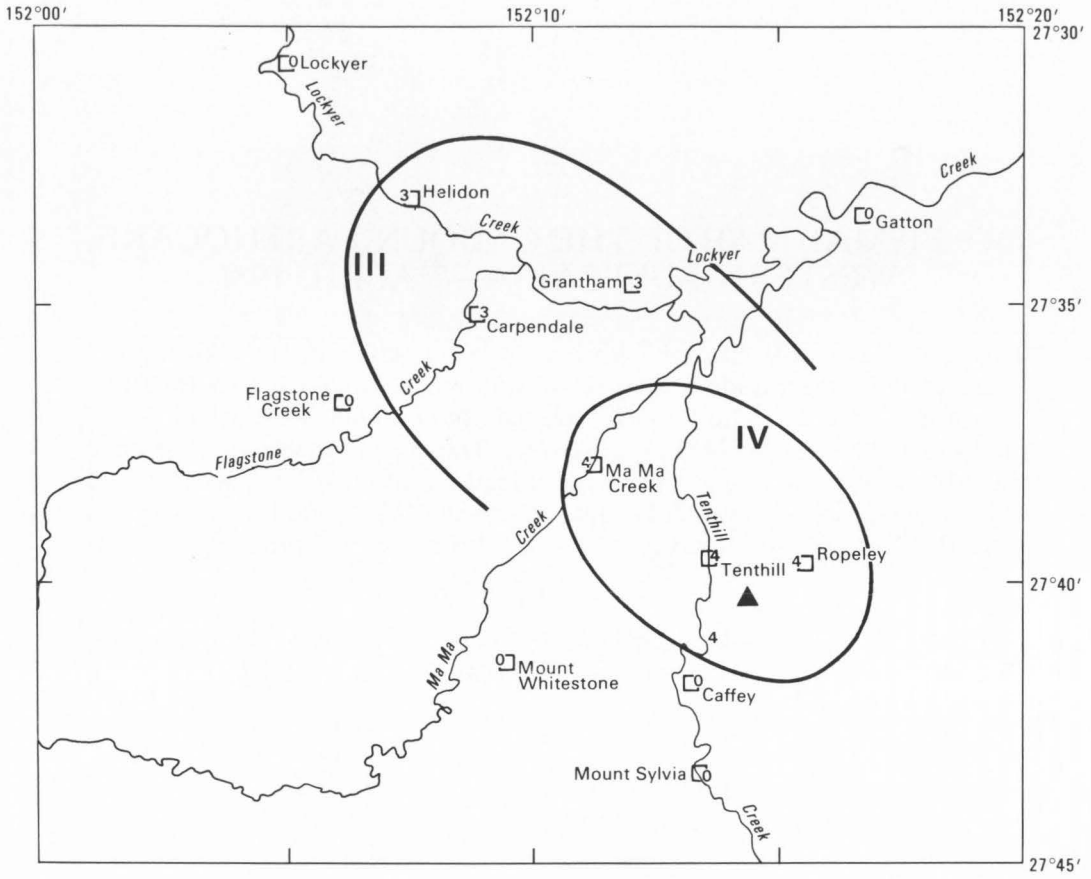
A classic foreshock–main-shock–aftershock sequence was associated with this activity. The main shock had a magnitude of ML(COO) = 2.7; the foreshock, which occurred at 18:34:09 UT, was assigned a magnitude MD(WIV) = 2.0; and the aftershock, which occurred at 19:29:24 UT on the same day, had a magnitude of MD(WIV) = 0.6. This earthquake sequence is important because of its proximity to the Wivenhoe Dam site.

For the main shock, nine earthquake questionnaires reported on the effects of the earthquake. The felt area covered about 500 km^2, in which a maximum intensity of MM IV was assigned to the Tenthill township.

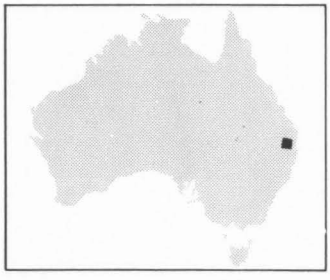
Reference

RYNN, J. M. W., 1984—The Tenthill, Lockyer Valley, southeast Queensland earthquakes of 24 March, 1981. *Papers of the Department of Geology, University of Queensland*, 10(4), 206–215.

ISOSEISMAL MAP OF THE TENTHILL EARTHQUAKE, QUEENSLAND, 24 MARCH 1981



0 10 km



DATE : 24 MARCH 1981
TIME : 18:34:16 UT
MAGNITUDE : 2.7ML (COO)
EPICENTRE : 27.67°S 152.24°E
DEPTH : 10km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/G56-14/3

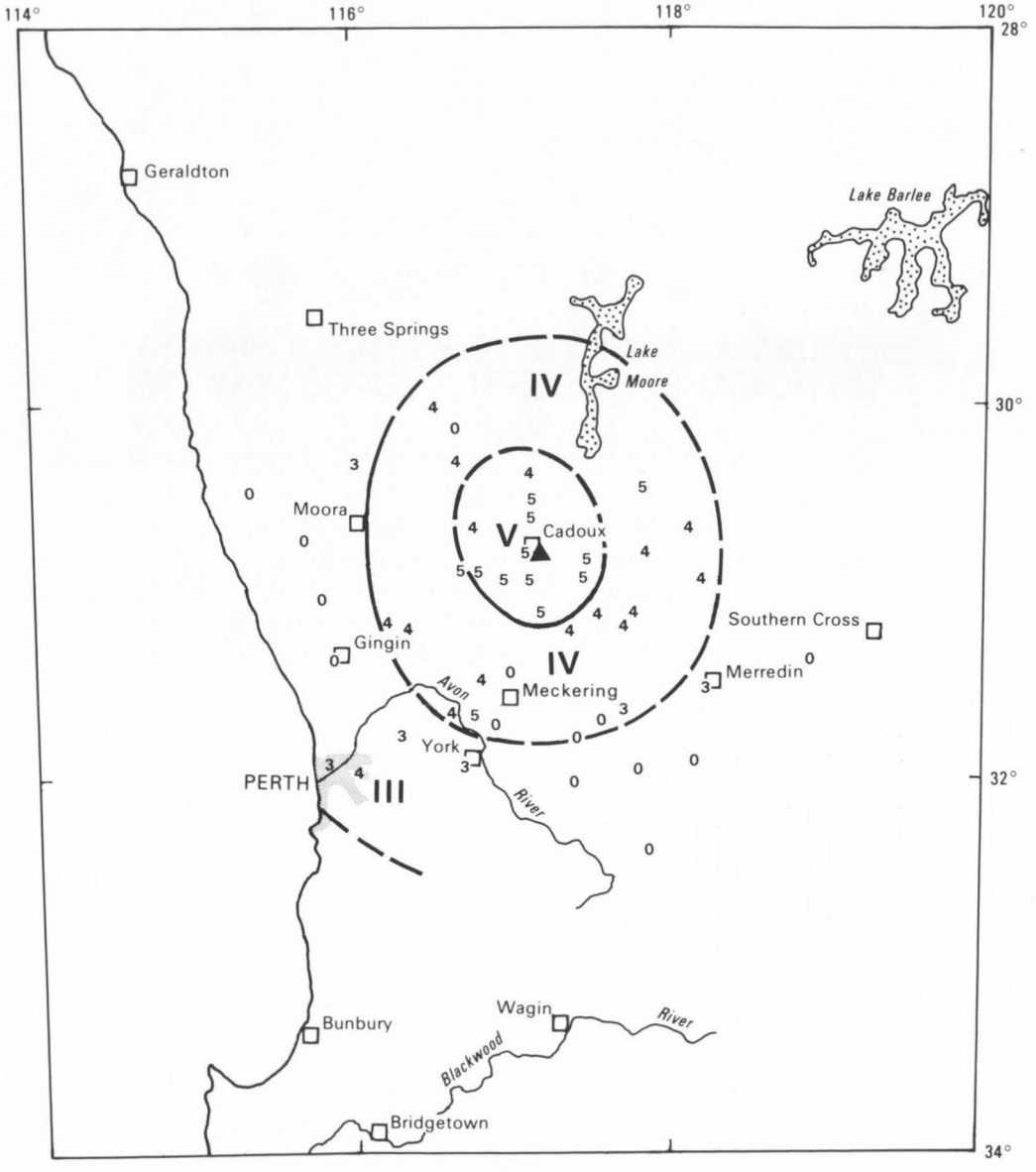
ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA—7 APRIL 1981

This earthquake took place on 7 April at 20:16 UT (4:16 a.m. on 8 April, local time). It had a magnitude of ML = 4.5 and was located 8 km southeast of the town of Cadoux. The felt area covered about 80 000 km^2, which had a radius of 100 km for the MM IV isoseismal. The maximum intensity assigned was MM V at Cadoux and the surrounding area of 6000 km^2, where small objects on shelves were moved. Isolated reports of MM III and IV were received from the Perth metropolitan area, 180 km from the epicentre.

Reference

GREGSON, P. J., 1982—Mundaring Geophysical Observatory annual report, 1981. *Bureau of Mineral Resources, Australia, Record* 1982/24.

ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA, 7 APRIL 1981



DATE : 7 APRIL 1981
TIME : 20:15:58 UT
MAGNITUDE : 4.5 ML (MUN)
EPICENTRE : 30.74°S 117.16°E
DEPTH : 0

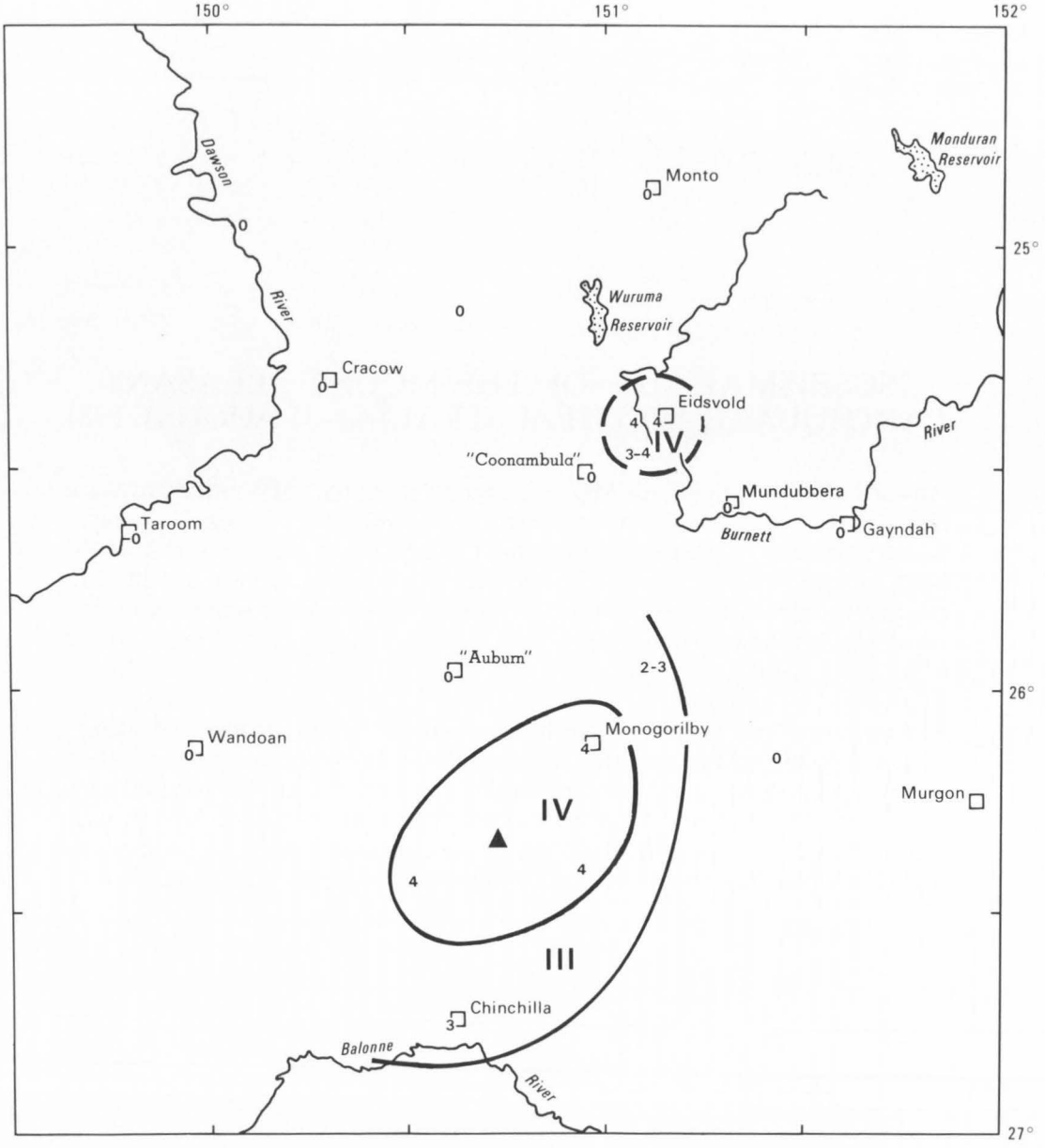
▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/WA/21

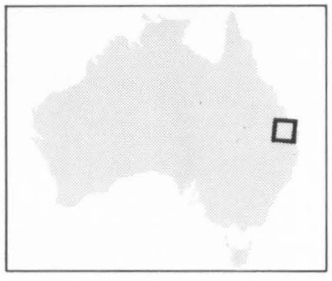
ISOSEISMAL MAP OF THE MONOGORILBY EARTHQUAKE, QUEENSLAND—10 MAY 1981

At 14:40 UT on 10 May 1981 (12:40 a.m. on 11 May, local time) an earthquake was felt in an area southwest of Mundubbera in central eastern Queensland. The affected area covered about 6000 km^2, in which a maximum intensity of MM IV was assigned to the Monogorilby pastoral district. A few reports of MM IV were also obtained near Eidsvold, 120 km northeast of the epicentre. Of 22 earthquake questionnaires returned, nine reported some form of felt effect. A magnitude of ML(I) = 3.8 was calculated from the isoseismal data.

ISOSEISMAL MAP OF THE MONOGORILBY EARTHQUAKE, QUEENSLAND, 10 MAY 1981



0 80 km



DATE : 10 MAY 1981
TIME : 14:39:37.39 UT
MAGNITUDE : 3.8 ML (I), 4.1 ML (CTA)
EPICENTRE : 26.33°S 150.73°E
DEPTH : 19 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

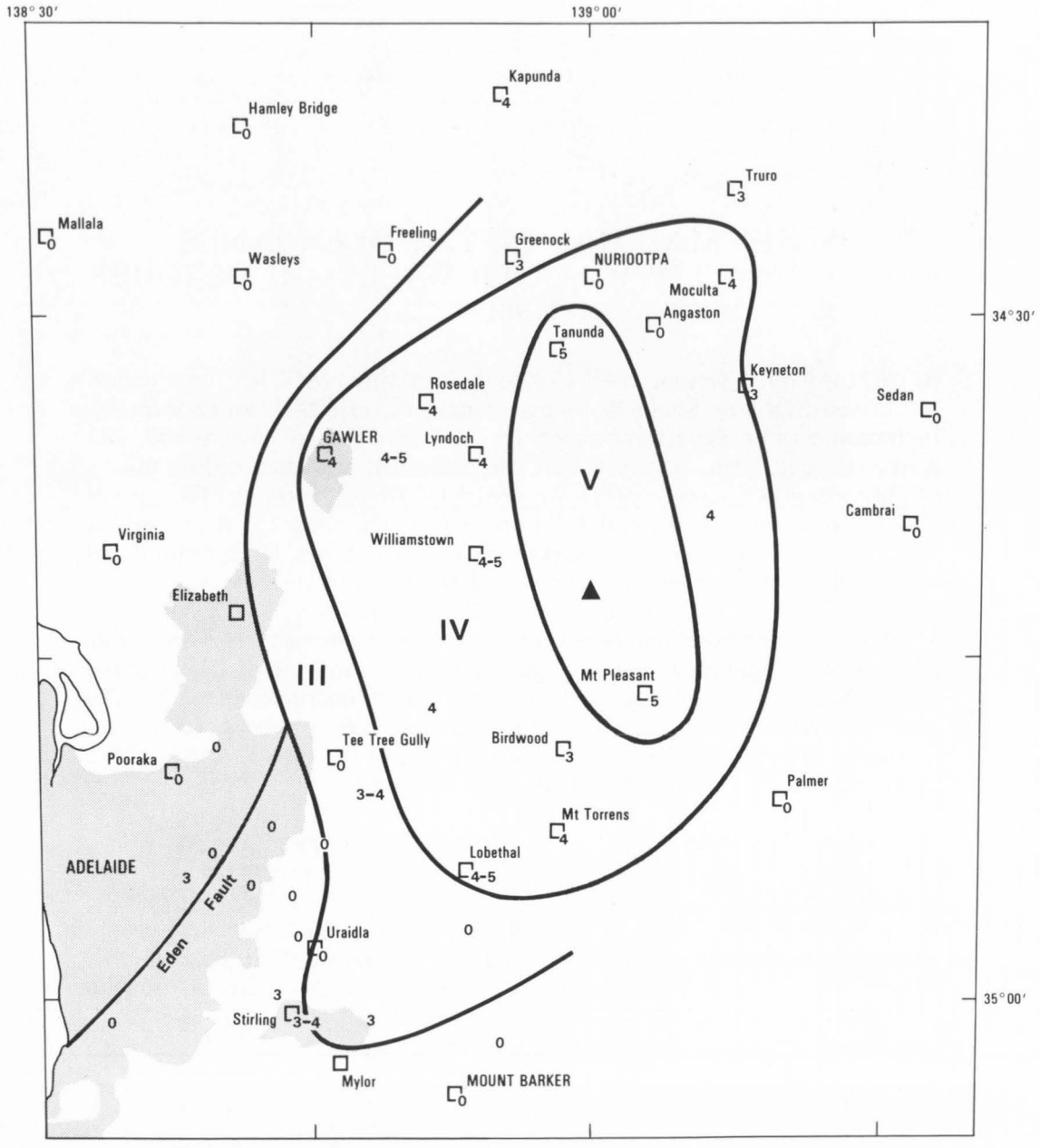
24/G56/17

ISOSEISMAL MAP OF THE MOUNT PLEASANT EARTHQUAKE, SOUTH AUSTRALIA—31 AUGUST 1981

An earthquake of magnitude ML = 2.8 awoke thousands of South Australians shortly after 5 a.m. local time on 1 September 1981 (19:35 UT on 31 August). The tremor was heard as a low rumble from farms in the mid-north of the State to homes in the east of Adelaide. Adelaide radio stations received calls, mainly from listeners northeast of Adelaide, who reported strong shaking and rattling of windows. Many woken by the quake thought that there had been a car crash nearby.

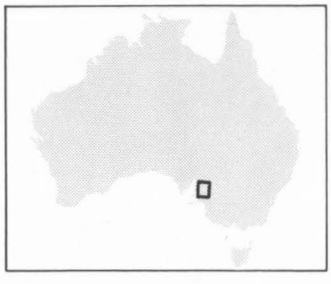
The epicentre was located between the towns of Williamstown and Mount Pleasant, 50 km northeast of the city of Adelaide. The epicentre and the pattern of felt reports show a close association with the Eden Fault. The worst affected areas were Tanunda and Mount Pleasant, where intensities of MM V were recorded. The isoseismal map was based on effects reported in 49 completed questionnaires. The radius of perceptibility of the shock was about 40 km.

ISOSEISMAL MAP OF THE MOUNT PLEASANT EARTHQUAKE, SOUTH AUSTRALIA, 31 AUGUST 1981



DATE : 31 August 1981
TIME : 19:35:17 UT
MAGNITUDE : 2.8 ML (ADE)
EPICENTRE : 34.709°S 139.040°E
DEPTH : 25 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/154-9/3

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES— 11 OCTOBER 1981

At 09:27 UT on 11 October 1981 (7:27 p.m. local time) the Glen Innes region of northeastern New South Wales experienced the effects of an earthquake. In response to an isoseismal survey by the University of Queensland, 285 earthquake questionnaire reports were completed; 181 of them noted the effects of the earthquake. These reports comprised 170 from the town of Glen Innes (128 recorded felt effects) and 115 from outside the town (53 recorded felt effects). The efforts of the students at the Glen Innes High School are specifically noted as they provided over 150 reports to the survey.

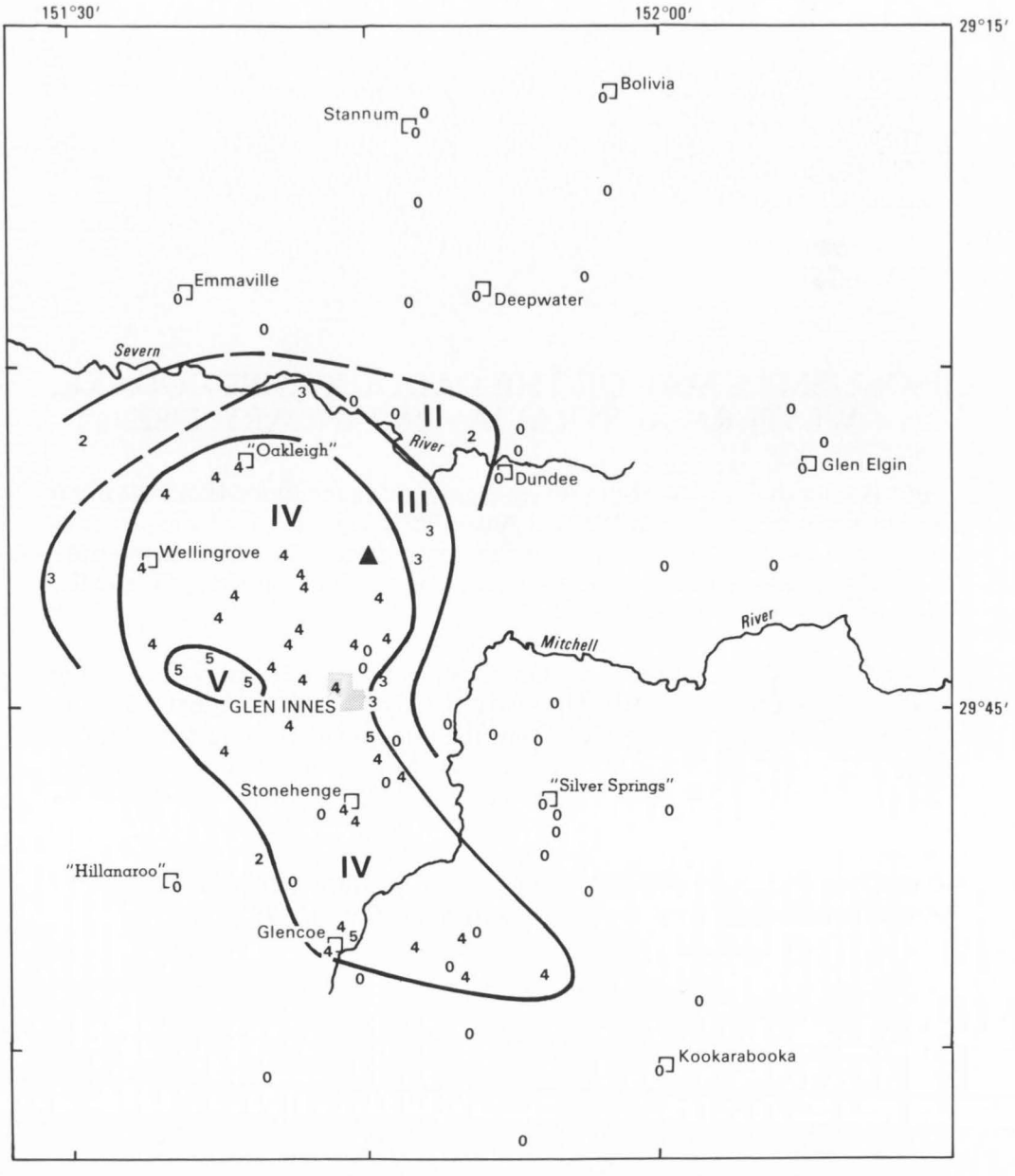
The felt area covered about 1400 km^2. A maximum intensity of MM V was assigned to a small area near Matheson (about 15 km west of Glen Innes), where tables and small objects on shelves were shifted. Instrumental magnitudes were calculated from the Wivenhoe Dam seismic network (southeast Queensland) and yielded an average value of ML(WIV) = 3.2. A magnitude of ML(I) = 3.2 was calculated from the felt reports.

No aftershocks were reported, or observed on any seismograms.

Reference

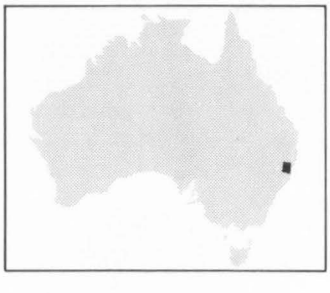
RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanhope-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30–42.

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES 11 OCTOBER 1981



DATE : 11 OCTOBER 1981
TIME : 09:26:34.7 UT
MAGNITUDE : 3.2 ML (WIV), 3.2 ML (I)
EPICENTRE : 29.64°S 151.75°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H56-6/2

ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA—24 JANUARY 1982

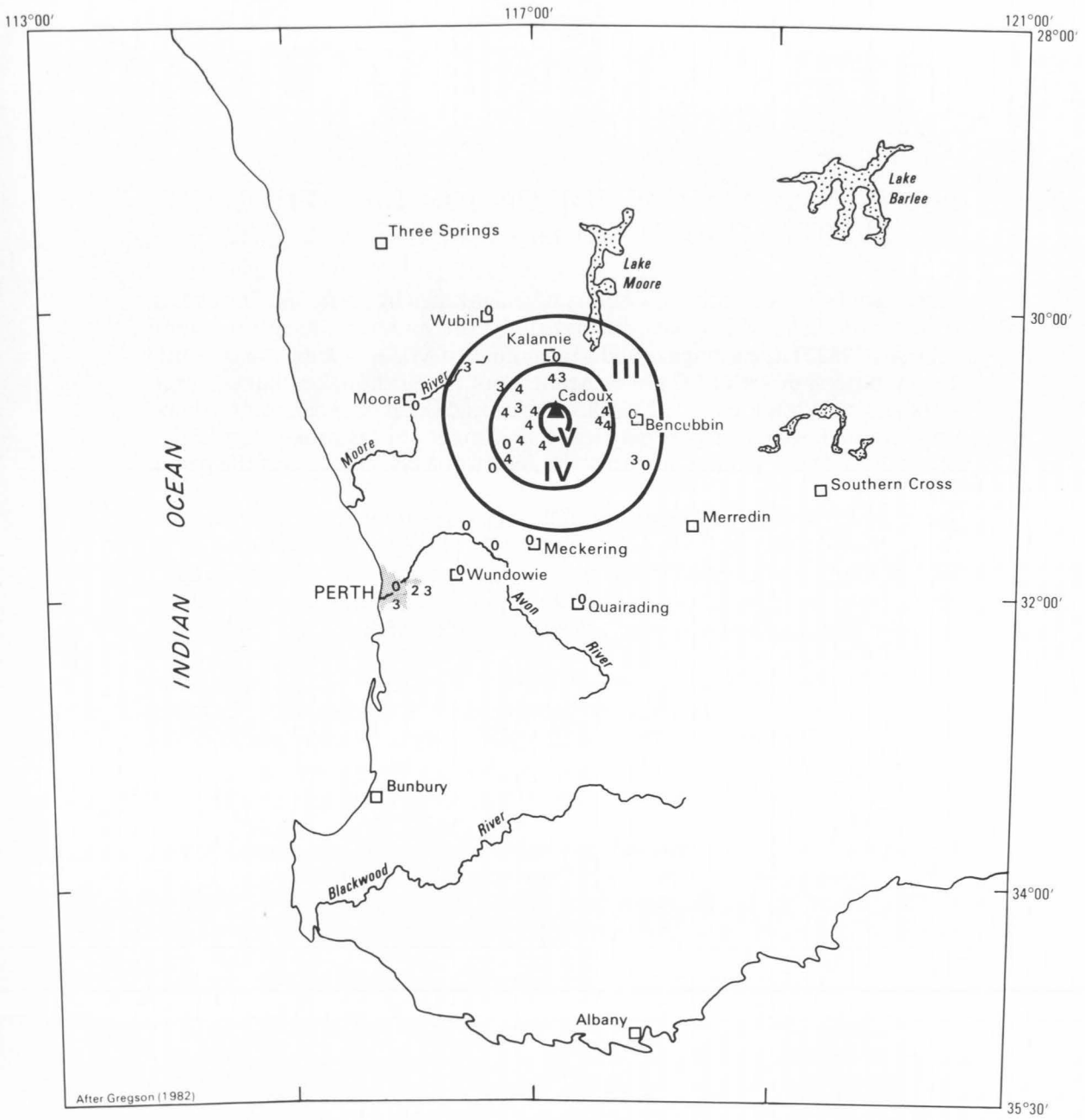
Shortly after midday local time, an earthquake of magnitude ML 4.3 occurred 15 km south of Cadoux in Western Australia. The earthquake was felt over an area of 20 000 km^2, but no damage was reported. The highest intensity was MM V, reported from the township of Cadoux. Intensity MM IV was felt over an area of radius 45 km.

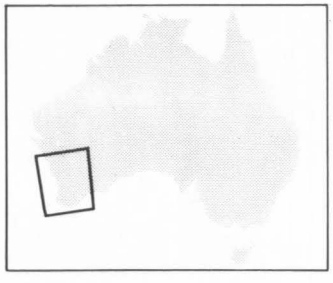
The response to earthquake questionnaires was poor, presumably because the earthquake was not widely felt. The map is based on about 50 returns (Gregson, 1984). Several other earthquakes from the same location were felt; the two largest produced isolated reports of intensity MM V on 23 January 2:02 a.m. (local time, ML = 3.8) and on 26 January 7:12 a.m. (local time, ML = 4.4).

Reference

GREGSON, P. J., 1984—Mundaring Geophysical Observatory annual report, 1982. *Bureau of Mineral Resources, Australia, Record* 1984/16.

ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA, 24 JANUARY 1982





DATE : 24 JANUARY 1982
TIME : 04:06:19 UT
MAGNITUDE : 4.3 ML (MUN), 3.5 MB
EPICENTRE : 30.90°S, 117.12°E
DEPTH : 5 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA—6 FEBRUARY 1982

Many people in the vicinity of Cadoux were awakened by severe shaking caused by an earthquake which occurred shortly before midnight, local time, on 6 February 1982. The earthquake had a magnitude of ML = 4.9, and an epicentre 12 km south-southeast of Cadoux, near that of the earthquakes that occurred in January 1982 (loc. cit.). The earthquake caused slight damage near Cadoux: walls cracked, water tanks sprang leaks, and small objects broke after falling off shelves. The maximum intensity assigned was MM VI (see over the page).

The isoseismal map, prepared from felt-report questionnaires, indicates that the earthquake was felt over an area of 90 000 km^2, in which intensities of MM IV were experienced up to 150 km from the epicentre. The outer boundaries of the lower isoseismals are not well defined because most residents outside the zone of severe shaking were asleep (Gregson, 1984).

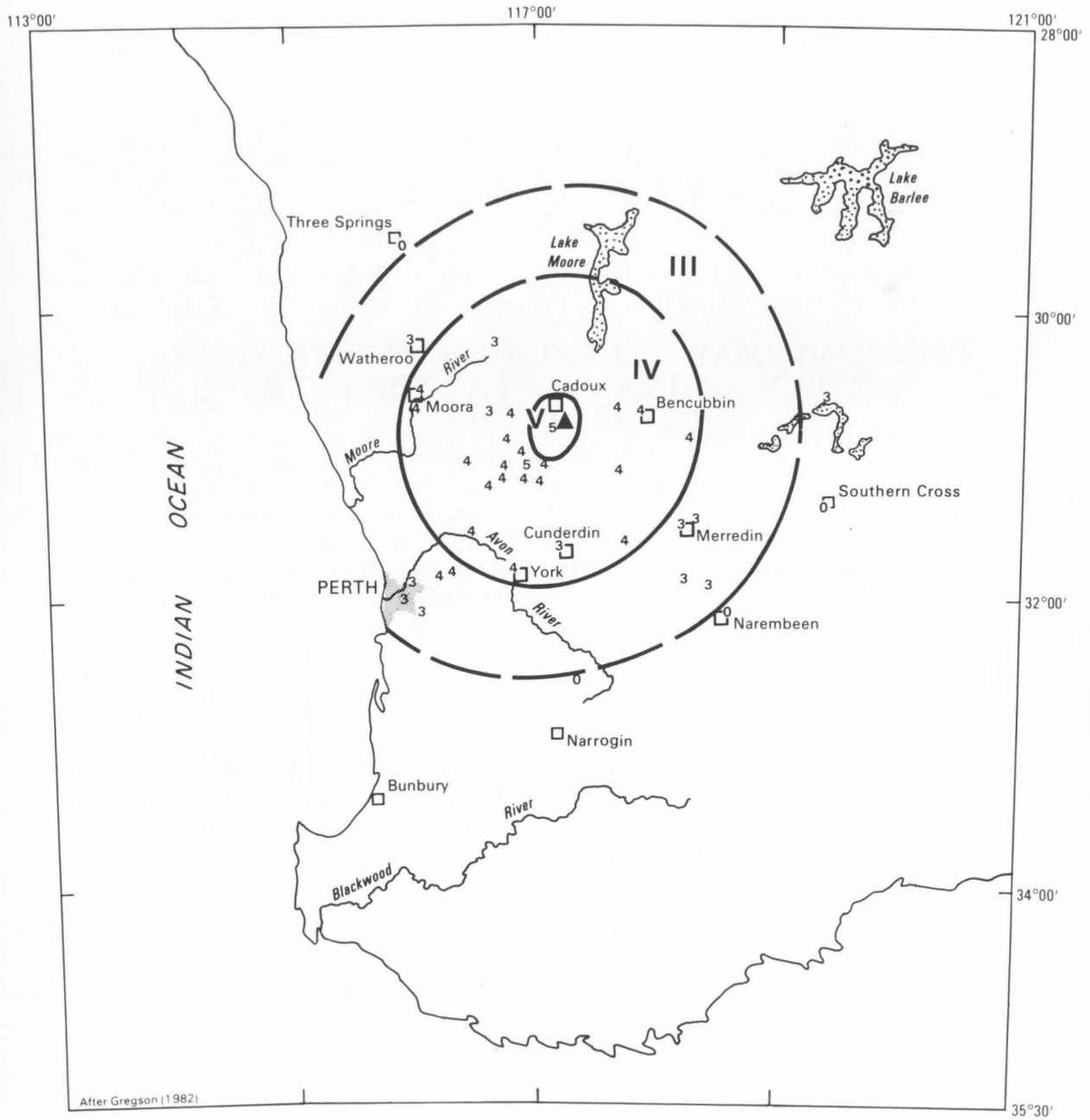
The earthquake was described by residents of Cadoux as the strongest since the series of earthquakes in June 1979 (Everingham & others, 1982). A second earthquake of magnitude ML 4.6 occurred six minutes later; the resulting intensities were about one unit lower than for the main event.

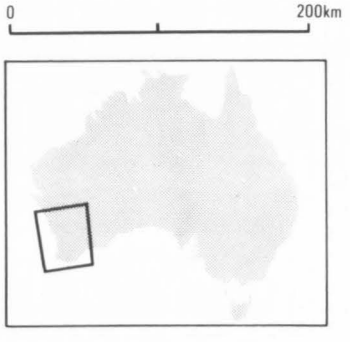
References

GREGSON, P. J., 1984—Mundaring Geophysical Observatory annual report, 1982. *Bureau of Mineral Resources, Australia, Record* 1984/16.

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA, 6 FEBRUARY 1982





DATE : 6 FEBRUARY 1982
TIME : 15:24:38.4
MAGNITUDE : 4.9 ML(MUN), 4.7 MB
EPICENTRE : 30.88°S 117.15°E
DEPTH : 7 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

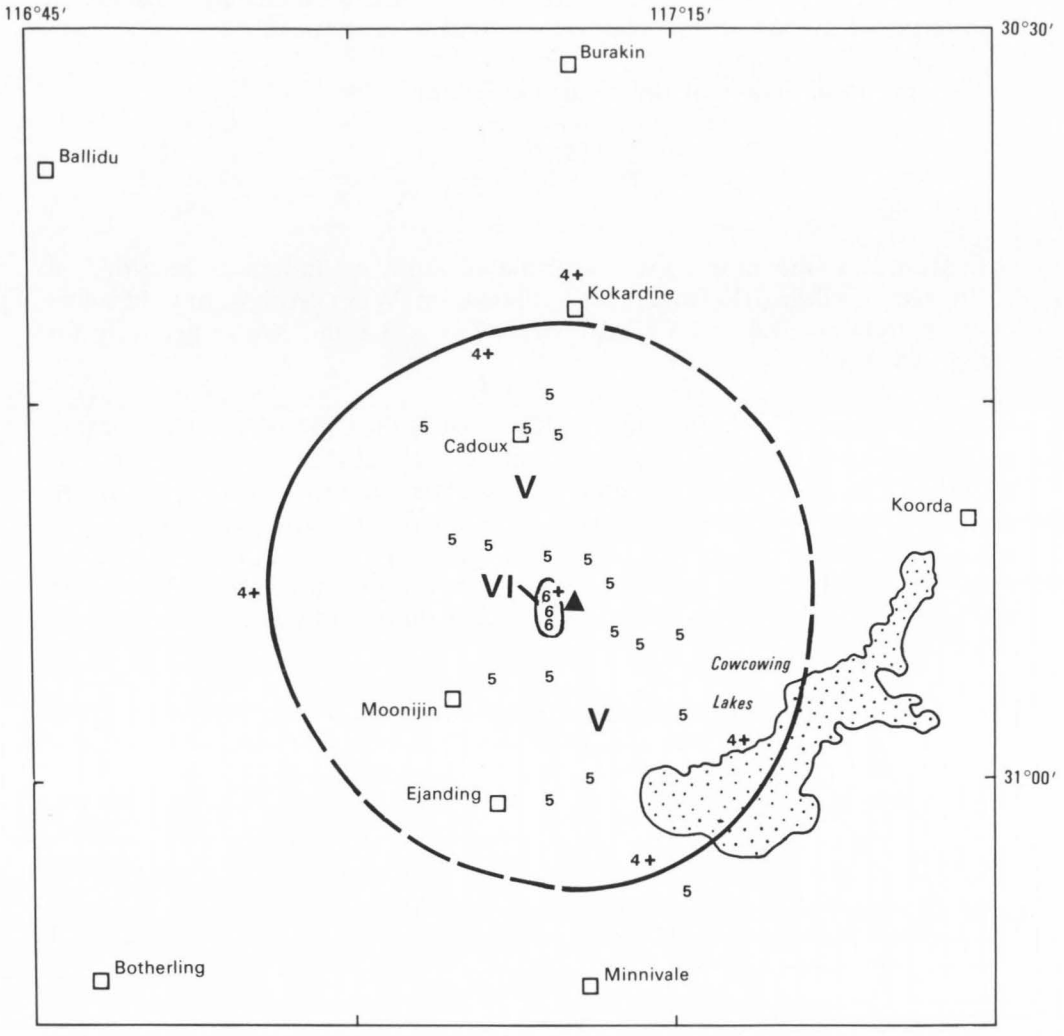
ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA, NEAR EPICENTRE— 6 FEBRUARY 1982

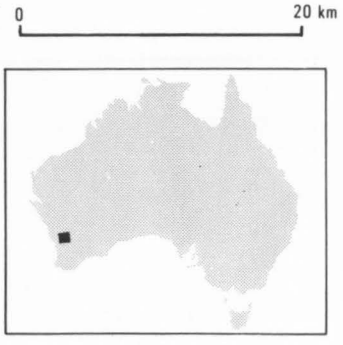
Members of the Mundaring Geophysical Observatory visited the Cadoux area to interview residents and determine the extent of the higher intensities. Intensities of MM VI were experienced at only three farm-houses over an area of about 8 km^2 located just to the west of the epicentre as determined by the observatory. Intensities of MM V were experienced over an area exceeding 1000 km^2.

Reference

GREGSON, P. J., 1984—Mundaring Geophysical Observatory annual report, 1982. *Bureau of Mineral Resources, Australia, Record* 1984/16.

ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA, 6 FEBRUARY 1982





DATE : 6 FEBRUARY 1982
TIME : 15:24:38.4 UT
MAGNITUDE : 4.9 ML (MUN) 4.7 MB
EPICENTRE : 30.88°S 117.15°E
DEPTH : 7 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/H50/12

ISOSEISMAL MAP OF THE INVERELL EARTHQUAKE, NEW SOUTH WALES—4 MARCH 1982

At about 10:03 UT on 4 March 1982 (about 9:03 p.m. local Eastern Summer Time) the Inverell district in northeastern New South Wales experienced the effects of an earthquake. Analysis of instrumental recordings revealed that in fact two earthquakes of almost the same magnitude had occurred within about 90 seconds of one another; the second was the larger of the two. None of the felt reports distinguish which event caused the reported effects, which—however—are probably related to the larger of the two events. Though many reports from the epicentral zone mention two possible events, all of them relate to only one period of shaking. For this reason, the isoseismal data are analysed in terms of a single event related to a 'double earthquake'.

The epicentral details of these earthquakes are:

	First earthquake	*Second earthquake*
Origin time:	10:01:05 UT	10:02:43 UT
Epicentre :	29.82°S, 151.28°E	29.82°S, 151.20°E
Focal depth:	0 km	20 km

Instrumental magnitudes were calculated from seismograms recorded at Riverview College (RIV) and the Wivenhoe Dam (WIV) network, to yield values of ML(RIV) = 3.4 and 3.7, and ML(WIV) = 3.4 and 3.6, respectively for the two events.

In response to an isoseismal survey undertaken by the University of Queensland, 161 earthquake questionnaires were completed; 116 of them recorded the effects of the earthquakes. Of these reports 65 were received from the town of Inverell (51 positive) and 96 from the surrounding district (65 positive). The felt area covered about 6500 km^2, in which the maximum intensity (outside the town of Inverell, MM V) was assigned to reports from two homesteads 5 to 10 km south of Elsmore (objects on shelves and furniture moved). A magnitude of ML(I) = 3.9 was determined from the felt reports.

Macroseismic effects on the town of Inverell. For the town of Inverell a detailed survey was undertaken with the assistance of the local radio station, 2NZ, and high schools in the town. Of 65 reports returned, 51 recorded the effects of the earthquake and 14 did not. The most affected areas appeared to be in the western parts of Inverell. The average assigned intensity was MM IV (windows, doors, etc., rattling). Several isolated cases of damage were reported, ranging from small objects being displaced from shelves (assigned MM V) to cracks in the concrete slabs of two houses (assigned MM VI). One such report resulted in an insurance claim for damage being settled.

Foreshocks. Twenty foreshocks are known to have occurred (from both felt reports and Cooney Observatory seismograms) in a period of 12 days before the main shocks. The maximum intensity reported was MM IV.

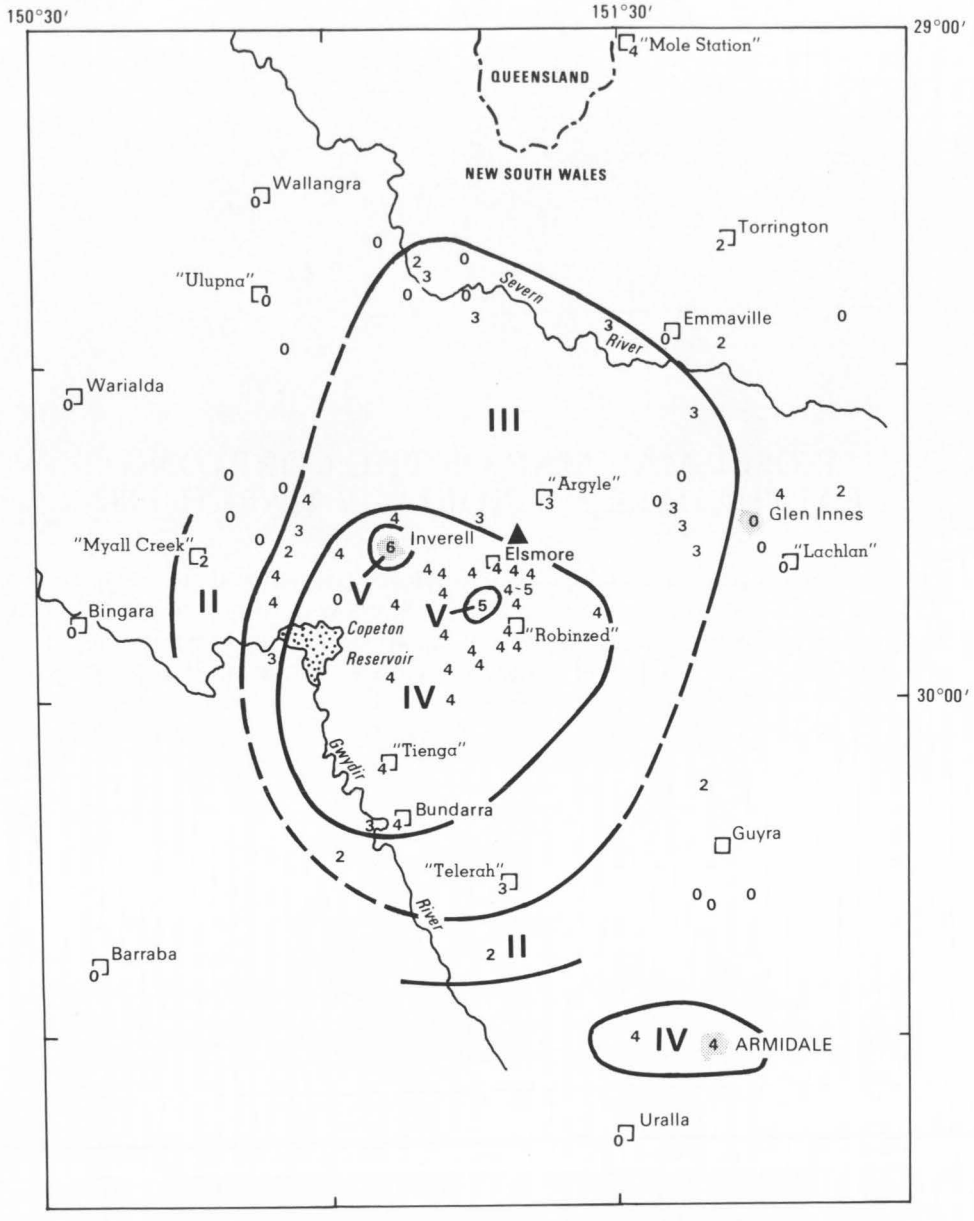
Aftershocks. Thirty aftershocks occurred up till 30 March 1982. There appear to have been two groups in time: one group having occurred within 24 hours of the main shock, and the other on 29 and 30 March. The epicentres of the later group appear to be 10 to 20 km west-southwest of those of the main shocks. The maximum intensity of the aftershocks was MM IV.

References

RYNN, J. M. W., & LYNAM, C. J., 1982—The seismicity of northeastern New South Wales (New England Fold Belt and southern portion of Clarence-Moreton Basin)—a preliminary study. *In* Proceedings of a symposium in honour of Emeritus Professor A. H. Voisey, University of New England, Armidale, 5-8 July 1982, 149-165.

RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanhope-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30-42.

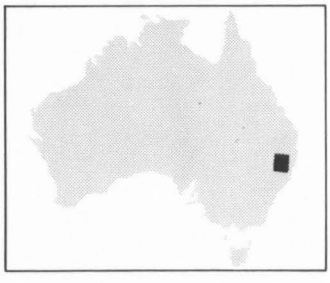
ISOSEISMAL MAP OF THE INVERELL EARTHQUAKE, NEW SOUTH WALES, 4 MARCH 1982



0 40 km

DATE : 4 MARCH 1982
TIME : 10:02:43 UT
MAGNITUDE : 3.7 ML (RIV), 3.6 ML (WIV)
EPICENTRE : 29.82°S 151.20°E
DEPTH : 20 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

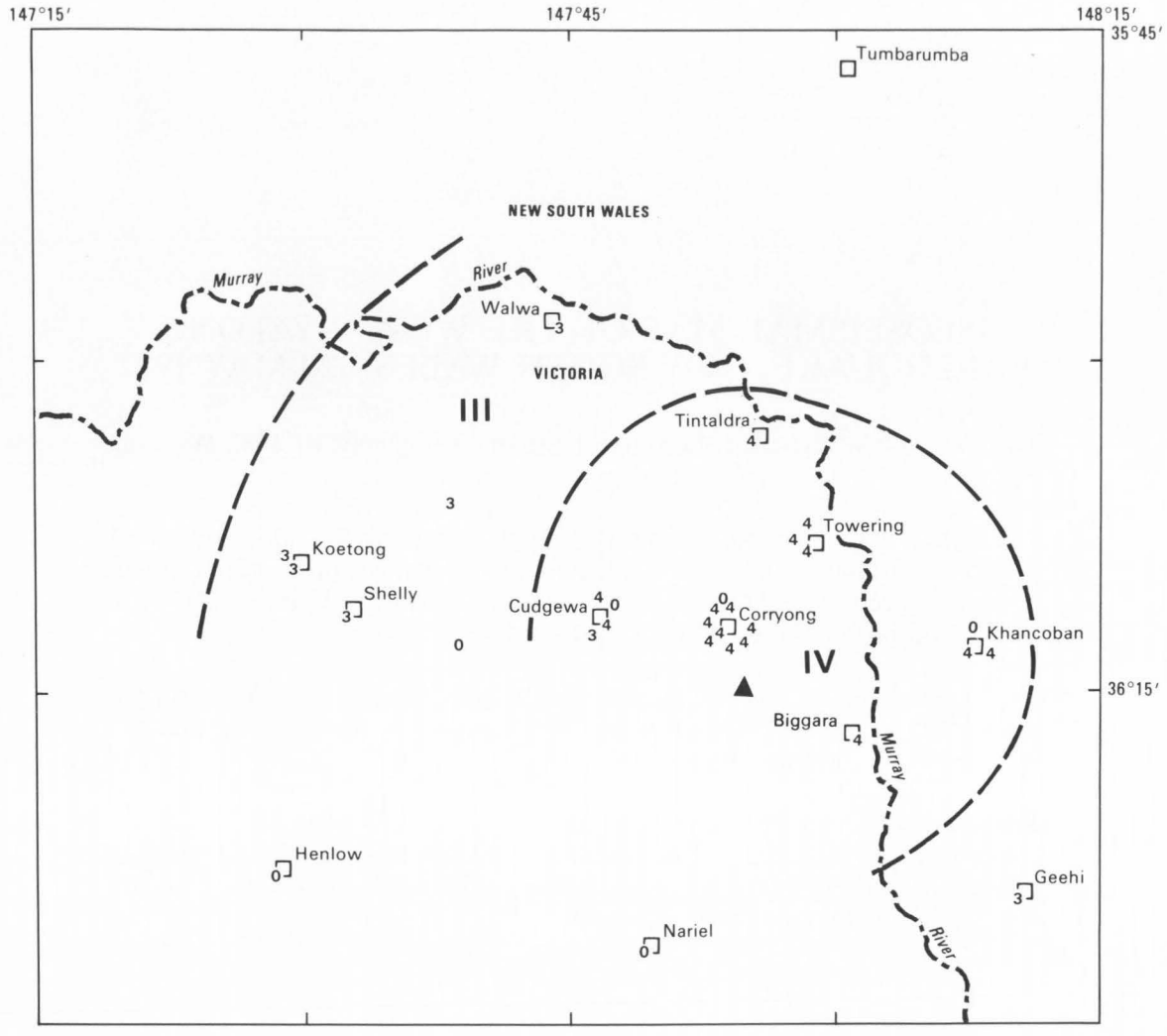


24/H56/6

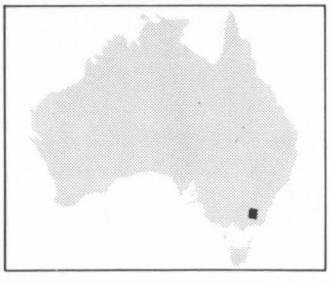
ISOSEISMAL MAP OF THE CORRYONG EARTHQUAKE, VICTORIA—9 MARCH 1982

The Corryong earthquake took place in a sparsely populated region of northern Victoria, and the spatial distribution of felt reports with respect to the epicentre is poor. The radius of perceptibility was about 40 km and the maximum reported intensity was only MM IV. The map shown was based on 30 data points.

ISOSEISMAL MAP OF THE CORRYONG EARTHQUAKE, VICTORIA, 9 MARCH 1982



0 20 km



DATE : 9 MARCH 1982
TIME : 00:09:26.5 UT
MAGNITUDE : 3.4 ML (BMR)
EPICENTRE : 36.24°S 147.92°E
DEPTH : 13 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/155/11

ISEOSEISMAL MAP OF THE WEST WYALONG EARTHQUAKE, NEW SOUTH WALES—20 MAY 1982

This earthquake signalled the start of the main sequence of 1982 Wyalong earthquakes. It occurred at 5:36 p.m. local time.

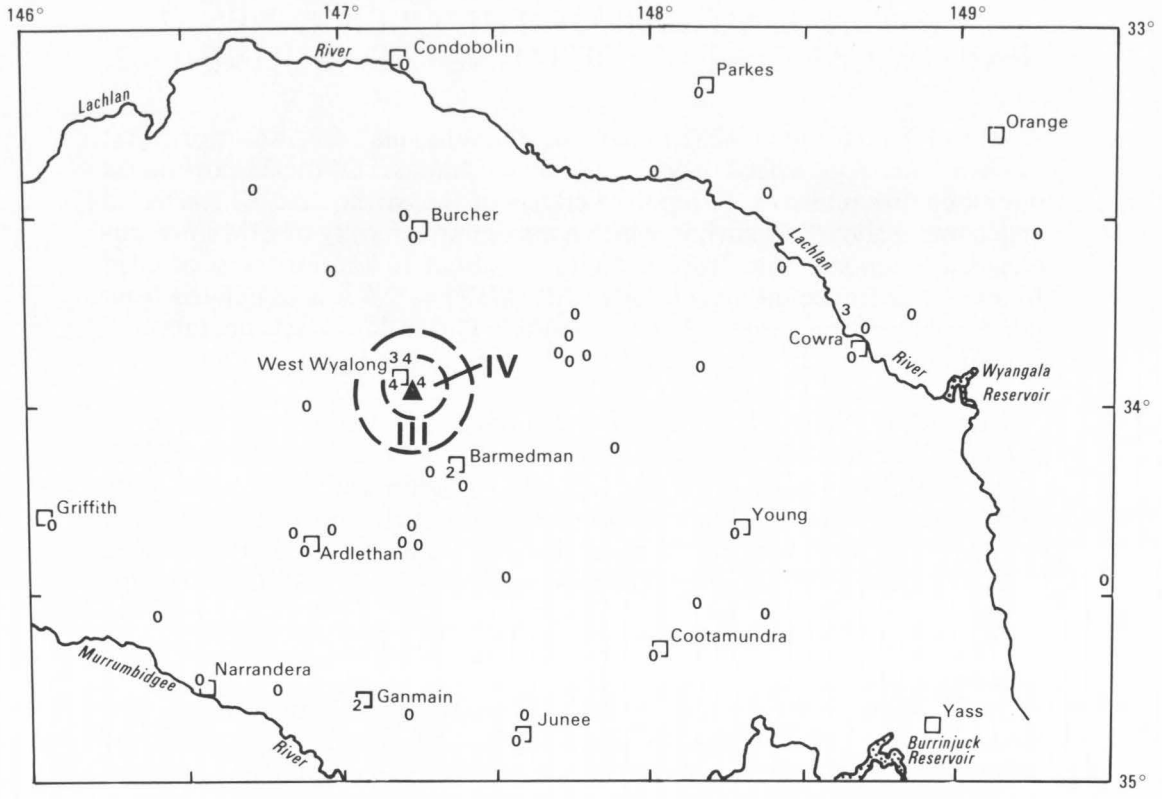
The highest intensity reported was MM IV in the towns of Wyalong and West Wyalong. The earthquake was felt generally at distances up to about 17 km from the epicentre, and also at Barmedman (25 km away), Ganmain (100 km away), and probably near Cowra (130 km away).

The isoseismal map was compiled by BMR from 54 questionnaires returned out of 108 distributed. However, all but 7 were 'not felt' reports, and the isoseismals are not well defined.

Reference

DENHAM, D., JONES, T., & WEEKES, J., 1984a—The 1982 Wyalong earthquakes (NSW) and recent crustal deformation. *BMR Journal of Australian Geology & Geophysics*, 9(4), 255–260.

ISOSEISMAL MAP OF THE WEST WYALONG EARTHQUAKE, NEW SOUTH WALES, 20 MAY 1982



0 80km

DATE : 20 MAY 1982
TIME : 07:36:18 UT
MAGNITUDE : 3.6 ML (BMR)
EPICENTRE : 33.96°S 147.24°E
DEPTH : 2 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

24/155/10

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES—8 JUNE 1982

At 03:13 UT on 8 June 1982 (1:13 p.m. local time) a small area west-northwest of Glen Innes experienced the effects of an earthquake. Of the 22 earthquake questionnaires returned, 10 reported effects of the earthquake. The affected area covered about 250 km^2, in which a maximum intensity of MM IV-V was assigned to reports from Truro homestead—about 16 km northwest of Glen Innes. An instrumental magnitude of ML(WIV) = 2.9 was calculated from the Wivenhoe Dam network (southeastern Queensland) seismograms. A magnitude of ML(I) = 2.5 was determined from the isoseismal data.

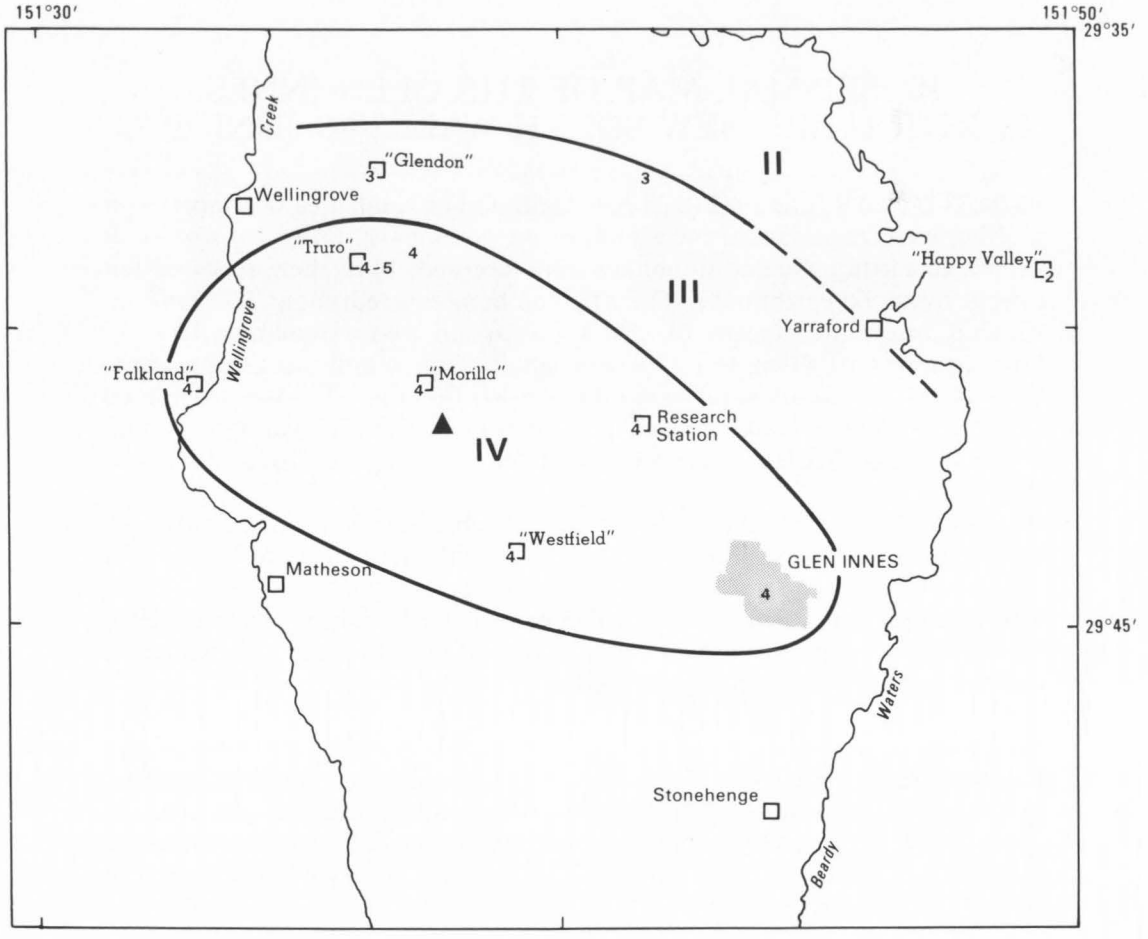
A series of 12 foreshocks on the previous day was recorded on the Cooney (COO) seismogram. In the twelve hours after the main shock, COO recorded eight aftershocks, two of which were felt in the Glen Innes area with an intensity of MM III. Little more than 24 hours after the main shock, a second felt earthquake occurred (see over the page). Thus the 8 June event and its associated foreshocks and aftershocks could be considered as foreshocks to the 9 June event.

References

RYNN, J. M. W., & LYNAM, C. J., 1982—The seismicity of northeastern New South Wales (New England Fold Belt and southern portion of Clarence-Moreton Basin)—a preliminary study. *In* Proceedings of a symposium in honour of Emeritus Professor A. H. Voisey, University of New England, Armidale, 5-8 July 1982, 149-165.

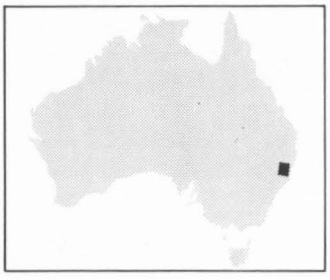
RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanhope-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30-42.

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES, 8 JUNE 1982



DATE : 8 JUNE 1982
TIME : 03:13:23.72 UT
MAGNITUDE : 2.9 ML (WIV), 2.5 ML (I)
EPICENTRE : 29.66°S 151.63°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H56/5

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES—9 JUNE 1982

At 04:33 UT on 9 June 1982 (2:33 p.m. local time) a small area west-northwest of Glen Innes experienced the effects of an earthquake. From an isoseismal survey, 26 earthquake questionnaires were returned; 14 of them reported felt effects from the earthquake. The affected area covered about 200 km^2, in which a maximum intensity of MM V was assigned to a small area 10 to 15 km northwest of Glen Innes (where small objects and furnishings were displaced). An instrumental magnitude of ML(WIV) = 3.5 was calculated from the Wivenhoe Dam network (southeast Queensland) seismograms, and a magnitude of ML(I) = 2.5 was calculated from the isoseismal data.

A series of 20 aftershocks recorded at Cooney Observatory was associated with this event. Of these, three were reported as felt with an intensity of MM II–III.

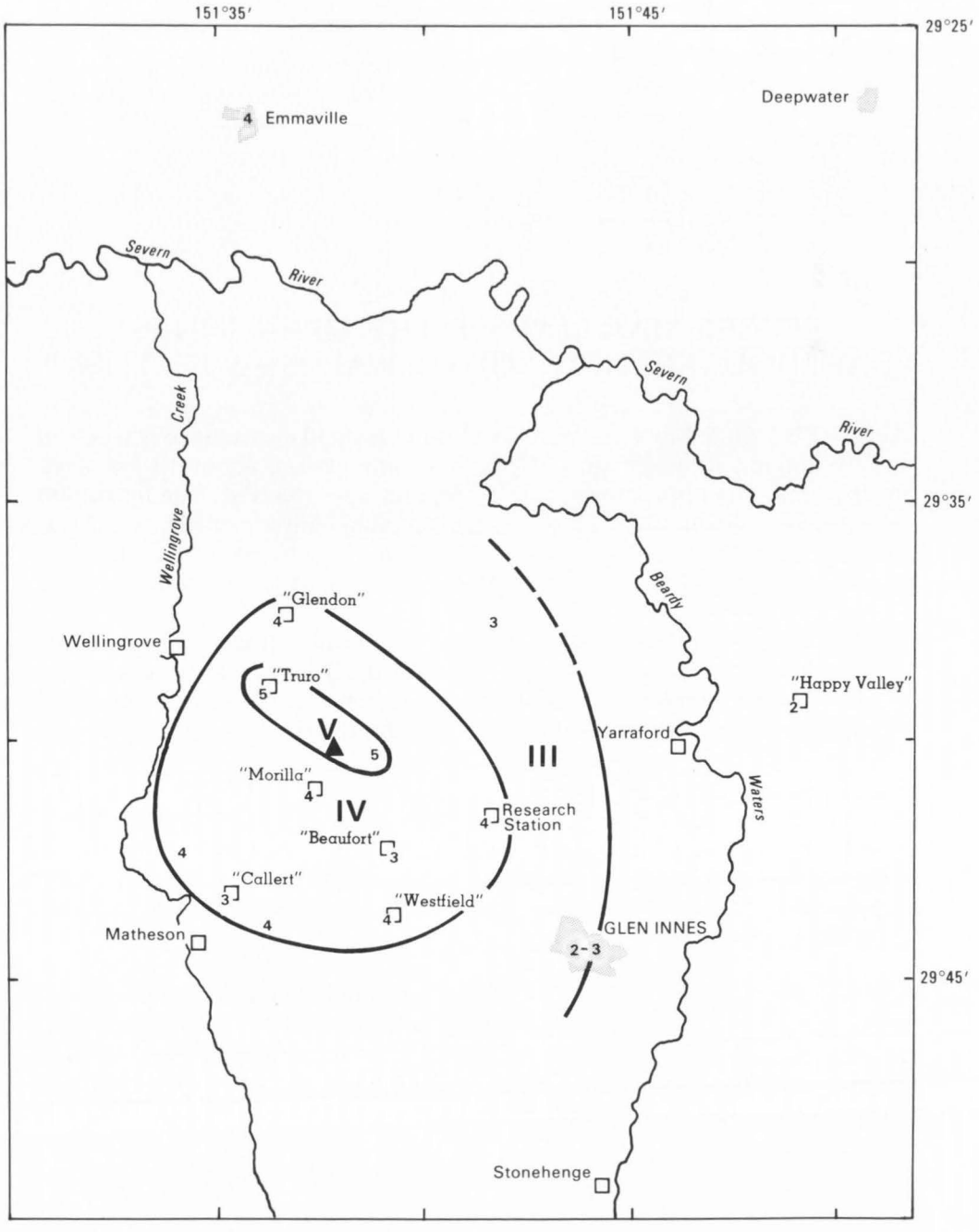
This earthquake is similar to that which preceded it on 8 June 1982 (loc. cit.). The later event may have been the main shock of the whole two-day sequence, and the earlier event the major foreshock.

References

RYNN, J. M. W., & LYNAM, C. J., 1982—The seismicity of northeastern New South Wales (New England Fold Belt and southern portion of Clarence-Moreton Basin)—a preliminary study. *In* Proceedings of a symposium in honour of Emeritus Professor A. H. Voisey, University of New England, Armidale, 5–8 July 1982, 149–165.

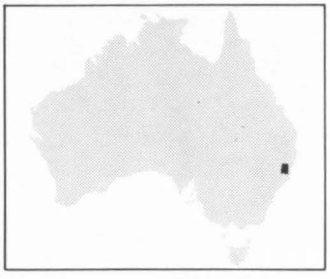
RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanhope-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30–42.

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES, 9 JUNE 1982



DATE : 9 JUNE 1982
TIME : 04:32:46.9 UT
MAGNITUDE : 3.5 ML(WIV), 2.5 ML (I)
EPICENTRE : 29.66°S 151.63°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H56-6/3

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES—5 JULY 1982

At 09:02 UT on 5 July (7:02 p.m. local time) a small earthquake was felt in the 'Wellington Rumbles' area (Rynn & Lynam, 1982), about 10 km west-northwest of Glen Innes town. Six felt reports were received. The maximum assigned intensity was MM IV. An instrumental magnitude of ML = 2.2 was obtained from both the Cooney Observatory and the Wivenhoe Dam Network. A magnitude of ML(I) = 1.8 was determined from the isoseismal data.

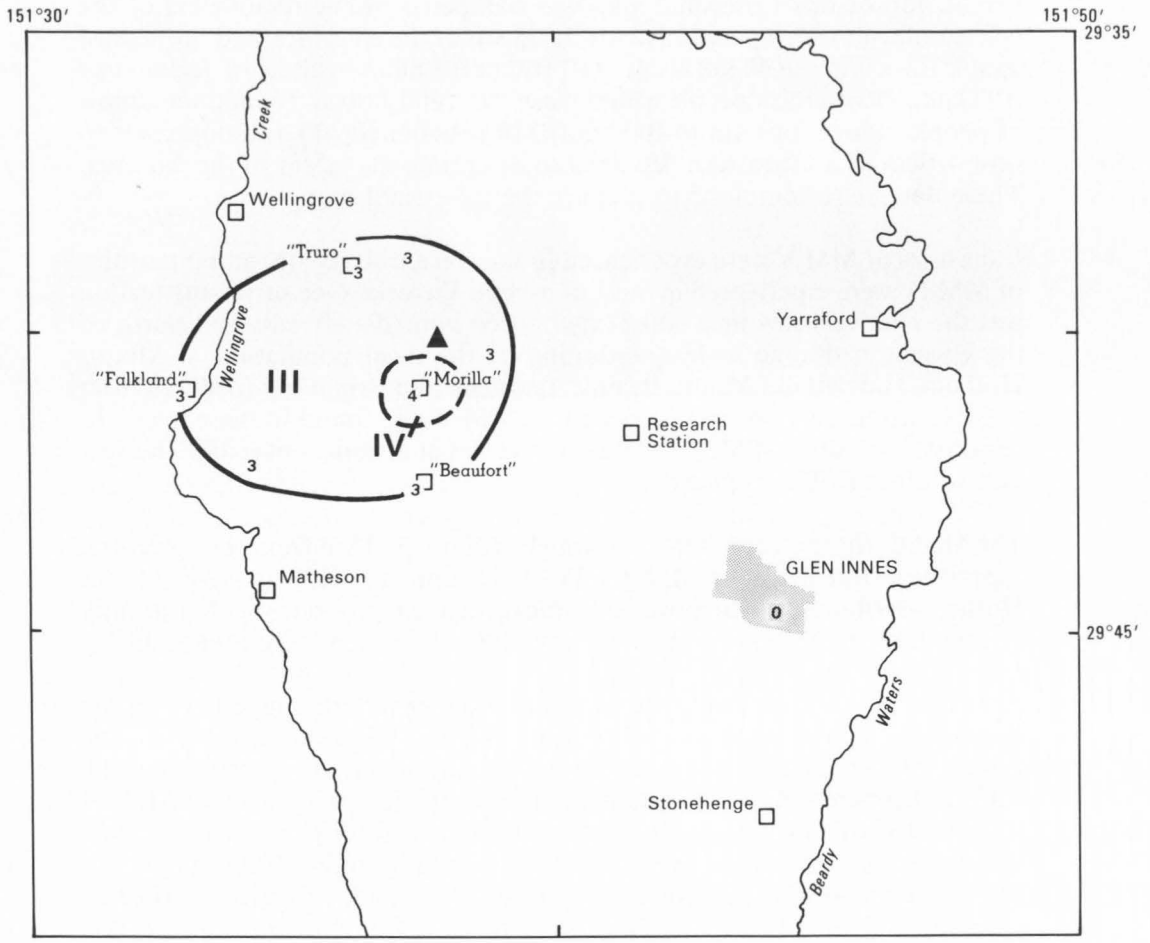
As with the previous earthquakes of 8 and 9 June 1982 (loc. cit.) in the same area, small earthquakes both before and after the 5 July event were recorded at the Cooney Observatory (COO). Four were considered as foreshocks, and two as aftershocks felt with intensities of MM II-III.

References

RYNN, J. M. W., & LYNAM, C. J., 1982—The seismicity of northeastern New South Wales (New England Fold Belt and southern portion of Clarence-Moreton Basin)—a preliminary study. *In* Proceedings of a symposium in honour of Emeritus Professor A. H. Voisey, University of New England, Armidale, 5-8 July 1982, 149-165.

RYNN, J. M. W., & LYNAM, C. J., 1984—Earthquakes and associated seismic phenomena within the New England Fold Belt. *In* HERBERT, H. K., & RYNN, J. M. W., (Editors)—Volcanics, granites and mineralisation of the Stanhope-Drake-Emmaville region. *Geological Society of Australia, Queensland Division, 1984 Field Conference Guide Book*, 30-42.

ISOSEISMAL MAP OF THE GLEN INNES EARTHQUAKE, NEW SOUTH WALES, 5 JULY 1982



DATE : 5 JULY 1982
TIME : 09:02:29.0 UT
MAGNITUDE : 2.2 ML (WIV), 2.2 ML (COO), 1.8 ML (I)
EPICENTRE : 29.67°S 151.63°E
DEPTH : Crustal

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT

ISOSEISMAL MAP OF THE WONNANGATTA EARTHQUAKE, VICTORIA—21 NOVEMBER, 1982

The Wonnangatta earthquake was widely felt throughout eastern Victoria and southeastern New South Wales. The most distant report (275 km) was from the fifth floor of a block of flats in Canberra, where a motion typical of MM I was experienced.

Production of this isoseismal map was hampered by the remoteness of the epicentral region: few people live within 35 km of the epicentre, and the nearest sizable town is about 60 km away. Staff from the Phillip Institute of Technology (PIT) interviewed most people within the epicentral region and a random sample of people at locations out to 100 km. BMR distributed 300 questionnaires to post offices in southeastern Australia to determine the extent of the felt area. These data were combined to prepare the isoseismal map.

Intensities of MM V were experienced in the epicentral region, and intensities of MM IV were experienced in most of eastern Victoria. One surprising feature was the relatively low intensities experienced immediately east and north of the epicentre: despite wide questioning of the local population at Mount Hotham, Harrietville, Mount Beauty, Tawonga, and Bright (up to 60 km from the epicentre), only one report exceeding MM V was found in these areas. In contrast, intensities of MM V were experienced at distances over 100 km west and southwest of the epicentre.

The Melbourne metropolitan area, which is about 180 km from the epicentre, experienced intensities of MM III–IV. This contrasts with the 1966 Mount Hotham earthquake, which was of almost identical size but was felt at only a few places in Melbourne (Underwood, 1967; Everingham & others, 1982).

A number of questionnaire returns and newspaper reports suggested that the earthquake could have caused minor damage to some houses in the Eildon–Mansfield area, Moe, and Morwell. Although, an inspection by PIT staff in these areas discovered damage consistent with an intensity of MM VI (damage to buildings of weak construction), the possibility remains that most of this damage was caused by subsidence resulting from the 1982 drought and that the damage was discovered only when the shock prompted people to examine their buildings. Strong ground motion from the earthquake was recorded by accelerographs at three sites in Victoria—PIT, PAT, and JEN, which are shown as small + signs on the map. The maximum recorded accelerations at these stations were 22, 160, and 75 mm s^{-2} respectively.

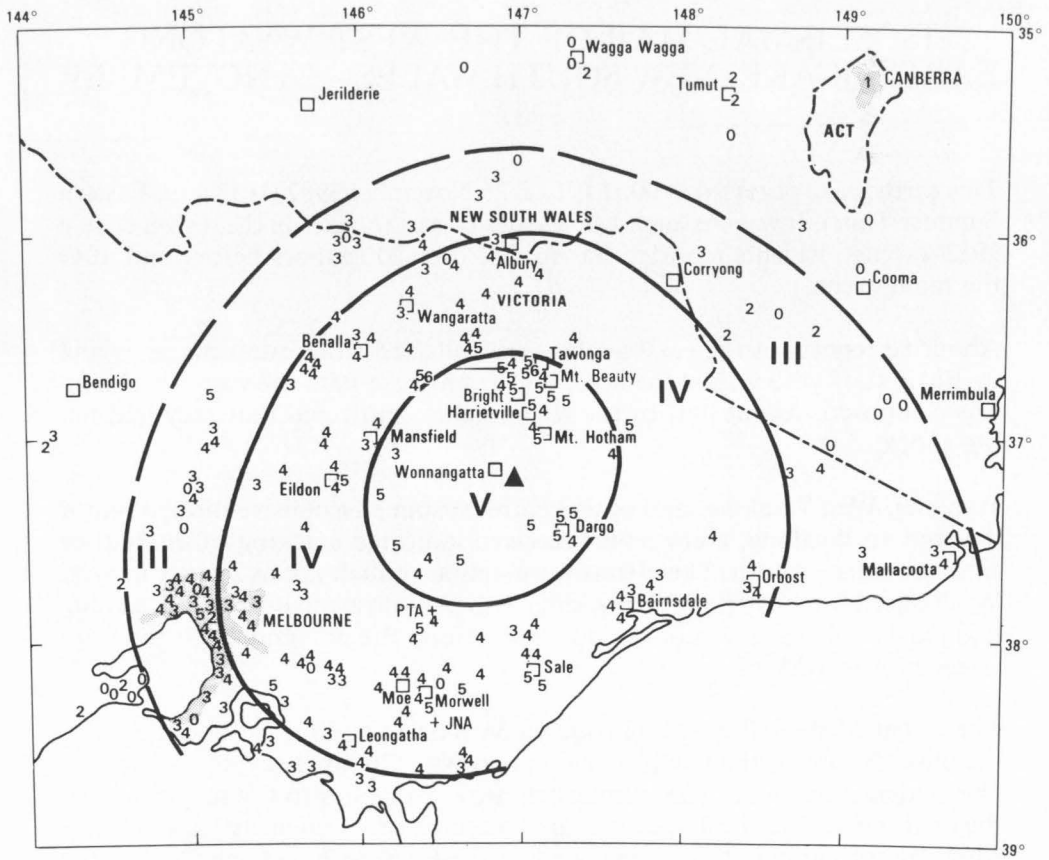
References

DENHAM, D., GIBSON, G., SMITH, R. S., & UNDERWOOD, R., 1985—Source mechanisms and strong ground motion from the 1982 Wonnangatta and the 1966 Mount Hotham earthquakes. *Australian Journal of Earth Sciences*, 32, 37–46.

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

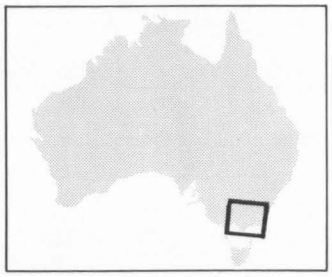
UNDERWOOD, R., 1967—The seismic network and its applications. *Ph.D Thesis, Australian National University, Canberra* (unpublished).

ISOSEISMAL MAP OF THE WONNANGATTA EARTHQUAKE, VICTORIA, 21 NOVEMBER 1982



DATE : 21 NOVEMBER 1982
TIME : 11:34:18.7 UT
MAGNITUDE : 3.8 MS(BMR) 4.8 MB(BMR), 5.4 ML(BMR)
EPICENTRE : 37.20°S 146.96°E
DEPTH : 17 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/V/7

ISOSEISMAL MAP OF THE WEST WYALONG EARTHQUAKE, NEW SOUTH WALES—26 NOVEMBER 1982

This earthquake occurred at 00:11 UT on 26 November 1982 (11:11 a.m. Eastern Summer Time). It was the largest of a series of earthquakes in the region during 1982—some residents reported having felt over 20 tremors before and after the main event.

About 80 reports of the earthquake were collected from questionnaires and by BMR staff who visited the area, and from these data the isoseismal map was composed. About half of the respondents confirmed that they had felt the shock.

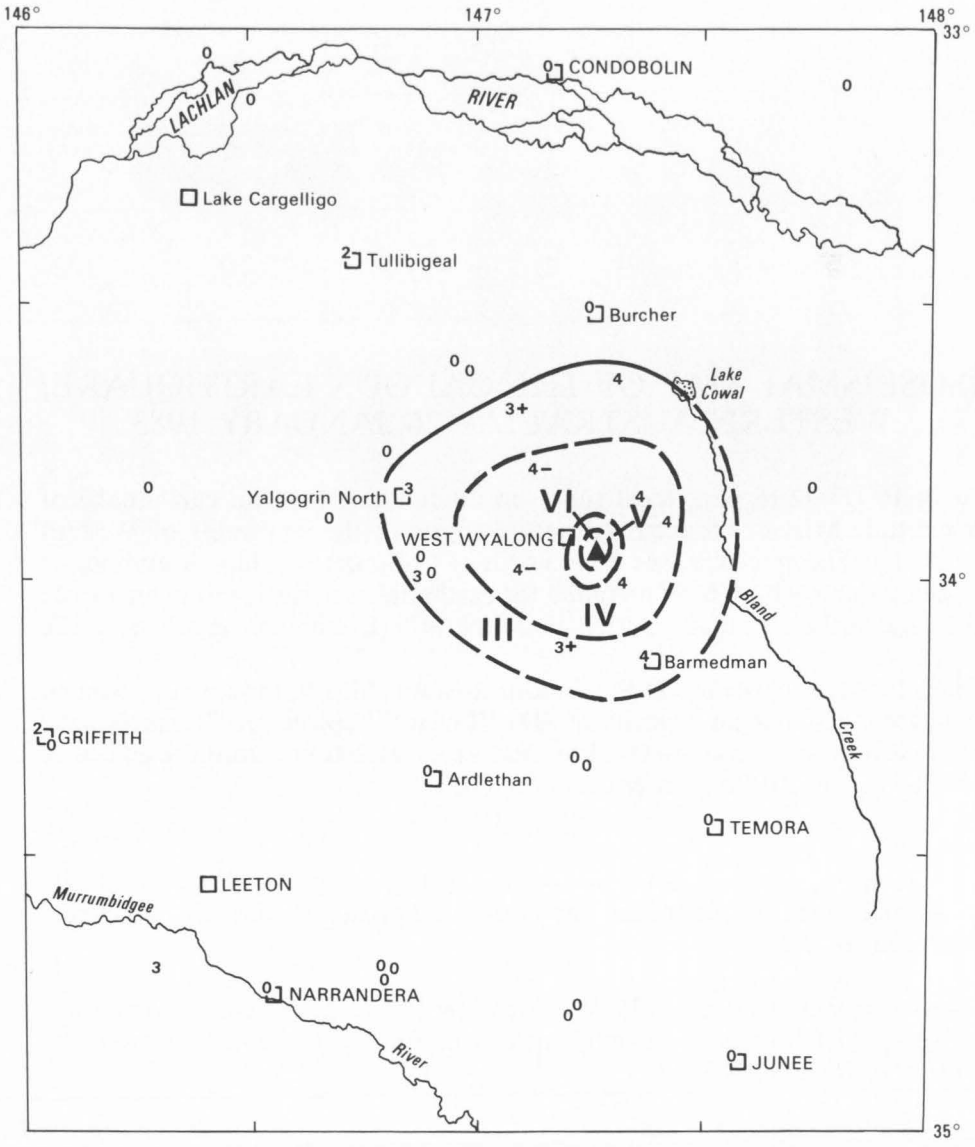
Wyalong, West Wyalong, and other centres sustained extensive though minor damage. In Wyalong, every report received indicated cracking of internal or external walls, or both. The effects were similar though not as intense in West Wyalong. In some Wyalong stores, stock was in disarray; in one, a shop awning had partly collapsed. According to these effects the maximum felt intensity assigned was MM VI.

The extent of the felt area was largely confined to a radius of about 35 km; the most distant of the few isolated reports was 120 km away, to the west of Narrandera. This remarkably small felt area in relation to the magnitude of the earthquake, and the associated rapid attenuation of intensity with distance from the epicentre, indicates that the hypocentre must have been close to the surface.

Reference

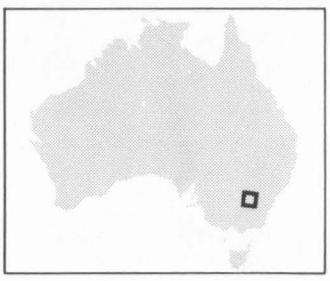
DENHAM, D., JONES, T., & WEEKES, J., 1985—The 1982 Wyalong earthquake (NSW) and recent crustal deformation. *BMR Journal of Australian Geology & Geophysics*, 9(4), 255–260.

ISOSEISMAL MAP OF THE WEST WYALONG EARTHQUAKE, NEW SOUTH WALES, 26 NOVEMBER 1982



DATE : 26 NOVEMBER 1982
TIME : 00:11:17 UT
MAGNITUDE : 4.6 ML (BMR), 5.4 MB (BMR)
EPICENTRE : 33.94°S 147.25°E
DEPTH : 4 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA—26 JANUARY 1983

At 06:16 UT (2:16 p.m. local time) on 26 January 1983 an earthquake of magnitude ML = 4.8 occurred near Cadoux in the southwest of Western Australia. The epicentre was 4 km north of Cadoux township. A number of isoseismal maps have been prepared for earthquakes in the Cadoux area since the large earthquake that occurred on 2 June 1979 (Everingham & others, 1982).

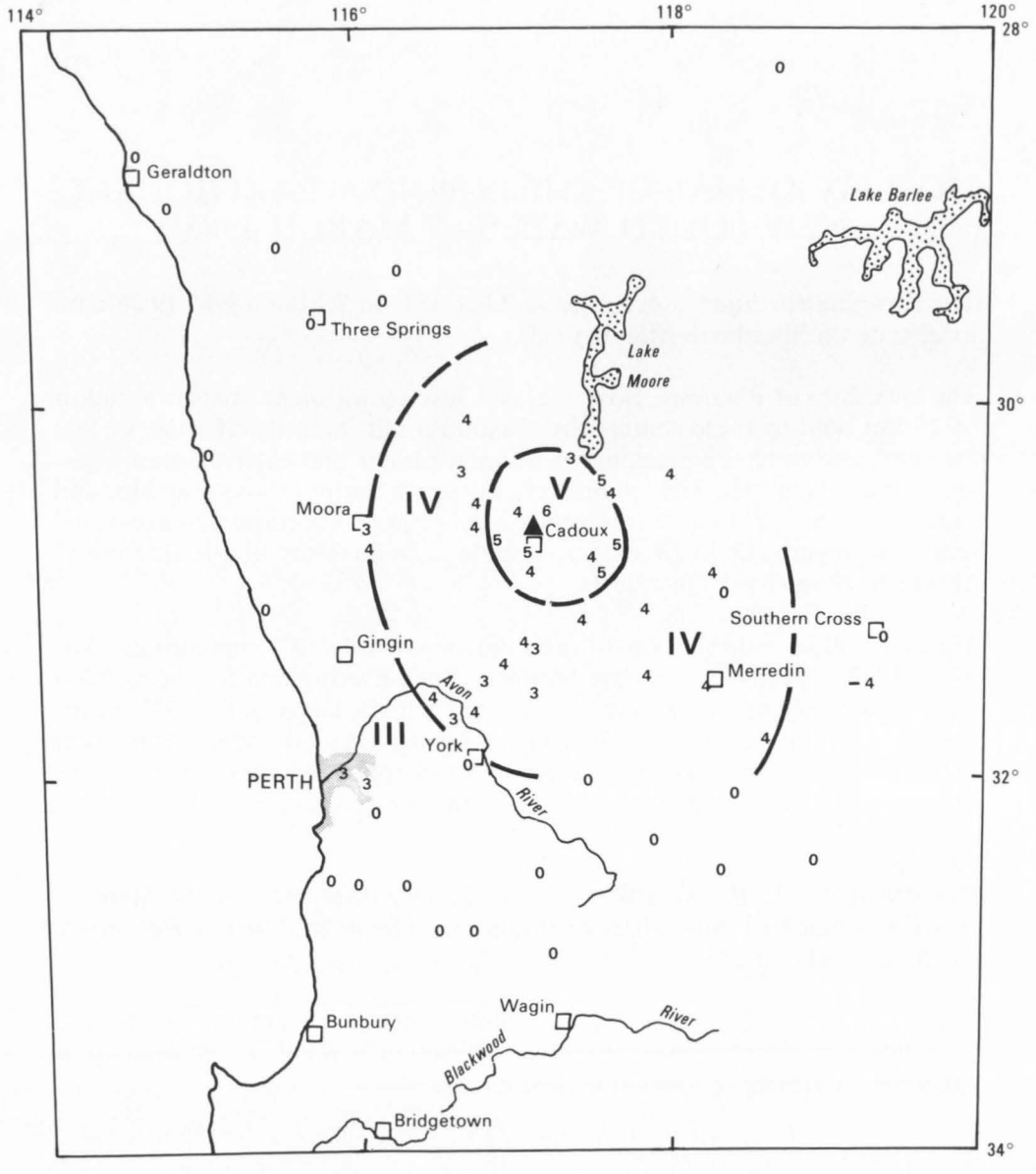
The intensity experienced in the Cadoux area was MM V, though one isolated report was assigned an intensity of MM VI near the epicentre. The earthquake was felt over an area of 50 000 km^2 and as far as 200 km from the epicentre to the southwest (Gregson & others, 1985).

References

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

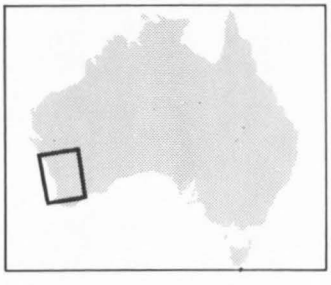
GREGSON, P. J., PAULL, E. P., WOAD, G., & PAGE, B. J., 1985—Mundaring Geophysical Observatory, twenty-fifth year. *Bureau of Mineral Resources, Australia, Record* 1985/37.

ISOSEISMAL MAP OF THE CADOUX EARTHQUAKE, WESTERN AUSTRALIA, 26 JANUARY 1983



DATE : 26 JANUARY 1983
TIME : 06:16:15.4 UT
MAGNITUDE : 4.8 ML (MUN), 5.1 MB
EPICENTRE : 30.73°S 117.13°E
DEPTH : 10 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/WA/29

ISOSEISMAL MAP OF THE BOWNING EARTHQUAKE, NEW SOUTH WALES—7 MARCH 1983

The Bowning earthquake occurred at 23:26 UT on 7 March 1983 (9:26 a.m. local time on Tuesday 8 March 1983).

The townships of Binalong, Bowning, and Yass lay within an epicentral radius of 25 km, and to these centres the maximum felt intensity of MM VI was assigned, owing to the cracking of internal plaster and exterior masonry—some of it substantial. The felt area extended to a radius of about 80 km, and showed evidence of elongate isoseismals in a northerly direction. The isoseismal map was prepared by BMR staff using data from 80 returned questionnaires, of which 47 reported felt effects.

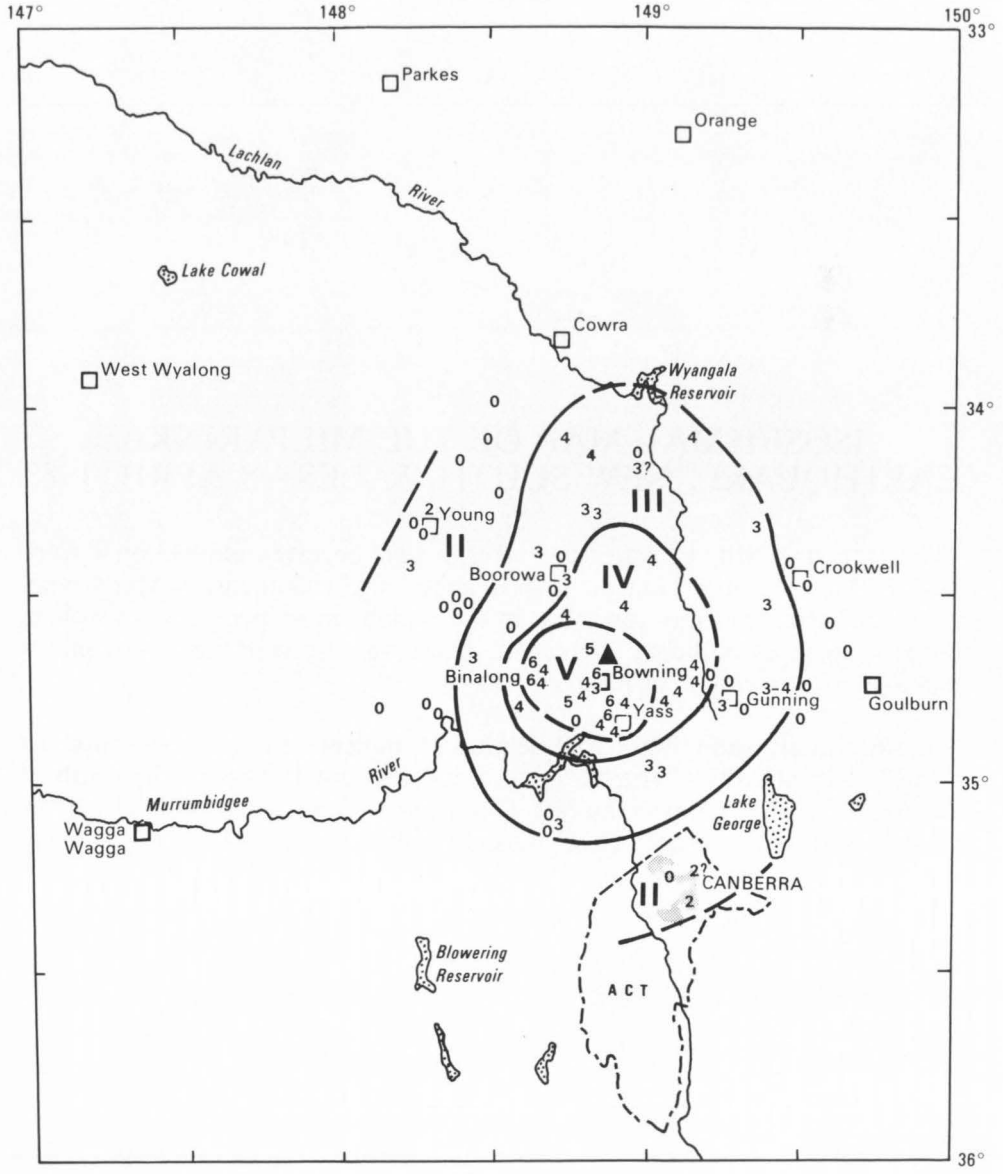
The earthquake and those on 30 June 1977 and 4 July 1977 (magnitudes ML 4.5 and 5.0 respectively; Smith & McEwin, 1980; Everingham & others, 1982) had virtually coincident epicentres. Compared with the larger of the 1977 events, the 1983 earthquake had a much smaller total felt area, but similar maximum felt intensities, indicating that there may be poor depth control in the hypocentral solution for one or more of these earthquakes.

References

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

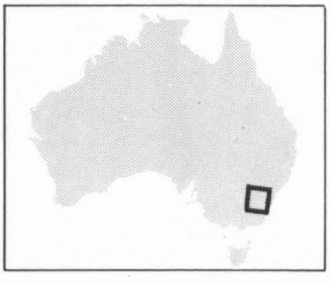
SMITH, R. S., & MCEWIN, A. J., 1980—Earthquake accelerograms and attenuation of seismic waves at Oolong, New South Wales. *BMR Journal of Australian Geology & Geophysics,* 5, 63–67.

ISOSEISMAL MAP OF THE BOWNING EARTHQUAKE, NEW SOUTH WALES, 7 MARCH 1983



DATE : 7 MARCH 1983
TIME : 23:26:01.5 UT
MAGNITUDE : 3.8 ML (BMR), 3.8 ML (PIT)
EPICENTRE : 34.69°S 148.88°E
DEPTH : 17 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



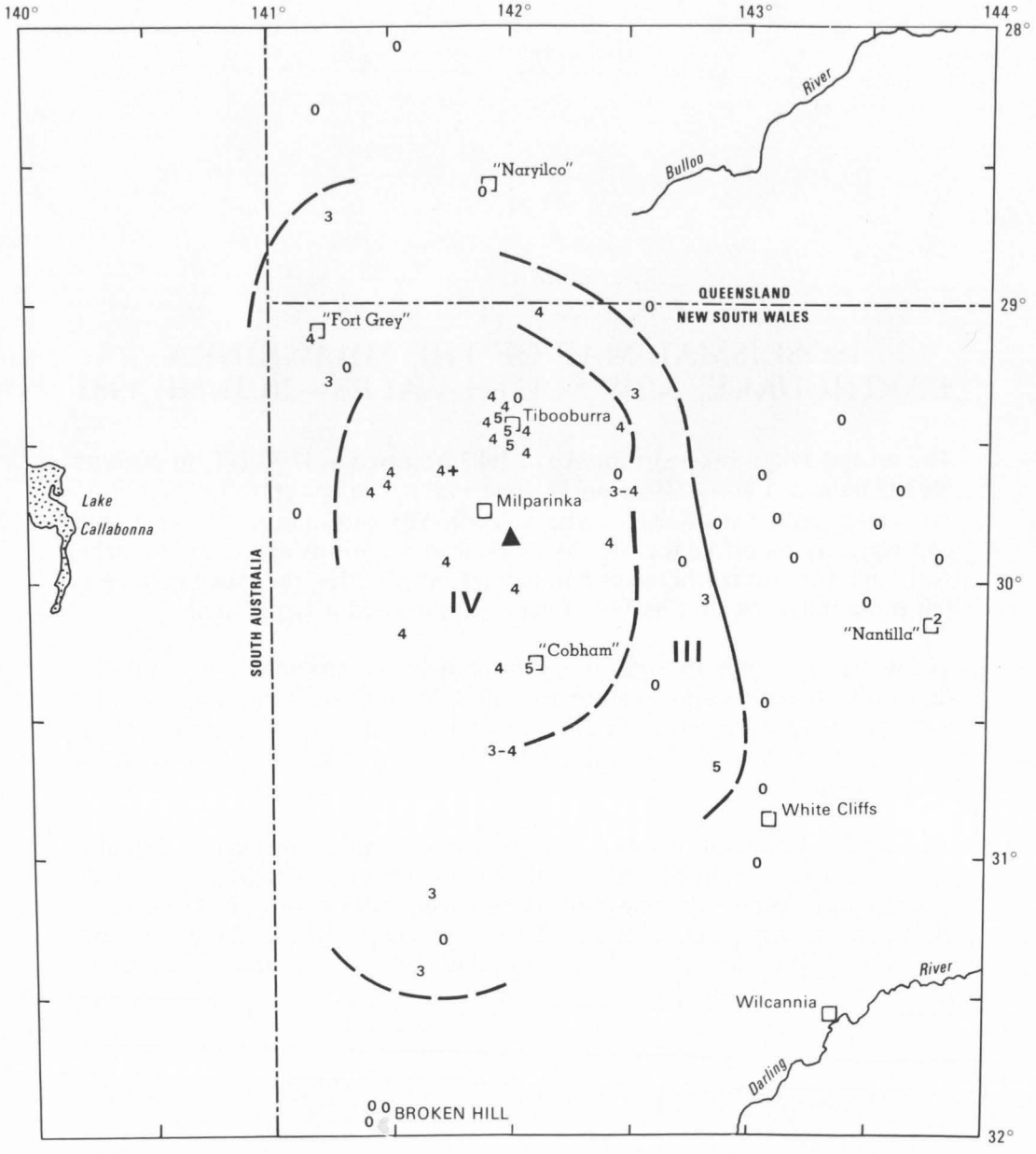
24/155/12

ISOSEISMAL MAP OF THE MILPARINKA EARTHQUAKE, NEW SOUTH WALES—8 APRIL 1983

The first of two Milparinka earthquakes in 1983 occurred at 19:33 on 8 April 1983 (5:03 a.m. Central Time on 9 April) about 20 km southeast of Milparinka. In Tibooburra, the only township in the region, most people were woken, though few reported being frightened. There were isolated reports of minor damage, mostly cracks in plasterwork.

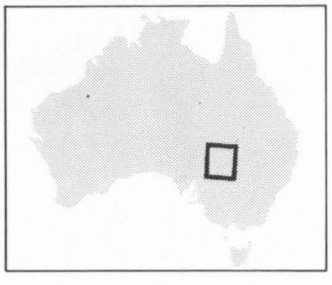
The isoseismals, though not well delineated, indicate a northwest–southeast trend in felt intensities. The felt area extended about 180 km to the south of the epicentre, and 70 km to the east. Questionnaires were distributed by BMR staff, and 83 were returned. The isoseismal map was prepared from these data.

ISOSEISMAL MAP OF THE MILPARINKA EARTHQUAKE, NEW SOUTH WALES, 8 APRIL 1983



DATE : 8 APRIL 1983
TIME : 19:33:18.0 UT
MAGNITUDE : 4.5 ML (BMR), 4.9 MB
EPICENTRE : 29.85°S 142.01°E
DEPTH : 45 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H54/2

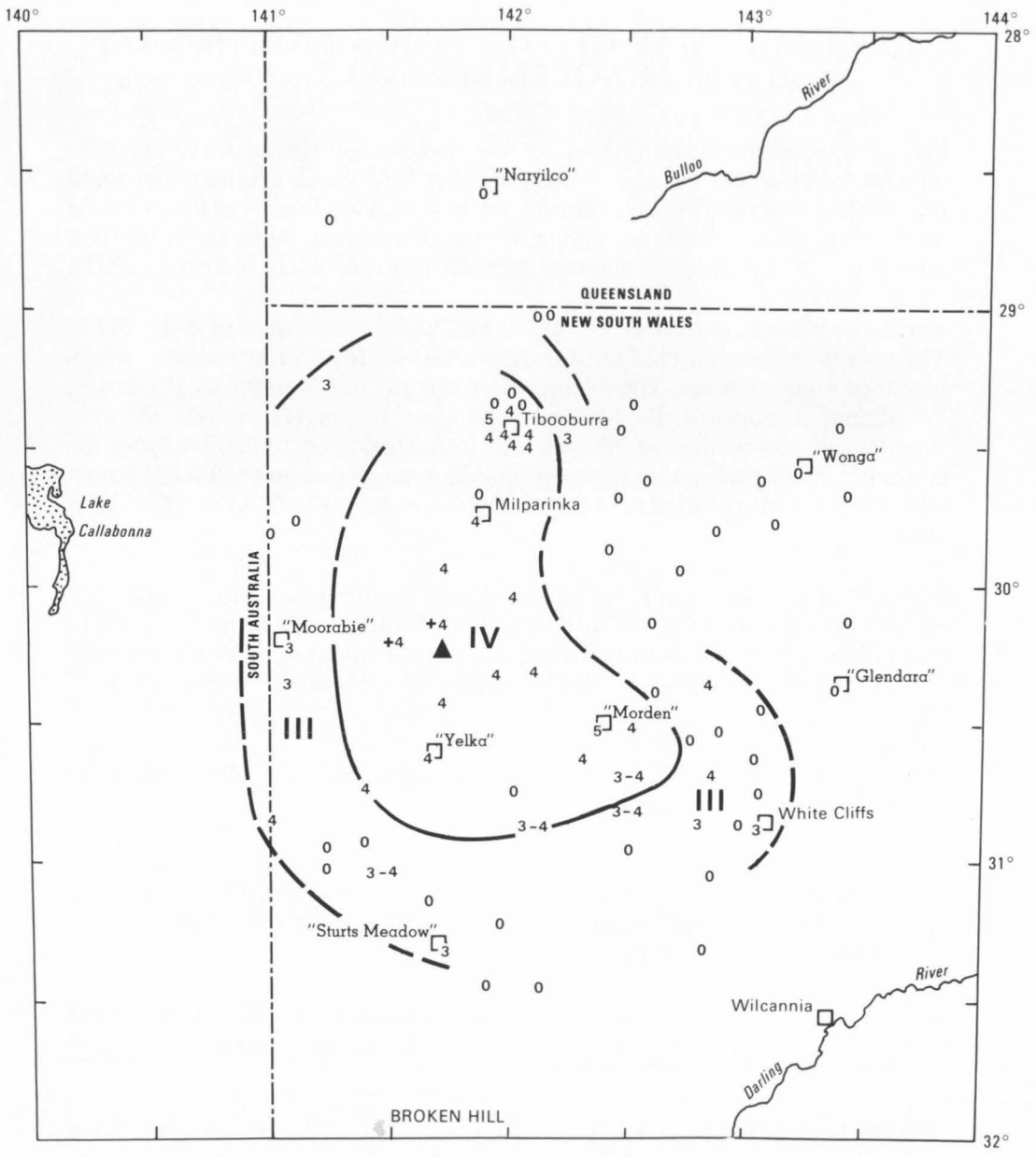
ISOSEISMAL MAP OF THE MILPARINKA EARTHQUAKE, NEW SOUTH WALES—20 JUNE 1983

The second Milparinka earthquake in 1983 occurred at 17:33 UT on 20 June 1983 (3:03 a.m. Central Time on 21 June 1983). The epicentre was about 55 km south-southwest of that of the 8 April 1983 earthquake (loc. cit.), and consequently its effect was not as marked in the township of Tibooburra. Although the two earthquakes had similar magnitudes, the April event was felt more intensely, and its felt effects encompassed a larger area.

The isoseismals for both earthquakes are elongated in the northwest-southeast direction. A noteworthy feature of the MM IV isoseismal for the later earthquake is its relatively short distance (45 km) east and west of the epicentre. BMR staff prepared the isoseismal map using data from 84 returned questionnaires.

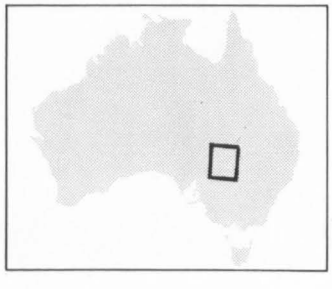
The depth estimate of 60 km is unusual for an intracontinental earthquake, and is poorly determined because of the absence of seismographic stations close to the epicentre (the one at Stephens Creek, 190 km away, is the nearest). However, the large area of the MM IV isoseismal, and the absence of any intensities higher than IV in the epicentral region, are indicative of a deeper-than-normal earthquake.

ISOSEISMAL MAP OF THE MILPARINKA EARTHQUAKE, NEW SOUTH WALES, 20 JUNE 1983



DATE : 20 JUNE 1983
TIME : 17:33:00.3 UT
MAGNITUDE : 4.7 ML (BMR)
EPICENTRE : 30.22°S 141.74°E
DEPTH : 60 km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION (MM)
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/H54/1

ISOSEISMAL MAP OF THE TIMOR EARTHQUAKE, 24 NOVEMBER 1983

Electric power and telephone services in parts of northern Australia were interrupted by an earthquake on 24 November 1983 which originated beneath the Banda Sea about 650 km northwest ofDarwin. The shock was felt intensely on the Indonesian islands of Sumba, Flores, Timor, and Alor, but there were no reports of casualties or damage (Scientific Event Alert Network, 1983).

The earthquake occurred at 05:30 UT, and had a magnitude of ML = 7.5. The maximum intensity assigned to Australia was MM VI in Darwin, which sustained minor damage. The earthquake shook the northern towns of Darwin, Wyndham, Kununurra, Derby, and Katherine. Intensities of MM IV were experienced over an area of 300 000 km^2 in Australia, up to 900 km from the epicentre. The isoseismal map was prepared from responses to 200 felt report questionnaires distributed throughout northern Australia (Gregson & others, 1985).

The earthquake had similar effects to those resulting from the Banda Sea earthquake of 29 October 1974 (Everingham & others, 1982), and was felt in tall buildings in Perth, as were the Indonesian earthquakes of 19 August 1977 (Gregson & others, 1979) and 4 November 1963 (Hearn & Webb, 1984).

References

EVERINGHAM, I. B., MCEWIN, A. J., & DENHAM, D., 1982—Atlas of isoseismal maps of Australian earthquakes. *Bureau of Mineral Resources, Australia, Bulletin* 214.

GREGSON, P. J., PAULL, E. P., & GAULL, B. A., 1979—The effects in Western Australia of a major earthquake in Indonesia on 19 August 1977. *BMR Journal of Australian Geology & Geophysics*, 4, 135–140.

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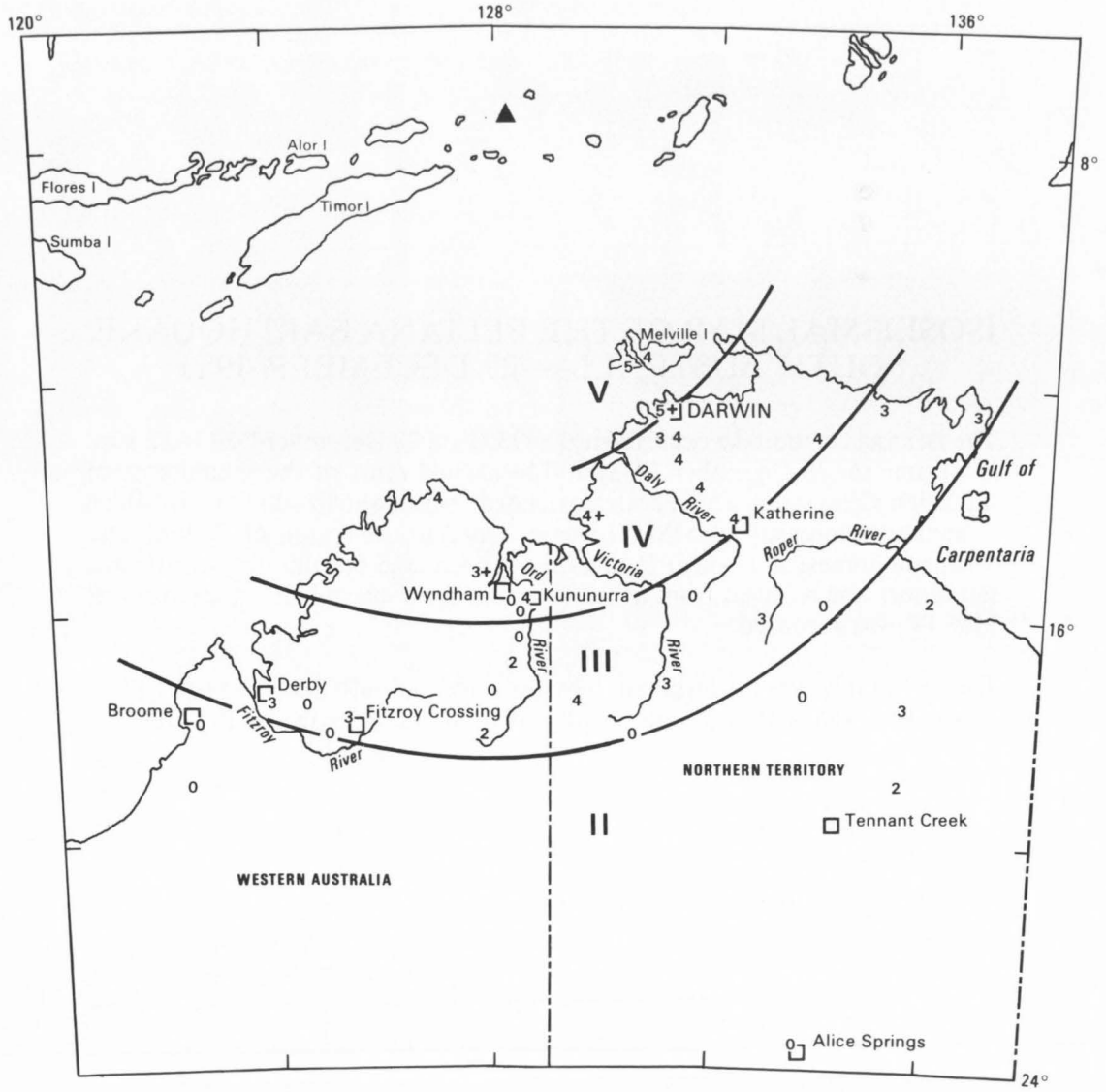
HEARN, S. J., & WEBB, J. P., 1984—Continental-scale felt effects of the large Banda Sea earthquake of 4 November 1963. *Bulletin of the Seismological Society of America*, 74(1), 349–351.

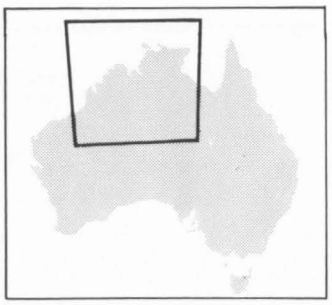
SCIENTIFIC EVENT ALERT NETWORK, 1983—Earthquakes. *SEAN Bulletin* 8(ll), 17, *Smithsonian Institution, Washington.*

ISOSEISMAL MAP OF THE TIMOR EARTHQUAKE, 24 NOVEMBER 1983



DATE : 24 NOVEMBER 1983
TIME : 05:30:34.2 UT
MAGNITUDE : 7.5 ML (MUN), 6.4 MB, 7.1 MS (GS)
EPICENTRE : 7.57°S 128.19°E
DEPTH : 180km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



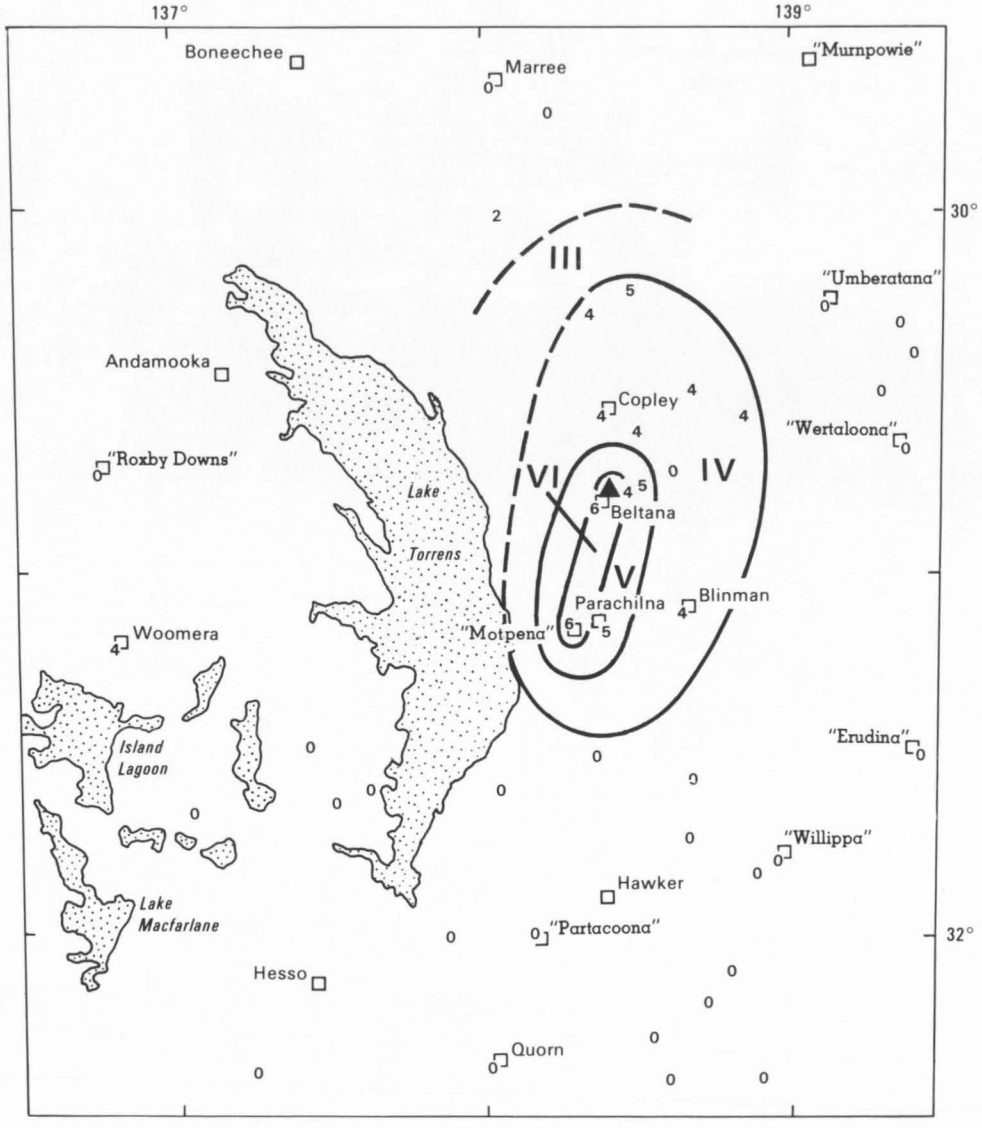
24/09/193

ISOSEISMAL MAP OF THE BELTANA EARTHQUAKE, SOUTH AUSTRALIA—29 DECEMBER 1983

The Beltana earthquake occurred at 17:42 UT on 29 December 1983 (4:12 a.m. local time on 30 December 1983) and awakened most of the inhabitants of the Leigh Creek area. The felt area extended over about 10 000 km^2, in which a maximum intensity of MM VI was assigned to the region of Beltana and Motpena homesteads—near Parachilna. An isolated but multiply confirmed felt report was received from as far away as Woomera, where an intensity of MM IV was recorded.

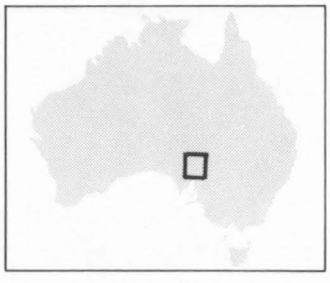
The earthquake was the largest to have occurred in South Australia since 1972. It was followed within 30 minutes by three aftershocks felt at Beltana.

ISOSEISMAL MAP OF THE BELTANA EARTHQUAKE, SOUTH AUSTRALIA, 29 DECEMBER 1983



DATE : 29 DECEMBER 1983
TIME : 17:42:02 UT
MAGNITUDE : 4.5 ML(I), 4.8 ML (ADE), 5.3 MB
EPICENTRE : 30.79°S 138.40°E
DEPTH : 20km

▲ EPICENTRE
IV ZONE INTENSITY DESIGNATION
4 EARTHQUAKE FELT (MM)
0 EARTHQUAKE NOT FELT



24/SA/7