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MUNDARING GEOPHYSICAL OBSERVATORY: 1986 TO 1989

by P J Gregson

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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

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P J Gregson

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. David Beddall, MP
Secretary: Greg Taylor

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Executive Director: Harvey Jacka

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SUMMARY

Annual reports detailing observatory activities have been prepared up till 1985. This report covers activity for the years 1986-1989.

Basic program in geomagnetism, ionospherics and seismology continued at the Mundaring Geophysical Observatory during the period. The main instruments were an Eschenhagen normal-run magnetograph, an IPS type 4B ionosonde, a Worldwide Standard Seismograph, and a Seismic Research Observatory.

Seismographs were operated at Ballidu, Kalgoorlie (Coolgardie), Forrest, Kellerberrin, Kununurra, Marble Bar, Meekatharra, Morawa, Mundaring, Rocky Gully, Narrogin and Warburton.

Earthquake strong motion recording was intensified and the observatory now operates 9 accelerographs and maintains a further 13 for the Water Authority and Telecom. The data base trebled in the four years.

The earthquake list (ML>2) shows details of 600 Western Australian earthquakes over the four year period.

Isoseismal maps were prepared for 14 earthquakes that occurred in Western Australia.

1. INTRODUCTION

The Mundaring Geophysical Observatory opened on 18 March 1959. Descriptions of the observatory and an outline of activity there to the end of 1985 have been given in previous records (e.g. Gregson & Others, 1987). This report outlines the activity for the period 1986 to 1989. Principal events in the observatory's history are given in Appendix 1.

The observatory controls seismological recording at Ballidu, Kalgoorlie (transferred to Coolgardie), Kellerberrin, Kununurra, Marble Bar, Meekatharra, Morawa, Mundaring, Nanutarra, Narrogin, Rocky Gully and Warburton with a new station installed at Forrest. The seismograph at Narrogin is a Seismic Research Observatory (SRO) and is operated in co-operation with the United States Geological Survey. Nine accelerographs are now operating in the South-west seismic zone. A further 13 are operated in co-operation with the Water Authority of Western Australia and Telecom. Magnetic recording is carried out at Gnangara and Learmonth, and ionospheric recording at Mundaring.

P.J. Gregson, E.P. Paull, V.F. Dent, B.A. Gaull, G. Woad and B.J. Page have contributed to this report.

2. STAFF AND VISITORS

Observatory staff are listed in Table 1 and staff absences other than recreation leave are listed in Table 2. Other personnel associated with the observatory's operations and Students who attended the observatory for work experience are shown in Tables 3 and 4 respectively. Table 5 lists the conferences and training courses attended and Table 6 the addresses given by staff. P.J. Gregson was a member of the Geophysics Advisory Committee, Western Australian Institute of Technology(now Curtin University of Technology) and the seismological data base sub-committee of the Accreditation Technical Experts Natural Disasters (ATEND).

Y.M. Moiler (Clerical Assistant Grade 3) and L.A. Van Reeken (Technical Assistant Grade 2) continued on a temporary basis until the positions were made permanent on 9 November 1987 and 19 June 1989 respectively. Both officers continued in the positions on a part-time basis of 20 hours per week.

E.P. Paull made two maintenance visits to Macquarie Island in December of 1987 and 1989. P.J. Gregson, E.P. Paull, V.F. Dent and B.J. Page were occupied for a total of 80 days on first order magnetic and the Australia Wide Array of Geomagnetic Stations (AWAGS) surveys.

P.J. Gregson acted as Administrator of the Australian Seismological Centre in Canberra from 8 February to 8 April 1988 and carried out relief duties at headquarters from 2 to 26 September 1989. E.P. Paull acted as Officer-in-Charge at Mundaring on both these occasions.

B.A. Gaull visited Japan, 1-24 August 1989 as a joint project between the Bureau of Mineral Resources, the Australian Academy of Science and the Japanese Society for the Promotion of Science. He visited the Department of Earthquake Engineering in Hokkaido University and many other institutions in order to plan a bi-lateral study of the microzonation of the Perth Basin in the Perth metropolitan area with the Japanese, who are experts in this field. Preliminary reports on this can be found in Gregson (1990).

G. Woad was nominated as safety officer by the BMR Engineering Services unit in July 1988 and became the observatory safety officer from January 1989.

During the latter part of 1987, the Resources and Energy Department was amalgamated with Primary Industries to form the Department of Primary Industries and Energy (DPIE). From September 1987 the roll of providing in-staff and purchasing matters was gradually taken over by DPIE (Perth) from Department of Administrative Services (DAS). This changeover was finalised by January 1988 The support given by DAS is gratefully acknowledged as is that given by DPIE since the changeover.

Visitors to the observatory are listed in Table 7.

3. SEISMOLOGY

Seismograph stations

Permanent seismograph stations were operated throughout the four years at Ballidu (BAL), Kellerberrin (KLB), Kununurra (KNA), Marble Bar (MBL), Meekatharra (MEK-MEKA), Morawa (MRWA), Mundaring (MUN), Nanutarra (NAU-NANU), Narrogin (NWAO), Rocky Gully (RKG) and Warburton (WBN-WARB). An insensitive seismograph was operated in the Mundaring office. The seismometers at Kalgoorlie, Meekatharra, Nanutarra and Warburton were resited to reduce the effects of cultural noise and required new codes. The station at Kalgoorlie was relocated at Coolgardie on 10 August 1988 and an additional seismograph was installed at Forrest on 8 October 1988.

Temporary MEQ 800 seismographs were operated at Burakin (22 March 1986 to 19 May 1989) and Pingrup (from 1 August 1989).

Details of station locations are given in Table 8 and seismograph calibration data is shown in Table 9. Brief descriptions of individual station operations are given below.

Ballidu (BAL).
1986 - The station operated well during the year apart from one significant period of line outage in February. This was caused by lightning and resulted in damage to Telecom equipment. The station was not recording for 11 days. (Total record loss 3.6%). The AS320 amplifier was replaced with a 42.50 amplifier.

1987 - Lightning continued to be a problem at this station with a strike on 11 October destroying the power brick in the 42.50 amplifier and interconnecting wires in the instrument case. The calibration coil in the seismometer also went open-circuit. Lightning protection devices were fitted to the seismometer and calibration coils at the seismometer vaultlet and to the power input, seismometer input and calibrator output at the telemetry instrument case. The battery lead was fused with a 0.5A fuse.

A standard wooden surround was fitted over the seismometer vaultlet to facilitate inspection of the seismometer.

1988 - Problems with the 42.50 pre-amplifier and minor line outages resulted in a 1.0% record loss for the year.

1989 - A standard telemetry unit housing was installed in April. A faulty Telecom transmitter caused interference on the data line in April but did not result in any record loss. Total record loss for the year was <0.5% resulting from line outage and DC power failure.

Kellerberrin (KLB).
1986-1989 - The station operated well throughout the four years with a <1.0% record loss. In January 1987 a small pulse every 11.5 seconds was isolated as being Telecom produced. It was eventually eliminated. A standard telemetry unit was installed in June 1989.

Kalgoorlie (KLG-KLGA).
1986 - Industrial ground noise from rock crushing plants increased to an unacceptable level during the year. The sensor was relocated on 12 May at Peter's Hill, 5 km north-west of the existing station. Data was transmitted back to the original recording site using FM telemetry on a Telecom line. The remote equipment was housed in the Telecom microwave building. A new code KLGA was assigned. Record loss for the year totalled 0.8%.

1987 - The station did not operate satisfactorily. Although the station was resited during 1986 to eliminate cultural noise it was still evident at the new location and increased during the year and it was planned to again resite the station during 1988.

Water seeped into the electronics vault in January resulting in damage to the 42.50 amplifier. Twenty two days recording were lost while repairs were effected. The amplifier was relocated in the Telecom power room. Line problems contributed to the major loss of record or poor recordings. A total of 8.8% of recording was affected. An Omega clock/receiver and new inverter were installed in July.

1988 - The seismograph operated with 1% record loss, however cultural noise continued to be a significant problem and the station was relocated to Coolgardie on 10 August.

Coolgardie (COOL).

This station was installed on 10 August 1988 as a replacement for Kalgoorlie. The seismometer is located at Emu Hill and a Telecom line using FM telemetry transmits the data back to the observatory office in Mundaring. The equipment consists of a Willmore Mark 2 seismometer, standard telemetry unit (Geotech 42.50 amplifier and VCO, Statronics power supply and calibrator) which is housed in the Telecom microwave building and a Geotech AR320 amplifier and helicorder. Time control is provided by the SRO clock at Mundaring. The telemetry link, providing a 450 km east-west base, has proved invaluablefor rapid location of earthquakes in the north-west of Western Australia.

The main problems during 1989 were with recorder pen translation with minor record loss caused by DC power failure and line outage. Total record losses during 1989 were 1.7%.

Forrest (FORR).

A new station was installed at Forrest on 7 October 1988 as part of the Australian program to monitor all magnitude ML 3 or greater earthquakes. It increased the coverage in the south-east corner of Western Australia (Gregson and Paull, 1991). The equipment consists of a Willmore Mark 2 seismometer located about 5 km north-west of the Meteorological office at Forrest. Data is telemetered via radio back to the Meteorological office where it is recorded using a Geotech AR311 amplifier and helicorder. Time control is provided from an Omega clock/receiver.

Meteorological staff maintain the station recording. The remote site is the standard installation used by the observatory for several years. It consists of three 30cm diameter PVC pipes, all buried to house the seismometer, battery and electronics (amplifier, calibrator and radio transmitter). The battery is maintained using a 40W solar panel. The solar panel and radio mast are the only equipment above ground. A Philips 471 MHz radio transmitter and receiver is used for telemetry.

Record loss in 1989 was 1.0%.

Although the seismometer is 5 km from the east-west standard gauge railway line an average of about 12 trains a day caused disturbance over several minutes each. Consideration will be given to relocating the seismometer further from the line.

Kununurra (KNA).

1986 - Minor clock and power problems resulted in a total record loss of 1.3%.

1987 - This station operated well throughout the year. The only difficulty resulted from time control with the closure of VNG. WWV was used as an alternative time source but reception was not always good although it was generally acceptable after 0700 UT.

1988 - Minor faults with power, pen translation and pen breaking resulted in a record loss less than 1.0%.

Marble Bar (MBL).

1986 - A series of minor problems related to late record change, pen translation, pen breaking and power problems resulted in a total record loss of 1.6%.

1987 - An Omega clock/receiver and new inverter were installed in October. Reception of the Omega signal throughout the town site of Marble Bar was poor. However reception was sufficient to maintain time control. Minor line outage occurred in January and February resulting from lightning. The main cause of record loss (1.1%) was due to late record changes.

1988-1989 - Minor faults related to power failure, pen breaking and pen pressure being too high resulted in about 1.0% record loss.

Meekatharra (MEK-MEKA).

1986 - Localised noise increased adjacent to the sensor. The sensor was shifted on 30 April to the vicinity of the Meteorological office, but still on airport property. The recording equipment was housed in the Meteorological office. A new code MEKA was assigned to the station. Total recording loss was 0.5%.

1987 - Clock failure resulted in a minor record loss. Otherwise the station operated well throughout the year. An Omega clock/receiver and new inverter were installed in September.

1988-1989 - Industrial noise increased considerably over the two years as a result of increased mining activity in the area. It became necessary to lower the gain to 25% of the original level. Record loss over the two years averaged 0.5%.

Morawa(MRWA).

1986 - Minor problems related to recording pen heat, pen breaking, power supplies and late record changing resulted in a total of 2.6% record loss.

1987 - Recorder failure was the major cause of record loss; 1% of a total of 1.6%.

The console was relocated in the office at the Agricultural School. In July an Omega clock/receiver and new inverter were installed.

1988-1989 - Power failure, pen heat, pressure and breakage resulted in an average of 1.0% record loss over the two years. The seismometer was cleaned in December 1989.

Mundaring (MUN).

1986 - A BMR designed and built digital telemetry unit was installed to telemeter all six components of the World Wide seismograph system to the Mundaring office. Both the long and short period photographic recording drums were converted by Mundaring technical officers to visual hot pen recorders. A Telecom circuit was used to telemeter the data which was recorded in the office. It was necessary to erect a 24 meter tower at the Weir site to achieve line of site for the radio link used by Telecom. Photographic recording ceased on August 13.

Record losses totalled 1.6% for the year, which was about double the normal loss This resulted mainly from teething problems with the changeover from photographic recording to visual recording.

Photographic recording of the high-gain vertical supplementary seismograph ceased and FM telemetry was used to transmit data from the Weir site to the office. A helicorder was used for recording.

The two Wood-Anderson seismographs were relocated at the Mundaring office but recording was still carried out on photographic paper. The three channel insensitive vertical seismograph located in the office operated satisfactorily throughout the year.

1987 - As usual the World Standard Seismograph continued to operate well with less than 1% record loss during the year. Filters were fitted to the telemetry unit in the office which shaped the long period response to the World Standard Curve. The system was calibrated and adjusted to have a magnification of 25K at 1.0 sec and 375 at 15 second for the short and long period components respectively.

The high gain vertical short period and the low gain seismographs operated with very little record loss during the year.

The Wood-Anderson seismographs were sent to headquarters in March, to fit photo-electric cells to convert either to digital or visual recording. They were still at headquarters at the end of 1989.

1988 - Total record loss for the WWSS was 1.0% resulting from poor connections in the LP-NS circuits, failure of both LP and SP recording drum drives and paper falling off the recorder drums. The latter was reduced by changing the sticky tape used to hold the paper on the recording drums.

Both the high-gain vertical short period and the low gain seismographs operated very satisfactorily throughout the year.

1989 - All components operated well with <0.5% record loss.

Nanutarra (NAU-NANU).
1986 - The majority of the 1.3% record loss occurred because of late record changing.

1987 - The EMI clock resulted in the major part of the record loss during the year. It was replaced by an Omega clock/receiver and new inverter in October. At the same time the seismometer was relocated about 5 km south-east of the old location and radio telemetry used to telemeter data back to the roadhouse for recording. The remote site installation was similar to that described at Forrest (see above). A new code, NANU was assigned.

1988 - The inverter failed in June resulting in a seismograph shut down for 16 days before a replacement could be installed.

1989 - Intermittent noise was a problem from September onwards, but did not result in record loss. The problem was eventually tracked down to the receiving antenna being off-line by 60 degrees. Recording loss during the year was <0.5%.

Narrogin (NWAO).
1986 - This station operated exceptionally well with a total record loss of 0.4%

1987 - Total analogue record loss was very low during the year. The uninterruptable power supply failed in September but did not result in record loss. A problem developed with the tape recording system in November which caused problems with the reliability of the digital recording. Advise was sought from Albuquerque Seismological Laboratory, however the problem continued into 1988.

A new aerial was erected in September to receive time signals from WWV and WWVH. These signals are now used to control the SRO clock as VNG ceased transmission at the end of September.

1988 - A number of components and boards were replaced in the tape recording systems. It was not until 8 April that the data electronics and tape drive boards were replaced and digital recording returned to normal.

The inverter at the remote site became unreliable in February and the main fuse regularly blew out resulting in the system running on mains. The problem was partly caused by low battery voltage battery charger turning off because the voltage was below the drop-out voltage. The batteries were re-charged, ELCB's fitted to the mains and inverter circuits and earth connections replaced.

1989 - There was <0.5% analog record loss during the year. The main inverter/ charger failed in January and the mains circuit breaker blew. Damaged components were replaced and the system was operating within a few hours.

Rocky Gully (RKG).
1986 - Two percent of record loss resulted from minor problems related to late record changing, loss of pen heat, pen breaking and power failures.

1987 - The major causes of record loss were late record changing (0.9%) and either loss of pen heat or the pen breaking (1.4%). An Omega clock/receiver and new inverter were installed in August.

1988 - Late record change and system power failures both resulted in 1.9% record loss.

1989 - Late record change showed improvement (1.8%). Power failures, broken pens and recorder failure resulted in a further 3% record loss. the recorder was replaced in October.

Warburton (WBN).

1986- Breaks in the cable between the seismometer and recorder were the main reason for record loss (1.2%). Late record changing accounted for 1.1% and power failures 0.7%. The total record loss was 3.2%

1987 - Late record changes were the main cause of record loss (1.4%). An Omega clock/receiver and new inverter were installed in July. At the same time the seismometer was relocated at a site about 9 km south-east of Warburton and data telemetered back to the recorder using radio telemetry. The remote site installation was similar to that described for Forrest (above). A new code WARB was assigned and location and calibration data are given in Tables 8 and 9 respectively.

1988 - Total record loss was 2.1% resulting from late changes (1.3%) and pen translation and power failures.

1989 - Operation was similar to 1988 except total record loss was 1.5%.

Temporary stations

Burakin (WA4). The Sprengnether MEQ 800 seismograph continued in operation at Burakin until 19 May 1989.

Pingrup (PIN). A Sprengnether MEQ800 was operated at Pingrup from 1 August 1989 and continued for the remainder of the year.

Wyalkatchem (WYAL). A Sprengnether MEQ800 seismograph was operated at Wyalkatchem from 14 January to 2 March 1988.

Accelerographs

By the end of 1989 there were 22 accelerographs in operation in Western Australia. Nine were owned by the Bureau of Mineral Resources; ten by the Water Authority of Western Australia and three by Telecom. All instruments were maintained by observatory staff. Details of instrumentation type, calibration data, location and dates of operation are given in Tables 11 and 12.

All the BMR accelerographs were located in the Southwest Seismic Zone. Digital accelerographs were introduced into the BMR network with the installation of Geotech A700 accelerographs at Cadoux on 2 July 1986 and 21 January 1987, Kelunji accelerographs at Goomalling and Dowerin on 20 December 1988 and 13 September 1989 respectively. The advantage of these recorders is they can record the entire P-wave, and lend themselves more easily to spectral analyses. BMR designed and built trigger/timer microprocessor systems were installed on all BMR owned MO accelerographs during 1986. This facilitated the identification of triggerings on the recordings.

The Water Authority installed Geotech A700 accelerographs on the following dams Canning (2) - 16 January 1987; Serpentine (2) - 5 May 1987; Lake Argyle (2) - 14 July 1989; North Dandalup (1) - 28 December 1989 and Victoria (1) - 30 December 1989. A SMA1 accelerograph was operated at Mundaring Weir for the four years and an MO2 was also installed on 21 August 1987.

The three Telecom accelerographs were SMA1 instruments and were operated for the four years in the main telephone exchange building in Perth.

Strong motion data recorded during the four years is listed in Table 13. The data base has more than trebled in the four year period and has been used in requests for various design spectra, as well as the basis for the study on attenuation of strong ground motion in Western Australia by Gaull (1988). Gaull and Michael-Leiba (1987) and Gaull and others (1990) used this data base directly in their papers on earthquake risk studies of Southwest Western Australia and Australia respectively. These papers are being used in the current update of Standards Australia's earthquake code.

Seismicity

Table 10 lists earthquakes of magnitude ML 2.0 or greater which occurred in Western Australia in 1986 to 1989. Epicentres of those with magnitude ML 2.5 or greater are shown in Figure 2 to 5. Individual areas are discussed below.
Where zone numbers are used they refer to zones defined by Gaull & others (1990) (Figure 1).

1986 (Figure 2) - Fourteen earthquakes of magnitude 4 or greater were located in the Western Australian region. Of these, 7 were located offshore; the largest being on 2 January, 300 km W of Augusta (ML 5.3) and on 18 February, 550 km S of Albany (ML 5.2).

The largest onshore earthquake occurred on 26 May, 300 km SE of Warburton (ML 4.5). The majority of activity occurred within, or close to the defined zones. The notable exceptions were a group of 7 earthquakes about 100 km offshore from Port Hedland and 13 earthquakes offshore about 300 km west of Augusta.

Southwest Seismic Zone. (zones 1 & 2) There were 80 earthquakes with ML>1.9 located in the Southwest Seismic Zone (see Figure 6). Activity was of a similar level to 1985. The most active area continued to be Cadoux where 39 events were located. The remainder of the activity was spread throughout the zone from Denmark in the south to Wongan Hills in the north and Merredin in the east. Ten earthquakes occurred in the Meckering area and 16 in the Quairading area.

Only two earthquakes of magnitude greater than 3.9 occurred in the zone; one on 17 May was located 15 km WSW of Wagin (ML 4.0) and the second on 1 September was located 5 km ESE of Meckering (ML 4.1). Of particular interest was an ML 20earthquake which was located 80 km SW of Fremantle on 1 October.

There were more than 400 tremors recorded in the zone. Information on these and those in 1987-1989 are stored on computer at Mundaring.

1987 (Figure 3) - There were only 12 earthquakes of magnitude 4 or greater during the year. All but 4 occurred offshore. Two of these were magnitude 5 occurring on 19 July and 4 December and were located 120 km WNW of Kalbarri and 200 km WNW of Broome. The largest onshore earthquake occurred on 8 July, 60 km SE of Norseman (ML 4.7).

The majority of the onshore earthquakes occurred in defined zones. The most active offshore zone was the north-west continental shelf (zone 11).

A magnitude 4.0 earthquake, about 150 km offshore from Port Hedland, on 24 September, occurred in the same area as a group of earthquakes in 1986 (see above). Three earthquakes of magnitude 5.0, 4.7, and 3.8 occurred offshore from Dirk Hartog Island. They were located between zone 3 and the coast.

Southwest Seismic Zone (zones 1 & 2). Seventy-seven earthquakes were located in the zone during 1987 (see Figure 7). Activity was slightly lower than during 1986. The largest earthquake occurred on 7 March, near Cadoux (ML 4.5). Overall the activity in the Cadoux area was much lower than in 1986 with only 14 events being located. Wyalkatchem, Meckering and Dumbleyung were all active with 24, 15 and 12 earthquakes respectively. Minor activity occurred at Quairading, Aldersyde and Wagin. Activity in the Wyalkatchem area has been described by Dent (1990).

1988 (Figure 4) - There were 13 earthquakes of magnitude 4 or greater in the region of Western Australia. The largest, (ML 5.7) 150 km north-east of Derby occurred on 6 February. Two magnitude 5 earthquakes occurred 90 km east of Marble Bar and 50 km north-east of Cocklebiddy on January 28 and 15 June respectively. Of these three, the Marble Bar earthquake was the only one in a recognised zone.

The majority of the remainder of onshore earthquakes were in recognised zones. Offshore activity was low compared with previous years, most occurring on the north-west shelf.

Southwest Seismic Zone (zones 1 & 2). Activity in this area was lower than 1987. Sixty-one earthquakes of magnitude 2 or greater occurred in the zone (Figure 8).
The largest earthquake (ML 4.3) occurred on 6 January and was located near Wyalkatchem. The majority of the activity occurred at Wyalkatchem, Meckering, Cadoux, Ballidu and Bencubbin with 16, 10, 10, 9 and 7 events respectively. Activity also occurred at Brookton, Beverley, Nyabing, Mt Barker, Dumbleyung and Kukerin.

1989 (Figure 5) - Only 5 earthquakes of magnitude 4 or greater were located in the Western Australian region. Two of these occurred in an area 40-50 NE of Broome (zone 9) on 13 October and 9 December (ML 5.4 and 4.2) and two, 160 km SE of Laverton (zone 5) on 3 March with magnitudes 4.8 and 5.4. The other occurred 60 km SE of Erong Station (zone 8) on 7 January, ML 4.0.

The majority of the activity occurred in or close to the defined zones. Notable exceptions were two earthquakes offshore from Dirk Hartog Island (see 1986) and one, 480 km west of Fremantle.

Southwest Seismic Zone (zones 1 & 2). The level of activity was about the same as for 1988. Sixty-two earthquakes of magnitude 2 or more were located in the zone (Figure 9). There were no events of magnitude 4 or greater. The largest earthquake occurred on 10 November near Cadoux, ML 3.6. A series of 13 earthquakes occurred near Wagin on 14 to 17 December, the largest being ML 2.6. The majority of the activity occurred at Cadoux (13), Wongan Hills (8), Wyalkatchem (7), Pingrup (5) and Meckering (4). Minor activity occurred near Brookton, Calingiri, Cranbrook, Nyabing and Narembeen.

Earthquake intensities and isoseismal maps

Isoseismal maps were prepared for 14 earthquakes from information received from the distribution of questionnaires.

Maximum intensities for other felt earthquakes are shown in Table 10.

Augusta, 15 January 1986 (Figure 10). Residents in the Southwest corner of Western Australia experienced the effects of a magnitude ML 3.8 earthquake on 15 January at 6.11 a.m. (2211 UT). The epicentre was 24 km south-west of Augusta. The isoseismal map was prepared from about 50 returned questionnaires. The response from the north-east of Augusta was not good, probably due to the relatively low population and the early hour of the morning.

The maximum intensity experienced was MM V at Karridale, 30km from the epicentre. Intensity MM IV was experienced up to a radius of 40km and the earthquake was felt at Busselton, 100km from the epicentre.

An earthquake on 3 January resulting in intensities of MM IV at the west coastal towns in the area was located 300km west of Augusta and had a magnitude ML 5.3. This earthquake was also felt in the Perth suburb of Maylands on the third floor of a block of four storey flats, by a women who was woken up while sleeping on the floor.

Wagin, 17 May 1986 (Figure 11). At 1241 UT (2041 local time) on 17 May 1986, an earthquake of magnitude ML 4.2 occurred near Wagin 200km south-east of Perth in the Southwest Seismic Zone of Western Australia.

Earthquake questionnaire forms were distributed over an area bounded by Narrogin, Darkan, Kojonup and Dumbleyung. This was followed by a visit to the area 10 days after the event, by an officer from the observatory when approximately 50 families were interviewed over a two day period.

In almost all cases, a significant noise was reported with the tremor, and in about 50% of reports, people said that although they heard it, they could not recall feeling the tremors. The noises were described like an explosion or thunderclap in localities near the epicentre, varying to rumbling like a truck or a roar from a chimney in other localities.

Small pockets of intensity MM V were experienced near the epicentre with the MM IV isoseismal being about 25km in radius. The earthquake was felt up to 70 km from the epicentre.

Ravensthorpe, 17 May 1986 (Figure 12). At 10.57 p.m. (1457 UT) on 17 May 1986 a small earthquake of magnitude ML 3.5 occurred 21km south west of Ravensthorpe near the south coast of Western Australia.

The majority of the population in the area is almost entirely confined to the two towns Ravensthorpe and Hopetoun with farms mostly along the highway east and west of Ravensthorpe. Results from questionnaires distributed through the local high school, supplemented by information obtained through phone calls were used to prepare the isoseismal map.

The maximum intensity reported was MM V at Hopetoun with the boundary between MM IV and III running along the east-west highway about 15 to 30km from the epicentre.

Meckering, 1 September 1986 (Figure 13). At 9.54 p.m. (1354 UT) an earthquake of magnitude ML 4.1 occurred 5km east-south-east of Meckering in Western Australia. It was the most severe earthquake in the area since 29 October 1976, and frightened many residents who recalled the magnitude ML 6.9 of 14 October 1968 (I.B. Everingham & Others, 1982).

The earthquake was felt over a wide area of 70,000 sq km. The maximum intensity reported was MM VI near Meckering in the vicinity of the epicentre. Plaster cracked and small objects fell. Several intensities of MM 5 were reported up to 50km from the epicentre. The MM IV isoseismal had an average radius of 100km. There were isolated reports of the earthquake being felt at Southern Cross, 220km to the east of the epicentre.

Numerous reports of intensity IV were received from the Perth hills area to the east of the Darling fault, 100km west of the epicentre. Very few felt reports were received from the Perth area west of the fault.

Two hundred questionnaires were distributed with a 75% response from which an isoseismal map was prepared.

Cadoux, 7 March 1987 (Figure 14). At 1.38 p.m. WST, an earthquake of Richter magnitude 4.5 occurred 4 km WSW of Cadoux, 170 km northeast of Perth, WA. It was the largest earthquake in the area since November 1985 (ML 4.5), and was felt at a ground intensity of up to MM VI near the epicentre where cracks up to 2 mm wide appeared at Hopkins farm along the old Robb Fault (which was produced during the major, ML 6.2 earthquake of 2 June 1979). The average radii of the MM V and MM IV isoseismals were 21 km and 100 km respectively, and the earthquake was felt (MM III) in the outer suburb of Perth. The isoseismal map is comparable with that for the magnitude 4.3 earthquake that occurred near Cadoux on 10 October 1985.

Two kilometres from the surface cracks, the greatest ground acceleration (3.0 ms^{-2}) yet noted in Western Australia was recorded on an A700 digital accelerograph. It also simultaneously triggered both newly-installed digital accelerographs in the dam wall at Canning Dam, 35 km south-east of Perth and 175 km from the epicentre.

Banda Sea, 17 June 1987 (Figure 15). Earthquakes that occur in the Banda, Timor or Arafura Seas can be expected to be felt moderately strongly in Darwin every two or so years.

An earthquake of magnitude MB 6.7, occurred at 0133 UT on 17 June 1987 in the Banda Sea, 740 km north of Darwin. The maximum intensity experience in Australia was MM V in Darwin. No damage was reported. Intensities of MM V were experienced over an area of 90,000 km^2 in Australia up to 800 km from the epicentre.

Isolated reports of MM II were reported from Brisbane where gentle swaying was observed generally on the second floor of buildings. About 100 questionnaires were distributed across the northern part of Australia. Response was poor from the remote areas.

The previous earthquake that was felt strongly in Darwin occurred on 23 October 1985(Gregson & others, 1987).

Dampier, 19 June 1987 (Figure 16). This earthquake occurred at 9.32 p.m. local time (1332 UT). The maximum intensity experienced was MM IV at Dampier and Karratha 10-25 km respectively from the epicentre. The earthquake was felt weakly up to 100 km from the epicentre.

Apart from Dampier, Karratha and Roebourne, the area is sparsely populated and therefore isoseismals are sketchy.

Reports of a bright light the size of the moon, travelling down towards the horizon north west of Roebourne occurred several minutes after the earthquake and was not related. The light could have been a meteorite.

Wooroloo, 5 July 1987 (Figure 17). This earthquake was located 3 km northeast of Wooroloo and occurred at 0528 UT (1.28 p.m. WST) on a Sunday afternoon.

Information was obtained from reports from residents in the area, and an on-site survey by staff of the observatory.

The maximum intensity felt was MM IV over an area of 20 km^2 with intensity MM III being felt up to 10 km from the epicentre. An isolated report (MM II) was received from Bakers Hill, 13 km from the epicentre.

Although the earthquake was relatively small (magnitude ML 3.0), it is of significance as it is the furthest west earthquake to be recorded in the Southwest Seismic Zone. It's epicentre was 25 km north-east of the observatory and 40 km from the centre of Perth. Previous tremors close to Perth have been at Clackline and Talbot Brook, 70 km east of Perth (Gregson & others, 1987).

Wyalkatchem, 6 January 1988 (Figure 18). The wheatbelt town of Wyalkatchem (170 km NE of Perth) was shaken by an earthquake of magnitude ML 4.3 at 1142 local time (0342 UTC) on 6 January. An isoseismal map was drawn from about 55 reports from questionnaires, telephone calls and a visit to the most affected area.

A maximum intensity of MM VI was assigned as a few brick farm houses showed minor damage. At one farm a concrete water trough, set in concrete at ground level was broken clean in half and an evaporative air conditioner perched on the roof moved, breaking some tiles.

The earthquakes was felt as far away as 130 kilometres, although the MM III isoseismal was drawn with a radius of about 80 kilometres.

Marble Bar, 28 January 1988 (Figure 19). Three sizeable earthquakes occurred in quick succession on 28 January with all epicentres in the same area, approximately 90 km east of Marble Bar. The first was at 09:46 WST (ML 4.8), the second at 09:49 (ML 4.6) and the third at 09:56 (ML 5.0).

Questionnaires were distributed but due to the remoteness of the area, only four felt reports were received. The maximum intensity was MM IV.

Doubtful Bay, 6 February 1988 (Figure 20). This earthquake was the largest to occur in Western Australia this year. The epicentre was near Doubtful Bay, 150 km NE of Derby in a remote area of the Kimberley Region. Questionnaires were distributed but only six felt reports were received. Derby experienced intensity MM IV.

Timor Sea, 30 May 1988 (Figure 21). This large, mb 6.5 shallow earthquake north east of Timor was strongly felt in northern parts of Western Australia and the Northern Territory. It was felt as far away as Broome and Tennant Creek, both about 1600 kilometres from the epicentre. Intensity MM V was reported from Batchelor and three cattle stations to the east of Darwin. Both Darwin and Kununurra reported a maximum intensity of MM IV. Surprisingly no damage was reported from Timor or islands near the epicentre.

Margaret River, 20 July 1989(Figure 22). This earthquake was located offshore about 10 km west of Prevelly Park. The maximum intensity felt was MM IV at the seaside resort of Cowaramup Bay and at the towns of Margaret River and Witchcliffe. There were no felt reports beyond 25 km from the epicentre.

Four small tremors occurred within the 10 hours prior to the main shock and there were ten afterwards, all in the magnitude range of 2.0 to 2.4. At least five of them were felt in Cowaramup Bay area.

Other earthquakes in the area in recent times were

1978, 09 June	12 km E of Mowen	ML 3.0
1986, 15 January	24 km SW of Augusta	ML 3.8

Broome, 13 October 1989 (Figure 23). At 0959 UT (5.59 p.m. local time), an earthquake of magnitude ML 5.4 was felt over a wide area between Broome and Cape Leveque. The epicentre was 42 km north-east of Broome.

The maximum intensity experienced MM VII was at Quandong Point, 27 km west of the epicentre, is graphically described by David Mayhew -
"fortunately Broome was 40 km south of the epicentre, but guess where I was? you have guessed it, 50 km north of Broome sitting on the very edge of the epicentre; at Kadilikan (Pt Quandong).

I was the only camp here at the time and was lying down waiting for the news to come on and they had just announced the time at 1759 hours, when the whooshing, rattling and banging commenced; seemed to come in from the north-east; next instant the sand surface was jiggling like a jelly and I was being jolted up and down. The durin (wild plum tree) which measures 8 feet in circumference was gyrating from side to side at crazy angles and also being projected upwards at the same time by the convulsions of the ground surface. I was fully convinced the ground would crack apart and take the lot including me: it was frightening, I can assure you.

From the first indications to the last rattle was about 15/20 seconds but that is not too reliable as the thoughts whizzing through my mind during the tremor were not given to documenting time but astonishment turning to a sort of bewilderment as the tremor intensified; was it a nuclear attack? no bright light yet! must be an earthquake! will the ground open up?

When the shaking and cracking sounds subsided I rose from the swag and looked out to sea and inland across the scrub but nothing stirred".

Broome was the closest town and experienced intensities of MM V. The earthquake was felt (MM II) as far as Sandfire, 280 km from the epicentre with the radius of the MM IV isoseismal being 130 km.

Earthquake magnitude

Progress has been made towards standardising earthquake magnitudes scales. Gaull and Gregson (1991) have completed a study which ties in the regional attenuation in Western Australia to the international Richter scale as defined by Richter (1958). This scale has been adopted for Western Australian earthquakes from 1 January 1990. Magnitude corrections determined for KLG, MEK, NAU and WBN were used for stations KLGA, MEKA, NANU and WARB which were located close to the original stations. Paull and Gaull (1990) have preliminary results on extending this scale using the duration of codas recorded on Western Australian seismographs.

Earthquake locations

Prior to 1989 earthquake locations were determined graphically by hand using a structural model WA1. With the installation of a Webster computer in December 1988 earthquakes were located using the PITSIS "eqlocl" program. At the same time the structural model WA2 was introduced. This model is basically the same as WA1 for close earthquakes but gives better locations for distant earthquakes as it uses a higher Pn velocity. Both these models are detailed by Dent (1989) together with other models generated using computer techniques.

Earthquake prediction

In 1987 three ground water instruments were installed in the Cadoux area to assist in the identification of possible water-level changes prior to a local earthquake. Gaull and others (1987) describe what may have been such an event which occurred about six hours before an ML 4.5 earthquake, located about 5 km away from the recorder. Other work on prediction included the monitoring of P-values in various places in the Southwest Seismic Zone. The results to date appear encouraging, but as yet not conclusive.

Data distribution, publication and requests

Monthly lists of Western Australian earthquakes were distributed to interested recipients.

Numerous requests for seismological data were attended to during the four years. Narrogin magnetic tapes were sent to ASL via the Australian Seismological Centre (Canberra) where they were copied prior to being forwarded. Mundaring WWSS and Narrogin SRO seismograms were sent to the WDC-A and Albuquerque Seismological Laboratory for copying.

4. GEOMAGNETISM

An Eschenhagen 20mm/hr magnetograph operated continuously at Gnangara recording the three components D, H and Z. Considerable time was spent on preparing the Elsec Automatic observatory digital magnetograph (AMO) for routine operation. Trials commenced in November 1989 in view of commencing routine recording on 1 January 1990.

An EDA fluxgate magnetometer was installed at Learmonth on 26 November 1986. Three components X, Y and Z are recorded digitally at minute intervals on an EDAS tape recorder. Details of the instrumentation and operations are given by Hopgood (1987).

GNANGARA

Eschenhagen magnetograph. The magnetograph operated satisfactorily throughout the four years. Six days (1.6%) of record were lost when the recording lamp blew.

The H ordinate was increased by 45mm on 6 February 1989 to reduce the number of negative ordinates. The Z recording magnet stuck during an orientation test on 16 January 1987. In the process of freeing the magnet, the ordinate decreased by about 17 mm and the Z scale value changed from 6.06 nT/mm to 5.80 nT/mm. The Z ordinate was reduced by 40 mm on 27 July 1988 as it was too close to the bottom of the magnetogram. The Z scale changed at the same time from 6.26 nT/mm to 5.14 nT/mm.

As in previous years, the Z scale value drifted between summer and winter, i.e. April to August becoming less sensitive and August to November becoming more sensitive. The range was in the order of 0.4 nT/mm.

There were no other abrupt changes in scale or base values.

Adopted scale and base values for 1986-1989 are given in Table 20. The corrections applied to the adopted values are given in Table 14. The standard deviations of observed baseline and scale values from adopted values for each year are given in Table 19. The values are fairly consistent with previous years.

Eschenhagen magnetograph tests

Temperature coefficients. (Table 17). Values of qH = 0.0 nT/^{o}C and qZ = 3.2 nT/^{o}C derived from 1981 data and confirmed from 1982 to 1985 plots were used throughout 1986. Adjustments on 16 January 1987 reduced qZ to 2.0 nT/^{o}C with a further reduction to 1.0 nT/^{o} C on 26 August 1988. These values were derived from least squared analysis of baseline at temperature and temperature data. Table 17 summarises the temperature coefficients used.

Orientation. Orientation tests were made on 16 January 1987 and 28 February 1989. Results are shown in Table 18. The orientation determined for all magnets were less than 1^{o} from the required azimuth and were compatible with previous results after allowing for secular variation and ordinate adjustments.

Parallax. No tests were performed during 1986-1989 and it was assumed that parallax remained unchanged from previous years. During 1973 it had been found that the parallax on variation trace time-mark spots (but not on baseline spots or hour lines) was zero on all components. The parallax for other time-marks can be measured from the trace time-marks.

Scale values. A magnetograph calibration MCO2 was used in conjunction with helmholtz coils to determine H and Z scale values once weekly. D scale value determinations were made using a helmholtz coil on 16 January 1987 and 28 January 1989. Results were 1.09'/mm in both cases.

Magnetometers

Absolute observations for D, H and Z values were made at weekly intervals. An Askania magnetometer (S/N 309319, circle 580135) was used throughout the four years for D observations. A proton vector magnetometer (PVM B/5/Z) was used for combined observations of F and Z (cancellation method). The PVM consisted of Elsec vector coils (set B), and MNS-2 proton precession magnetometer (S/N 5) and sensor (S/N Z). H and I values were calculated from the F and Z values.

Table 14 shows the details of the magnetometers and the correction applied to the observed values.

Comparisons

Several sets of comparisons were made. These are detailed in Table 15. Indications are that the correction (0.5'E) being used in Askania 319 is too low.

Reference marks

The relative angles between reference marks were checked on two occasions. They were consistent with previous observations. Table 16 shows the observed values since installation of the reference marks in 1982.

Automatic magnetic observatory Installation and tests were completed on the Elsec Automatic Magnetic Observatory at Gnangara before the end of 1989. Routine recording was planned to begin on 1 January 1990 and to phase out recording on the Eschenhagen by 31 December 1990.

Accessory equipment

An Askania H visual variograph at the Mundaring office was operated throughout the year with minor record loss.

LEARMONTH

EDA fluxgate magnetograph. Components of X, Y and Z were recorded satisfactorily since installation of the magnetometer on 26 November 1986. Recording of an F channel were spasmodic, but as the field could be defined by X, Y and Z it was not a problem.

Adopted base, scale and zero values for 1986-1989 are listed in Table 28. The corrections applied are shown in Table 23. Unexplained jumps occurred as follows:

1987 October 26	SX	0.1948 to 0.1968 nT/count
1987 October 26	SZ	0.1968 to 0.1930 nT/count
1988 June 06	SZ	0.1926 to 0.1944 nT/count
1988 February 16	OY	4980 to 4990
1988 August 26	OZ	4998 to 5015
1988 July 10	OZ	5016 to 5064
1987 October 25	BX	29459 to 29443

The last jump resulted in a drift in the H base value of about 60 nT up till 29 February 1988.

Standard deviations of observed base, scale and zero values from adopted values for each year are shown in Table 28. The values are fairly consistent from year to year.

Temperature coefficients

Preliminary values were determined at installation in November 1986. Observations were few and scattered. Data for 1987 and 1988 were analysed. Although observations were scattered the values computed were compatible and consistent with those determined at installation.

Baseline at temperature plots for 1989 data follow the same trends as for the previous two years. Computed and adopted values for 1986-1989 are shown in Table 26. The Doric thermograph count conversion to temperature was confirmed using 1987-1988 data.

$$T^{o}C = \text{count} \times 0.019924 - 0.176$$

Magnetometers

Absolute observations for D, F and I were made at weekly intervals using a DIM and Elsec E801 proton precession magnetometer. Table 23 gives the details of instruments and corrections used.

Comparisons

Comparisons made during installation, in October 1987 and August 1988 are summarised in Table 24. The jump in the X baseline value during the August 1987 comparisons means that the comparison with QHM 173 is suspect.

Reference marks

The azimuth of reference marks were initially determined by the Australian Survey Office. The relative locations of these marks and the observing pier are shown in Figure 24.

Round of angle measurements between reference marks made at installation, October 1987 and August 1988, are shown in Table 25. The observations in 1988 were not complete as the wrong NDB tower was observed.

Data reduction and publication

Routine distribution and publication of data from Gnangara and Learmonth is shown in Table 31.

Gnangara

Magnetograms and reduction data were prepared in monthly batches about six weeks after the end of the month and sent to headquarters for reduction to mean hourly values.

Monthly and annual mean values of H, D, Z, F and K-index for 1986 to 1989 are listed in Table 21. The field values were derived from the five local quiet days each month by scaling a mean ordinate for each component from each magnetogram. The F value was calculated from H and Z values. Annual values and secular variation for all components since 1976 are shown in Table 24. Changes in D continued the trend commenced in the early 1980's with D becoming more easterly by about 2.5' per year. H continued to decrease by an average of 15 nT per year and Z continued to decrease but the rate slowed down from 20 nT in 1986 to 2 nT in 1989. The mean value of F increased by about 10 nT in 1986 and 1987 but dropped slightly in 1988 and 1989.

K-indices for each week are dispatched to the Ionospheric Prediction Service (Sydney) from where they are distributed to their recipients. Components of K-index are stored on computer at headquarters.

Checked data for solar flare effects for 1984-1987 were prepared for the IAGA Bulletin.

Learmonth

All control data is prepared at Mundaring. Digital tapes of minute values of X, Y, Z are sent direct to headquarters where they are stored for further processing.

Monthly mean and annual values of field components are determined at headquarters and are shown in Table 29 and 30 respectively. The trends indicated since installation of the magnetograph in 1986 are D becoming more easterly (1.5'/ annum), H remaining fairly constant, Z becoming more negative (6 nT/annum) and F increasing (5 nT/annum).

Magnetic surveys

Observatory staff occupied first order magnetic stations as follows:-

May 1987	(P.J. Gregson)	Wyndham, Halls Creek, Derby, Port Hedland, Telfer and Carnarvon
May 1987	(E.P. Paull)	Carnarvon, Mt Vernon, Meekatharra, Geraldton and Southern Cross
June 1987	(V.F. Dent)	Southern Cross, Carnegie*, Laverton*, Warburton, Zanthus, Esperance, Albany and Augusta * B.J. Page accompanied the survey
May 1988		(P.J. Gregson) Cocos and Christmas Islands

Magnetometers were deployed and absolute observations made as part of the Australia Wide Array of Geomagnetic Stations in October 1989. E.P Paull and B.J. Page occupied Geraldton, Southern Cross, Laverton, Zanthus, Esperance and Albany.

5. IONOSPHERICS

A quarter-hourly sounding schedule was continued throughout the period using a model 4B ionosonde. The ionosonde spare components and film were supplied by the Ionospheric Prediction Service.

There were no major technical problems.

Data distribution and publication

The F2 layer critical frequency at each six hours UT and local noon were scaled. The six-hourly values were sent to IPS for distribution internationally and the monthly median of the noon values was telexed to the International Radio Consultative Committee (Geneva) for the determination of the index IF2. The weekly film was sent to IPS Sydney for scaling of the remaining parameters. Hourly values of all parameters are published in the IPS Series D and are distributed internationally. Ionograms are available on loan within Australia from IPS and internationally through the WDC-A.

6. GENERAL OPERATIONS

Accommodation

The office building was extended in late 1987 and officially opened in April 1988. The extensions consisted of two new offices, a small store room and reception area (total area 60 m^0). The purpose of the extension was

(a) to allow for one additional officer working on an extended program in earthquake risk and prediction
(b) to provide space for additional recording facilities
(c) to allow room for visiting scientists
(d) to provide space for the two part-time staff (formally one full-time).

Computing 1986 with the installation of a permanent Austpac link via the Australian Seismological Centre (ASC) SUN computer. The HP was decommissioned with the installation of a Webster computer (see below).

HP2645 terminal. Access to the BMR HP computer was upgraded in September 1986 with the installation of a permanent Austpac link via the Australian Seismological Centre (ASC) SUN computer. The HP was decommissioned with the installation of a Webster computer (see below).

ASC SUN computer. Use of the BMR HP computer diminished and the majority of usage shifted to the ASC SUN for handling of seismic data and general usage.

DDS line. To provide for faster, more reliable communication and allow for increased transfer of data a DDS line and statmux with 8 ports were installed in 1988.

Webster computer. A Webster computer was installed in December 1988. This supported the Preston Institute of Technology Seismic Interpretation System (PITSIS) which greatly enhanced the handling of earthquake data and earthquake locations. The computer supports a Toshiba P350 printer, a Graphtec MP3200 plotter, 7 Wyse and one digital VT340 terminal.

Works program.
There was no major works projects in the four years other than the normal program of painting, etc.

Telex.
The telex was decommissioned in early 1988 and replaced with a fax machine.

7. ACKNOWLEDGMENTS

The assistance of the daily attendants listed in Table 3 and the co-operation of Telecom for housing the seismograph at Marble Bar is hereby acknowledged. Remote seismometers and telemetry equipment were located on the properties of K. Quartermaine (Narrogin), V. Wright (Kellerberrin) and T. Mailey (Ballidu). Yvonne Moiler's work in typing and collating this record is appreciated.

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APPENDIX 1

PRINCIPAL EVENTS

MUNDARING GEOPHYSICAL OBSERVATORY 1957-1989

1957 May	Geomagnetic recording commenced at Gnangara (La Cour)
1959 Mar 18	Transfer of observatory from Watheroo to Mundaring
1959 Apr 03	Ionospheric recording commenced (Type 2 ionosonde)
1959 Jul 30	MUN seismograph recording commenced (Benioff)
1960 Mar-Oct	Atmospheric noise recording (for CSIRO)
1960 Apr 30	Eschenhagen normal magnetograph replaced La Cour at Gnangara
1960 May 01	Cossor ionosonde replaced Type 2
1960 Jun 22	Absolute magnetic observations commenced in new absolute house
1962 Jun	WWSS system commenced recording at MUN
1963 Apr 19-Dec 17	GRV seismograph operation
1963 May 30-Dec 19	NGN seismograph operation
1964 Nov 06	KLG SP seismograph recording commenced
1965 Nov 29-1966 Aug 24	LVS seismograph operation
1965 Nov	KNA SP-Z seismograph recording commenced; operation intermittent till February 1972
1967 Feb	Fremantle Region Upper Mantle Project
1967 Oct 26	MEK SP-Z seismograph recording commenced
1968 Oct-Nov 26	Field seismograph operation at Meckering
1968 Nov16-1971 Dec 31	AFMAG recording at Mundaring
1970 Jan 01	Routine analysis of KNA seismograms commenced
1970 Feb 26	IPS IIIE ionosonde replaced Cossor
1971 Feb 10-1972 Jul 31	KAA SP-Z seismograph operation
1971 Nov 30	Two MO2 accelerographs installed at Meckering
1972 Feb 29	KNA seismograph upgraded to 3 components
1972 Mar 01	MO2 accelerograph (PWD) installed at Kununurra
1972 Jun 27	Proton scalar magnetometer introduced for Z baseline control
1972 Oct 12-1975 Feb	MBT SP-Z seismograph recording
1972 Nov 16	MO2 accelerograph (PWD) at Kununurra
1973 Jan 31	Mobile SP-Z recording at various sites in SW seismic started
1973 Mar 01	MEK reduced to 3 component SP
1973 Mar 30	KLG reduced to SP-Z
1973 May 23	MUN 2 Wood Andersons installed
1973 May 25	MUN Benimore SP-Z withdrawn; Benioff SP-Z started
1974 Apr 01	Proton vector coils introduced for Z baseline control
1974 May 01	Proton vector coils introduced for H baseline control
1974 Jun 17-31	Riometer recording at Mundaring during solar eclipse
1974 Sep-1978 Jun	GLS SP-Z recording
1975 Jul 18-Nov 19	Earthtide recording at Mundaring
1975 Mar	Magnetic pulsation recording commenced at Mundaring
1975 Mar 19-Aug 15	SWV SP-Z recording
1975 Sep 02-1976 Feb 05	NWAO SP-Z recording

1976 Mar 27	NWAO Seismic Research Observatory commenced
1976 Jun	MBL SP-Z recording commenced
1976 Sep-1977 Nov 27	XMI recording
1976 Oct	Special ionospheric sounding, solar eclipse (23 Oct)
1977 Nov 28	A third MO2 accelerograph installed at Meckering
1978 Feb	A fourth MO2 accelerograph installed at Meckering
1978 Jun 27	WBN SP-Z recording commenced
1980 Jun 19	NAU SP-Z recording commenced
1981 Aug 07-1982 Mar 27	BAL SP-Z recording commenced
1981 Sep 23	KLG SP-Z recording commenced
1981 NOv 19-1982 Jun 27	Walpole SP-Z field recording
1982 Nov 26	BAL SP-Z recording commenced
1983 Aug 03	RKG SP-Z recording commenced
1984 Jun 21	MRWA SP-Z recording commenced
1986 Mar 04	First digital accelerograph (A700) installed at Cadoux
1986 Apr 30	MEK SP-Z recording transferred to MEKA
1986 May 12	KLG SP-Z recording transferred to KLGA
1986 Oct 26	Geomagnetic recording commenced at Learmonth
1987 Jan 16	Program of strong motion recording commenced on WAWA dams
1987 Jun 27	WBN SP-Z recording transferred to WARB
1987 Oct 22	NAU SP-Z recording transferred to NANU
1988 Apr	Office accommodation extended
1988 Aug 10	KLGA SP-Z recording transferred to COOL
1988 Oct 07	FORR SP-Z recording commenced
1988 Dec	Webster computer installed
1989 Sep 13	First Kelunji recording equipment installed at Dowerin

TABLE 1
OBSERVATORY STAFF 1986 TO 1989

Officer	Designation
P.J. Gregson	Geophysicist Class 3
B.A. Gaull	Geophysicist Class 3
E.P. Paull	Geophysicist Class 2
V.F. Dent	Geophysicist Class 2
G. Woad	Senior Technical Officer Grade 1
B.J. Page	Technical Officer Grade 2
D. Smith	Clerical Assistant Grade 3 (temporary, part-time 1986, 13 Jan - 24 Apr)
Y.M. Moiler (Mrs)	Clerical Assistant Grade 3 (temporary, part-time 1986, 1-10 Jan 1986, 28 Apr - 24 Dec 1987, 12 Jan - 8 Nov, permanent, part-time from 9 Nov) 1988, Position redesignated to Administrative Sevice Officer Grade 1
L.A. Van Reeken (Mrs)	Technical Assistant Grade 2 (temporary part-time 1986, 13 Jan - 24 Dec 1987, 12 Jan - 31 Dec 1988, 1-22 Jan, 8 Feb-31 Dec 1989, 1 Jan - 18 Jun, permanent part-time from 19 Jun)
C.L Ashman	Technical Assistant Grade 2 (to 19 Feb 1986)
D. George	Technical Officer Grade 1 (temporary, part-time 1986, 8 Sep to 12 Nov)
S. Dare	Technical Assistant Grade 2 (temporary 1988, 21 Mar to 30 Jun)

TABLE 2
OBSERVATORY STAFF ABSENCES 1986 TO 1989

Nature of absences	No. of days			
	1986	1987	1988	1989
Sick leave	27	19	14	32
Special leave	0	4	2	4
Furlough	46	29	62	24
Outstation visits and field operations	128	82	114	62
Conferences and training	14	7	8	29
Magnetic surveys		49	15	16
Headquarters		39	57	43
Macquarie Island		15	25	
	222	244	297	210

TABLE 3
ASSOCIATED PERSONNEL 1986 TO 1989

Name	Nature of Duties	
B. Carling	Daily attendant, Gnangara	
C. Mckay	Daily attendant, Kununurra	(to 31 Oct 1986)
D. Diversi	Daily attendant, Kununurra	(1 Nov - 31 Dec 1986)
L. Wooton	Daily attendant, Kununurra	(from 1 Jan 1987)
P. East	Daily attendant, Kalgoorlie	(to Aug 1988)
D. Maley	Daily attendant, Meekatharra	(to 1 May 1986)
N. Simon	Daily attendant, Meekatharra	(2 May 1986 - 31 Aug 1987)
A. Jennings	Daily attendant, Meekatharra	(1 Sep 1987 - Aug 1988)
P. Kildea	Daily attendant, Meekatharra	(from Aug 1988)
D. Hart	Daily attendant, Morawa	
M. Scullard	Daily attendant, Nanutarra	(to 28 Feb 1989)
J. Bartlet	Daily attendant, Nanutarra	(from 1 Mar 1989)
L. Lowe	Daily attendant, Warburton	(to 21 Jun 1988)
F. Mathews	Daily attendant, Warburton	(22 Jun 1988 - 7 Jun 1989)
S. Curtis	Daily attendant, Warburton	(from 8 Jun 1989)
A. Mead	Daily attendant, Marble Bar	(to 21 Jun 1988)
J. Solonec	Daily attendant, Marble Bar	(22 Jun 1988 - 24 Sep 1989)
R. Tregonning	Daily attendant, Marble Bar	(From 25 Sep 1989)
S. Cameron	Daily attendant, Rocky Gully	
W. Briggs	Ground maintenance	(to 20 Dec 1989)
D. Schoch	Ground maintenance	(from 21 Dec 1989)
L. Page	Cleaning	(to 19 Aug 1987)
S. Lozsan	Cleaning	(from 20 Aug 1987)

TABLE 4
WORK EXPERIENCE STUDENTS 1986 TO 1989

Name	School	Dates	Duty
		1986	
Nathan Tetlaw	EHSHS	Jul 28-Aug 04	Technical
Cassandra Browning	SMC	Jul 28-Aug 08	Technical
Wendy Coake	EHSHS	Aug 18-29	Clerical
Joshua Gaull	ASHS	Aug 18-22	Technical
		1987	
Owen Mulders		Jun 22-Jul 03	Technical
Jason Micaleff		Jun 29-Jul 03	Technical
Robert Weymouth		Jun 29-Jul 10	Technical
		1988	
Jamie Dilks		Sep 05-09	Technical
Chris Harris		Sep 05-09	Technical
Michael Cassotti		Sep 19-23	Technical
Britt Barkman	SVSHS	Nov 07-11	Clerical

ASHS	Applecross Senior High School	SMC	Santa Maria College
EHSHS	Eastern Hills Senior High School	SVSHS	Swan View Senior High School

TABLE 5

CONFERENCES, TRAINING AND COMMITTEES 1986 TO 1989

Officer	Date	Conference
	1986	
B.A. Gaull	Feb 17-21	Australian Geological Conference, Adelaide
P.J. Gregson	Sep 22-26	Program discussions, Canberra
	Sep 24-25	Conference on nuclear monitoring, Canberra
	Sep 23	Opening of Australian Seismological Centre, Canberra
B.A. Gaull	Dec 1-3	Engineering Symposium, Sydney
B.A. Gaull	Dec 04	Magnitude workshop, Sydney
B.A. Gaull	Dec 5-10	Program discussions, Canberra
	1987	
B.A. Gaull	Jan 27-31	Counter Disaster College, Earthquake Risk Workshop, Mount Macedon
P.J. Gregson	Feb 24-26	Australian Society of Exploration Geophysicists, Perth
V.F. Dent	Apr 13-14	Computer course, BMR Canberra
	1988	
B.A. Gaull	Jan 31-Feb 2	9th Australian Geological Conference, Hobart
V.F. Dent	Jan 31 Feb 5	9th Australian Geological Conference, Hobart
G. Woad	Sep 21-22	Fire Fighting, Perth
	1989	
B.A. Gaull	Feb 13-17	Earthquake Symposium, Canberra
V.F. Dent	Feb 13-17	Earthquake Symposium, Canberra
E.P. Paull	Mar 15-17	Analytical methods, DPIE, Perth
P.J. Gregson	Apr 3-4	Burnout, DPIE, Perth
E.P. Paull	Apr 17-18	Leadership and Influence, DPIE, Perth
V.F. Dent	Apr 17-18	Introduction to Oracle, BMR, Canberra
P. J. Gregson	Apr 20,21,27,28	Performance Management, DPIE, Perth
E.P. Paull	Jun 26-27	Staff Counselling, DPIE, Perth
B.J. Page	2nd Semester	Electronics course, Midland Technical College
		Committees
P.J. Gregson		Geophysics Advisory Committee, Western Australian Institute of Technology
P.J. Gregson		Seismological data base sub-committee of the Accreditation Technical Natural Disasters (ATEND)

TABLE 6

ADDRESSES

Officer	Date	Organisation
	1986	
B.A. Gaull	Feb 05	Fremantle Probus Group - "Earthquakes".
B.A. Gaull	Feb 17-21	Australian Geological Conference, Adelaide - "New Earthquake risk maps for Australia".
B.A. Gaull		Engineering Symposium Sydney - "Interpretation of the new earthquake risk maps for Australia".
P.J. Gregson	Mar 05	Wanneroo Rotary Club - "Earthquakes".
B.A. Gaull	Jul 09	Perth City Council - "Earthquakes".
B.A. Gaull	Sep 09	Country Women's Association, Cadoux - "Earthquakes".
B.A. Gaull	Dec 04	Magnitude workshop, Sydney - "A local magnitude scale for WA".
	1987	
P.J. Gregson	Apr 6	Rotary - "Earthquakes".
E.P. Paull	May 11	Carlisle Pensioners Club - "Earthquakes".
	1988	
P.J. Gregson	Sep 01	Curtin University - "Global seismology".
E.P. Paull	Sep 01	Curtin University - "Global seismology".
P.J. Gregson	Oct 10	State Emergency Service - "Earthquake hazards".
	1989	
E.P. Paull	Jan 09	Glen Forest Probus - "Earthquakes".
P.J. Gregson	Feb 08	Rockingham Rotary - "Earthquakes".
B.A. Gaull	Feb 13	Earthquake symposium, Canberra.
P.J. Gregson	Feb 22	Amatuer Radio Group, Kalamunda - "Earthquakes in Western Australia".
P.J. Gregson	Nov 21	Claremont-Cottesloe Rotary - "Earthquakes".

TABLE 7
VISITORS 1986 TO 1989

Visitor	Institution
1986	
William Hassell	Leader of State Opposition
Gordon Masters	Member of Legislative Assembly
S. Hart	Candidate for Legislative Assembly
Greg Black	Bureau of Mineral Resources
Kevin Seers	Bureau of Mineral Resources
Peta Kelsey	Bureau of Mineral Resources
Peter Hopgood	Bureau of Mineral Resources
John Rutledge	Rig seismic
R. Curtis	Rig seismic
M. O'Connor	Rig seismic
Jack Pitlar	Rig seismic
Barry Meyers	WA Water Authority
John Waters	WA Water Authority
D. Recla	Geotech
John Rickards	Teledyne (Melbourne)
G. Mudge	Goldfields Exploration
Ian Everingham	Dept of Mines, Fiji
Peter Veryard	Dept Local Govt & Administrative Services
Peter McCann	Dept Local Govt & Administrative Services
F. Gillespie	Dept Local Govt & Administrative Services
Ian Tungate	Dept Local Govt & Administrative Services
	Midland Scouts (20)
	Greenwood & Maddington PEAC students (44)
	Eastern Hills Senior High School Students (24)
	Helena Primary School (24)
1987	
Charles Langston	USA
D. Heath	Curtin University,Geophysics
John Rickards	Teledyne-Geotech, Melbourne
Mike McElhinny	Bureau Mineral Resources
Jo Lock	Bureau Mineral Resources
Charlie Barton	Bureau Mineral Resources
Phil McFadden	Bureau Mineral Resources
Ian Hone	Bureau Mineral Resources
Cedric Wright	Bureau Mineral Resources
Kevin McCue	Bureau mineral Resources
Greg Black	Bureau mineral Resources
John Waters	Water Authority of WA
Barry Myers	Water Authority of WA
Peter Illedge	Dept Primary Industries & Energy, Perth
Derek Bartholomeusz	Dept Primary Industries & Energy, Perth
Stan Snook	Dept Primary Industries & Energy, Perth
George Read	Dept Primary Industries & Energy, Perth
Jack Noble	Dept Primary Industries & Energy, Perth
Probus Club (25)	
EasternHills Senior High School (30)	

TABLE 7 (Contd)

Visitor	Institution
1988	
Tom Trosper	Teledyne-Geotech, USA
John Rickards	Teledyne-Geotech, Melbourne
Murray Hill	Curtin University, Computing Dept
Clive Richards	Bond Petrochemical Industries
Andrew McEwin	Bureau Mineral resources
Steve Bottomley	Marathon Petroleum
Bob Walk	Water Authority of WA
John Waters	Water Authority of WA
Sandra Wright	Dept Primary Industries & Energy, Perth
John Condon	Dept Primary Industries & Energy, Perth
Paul Castle	Dept Primary Industries & Energy, Perth
Clive Findlay	Dept Primary Industries & Energy, Perth
Pat Rimmington	Dept Administrative Service, Perth
Shaun Brandon	Bureau of Mineral Resources
Dr Mike McElhinny	Bureau of Mineral Resources
Clive Robinson	Bond, Petrochemical Plant
Barbara Matz	University of Nevada
Dennis Murphy	Regional Director, DPIE, Perth
Lee Ranford	Deputy Director, Geological Survey of WA
Greg Street	Geological Survey of WA
Laszlo Kevi	Geological Survey of WA
Robert Mather	Geological Survey of WA
Brian O'Connor	Curtin University
Dr Robert Pidgeon	Geoscience, Curtin University
Tony Moulds	Water Authority of WA
Duncan McKellar	Survey & Land Information Group
Tom Cairns	Building Management Authority
Robert Burnett	State Emergency Service
Cedric Kleinman	State Emergency Service
Hugh Doyle	Geology Dept, University of WA
Prof Peter Harris	Geology Dept, University of WA
Ken Alexander	Lands & Surveys, WA
Dr David Denham	Australian Seismological Centre
Dr Brian Embleton	Chief, Division Exploration Geoscience
Mrs Embleton	CSIRO
Ms Lynette McConnell	Senator Cook's office
Noel Williams	Headmaster, Mundaring Primary School
Mahogony Creek Guides	
Students (28)	
1989	
Syd Booth	Curtin University, Geophysics
John Cahill	Bureau Mineral Resources
Geoff Feasey	Bureau mineral Resources
Roy Wellington	Bureau Mineral Resources
Peter Cox	ADSTE
Gary Gibson	Phillip Institute of Technology, Victoria
John Rickards	Teledyne-Geotech, Melbourne
Keith Harroway	State Emergency Service, Northam

TABLE 7 (Contd)

Visitor	Institution
Chinese delegation:	
Zhou Rui	State Seismological Bureau (SSB), China
Chen Zhangli	Dept Scientific Analysis & Prediction, SSB
Yu Zhaokang	SSB, Fujian Province
Wu Ronghui	Dept of International Co-operation, SSB
Xia Wenyi	SSB, Yunnan Province
Derek Bartholomeusz	Dept Primary Industries, Perth
Ian Everingham	Ex BMR, MGO, Perth
Students (4)	Curtin University, Geophysics
Students (60)	Swan View Senior High School
Students (60)	Mount Helena Primary School

TABLE 8

WESTERN AUSTRALIAN SEISMOGRAPH STATIONS 1986 TO 1989

CODE	STATION NAME	LAT S	LONG E	ELEV	OPENED	CLOSED
BAL	Ballidu	30.6065	116.7072	300	82 Aug 27	
COOL	Coolgardie	30.8838	121.1447	500	88 Aug 10	
FORR	Forrest	30.7992	128.0673	530	88 Oct 07	
KLB	Kellerberrin	31.5923	117.7600	300	81 Sep 23	
KLG	Kalgoorlie	30.7833	121.4583	360	64 Nov 06	86 May 12
KLGA	Kalgoorlie	30.7175	121.4383	390	86 May 12	88 Aug 10
KNA	Kununurra	15.7500	128.7667	150	72 Feb 28	
MBL	Marble Bar	21.1600	119.8333	200	76 Jun 21	
MEK	Meekatharra	26.6133	118.5450	520	67 Oct 26	86 May 01
MEKA	Meekatharra	26.6142	118.5336	520	86 May 01	
MRWA	Morawa	29.2180	115.9960	300	84 Jun 21	
MGO	Mundaring Office	31.9033	116.1650	250	79 Jan 11	
MUN	Mundaring	31.9783	116.2083	253	62 Jun 01	
NANU	Nanutarra	22.5620	115.5290	300	87 Oct 22	
NAU	Nanutarra	22.4420	115.5000	80	80 Apr 19	87 Oct 22
NWAO	Narrogin	32.9267	117.2333	265	76 Mar 19	
PIN	Pingrup	33.5165	118.6143	300	89 Aug 01	
RKG	Rocky Gully	34.5698	117.0103	300	83 Aug 83	
WA4	Burakin	30.602	117.225	320	86 Mar 22	89 May 19
WARB	Warburton	26.1838	126.6430	460	87 Jun 28	
WBN	Warburton	26.1400	126.5780	457	78 Jun 27	87 Jun 28

TABLE 9

SEISMOGRAPH CALIBRATION DATA 1986 to 1989

MAGNIFICATION (x1000)

SHORT PERIOD

PERIOD (Second)	0.1	0.15	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
BAL Z to 25 Mar 86	273	381	234	270	233	172	127	95	75	5644	34	
BAL Z fm 26 Mar 86	224	300	282	254	238	148	99	66	49	36	26	19
COOL Z fm 10 Aug 88	200		417		399	255	178	130	91	70	50	36
FORR Z fm 07 Oct 88	207	358	402	389	343	232	151	99	63	43	29	19
KLB Z	200	426	475	438	376	262	183	130	92	66	43	37
KLG Z to 12 May 86		10	174	270	238	184	144	112	87	66	54	43
KLGA Z fm 12 May 86	233	381	455	429	381	281	198	140	99	70	50	35
KNA Z	135	187	200	187	164	118	86	65	49	37	28	21
KNA N,E	36	54	61	62	58	48	39	32	27	22	19	16
MBL Z to 05 May 86	480	800	863	827	733	510	352	247	173	130	92	68
MBL Z fm 05 May 86	481	748	828	794	711	500	380	293	220	177	140	116
MEK Z to 30 Apr 86	449	452	402	348	305	236	192	156	126	98	75	60
MEKA Z fm 30 Apr 86	349	453	480	448	393	280	200	143	105	78	58	43
MRWA Z	650	878	974	926	808	556	364	240	156	105	72	47
MGO INS	2.60	3.03	2.98	2.97	2.97	2.87	2.59	2.25	1.89	1.70	1.40	1.11
MUN+ZNE	3	6	10	14.5	20	31	39	41	40	36	31	25
MUN HGZ	406	380	338	324	326	318	207	101	55	31	21	14
MUN WA	2.05		2.05	1.98	1.83	1.68	1.50	1.35	1.21	1.06	0.95	
NANU Z fm 22 Oct 87	480	940	1010	954	823	520	348	190	115	76	53	40
NAU Z to 22 Oct 87		27	340		432	318	222	150	92	57	38	28
NWA0*Z	30	110	193	238	260	242	190	150	120	90	70	50
PIN Z fm 01 Aug 89	296	336	304	264	224	164	154	230	60	48	30	21
RKG Z	544	632	616	540	408	246	160	104	68	48	32	22
WA4 Z fm 22 Mar 86	296	336	304	264	224	164	154	96	60	48	30	21
WA4 Z to 19 May 89												
WARB Z fm 28 Jun 87	900	1220	1300	1190	1010	673	430	265	176	116	78	55
WBN Z to 28 Jun 87	670	788	750	670	595	436	319	230	173	127	95	72
WA (STANDARD)	2.77		2.75		2.65	2.43	2.25	2.03	1.82	1.61	1.43	1.27

LONG PERIOD

PERIOD (Second)	8	9	10	15	20	25	30	40	50	60	80	100
MUN+Z	.62	.69	.72	.75	.67	.50	.55	.35	.29	.22	.15	.11
MUN+Z fm 01 Jun 86	.31	.34	.36	.37	.34	.25	.27	.18	.14	.11	.08	.06
MUN+NE	.31	.34	.36	.37	.34	.25	.27	.18	.14	.11	.08	.06
NWAO*ZNE fm 19 Mar86	2.8	4.0	6.8	8.8	32.8	40.0	40.0	31.6	26.4	16.0	8.0	4.4
NWAO*ZNE fm 01 Apr86	0.7	1.0	1.7	2.2	8.2	10.0	10.0	7.9	6.6	4.0	2.0	1.1

+	World Wide Standard Seismograph	SP-Z,N,E	LP-Z,N,E
*	Seismic Research Observatory	SP-Z	LP-Z,N,E
HG	High Gain Short Period Vertical		
WA	Wood Anderson Seismograph		

TABLE 10

WESTERN AUSTRALIAN EARTHQUAKES 1986 to 1989

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
86 01 02	213344.2	34.30	112.04	0	5.3 ML	AUGUSTA, 300KM W
86 01 02	215942.3	34.50	112.01	5 N	3.4 ML	AUGUSTA, 300KM W
86 01 02	231350.5	20.79	115.15	5 N	3.0 ML	NEAR BARROW ISLAND
86 01 03	133348.0	34.56	111.95	5 N	3.3 ML	AUGUSTA, 300KM W
86 01 04	030945.6	34.52	112.19	5 N	2.8 ML	AUGUSTA, 280KM W
86 01 04	131120.5	30.79	117.09	5 N	2.7 ML	CADOUX, 5KM SW
86 01 05	213950.4	30.76	117.11	5 N	2.3 ML	CADOUX, 2KM W
86 01 06	134555.9	30.75	117.12	5 N	2.5 ML	CADOUX, 1.5KM NW
86 01 06	191757.6	30.80	117.05	5 N	2.4 ML	CADOUX, 9KM W
86 01 07	022718.1	30.77	117.09	5 N	2.3 ML	CADOUX, 4KM W
86 01 07	080716.9	30.77	117.09	5 N	2.2 ML	CADOUX, 4KM WSW
86 01 09	053625.3	30.75	117.12	5 N	2.0 ML	CADOUX, 2KM NNW
86 01 09	155901.9	30.79	117.08	5 N	2.1 ML	CADOUX, 6KM SW
86 01 04	003807.0	23.87	113.44	5 N	4.2 ML	CARNARVON, 113KM N
86 01 14	054107.0	23.87	113.60	5 N	3.5 ML	CARNARVON, 112KM N
86 01 15	221128.0	34.51	114.99	5 N	3.8 ML	AUGUSTA, 24KM SW
86 01 16	022818.9	30.77	117.11	5 N	2.0 ML	CADOUX, 2KM WSW
86 01 19	085312.8	30.77	117.10	5 N	1.9 ML	CADOUX, 3KM WSW
86 01 19	103504.0	30.77	117.10	5 N	2.4 ML	CADOUX, 3KM WSW
86 01 20	074618.0	32.36	122.34	5 N	4.2 ML	NORSEMAN, 57KM ESE
86 01 20	101641.7	32.48	122.30	5 N	3.6 ML	NORSEMAN, 60KM ESE
86 01 20	233145.5	29.05	124.22	10 N	3.8 ML	KALGOORLIE, 330KM NE
86 01 27	171725.0	18.29	123.00	5 N	3.3 ML	BROOME, 90KM ESE
86 01 27	200537.3	30.77	117.10	5 N	1.9 ML	CADOUX, 3KM WSW
86 01 27	215350.9	32.04	116.70	5 N	2.4 ML	YORK, 18KM SSW
86 01 28	162957.7	25.75	113.59	5 N	3.3 ML	CARNARVON, 100KM S
86 02 02	060257.3	31.66	117.06	5	2.6 ML	MECKERING, 6KM SE
86 02 02	225641.0	20.29	115.93	5 N	3.0 ML	DAMPIER, 90KM WNW
86 02 06	101759.8	30.78	117.08	5 N	3.5 ML	CADOUX, 5KM WSW
86 02 06	114413.0	18.25	119.12	5 N	3.8 ML	PORT HEDLAND, 230KM NNE
86 02 09	022459.0	30.88	117.88	5 N	2.5 ML	BENCUBBIN, 8KM SSE
86 02 16	213146.2	16.65	128.16	5 N	2.4 ML	KUNUNURRA, 100KM S
86 02 17	020638.0	32.23	117.41	5 N	3.2 ML	QUAIRADING, 24KM S
86 03 03	023741.0	34.00	110.71	5 N	3.1 ML	AUGUSTA, 400KM W
86 03 04	070140.8	16.58	128.46	5 N	2.2 ML	KUNUNURRA, 90KM SSW
86 03 06	212109.7	31.99	117.27	5 N	2.2 ML	QUAIRADING, 12KM WNW
86 03 14	165410.0	29.02	113.71	5 N	3.0 ML	GERALDTON, 90KM WSW
86 03 16	064450.0	28.10	126.61	5 N	3.6 ML	WARBURTON, 215KM S
86 03 20	095006.8	31.26	118.58	5 N	2.0 ML	MERREDIN, 38KM NE
86 03 30	183651.3	37.83	113.82	10	3.7 ML	AUGUSTA, 400KM SSW
86 03 30	202015.0	24.81	120.85	5 N	2.5 ML	MEEKATHARRA, 310KM NE
86 03 30	212142.0	20.02	113.83	5 N	3.3 ML	EXMOUTH, 210KM N
86 04 01	234903.7	30.74	117.10	5 N	2.1 ML	CADOUX, 4KM NW
86 04 02	033746.1	30.68	117.14	5 N	2.2 ML	CADOUX, 9KM N
86 04 02	100811.8	31.98	117.26	5 N	2.3 ML	QUAIRADING, 14KM WNW
86 04 03	080636.1	30.82	116.46	5 N	2.5 ML	WONGAN HILLS, 25KM WNW
86 04 03	183427.8	32.51	122.22	5 N	3.2 ML	NORSEMAN, 50KM SE
86 04 03	223017.7	32.51	122.22	5 N	3.4 ML	NORSEMAN, 50KM SE
86 04 05	152825.8	32.22	117.39	5 N	2.6 ML	QUAIRADING, 23KM S
86 04 07	172511.8	31.70	117.08	5 N	1.7 ML	MECKERING, 10KM SE

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
86 04 13	151551.0	21.86	120.22	5 N	2.8 ML	NEAR NULLAGINE
86 04 14	063323.0	21.76	126.27	5 N	3.5 ML	NEAR LAKE TOBIN
86 04 16	060121.0	20.45	123.48	5 N	3.7 ML	GREAT SANDY DESERT
86 04 16	092026.6	30.75	117.10	5 N	2.0 ML	CADOUX, 4KM NW
86 04 20	114123.5	19.59	115.01	5 N	3.7 ML	DAMPIER, 215KM NW
86 04 21	145800.6	31.68	117.07	5 N	1.8 ML	MECKERING, 9KM SE
86 04 24	082354.0	18.09	127.88	5 N	3.2 ML	HALLS CREEK, 25KM NE
86 04 27	135600.7	31.30	118.38	5 N	2.0 ML	MERREDIN, 22KM NE
86 04 28	200921.0	30.76	117.10	5 N	2.0 ML	CADOUX, 4KM W
86 04 29	192421.0	32.51	122.22	5 N	3.2 ML	NORSEMAN, 50KM SE
86 05 01	194927.3	32.59	122.31	5 N	3.1 ML	NORSEMAN, 65KM SE
86 05 04	215141.3	30.85	117.06	5 N	2.6 ML	CADOUX, 11KM SW
86 05 08	174704.0	19.62	116.54	5 N	3.5 ML	DAMPIER, 120KM NNW
86 05 09	083621.4	31.38	121.07	5 N	2.6 ML	COOLGARDIE, 20KM SSW
86 05 10	231843.6	33.00	110.38	5 N	3.6 ML	FREMANTLE, 510KM W
86 05 15	120542.9	30.76	117.10	8	3.4 ML	CADOUX, 3KM W
86 05 16	164222.0	14.69	128.51	5 N	2.4 ML	KUNUNURRA, 120KM NNE
86 05 17	124126.7	33.36	117.20	5 N	4.0 ML	WAGIN, 15KM WSW
86 05 17	145744.3	33.76	119.80	5 N	3.6 ML	RAVENSTHORPE, 30KM SW
86 05 20	171811.6	21.08	121.29	5 N	2.6 ML	MARBLE BAR, 150KM E
86 05 21	032641.8	30.76	117.10	5 N	2.4 ML	CADOUX, 3.5KM W
86 05 21	204226.6	25.31	116.22	5 N	3.6 ML	LANDOR, 70KM WSW
86 05 22	210033.5	24.92	111.30	5 N	3.1 ML	CARNARVON, 235KM W
86 05 26	103423.1	17.59	123.55	5 N	3.3 ML	DERBY, 35KM SSW
86 05 27	171035.6	30.83	117.12	5 N	3.0 ML	CADOUX, 8KM S
86 05 31	103800.0	31.30	111.42	10 N	3.1 ML	FREMANTLE, 420KM WNW
86 05 31	203812.8	18.57	118.02	10 N	4.1 ML	PORT HEDLAND, 190KM NNW
86 06 04	232407.9	32.03	117.37	5 N	2.0 ML	QUAIRADING, 4KM SW
86 06 10	172252.9	34.73	117.37	5 N	2.0 ML	DENMARK, 27KM N
86 06 13	105052.3	32.03	117.36	5 N	2.3 ML	QUAIRADING, 3KM SW
86 06 15	023326.0	25.34	125.93	5 N	2.9 ML	WARBURTON, 110KM NW
86 06 17	162544.0	30.75	117.81	5 N	2.5 ML	BENCUBBIN, 8KM NW
86 06 23	153027.0	27.59	124.78	5 N	3.8 ML	LAVERTON, 255KM ENE
86 06 29	011455.3	30.76	117.10	5 N	2.0 ML	CADOUX, 3KM W
86 07 06	110142.0	32.82	117.63	5 N	1.8 ML	NARROGIN, 36KM ENE
86 07 07	202407.3	30.83	117.04	5 N	2.8 ML	CADOUX, 11KM SW
86 07 19	052744.2	31.66	117.06	5 N	2.0 ML	MECKERING, 6KM SE
86 07 20	012528.2	21.98	126.46	5 N	3.6 ML	TOBIN LAKE
86 07 26	084116.6	31.70	117.05	5 N	3.0 ML	MECKERING, 11KM SSE
86 07 28	200521.7	23.71	115.18	5 N	2.5 ML	NANUTARRA, 130KM SSW
86 07 30	030031.0	31.72	117.06	5 N	1.8 ML	MECKERING, 13KM SSE
86 08 03	172146.4	31.64	117.02	5 N	1.9 ML	MECKERING, 4KM S
86 08 08	141426.6	31.16	121.07	5 N	2.5 ML	COOLGARDIE, 25KM SSW
86 08 11	001241.0	32.22	117.38	5 N	2.3 ML	QUAIRADING, 23KM S
86 08 11	151539.5	31.16	121.07	5 N	2.5 ML	COOLGARDIE, 25KM SSW
86 08 13	073058.0	32.22	117.38	5 N	1.9 ML	QUAIRADING,, 23KM S
86 08 15	220811.6	32.51	122.22	5 N	2.9 ML	NORSEMAN, 50KM SE
86 08 23	060208.6	30.76	117.08	5 N	2.6 ML	CADOUX, 5KM E
86 08 24	045439.0	21.41	126.54	5 N	4.0 ML	TOBIN LAKE, 80KM NE
86 08 25	022717.4	29.27	114.41	5 N	2.0 ML	DONGARA, 50KM W
86 08 27	035243.6	34.67	112.17	5 N	2.5 ML	AUGUSTA, 270KM W
86 09 01	135349.7	31.63	117.06	5 N	4.1 ML	MECKERING, 5KM ESE
86 09 01	203244.5	34.55	117.63	5 N	2.0 ML	MT BARKER, 5KM NNW
86 09 02	030227.8	38.00	112.20	5 N	2.7 ML	AUGUSTA, 485KM SW

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
86 09 02	055704.8	38.00	112.20	5 N	3.2 ML	AUGUSTA, 485KM SW
86 09 02	152453.7	38.00	112.20	5 N	3.0 ML	AUGUSTA, 485KM SW
86 09 04	183926.7	38.00	112.20	5 N	3.2 ML	AUGUSTA, 485KM SW
86 09 05	061854.1	37.06	117.00	5 N	3.1 ML	ALBANY, 240KM SSW
86 09 06	104105.0	22.73	119.05	5 N	3.1 ML	EXMOUTH, 490KM W
86 09 06	224538.8	32.04	117.35	5 N	2.1 ML	QUAIRADING, 6KM WSW
86 09 07	062929.0	32.05	117.36	5 N	2.3 ML	QUAIRADING, 5KM SW
86 09 11	000519.2	30.81	117.08	5 N	2.0 ML	CADOUX, 7KM SW
86 09 13	023704.5	15.81	120.95	5 N	4.3 ML	BROOME, 270KM NNW
86 09 13	132353.0	18.44	121.20	5 N	3.1 ML	BROOME, 115KM WSW
86 09 13	191333.9	22.68	113.25	5 N	3.0 ML	EXMOUTH, 120KM SW
86 09 16	161640.2	32.59	122.31	5 N	3.5 ML	NORSEMAN, 66KM SE
86 09 17	055143.6	34.51	117.58	5 N	2.2 ML	MT BARKER, 13KM N
86 09 23	060652.0	30.51	117.02	2	2.3 ML	CADOUX, 31KM NNW
86 09 23	204155.6	21.50	119.82	11	3.2 ML	MARBLE BAR, 37KM S
86 09 27	070042.7	30.71	117.12	3	2.3 ML	CADOUX, 6KM N
86 09 27	070222.6	30.72	117.14	5 N	2.1 ML	CADOUX, 6KM N
86 09 28	171835.2	30.75	117.14	8	2.8 ML	CADOUX, 2KM NNE
86 09 29	045728.7	30.79	117.12	5 N	2.0 ML	CADOUX, 2KM SSW
86 09 29	150953.0	16.92	118.33	5 N	3.0 ML	ROWLEY SHOALS, 100KM NW
86 09 29	215722.0	30.73	117.13	7	3.3 ML	CADOUX, 4KM N
86 10 01	114100.0	32.68	114.98	5 N	2.0 ML	MANDURAH, 70KM WSW
86 10 01	131933.0	32.25	126.24	5 N	3.4 ML	NEAR EYRE.
86 10 01	192106.1	30.78	117.12	5 N	2.0 ML	CADOUX, 2KM SW
86 10 01	231746.5	34.10	118.82	5 N	2.2 ML	JERRAMUNGUP, 15KM S
86 10 02	034323.6	30.58	121.60	5 N	3.0 ML	NEAR KALGOORLIE.
86 10 04	162751.3	30.76	117.07	5 N	1.8 ML	CADOUX, 6KM WNW
86 10 05	013150.4	30.76	117.08	5 N	2.6 ML	CADOUX, 5KM W
86 10 05	014259.8	30.75	117.09	5 N	2.2 ML	CADOUX, 5KM W
86 10 05	124040.0	32.43	122.20	5 N	3.0 ML	NORSEMAN, 45KM SE
86 10 09	015635.9	30.72	117.12	5 N	2.7 ML	CADOUX, 6KM N
86 10 13	120610.2	33.95	118.81	5 N	3.2 ML	JERRAMUNGUP, 15KM W
86 10 16	213631.0	22.61	114.59	5 N	4.1 ML	LEARMONTH, 65KM SE
86 10 18	023250.7	30.71	117.14	5 N	2.2 ML	CADOUX, WA
86 10 18	040502.0	28.63	118.58	5 N	2.2 ML	YOUANMI, 24KM W
86 10 18	130654.0	22.29	119.75	5 N	2.7 ML	MARBLE BAR, 125KM S
86 10 23	094400.0	31.28	118.62	5 N	2.2 ML	MERREDIN, 25KM N
86 10 25	015849.0	16.62	121.04	5 N	3.8 ML	BROOME, 190KM NW
86 10 26	055227.0	26.67	111.19	5 N	3.0 ML	KALBARRI, 300KM WNW
86 10 27	103606.8	30.73	117.12	5 N	2.0 ML	CADOUX, 46KM NNW
86 10 27	170813.0	23.11	128.22	5 N	3.3 ML	LAKE MACKAY, 60KM SW
86 11 01	185401.2	19.96	116.41	5 N	2.8 ML	DAMPIER, 80KM NNW
86 11 05	075756.0	18.47	118.85	5 N	4.0 ML	PORT HEDLAND, 200KM N
86 11 07	010943.0	22.23	114.31	5 N	2.7 ML	EXMOUTH GULF
86 11 22	075426.2	31.73	117.02	7	2.3 ML	MECKERING, 12KM S
86 11 23	104218.9	16.53	128.70	5 N	2.3 ML	KUNUNURRA, 90KM S
86 11 23	104332.6	16.53	128.70	5 N	2.4 ML	KUNUNURRA, 90KM S
86 11 29	223322.4	27.49	114.00	5 N	2.6 ML	KALBARRI, 30KM NW
86 12 04	134716.0	20.25	115.83	5 N	4.0 ML	DAMPIER, 100KM WNW
86 12 06	205415.5	21.36	120.65	5 N	2.5 ML	MARBLE BAR, 100KM W
86 12 14	093245.0	19.18	121.51	5 N	3.6 ML	BROOME, 160KM SSW
86 12 15	093110.5	30.79	117.09	5 N	2.1 ML	CADOUX, 4KM SW
86 12 17	014942.9	32.22	117.41	5 N	2.2 ML	QUAIRADING, 23KM S
86 12 17	091308.0	32.36	122.27	5 N	3.3 ML	NORSEMAN, 50KM WSW

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
86 12 18	012635.0	16.79	122.59	5 N	3.9 ML	BROOME, 130KM NNW
86 12 18	065851.0	27.83	116.82	5 N	4.3 ML	MT MAGNET,205KM WNW
86 12 19	102739.3	32.22	117.41	5 N	2.8 ML	QUAIRADING, 23KM S
86 12 20	104327.0	32.21	117.39	5 N	2.1 ML	QUAIRADING, 22KM S
86 12 22	125016.0	32.22	117.41	5 N	2.1 ML	QUAIRADING, 23KM S
86 12 25	011505.7	32.21	117.39	5 N	2.1 ML	QUAIRADING, 22KM S
86 12 26	011501.0	32.22	117.41	5 N	1.8 ML	QUAIRADING, 23KM S
86 12 27	074358.0	32.51	122.22	5 N	3.2 ML	NORSEMAN, 50KM SE
86 12 30	145259.0	26.06	111.37	5 N	2.8 ML	CARNARVON, 260KM WSW
86 12 30	170003.3	20.65	116.09	5 N	3.0 ML	DAMPIER, 70KM W
87 01 01	134656.7	33.36	117.74	5 N	1.7 ML	DUMBLEYUNG, 4KM S
87 01 01	203951.3	30.69	117.12	5 N	2.0 ML	CADOUX, 8KM S
87 01 03	080905.0	38.00	112.25	5 N	2.8 ML	AUGUSTA, 480KM SW
87 01 07	052606.0	19.31	117.75	5 N	3.4 ML	PT HEDLAND,140KM NW
87 01 12	181027.0	33.33	117.47	8	1.6 ML	WAGIN, 11KM E
87 01 19	100334.4	33.41	117.71	13	2.6 ML	DUMBLEYUNG, 11KM SSW
87 01 20	020712.0	33.40	117.67	6	1.6 ML	DUMBLEYUNG, 11KM SW
87 01 22	135630.0	30.60	118.89	5 N	2.5 ML	BONNIE ROCK, 50KM E
87 01 23	104330.2	30.86	117.16	5	2.0 ML	CADOUX, 12KM SSE
87 01 23	112139.7	30.86	117.18	3	2.3 ML	CADOUX, 11KM SSE
87 01 23	214030.6	16.59	128.56	5 N	2.2 ML	KUNUNURRA, 96KM S
87 01 25	061410.2	33.40	117.74	5	2.3 ML	DUMBLEYUNG, 9KM S
87 01 27	150558.6	33.40	117.72	10	2.0 ML	DUMBLEYUNG, 9KM SSW
87 01 30	035033.8	31.83	116.98	5	2.7 ML	MECKERING, 24KM S
87 02 02	182538.3	31.84	116.98	5	2.8 ML	MECKERING, 25KM S
87 02 02	204239.0	31.83	116.96	15	2.0 ML	MECKERING, 25KM S
87 02 04	131748.5	31.84	116.97	5 N	2.4 ML	MECKERING, 24KM S
87 02 07	073946.2	32.22	117.37	5 N	2.1 ML	QUAIRADING, 22KM S
87 02 07	220757.6	30.74	117.13	5	2.3 ML	CADOUX, 3KM N
87 02 08	173754.5	33.40	117.74	5 N	2.2 ML	DUMBLEYUNG, 9KM S
87 02 09	075821.7	31.61	117.08	6	3.2 ML	MECKERING, 6KM E
87 02 09	180648.0	31.57	117.10	5 N	2.2 ML	MECKERING, 9KM ENE
87 02 09	180733.3	31.62	117.08	4	2.3 ML	MECKERING, 7KM ESE
87 02 14	090341.1	33.41	117.74	8	2.0 ML	DUMBLEYUNG, 10KM S
87 02 14	111353.3	33.41	117.73	8	2.0 ML	DUMBLEYUNG, 10KM S
87 02 17	101658.9	30.82	117.07	5	2.5 ML	CADOUX, 8KM SW
87 02 19	142445.0	39.49	117.50	5 N	3.3 ML	ALBANY, 500KM S
87 02 28	081050.5	32.51	122.22	5 N	3.0 ML	NORSEMAN, 50KM SW
87 03 02	122614.5	31.24	117.46	5 N	2.0 ML	WYALKATCHEM, 10KM SE
87 03 02	132742.2	31.20	117.48	7	2.5 ML	WYALKATCHEM, 10KM E
87 03 02	133437.8	31.23	117.49	5 N	1.8 ML	WYALKATCHEM, 12KM ESE
87 03 02	133851.6	31.23	117.48	5 N	2.0 ML	WYALKATCHEM, 10KM ESE
87 03 02	164417.1	31.62	117.05	8	3.8 ML	MECKERING, 3KM E
87 03 02	175317.2	31.60	117.05	5	2.2 ML	MECKERING, 4KM ENE
87 03 02	222213.2	31.22	117.49	2	3.1 ML	WYALKATCHEM, 11KM ESE
87 03 02	222220.0	31.22	117.49	5 N	3.0 ML	WYALKATCHEM, 11KM ESE
87 03 02	235703.5	31.22	117.46	5 N	2.0 ML	WYALKATCHEM, 9KM ESE
87 03 03	022742.6	31.20	117.48	2	2.2 ML	WYALKATCHEM, 10KM ESE
87 03 06	141921.0	31.22	117.49	2	2.2 ML	WYALKATCHEM, 11KM ESE
87 03 07	053807.7	30.77	117.09	5	4.5 ML	CADOUX, 4KM W
87 03 09	081356.9	30.77	117.10	5 N	2.0 ML	CADOUX, 3KM W
87 03 09	135045.3	32.44	117.78	5 N	2.8 ML	CORRIGIN, 15KM SW
87 03 10	210435.9	30.70	117.14	5 N	2.0 ML	CADOUX, 7KM N
87 03 13	105038.2	31.22	117.49	5 N	2.3 ML	WYALKATCHEM, 11KM ESE

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
87 03 14	192538.8	22.75	114.10	5 N	3.0 ML	EXMOUTH, 106KM S
87 03 17	110020.0	32.32	117.22	5 N	1.8 ML	ALDERSYDE, 5KM NW
87 03 18	083926.9	32.31	117.23	5 N	1.7 ML	ALDERSYDE, 5KM NW
87 03 18	131008.6	31.70	117.04	9	1.8 ML	MECKERING, 10KM SSE
87 03 18	131817.6	31.70	117.03	7	2.0 ML	MECKERING, 9KM SSE
87 03 20	161326.6	22.84	114.14	5 N	3.0 ML	EXMOUTH, 105KM S
87 03 24	125500.1	31.70	116.98	5 N	1.8 ML	MECKERING, 10KM SSW
87 03 29	153922.0	18.90	118.84	5 N	3.0 ML	PT HEDLAND, 155KM N
87 03 31	101333.9	38.11	112.03	5 N	3.6 ML	AUGUSTA, 513KM SW
87 04 06	121942.9	31.72	117.07	5	2.0 ML	MECKERING, 12KM SSE
87 04 10	064329.0	17.25	122.10	5 N	3.7 ML	BROOME, 75KM N
87 04 10	121129.0	31.20	121.11	5 N	2.3 ML	COOLGARDIE, 25KM S
87 04 11	111407.5	32.01	117.33	1	1.7 ML	QUAIRADING, 7KM W
87 04 17	134923.0	25.52	115.93	5 N	2.5 ML	ERONG, 70KM W
87 04 17	165822.3	25.46	115.98	23	3.2 ML	ERONG, 65KM W
87 04 19	224120.0	32.61	122.26	5 N	3.2 ML	NORSEMAN, 50KM SE
87 04 27	020526.3	32.74	118.09	5 N	1.6 ML	KULIN, 6KM SW
87 05 02	234926.0	30.66	121.36	5 N	3.5 ML	KALGOORLIE, 10KM NW
87 05 05	211548.6	30.86	117.23	5 N	1.9 ML	CADOUX, 13KM SE
87 05 05	232414.5	32.04	116.72	5	3.8 ML	TALBOT BROOK, 5KM SE
87 05 06	071553.9	32.02	117.33	5 N	2.0 ML	QUAIRADING, 7KM W
87 05 07	222803.2	31.74	117.03	5 N	1.7 ML	MECKERING, 13KM SSE
87 05 08	133528.0	32.51	122.22	5 N	3.0 ML	NORSEMAN, 50KM SE
87 05 10	013053.3	32.13	117.19	3	2.0 ML	QUAIRADING, 24KM SE
87 05 10	233635.3	33.39	117.74	5	3.2 ML	DUMBLEYUNG, 9KM S
87 05 11	092102.3	29.51	116.06	5 N	2.2 ML	THREE SPRINGS, 28KM E
87 05 12	144941.8	33.39	117.74	5	2.3 ML	DUMBLEYUNG, 9KM S
87 05 12	165457.7	32.24	117.37	5 N	2.5 ML	ALDERSYDE, 16KM NNE
87 05 15	090620.0	29.43	114.29	5 N	2.3 ML	DONGARA, 65KM WSW
87 05 16	235442.0	33.39	117.74	5	2.1 ML	DUMBLEYUNG, 9KM S
87 05 17	154230.0	17.47	122.59	5 N	3.4 ML	BROOME, 65KM NE
87 05 20	172404.1	31.25	116.64	5	2.5 ML	GOOMALLING, 18KM WNW
87 06 03	150100.4	35.18	123.59	5 N	3.4 ML	ESPERANCE, 210KM SE
87 06 04	033309.5	32.59	122.31	5 N	3.5 ML	NORSEMAN, 65KM SE
87 06 11	121842.4	31.20	117.51	3	3.5 ML	WYALKATCHEM, 13KM E
87 06 11	121943.1	31.20	117.51	3	3.2 ML	WYALKATCHEM, 13KM E
87 06 11	171153.0	31.21	117.51	3	3.2 ML	WYALKATCHEM, 13KM ESE
87 06 12	003010.8	31.21	117.49	1 N	2.6 ML	WYALKATCHEM, 11KM ESE
87 06 14	180632.5	32.59	122.31	5 N	3.0 ML	NORSEMAN, 65KM SE
87 06 19	133203.0	20.56	116.69	5 N	3.7 ML	DAMPIER, 10KM N
87 06 21	094121.3	37.00	117.45	5 N	2.3 ML	ALBANY, 230KM S
87 06 21	161533.7	18.17	118.99	5 N	4.0 ML	ROWLEY SHOALS, 60KM S
87 06 23	020612.1	31.22	117.49	1 N	2.3 ML	WYALKATCHEM, 12KM ESE
87 06 24	110738.4	31.22	117.49	2	2.0 ML	WYALKATCHEM, 12KM ESE
87 07 05	052840.5	31.78	116.34	5 N	2.7 ML	WOOROLOO, 3KM NE
87 07 05	110535.0	18.47	120.70	5 N	3.3 ML	BROOME, 170KM WSW
87 07 07	022216.7	30.85	117.08	3	2.2 ML	CADOUX, 10KM SW
87 07 08	103804.5	32.54	122.28	5 N	4.7 ML	NORSEMAN, 60KM SE
87 07 08	115757.0	32.54	122.28	5 N	3.1 ML	NORSEMAN, 60KM SE
87 07 09	063718.0	31.21	117.48	1 N	2.4 ML	WYALKATCHEM, 10KM ESE
87 07 10	223254.2	31.22	117.47	1 N	2.6 ML	WYALKATCHEM, 10KM ESE
87 07 12	195133.2	32.54	122.28	5 N	3.3 ML	NORSEMAN, 60KM SE
87 07 18	203127.0	38.26	114.71	5 N	2.7 ML	AUGUSTA, 440KM S
87 07 19	030329.2	27.22	113.06	5 N	5.0 ML	KALBARRI, 120KM WNW

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
87 07 30	215859.0	36.78	124.91	5 N	3.7 ML	ESPERANCE, 425KM SE
87 08 11	044011.6	33.21	118.08	5 N	2.1 ML	DUMBLEYUNG, 34KM ENE
87 08 13	114252.0	31.22	117.49	5 N	2.2 ML	WYALKATCHEM, 12KM ESE
87 08 21	093939.8	32.66	122.37	5 N	3.1 ML	NORSEMAN, 75KM SE
87 08 22	151950.9	30.74	117.79	5 N	2.8 ML	BENCUBBIN, 10KM NW
87 08 26	223149.0	21.39	120.24	5	3.3 ML	MARBLE BAR, 60KM SE
87 08 30	142345.2	16.61	128.64	5 N	3.0 ML	KUNUNURRA, 96KM S
87 08 30	200858.0	37.41	128.42	5 N	3.1 ML	EUCLA, 640KM S
87 09 10	235045.0	31.42	116.66	5	2.6 ML	GOOMALLING, 20KM SW
87 09 18	004131.0	16.76	119.22	5 N	4.0 ML	ROWLEY SHOALS, 50KM N
87 09 23	022931.0	17.65	123.38	5 N	3.2 ML	DERBY, 50KM SW
87 09 24	155319.5	21.33	120.24	5 N	3.0 ML	MARBLE BAR, 55KM WSW
87 09 24	204651.0	19.67	115.65	5 N	4.0 ML	DAMPIER, 150KM NW
87 09 25	082719.2	30.73	117.83	5 N	2.5 ML	BENCUBBIN, 8KM NNW
87 09 25	091830.5	30.69	117.88	5 N	2.8 ML	BENCUBBIN, 12KM N
87 09 26	145417.6	30.74	117.16	2	2.5 ML	CADOUX, 4KM NE
87 09 27	121050.6	30.74	117.16	2	2.0 ML	CADOUX, 3.5KM NE
87 10 05	021914.5	29.77	116.20	5	2.0 ML	LATHAM, 22KM W
87 10 09	035848.6	30.90	121.27	16	4.5 ML	COOLGARDIE, 10KM ENE
87 10 12	045315.0	34.91	118.47	5	3.2 ML	ALBANY, 50KM E
87 10 16	105532.0	38.76	112.17	5	3.3 ML	AUGUSTA, 540KM SW
87 10 16	111938.0	25.76	112.56	5	4.7 ML	DENHAM, 100KM W
87 10 21	023321.0	26.36	112.84	5	3.8 ML	USELESS LOOP, 60KM WSW
87 10 21	183254.0	30.92	121.23	5	3.3 ML	COOLGARDIE, 10KM NE
87 10 22	211344.0	30.92	121.23	5	3.6 ML	COOLGARDIE, 10KM NE
87 10 25	224235.0	18.17	119.22	5	3.7 ML	PORT HEDLAND, 250KM NNE
87 11 01	152740.0	22.08	126.60	5	3.6 ML	TOBIN LAKE, 50KM ESE
87 11 01	181011.1	30.72	117.18	5	2.6 ML	CADOUX, 7KM NE
87 11 02	101811.0	30.52	121.24	5	2.9 ML	KALGOORLIE, 30KM NW
87 11 04	053551.9	31.68	117.06	5	2.2 ML	MECKERING, 8KM SE
87 11 06	133635.0	13.08	122.84	5	4.5 ML	DERBY, 470KM N
87 11 07	045916.0	13.08	122.84	5	3.8 ML	DERBY, 470KM N
87 11 15	112933.0	29.62	115.05	5	2.5 ML	ENEABBA, 32KM NW
87 11 15	122713.0	32.51	122.22	5	3.1 ML	NORSEMAN, 50KM SE
87 11 15	123756.9	23.31	114.00	5	3.1 ML	LEARMONTH, 120KM S
87 11 17	205704.6	30.81	117.11	4	2.6 ML	CADOUX, 5KM SW
87 11 18	093719.7	21.28	120.18	11	3.8 ML	MARBLE BAR, 55KM ESE
87 11 18	155749.9	30.00	117.10	4	2.3 ML	CADOUX, 4KM SW
87 11 19	180016.9	21.30	120.15	25	4.1 ML	MARBLE BAR, 45KM ESE
87 11 20	045458.9	21.30	120.15	5	3.5 ML	MARBLE BAR, 45KM ESE
87 12 04	131557.0	17.44	120.46	5	5.0 ML	BROOME, 200KM WNW
87 12 06	223736.0	31.82	110.89	5	3.4 ML	PERTH, 460KM W
87 12 12	120656.0	16.94	119.57	5	3.3 ML	ROWLEY SHOALS
87 12 12	144926.2	31.03	116.68	2	2.7 ML	WONGAN HILLS, 14KM SSW
87 12 13	152903.0	29.61	126.27	5	3.5 ML	FORREST, 220KM NW
87 12 18	175549.4	31.20	117.50	3	3.4 ML	WYALKATCHEM, 12KM E
87 12 19	014328.6	31.20	117.50	5	2.6 ML	WYALKATCHEM, 12KM E
87 12 20	121148.0	30.50	121.16	5	3.8 ML	KALGOORLIE, 40KM NW
87 12 20	161338.7	33.43	117.42	3	1.8 ML	WAGIN 15KM SSE
87 12 21	131424.0	31.18	117.51	4	2.2 ML	WYALKATCHEM, 13KM E
87 12 21	215356.9	31.18	117.51	4	3.2 ML	WYALKATCHEM, 13KM E
87 12 25	193625.0	16.34	120.69	5	4.6 ML	BROOME, 240KM NW
87 12 27	080707.0	23.76	114.38	5	3.5 ML	MINILYA, 40KM E
87 12 28	231259.0	31.18	117.51	4	2.5 ML	WYALKATCHEM, 13KM E

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
88 01 01	090115.8	30.76	117.77	5	3.8 ML	BENCUBBIN, 7KM NW
88 01 01	090443.0	30.76	117.77	5	2.4 ML	BENCUBBIN, 7KM NW
88 01 01	112900.0	30.76	117.77	5	2.3 ML	BENCUBBIN, 7KM NW
88 01 01	112946.3	30.76	117.77	5	2.7 ML	BENCUBBIN, 7KM NW
88 01 04	221647.3	31.21	117.50	3	2.3 ML	WYALKATCHEM, 12KM ESE
88 01 05	232740.6	31.20	117.50	5	2.8 ML	WYALKATCHEM, 12KM E
88 01 06	034208.0	31.20	117.50	2	4.3 ML	WYALKATCHEM, 12KM E
88 01 06	035511.8	31.20	117.50	5	2.9 ML	WYALKATCHEM, 12KM E
88 01 06	050846.8	31.20	117.50	5	2.4 ML	WYALKATCHEM, 12KM E
88 01 06	051309.1	31.20	117.50	5	1.8 ML	WYALKATCHEM, 12KM E
88 01 06	065603.0	17.04	128.46	5	2.7 ML	TURKEY CREEK, 25KM E
88 01 06	104602.3	31.20	117.50	5	2.1 ML	WYALKATCHEM, 12KM E
88 01 07	091142.9	31.20	117.50	5	2.4 ML	WYALKATCHEM, 12KM E
88 01 09	161320.0	17.67	126.69	5	3.1 ML	HALLS CREEK, 120KM NW
88 01 10	053744.0	30.75	117.83	5	3.0 ML	BENCUBBIN, 7KM NNW
88 01 11	205610.5	30.75	117.83	5	2.6 ML	BENCUBBIN, 7KM NNW
88 01 18	030242.0	32.51	122.22	5 N	2.8 ML	NORSEMAN, 50KM SE
88 01 19	085743.8	31.20	117.50	5 N	2.0 ML	WYALKATCHEM, 12KM E
88 01 20	174008.0	18.00	116.37	5 N	3.6 ML	DAMPIER, 300KM N
88 01 28	014630.0	21.05	120.60	5 N	4.8 ML	MARBLE BAR, 90KM E
88 01 28	014934.0	21.05	120.60	5 N	4.6 ML	MARBLE BAR, 90KM E
88 01 28	015617.5	21.05	120.60	5 N	5.0 ML	MARBLE BAR, 90KM E
88 01 28	153344.7	31.72	117.07	3	2.0 ML	MECKERING, 12KM SE
88 01 29	033019.2	31.20	117.50	2	2.3 ML	WYALKATCHEM, 12KM E
88 02 04	214850.2	30.77	117.09	5	2.7 ML	CADOUX, 4KM E
88 02 06	052358.0	16.18	124.51	5 N	5.7 ML	DERBY, 150KM NE
88 02 07	004129.0	30.78	118.44	5 N	2.0 ML	MUKINBUDIN, 25KM NE
88 02 11	125239.3	31.20	117.51	5	2.6 ML	WYALKATCHEM, 13KM E
88 02 16	111647.0	18.04	118.88	5 N	2.4 ML	PORT HEDLAND, 250KM N
88 02 21	123409.3	30.93	117.14	2	2.5 ML	CADOUX, 18KM S
88 02 27	221339.3	34.63	116.81	5 N	2.0 ML	ROCKY GULLY, 20KM SW
88 02 28	175616.4	33.60	118.27	3	2.7 ML	NYABING, 13KM ESE
88 03 12	135905.4	16.60	128.76	5 N	2.4 ML	KUNUNURRA, 90KM S
88 03 13	194400.4	30.53	116.79	2	2.4 ML	BALLIDU, 9KM NNE
88 03 14	074824.5	30.54	116.80	4	3.6 ML	BALLIDU, 8KM NE
88 03 14	144455.3	30.54	116.80	4	2.5 ML	BALLIDU, 8KM NE
88 03 18	200337.9	32.15	117.17	5 N	2.6 ML	BEVERLEY, 23KM E
88 03 20	191552.5	29.11	114.00	5 N	3.0 ML	GERALDTON, 70KM WSW
88 03 25	210558.0	26.11	116.15	5 N	2.5 ML	MEEKATHARRA, 230KM WNW
88 03 26	091859.9	31.25	117.49	5 N	2.2 ML	WYALKATCHEM, 14KM SE
88 03 28	212449.0	36.83	108.44	5 N	3.8 ML	AUGUSTA, 660KM WSW
88 04 03	004000.3	30.77	117.09	5	2.4 ML	CADOUX, 4KM W
88 04 05	183833.0	20.73	115.79	5 N	2.5 ML	DAMPIER, 100KM W
88 04 07	051516.5	30.88	117.17	5	2.0 ML	CADOUX, 13KM SSE
88 04 11	080517.9	34.45	117.58	5 N	2.1 ML	MT BARKER, 17KM NNW
88 04 17	135346.5	30.52	116.77	2	2.5 ML	BALLIDU, 9KM NNE
88 04 17	135404.9	30.52	116.77	2	3.0 ML	BALLIDU, 9KM NNE
88 04 21	104631.1	33.36	117.69	5 N	2.2 ML	DUMBLEYUNG, 7KM SW
88 04 21	115420.5	38.14	112.74	5 N	3.2 ML	AUGUSTA, 480KM SSW
88 04 23	233808.0	21.95	126.65	5 N	3.0 ML	TOBIN LAKE, 40KM E
88 04 26	184520.0	27.93	106.72	5 N	4.0 ML	GERALDTON, 770KM W
88 05 02	044151.0	28.20	107.17	5 N	3.5 ML	GERALDTON, 720KM W
88 05 04	045242.6	31.62	117.02	2	2.0 ML	MECKERING, 1KM SE
88 05 08	155337.0	22.83	124.73	5 N	3.5 ML	TOBIN LAKE, 160KM SW

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
88 05 09	192433.0	21.92	126.43	5 N	3.7 ML	TOBIN LAKE, 40KM E
88 05 16	181600.5	21.42	120.19	5 N	3.0 ML	MARBLE BAR, 55KM SE
88 05 17	012546.8	31.22	116.48	5 N	2.0 ML	BOLGART, 7KM NNE
88 05 18	090304.0	18.96	122.28	5 N	3.5 ML	BROOME, 110KM S
88 05 18	111415.2	30.52	116.80	2	2.2 ML	BALLIDU, 10KM NE
88 05 25	151924.2	32.41	117.13	2	2.0 ML	BROOKTON, 13KM ESE
88 05 26	170430.0	27.90	116.91	5 N	3.0 ML	MT MAGNET, 90KM W
88 05 29	060615.0	13.91	122.44	5 N	4.0 ML	SCOTT REEF, 50KM E
88 06 12	043546.3	31.72	117.00	5 N	2.0 ML	MECKERING, 11KM S
88 06 15	091346.5	31.72	126.50	5 N	5.0 ML	COCKLEBIDDY, 50KM NE
88 06 15	161406.0	31.72	126.50	5 N	3.0 ML	COCKLEBIDDY, 50KM NE
88 06 16	225829.7	32.57	122.23	5 N	3.4 ML	NORSEMAN, 60KM SE
88 06 18	213525.5	30.78	117.12	5	2.3 ML	CADOUX, 2KM SE
88 06 20	211628.4	30.80	117.10	5	2.6 ML	CADOUX, 5KM SW
88 06 23	113118.5	16.66	128.70	5 N	4.2 ML	LISSADELL STN 17KM E
88 06 24	175632.5	36.59	117.79	5 N	3.0 ML	ALBANY, 175KM S
88 06 29	192202.9	31.20	117.49	5 N	2.8 ML	WYALKATCHEM, 11KM SE
88 06 30	040559.3	31.20	117.49	5 N	2.4 ML	WYALKATCHEM, 11KM SE
88 07 04	214310.0	31.72	126.50	5 N	3.0 ML	COCKLEBIDDY, 50KM NE
88 07 05	080013.4	30.53	116.79	1	2.0 ML	BALLIDU, 9KM NE
88 07 05	090016.0	22.50	123.07	5 N	3.3 ML	MARBLE BAR, 370KM SE
88 07 06	213749.4	30.79	117.74	2 N	2.1 ML	BENCUBBIN, 10KM WNW
88 07 06	224052.6	30.53	116.79	2	2.5 ML	BALLIDU, 9KM NE
88 07 07	234039.0	31.20	117.44	2 N	2.0 ML	WYALKATCHEM, 7KM ESE
88 07 10	175107.0	33.50	117.94	5	3.0 ML	NYABING, 19KM WNW
88 07 14	223651.0	16.65	128.63	5 N	3.3 ML	LISSADELL STN, 10KM E
88 07 16	001614.0	25.08	117.05	50 N	3.2 ML	LANDOR STN, 15KM E
88 07 16	191919.0	32.48	122.18	5 N	3.1 ML	NORSEMAN, 50KM SE
88 07 16	205000.5	32.48	122.18	5 N	3.6 ML	NORSEMAN, 50KM SE
88 07 18	020930.1	32.23	117.39	5 N	2.2 ML	ALDERSYDE, 19KM NE
88 07 18	174948.0	32.23	117.39	5 N	2.0 ML	ALDERSYDE, 19KM NE
88 07 24	210349.0	21.63	126.07	5 N	3.0 ML	TOBIN LAKE, 30KM NE
88 07 25	192908.0	14.89	127.68	5 N	3.3 ML	WYNDHAM, 75KM NE
88 07 28	214402.8	33.17	118.12	2 N	2.0 ML	KUKERIN, 4KM ENE
88 07 30	041459.5	18.41	123.54	5 N	3.6 ML	BROOME, 150KM ESE
88 08 04	051120.8	31.70	117.06	6	2.5 ML	MECKERING, 10KM SSE
88 08 07	153838.6	33.32	116.56	1 N	2.1 ML	DARKAN, 17KM W
88 08 08	181350.0	27.30	126.56	5 N	4.8 ML	WARBURTON, 125KM S
88 08 11	052610.0	15.00	121.33	5 N	4.2 ML	BROOME, 330KM NNW
88 08 13	192039.0	22.08	126.32	5 N	3.0 ML	TOBIN LAKE, 20KM SE
88 08 15	041331.6	32.51	122.22	5 N	3.7 ML	NORSEMAN, 50KM SE
88 08 18	073941.8	33.31	116.54	1 N	2.6 ML	DARKAN, 18KM W
88 08 20	090011.5	24.96	126.60	5 N	2.6 ML	WARBURTON, 130KM N
88 08 20	093544.0	31.39	119.54	5 N	2.0 ML	SOUTHERN CROSS, 30KM SE
88 08 22	131304.5	16.42	121.66	5 N	4.0 ML	BROOME, 180KM NNW
88 08 25	213305.7	16.56	128.68	5 N	3.2 ML	KUNUNURRA, 90KM S
88 08 27	051609.9	36.64	114.54	5 N	2.2 ML	WALPOLE, 270KM SW
88 08 30	212551.6	33.32	116.56	1 N	2.2 ML	DARKAN, 17KM W
88 09 01	113457.8	33.30	116.56	2	2.5 ML	DARKAN, 17KM WNW
88 09 03	181547.0	30.83	117.07	2	2.3 ML	CADOUX, 9KM SW
88 09 10	074603.3	33.32	116.56	1	3.0 ML	DARKAN, 17KM W
88 09 16	025032.7	31.62	117.05	2	2.0 ML	MECKERING, 3KM E
88 09 17	060556.1	32.51	122.22	5 N	3.0 ML	NORSEMAN, 50KM SE
88 09 21	022801.5	17.38	128.13	5 N	3.5 ML	TURKEY CREEK, 40KM SSW

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
88 09 25	004055.0	28.21	107.10	5 N	3.5 ML	GERALDTON, 730 KM W
88 10 09	031516.6	28.36	119.48	12	2.6 ML	SANDSTONE, 50KM SSE
88 10 16	093717.3	31.16	119.46	5 N	2.4 ML	SOUTHERN CROSS, 10KM NE
88 10 19	154909.5	22.84	115.31	5 N	3.8 ML	NANUTARRA, 30KM SE
88 10 20	215634.6	31.65	116.99	4	2.5 ML	MECKERING, 4KM SE
88 10 21	144915.7	31.66	117.00	5	2.8 ML	MECKERING, 5KM SSW
88 10 24	175926.0	20.26	115.83	5 N	3.4 ML	DAMPIER, 100KM WNW
88 10 25	100532.0	19.94	113.90	5 N	3.3 ML	BARROW ISLAND, 180KM NW
88 10 27	080008.0	30.78	117.74	0 N	2.5 ML	BENCUBBIN, 10KM WNW
88 10 27	080837.0	30.78	117.74	0 N	2.3 ML	BENCUBBIN, 10KM WNW
88 11 02	090841.0	30.70	117.17	2	2.5 ML	CADOUX, 9KM NW
88 11 04	073443.0	29.94	128.03	5 N	3.0 ML	FORREST, 100KM N
88 11 05	164402.1	32.10	117.15	1	2.0 ML	BEVERLEY, 21KM E
88 11 07	034024.7	30.70	117.17	2	2.3 ML	CADOUX, 9KM NE
88 11 23	200723.4	27.34	123.01	5 N	3.3 ML	WARBURTON, 379KM WSW
88 11 24	234435.0	25.35	116.44	5 N	3.3 ML	MEEKATHARRA, 239KM NW
88 11 27	140716.3	30.37	123.01	5 N	3.3 ML	KALGOORLIE, 153KM E
88 12 05	073709.1	31.65	116.98	2	2.3 ML	MECKERING, 4KM SW
88 12 05	073734.7	31.65	116.98	2 N	2.6 ML	MECKERING, 2KM SW
88 12 15	185624.0	18.69	124.33	5	4.4 ML	FITZROY CROSS, 140KM SSW
88 12 18	040936.0	28.94	123.79	5 N	3.0 ML	LAVERSON, 140KM WSW
88 12 20	145826.1	31.70	117.08	13	2.6 ML	MECKERING, 10KM SE
88 12 23	042458.5	22.00	126.51	5 N	3.5 ML	TOBIN LAKE, 40KM E
88 12 25	100147.0	27.42	117.73	5 N	3.0 ML	MEEKATHARRA, 120KM SW
88 12 29	114057.0	18.68	117.89	5 N	3.2 ML	PT HEDLAND, 195KM NNW
89 01 02	193332.7	27.84	107.57	5 N	3.5 ML	GERALDTON, 710KM W
89 01 05	085715.0	15.90	123.32	5 N	3.2 ML	DERBY, 180KM N
89 01 07	040314.8	31.84	119.66	6	2.3 ML	COOLGARDIE, 175KM SW
89 01 07	114143.9	25.39	116.06	5 N	4.0 ML	ERONG, 60KM WNW
89 01 11	093700.0	31.84	119.66	5 N	2.0 ML	COOLGARDIE, 175KM SW
89 01 13	163837.8	30.91	117.16	5	3.0 ML	CADOUX, 16KM S
89 01 19	080203.3	30.69	117.13	1 N	2.1 ML	CADOUX, 9KM N
89 01 19	150820.4	16.87	128.59	5 N	2.6 ML	LISSADELL STN, 20KM S
89 01 19	195225.7	30.95	116.85	7	2.1 ML	WONGAN HILLS, 14KM E
89 01 21	194547.4	30.90	117.14	5	2.4 ML	CADOUX, 15KM S
89 01 30	054850.7	32.39	117.14	3	2.2 ML	BROOKTON, 14KM ESE
89 01 31	074813.3	32.40	117.13	1	2.1 ML	BROOKTON, 14KM ESE
89 02 02	034317.4	31.14	117.25	6	2.1 ML	WYALKATCHEM, 13KM W
89 02 02	034328.8	31.15	117.22	6 C	2.2 ML	WYALKATCHEM, 16KM W
89 02 02	071434.1	31.16	117.24	6	2.5 ML	WYALKATCHEM, 14KM W
89 02 04	010327.5	30.93	117.14	1 C	2.2 ML	CADOUX, 18KM S
89 02 06	031809.3	31.23	117.48	1 C	1.9 ML	WYALKATCHEM, 11KM ESE
89 02 13	140912.6	30.54	116.80	2	2.5 ML	BALLIDU, 12KM NE
89 02 17	115121.5	19.34	117.55	5 N	3.3 ML	PORT HEDLAND, 152KM NW
89 02 17	141634.0	14.81	121.13	5 N	3.9 ML	BROOME, 370KM NNW
89 02 21	133928.8	32.12	117.16	5 N	2.0 ML	BEVERLEY, 22KM E
89 02 24	121651.0	20.03	113.94	5 N	3.4 ML	EXMOUTH, 210KM N
89 02 27	124822.9	30.76	117.09	1	2.1 ML	CADOUX, 3KM W
89 03 02	132651.2	31.70	117.05	3	2.0 ML	MECKERING, 9KM SE
89 03 03	005106.7	21.69	121.57	5 N	3.0 ML	MARBLE BAR, 190KM E
89 03 03	092207.0	29.59	123.64	5 N	4.8 ML	LAVERTON, 160KM SE
89 03 03	132641.7	29.60	123.65	5 N	5.4 ML	LAVERTON, 160KM SE
89 03 03	140910.3	29.60	123.65	5 N	3.5 ML	LAVERTON, 160KM SE
89 03 03	144945.0	29.60	123.65	5 N	3.2 ML	LAVERTON, 160KM SE

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
89 03 03	174951.0	29.60	123.65	5 N	2.7 ML	LAVERTON, 160KM SE
89 03 04	182051.6	18.13	119.52	5 N	2.0 ML	ROWLEY SHOALS, 50KM SE
89 03 05	144159.3	30.90	117.17	5	1.9 ML	CADOUX, 16KM S
89 03 07	170600.9	30.72	124.75	5 N	2.7 ML	KALGOORLIE, 310KM E
89 03 19	053543.1	30.96	116.83	3	2.3 ML	WONGAN HILLS, 13KM SE
89 03 19	125252.6	30.95	116.83	7	2.0 ML	WONGAN HILLS, 13KM SE
89 03 20	063734.8	30.96	116.83	3	2.0 ML	WONGAN HILLS, 13KM SE
89 03 21	180024.6	23.24	114.58	10 C	3.5 ML	EXMOUTH, 154KM S
89 03 27	122553.4	25.58	111.73	5 N	3.2 ML	CARNARVON, 200KM E
89 03 28	182123.8	30.91	117.14	1 C	1.9 ML	CADOUX, 16KM S
89 03 31	040005.6	30.95	116.81	3	3.0 ML	WONGAN HILLS, 11KM SE
89 04 01	013127.5	30.95	116.82	6	2.0 ML	WONGAN HILLS, 13KM SE
89 04 01	051740.7	19.34	127.72	5 N	3.7 ML	HALLS CREEK, 125KM S
89 04 02	040104.0	31.18	117.52	6	1.9 ML	WYALKATCHEM, 11KM E
89 04 10	073734.2	17.12	126.62	5 N	3.5 ML	WA
89 04 13	140307.1	30.92	116.87	1 C	2.0 ML	WONGAN HILLS, SE OF
89 04 17	155620.8	16.37	121.41	5 N	3.0 ML	WA
89 04 19	134227.4	34.35	116.93	1 C	2.6 ML	ROCKY GULLY, 21KM N
89 04 28	115117.2	31.70	117.05	3	2.1 ML	MECKERING, 9KM SE
89 04 30	161646.4	20.52	117.26	5 N	2.5 ML	KARRATHA, 50KM NE
89 05 15	154732.9	30.47	124.14	5 C	2.5 ML	ZANTHUS, 83KM NE
89 05 15	191729.5	20.33	112.02	5 C	2.5 ML	EXMOUTH, 281KM NW
89 05 24	163412.7	32.75	122.79	5 C	2.3 ML	NORSEMAN, 113KM SE
89 05 25	221725.8	18.29	114.91	5 C	2.8 ML	DAMPIER, 324KM NW
89 06 03	144641.7	31.14	117.28	8	2.1 ML	WYALKATCHEM, 10KM NW
89 06 06	050700.4	18.37	127.74	5 N	2.5 ML	HALLS CREEK, 17KM SE
89 06 09	183326.3	30.75	121.41	12	2.5 ML	KALGOORLIE, 7KM W
89 06 14	233225.9	30.89	116.47	1 C	2.0 ML	CALINGIRI, 21KM N
89 06 15	181426.7	33.35	117.29	12	2.6 ML	WAGIN, 5KM SW
89 06 19	013555.5	33.40	117.82	7	2.1 ML	DUMBLEYUNG, 12KM SE
89 06 20	211922.1	25.41	116.88	5 N	2.5 ML	MEEKATHARRA, 213KM NW
89 06 21	041955.7	31.16	117.26	1	2.2 ML	WYALKATCHEM, 12KM W
89 06 25	144102.7	26.14	128.19	5 N	2.5 ML	WARBURTON, 155KM E
89 06 26	175711.1	31.22	111.14	5 C	3.5 ML	OFFSHORE, 454KM W PERTH
89 06 28	090134.1	21.73	109.97	5 N	3.2 ML	EXMOUTH, 430KM W
89 06 28	140823.1	26.91	114.00	5	2.2 ML	NORTHAMPTON, 172KM N
89 06 28	171148.6	32.55	122.32	7	2.8 ML	NORSEMAN, 64KM SE
89 06 30	130830.8	34.52	117.67	5 C	2.1 ML	CRANBROOK, 27KM SE
89 07 04	124406.1	20.22	113.57	5 N	3.3 ML	EXMOUTH, 197KM NNW
89 07 04	222927.7	33.95	114.58	5 N	2.0 ML	MARGARET RIVER, 45KM W
89 07 19	232434.6	33.99	114.84	5 N	2.3 ML	MARGARET RIVER, 21KM W
89 07 19	232455.9	33.99	114.84	5 C	2.3 ML	MARGARET RIVER, 22KM W
89 07 19	235936.4	33.97	114.89	5 N	2.1 ML	MARGARET RIVER, 17KM W
89 07 19	235944.4	33.97	114.89	5 N	2.4 ML	MARGARET RIVER, 17KM W
89 07 20	092924.5	33.97	114.89	5 N	3.2 ML	MARGARET RIVER, 17KM W
89 07 20	104421.0	33.97	114.89	5 N	2.2 ML	MARGARET RIVER, 17KM W
89 07 20	105024.1	33.97	114.89	5 N	2.2 ML	MARGARET RIVER, 17KM W
89 07 20	140149.9	33.97	114.89	5 N	2.0 ML	MARGARET RIVER, 17KM W
89 07 20	232934.8	33.99	114.86	5 N	2.2 ML	MARGARET RIVER, 20KM WSW
89 07 21	073303.2	33.97	114.89	5 N	2.1 ML	MARGARET RIVER, 17KM W
89 07 21	085631.3	33.97	114.09	5 N	2.2 ML	MARGARET RIVER, 17KM W
89 07 21	105242.3	33.97	114.89	5 N	2.3 ML	MARGARET RIVER, 17KM W
89 07 21	210540.1	33.97	114.89	5 N	2.2 ML	MARGARET RIVER, 17KM W
89 07 22	171849.3	33.97	114.89	5 N	2.3 ML	MARGARET RIVER, 17KM W

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
89 07 23	012002.6	33.57	118.33	1 C	2.9 ML	PINGRUP, 16KM WSW
89 07 26	091439.5	33.57	118.34	1 C	2.8 ML	PINGRUP, 16KM WSW
89 07 26	092214.0	33.57	118.34	1 C	2.7 ML	PINGRUP, 16KM WSW
89 07 26	094052.3	33.58	118.35	1 C	2.7 ML	PINGRUP, 15KM WSW
89 07 27	022756.7	31.49	117.57	5 N	2.1 ML	TAMMIN, 17KM NNE
89 07 27	060630.0	26.09	125.47	5 N	2.3 ML	WARBURTON, 111KM W
89 07 27	060748.7	26.09	125.47	5 N	3.0 ML	WARBURTON, 111KM W
89 07 29	064052.6	21.97	126.63	4	2.4 ML	TOBIN LAKE, 52KM E
89 07 29	172634.5	18.16	119.12	5 N	2.0 ML	PORT HEDLAND, 245KM NNE
89 08 05	134940.5	36.45	115.96	5 N	2.5 ML	ALBANY, 236KM SW
89 08 06	055417.6	18.47	118.30	5 N	2.6 ML	PORT HEDLAND, 206KM N
89 08 08	010154.8	21.50	119.84	5 N	2.4 ML	MARBLE BAR, 37KM SSE
89 08 10	154528.8	29.95	124.70	5 N	3.1 ML	ZANTHUS, 161KM NE
89 08 13	125459.6	33.59	118.34	1 C	2.2 ML	PINGRUP, 16KM WSW
89 08 14	075842.5	16.56	128.62	5 C	2.3 ML	KUNUNURRA, 87KM S
89 08 14	155043.3	20.63	119.86	5 N	2.5 ML	MARBLE BAR, 61KM N
89 08 28	212421.5	22.50	113.76	5 N	2.5 ML	EXMOUTH, 75KM SSW
89 08 28	212511.8	22.54	113.80	0	2.6 ML	EXMOUTH, 77KM SSW
89 09 04	081112.5	16.46	128.78	5 N	2.0 ML	KUNUNURRA, 75KM S
89 09 04	095249.6	25.02	112.98	5 N	2.7 ML	CARNARVON, 71KM W
89 09 04	233155.0	33.28	116.56	0	2.2 ML	DARKAN, 16KM WNW
89 09 12	042432.8	34.40	117.61	1	2.0 ML	CRANBROOK, 12KM SSE
89 09 12	100702.5	25.62	116.08	5 N	3.0 ML	ERONG SPRINGS, 59KM W
89 09 13	202730.2	24.85	110.43	5	3.4 ML	CARNARVON, 326KM W
89 09 19	223930.6	31.62	117.10	1	1.9 ML	MECKERING, 8KM E
89 09 21	095358.8	25.31	118.45	5 N	2.2 ML	MEEKATHARRA, 141KM N
89 09 21	224254.6	33.41	116.32	1 C	1.8 ML	COLLIE, 16KM ESE
89 10 02	115643.7	28.97	116.26	5 N	2.1 ML	MORAWA, 37KM NE
89 10 02	160704.6	24.42	111.17	5 N	3.1 ML	CARNARVON, 258KM W
89 10 04	114304.2	33.56	117.97	1 C	2.2 ML	NYABING, 16KM W
89 10 06	133419.8	30.86	117.17	1 C	2.1 ML	CADOUX, 10KM SSE
89 10 08	013039.0	27.35	113.25	5 N	2.5 ML	NORTHAMPTON, 175KM NW
89 10 11	072346.1	30.85	117.18	1 C	2.2 ML	CADOUX, 10KM SSE
89 10 11	072620.6	30.87	117.16	1 C	2.2 ML	CADOUX, 11KM SSE
89 10 11	080545.6	30.85	117.17	1 C	2.2 ML	CADOUX, 11KM SSE
89 10 12	040329.5	27.69	122.92	5 N	3.5 ML	COSMO NEWBERRY, 33KM N
89 10 12	102739.0	27.78	123.39	5 N	2.4 ML	COSMO NEWBERRY, 52KM ENE
89 10 13	095914.6	17.64	122.43	5 N	5.4 ML	BROOME, 42KM ENE
89 10 13	103235.6	17.72	122.46	10 C	3.3 ML	BROOME, 37KM NE
89 10 16	182507.1	31.68	117.07	3 C	1.9 ML	MECKERING, 8KM SE
89 10 18	191006.6	17.63	122.33	5 N	2.7 ML	BROOME, 40KM NNE
89 10 25	185505.0	17.67	122.40	5 N	3.3 ML	BROOME, 38KM NNE
89 10 28	113027.6	30.78	116.80	2	1.9 ML	WONGAN HILLS, 16KM NNE
89 10 30	224141.8	31.89	118.24	1 C	2.0 ML	NAREMBEEN, 25KM NW
89 11 04	005741.1	17.24	127.80	5 N	3.4 ML	HALLS CREEK, 111KM N
89 11 09	211730.0	30.74	117.15	1	2.8 ML	CADOUX, 4KM NE
89 11 10	165808.8	30.75	117.13	2	3.6 ML	CADOUX, 3KM N
89 11 15	183100.0	30.72	117.15	3	3.0 ML	CADOUX, 6KM NNE
89 11 27	170513.7	29.78	116.32	1 C	2.1 ML	LATHAM, 11KM WSW
89 11 30	203017.8	16.78	127.13	5 N	2.3 ML	HALLS CREEK, 171KM NNW
89 12 05	224937.6	20.26	118.87	5 N	3.6 ML	PORT HEDLAND, 30KM E
89 12 09	210530.1	17.51	122.30	5 N	4.2 ML	BROOME, 51KM N
89 12 10	005741.1	17.46	122.38	5 N	3.4 ML	BROOME, 59KM NNE
89 12 14	020012.2	33.34	117.22	1	2.2 ML	WAGIN, 11KM WSW

TABLE 10 (Contd)

UT Date	UT Time	Lat°S	Long°E	Depth	Mag	Place
89 12 14	034207.8	33.35	117.21	0	2.2 ML	WAGIN, 12KM WSW
89 12 14	052012.9	33.35	117.22	2	2.6 ML	WAGIN, 11KM WSW
89 12 14	070013.0	33.35	117.21	3	2.1 ML	WAGIN, 11KM WSW
89 12 14	070146.8	33.35	117.26	5 N	2.0 ML	WAGIN, 8KM WSW
89 12 14	072523.6	33.35	117.22	5	2.1 ML	WAGIN, 11KM WSW
89 12 14	072841.3	33.35	117.21	3	1.9 ML	WAGIN, 12KM WSW
89 12 14	171007.1	33.35	117.21	3	1.7 ML	WAGIN, 11KM WSW
89 12 14	202057.4	33.35	117.20	3	2.0 ML	WAGIN, 12KM WSW
89 12 16	134436.4	33.35	117.19	2	2.2 ML	WAGIN, 13KM WSW
89 12 16	174855.4	33.35	117.22	2	2.1 ML	WAGIN, 11KM WSW
89 12 16	182255.8	33.34	117.21	3	2.5 ML	WAGIN, 11KM WSW
89 12 17	044416.0	33.35	117.22	2	1.8 ML	WAGIN, 10KM WSW
89 12 18	151047.1	26.66	111.55	5 N	2.6 ML	CARNARVON, 290KM SW
89 12 21	172900.7	21.87	114.09	5 N	2.9 ML	EXMOUTH, 8KM NW
89 12 21	190554.4	17.50	122.27	5 N	4.0 ML	BROOME, 52KM N
89 12 22	031228.6	35.88	116.40	5 N	3.2 ML	ALBANY, 150KM SW
89 12 27	131034.5	26.94	113.32	5 N	2.5 ML	CARNARVON, 232KM S
89 12 30	115754.6	21.12	109.05	5 N	4.1 ML	EXMOUTH, 540KM W

TABLE 11
WESTERN AUSTRALIAN ACCELEROGRAPH LOCATIONS 1986 to 1989

LOCALITY	CODE	LAT°S	LONG°E	ELEV	FOUNDATION	OPERATOR
CADOUX						
Avery C.	CA-C	30.851	117.160	300	Alluvium-Granite	BMR
Cousins I.	CA-I	30.873	116.928	300	Granite	BMR
Emmott J.	CA-E	30.895	117.123	320	Laterite	BMR
Kalajzic C.	CA-K	30.718	117.141	300	Granite	BMR
Kalajzic M.	CA-A	30.746	117.151	300	Weathered Granite	BMR
Robb A.	CA-R	30.781	117.138	300	Alluvium-Granite	BMR
Shankland	CA-S	30.810	117.132	300	Alluvium- Granite	BMR
CANNING DAM						
Lower gallery	CD-L	32.154	116.126	142	Granite	WAWA/BMR
Upper gallery	CD-U	32.154	116.126	202	Granite	WAWA/BMR
DOWERIN						
Uberin Rock	DO-W	31.010	116.982	300	Granite	BMR
GOOMALLING						
Skett	GO-O	31.394	116.852	250	Granite	BMR
KUNUNURRA						
Dam abutment	KN-A	16.113	128.737		Phyllite	WAWA
Dam wall	KN-W	16.113	128.738		Rock fill, 3m clay 90m quartzite	WAWA
MECKERING						
Kelly	ME-K	31.694	116.982	200	Alluvium/Granite	BMR
MUNDARING						
Weir	MU-W	31.958	116.164	140	Concrete wall 42m	WAWA/BMR
O'Conner Museum	MU-C	31.957	116.162	106	Concrete floor	WAWA/BMR
NORTH DANDALUP						
Downstream	ND-D	32.52	116.01	205	Granite	WAWA/BMR
PERTH						
Telecom)	PT-B	31.953	115.850	10	Perth Basin Sediment	TEL/BMR
Exchange)	PT-M	31.953	115.850	40	Perth Basin Sediment	TEL/BMR
Building)	PT-T	31.953	115.850	70	Perth Basin Sediment	TEL/BMR
SERPENTINE DAM						
Basement	SE-B	32.40	116.10		Granite	WAWA/BMR
Wall	SE-W	32.40	116.10		Earthfill	WAWA/BMR
VICTORIA DAM						
Survey marker	VI-D	32.04	116/06		Granite	WAWA/BMR

OPERATORS
BMR - Bureau of mineral Resources, Mundaring Geophysical Observatory
WAWA - Water Authority of Western Australia
WAWA/BMR -Owned by WAWA but operated by BMR
TEL/BMR - Owned by Telecom but operated by BMR

TABLE 12

ACCELEROGRAPH CALIBRATION DATA

CODE	DATE OF OPERATION	INSTR. NO.	BLOCK NO.	CALIBRATION DATA g-cm and azimuth Ia	Ib	Ic
CA-A	Fm 1986 Jul 02	A700 033	ID002	1.159V 090	1.172V 000	1.167V Up
CA-C	Fm 1986 Oct 03	MO2 291	1196	0.590 090	0.560 000	0.394 Up
CA-E	Fm 1987 Jan 21	A700 030	ID003	1.178V 090	1.216V 000	1.187V Up
CA-I	Fm 1987 Dec 11 To 1989 Jun 23	MO2 245	448	0.602 090	0.628 000	0.409 Up
CA-K	Fm 1985 Dec 18	MO2 289	1166A	0.582 090	0.548 000	0.348 Up
CA-R	Fm 1986 Jul 01 To 1986 Aug 05	MO2 291	1196	0.540 090	0.560 000	0.394 Up
	Fm 1986 Aug 05	MO2 290	651	0.631 090	0.659 000	0.433 Up
CA-S	Fm 1985 Dec 18	MO2	1462	0.609	0.597	0.417
CD-L	Fm 1987 Jan 16	A700 072	ID032	2.339V 090	2.400V 000	2.308V Up
CD-U	Fm 1987 Jan 16	A700 056	ID033	2.436V 090	2.396V 000	2.420V Up
DO-W	Fm 1989 Sep 13	Kelunji		$2x10^6$counts/g		
GO-O	Fm 1988 Dec 20	Kelunji		$2x10^6$counts/g		
KN-A	Fm 1989 Jul 04	A700 244	ID040	1.200V 090	1.217V 000	1.221V Up
KN-W	Fm 1989 Jul 04	A700 203	ID041	1.209V 090	1.247V 000	1.233V Up
ME-K	Fm 1989 Jul 01	MO2 245	837	0.625 090	0.642 000	0.443 Up
MU-C	Fm 1987 Aug 21	MO2 244	423			
MU-W	Fm 1979 Apr 24	SMA-1 1072		0.510 000	0.526 Up	0.568 090

TABLE 12 (Contd)

CODE	DATE OF OPERATION	INSTR. NO.	BLOCK NO.	CALIBRATION DATA g-cm and azimuth Ia	Ib	Ic
ND-D	Fm 1989 Dec 28	A700 200	ID044	2.443V	2.450V 090	2.413V 000 Up
PT-B	Fm 1981 Sep 21	SMA-1 4271		0.148 300	0.138 Up	0.135 210
PT-M	Fm 1981 Sep 21	SMA-1 4272		0.138 300	0.144 Up	0.135 210
PT-T	Fm 1981 Sep 21	SMA-1 4273		0.151 300	0.136 Up	0.136 210
SE-B	Fm 1987 May 05	A700 069	ID036	2.339V 090	2.395V 000	2.314V Up
SE-W	Fm 1987 May 05	A700 078	ID037 090	2.377V 000	2.395V Up	2.314V
VI-D	Fm 1989 Dec 30	A700 201	ID047	2.378V 090	2.424 000	2.421 Up

TABLE 13
ACCELEROGRAM DATA - 1986 to 1989

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
86 01 04	1311	30.79	117.09	2.7	CA-S	(6)/(4)	PZ	0.04	41
							PN	0.04	26
							PE	0.05	24
							SZ	0.04	80
							SN	0.06	61
							SE	0.06	149
86 01 05	2140	30.76	117.11	2.3	CA-S	(6)/(4)	PZ	0.03	20
(S-P) = 0.34,,MMIV							PN	0.03	6
							PE	0.03	24
							SZ	0.04	18
							SN	0.05	44
							SE	0.04	36
86 01 06	1346	30.75	117.12	2.5	CA-S	(8)/(6)	SZ	0.03	16
MMIV							SN	0.07	26
							SE	0.09	57
86 01 06	1918	30.80	117.05	2.4	CA-S	(10)/(9)	PZ	0.03	72
S-P=(0.36),,MMIII							PN	0.04	26
							PE	0.03	6
							SZ	0.03	65
							SN	0.04	44
							SE	0.05	89
86 01 07	0227	30.77	117.09	2.3	CA-S	(8)/(6)	SZ	0.03	4
MMIII							SN	0.04	6
							SE	0.04	6
86 01 07	0807	30.77	117.09	2.2	CA-S	(7)/(5)	PZ	0.03	20
S-P=(0.37),,MMIII							PN	0.04	6
							PE	0.04	12
							SZ	0.03	31
							SN	0.04	29
							SE	0.04	48
86 01 09	0536	30.75	117.12	2.0	CA-S	(8)/(6)	PZ	0.04	20
S-P=(0.38),,MMIII							PN	0.04	6
							PE	0.04	15
							SZ	0.03	25
							SN	0.05	44
							SE	0.05	54
86 01 19	0853	30.77	117.10	1.8	CA-S	(6)/(4)	LZ	0.066	78
MMIV							LN	0.054	69
							LE	0.048	59

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
86 01 19	1035	30.77	117.10	2.4	CA-S	(6)/(4)	SZ	0.042	20
MMIII							SN	0.042	10
							SE	0.048	39
					CA-K	(9)/(8)	LZ	0.027	29
							LN	0.030	29
							LE	0.042	39
86 02 06	1018	30.78	117.08	3.4	CA-S	(7)/(5)	PZ	0.030	98
S-P=(0.33),,MMIV							PN	0.042	294
							PE	0.042	49
							LZ	0.042	363
							LN	0.077	529
							LE	0.071	451
					CA-K	(10)/(9)	LZ	0.027	20
							LN	0.030	29
							LE	0.030	20
86 03 31	1032	30.72	117.13	1.8	CA-K	6/2	SZ	0.036	48
MMIII-IV nearby							SN	0.030	16
							SE	0.036	28
86 05 15	1206	30.76	117.16	3.4	CA-K	8/6.5	PZ	0.036	17
S-P=1.0							PN	0.030	20
							PE	0.030	10
							SZ	0.042	34
							SN	0.024	53
							SE	0.042	150
					CA-S	5.5/4	PZ	0.036	42
FELT MMIV							PN	0.045	70
S-P 0.7							PE	0.036	40
							SZ	0.036	25
							SN	0.088	140
							SE	0.072	60
							LZ	0.076	60
							LN	0.076	140
							LE	0.076	70
86 05 21	0327	30.78	117.10	2.4	CA-S	4.0/1.0	PZ	0.030	33
FELT MM IV							PN	0.024	42
S-P 0.5							PE	0.024	24
							SZ	0.030	25
							SN	0.036	18
							SE	0.052	100
86 05 27	1711	30.83	117.12	3.0	CA-S	6.5/3.5	SZ	0.042	33
FELT MM IV							SN	0.042	60
							SE	0.048	91

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
86 05 31	1748	30.81	117.13	1.5	CA-S	3.0/0.0	PZ	0.030	8
FELT MM III							PN	0.036	12
S-P 0.4							PE	0.036	12
							SZ	0.036	13
							SN	0.054	24
							SE	0.048	24
86 07 07	2024	30.83	117.04	2.8	CA-S	9/9	PZ	0.04	40
MM IV							PN	0.04	6
S-P 0.37							PE	0.04	18
							SZ	0.03	32
							SN	0.03	28
							SE	0.05	18
							LZ	0.03	40
							LN	0.05	40
							LE	0.03	18
					CA-K	15/15	LZ	0.03	14
							LN	0.03	16
							LE	0.03	23
					CA-R	11/11	LZ	0.03	28
							LN	0.05	54
							LE	0.05	28
86 07 18	1009	30.80	117.06	2.2	CA-K	(10)/(10)	LZ	0.025	14
							LN	0.03	11
							LE	0.03	12
86 08 09	1342	30.75	117.15	1.0	CA-A	(1)/(0)	LZ	0.065	60
MMIII at farm							LN	0.020	191
							LE	0.026	284
86 08 13	0905	30.78	117.14	1.5	CA-R	(2)/(1)	LZ	0.030	6
MMIII adjacant farm							LN	0.061	6
							LE	0.073	6
86 08 20	2025	30.75	117.15	1.3	CA-A	2/1	SZ	0.025	118
S-P=0.23s							SN	0.025	460
							SE	0.035	225
86 08 23	0602	30.76	117.08	2.6	CA-S	8/7	PZ	0.037	62
MMIV nearby, S-P=0.8							PN	0.030	41
Film not translating properly							PE	0.030	36
							SZ	0.037	70
							SN	0.030	35
							SE	0.037	95
					CA-A	6/4	SZ	0.067	59
							SN	0.030	137
							SE	0.030	147

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
86 08 27	0729	30.75	117.15	1.0	CA-A	(2)/(1)	SZ	0.065	83
							SN	0.030	166
							SE	0.025	88
86 09 11	0005	30.81	117.08	2.0	CA-K	(3)/(4)	LZ	0.030	7
							LN	0.030	11
							LE	0.043	15
86 09 18	0702	30.69	117.16	1.5	CA-K	(3)/(4)	LZ	0.024	04
							LN	0.030	11
							LE	0.043	12
86 09 27	0701	30.72	117.14	2.3	CA-A	(5)/(4)	SZ	(0.18)	34
							SN	0.038	118
							SE	0.038	69
86 09 28	1718	30.75	117.14	2.8	CA-A	(3)/(1.5)	PZ	0.12	54
(S-P) = 0.42s							PZ	0.23	20
							SE	0.13	08
							SZ	0.038	98
							SN	0.038	304
							SE	0.038	147
86 09 29	2157	30.73	117.13	3.3	CA-A	5/2.5	PZ	0.013	49
S-P=0.58							PN	0.17	51
							PE	0.13	9
							SZ	0.13	167
							SN	0.05	641
							SE	0.04	265
86 10 01	1921	30.78	117.12	2.0	CA-A	(5)/(5)	SZ	(0.14)	34
S-P=(0.42)							SN	0.038	162
							SE	0.038	108
86 10 03	0932	30.72	117.14	1.3	CA-K	(2)/(1)	SZ	0.030	14
							SN	0.030	27
							SE	0.030	57
86 10 04	1628	30.76	117.07	1.8	CA-K	(5)/(4)	PZ	0.021	7
S-P=(0.4)							PN	0.021	6
							PE	0.021	6
							SZ	0.030	69
							SN	0.030	91
							SE	0.024	57
86 10 05	0132	30.76	117.08	2.6	CA-K	(5)/(4)	PZ	0.030	58
S-P=0.38 (Double event)							PN	0.030	27
							PE	0.030	29
							SZ	0.042	228
							SN	0.048	188
							SE	0.045	284

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
Second event							PZ	0.030	187
							PN	0.030	27
							PE	0.030	114
							SZ	0.030	219
							PN	0.042	215
							PE	0.036	228
					CA-A	(7)/(6)	SZ	0.16	29
							SN	0.051	132
							SE	0.05	49
86 10 05	0143	30.75	117.09	2.2	CA-K	(5)/(4)	PZ	0.024	23
							PN	0.024	11
							PE	0.024	3
							SZ	0.030	58
							SN	0.042	79
							SE	0.030	57
86 10 05	0402	30.73	117.14	0.4	CA-K	(2)/(1)	SZ	0.030	7
							SN	0.030	11
							SE	0.030	9
86 10 05	1048	30.73	117.13	0.7	CA-K	(3)/(2)	PZ	0.030	7
S-P=(0.25)							PN	0.030	6
							PE	-	VLA
							SZ	0.030	34
							SN	0.024	37
							SE	0.030	69
86 10 06	1252	30.76	117.08	1.2	CA-K	(5)/(4)	PZ	0.024	7
S-P=0.38	(Double event)						PN	-	VLA
							PE	-	VLA
							SZ	0.030	27
							SN	0.036	43
							SE	0.030	17
Second event				0.9			PZ	0.024	30
							PN	0.024	6
							PE	0.030	9
							SZ	0.030	21
							SN	0.030	32
							SE	0.030	23
86 10 08	1955	30.77	117.08	1.5	CA-K	(6)/(5)	PZ	0.024	7
S-P=0.48	(Double event)						PN	-	VLA
							PE	0.024	3
							SZ	0.024	55
							SN	0.024	11
							SE	0.024	12

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
Second event				1.2			PZ	0.030	17
							PN	-	VLA
							PE	0.036	3
							SZ	0.024	21
							SN	0.024	05
							SE	0.024	12
86 10 09	0156	30.72	117.12	2.7	CA-K	4/1	PZ	0.024	34
S-P(0.39)							PN	0.024	27
							PE	0.024	24
							SZ	0.048	136
							SN	0.045	403
							SE	0.045	217
					CA-A	6/4	SZ	0.08	44
							SN	0.058	172
							SE	0.08	74
86 10 19	2036	30.75	117.15	1.8	CA-A	3/1	PZ	0.019	90
S-P=0.32							PN	0.021	31
							PE	0.02	74
							SZ	0.029	191
							SN	0.029	524
							SE	0.3	392
86 10 25	0823	30.75	117.15	1.5	CA-A	2/1	SZ	0.019	123
							SN	0.019	142
							SE	0.02	206
86 10 27	1036	20.73	117.12	2.0	CA-K	4/2	PZ	0.021	7
S-P=(0.36)							PN	0.021	5
							PE	0.021	6
							SZ	0.024	34
							SN	0.030	37
							SE	0.024	63
86 11 03	1331	30.73	117.12	1.6	CA-K	(4)/(2)	SZ	0.030	20
							SN	0.030	5
							SE	0.030	10
86 11 07	2055	30.72	117.13	1.5	CA-K	(3)/(1)	PZ	0.030	3
S-P=(0.33)							PN	0.030	5
							PE	0.030	6
							SZ	0.024	108
							SN	0.024	97
							SE	0.030	46
86 11 10	2253	30.72	117.14	1.1	CA-K	(3)/(2)	PZ	0.030	7
S-P=(0.37)							PN	0.030	5
							PE	0.030	6

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
							SZ	0.024	7
							SN	0.037	16
							SE	0.037	22
86 11 16	0215	30.73	117.12	1.7	CA-K	(4)/(2)	PZ	0.021	31
S-P=(0.40)							PN	0.021	5
Felt MMIII at Shankland's farm							PE	0.043	6
							SZ	0.030	51
							SN	0.043	54
							SE	0.043	74
86 12 15	0932	30.79	117.09	2.1	CA-R	(6)/(5)	LZ	0.037	21
							LN	0.037	(6)
							LE	0.037	(6)
86 12 31	2023	30.78	117.12	1.2	CA-R	(4)/(2)	LZ	0.04	(4)
							LN	0.04	(4)
							LE	0.04	(4)
87 01 28	0656	Unlocatable		(1.3)	CA-K		LZ	0.037	27
							LN	0.037	32
							LE	0.037	46
87 02 07	2208	30.74	117.13	2.3	CA-R	(6)/(4)	LZ	0.040	42
Felt Shankland's MMIII							LN	0.054	45
(Adjacent farm)							LE	0.054	25
87 02 17	1017	30.82	117.07	2.5	CA-R	(8)/(7)	LZ	0.037	9
Felt Shankland's MMIV							LN	0.037	45
(Adjacent farm)							LE	0.061	37
87 03 07	0538	30.77	117.09	4.5	CA-S	7/5	PZ	0.034	593
							PN	0.031	123
							PE	0.031	119
S-P = 1.0s, Felt MMV							SZ	0.017	1103
Estimated time of vibration							SN	0.016	1053
was a good 30 secs (reliable observer)							SE	0.2	1552
					CA-R	7/5	PZ	0.13	212
							PN	0.11	65
							PE	0.11	216
S-P = 0.95s							SZ	0.16	1100
							SN	0.16	646
							SE	0.16	1050
					CA-K	9/8	PZ	0.030	119
							PN	0.030	81
							PE	0.030	57
S-P = 1.10s							SZ	0.037	819
							SN	0.049	859
							SE	0.043	1141

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
					CA-A	8/6	PZ	0.023	300
							PN	0.04	88
							PE	0.04	88
S-P = 0.97s							SZ	0.097	272
(BMR instrument)							SN	0.037	2510
Rumbling for 30s on							SE	0.044	2860
adjacent farm (Hopkins) reported									
					CA-A	8/6	PZ	0.05	160
							PN	0.04	60
							PE	0.04	40
S-P = 0.97s							SZ	0.05	606
(WAWA instrument)							SN	0.037	247
							E	0.044	215
					CA-E	14/13	PZ	0.05	50
							PN	0.04	17
							PE	0.04	16
S-P = 1.74s							SZ	0.04	210
							SN	0.04	400
							E	0.06	420
87 03 07					CD-L	175/175	SZ	(0.3)	(3)
							SN	(0.2)	(50)
							SE	(0.2)	(50)
					CD-U	175/175	SZ	0.14	7
							SN	0.15	30
							SE	0.17	20
87 03 07	1438	(30.77)	(117.09)	(1.8)	CA-S	(7)/(5)	LZ	0.037	16
							LN	0.037	12
							LE	0.037	12
					CA-R	(7)/(5)	LZ	0.030	21
							LN	0.030	6
							LE	0.030	6
87 03 09	0814	30.77	117.10	2.0	CA-S	(6)/(5)	LZ	0.061	16
							LN	0.061	12
							LE	0.061	6
87 03 10	2104	30.67	117.12	2.0	CA-K	(3)/(3)	PZ	0.028	72
							PN	0.028	44
(S-P = 0.38							PE	0.034	35
							SZ	0.025	108
							SN	0.037	137
							SE	0.046	147
87 03 11	1928	30.67	117.12	1.7	CA-K	(3)/(3)	PZ	0.028	25
Felt Shankland's MM III							PN	0.031	10
(S-P) = 0.38							PE	0.030	10

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
							SZ	0.024	68
							SN	0.030	44
							SE	0.025	11
87 03 23	1511	30.67	117.12	1.6	CA-K	(3)/(3)	PZ	0.024	25
							PN	0.025	8
(S-P) = 0.38							PE	0.027	18
							SZ	0.024	54
							SN	0.027	82
							SE	0.016	58
87 03 26	2201	30.71	117.13	0.6	CA-K	(2)/(1)	PZ	0.030	4
							PN	0.030	5
(S-P) = 0.24							PE	-	-
							SZ	0.028	65
							SN	0.028	82
							SE	0.028	94
87 03 26	2202	30.71	117.13	0.5	CA-K	(2)/(1)	SZ	0.029	29
							SN	0.028	10
							SE	0.028	23
87 04 19	0048	30.71	117.13	1.4	CA-K	(2)/(1)	PZ	0.023	94
							PN	0.024	33
(S-P) = 0.24							PE	0.027	29
							SZ	0.029	360
							SN	0.024	192
							SE	0.048	294
87 04 21	0953	30.71	117.13	1.1	CA-K	(2)/(1)	SZ	0.024	162
							SN	0.024	77
(S-P) = 0.24							E	0.024	70
87 04 24	1304	30.71	117.13	0.6	CA-K	(2)/(1)	PZ	0.024	7
							PN	0.024	5
(S-P) = 0.24							PE	-	-
							SZ	0.029	61
							SN	0.015	38
							SE	0.036	76
87 05 02	0044	Unlocatable		(1.3)	CA-A	6/5	PZ	(0.08)	5
							PN	(0.08)	6
(S-P) = 0.74							PE	(0.08)	10
							SZ	0.03	155
							SN	0.026	391
							SE	0.030	348
87 05 23	1736	30.82	117.12	1.1	CA-S	(3)/(2)	LZ	0.048	12
Felt Shankland's MM III							LN	0.048	6
							LE	0.048	6

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
87 05 30	2122	30.74	117.1	1.7	CA-A	5/4	PZ	0.045	29
Felt Shankland's MM III							PN	0.032	28
S-P = 0.58							PE	(0.08)	18
							SZ	(0.07)	20
							SN	0.026	196
							SE	0.032	126
As above, but some doubt as no readable event time on film.					CA-K	(4)/(3)	PZ	0.024	34
							PN	0.024	21
(S-P) = 0.45							PE	0.024	60
							SZ	0.027	68
							SN	0.033	53
							SE	0.024	57
87 07 02	1641	(30.75)	(117.15)	0.5	CA-A	(1)/(0)	SZ	-	20
							SN	0.029	74
							SE	0.026	98
87 07 29	1512	(30.75)	(117.15)	1.0	CA-A	(1)/(0)	SZ	0.032	(529)
							SN	0.026	231
							SE	0.027	226
87 09 22	0413	30.76	117.15	0.8	CA-A	3/3	SZ	0.028	69
							SN	0.028	206
							SE	0.028	98
87 09 22	1756	30.75	117.16	0.8	CA-A	1.5/1	SZ	0.03	39
							SN	0.028	167
							SE	0.028	83
87 09 23	0138	30.75	117.16	1.0	CA-A	1.5/1	SZ	0.032	83
							SN	0.028	319
							SE	0.028	245
87 09 23	0331	30.76	117.17	0.8	CA-A	2/2	SZ	0.032	225
							SN	0.028	294
							SE	0.028	245
87 09 24	0732	30.76	117.15	0.2	CA-A	2/2	SZ	0.028	39
							SN	0.028	113
							SE	0.028	118
87 09 24	0914	30.77	117.15	0.8	CA-A	2/2	SZ	0.029	74
							SN	0.028	-
							SE	0.033	176
87 09 25	1214	30.75	117.16	0.8	CA-A	1.5/1	SZ	0.032	59
							SN	0.035	211
							SE	0.028	127
87 09 26	1454	30.73	117.16	1.9	CA-A	2/2	SZ	0.055	123
S-P = 0.25							SN	0.055	328
							SE	0.048	255

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
87 09 26	1833	30.76	117.16	0.7	CA-A	2/2	SZ	(0.028)	54
							SN	0.028	108
							SE	0.028	98
87 09 27	1210	30.75	117.16	1.6	CA-A	1.5/1	SZ	0.032	181
							SN	0.028	245
							SE	0.028	198
87 09 28	0424	30.72	117.165	1.2	CA-A	3/3	SZ	0.045	49
							SN	0.025	201
							SE	0.028	78
87 09 28	0924	30.76	117.14	0.2	CA-A	1/1	SZ	(0.028)	53
							SN	0.028	132
							SE	0.028	132
87 10 02	1941	30.76	117.14	0.8	CA-A	1/1	SZ	0.042	54
							SN	0.033	137
							SE	0.036	172
87 10 14	2059	30.78	117.18	0.4	CA-A	4/4	SZ	(0.035)	34
							SN	0.035	152
							SE	0.028	74
87 10 19	0234	30.45	117.16	1.0	CA-A	1/1	SZ	(0.033)	25
							SN	0.033	127
							SE	(0.033)	83
87 10 21	1728	30.76	117.165	1.4	CA-A	2/2	SZ	0.026	83
							SN	0.020	348
							SE	(0.020)	152
					CA-R	4/4	LZ	0.036	8
							LN	0.048	6
							LE	0.048	6
87 10 31	0115	30.72	117.17	0.8	CA-A	3/3	SZ	0.032	98
S-P = 0.22							SN	0.028	176
							SE	0.025	181
87 11 01	1239	30.74	117.17	1.1	CA-A	2/2	SZ	0.026	82
S-P = 0.24							SN	0.022	207
							SE	0.022	187
87 11 01	1810	30.72	117.18	2.6	CA-A	4/4	SZ	0.039	740
S-P = 0.25							SN	0.031	1720
							SE	0.030	1495
					CA-R	8/8	LZ	0.036	11
							LN	0.048	6
							LE	0.048	6
87 11 10	0120	30.745	117.16	1.3	CA-A	1/1	SZ	0.04	69
(S-P) = 0.18							SN	0.039	191
							SE	0.041	216

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
87 11 14	0056	30.75	117.10	0.9	CA-K	5/5	LZ	0.030	6
							LN	0.030	10
							LE	0.030	11
87 11 14	0342	30.74	117.10	0.7	CA-K	5/5	LZ	0.030	3
							LN	0.030	5
							LE	0.030	0
87 11 14	0433	30.75	117.10	0.9	CA-K	5/5	LZ	0.030	6
							LN	0.030	5
							LE	0.030	11
87 11 16	0649	30.75	117.13	1.3	CA-A	2/2	SZ	0.061	59
							SN	0.036	132
							SE	0.036	108
87 11 17	2057	30.81	117.11	2.6	CA-S	(5)/(4)	LZ	0.036	155
Felt Shankland's MM IV							LN	0.060	88
							LE	0.045	60
88 01 06	0343	31.20	117.50	4.3	CA-R	55/55	LZ	0.043	20
MM III felt in area							LN	0.049	20
							LE	0.049	13
88 02 04	2149	30.77	117.09	2.7	CA-A	(7)/(7)	SZ	(0.024)	54
							SN	0.024	98
							SE	0.024	108
					CA-C	(12)/(12)	LZ	0.036	19
							LN	0.057	27
							LE	0.045	17
No T/M on film to uniquely match component this event with this earthquake. Also the maximum amplitude was passed at the commencement of this recording. Intensity estimate of MMV at farmhouse.					CA-I	(18)/(18)	LZ	No Z	
							LN	0.024	12
							LE	0.024	18
88 09 08	0028	30.76	117.11	1.5	CA-K	(6)/(5)	LZ	0.036	3
							LN	0.036	5
							LE	0.036	6
88 09 14	1901	30.72	117.18	1.4	CA-K	(8)/(8)	LZ	0.036	3
							LN	0.036	5
							LE	0.036	6
88 11 02	0909	30.70	117.17	2.5	CA-K	(5)/(5)	LZ	0.036	27
							LN	0.036	113
							LE	0.036	63
88 11 02	1301	30.70	117.16	1.4	CA-K	(5)/(5)	LZ	0.036	3
							LN	0.036	5
							LE	0.036	6

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
88 11 05	1149	30.70	117.20	1.2	CA-K	(8)/(8)	LZ	0.030	5
							LN	0.036	5
							LE	0.036	6
88 11 07	0341	30.70	117.17	2.3	CA-K	(5)/(5)	LZ	0.030	38
							LN	0.036	48
							LE	0.036	63
88 11 08	1250	30.69	117.17	1.4	CA-K	(6)/(6)	LZ	0.030	3
							LN	0.036	5
							LE	0.036	6
88 12 20	1458	31.70	117.08	2.6	GOO	35/35	PZ	0.035	3
(S-P = 4.3s)							PN	0.035	2
Felt at farmhouse. Recorder installed same day!							PE	0.035	4
							SZ	0.035	13
							SN	0.035	13
							SE	0.050	34
88 12 24	0536	31.69	117.06	1.2	GOO	35/35	SZ	0.030	2
							SN	0.030	3
							SE	0.040	6
89 01 25	1306	30.69	117.11	1.3	CA-K	(3)/(3)	LZ	0.029	14
							LN	0.029	16
							LE	0.029	17
89 02 19	1603	30.73	117.12	1.8	CA-K	(2)/(2)	SZ	0.026	20
							SN	0.024	11
							SE	0.024	17
							LZ	0.029	34
							LN	0.029	32
							LE	0.024	57
89 02 27	1249	30.76	117.10	1.8	CA-K	(7)/(7)	LZ	0.029	17
							LN	0.029	21
							LE	0.24	17
89 03 25	0516	(30.75)	(117.15)	0.3	CA-A	(1)/(1)	LZ	(0.14)	25
							LN	0.027	142
							LE	(0.14)	34
89 05 31	0948	(30.74)	(117.11)	1.3	CA-K	(4)/(4)	LZ	0.024	7
Two-station location							LN	0.024	11
							LE	0.024	6
89 06 05	2130	(30.74)	(117.11)	0.9	CA-K	(4)/(4)	LZ	0.024	7
Two-station location							LN	0.024	5
							LE	0.024	6
89 06 10	1343	(30.74)	(117.11)	1.2	CA-K	(4)/(4)	LZ	0.036	10
Two-station location							LN	0.024	5
							LE	0.024	11

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
89 06 20	0030	30.89	117.16	1.6	CA-E	3/2	PZ	0.081	9
							PN	(0.222)	7
							PE	(0.3)	7
							SZ	0.032	20
							SN	0.030	64
							SE	0.030	55
89 07 01	0632	(30.75)	(117.15)	0.5	CA-A	(1)/(1)	PZ	(0.13)	5
							PN	(0.3)	3
							E	-	0
							SZ	0.038	16
							SN	0.029	117
							SE	0.038	98
89 09 19	2239	31.62	117.10	1.9	GO-O	44/44	PZ	0.030	1
							PN	0.030	2
							PE	0.030	3
							SZ	0.030	5
							SN	0.040	9
							SE	0.040	9
89 10 11	0723	30.85	117.18	2.1	CA-C	2/2	LZ	-	-
							LN	0.041	69
							LE	0.041	28
89 10 11	0726	30.88	117.15	2.0	CA-C	3/3	LZ	0.049	52
							LN	0.041	69
							LE	0.041	14
89 10 16	1825	31.70	117.08	1.8	GO-O	45/45	PZ	0.040	1.0
							PN	0.040	2.0
							PE	0.040	2.0
							SZ	0.040	3.0
							SN	0.040	6.0
							SE	0.040	6.0
89 10 31	0005	31.68	117.08	1.5	GO-O	44/44	PZ	0.040	.05
							PN	0.040	1.0
							PE	0.040	1.0
							SZ	0.040	2.0
							SN	0.040	4.0
							SE	0.040	4.0
89 11 09	2117	30.75	117.15	2.3	CA-A	1/1	PZ	0.035	300
							PN	(0.15)	64
							PE	0.087	43
							SZ	0.048	51
							SN	0.055	203
							SE	0.048	155

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
					CA-K	3/3	LZ	0.029	34
							LN	0.029	16
							LE	0.029	32
89 11 09	2149	30.73	117.16	1.5	CA-A	2/2	PZ	0.145	7
							PN	0.026	50
							PE	0.14	12
							SZ	0.113	83
							SN	0.026	144
							SE	0.035	83
89 11 10	1658	30.75	117.14	3.6	CA-A	2.5/2	PZ	0.065	441
Felt MM5, rumbled for 5-6s							PN	0.020	274
S-P = 0.32s+/-0.1s							PE	0.020	206
							SZ	0.048	323
							SN	0.030	686
							SE	0.032	451
S-P = 0.45+/-0.1s					CA-K	3.5/3	PZ	0.034	65
							PN	0.034	86
							PE	0.029	46
							SZ	0.046	580
							SN	0.046	510
							SE	0.034	540
FELT, Rumbled on for considerable time; did not record peak acceleration					CA-S	9/8.5	LZ	0.037	20
							LN	0.037	30
							LE	0.037	30
					DO-W	33/33	PZ	0.040	2.0
							PN	0.040	2.0
							PE	0.040	2.0
							SZ	0.040	2.0
							SN	0.040	6.0
							SE	0.040	9.0
					GO-O	77/77	PZ	0.040	1.0
							PN	0.040	2.0
							PE	0.040	3.0
							SZ	0.045	2.0
							SN	0.045	8.0
							SE	0.045	9.0
89 11 10	1700	(30.75)	(117.14)	1.6	CA-A	(2)/(2)	PZ	0.116	33
							PN	0.097	6
							PE	-	0
							SZ	0.16	28
							SN	0.023	155
							SE	0.023	108

Table 13 (Cont'd)

Date UTC	Time	Lat°S	Long°E	ML	Site	H/E km	C	T sec	Acc mms^{-2}
89 11 10	1713	30.73	117.15	1.4	CA-K	1/1	LZ	0.034	34
							LN	0.034	11
							LE	0.034	23
89 11 10	1808	30.73	117.17	1.2	CA-A	2/2	PZ	0.023	6
							PN	0.123	20
							PE	(0.123)	4
							SZ	(0.22)	31
							SN	0.042	78
							SE	0.058	81
89 11 10	2211	30.72	117.16	1.2	CA-A	4/4	PZ	0.052	45
							PN	0.137	12
							PE	-	0
							SZ	0.045	93
							SN	0.027	180
							SE	0.021	131
89 11 13	0805	30.77	117.13	1.3	CA-A	3/3	PZ	0.097	51
							PN	0.011	12
							PE	-	00
							SZ	0.035	74
							SN	0.025	187
							SE	0.065	147
89 11 15	1831	30.72	117.15	3.0	CA-K	3/1	PZ	0.030	31
S-P = 0.4s							PN	0.030	21
							PE	0.030	11
							SZ	0.042	100
							SN	0.038	81
							SE	0.030	74
S-P = 0.5+s					CA-R	8/7	PZ	0.035	17
							PN	0.035	6
							PE	0.035	12
							SZ	0.059	72
							SN	0.059	110
							SE	0.059	68
89 12 04	0257	(30.72)	(117.15)	1.9	CA-K	(3)/(1)	LZ	0.030	27
							LN	0.030	27
							LE	0.030	11

ML = Richter magnitude
H/E = hypocentral/epicentral distance in kilometres
COM = component
T = ground period in seconds
VLA = Very low amplitude.

TABLE 14
GNANGARA - ABSOLUTE INSTRUMENTS, 1986 to 1989

Used From	Component	Instrument	Ser No.	Correction
1986 Jan 01	H	PVM MNS-2	B/5/Z#	0 nT
1986 Jan 01	D	Askania Circle	509319 580135	0.5'
1986 Jan 01	Z	PVM MNS-2	B/5/Z#	0 nT

PVM serial number coil/magnetometer/sensor

TABLE 15
GNANGARA - INSTRUMENT COMPARISONS, 1986 to 1989

Date	Instruments	Difference	No of Obs.
1986 Dec 02	H.PVM B/5/Z - H.462	-2.7 +/- 0.9nT	5
1986 Dec 02	D.319 - D.506	-3.9 +/- 0.3'	8
1987 Jun 09 - 16	D.319 - D.DIM 30887/202	-1.8 +/- 0.5'	18
1987 Jun 09 - 16	H.PVM B/5/Z - H.DIM 30887	-1.8 +/- 1.5nT	12
1987 Jun 09 - 16	Z.PVM B/5/Z - Z.DIM 30887	3.2 +/- 2.2nT	12
1989 Oct 24 & 31	D.319 - D.DIM 313837	-2.2 +/- 0.7'	16
1989 Oct 24 & 31	F.MNS2/5 - F.Elsec 215	1.8 +/- 3.0nT	4

TABLE 16
GNANGARA - AZIMUTHS OF REFERENCE MARKS

	E	SE	SW	N
	Datum#	Temporary	Permanent	Permanent
Distance from	70m	30m	85m	130m
Resolution 1mm	0.05'	0.09'	0.04'	0.25'
Date	Azimuth from NE pier			
1982 Aug 11	77 23.6	150 28.4	198 59.0	03 10.4
1982 Sep 20	77 23.6	150 28.4	198 59.4	03 10.6
1982 Oct 07	77 23.6	150 28.4	198 59.4	03 10.4
1983 Aug 21	77 23.6		198 59.3	03 10.3
1985 Aug 21	77 23.6		198 59.2	03 10.3
1987 Jan 87	77 23.6		198 59.2	03 10.4
1989 Nov 24	77 23.6		198 53.3	03 10.4
Adopted	77 23.6	150 28.4	198 59.3	03 10.4

Azimuth determined by Australian Survey Office.
All other azimuths are relative to this value.
Azimuths read from NE pier.

TABLE 17

GNANGARA - VARIOMETER TEMPERATURE COEFFICIENTS

Used from Yr	mn	dy	hr	Component	Coefficient nT/°C
1981	Jan	01	00	H	0.0
1981	Jan	01	00	Z	3.2
1987	Jan	16	06	Z	2.0
1988	Aug	26	00	Z	1.0

TABLE 18

GNANGARA - ORIENTATION TESTS, 1986 to 1989

Date	Ccmponent	Referemce	Magnet	Orientation	N Pole
1985 Jul 09	H	23247 nT	East	0.2°	South
1987 Jan 16	H	23241 nT	East	0.3	South
1989 Feb 28	H	23204 nT	East	0.8	South
1989 Feb 28*	H	23204 nT	East	0.3	North
1985 Jul 09	D	3 17.5'W	North	0.2	West
1986 Jan 16	D	3 15.0 W	North	0.1	West
1989 Feb 28	D	3 10.0 W	North	0.2	West
1985 Jul 09	Z	53771 nT	North	0.5	Up
1989 Feb 28	Z	53809 nT	North	0.3	Up

* After adjustment

TABLE 19

GNANGARA - STANDARD DEVIATION OF OBSERVATIONS

Year	H Scale value	Z Scale value	D Base value	H Base value	D Base value
1981	0.02	0.04	0.7(0.1)	1.1	1.2
1982	0.02	0.03	1.5(0.2)	1.4	1.7
1983	0.01	0.03	1.7(0.25)	0.9	1.3
1984	0.02	0.04	1.4(0.20)	1.4	1.0
1985	0.013	0.033	1.4(0.19)	1.14	1.43
1986	0.012	0.019	1.5(0.22)	1.06	1.87
1987	0.015	0.023	1.3(0.20)	1.49	1.90
1988	0.014	0.026	1.8(0.26)	1.04	1.73
1989	0.013	0.033	1.4(0.19)	1.14	1.43

TABLE 20
GNANGARA - ADOPTED CONTROL VALUES, 1986 TO 1989

	Date from Yr	Mn	Dy	Hr	Mn	Value		Remarks
BD	86	01	01	00	00	3	02.8	
BD	86	01	06	00	00	3	02.9	
BD	86	01	11	00	00	3	03.0	
BD	86	01	16	00	00	3	03.1	
BD	86	03	01	00	00	3	03.0	
BD	86	03	11	00	00	3	02.9	
BD	86	03	21	00	00	3	02.8	
BD	86	04	01	00	00	3	02.7	
BD	86	04	16	00	00	3	02.6	
BD	86	05	01	00	00	3	02.5	
BD	86	05	16	00	00	3	02.4	
BD	86	08	16	00	00	3	02.3	
BD	86	10	11	00	00	3	02.4	
BD	86	11	01	00	00	3	02.5	
BD	87	01	01	00	00	3	02.6	
BD	87	01	11	00	00	3	02.7	
BD	87	01	16	00	00	3	02.8	
BD	87	01	21	00	00	3	02.9	
BD	87	03	06	00	00	3	03.0	
BD	87	03	26	00	00	3	02.9	
BD	87	04	01	00	00	3	02.8	
BD	87	04	06	00	00	3	02.7	
BD	87	05	01	00	00	3	02.8	
BD	87	05	26	00	00	3	02.7	
BD	87	06	01	00	00	3	02.6	
BD	87	06	06	00	00	3	02.5	
BD	87	06	11	00	00	3	02.4	
BD	87	06	16	00	00	3	02.3	
BD	87	06	21	00	00	3	02.2	
BD	87	07	01	00	00	3	02.3	
BD	87	07	06	00	00	3	02.4	
BD	87	07	11	00	00	3	02.5	
BD	87	07	16	00	00	3	02.6	
BD	87	09	01	00	00	3	02.7	
BD	87	10	01	00	00	3	02.8	
BD	87	10	21	00	00	3	02.7	
BD	87	10	26	00	00	3	02.6	
BD	87	11	01	00	00	3	02.5	
BD	87	12	01	00	00	3	02.6	
BD	88	02	01	00	00	3	02.7	
BD	88	05	01	00	00	3	02.6	
BD	88	07	01	00	00	3	02.5	
BD	88	07	11	00	00	3	02.4	
BD	88	07	21	00	00	3	02.3	
BD	88	08	01	00	00	3	02.2	
BD	88	09	01	00	00	3	02.3	
BD	88	11	01	00	00	3	02.2	
BD	89	01	01	00	00	3	02.3	
BD	89	01	06	00	00	3	02.4	
BD	89	03	01	00	00	3	02.5	
BD	89	05	01	00	00	3	02.4	
BD	89	05	04	00	00	3	02.3	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
BD	89	05	07	00	00	3 02.2	
BD	89	05	10	00	00	3 02.1	
BD	89	05	13	00	00	3 02.0	
BD	89	05	16	00	00	3 01.9	
BD	89	06	06	00	00	3 02.0	
BD	89	07	01	00	00	3 02.1	
BD	89	07	16	00	00	3 02.2	
BD	89	08	01	00	00	3 02.3	
BD	89	11	01	00	00	3 02.4	
BD	89	12	01	00	00	3 02.5	
BHt	86	01	01	00	00	23227	
BHt	86	02	01	00	00	23226	
BHt	86	02	16	00	00	23225	
BHt	86	03	16	00	00	23224	
BHt	86	04	01	00	00	23223	
BHt	86	04	11	00	00	23222	
BHt	86	04	21	00	00	23221	
BHt	86	05	01	00	00	23220	
BHt	86	06	16	00	00	23221	
BHt	86	07	01	00	00	23222	
BHt	86	07	11	00	00	23223	
BHt	86	07	21	00	00	23224	
BHt	86	08	01	00	00	23225	
BHt	86	08	11	00	00	23226	
BHt	86	08	21	00	00	23227	
BHt	86	09	01	00	00	23228	
BHt	86	10	06	00	00	23227	
BHt	86	10	11	00	00	23226	
BHt	86	11	16	00	00	23225	
BHt	86	11	21	00	00	23224	
BHt	87	01	01	00	00	23223	
BHt	87	03	01	00	00	23222	
BHt	87	03	11	00	00	23221	
BHt	87	04	01	00	00	23220	
BHt	87	04	11	00	00	23219	
BHt	87	06	01	00	00	23220	
BHt	87	07	01	00	00	23219	
BHt	87	11	01	00	00	23220	
BHt	88	02	01	00	00	23219	
BHt	88	03	01	00	00	23218	
BHt	88	04	01	00	00	23217	
BHt	88	05	01	00	00	23218	
BHt	88	06	01	00	00	23219	
BHt	88	08	01	00	00	23220	
BHt	88	10	01	00	00	23221	
BHt	88	10	16	00	00	23220	
BHt	88	11	01	00	00	23219	
BHt	88	11	16	00	00	23218	
BHt	88	12	11	00	00	23219	
BHt	88	12	21	00	00	23220	
BHt	89	01	01	00	00	23221	
BHt	89	01	16	00	00	23220	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
BHt	89	02	01	00	00	23219	
BHt	89	02	28	06	00	23103	Ordinate adjustment
BHt	89	03	06	00	00	23102	
BHt	89	03	11	00	00	23101	
BHt	89	03	16	00	00	23100	
BHt	89	03	21	00	00	23099	
BHt	89	03	26	00	00	23098	
BHt	89	05	01	00	00	23097	
BHt	89	05	26	00	00	23098	
BHt	89	06	06	00	00	23099	
BHt	89	07	16	00	00	23100	
BHt	89	08	01	00	00	23101	
BHt	89	09	01	00	00	23102	
BHt	89	09	06	00	00	23103	
BHt	89	09	11	00	00	23104	
BHt	89	10	01	00	00	23103	
BHt	89	11	01	00	00	23102	
BHt	89	11	06	00	00	23101	
BZt	86	01	01	00	00	53437	
BZt	86	01	07	00	00	53438	
BZt	86	01	09	00	00	53439	
BZt	86	01	24	00	00	53440	
BZt	86	01	27	00	00	53441	
BZt	86	02	01	00	00	53442	
BZt	86	02	07	00	00	53441	
BZt	86	02	10	00	00	53440	
BZt	86	02	15	00	00	53439	
BZt	86	02	17	00	00	53438	
BZt	86	02	19	00	00	53437	
BZt	86	02	23	00	00	53436	
BZt	86	02	25	00	00	53437	
BZt	86	03	01	00	00	53438	
BZt	86	03	05	00	00	53437	
BZt	86	03	09	00	00	53436	
BZt	86	03	17	00	00	53435	
BZt	86	03	21	00	00	53434	
BZt	86	03	23	00	00	53433	
BZt	86	03	25	00	00	53432	
BZt	86	03	28	00	00	53431	
BZt	86	04	09	00	00	53430	
BZt	86	04	11	00	00	53429	
BZt	86	04	13	00	00	53428	
BZt	86	04	15	00	00	53427	
BZt	86	04	20	00	00	53426	
BZt	86	04	24	00	00	53425	
BZt	86	04	28	00	00	53424	
BZt	86	05	05	00	00	53423	
BZt	86	05	09	00	00	53422	
BZt	86	05	12	00	00	53421	
BZt	86	05	15	00	00	53420	
BZt	86	05	17	00	00	53419	
BZt	86	05	19	00	00	53418	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
BZt	86	05	21	00	00	53417	
BZt	86	05	23	00	00	53416	
BZt	86	05	25	00	00	53415	
BZt	86	05	27	00	00	53414	
BZt	86	05	29	00	00	53413	
BZt	86	06	01	00	00	53412	
BZt	86	06	03	00	00	53411	
BZt	86	06	09	00	00	53410	
BZt	86	06	27	00	00	53409	
BZt	86	06	29	00	00	53408	
BZt	86	07	01	00	00	53407	
BZt	86	07	03	00	00	53406	
BZt	86	07	05	00	00	53405	
BZt	86	07	07	00	00	53404	
BZt	86	07	10	00	00	53403	
BZt	86	07	13	00	00	53402	
BZt	86	07	16	00	00	53401	
BZt	86	07	24	00	00	53400	
BZt	86	07	27	00	00	53399	
BZt	86	08	06	00	00	53398	
BZt	86	08	11	00	00	53397	
BZt	86	08	16	00	00	53396	
BZt	86	08	29	00	00	53397	
BZt	86	09	03	00	00	53398	
BZt	86	09	06	00	00	53399	
BZt	86	09	09	00	00	53400	
BZt	86	09	11	00	00	53401	
BZt	86	09	16	00	00	53402	
BZt	86	09	19	00	00	53403	
BZt	86	09	21	00	00	53404	
BZt	86	09	22	00	00	53405	
BZt	86	09	24	00	00	53406	
BZt	86	09	25	00	00	53407	
BZt	86	09	26	00	00	53408	
BZt	86	09	28	00	00	53409	
BZt	86	09	30	00	00	53410	
BZt	86	10	01	00	00	53411	
BZt	86	10	06	00	00	53412	
BZt	86	10	16	00	00	53413	
BZt	86	10	22	00	00	53414	
BZt	86	10	23	00	00	53415	
BZt	86	10	25	00	00	53416	
BZt	86	10	26	00	00	53417	
BZt	86	10	27	00	00	53418	
BZt	86	10	29	00	00	53419	
BZt	86	11	02	00	00	53420	
BZt	86	11	03	00	00	53421	
BZt	86	11	05	00	00	53422	
BZt	86	11	07	00	00	53423	
BZt	86	11	09	00	00	53424	
BZt	86	11	14	00	00	53425	
BZt	86	11	18	00	00	53426	
BZt	86	11	19	00	00	53427	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
BZt	86	11	20	00	00	53428	
BZt	86	11	22	00	00	53429	
BZt	86	11	24	00	00	53430	
BZt	86	11	26	00	00	53431	
BZt	86	11	29	00	00	53432	
BZt	86	12	07	00	00	53433	
BZt	86	12	11	00	00	53434	
BZt	86	12	14	00	00	53435	
BZt	86	12	16	00	00	53436	
BZt	86	12	18	00	00	53437	
BZt	86	12	20	00	00	53438	
BZt	86	12	22	00	00	53439	
BZt	87	01	01	00	00	53440	
BZt	87	01	05	00	00	53441	
BZt	87	01	16	06	00	53554	
BZt	87	01	17	00	00	53555	
BZt	87	01	08	00	00	53556	
BZt	87	01	19	00	00	53557	
BZt	87	01	20	00	00	53558	
BZt	87	01	21	00	00	53559	
BZt	87	01	22	00	00	53560	
BZt	87	01	23	00	00	53561	
BZt	87	01	24	00	00	53563	
BZt	87	01	25	00	00	53564	
BZt	87	01	26	00	00	53565	
BZt	87	01	27	00	00	53566	
BZt	87	01	28	00	00	53567	
BZt	87	01	29	00	00	53568	
BZt	87	01	30	00	00	53569	
BZt	87	01	31	00	00	53570	
BZt	87	02	01	00	00	53571	
BZt	87	02	05	00	00	53572	
BZt	87	02	10	00	00	53573	
BZt	87	02	15	00	00	53574	
BZt	87	02	20	00	00	53575	
BZt	87	03	01	00	00	53576	
BZt	87	03	06	00	00	53577	
BZt	87	03	13	00	00	53576	
BZt	87	03	27	00	00	53574	
BZt	87	04	01	00	00	53573	
BZt	87	04	05	00	00	53572	
BZt	87	04	07	00	00	53571	
BZt	87	04	08	00	00	53570	
BZt	87	04	09	00	00	53569	
BZt	87	04	10	00	00	53568	
BZt	87	04	11	00	00	53567	
BZt	87	04	12	00	00	53566	
BZt	87	04	14	00	00	53565	
BZt	87	04	16	00	00	53564	
BZt	87	04	18	00	00	53565	
BZt	87	04	20	00	00	53566	
BZt	87	04	24	00	00	53565	
BZt	87	04	26	00	00	53564	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
BZt	87	04	29	00	00	53563	
BZt	87	05	01	00	00	53562	
BZt	87	05	02	00	00	53561	
BZt	87	05	03	00	00	53560	
BZt	87	05	04	00	00	53559	
BZt	87	05	08	00	00	53558	
BZt	87	05	10	00	00	53557	
BZt	87	05	12	00	00	53556	
BZt	87	05	14	00	00	53555	
BZt	87	05	16	00	00	53554	
BZt	87	05	19	00	00	53553	
BZt	87	05	21	00	00	53552	
BZt	87	05	26	00	00	53551	
BZt	87	05	29	00	00	53550	
BZt	87	06	01	00	00	53549	
BZt	87	06	19	00	00	53548	
BZt	87	06	22	00	00	53547	
BZt	87	07	11	00	00	53546	
BZt	87	07	16	00	00	53545	
BZt	87	07	20	00	00	53544	
BZt	87	08	03	00	00	53543	
BZt	87	08	04	00	00	53542	
BZt	87	08	05	00	00	53541	
BZt	87	08	06	00	00	53540	
BZt	87	08	07	00	00	53539	
BZt	87	08	09	00	00	53538	
BZt	87	08	11	00	00	53537	
BZt	87	08	23	00	00	53538	
BZt	87	09	09	00	00	53539	
BZt	87	09	10	00	00	53540	
BZt	87	09	13	00	00	53541	
BZt	87	09	15	00	00	53542	
BZt	87	09	26	00	00	53541	
BZt	87	10	01	00	00	53542	
BZt	87	10	03	00	00	53543	
BZt	87	10	05	00	00	53544	
BZt	87	10	06	00	00	53545	
BZt	87	10	07	00	00	53546	
BZt	87	10	09	00	00	53547	
BZt	87	10	10	00	00	53548	
BZt	87	10	12	00	00	53549	
BZt	87	10	13	00	00	53550	
BZt	87	10	23	00	00	53551	
BZt	87	11	01	00	00	53552	
BZt	87	11	04	00	00	53553	
BZt	87	11	08	00	00	53554	
BZt	87	11	13	00	00	53555	
BZt	87	11	16	00	00	53556	
BZt	87	11	21	00	00	53555	
BZt	87	12	02	00	00	53556	
BZt	87	12	06	00	00	53557	
BZt	87	12	09	00	00	53558	
BZt	87	12	12	00	00	53559	

TABLE 20(Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
BZt	87	12	15	00	00	53560	
BZt	87	12	16	00	00	53561	
BZt	87	12	18	00	00	53562	
BZt	87	12	20	00	00	53563	
BZt	87	12	11	00	00	53562	
BZt	87	12	23	00	00	53563	
BZt	87	12	27	00	00	53464	
BZt	88	01	01	00	00	53563	
BZt	88	01	11	00	00	53562	
BZt	88	01	23	00	00	53553	
BZt	88	02	04	00	00	53564	
BZt	88	02	07	00	00	53565	
BZt	88	02	13	00	00	53566	
BZt	88	02	18	00	00	53567	
BZt	88	02	21	00	00	53568	
BZt	88	02	28	00	00	53567	
BZt	88	03	03	00	00	53566	
BZt	88	03	05	00	00	53565	
BZt	88	03	24	00	00	53564	
BZt	88	03	27	00	00	53563	
BZt	88	03	30	00	00	53562	
BZt	88	04	01	00	00	53561	
BZt	88	04	11	00	00	53560	
BZt	88	04	20	00	00	53559	
BZt	88	04	23	00	00	53558	
BZt	88	04	26	00	00	53557	
BZt	88	04	28	00	00	53556	
BZt	88	04	30	00	00	53555	
BZt	88	05	03	00	00	53554	
BZt	88	05	07	00	00	53553	
BZt	88	05	10	00	00	53552	
BZt	88	05	14	00	00	53551	
BZt	88	05	18	00	00	53550	
BZt	88	05	19	00	00	53549	
BZt	88	05	21	00	00	53548	
BZt	88	05	22	00	00	53547	
BZt	88	05	23	00	00	53546	
BZt	88	05	29	00	00	53547	
BZt	88	06	04	00	00	53546	
BZt	88	06	07	00	00	53545	
BZt	88	06	09	00	00	53544	
BZt	88	06	13	00	00	53545	
BZt	88	06	17	00	00	53544	
BZt	88	06	20	00	00	53543	
BZt	88	06	23	00	00	53542	
BZt	88	06	25	00	00	53541	
BZt	88	06	27	00	00	53540	
BZt	88	07	05	00	00	53539	
BZt	88	07	08	00	00	53538	
BZt	88	07	21	00	00	53537	
BZt	88	07	26	00	00	53589	
BZt	88	09	01	00	00	53790	
BZt	88	09	08	00	00	53791	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
BZt	88	10	11	00	00	53792	
BZt	88	10	16	00	00	53793	
BZt	88	11	01	00	00	53794	
BZt	88	11	17	00	00	53795	
BZt	88	11	21	00	00	53796	
BZt	88	12	04	00	00	53797	
BZt	88	12	11	00	00	53798	
BZt	88	12	19	00	00	53799	
BZt	89	01	01	00	00	53800	
BZt	89	01	20	00	00	53801	
BZt	89	02	23	00	00	53800	
BZt	89	03	04	00	00	53801	
BZt	89	03	14	00	00	53800	
BZt	89	03	24	00	00	53799	
BZt	89	04	01	00	00	53798	
BZt	89	04	04	00	00	53797	
BZt	89	04	11	00	00	53796	
BZt	89	04	16	00	00	53795	
BZt	89	04	28	00	00	53794	
BZt	89	05	02	00	00	53792	
BZt	89	05	14	00	00	53793	
BZt	89	05	18	00	00	53792	
BZt	89	05	22	00	00	53791	
BZt	89	05	26	00	00	53790	
BZt	89	06	08	00	00	53789	
BZt	89	06	13	00	00	53788	
BZt	89	06	18	00	00	53787	
BZt	89	06	24	00	00	53786	
BZt	89	07	11	00	00	53787	
BZt	89	08	11	00	00	53788	
BZt	89	08	17	00	00	53789	
BZt	89	08	21	00	00	53790	
BZt	89	08	27	00	00	53791	
BZt	89	09	01	00	00	53792	
BZt	89	09	16	00	00	53793	
BZt	89	09	25	00	00	53794	
BZt	89	10	11	00	00	53793	
BZt	89	11	00	00	00	53792	
BZt	89	11	04	00	00	53793	
BZt	89	11	04	00	00	53794	
BZt	89	11	09	00	00	53795	
BZt	89	11	18	00	00	53796	
BZt	89	11	26	00	00	53797	
BZt	89	12	01	00	00	53796	
BZt	89	12	06	00	00	53797	
SD	86	01	01	00	00	1.09	
So	86	01	01	00	00	2.44	nT/mm
So	86	03	01	00	00	2.43	
So	86	04	01	00	00	2.44	
So	86	06	01	00	00	2.45	
So	86	09	01	00	00	2.44	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
So	86	11	01	00	00	2.45	
So	87	02	01	00	00	2.44	
So	87	06	01	00	00	2.45	
So	89	04	01	00	00	2.44	
So	89	05	01	00	00	2.45	
So	89	06	01	00	00	2.44	
So	89	08	01	00	00	2.45	
SZ	86	01	01	00	00	6.00	
SZ	86	02	01	00	00	6.02	
SZ	86	03	01	00	00	6.04	
SZ	86	03	16	00	00	6.06	
SZ	86	04	13	00	00	6.08	
SZ	86	04	19	00	00	6.10	Drift due to temperature through
SZ	86	04	25	00	00	6.12	to August 07
SZ	86	05	01	00	00	6.14	
SZ	86	05	07	00	00	6.16	
SZ	86	05	13	00	00	6.18	
SZ	86	05	19	00	00	6.20	
SZ	86	05	25	00	00	6.22	
SZ	86	06	01	00	00	6.24	
SZ	86	06	07	00	00	6.26	
SZ	86	06	13	00	00	6.28	
SZ	86	06	19	00	00	6.30	
SZ	86	06	25	00	00	6.32	
SZ	86	07	01	00	00	6.34	
SZ	86	07	17	00	00	6.36	
SZ	86	07	20	00	00	6.38	
SZ	86	07	23	00	00	6.40	
SZ	86	07	26	00	00	6.42	
SZ	86	07	29	00	00	6.44	
SZ	86	08	01	00	00	6.46	
SZ	86	08	04	00	00	6.48	
SZ	86	08	07	00	00	6.50	
SZ	86	09	11	00	00	6.48	Drift due to temperature through
SZ	86	09	13	00	00	6.46	to November 20
SZ	86	09	15	00	00	6.44	
SZ	86	09	17	00	00	6.42	
SZ	86	09	19	00	00	6.40	
SZ	86	09	21	00	00	6.38	
SZ	86	09	23	00	00	6.36	
SZ	86	09	25	00	00	6.34	
SZ	86	09	27	00	00	6.32	
SZ	86	09	29	00	00	6.30	
SZ	86	10	01	00	00	6.28	
SZ	86	10	06	00	00	6.26	
SZ	86	10	11	00	00	6.24	
SZ	86	10	16	00	00	6.22	
SZ	86	10	21	00	00	6.20	
SZ	86	01	26	00	00	6.18	
SZ	86	11	12	00	00	6.16	
SZ	86	11	14	00	00	6.14	
SZ	86	11	16	00	00	6.12	

TABLE 20 (Contd)

	Date from Yr Mn Dy Hr Mn	Value	Remarks
SZ	86 11 18 00 00	6.10	
SZ	86 11 20 00 00	6.08	
SZ	87 01 01 00 00	6.06	During orientation test
SZ	87 01 16 06 00	5.80	
SZ	87 03 01 00 00	5.82	
SZ	87 04 01 00 00	5.84	
SZ	87 04 11 00 00	5.86	
SZ	87 04 21 00 00	5.88	Drift due to temperature through
SZ	87 04 26 00 00	5.90	to August 15
SZ	87 05 01 00 00	5.92	
SZ	87 05 03 00 00	5.94	
SZ	87 05 05 00 00	5.96	
SZ	87 05 07 00 00	5.98	
SZ	87 05 09 00 00	6.00	
SZ	87 05 11 00 00	6.02	
SZ	87 06 01 00 00	6.04	
SZ	87 06 06 00 00	6.06	
SZ	87 06 11 00 00	6.08	
SZ	87 06 21 00 00	6.10	
SZ	87 07 01 00 00	6.12	
SZ	87 07 05 00 00	6.14	
SZ	87 07 09 00 00	6.16	
SZ	87 07 13 00 00	6.18	
SZ	87 07 17 00 00	6.20	
SZ	87 07 26 00 00	6.22	
SZ	87 08 01 00 00	6.24	
SZ	87 08 06 00 00	6.26	
SZ	87 08 11 00 00	6.28	
SZ	87 08 16 00 00	6.30	
SZ	87 09 11 00 00	6.28	
SZ	87 09 14 00 00	6.26	
SZ	87 09 17 00 00	6.24	
SZ	87 09 20 00 00	6.22	
SZ	87 09 23 00 00	6.20	
SZ	87 09 26 00 00	6.18	
SZ	87 09 29 00 00	6.16	
SZ	87 10 02 00 00	6.14	
SZ	87 10 05 00 00	6.12	
SZ	87 10 08 00 00	6.10	
SZ	87 10 11 00 00	6.08	
SZ	87 10 14 00 00	6.06	
SZ	87 10 17 00 00	6.04	
SZ	87 10 21 00 00	6.02	
SZ	87 10 26 00 00	6.00	
SZ	87 11 01 00 00	5.98	
SZ	87 11 06 00 00	5.96	
SZ	88 01 01 00 00	5.94	
SZ	88 01 11 00 00	5.92	Drift due to temperature through
SZ	88 01 21 00 00	5.90	to July 27
SZ	88 04 11 00 00	5.92	
SZ	88 04 17 00 00	5.94	
SZ	88 04 23 00 00	5.96	
SZ	88 04 29 00 00	5.98	

TABLE 20 (Contd

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
SZ	88	05	05	00	00	6.00	
SZ	88	05	11	00	00	6.02	
SZ	88	05	17	00	00	6.04	
SZ	88	05	23	00	00	6.06	
SZ	88	05	29	00	00	6.08	
SZ	88	06	04	00	00	6.10	
SZ	88	06	10	00	00	6.12	
SZ	88	06	16	00	00	6.14	
SZ	88	06	22	00	00	6.16	
SZ	88	06	28	00	00	6.18	
SZ	88	07	04	00	00	6.20	
SZ	88	07	10	00	00	6.22	
SZ	88	07	16	00	00	6.24	
SZ	88	07	21	00	00	6.26	
SZ	88	07	27	08	00	5.14	Ordinate adjustment
SZ	88	09	01	00	00	5.16	
SZ	88	09	16	00	00	5.18	
SZ	88	09	26	00	00	5.20	
SZ	88	10	09	00	00	5.18	
SZ	88	10	16	00	00	5.16	
SZ	88	10	22	00	00	5.14	
SZ	88	11	01	00	00	5.12	
SZ	88	11	09	00	00	5.10	
SZ	89	01	01	00	00	5.12	
SZ	89	02	01	00	00	5.14	
SZ	89	03	01	00	00	5.12	
SZ	89	03	16	00	00	5.10	
SZ	89	04	11	00	00	5.12	Drift due to temperature through
SZ	89	04	21	00	00	5.14	to August 20
SZ	89	05	01	00	00	5.16	
SZ	89	05	11	00	00	5.18	
SZ	89	05	21	00	00	5.20	
SZ	89	05	26	00	00	5.22	
SZ	89	05	29	00	00	5.24	
SZ	89	06	01	00	00	5.26	
SZ	89	06	04	00	00	5.28	
SZ	89	06	16	00	00	5.30	
SZ	89	06	21	00	00	5.32	
SZ	89	06	24	00	00	5.34	
SZ	89	06	27	00	00	5.36	
SZ	89	07	01	00	00	5.38	
SZ	89	07	21	00	00	5.40	
SZ	89	08	01	00	00	5.42	
SZ	89	08	11	00	00	5.44	
SZ	89	08	21	00	00	5.46	
SZ	89	09	01	00	00	5.44	Drift due to temperature through
SZ	89	09	11	00	00	5.42	to October 26
SZ	89	09	21	00	00	5.40	
SZ	89	10	01	00	00	5.38	
SZ	89	10	06	00	00	5.36	
SZ	89	10	11	00	00	5.34	
SZ	89	10	16	00	00	5.32	
SZ	89	10	21	00	00	5.30	

TABLE 20 (Contd)

	Date from Yr	Mn	Dy	Hr	Mn	Value	Remarks
SZ	89	10	22	00	00	5.28	
SZ	89	10	23	00	00	5.26	
SZ	89	10	24	00	00	5.24	
SZ	89	10	25	00	00	5.22	
SZ	89	11	16	00	00	5.18	
SZ	89	12	01	00	00	5.16	
SZ	89	12	16	00	00	5.14	

TABLE 21
GNANGARA - PRELIMINARY MONTHLY MEAN GEOMAGNETIC VALUES AND K-INDICES, 1986 TO 1989

Month	D(West)	H,nT	Z,nT	F,nT	K
1986					
January	3° 17.2	23254	53784	58596	2.16
February	16.7	237	791	595	2.66
March	15.9	236	789	593	2.05
April	15.7	235	788	592	1.36
May	15.6	238	791	596	1.59
June	15.4	239	792	597	1.54
July	15.2	240	789	595	1.51
August	15.3	237	792	596	2.11
September	14.7	232	797	599	2.19
October	14.6	238	796	600	1.82
November	15.0	241	799	604	2.01
December	15.0	241	799	604	1.86
1987					
January	14.9	241	805	610	1.78
February	14.5	235	802	605	1.91
March	14.1	228	804	604	1.62
April	13.5	228	800	600	1.26
May	13.6	237	795	599	1.36
June	13.2	228	801	601	1.29
July	13.4	232	806	607	2.06
August	13.1	223	804	602	2.22
September	13.0	213	814	607	2.55
October	12.9	215	818	612	2.28
November	12.6	223	812	609	2.20
December	12.8	230	811	611	1.72
1988					
January	12.5	223	812	609	2.16
February	11.8	222	810	607	2.21
March	11.6	218	810	605	2.25
April	11.4	206	811	602	2.06
May	11.2	209	816	607	1.71
June	11.1	216	810	605	1.61
July	11.0	212	812	605	1.69
August	10.9	209	812	604	1.82
September	10.6	207	806	597	1.84
October	10.3	211	806	599	1.81
November	10.4	220	810	606	2.19
December	10.0	216	814	608	2.41
1989					
January	10.2	204	816	605	2.84
February	10.0	203	809	599	2.44
March	09.8	187	820	602	3.38
April	09.1	196	816	602	2.50
May	08.4	181	815	595	2.02
June	08.2	290	819	603	1.94
July	08.4	203	812	601	1.29
August	07.9	204	809	599	2.19
September	08.0	183	812	593	2.06
October	08.0	204	807	597	2.30
November	07.9	199	809	597	2.70
December	08.0	215	810	604	2.61

TABLE 22

GNANGARA - GEOMAGNETIC ANNUAL MEAN VALUES (AND SECULAR CHANGES) 1967-1989

Year	D	I	H,nT	X,nT	Y,nT	Z,nT	F,nT	Notes
1976	3°12.4	66°14.2	23567	23530	-1318	53528	58528	C
	(-0.8)	(-2.8)	(-49)	(-39)	(- 6)	(-29)	(+11)	
1977	13.6	17.0	528	491	-1324	557	497	C
	(-1.5)	(-2.5)	(-47)	(48)	(- 8)	(-39)	(+17)	
1978	15.1	20.5	481	443	-1332	596	514	C
	(-0.6)	(-2.6)	(-37)	(-38)	(- 7)	(-28)	(+11)	
1979	16.5	23.1	444	405	-1339	624	525	C
	(-1.3)	(-2.6)	(-33)	(-35)	(- 7)	(-28)	(+11)	
1980	17.8	25.7	409	370	-1346	652	536	C
	(-2.1)	(-3.2)	(-45)	(-45)	(-12)	(-33)	(+14)	
1981	19.9	28.9	364	325	-1358	685	550	D
	(+0.4)	(-3.0)	(-43)	(-43)	(-29)	(-29)	(+8)	
1982	19.5	31.9	321	282	-1353	714	558	D
	(+0.2)	(-1.8)	(-27)	(-27)	(+ 3)	(-16)	(+ 4)	
1983	19.3	33.7	294	255	-1350	730	562	D
	(+0.3)	(-1.6)	(-21)	(-21)	(+ 4)	(-22)	(+14)	
1984	19.0	35.3	273	234	-1346	752	574	D
	(+1.1)	(-1.7)	(-15)	(-15)	(+ 8)	(-20)	(+13)	
1985	17.9	37.0	258	219	-1338	772	587	D
	(+2.4)	(-1.1)	(-19)	(-18)	(+18)	(-20)	(+10)	
1986	15.5	38.1	239	201	-1320	792	597	D
	(+2.0)	(-0.9)	(-11)	(-10)	(+13)	(-14)	(+09)	
1987	13.5	39.0	228	191	-1307	806	606	D
	(+1.8)	(-0.9)	-14)	(-13)	(+13)	(-05)	(-02)	
1988	11.7	39.9	214	178	-1294	811	604	D
	(+3.1)	(-0.9)	(-17)	(-16)	(+22)	(-02)	(-04)	
1989	08.6	40.8	197	162	-1272	813	600	D

Notes: C Preliminary values = Mean daily values, 10 days
D Preliminary values = Mean daily values, 5 days

TABLE 23
LEARMONTH - ABSOLUTE INSTRUMENTS

Used From	Component	Instrument	Serial No.	Correction
1986 Nov 30	D	DIM	E801/201	0
1986 Nov 30	I	DIM	E801/201	0
1986 Dec 31	F	PPM Elsec	E770/189	0

TABLE 24

LEARMONTH - INSTRUMENT COMPARISONS, 1986 TO 1989

Date	Instruments	Difference	No. of obs.
1987 Oct 24-26	D.DIM 201 - D.Ask 505	-1.1 +/- 0.7'	12
	H.DIM 201 - H.QHM 173	4.4 +/- 1.2nT	10
1988 Aug 23-26	D.DIM 201 - D.Ask 505	0.0 +/- 0.6'	10
	H.DIM 201 - H.QHM 173	-7.4 +/- 1.1nT	9

TABLE 25

LEARMONTH - AZIMUTH OF REFERENCE MARKS

Date	Windsock(WSK)	Optical building	
	Azimuth from observing pier		
1984 Sep *	283°02.3'	17°55.5'	195°52.15'
1986 Nov 21	283 02.3	17 55.5	195 52.3
1987 Oct 27	283 02.3	17 55.5	195 52.1
1988 Aug 26	283 02.3	17.55.5	Wrong tower
Adopted	283 02.3	17 55.5	195 52.2

* Determined by the Australian Survey Office
All other azimuths are relative to this pier

TABLE 26

LEARMONTH - TEMPERATURE COEFFICIENTS

Data set	Component	Temperature coefficient nT/°C
1986 Nov	X	0.77
1986 Nov	Y	0.04
1986 Nov	Z	-0.65
1987 Jan - Oct	X	0.682
1987 Jan - Dec	Z	-0.506
1988 Mar - Dec	X	0.563
1988 Jan - dec	Z	-0.498
Adopted Values from yr mm dd hr		
1986 11 26 00	X	0.6
1986 11 26 00	Y	0.0
1986 11 26 00	Z	-0.5

TABLE 27

LEARMONTH - STANDARD DEVIATION OF OBSERVATIONS

Year	Scale value			Base values			Zero values		
	X	Y	Z	X	Y	Z	X	Y	Z
1987	0.00035	0.0023	0.00013	2.27	2.63	1.72	0.5	1.4	0.6
1988	0.00023	0.0012	0.00018	2.27	2.59	2.46	0.5	0.5	0.5
1989	0.00034	0.0017	0.00031	1.89	2.90	2.25	0.7	0.4	0.4

BLE 28

LEARMONTH - ADOPTED NTROL VALUES, 1986 to 1989

	Yr	Mn	Dy	Hr	Mn	Value	
BX	87	01	01	00	00	29495	
BX	87	01	11	00	00	29496	
BX	87	01	21	00	00	29497	
BX	87	02	01	00	00	29498	
BX	87	03	01	00	00	29499	
BX	87	03	16	00	00	29500	
BX	87	04	06	00	00	29499	
BX	87	04	11	00	00	29498	
BX	87	04	16	00	00	29497	
BX	87	04	21	00	00	29496	
BX	87	05	01	00	00	29495	
BX	87	06	11	00	00	29494	
BX	87	06	12	00	00	29493	
BX	87	06	13	00	00	29492	
BX	87	06	14	00	00	29491	
BX	87	06	15	00	00	29490	
BX	87	10	24	00	00	29459	
BX	87	10	25	00	00	29443	unknown cause
BX	87	10	27	00	00	29444	
BX	87	10	28	00	00	29445	
BX	87	10	29	00	00	29446	
BX	87	10	30	00	00	29447	
BX	87	10	31	00	00	29448	
BX	87	11	01	00	00	29449	
BX	87	11	02	00	00	29450	
BX	87	11	04	00	00	29451	
BX	87	11	06	00	00	29452	
BX	87	11	08	00	00	29453	
BX	87	11	10	00	00	29454	
BX	87	11	12	00	00	29455	
BX	87	11	14	00	00	29456	
BX	87	11	16	00	00	29457	
BX	87	11	18	00	00	29458	
BX	87	11	20	00	00	29459	
BX	87	11	22	00	00	29460	
BX	87	11	24	00	00	29461	
BX	87	11	26	00	00	29462	
BX	87	11	28	00	00	29463	
BX	87	11	30	00	00	29464	
BX	87	12	02	00	00	29465	
BX	87	12	04	00	00	29466	
BX	87	12	06	00	00	29467	
BX	87	12	08	00	00	29468	
BX	87	12	10	00	00	29469	
BX	87	12	12	00	00	29470	
BX	87	12	14	00	00	29471	
BX	87	12	16	00	00	29472	
BX	87	12	18	00	00	29473	
BX	87	12	20	00	00	29474	
BX	87	12	22	00	00	29475	
BX	87	12	24	00	00	29476	
BX	87	12	26	00	00	29477	
BX	87	12	28	00	00	29478	

TABLE 28 (Contd)

	Yr	Mn	Dy	Hr	Mn	Value
BX	87	12	30	00	00	29479
BX	88	01	01	00	00	29480
BX	88	01	03	00	00	29482
BX	88	01	06	00	00	29483
BX	88	01	09	00	00	29484
BX	88	01	12	00	00	29485
BX	88	01	15	00	00	29486
BX	88	01	18	00	00	29487
BX	88	01	21	00	00	29488
BX	88	01	24	00	00	29489
BX	88	01	27	00	00	29490
BX	88	01	30	00	00	29491
BX	88	02	02	00	00	29492
BX	88	02	05	00	00	29493
BX	88	02	08	00	00	29494
BX	88	02	11	00	00	29495
BX	88	02	14	00	00	29496
BX	88	02	17	00	00	29497
BX	88	02	20	00	00	29498
BX	88	02	23	00	00	29499
BX	88	02	26	00	00	29500
BX	88	05	11	00	00	29499
BX	88	05	16	00	00	29498
BX	88	05	21	00	00	29497
BX	88	05	26	00	00	29496
BX	88	06	01	00	00	29495
BX	88	06	21	00	00	29494
BX	88	06	26	00	00	29493
BX	88	07	01	00	00	29492
BX	88	09	01	00	00	29493
BX	88	10	06	00	00	29494
BX	88	10	11	00	00	29495
BX	88	10	16	00	00	29496
BX	88	10	21	00	00	29497
BX	88	10	26	00	00	29498
BX	88	11	01	00	00	29499
BX	88	11	06	00	00	29500
BX	88	11	11	00	00	29501
BX	88	11	16	00	00	29502
BX	88	11	21	00	00	29503
BX	88	12	01	00	00	29504
BX	88	12	11	00	00	29505
BX	88	12	21	00	00	29506
BX	89	01	01	00	00	29507
BX	89	05	04	00	00	29506
BX	89	05	07	00	00	29505
BX	89	05	10	00	00	29504
BX	89	05	13	00	00	29503
BX	89	05	16	00	00	29502
BX	89	05	19	00	00	29501
BX	89	05	22	00	00	29500
BX	89	05	25	00	00	29499
BX	89	05	28	00	00	29498
BX	89	06	01	00	00	29497

TABLE 28 (Contd)

	Yr	Mn	Dy	Hr	Mn	Value
BX	89	06	05	00	00	29496
BX	89	06	09	00	00	29495
BX	89	06	13	00	00	29494
BX	89	06	21	00	00	29495
BX	89	07	01	00	00	29496
BX	89	08	01	00	00	29497
BX	89	09	01	00	00	29498
BX	89	09	11	00	00	29499
BX	89	09	21	00	00	29500
BX	89	10	01	00	00	29501
BX	89	10	11	00	00	29502
BX	89	10	21	00	00	29503
BX	89	11	01	00	00	29504
BX	89	11	16	00	00	29505
BY	87	01	01	00	00	-196
BY	87	01	21	00	00	-194
BY	87	02	01	00	00	-193
BY	87	04	01	00	00	-192
BY	87	05	21	00	00	-191
BY	87	07	21	00	00	-190
BY	87	08	01	00	00	-189
BY	87	08	11	00	00	-188
BY	88	01	01	00	00	-188
BY	88	10	01	00	00	-186
BY	88	10	16	00	00	-184
BY	88	11	01	00	00	-182
BY	88	12	11	00	00	-181
BY	88	12	21	00	00	-180
BY	89	01	01	00	00	-174
BY	89	02	01	00	00	-176
BY	89	03	01	00	00	-178
BY	89	04	01	00	00	-180
BY	89	05	01	00	00	-182
BY	89	06	01	00	00	-184
BY	89	08	11	00	00	-186
BY	89	08	21	00	00	-188
BY	89	11	01	00	00	-186
BY	89	12	16	00	00	-184
BZ	87	01	01	00	00	-44409
BZ	87	04	01	00	00	-44410
BZ	87	04	26	00	00	-44409
BZ	87	05	01	00	00	-44408
BZ	87	05	06	00	00	-44407
BZ	87	05	11	00	00	-44406
BZ	87	06	01	00	00	-44405
BZ	87	06	06	00	00	-44404
BZ	87	06	11	00	00	-44403
BZ	87	06	16	00	00	-44402
BZ	87	06	21	00	00	-44401
BZ	87	06	26	00	00	-44400
BZ	87	07	01	00	00	-44399
BZ	87	07	06	00	00	-44398

TABLE 28 (Contd)

	Yr	Mn	Dy	Hr	Mn	Value
BZ	87	08	11	00	00	-44399
BZ	87	08	16	00	00	-44400
BZ	87	08	21	00	00	-44401
BZ	87	08	26	00	00	-44402
BZ	87	09	01	00	00	-44403
BZ	87	10	16	00	00	-44404
BZ	87	10	21	00	00	-44405
BZ	87	10	26	00	00	-44406
BZ	87	11	01	00	00	-44407
BZ	87	11	06	00	00	-44408
BZ	87	11	11	00	00	-44409
BZ	87	11	16	00	00	-44410
BZ	87	11	21	00	00	-44411
BZ	87	11	26	00	00	-44412
BZ	87	12	01	00	00	-44413
BZ	87	12	06	00	00	-44414
BZ	87	12	11	00	00	-44415
BZ	87	12	16	00	00	-44416
BZ	87	12	21	00	00	-44417
BZ	87	12	26	00	00	-44418
BZ	88	01	01	00	00	-44419
BZ	88	03	21	00	00	-44418
BZ	88	04	01	00	00	-44417
BZ	88	04	11	00	00	-44416
BZ	88	04	21	00	00	-44415
BZ	88	05	01	00	00	-44414
BZ	88	05	11	00	00	-44413
BZ	88	05	21	00	00	-44412
BZ	88	05	26	00	00	-44411
BZ	88	06	01	00	00	-44410
BZ	88	06	06	00	00	-44409
BZ	88	06	11	00	00	-44408
BZ	88	06	16	00	00	-44407
BZ	88	06	21	00	00	-44406
BZ	88	06	26	00	00	-44405
BZ	88	07	06	00	00	-44404
BZ	88	07	11	00	00	-44403
BZ	88	07	16	00	00	-44402
BZ	88	07	21	00	00	-44401
BZ	88	07	26	00	00	-44400
BZ	88	08	01	00	00	-44399
BZ	88	08	06	00	00	-44398
BZ	88	08	11	00	00	-44397
BZ	88	08	16	00	00	-44396
BZ	88	09	01	00	00	-44397
BZ	88	09	06	00	00	-44398
BZ	88	09	11	00	00	-44399
BZ	88	09	16	00	00	-44400
BZ	88	09	21	00	00	-44401
BZ	88	09	26	00	00	-44402
BZ	88	10	01	00	00	-44403
BZ	88	10	06	00	00	-44404
BZ	88	10	11	00	00	-44405
BZ	88	10	16	00	00	-44406

TABLE 28 (Contd)

	Yr	Mn	Dy	Hr	Mn	Value	
BZ	88	10	21	00	00	-44407	
BZ	88	10	26	00	00	-44408	
BZ	88	11	01	00	00	-44409	
BZ	88	11	06	00	00	-44410	
BZ	88	11	11	00	00	-44411	
BZ	88	11	16	00	00	-44412	
BZ	88	11	21	00	00	-44413	
BZ	88	11	26	00	00	-44414	
BZ	88	12	01	00	00	-44415	
BZ	88	12	06	00	00	-44416	
BZ	88	12	11	00	00	-44417	
BZ	88	12	16	00	00	-44418	
BZ	89	01	01	00	00	-44418	
BZ	89	05	06	00	00	-44417	
BZ	89	05	11	00	00	-44416	
BZ	89	05	16	00	00	-44415	
BZ	89	05	21	00	00	-44414	
BZ	89	05	26	00	00	-44413	
BZ	89	06	01	00	00	-44412	
BZ	89	06	06	00	00	-44411	
BZ	89	06	11	00	00	-44410	
BZ	89	06	12	00	00	-44409	
BZ	89	06	13	00	00	-44408	
BZ	89	06	14	00	00	-44407	
BZ	89	06	15	00	00	-44406	
BZ	89	06	16	00	00	-44405	
BZ	89	06	17	00	00	-44404	
BZ	89	06	18	00	00	-44403	
BZ	89	06	19	00	00	-44402	
BZ	89	06	20	00	00	-44401	
BZ	89	06	21	00	00	-44400	
BZ	89	08	16	00	00	-44401	
BZ	89	09	01	00	00	-44402	
BZ	89	09	16	00	00	-44403	
BZ	89	10	01	00	00	-44404	
BZ	89	10	11	00	00	-44405	
BZ	89	10	21	00	00	-44406	
BZ	89	11	01	00	00	-44407	
BZ	89	11	11	00	00	-44408	
BZ	89	11	21	00	00	-44409	
BZ	89	12	01	00	00	-44410	
SX	87	01	01	00	00	0.1984	
SX	87	05	01	00	00	0.1986	
SX	87	07	01	00	00	0.1984	
SX	87	08	01	00	00	0.1986	
SX	87	09	01	00	00	0.1984	
SX	87	10	26	00	00	0.1968	Date unsure - unknown cause
SX	88	02	06	00	00	0.1966	
SX	88	02	11	00	00	0.1964	
SX	88	06	01	00	00	0.1962	
SX	88	08	16	00	00	0.1964	
SX	88	09	01	00	00	0.1966	
SX	88	09	16	00	00	0.1968	

TABLE 28 (Contd)

	Yr	Mn	Dy	Hr	Mn	Value	
SX	88	10	01	00	00	0.1970	
SX	89	01	01	00	00	0.1970	
SX	89	06	01	00	00	0.1968	
SX	89	06	16	00	00	0.1966	
SY	87	01	01	00	00	0.2040	
SY	87	02	01	00	00	0.2030	
SY	87	02	16	00	00	0.2020	
SY	87	03	01	00	00	0.2010	
SY	87	03	16	00	00	0.2020	
SY	87	03	21	00	00	0.2030	
SY	87	03	26	00	00	0.2040	
SY	87	04	01	00	00	0.2050	
SY	87	04	21	00	00	0.2040	
SY	87	04	26	00	00	0.2030	
SY	87	05	01	00	00	0.2020	
SY	87	06	11	00	00	0.2010	
SY	87	06	21	00	00	0.2000	
SY	87	11	01	00	00	0.2010	
SY	88	03	15	00	00	0.2020	
SY	88	06	01	00	00	0.2030	
SY	88	06	16	00	00	0.2040	
SY	88	07	01	00	00	0.2030	
SY	88	08	01	00	00	0.2020	
SY	88	09	01	00	00	0.2010	
SY	88	12	01	00	00	0.2000	
SY	89	01	01	00	00	0.1990	
SY	89	02	01	00	00	0.2000	
SY	89	04	01	00	00	0.2010	
SY	89	04	16	00	00	0.2020	
SY	89	05	01	00	00	0.2030	
SY	89	07	16	00	00	0.2040	
SY	89	10	01	00	00	0.2030	
SY	89	12	01	00	00	0.2020	
SY	89	12	06	00	00	0.2010	
SY	89	12	11	00	00	0.2000	
SZ	87	01	01	00	00	0.1966	
SZ	87	03	01	00	00	0.1968	
SZ	87	07	01	00	00	0.1966	
SZ	87	09	01	00	00	0.1968	
SZ	87	10	26	00	00	0.1930	Date unsure - unknown cause
SZ	87	12	01	00	00	0.1932	
SZ	88	01	01	00	00	0.1930	
SZ	88	01	16	00	00	0.1928	
SZ	88	04	16	00	00	0.1926	
SZ	88	06	06	00	00	0.1944	Date unsure - unknown cause
SZ	88	07	01	00	00	0.1946	
SZ	88	07	16	00	00	0.1948	
SZ	88	09	01	00	00	0.1950	
SZ	88	09	16	00	00	0.1952	
SZ	89	04	01	00	00	0.1950	
SZ	89	06	01	00	00	0.1948	
SZ	89	07	01	00	00	0.1950	

TABLE 28 (Contd)

	Yr	Mn	Dy	Hr	Mn	Value	
OX	87	01	01	00	00	5000	
OX	87	03	01	00	00	4999	
OX	87	08	01	00	00	4998	
OX	87	11	01	00	00	4997	
OX	87	12	16	00	00	4996	
OX	88	01	01	00	00	4998	
OX	88	05	16	00	00	4999	
OX	88	09	16	00	00	4998	
OX	88	09	21	00	00	4997	
OX	89	04	21	00	00	4998	
OX	89	05	01	00	00	4999	
OY	87	01	01	00	00	4980	
OY	87	02	16	00	00	4990	Date unsure - unknown cause
OY	87	05	01	00	00	4992	
OY	87	06	01	00	00	4993	
OY	87	08	01	00	00	4994	
OY	87	12	01	00	00	4996	
OY	88	03	01	00	00	4997	
OY	88	05	01	00	00	4996	
OY	88	10	01	00	00	4997	
OY	89	01	01	00	00	4998	
OY	89	06	11	00	00	4997	
OY	89	11	01	00	00	4998	
OY	89	12	01	00	00	4997	
OZ	87	01	01	00	00	4999	
OZ	87	06	01	00	00	4998	
OZ	87	08	01	00	00	4997	
OZ	87	12	16	00	00	4996	
OZ	88	01	01	00	00	4996	
OZ	88	01	16	00	00	4997	
OZ	88	05	01	00	00	4998	
OZ	88	08	26	00	00	5015	Date unsure - unknown cause
OZ	89	05	01	00	00	5016	
OZ	89	07	11	00	00	5064	Date unsure - unknown cause
OZ	89	10	21	00	00	5063	

TABLE 29

LEARMONTH - PRELIMINARY MONTHLY MEAN GEOMAGNETIC VALUES AND K-INDICES, 1987 to 1989

Month	D(West)	H,nT	Z,nT	F,nT	I
1987					
January	00° 37.5'	29481	-44411	53306	56° 25.4
February	00 37.4	29481	-44414	53307	56 25.5
March	00 37.6	29473	-44414	53303	56 25.9
April	00 37.6	29479	-44414	53307	56 25.6
May	00 37.2	29481	-44414	53308	56 25.5
June	00 37.4	29472	-44423	53311	56 26.3
July	00 37.5	29483	-44424	53317	56 25.7
August	00 37.5	29473	-44426	53314	56 26.4
September	00 37.5	29467	-44427	53311	56 26.7
October	00 37.5	29471	-44429	53315	56 26.6
November	00 37.2	29522	-44427	53342	56 23.8
December	00 37.1	29509	-44426	53333	56 24.4
1988					
January	00 37.5	29492	-44423	53321	56 25.2
February	00 37.3	29495	-44421	53321	56 25.0
March	00 37.0	29481	-44419	53312	56 25.7
April	00 36.6	29472	-44424	53311	56 26.3
May	00 36.6	29472	-44426	53313	56 26.4
June	00 36.3	29480	-44424	53315	56 25.9
July	00 35.9	29479	-44429	53319	56 26.2
August	00 36.2	29485	-44434	53327	56 26.0
September	00 35.9	29488	-44436	53330	56 25.9
October	00 36.2	29484	-44436	53328	56 26.1
November	00 35.9	29488	-44430	53325	56 25.7
December	00 35.6	29487	-44430	53324	56 25.8
1989					
January	00 35.6	29477	-44430	53319	56 26.3
February	00 34.9	29485	-44423	53317	56 25.6
March	00 35.7	29449	-44432	53305	56 27.9
April	00 34.9	29478	-44428	53318	56 26.2
May	00 34.3	29469	-44427	53312	56 26.6
June	00 34.2	29478	-44438	53326	56 26.5
July	00 34.2	29483	-44436	53328	56 26.1
August	00 33.9	29489	-44436	53331	56 25.8
September	00 33.5	29474	-44440	53326	56 26.8
October	00 33.4	29492	-44432	53329	56 25.5
November	00 33.4	29491	-44439	53334	56 25.8
December	00 33.2	29505	-44437	53340	56 25.0

TABLE 30

LEARMONTH - GEOMAGNETIC ANNUAL MEAN VALUES (AND SECULAR CHANGES), 1986-1989

Year	D	I	H,nT	X,nT	Y,nT	Z,nT	F,nT
1987	-00° 37.4'	-56° 25.6'	29483	29481	-321	-44421	53314
	(+1.0)	(-0.2)	(+1)	(+1)	(+9)	(-7)	(+6)
1988	-00 36.4	-56 25.8	29484	29482	-312	-44428	53320
	(+2.1)	(-0.4)	(-3)	(-3)	(+18)	(-5)	(+4)
1989	-00 34.3	-56 26.2	29481	29479	-294	-44433	53324

TABLE 31

ROUTINE DISTRIBUTION OF GEOMAGNETIC DATA

	Weekly K-indices				
Gnangara	Ionospheric Prediction Service for distribution to their recipients				
Monthly	K-Indices	Rapid Variations	Principal Storms	Preliminary Mean Values	Magnetogram 16mm copy
Gnangara					
BMR, Canberra	*1	*1	*1	*1	
IPS, Sydney	*	*	*		
WDC A, Washington	*	*	*		*
WDC C1, Denmark	*	*	*		
WDC C2, Kyoto	*	*	*		
Observatory de Elbo		*2			
Institute de Physiques du Globe	*				
Learmonth					
BMR, Canberra				*1	

Data published

1. Geophysical Observatory Report, Bureau of Mineral Resources, Geology and Geophysics

2. IAGA Bulletin, Geomagnetic data.

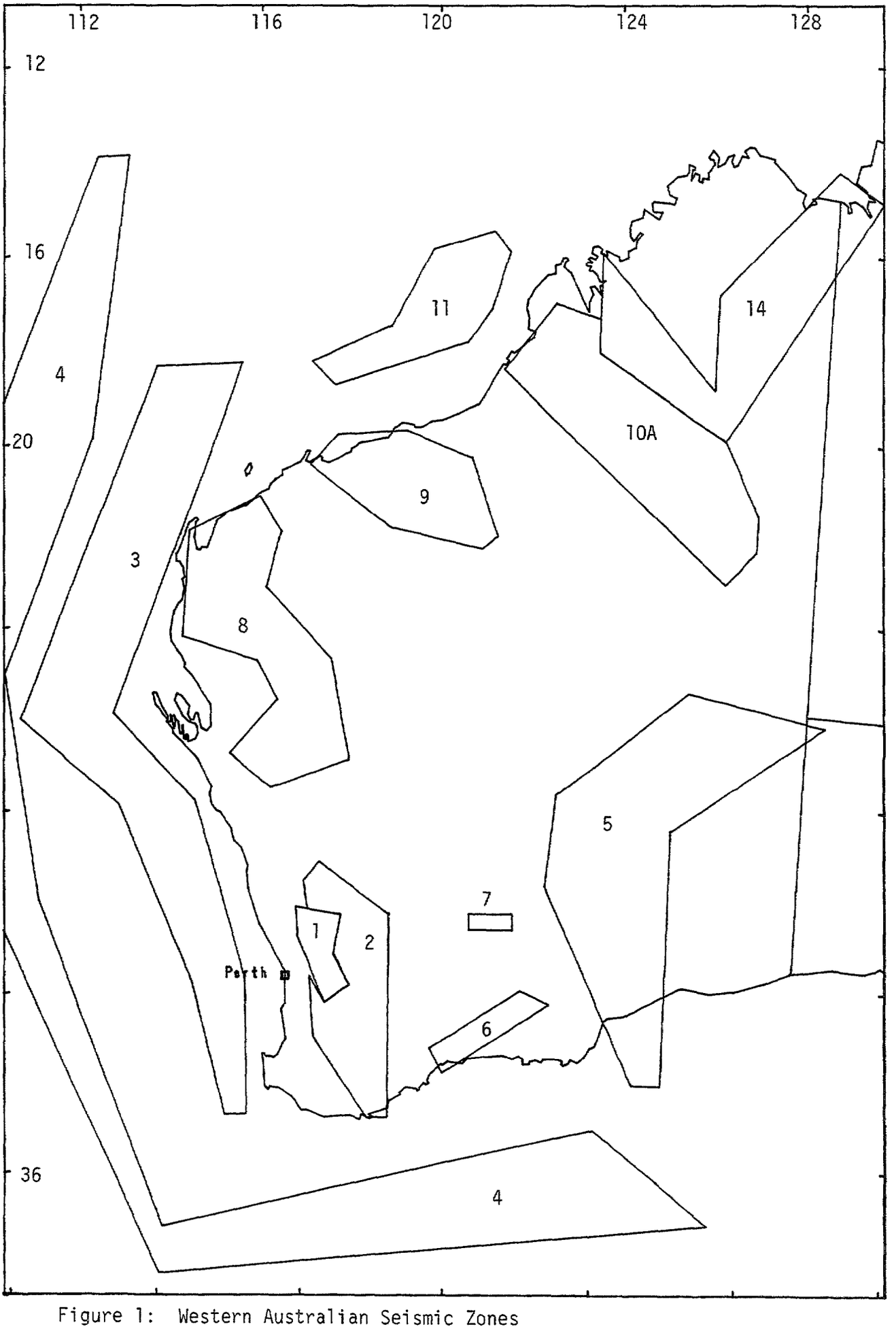


Figure 1: Western Australian Seismic Zones

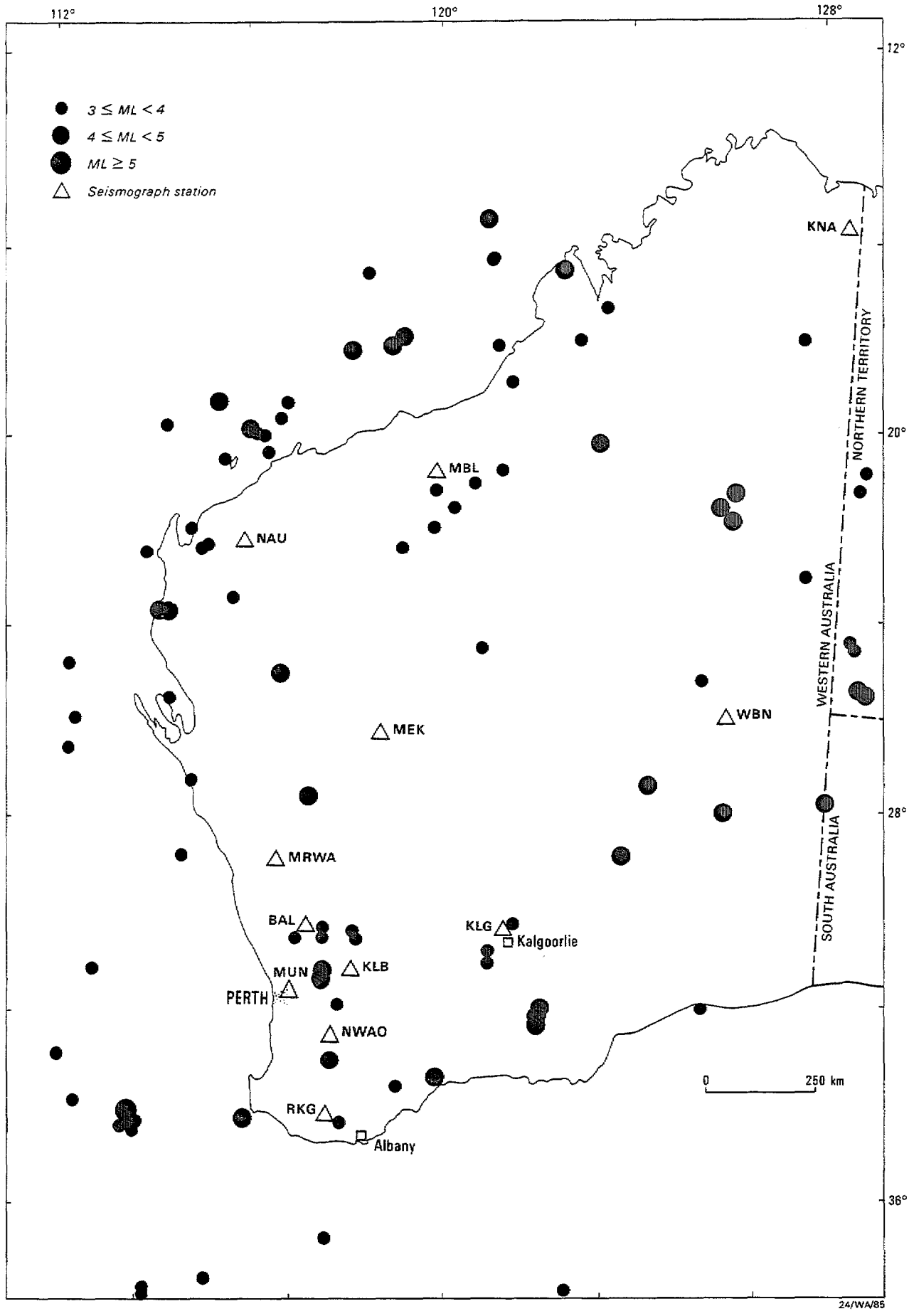


Figure 2. Earthquakes in the region of Western Australia ML > 2.4, 1986

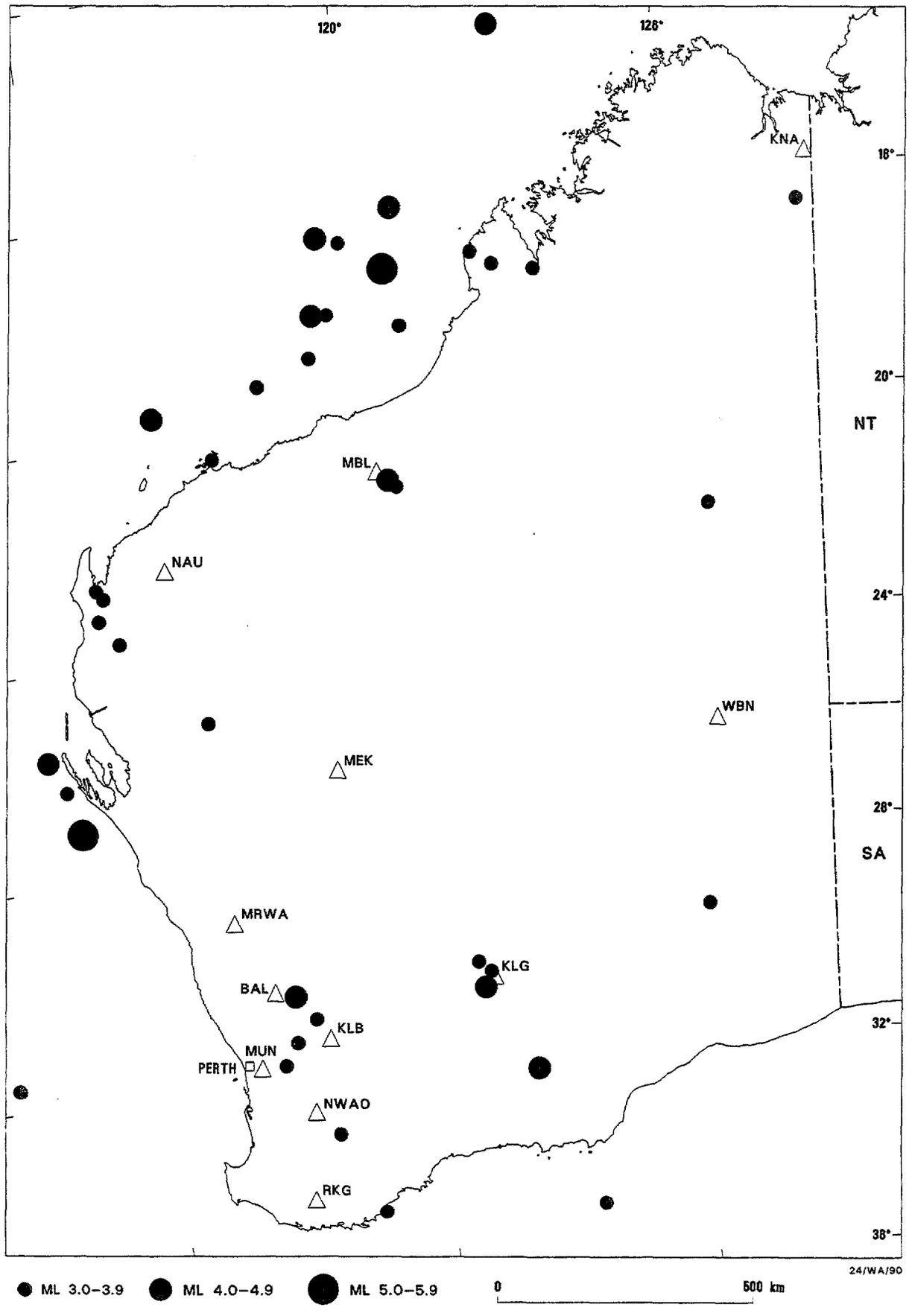


Figure 3. Earthquakes in the region of Western Australia ML > 2.4, 1987

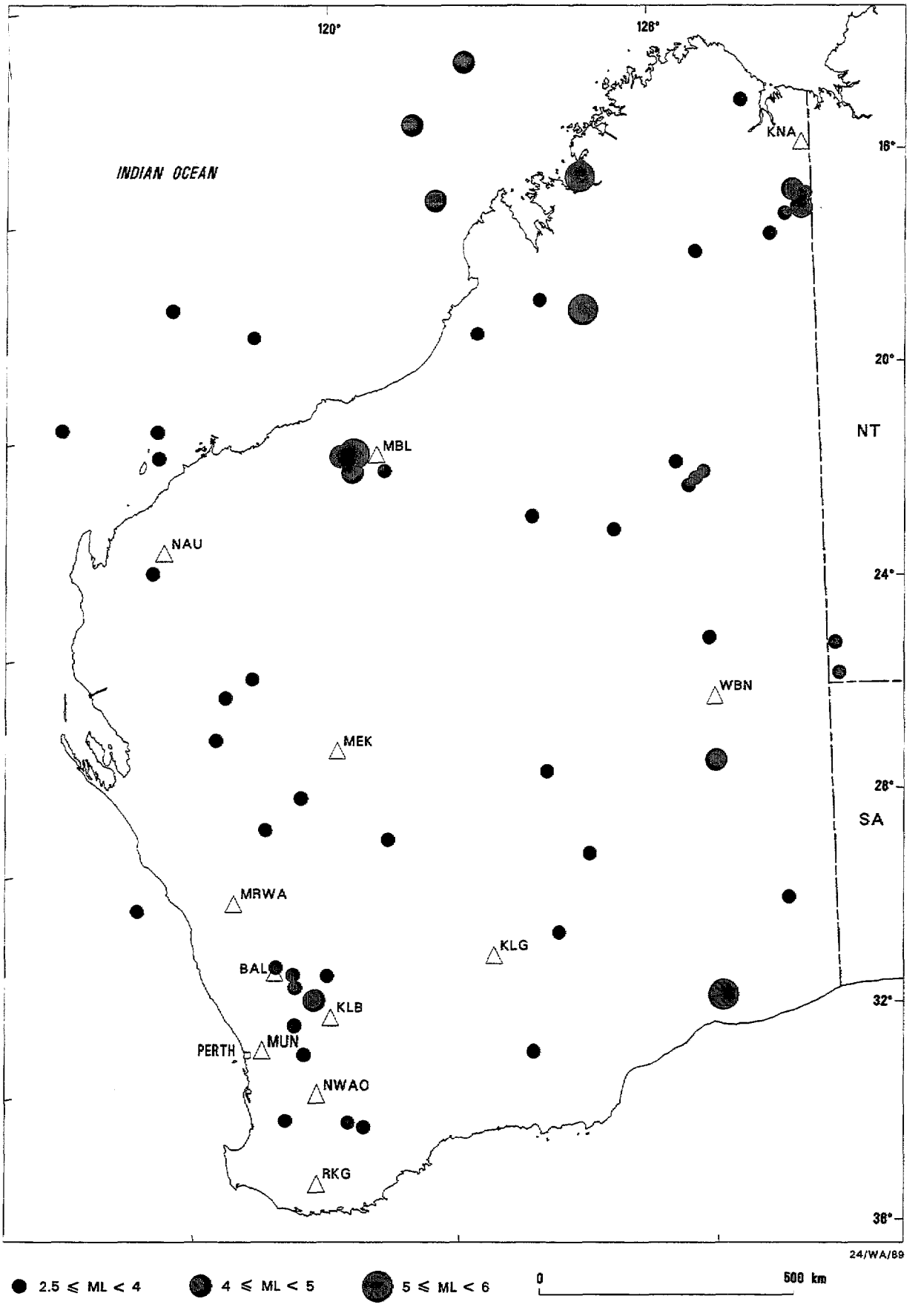


Figure 4. Earthquakes in the region of Western Australia ML > 2.4, 1988

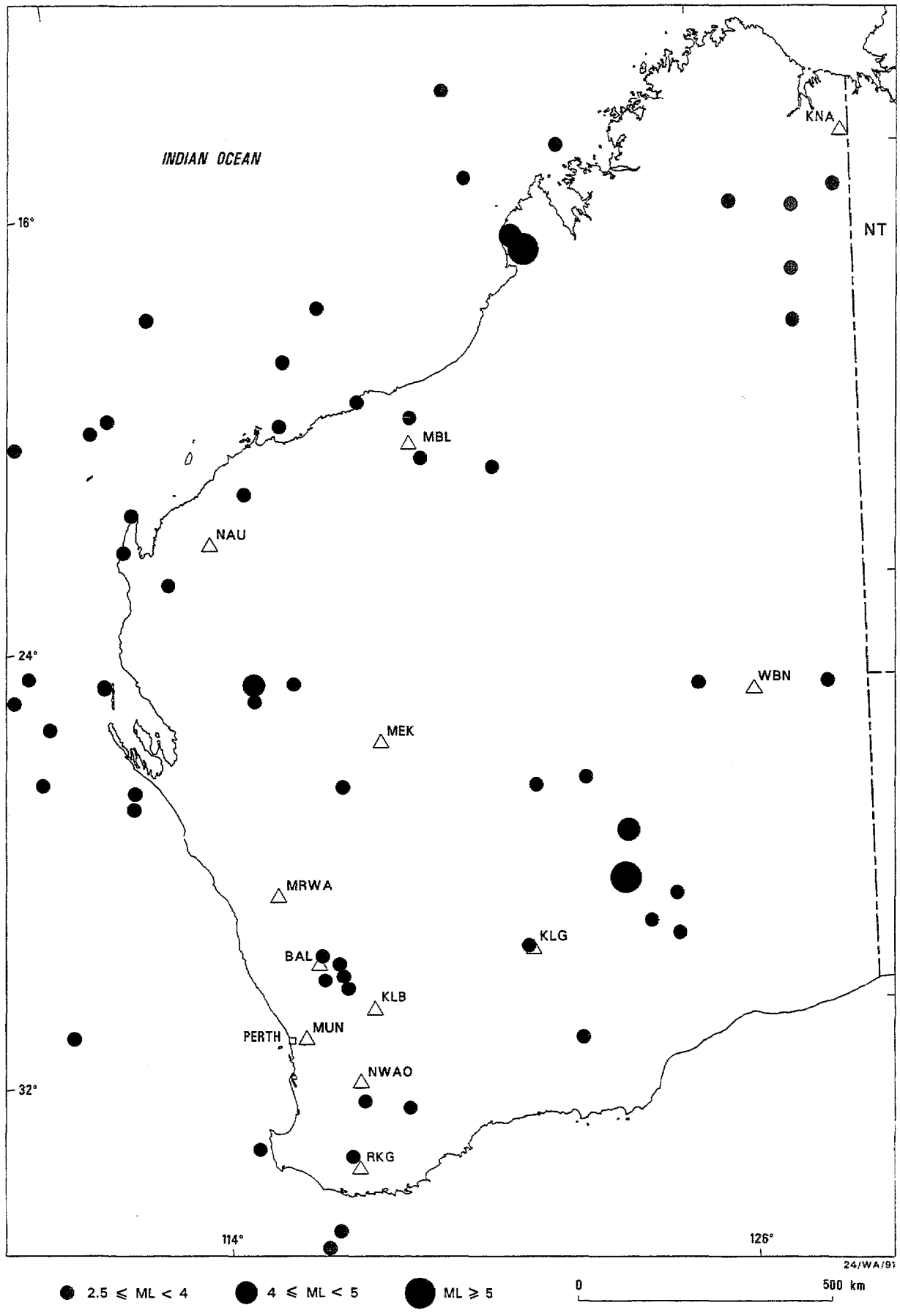


Figure 5. Earthquakes in the region of Western Australia ML > 2.4, 1989

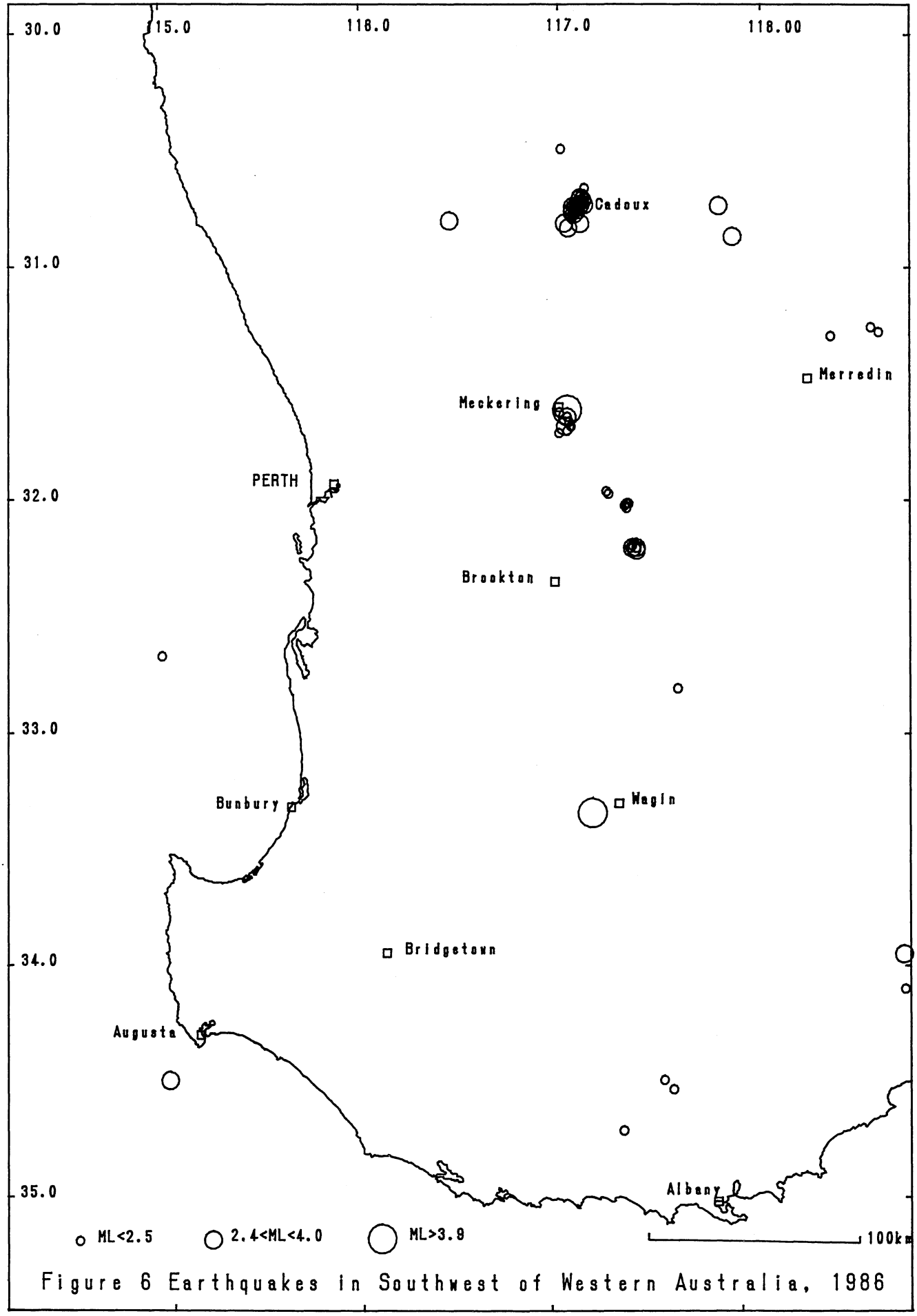


Figure 6 Earthquakes in Southwest of Western Australia, 1986

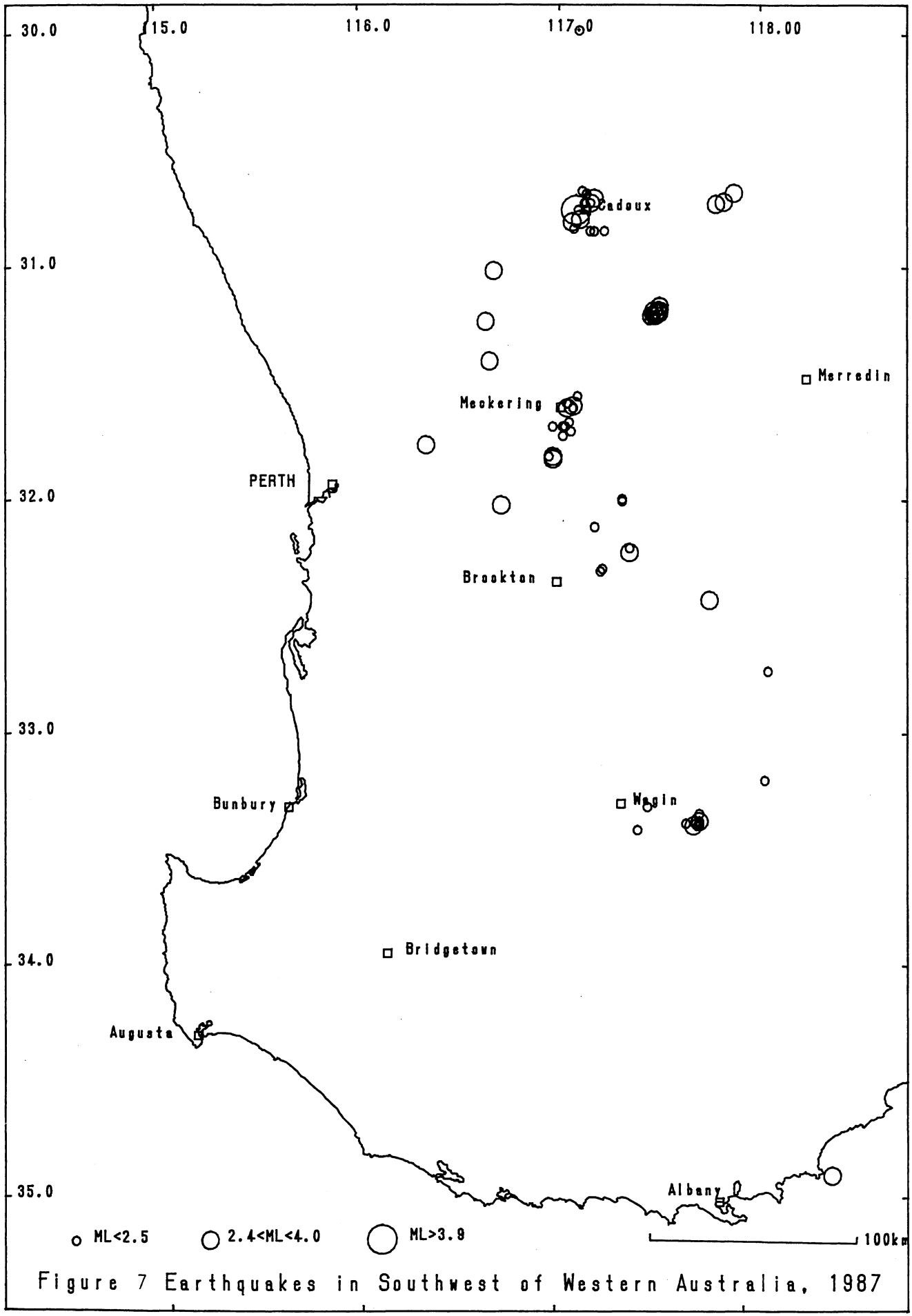


Figure 7 Earthquakes in Southwest of Western Australia, 1987

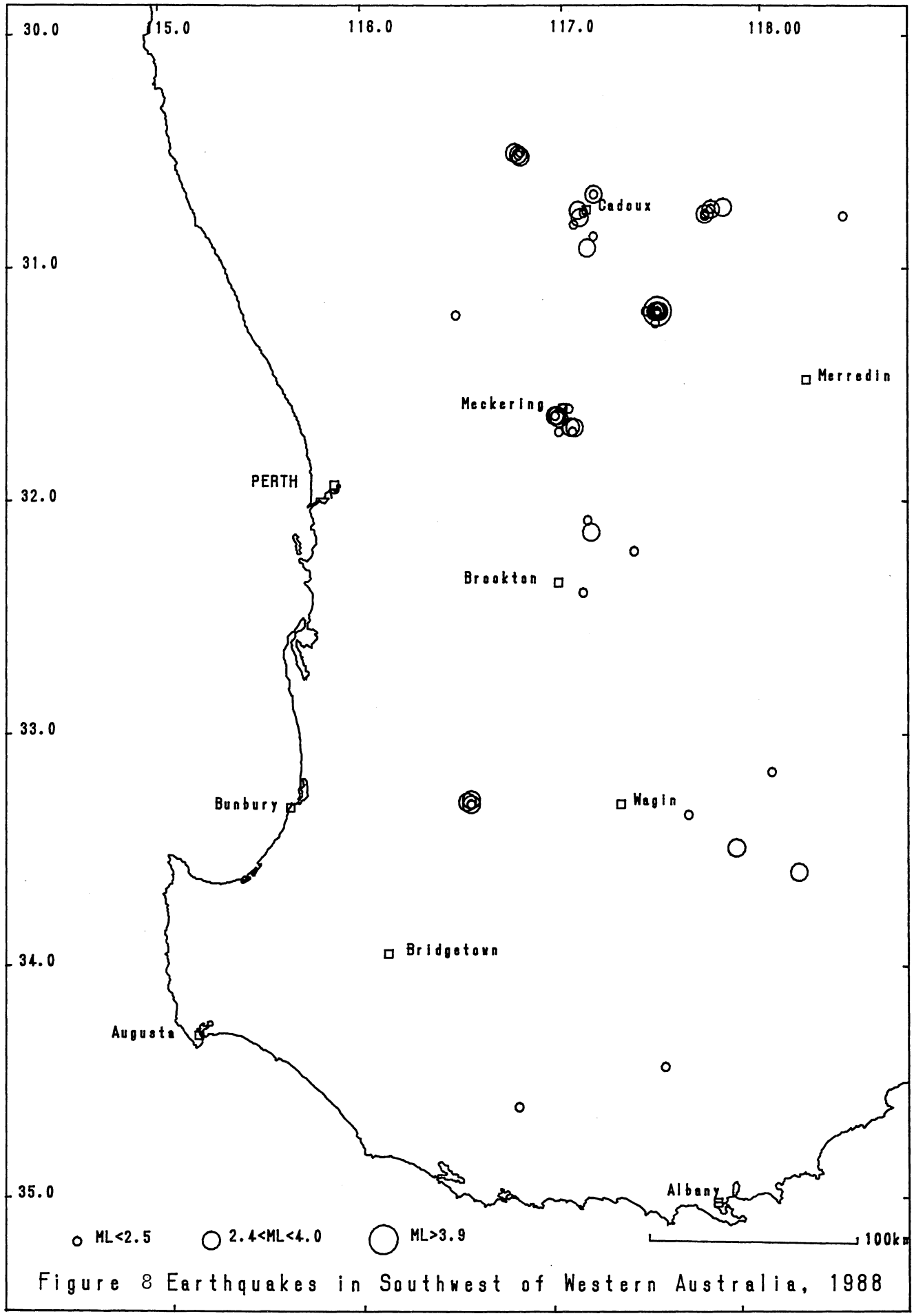


Figure 8 Earthquakes in Southwest of Western Australia, 1988

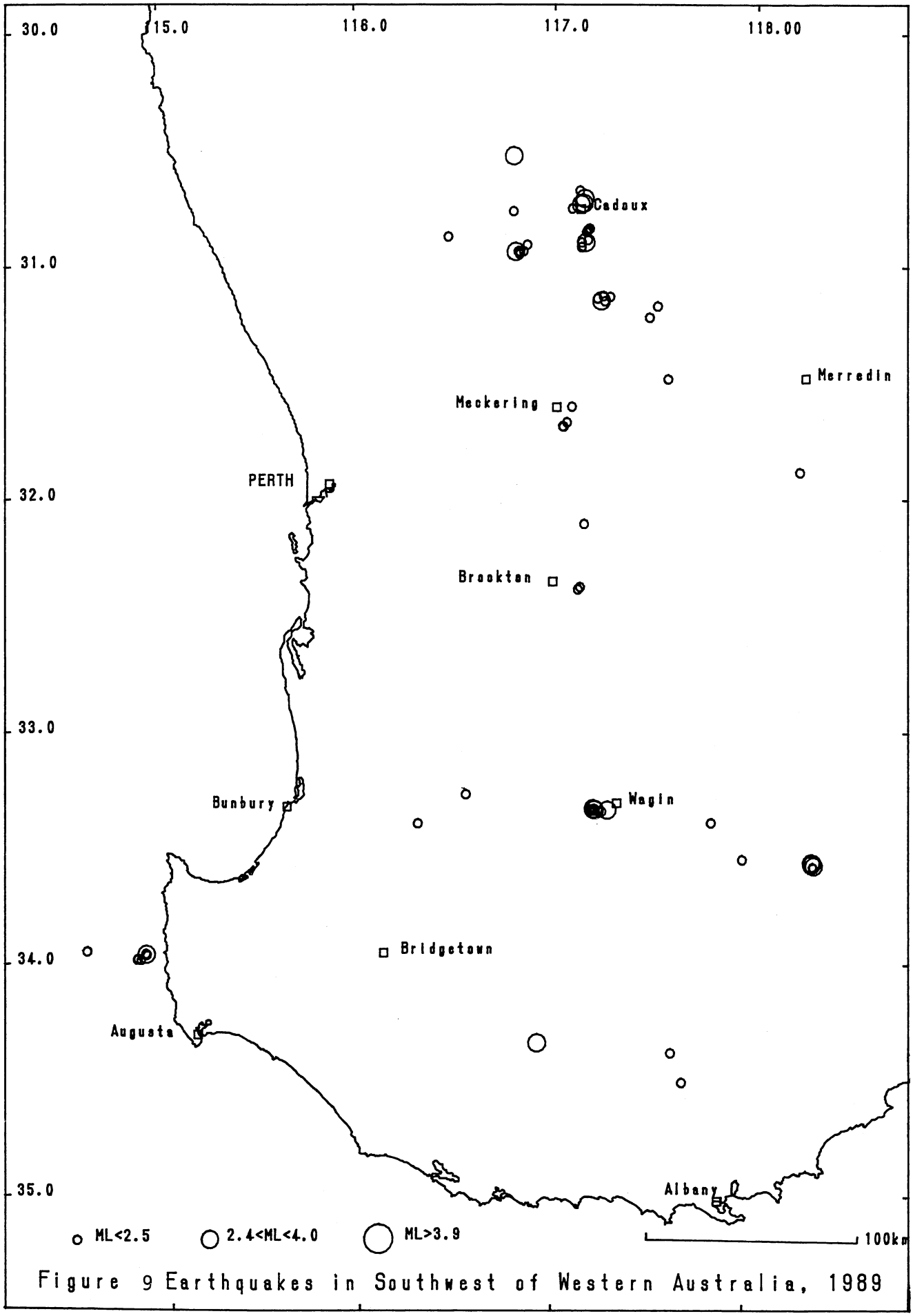
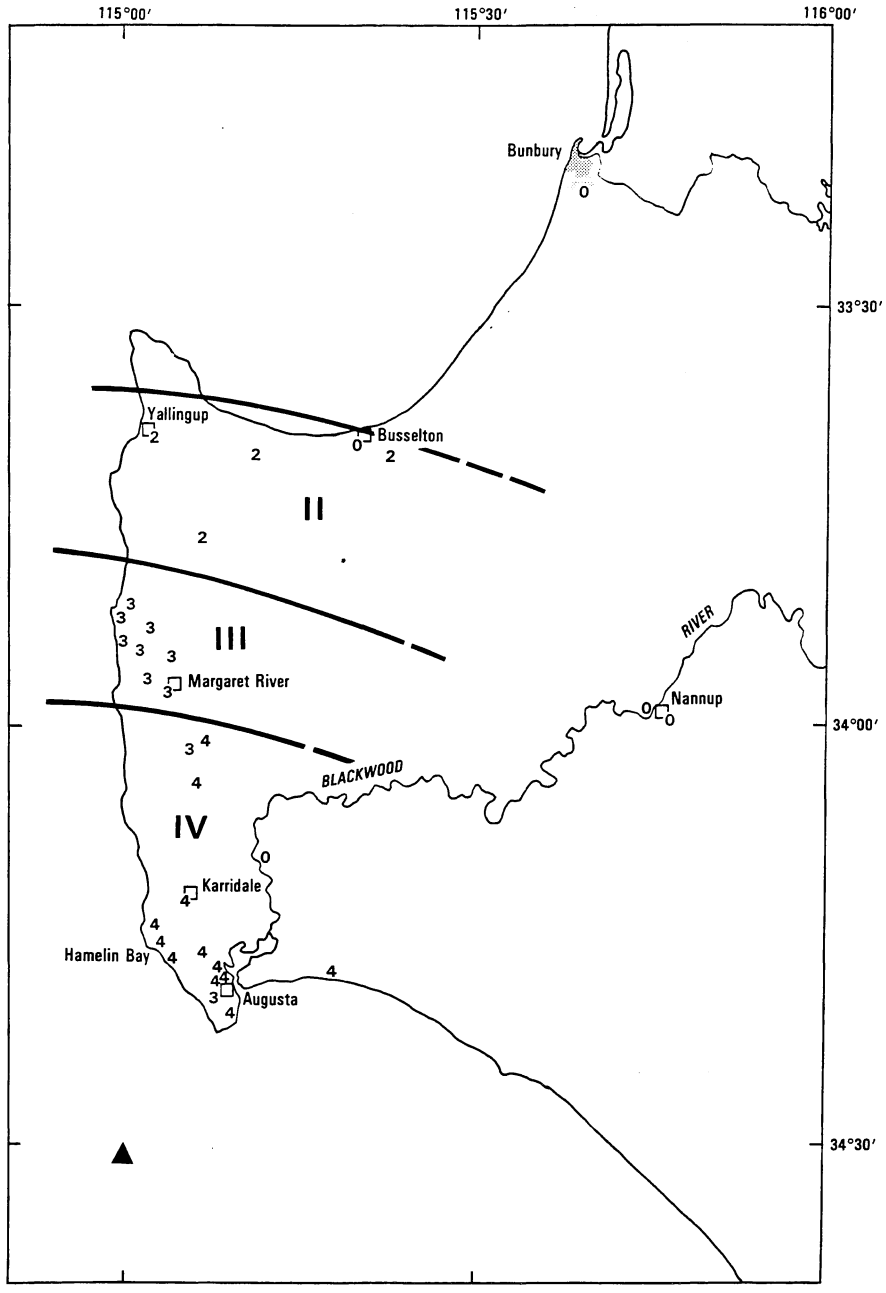


Figure 9 Earthquakes in Southwest of Western Australia, 1989

ISOSEISMAL MAP OF THE AUGUSTA EARTHQUAKE, WESTERN AUSTRALIA 15 JANUARY 1986



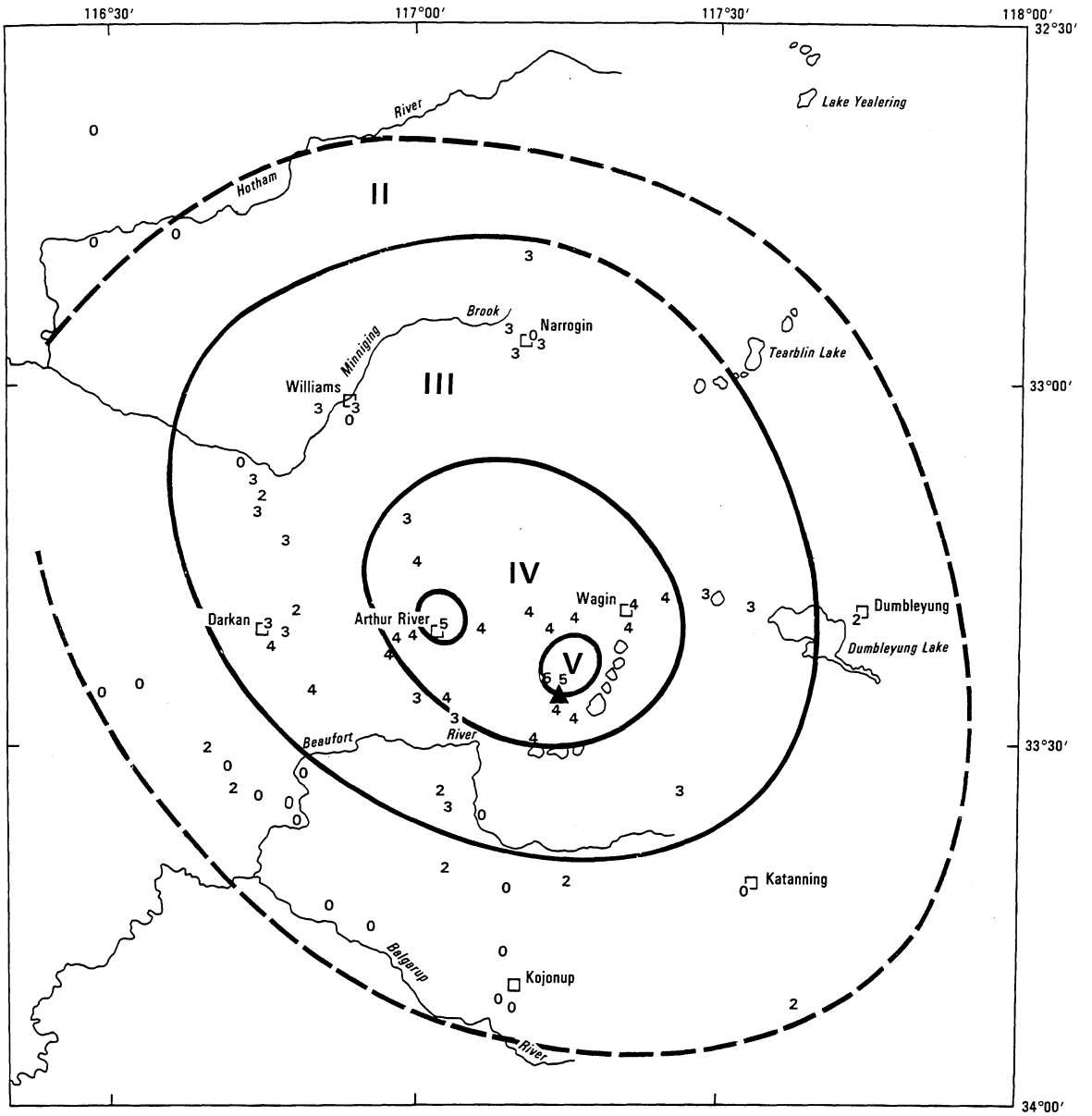
DATE :15 JANUARY 1986
TIME : 22:11:28.0 UT
MAGNITUDE : 3.8 ML (MUN)
EPICENTRE : 34.51°S 114.99°E

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

Figure 10.

24/150/4

ISOSEISMAL MAP OF THE ARTHUR RIVER EARTHQUAKE, WESTERN AUSTRALIA, 17 MAY 1986



DATE : 17 MAY 1986
TIME : 12:41:28.5 UT
MAGNITUDE : 4.2 ML (MUN)
EPICENTRE : 33.43°S 117.24°E

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

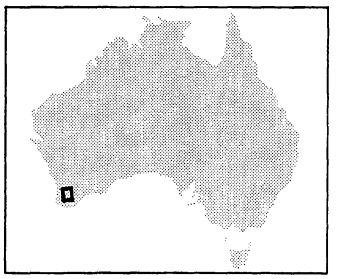
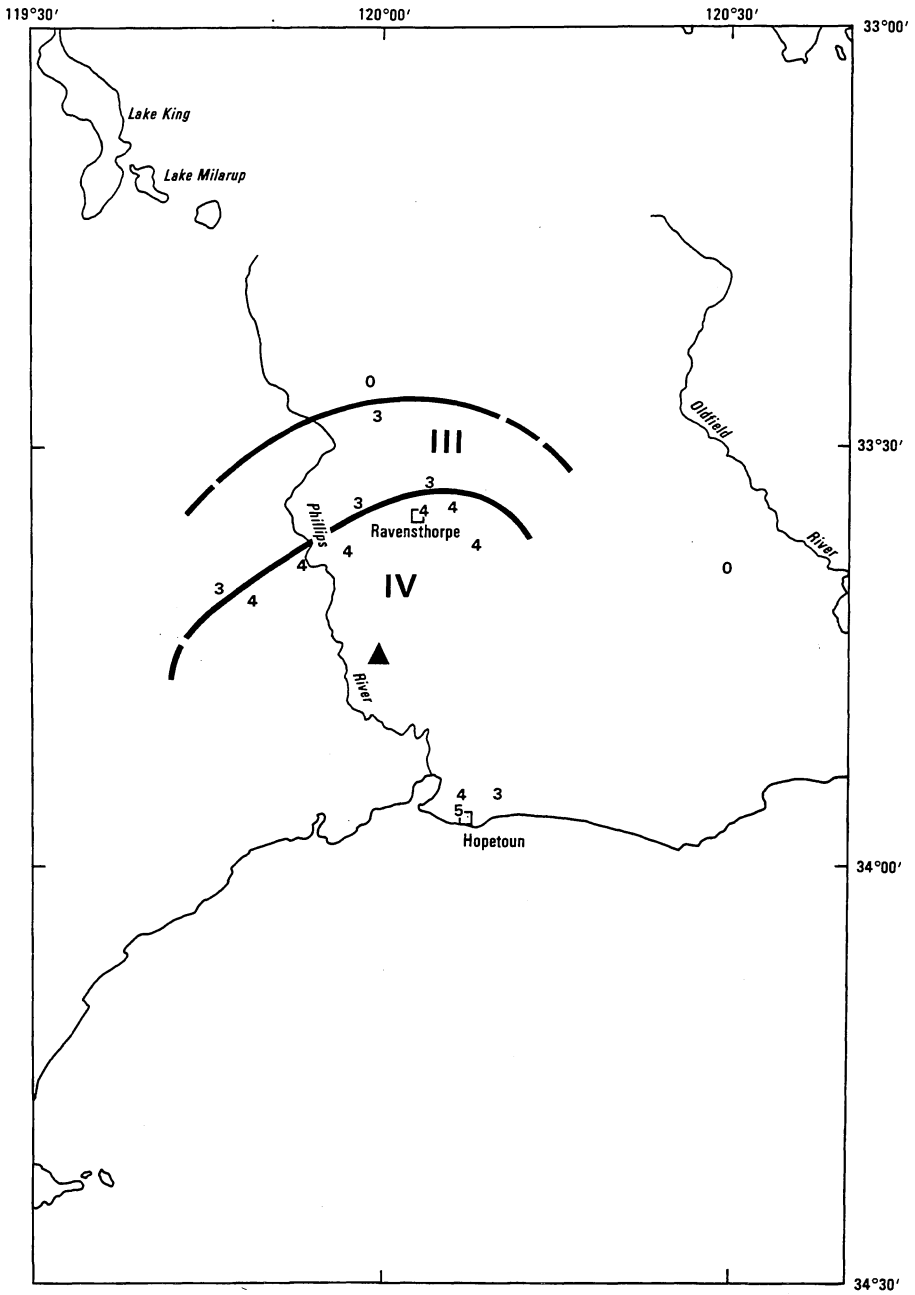


Figure 11.

24/150/5

ISOSEISMAL MAP OF THE RAVENSTHORPE EARTHQUAKE, WESTERN AUSTRALIA, 17 MAY 1986



DATE : 17 MAY 1986
TIME : 14:57:44.3 UT
MAGNITUDE : 3.4 ML (MUN)
EPICENTRE : 33.75°S 119.93°E

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

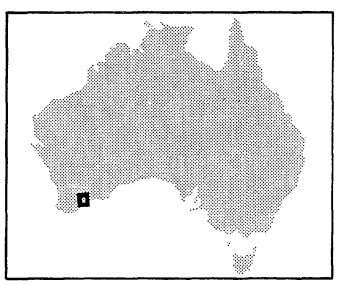
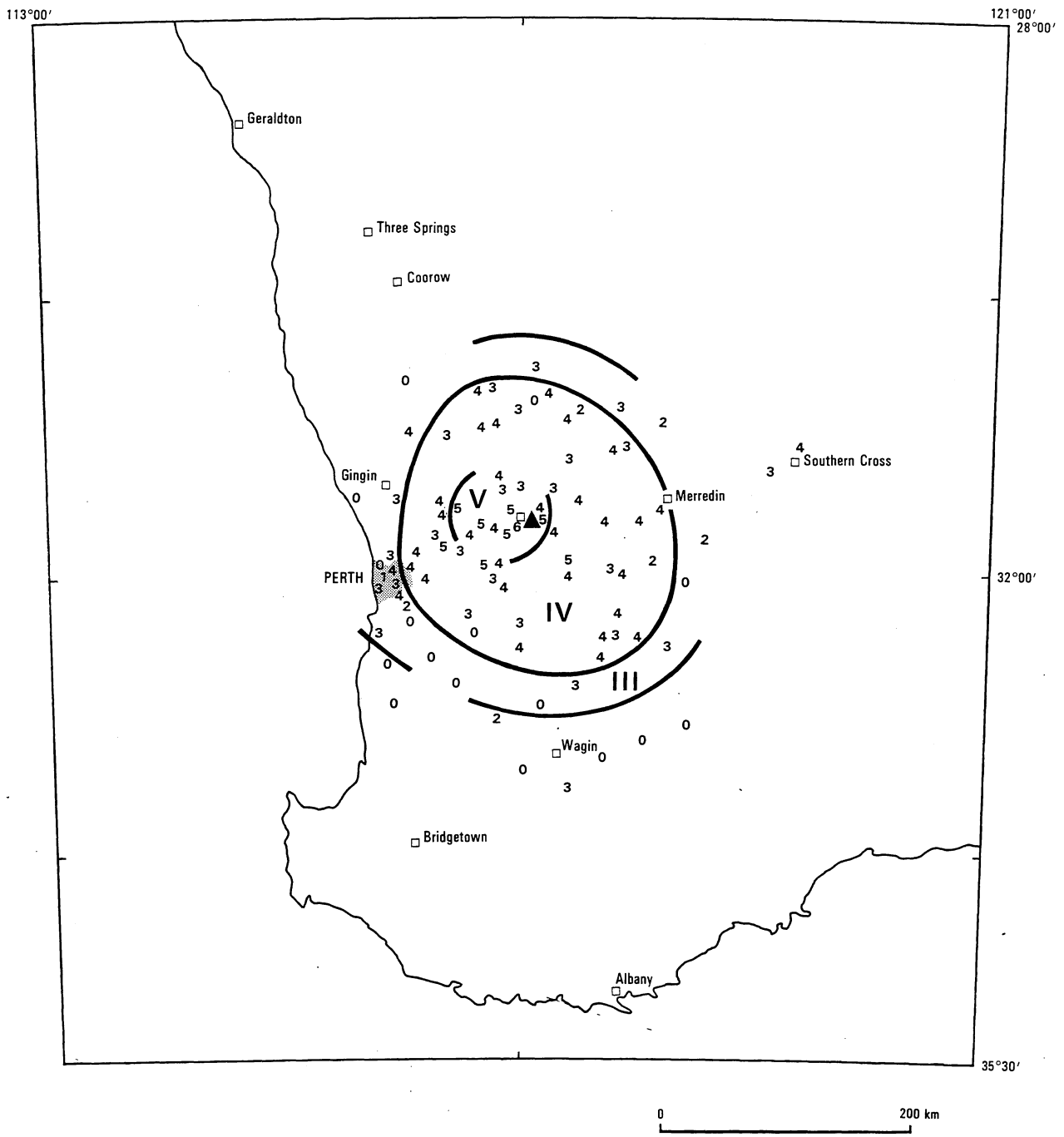


Figure 12.

24/151/1

ISOSEISMAL MAP OF A MECKERING EARTHQUAKE, WESTERN AUSTRALIA, 1 SEPTEMBER 1986



DATE : *1 September 1986*
TIME : *135349.7 UT*
MAGNITUDE : *4.1 ML (MUN)*
EPICENTRE : *31.63°S, 117.06°E*

▲ *Epicentre*
IV *Zone Intensity Designation*
4 *Earthquake Felt (MM)*
0 *Earthquake Not Felt*

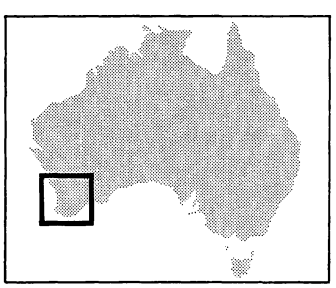
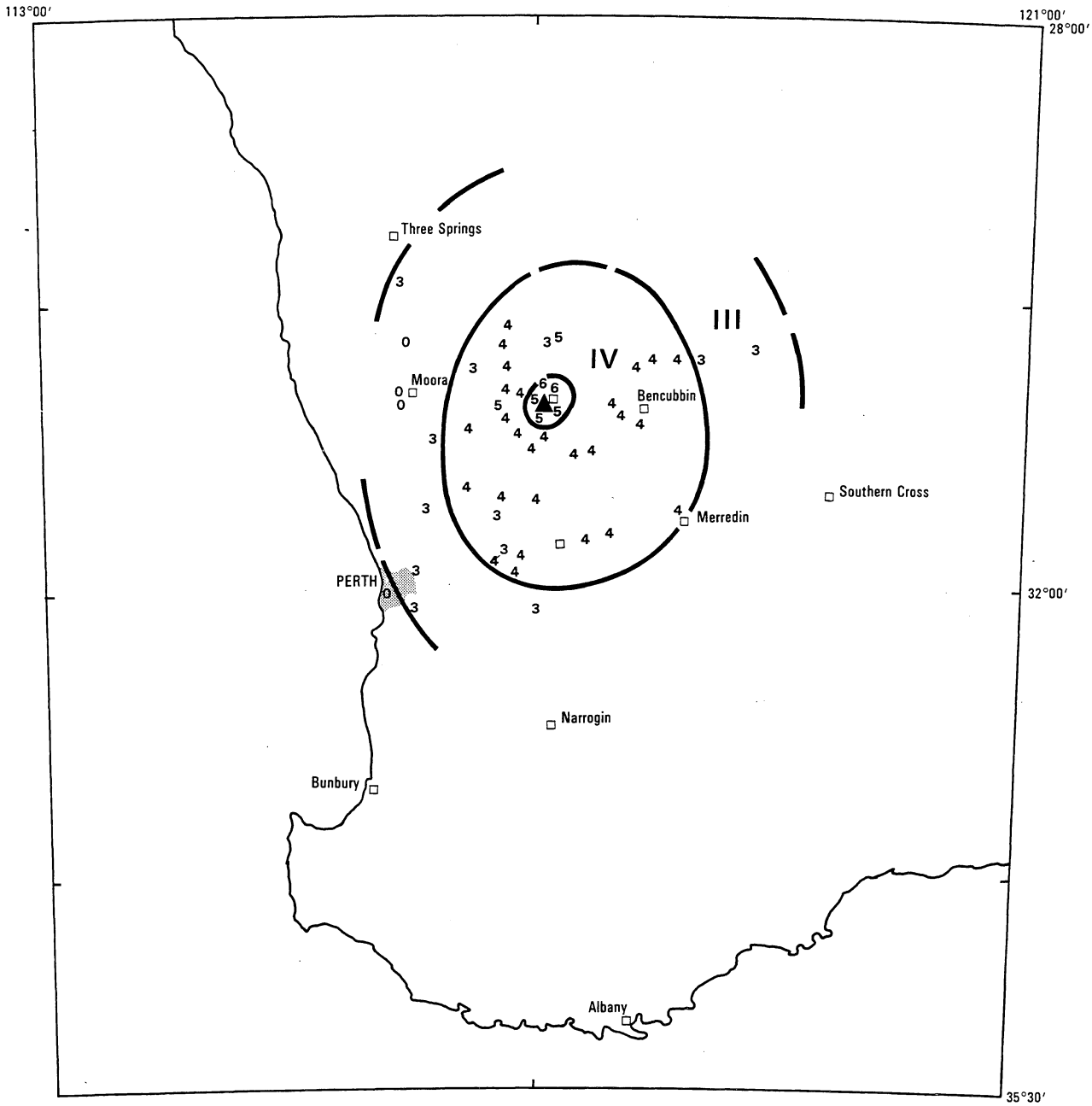


Figure 13.

24/H50/22

ISOSEISMAL MAP OF A CADOUX EARTHQUAKE, WESTERN AUSTRALIA 7 MARCH 1987



DATE : *7 March 1987*
TIME : *053807.7 UT*
MAGNITUDE : *4.5 ML (MUN)*
EPICENTRE : *30.77°S, 117.09°E*
DEPTH : *5 km*

▲ *Epicentre*
IV *Zone Intensity Designation*
4 *Earthquake Felt (MM)*
0 *Earthquake Not Felt*

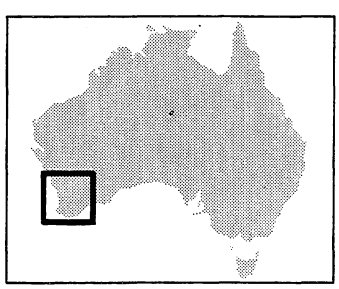
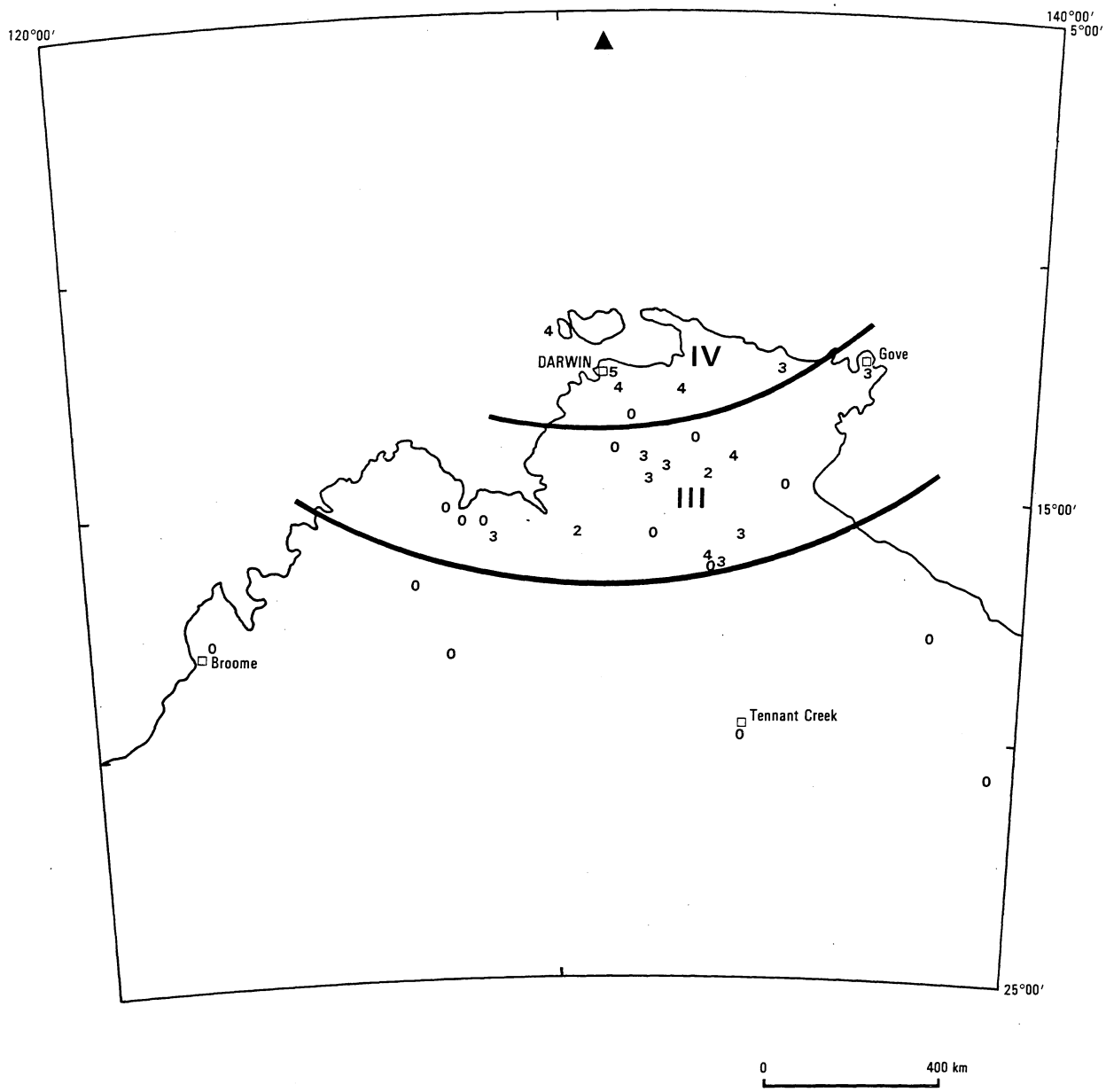


Figure 14.

24/H50/21

ISOSEISMAL MAP OF THE BANDA SEA EARTHQUAKE, 17 JUNE 1987



DATE : *17 June 1987*
TIME : *013255.6 UT*
MAGNITUDE : *6.7 MB*
EPICENTRE : *5.583°S, 130.882°E*
DEPTH : *84 km*

▲ *Epicentre*
IV *Zone Intensity Designation*
4 *Earthquake Felt (MM)*
0 *Earthquake Not Felt*

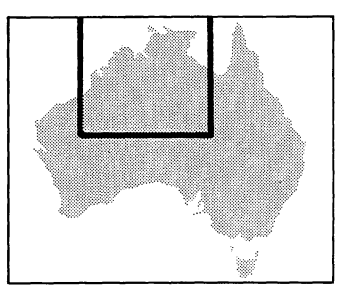
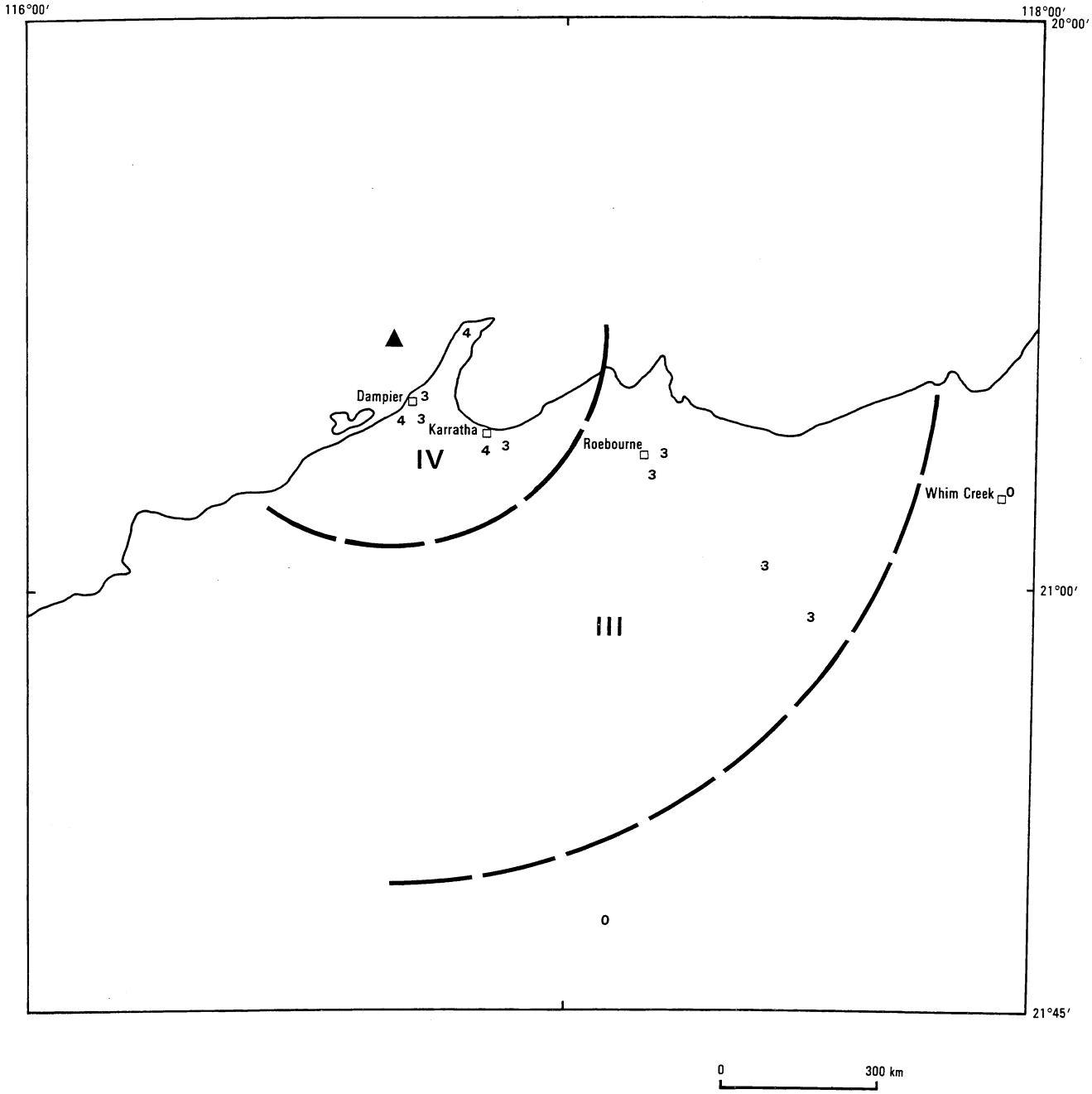


Figure 15.

24/OA/5

ISOSEISMAL MAP OF THE DAMPIER EARTHQUAKE, WESTERN AUSTRALIA 19 JUNE 1987



DATE : *19 June 1987*
TIME : *133203.0 UT*
MAGNITUDE : *3.7 ML (MUN)*
EPICENTRE : *20.56°S, 116.69°E*
DEPTH : *5km*

▲ *Epicentre*
IV *Zone Intensity Designation*
4 *Earthquake Felt (MM)*
0 *Earthquake Not Felt*

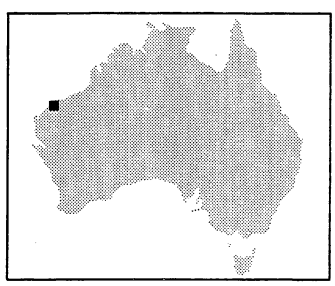
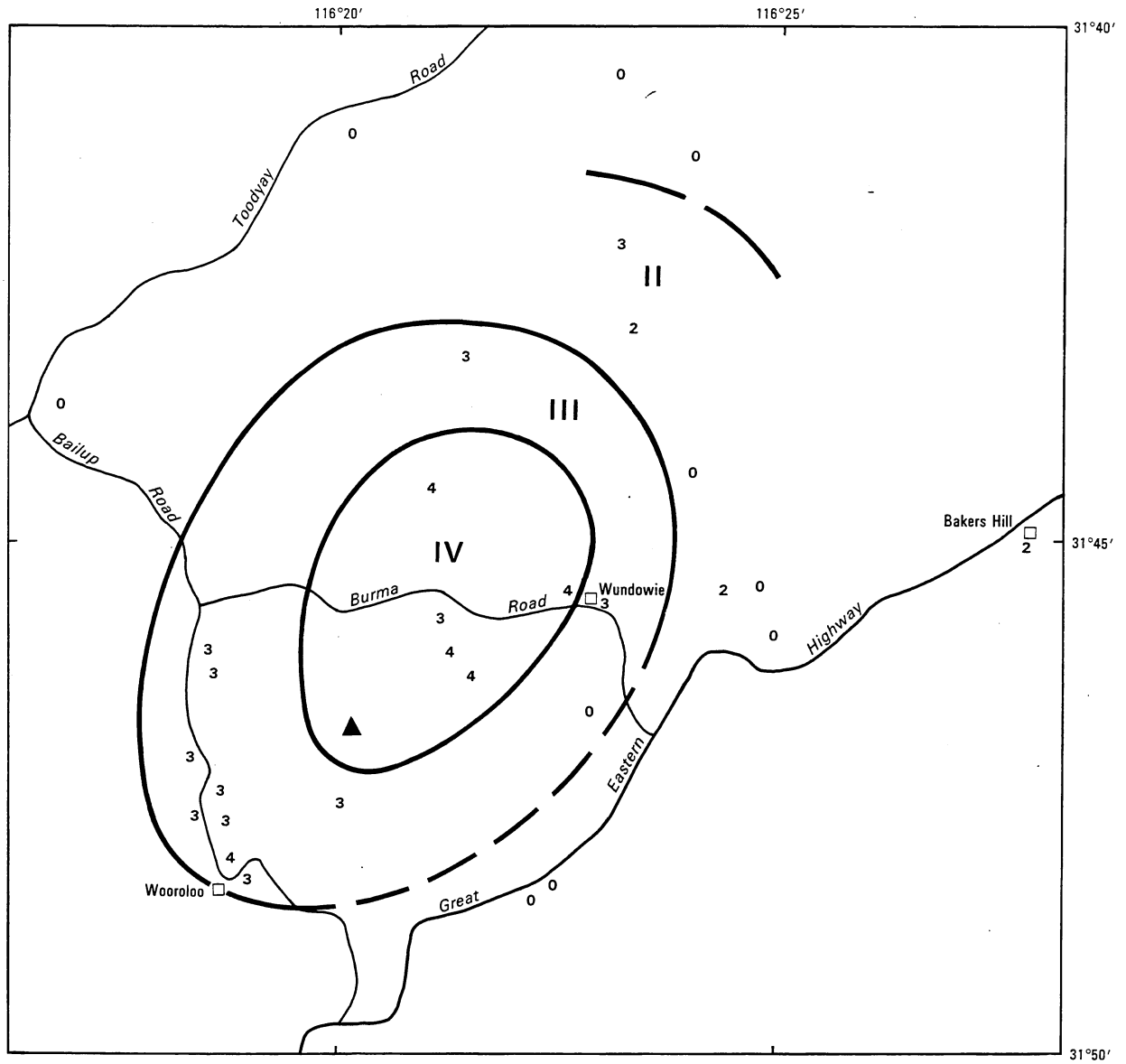


Figure 16.

24/F50/3

ISOSEISMAL MAP OF THE WOOROLOO EARTHQUAKE, WESTERN AUSTRALIA 5 JULY 1987



DATE : *5 July 1987*
TIME : *052840.5 UT*
MAGNITUDE : *3.0 ML (MUN)*
EPICENTRE : *31.78°S, 116.34°E*
DEPTH : *5 km*

▲ *Epicentre*
IV *Zone Intensity Designation*
4 *Earthquake Felt (MM)*
0 *Earthquake Not Felt*

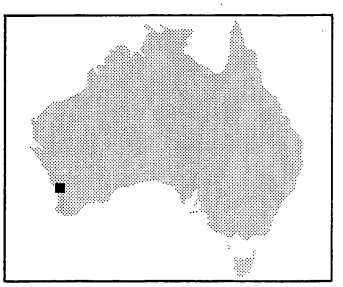
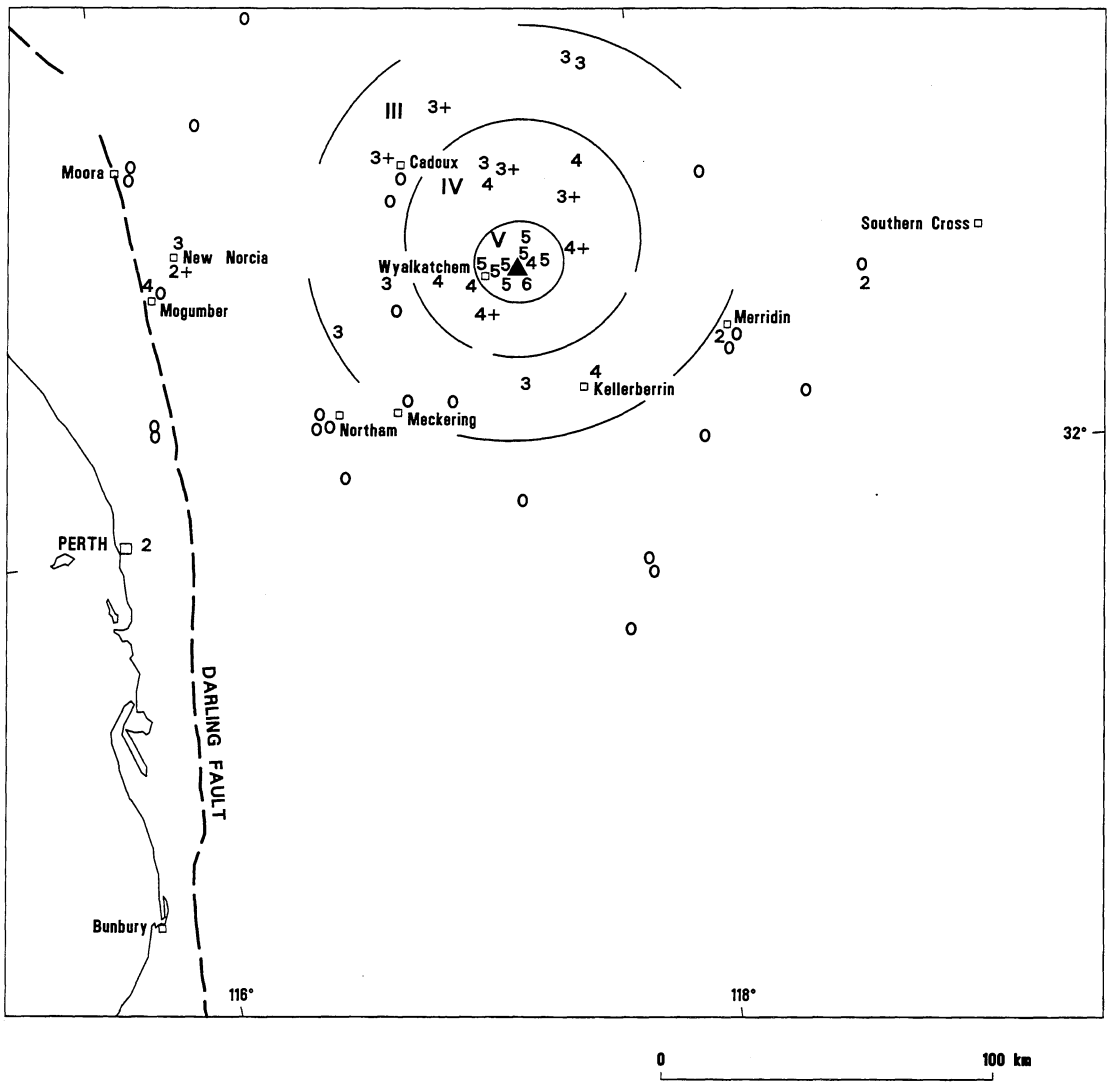


Figure 17.

24/H50-14/2

ISOSEISMAL MAP OF A WYALKATCHEM EARTHQUAKE, WESTERN AUSTRALIA, 6 JANUARY 1988



DATE:	6 January 1988
TIME:	03:42:08 UTC
MAGNITUDE:	4.3 ML (MUN)
EPICENTRE:	31.2°S 117.5°E
DEPTH:	2 km

▲	*Epicentre*
IV	*Zone intensity designation*
4	*Earthquake felt (MM)*
0	*Earthquake not felt*

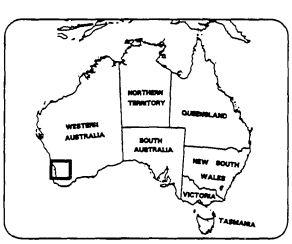
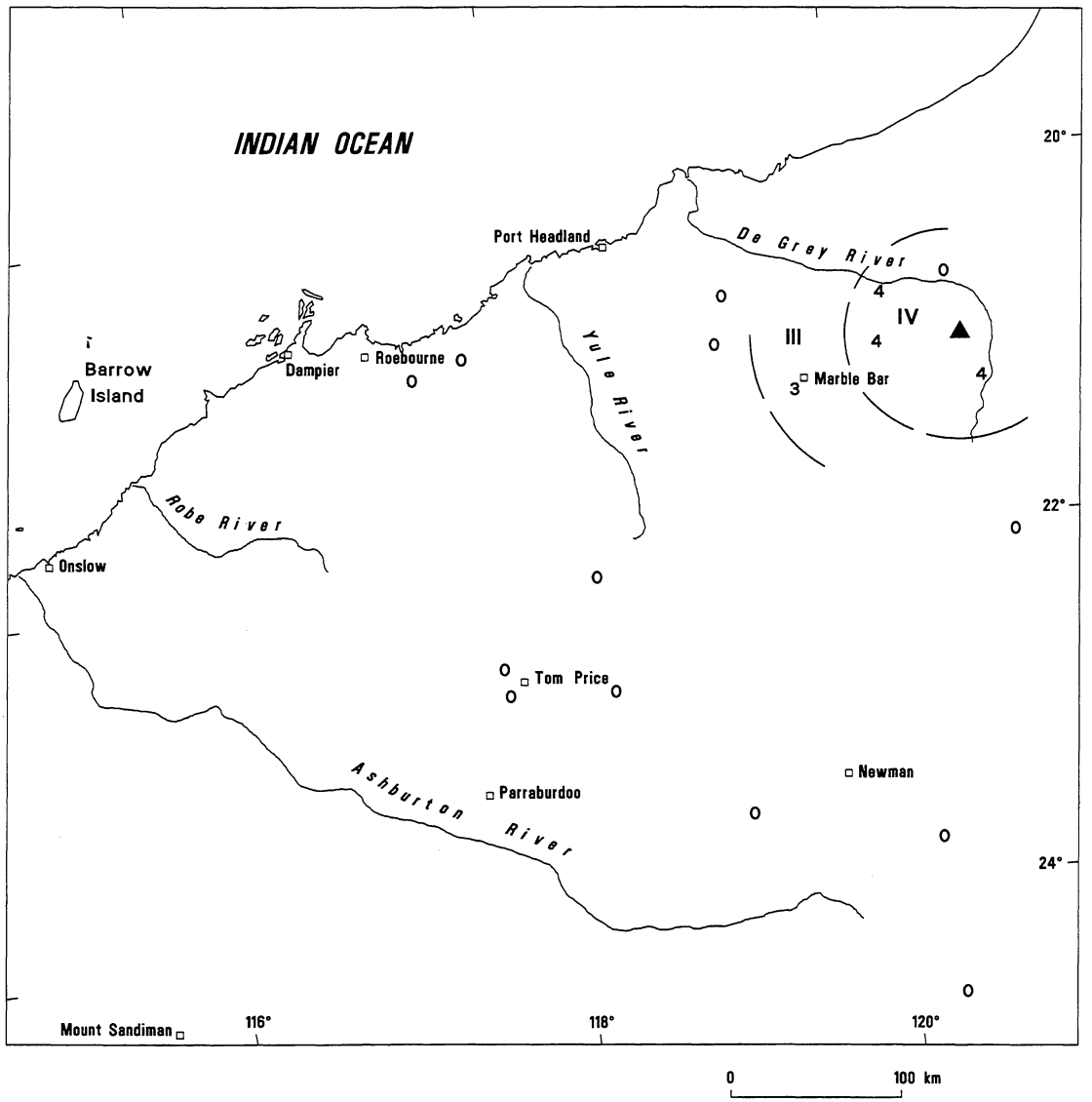


Figure 18.

24/H50/25

ISOSEISMAL MAP OF THE MARBLE BAR EARTHQUAKE, WESTERN AUSTRALIA, 28 JANUARY 1988



DATE:	28 January 1988
TIME:	01:56:17.5 UTC
MAGNITUDE:	5.0 ML (MUN)
EPICENTRE:	21.05°S 119.60°E
DEPTH:	5 km

▲	*Epicentre*
IV	*Zone intensity designation*
0	*Earthquake felt (MM)*
4	*Earthquake not felt*

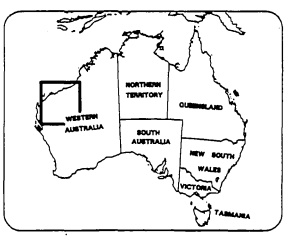
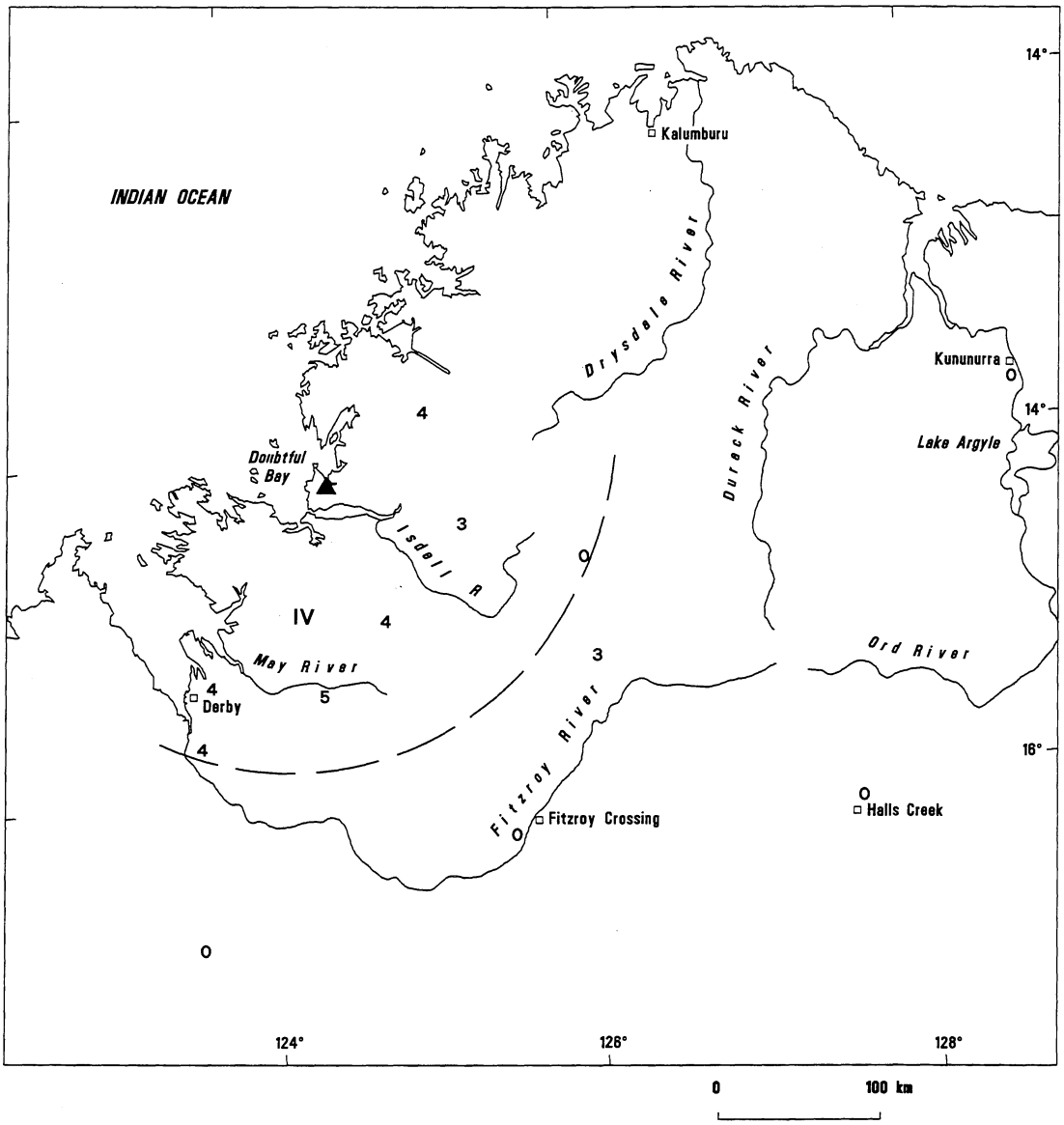


Figure 19.

24/150/7

ISOSEISMAL MAP OF THE DOUBTFUL BAY EARTHQUAKE, WESTERN AUSTRALIA, 6 FEBRUARY 1988



DATE: 6 February 1988
TIME: 05:23:58 UTC
MAGNITUDE: 5.7 ML (MUN)
EPICENTRE: 16.18°S 124.51°E

▲ *Epicentre*
IV *Zone intensity designation*
4 *Earthquake felt (MM)*
0 *Earthquake not felt*

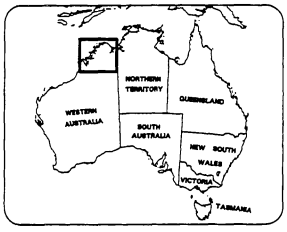
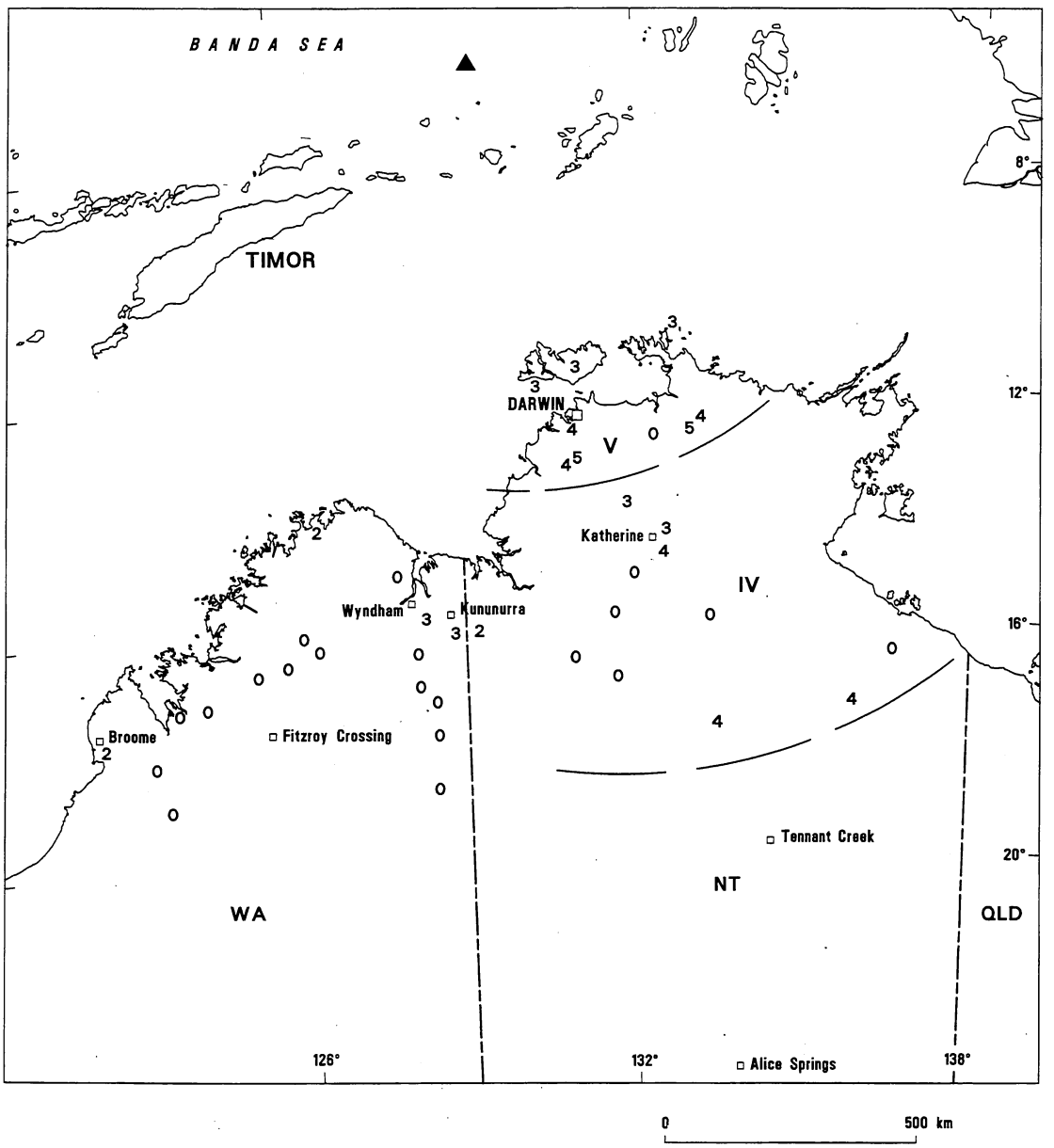


Figure 20.

24/E61/2

ISOSEISMAL MAP OF THE BANDA SEA EARTHQUAKE, INDONESIA, 30 MAY 1988



DATE:	30 May 1988
TIME:	21:11:11.3 UTC
MAGNITUDE:	6.5 MB (USGS)
EPICENTRE:	7.50°S 128.32°E
DEPTH:	86 km

▲	*Epicentre*
IV	*Zone intensity designation*
4	*Earthquake felt (MM)*
0	*Earthquake not felt*

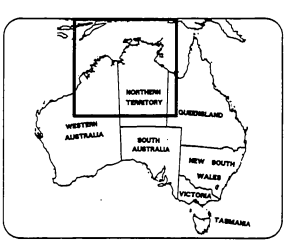
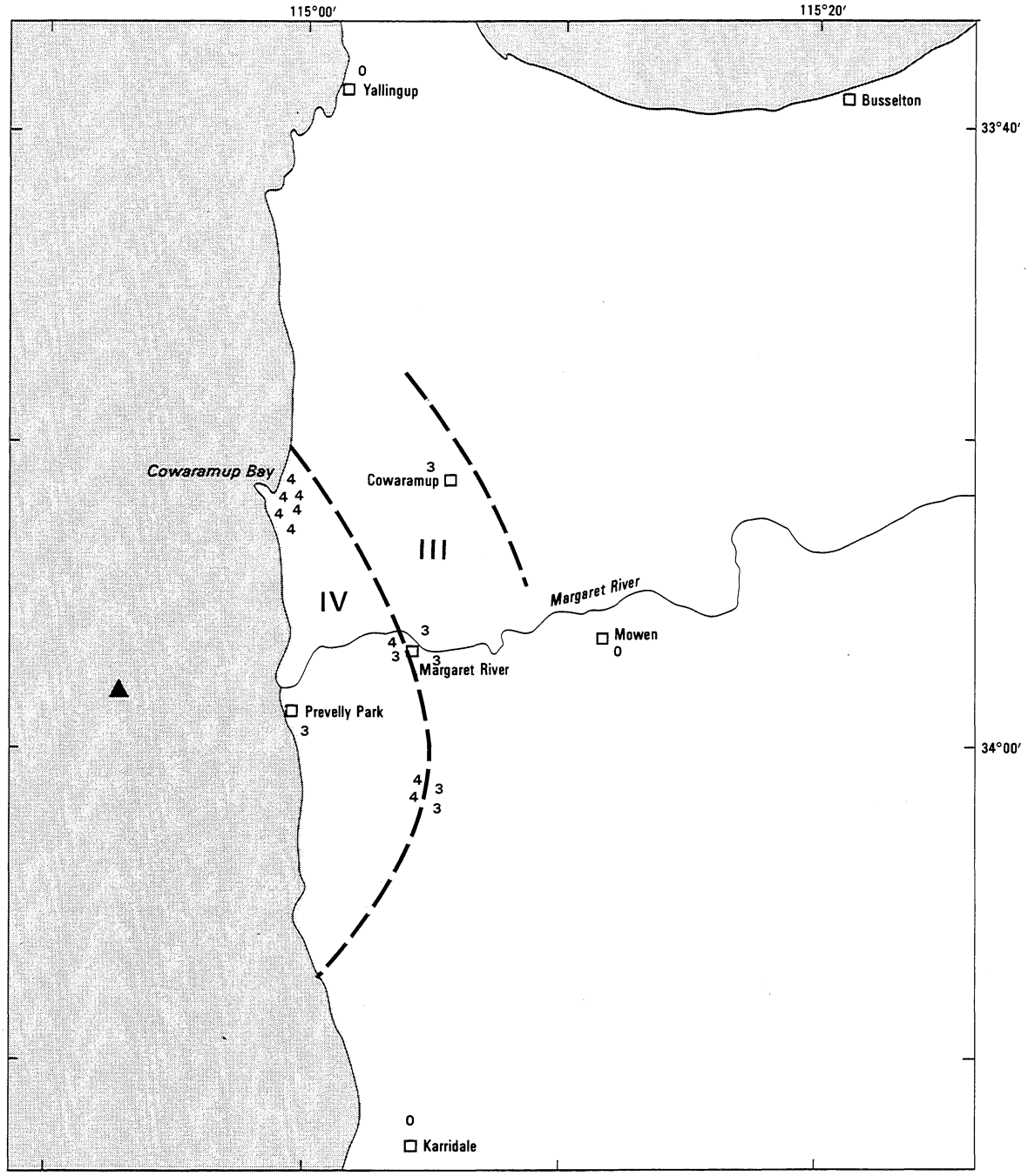


Figure 21.

24/0A/33

ISOSEISMAL MAP OF THE MARGARET RIVER EARTHQUAKE, WESTERN AUSTRALIA, 20 JULY 1989



DATE : *20 July 1989*
TIME : *09:29:24.5 UT*
MAGNITUDE : *3.2 ML (MUN)*
EPICENTRE : *34.0°S 114.9°E*

▲ *Epicentre*
IV *Zone Intensity Designation*
4 *Earthquake Felt (MM)*
0 *Earthquake Not Felt*

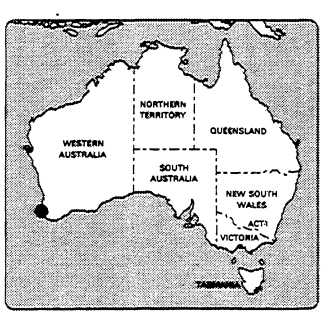
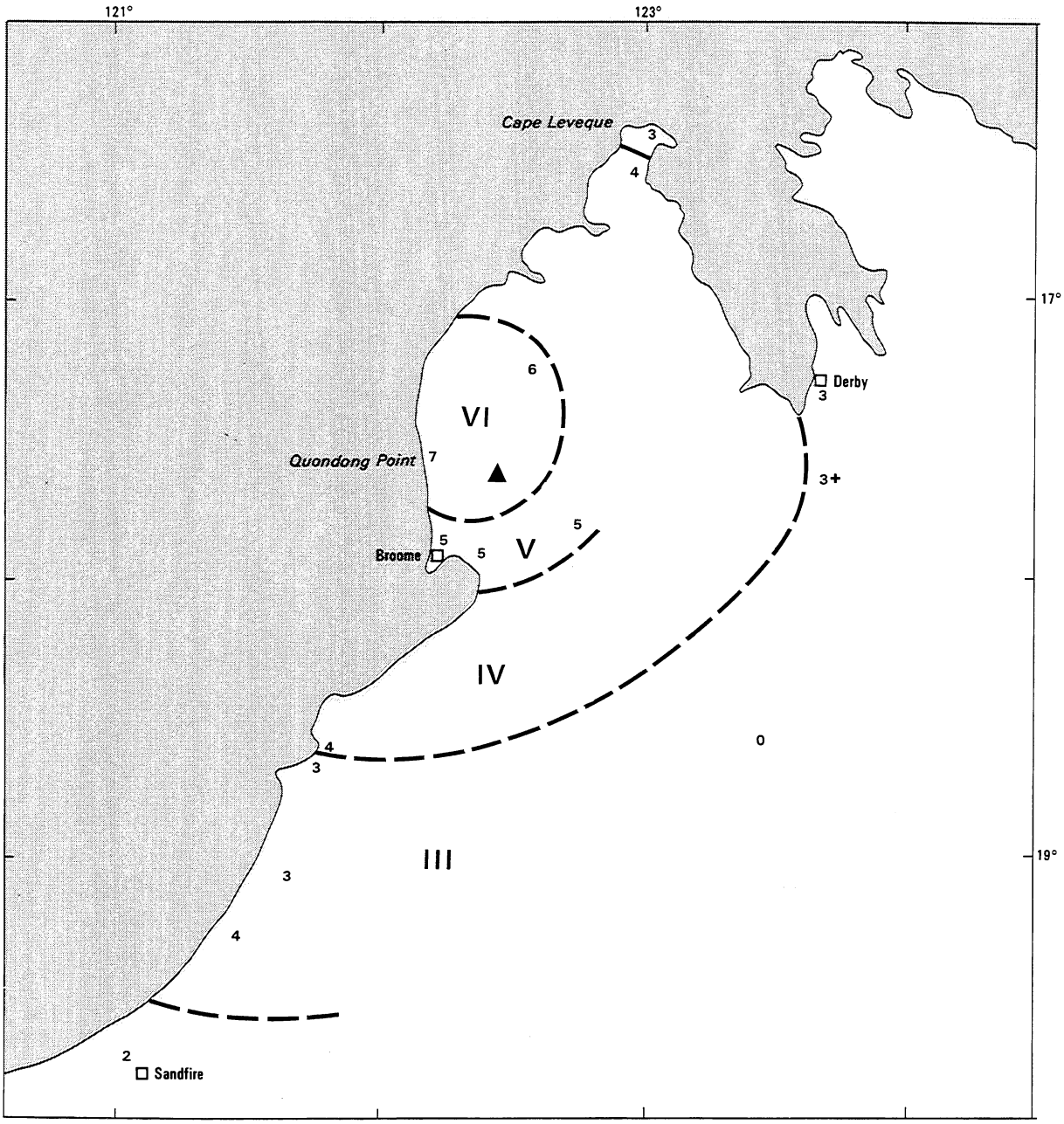


Figure 22.

24/150/6

ISOSEISMAL MAP OF THE BROOME EARTHQUAKE, WESTERN AUSTRALIA, 13 OCTOBER 1989



DATE : *13 October 1989*
TIME : *09:59:14.6 UT*
MAGNITUDE : *5.4 ML (MUN)*
EPICENTRE : *17.6°S 122.4°E*
DEPTH : *Crustal*

▲ *Epicentre*
IV *Zone Intensity Designation*
4 *Earthquake Felt (MM)*
0 *Earthquake Not Felt*

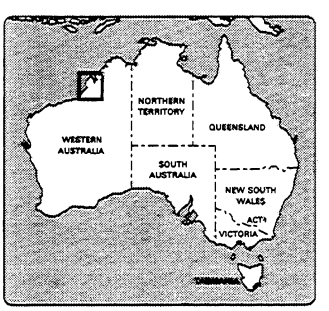


Figure 23.

24/E51/1

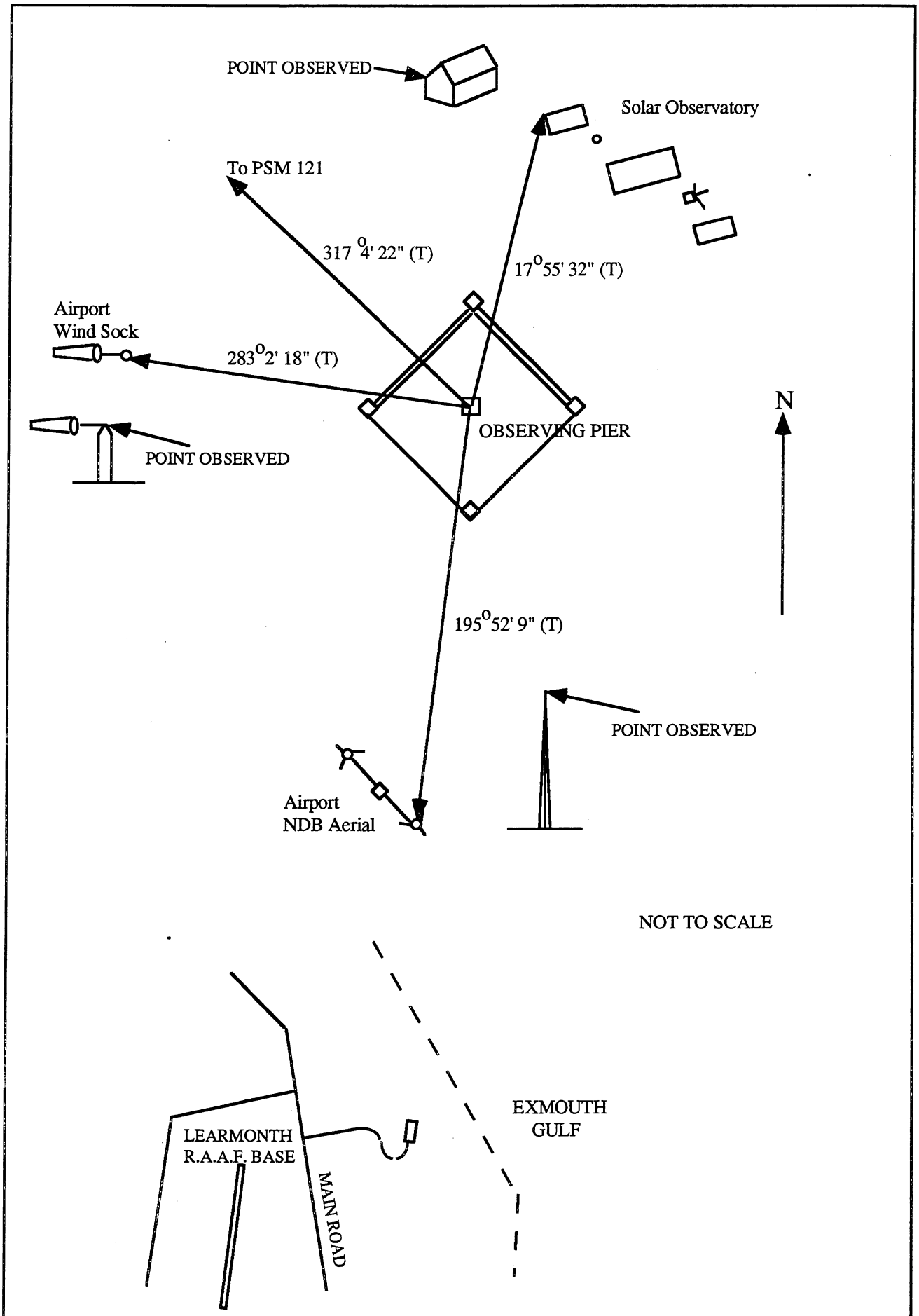


Figure 24 Azimuth of Reference Marks - Learmonth