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DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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The South Gippsland Earthquake of 20 June, 1969

by

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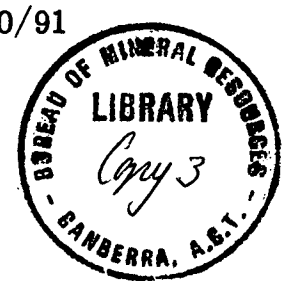

THE SOUTH GIPPSLAND EARTHQUAKE OF 20 JUNE 1969

by

J.R. WILKIE

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SUMMARY

The southern Gippsland area of Victoria was shaken by an earthquake of approximate magnitude 5 on 20th June 1969. USCGS results locate the epicentre at latitude 38.55°S, longitude 146.01°E, depth 19 km, and give an origin time of 11h 15m 31.5s Universal Time.

A maximum Modified Mercalli intensity of VI was experienced over a small area including the towns of Mirboo and Boolarra. The earthquake was felt in most Melbourne suburbs at MM intensity II - III.

1. INTRODUCTION

The South Gippsland earthquake of 20th June 1969, was felt widely throughout eastern Victoria and was reported to have been felt in the upper storeys of a building as far away as Canberra.

It was the most strongly felt earthquake that people in the area can remember and caused considerable public concern because it occurred at night and was followed by widespread blackouts. These were caused by the tripping of circuit breakers at Yallourn, Hazelwood, Morwell East, Leongatha, and Ferntree Gully.

The following extracts from newspaper reports indicate the severity with which the tremor was felt.

'A series of strong earth tremors shook most of Victoria from 9.16 last night. The shocks lasted for up to 45 seconds and in some areas were accompanied by a "whining and howling" noise.'

'There were power blackouts of up to 20 minutes in country areas and outer Melbourne suburbs. Crockery was smashed in kitchens and bottles tumbled from bar shelves.'

'Damage to buildings was apparently confined to isolated cracks in brick walls.'

'Some families ran into the streets.'

'Residents of Carrum ran out of their houses and lined the streets as police cars toured the area looking for signs of damage.'

Aftershocks were felt for several days after the initial tremor, the most severe being felt throughout Gippsland at 2.30 a.m. on 23rd June.

2. INVESTIGATION

The United States Coast and Geodetic Survey has determined the epicentre for the earthquake at latitude 38.55°S and longitude 146.01°E with a depth of 19 km, but from the interpretation of the returned questionnaires the epicentre is probably slightly to the northeast (38.4°, 146.2°).

The only magnitude information available is a surface wave magnitude of 4.8 determined from Port Moresby records. Because of the proximity to the earthquake and the high magnification of the Toolangi instruments (50,000 at 1 sec.) the short-period traces completely disappeared and were useful only to determine the P arrival time. Trace movement was also too fast to record on the insensitive visible recorder which is run in the Melbourne Office; it is connected to a Willmore seismometer at the old observatory site in the Botanic Gardens.

A reported crack in the ground between Dumbalk North and Mirboo appeared to have been a subsidence of a waterlogged road on the side of a steep hill which may or may not have been triggered by the tremor.

Postmasters in most eastern Victorian towns were requested to distribute questionnaires seeking information on the felt intensity of the earthquake. About 200 were returned out of approximately 480 distributed.

Plate 1 shows the resulting isoseismal map, which indicates that the tremor was felt over a radius of approximately 250 km. The earthquake was not felt along the northern coast of Tasmania but was detected at Flinders Island. The maximum Modified Mercalli intensity was VI and the intensity in most Melbourne suburbs was II or III.

The magnitude of aftershocks was very small and only one (2.30 a.m. 23rd June) was reported felt throughout Gippsland. There were at least 20 aftershocks during the three days that followed the main tremor.

3. DISCUSSION

The shape of the isoseismals is fairly well defined, but details of response in the area of the Mornington Peninsula and Phillip Island will need confirmation by future earthquake intensity surveys. The extension of the pattern to the northwest appears to indicate that the earthquake energy was least attenuated parallel to the fault lines which run northwest -southeast through this area. In South Gippsland, faults run northeast - southwest, and because of their complexity no particular fault can be associated with the present earthquake.

Higher intensities are associated with the sedimentary coastal areas to the southwest of the epicentre, and at Welshpool on the coast to the south, intensity VI, the same as the maximum intensity, was felt. No reports were received from Wilson's Promontory and consequently the IV - V isoseismal through this area has not been drawn. However, because most of the promontory is granitic rock it would record low intensities (Neumann, 1954), and the IV - V isoseismal would most likely have crossed the northern part.

Damage reports were confined to cracked plaster and chimneys, and broken crockery.

Sound was strongly associated with the arrival of the earthquake waves, and in some areas a sound like thunder was the only indication that the earthquake had occurred.

Except for a surface wave magnitude of 4.8 obtained from Port Moresby records, no instrumental estimate of the magnitude is available. However, a magnitude of approximately 5 is confirmed by intensity versus distance graphs for Canada (Milne & Davenport, 1969) which indicate that a maximum intensity of VI can be expected from a shallow magnitude 5 earthquake. A very weak P phase was recorded at Mundaring, which again suggests a body-wave magnitude not greater than 5.

Although the earthquake occurred in the most seismically active area of Victoria (Doyle, Everingham, & Sutton, 1968) insufficient data are available to make any statistical prediction of the probability of recurrence of an earthquake in any particular magnitude range.

Blake (1941) has shown how the focal depth can be estimated from the isoseismal radii. In this example the isoseismals are highly elongated and the method cannot be applied with consistency; however, the innermost curve suggests a depth of about 12 km, which agrees fairly well with the instrumental determination by USCGS. The isoseismal pattern suggests that the epicentre was close to latitude 38° 25.5'S, 146° 15.0'E.

Evidence obtained in Canada (Milne & Davenport, 1969) and United States (Neumann, 1954) indicates that the maximum acceleration experienced during the earthquake would be less than 0.1 g at a frequency of a few Hertz.

4. REFERENCES

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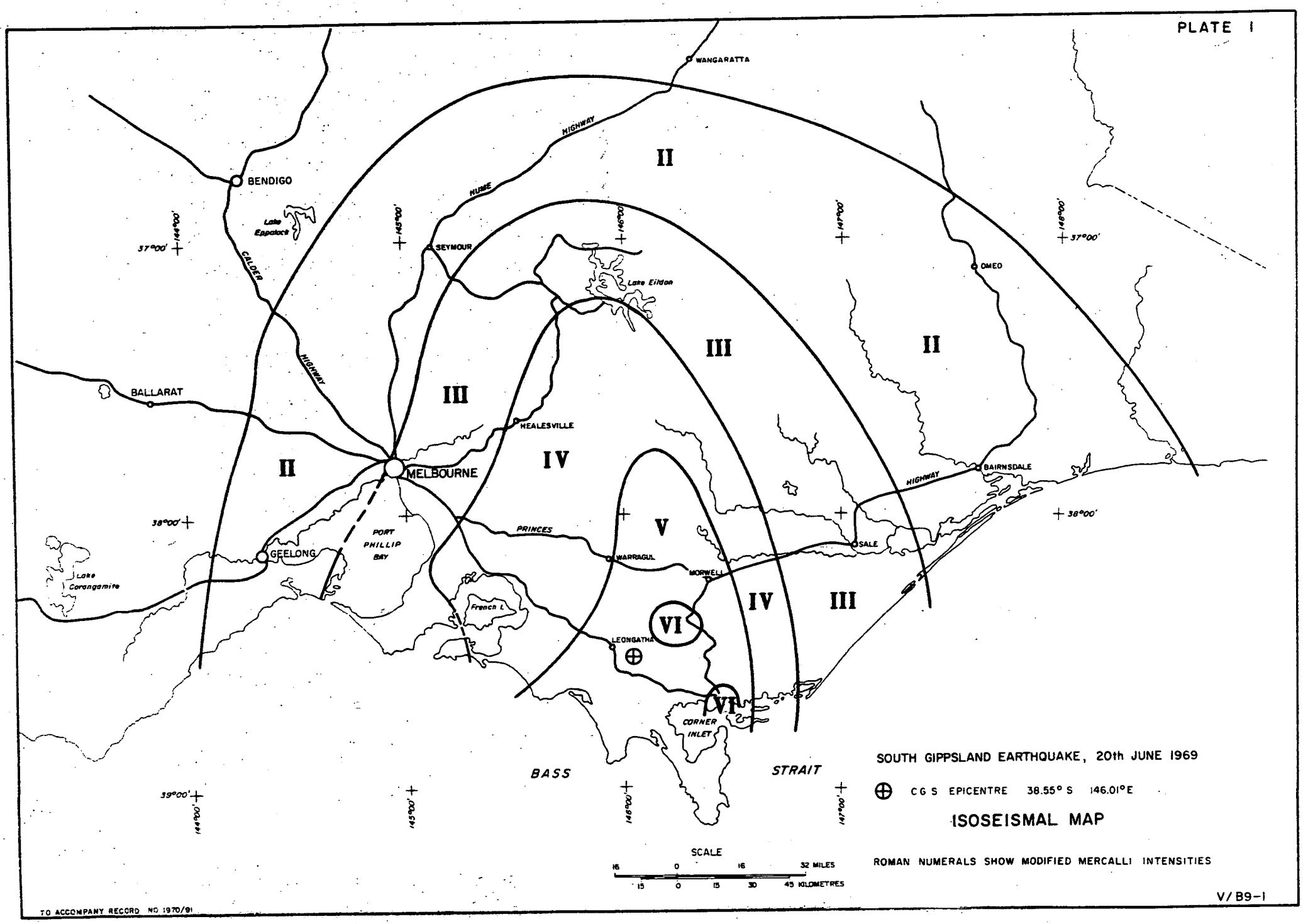
PLATE 1



SOUTH GIPPSLAND EARTHQUAKE, 20th JUNE 1969

⊕ C G S EPICENTRE 38.55° S 146.01° E

ISOSEISMAL MAP

ROMAN NUMERALS SHOW MODIFIED MERCALLI INTENSITIES

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