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# BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

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# SEISMICITY OF BOUGAINVILLE, 1960 - 1966

by

D. DENHAM

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## SUMMARY

A detailed analysis of earthquakes occurring in the Bougainville region during the period 1960-1966 reveals a high level of seismic activity. The largest earthquake occurring during this period has a magnitude of 6.8 and the maximum intensity reported was that of 7 on the Modified Mercalli scale at Buin in April 1964. It is recommended that earthquake risk should be considered in all building operations undertaken on Bougainville.

## 1. INTRODUCTION

Brooks (1965) has catalogued most of the earthquakes having a magnitude greater than 6 on the Richter scale that occurred in the Territory of Papua and New Guinea for the years 1906-1962. This report endeavours to examine in more detail the Bougainville region for the period 1960-1966.

Since 1960, World-wide Standard Seismographs have been set up at many stations throughout the world and this has enabled an analysis to be made of the majority of events having a magnitude of 5 or greater. In some areas such as the west coast of the United States it is possible to analyse all events down to a magnitude of 4. However, until more recording stations are installed in the Territory of Papua and New Guinea it will not be possible to examine all the shocks as small as this.

## 2. RESULTS

### Earthquake statistics

Data on the earthquakes occurring in the area of interest were compiled from the USCGS earthquake data reports from 1960 to 1966 and the seismicity evaluations carried out by Texas Instruments Inc. (1964a & b) for the years 1960 and 1963.

The results of the investigation are presented in Tables 1 and 2 and in Plates 1 to 4. In theory one would like to examine the distribution of the earthquakes, study the reports of felt intensities, and devise a simple empirical relationship between the size and location of the shock and the amount of shaking it will produce at the surface. As will be shown later this simple approach does not work very well in the Bougainville region.

Plate 1 shows the locations of all the earthquakes with magnitudes greater than 5 that occurred between January 1960 and December 1966. The largest event took place on 2nd February 1961; it had a magnitude of about 6.8 (CGS) and was felt over the whole of the island.

All magnitudes have been normalised to be compatible with those published by the United States Coast and Geodetic Survey in their preliminary bulletins. These values are about 0.3 of a magnitude smaller than the Richter magnitude and are derived from the amplitude of the first arrivals.

The overall north-westerly trend is clearly shown in Plate 1. Most of the earthquakes originate off-shore in a depth range of 10 to 500 km. There is no clear pattern in the depth distribution but the most frequent depth of occurrence is at about 70 km.

Table 1 lists all the known earthquakes in the Bougainville region from 1960 until the end of 1966. These include events having magnitudes larger and smaller than 5.0. The depths and magnitudes of some of the shocks are not known. Where a magnitude has not been determined it can usually be assumed that it is smaller than 5.0. Column six contains a list of places where the earthquakes were felt and the number in brackets is the felt intensity of the shaking on the Modified Mercalli scale (see Appendix ).

It is evident that only a small percentage of the earthquakes are reported as being felt. Whether this is due to poor reporting from the observers or whether it is a genuine effect cannot easily be determined yet.

Plate 2 contains a histogram of all the earthquakes listed in Table 1.

It is found that in most regions throughout the world the empirical relation

$$\mathrm{Log}_{10} N = a - bM$$

specifies fairly accurately the distribution of earthquakes for a given region (Gutenberg and Richter, 1954). N is the number of shocks with a magnitude in the range $M \pm \Delta M$ and a and b are constants. In Plate 2, $2\Delta M$ is 0.5 of a magnitude. It is seen that in the Bougainville area this relation holds down to $M = 5.0$; below this it seems probable that only a small percentage of the earthquakes are recorded by enough stations for an epicentral determination to be made. Hence below magnitude 5.0 the observed shocks fall below the line.

Plate 3 is a similar plot for the Bougainville earthquakes 1906-1962. This plot was obtained by abstracting the Bougainville events from Brooks' (1965) report. The magnitudes in Plate 3 are given on the Richter scale and hence each value is about 0.3 above the magnitude value in Plate 2. The slopes of the lines in both figures are almost identical, indicating that the above equation holds at least in the magnitude range 5.0 to 7.5 for the Bougainville area.

## Felt reports

Table 2 lists the felt reports forwarded either to the Rabaul Vulcanological Observatory or the Port Moresby Geophysical Observatory. Times are all in GMT and the latitudes and longitudes are those of the place reporting the shaking. The magnitudes are derived from body waves and the distance of the station reporting is given in kilometres, after having taken the depth of the earthquake into account.

The table indicates that many earthquakes are felt but were not large enough to be located by a sufficient number of stations for an epicentral determination to be made. However, all shocks that give rise to an intensity of 5 and over were large enough to be located.

One of the limitations of this type of presentation is that only a small number of places send in reports of felt tremors. Currently there are only about twenty observers in the Bougainville region. This means that only a poor coverage is at best obtained and in many cases the observers may not even send the reports in (this is a voluntary service and the observer may not be to hand at the time of the shock).

Plate 4 is a plot of the intensities observed from different shocks. One might hope to be able to contour the plotted intensities and thereby obtain an estimate for the maximum intensity to be expected from an earthquake of a certain size and located in a certain position. However, as the diagram shows no such simple relation exists.

## 3. CONCLUSIONS

In the years 1960-1966 at least eight earthquakes took place to give rise to intensities of 5 and above on the Modified Mercalli scale, the maximum intensity reported being that of 7 at Buin in April 1964. The maximum felt intensity reported since 1906 was one of 8 and it is thought that in designing buildings to last 50 years, protection should be incorporated for them to withstand a shaking to at least this value.

## 4. REFERENCES

BROOKS, J.A. 1965 Earthquake activity and seismic risk in Papua and New Guinea. Bur.Min.Resour.Aust.Rep. 74.

TEXAS INSTRUMENTS INC. 1964a Final report on evaluation of 1960 seismicity. Contract AF 19(604) - 8517.

TEXAS INSTRUMENTS INC. 1964b Evaluation of 1963 seismicity. Contract No. AF(604) - 8517

GUTENBERG, B and RICHTER, C.F. 1954 SEISMICITY OF THE EARTH AND ASSOCIATED PHENOMENA. Princeton University Press.

## APPENDIX

## MODIFIED MERCALLI INTENSITY SCALE OF 1931

(Abridged and rewritten)

I. Not felt. Marginal and long period effects of large earthquakes (for details see text).

II. Felt by persons at rest, on upper floors, or favourably placed.

III. Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognised as an earthquake.

IV. Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV wooden walls and frame creak.

V. Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.

VI. Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle - CRF).

VII. Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments - CRF). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.

VIII. Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed pilings broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.

IX. General panic. Masonry D destroyed, masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations - CRF). Frame structures, if not bolted shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated areas sand and mud ejected, earthquake fountains, sand craters.

X. Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.

XI. Rails bent greatly. Underground pipelines completely out of service.

XII. Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

TABLE 1

Bougainville earthquakes 1960-1966

(Epicentres located within range 5°-7.5°S and 154°-156°E)

| Date | | Lat. (°S) | Long. (°E) | Depth (km) | Magnitude (CGS) | Felt reports (and intensities) |
|---|---|---|---|---|---|---|
| 1960 | | | | | | |
| Jan. | 12 | 5.0 | 154.0 | | 5.6 | |
| Feb. | 3 | 7.0 | 154.5 | | 5.1 | |
| | 6 | 5.0 | 155.0 | | 4.7 | |
| | 8 | 5.5 | 155.0 | | 5.0 | |
| | 8 | 5.0 | 155.0 | 100 | 5.4 | |
| | 9 | 5.0 | 155.0 | | 5.0 | |
| | 11 | 6.0 | 155.0 | 100 | 5.3 | |
| | 14 | 5.5 | 155.5 | | 4.5 | |
| | 14 | 5.0 | 154.5 | | 5.7 | |
| | 16 | 6.5 | 154.5 | | 5.2 | |
| | 23 | 6.0 | 154.5 | | 5.6 | |
| | 23 | 6.4 | 154.2 | | 6.2 | |
| | 24 | 7.2 | 155.8 | | 6.6 | Kieta (iii)<br>Numa Numa (ii) |
| | 25 | 7.0 | 154.0 | 300 | 4.3 | |
| | 27 | 7.0 | 156.0 | 150 | 5.1 | |
| Mar. | 3 | 7.0 | 156.0 | | 5.0 | |
| | 23 | 7.0 | 155.0 | | 5.2 | |
| | 24 | 6.5 | 156.0 | 200 | 5.1 | |
| April | 23 | 6.0 | 154.5 | | 5.0 | |
| May | 9 | 7.0 | 155.0 | | 5.2 | |
| July | 6 | 5.5 | 155.0 | | 5.1 | |
| Sept. | 3 | 6.1 | 154.5 | 457 | 5.9 | Karoola (v) |
| | 14 | 6.5 | 155.1 | 100 | 4.9 | |
| | 17 | 6.3 | 154.5 | 134 | 4.7 | |
| Oct. | 4 | 7.5 | 155.3 | 134 | 5.3 | |
| | 18 | 7.5 | 156.0 | 33 | 5.3 | |
| | 25 | 6.8 | 155.1 | 145 | 4.3 | |
| | 27 | 6.4 | 154.7 | 118 | 4.5 | |
| Dec. | 22 | 6.9 | 155.3 | 469 | 5.9 | |
| 1961 | | | | | | |
| Jan. | 27 | 6.4 | 154.9 | 23 | 5.6 | |
| Feb. | 6 | 6.8 | 155.3 | 59 | 6.8 | Boku (vi)<br>Buin (vi)<br>Karoola (v)<br>Sohano (iii) |

| Date | | Lat.($^oS$) | Long. ($^oE$) | Depth (km) | Magnitude (CGS) | Felt reports (and intensities) |
|---|---|---|---|---|---|---|
| Feb. | 6 | 6.4 | 155.0 | 25 | 5.2 | |
| | 8 | 7.2 | 154.7 | 140 | ? | |
| | 13 | 6.9 | 155.7 | 25 | 4.5 | |
| | 14 | 6.2 | 154.1 | 126 | 4.5 | |
| | 16 | 6.9 | 155.1 | 162 | ? | |
| | 21 | 6.9 | 155.7 | 83 | ? | |
| Mar. | 2 | 6.5 | 155.8 | 138 | ? | |
| | 11 | 6.0 | 155.8 | 85 | ? | |
| | 11 | 6.8 | 155.2 | 104 | 4.9 | |
| | 12 | 5.3 | 155.4 | 64 | 4.7 | Karoola (iii) |
| | 23 | 6.6 | 155.2 | 60 | ? | |
| May | 7 | 6.1 | 154.4 | 123 | 6.4 | |
| | 7 | 7.0 | 154.8 | 171 | ? | |
| | 9 | 6.2 | 154.5 | 110 | 5.1 | |
| | 13 | 6.7 | 154.7 | 192 | ? | |
| | 20 | 5.5 | 154.5 | 81 | ? | |
| Jun. | 12 | 6.9 | 155.0 | 110 | 5.2 | |
| Aug. | 16 | 6.7 | 156.0 | 55 | ? | |
| | 13 | 6.0 | 154.8 | 111 | 4.8 | |
| | 20 | 6.3 | 155.4 | 72 | 5.0 | |
| Sept. | 15 | 6.8 | 155.3 | 68 | ? | |
| Oct. | 4 | 5.4 | 154.2 | 204 | 5.1 | |
| | 10 | 5.4 | 154.3 | 154 | ? | Karoola (iii) |
| Nov. | 19 | 7.0 | 154.8 | 85 | 5.2 | |
| | 25 | 6.3 | 154.8 | 83 | 6.2 | |
| Dec. | 7 | 6.8 | 155.2 | 62 | 4.8 | |
| | 8 | 6.7 | 155.0 | 54 | 4.8 | |
| | 29 | 6.3 | 154.5 | 44 | 5.3 | |
| <u>1962</u> | | | | | | |
| Mar. | 8 | 6.6 | 154.5 | 67 | ? | |
| | 9 | 6.4 | 154.7 | 117 | ? | |
| | 24 | 6.7 | 155.3 | 53 | ? | |
| Apr. | 24 | 5.8 | 154.6 | 92 | ? | |
| May. | 19 | 6.3 | 155.0 | 70 | ? | |
| June | 8 | 7.3 | 155.7 | 54 | ? | |
| | 21 | 7.0 | 155.7 | 69 | ? | |
| Aug. | 22 | 6.4 | 154.1 | 179 | ? | |
| | 27 | 5.7 | 154.9 | 370 | ? | |
| Nov. | 20 | 6.1 | 154.9 | 69 | 5.4 | Karoola (iv) |
| <u>1963</u> | | | | | | |
| Jan | 1 | 6.2 | 156.0 | 308 | 6.3 | |
| | 1 | 6.9 | 155.5 | 82 | ? | |
| | 3 | 6.9 | 155.2 | 91 | 5.4 | Boku (iv) |
| | 3 | 5.9 | 155.0 | 99 | 5.4 | |

| Date | | Lat. (°S) | Long. (°E) | Depth (km) | Magnitude (CGS) | Felt reports (and intensities) |
|---|---|---|---|---|---|---|
| Jan. | 7 | 6.4 | 154.7 | 80 | 5.4 | Boku (iv) |
| Feb. | 2 | 7.1 | 155.7 | 96 | ? | |
| | 20 | 6.3 | 154.0 | 37 | 5.1 | |
| Apr. | 22 | 5.1 | 154.1 | 132 | 5.2 | |
| May | 13 | 5.5 | 154.6 | 387 | 5.1 | |
| | 26 | 6.9 | 155.6 | 87 | 5.0 | |
| June | 22 | 6.1 | 154.5 | 64 | 4.9 | |
| | 25 | 7.2 | 154.8 | 207 | 4.8 | |
| July | 24 | 9.7 | 154.4 | 16 | 5.2 | |
| Aug. | 3 | 7.6 | 156.8 | 402 | 5.1 | |
| Sept. | 2 | 6.0 | 154.8 | 321 | 4.2 | |
| Nov. | 2 | 6.2 | 154.4 | 63 | 5.9 | |
| | 22 | 6.1 | 154.3 | 78 | 4.7 | |
| Dec. | 1 | 4.6 | 154.8 | 479 | 4.6 | |
| | 10 | 7.1 | 155.5 | 88 | 4.6 | |
| | 14 | 7.1 | 155.7 | 95 | 4.5 | |
| | 21 | 7.3 | 155.1 | 133 | 4.3 | |
| | 29 | 6.2 | 155.5 | 50 | 5.2 | |
| 1964 | | | | | | |
| Jan. | 8 | 6.9 | 155.3 | 101 | 4.2 | |
| | 15 | 7.1 | 154.8 | 55 | 4.9 | |
| | 24 | 5.9 | 154.0 | 85 | 5.4 | |
| Feb. | 7 | 5.8 | 154.0 | 77 | 4.6 | |
| | 11 | 7.1 | 154.5 | 78 | | |
| Mar. | 1 | 7.1 | 155.4 | 100 | 4.8 | Buin (v-vi) |
| | 3 | 6.0 | 154.6 | 422 | 4.8 | |
| | 6 | 6.1 | 154.4 | 74 | 5.8 | |
| | 13 | 7.0 | 155.5 | 95 | 4.5 | Buin (v) |
| | 29 | 6.7 | 155.1 | 68 | 5.3 | |
| Apr. | 7 | 6.8 | 155.1 | 35 | 4.6 | |
| | 16 | 7.0 | 155.7 | 78 | 5.4 | Kieta (iii) |
| | 17 | 6.6 | 154.9 | 83 | 5.4 | Buin (vii)<br>Kieta (iv) |
| | 23 | 6.7 | 155.0 | 72 | 5.0 | |
| | 23 | 6.6 | 155.1 | 60 | 5.3 | Buin (v) |
| | 25 | 6.7 | 155.0 | 72 | 5.1 | |
| | 29 | 7.2 | 155.7 | 78 | 5.2 | |
| June | 16 | 5.8 | 154.0 | 60 | 5.7 | |
| | 24 | 7.1 | 155.6 | 123 | 5.0 | |
| July | 8 | 6.4 | 154.8 | 73 | 5.1 | |
| | 6 | 6.3 | 154.7 | 49 | 6.4 | |
| | 24 | 6.6 | 154.8 | 62 | 5.6 | |
| | 20 | 6.7 | 154.6 | 78 | 5.0 | |
| | 30 | 6.0 | 154.4 | 79 | 4.8 | |
| Aug. | 10 | 6.2 | 154.5 | 105 | 5.7 | |
| | 11 | 5.8 | 154.1 | 425 | 5.3 | |
| | 13 | 5.4 | 154.3 | 383 | 6.0 | |
| | 10 | 6.4 | 154.2 | 166 | 4.7 | |

| Date | | Lat. ($^{o}$S) | Long. ($^{o}$E) | Depth (km) | Magnitude (CGS) | Felt reports (and intensities |
|---|---|---|---|---|---|---|
| Sept. | 5 | 5.8 | 154.0 | 69 | 6.4 | |
| Oct. | 7 | 6.8 | 155.2 | 70 | 5.5 | |
| | 8 | 6.5 | 154.4 | 74 | 5.2 | |
| | 15 | 6.6 | 154.8 | 62 | 5.1 | |
| | 17 | 7.0 | 155.8 | 58 | 4.7 | Buin (v) |
| | 28 | 6.4 | 154.7 | 90 | 4.9 | |
| | 28 | 6.8 | 155.1 | 85 | 4.8 | |
| Nov. | 21 | 6.7 | 154.3 | 103 | 4.9 | |
| Dec. | 21 | 5.9 | 154.3 | 40 | 4.8 | |
| | 29 | 6.2 | 155.5 | 50 | 5.2 | Kieta (iv) |
| | 31 | 7.4 | 156.0 | 48 | 4.8 | |
| <u>1965</u> | | | | | | |
| Jan. | 5 | 6.3 | 154.3 | 10 | 5.1 | Kieta (iv) |
| | 10 | 5.6 | 154.5 | 126 | 5.0 | |
| | 11 | 6.5 | 154.4 | 100 | 5.3 | |
| | 27 | 6.7 | 154.7 | 49 | 4.7 | |
| | 28 | 6.1 | 154.4 | 45 | 4.9 | |
| Feb. | 4 | 5.7 | 154.4 | 183 | 4.3 | |
| Mar. | 30 | 6.4 | 154.5 | 70 | 5.2 | |
| Apr. | 16 | 6.3 | 154.7 | 127 | 5.8 | |
| | 14 | 5.4 | 154.1 | 166 | 5.0 | |
| | 28 | 7.2 | 155.0 | 143 | 4.7 | |
| May | 19 | 6.8 | 154.7 | 73 | 5.0 | |
| June | 3 | 6.2 | 155.0 | 123 | 4.2 | Torokina (iii) |
| July | 26 | 7.4 | 155.9 | 48 | 4.9 | |
| | 27 | 6.8 | 155.1 | 86 | 5.5 | Torokina (iii)<br>Buin (iii) |
| Sept. | 16 | 5.5 | 154.2 | 133 | 5.3 | |
| | 15 | 6.4 | 154.0 | 76 | 5.0 | |
| | 17 | 6.9 | 154.6 | 168 | 4.7 | |
| | 19 | 5.5 | 154.4 | 116 | 5.6 | |
| Oct. | 8 | 7.1 | 154.9 | 85 | 5.1 | |
| | 10 | 6.7 | 155.0 | 109 | 4.7 | |
| | 16 | 6.9 | 154.6 | 84 | 4.9 | |
| | 18 | 6.9 | 154.3 | 131 | 4.8 | |
| | 19 | 6.8 | 154.2 | 167 | 4.4 | |
| Dec. | 29 | 6.6 | 155.0 | 68 | 5.4 | |
| <u>1966</u> | | | | | | |
| Jan. | 10 | 6.6 | 154.5 | 64 | 5.2 | Buin (ii-iii) |
| | 11 | 6.8 | 155.2 | 69 | 5.0 | Buin (ii-iii) |
| Feb. | 5 | 7.1 | 155.4 | 70 | 5.0 | Torokina (ii) |
| | 4 | 7.1 | 155.1 | 88 | 5.0 | |

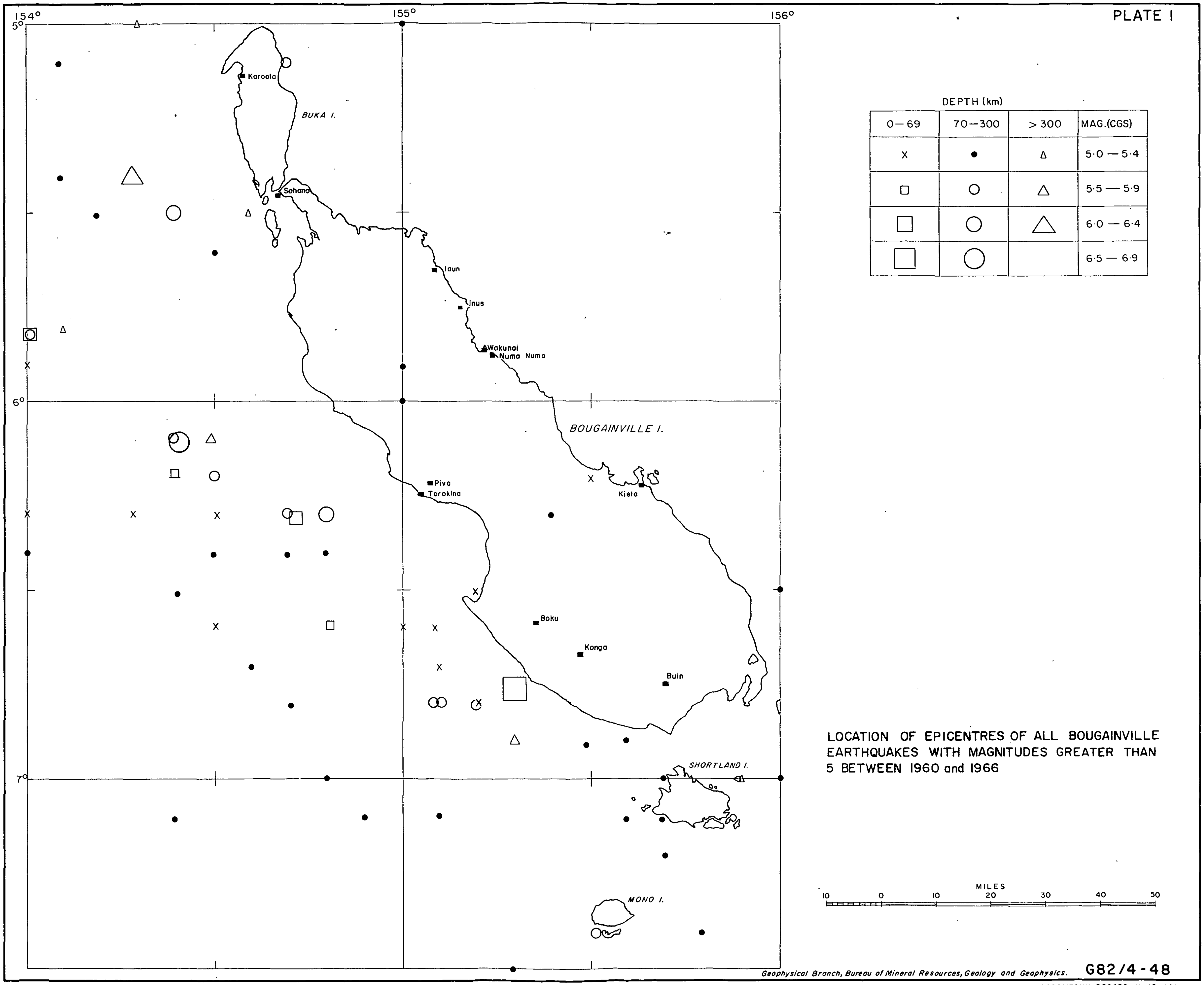
| Date | | Lat. (°S) | Long. (°E) | Depth (km) | Magnitude (CGS) | Felt reports (and intensities |
|---|---|---|---|---|---|---|
| May | 22 | 7.4 | 155.5 | 83 | 5.6 | Buin (iv-v) |
| | 23 | 7.4 | 155.8 | 111 | 5.4 | |
| July | 7 | 6.2 | 154.5 | 46 | 4.4 | |
| | 21 | 5.0 | 154.3 | 415 | 5.0 | |
| Aug. | 28 | 4.6 | 155.2 | 509 | 5.6 | |
| Sept. | 7 | 5.1 | 154.7 | 77 | 5.5 | Wakunai (iv) |
| Oct. | 14 | 6.0 | 154.6 | 224 | 4.5 | |
| | 23 | 6.4 | 155.2 | 34 | 5.0 | Iaun (iii)<br>Buin (ii) |
| Nov. | 28 | 7.4 | 154.8 | 13 | 5.0 | |
| Dec. | 4 | 6.4 | 154.4 | 87 | 4.7 | |
| | 21 | 6.7 | 154.9 | 89 | 4.8 | |

TABLE 2

Shocks felt in Bougainville

| Date | Time | Locality | Intensity | Lat. (°S) | Long. (°E) | Distance from origin (km) | Magnitude (CGS) |
|---|---|---|---|---|---|---|---|
| 4. 2.60 | 0347 | Sohano | iv | 05°20' | 154°40' | | |
| 4. 2.60 | 0347 | Kieta | iii | 06 15 | 155 40 | | |
| 4. 2.60 | 0347 | Numa Numa | iv | 05 50 | 155 15 | | |
| 4. 2.60 | 0347 | Inus | iii | 05 40 | 155 10 | | |
| 24. 2.60 | 2138 | Numa Numa | ii | 05 50 | 155 15 | | |
| 24. 2.60 | 2138 | Kieta | iii | 06 15 | 155 40 | | |
| 3. 9.60 | 0822 | Karoola | v | 05 10 | 154 35 | 470 | 5.9 |
| 24.11.60 | 0450 | Karoola | iv | 05 10 | 154 35 | | |
| 6. 2.61 | 2146 | Sohano | ii-iii | 05 25 | 154 40 | 180 | 6.8 |
| 6. 2.61 | 2146 | Karoola | v | 05 10 | 154 35 | 210 | 6.8 |
| 6. 2.61 | 2146 | Buin | vi | 06 50 | 155 45 | 90 | 6.8 |
| 6. 2.61 | 2146 | Boku | vi | 06 35 | 155 20 | 70 | 6.8 |
| 12. 3.61 | 0409 | Karoola | iii | 05 10 | 154 35 | 110 | 4.7 |
| 10.10.61 | 0826 | Karoola | iii | 05 10 | 154 35 | 180 | 4.2 |
| 12. 3.61 | 0409 | Karoola | iii | 05 10 | 154 35 | 110 | 4.7 |
| 11. 2.62 | 1855 | Boku | iv | 06 35 | 155 20 | | |
| 20.11.62 | 1011 | Karoola | iv | 05 10 | 154 35 | 120 | 5.4 |
| 3. 1.63 | 1357 | Boku | iv | 06 35 | 155 20 | 100 | 5.4 |
| 7. 1.63 | 0625 | Boku | iv | 06 35 | 155 20 | 110 | 5.4 |
| 1. 3.64 | 0241 | Buin | v-vi | 06 50 | 155 45 | 180 | 4.8 |
| 13. 3.64 | 1336 | Buin | v | 06 51 | 155 44 | 100 | 4.5 |
| 16. 4.64 | 1406 | Kieta | iii | 06 13 | 155 38 | 120 | 5.4 |
| 17. 4.64 | 0600 | Buin | vii | 06 51 | 155 44 | 130 | 5.4 |
| 17. 4.64 | 0600 | Kieta | iv | 06 13 | 155 38 | 130 | 5.4 |
| 17. 4.64 | 0921 | Buin | iii | 06 51 | 155 44 | | |
| 17. 4.64 | 0921 | Kieta | i | 06 13 | 155 38 | | |
| 19. 4.64 | 1655 | Buin | iii-iv | 06 51 | 155 44 | | |
| 23. 4.64 | 0337 | Buin | v | 06 51 | 155 44 | 110 | 5.0 |
| 17.10.64 | 0139 | Buin | v | 06 51 | 155 44 | 60 | 4.7 |
| 29.12.64 | 2323 | Kieta | iv | 06 13 | 155 38 | 50 | 5.2 |
| 30.12.64 | 0015 | Kieta | ii | 06 13 | 155 38 | | |
| 30.12.64 | 0146 | Kieta | iv | 06 13 | 155 38 | | |
| 30.12.64 | 1835 | Kieta | iii | 06 13 | 155 38 | | |
| 6. 1.65 | 1924 | Kieta | iv | 06 13 | 155 38 | 150 | 5.1 |
| 3. 6.65 | 1438 | Torokina | iii | 06 14 | 155 03 | 120 | 4.2 |
| 18. 6.65 | 1110 | Buin | i-ii | 06 51 | 155 44 | | |
| 18. 6.65 | 1300 | Buin | i-ii | 06 51 | 155 44 | | |
| 18. 6.65 | 0536 | Buin | i-ii | 06 51 | 155 44 | | |
| 28. 6.65 | 0334 | Sohano | iii | 05 27 | 154 40 | | |
| 5. 7.65 | 1330 | Buin | iii | 06 51 | 155 44 | | |

| Date | Time | Locality | Intensity | Lat. (°S) | Long. (°E) | Distance from origin (km) | Magnitude (CGS) |
|---|---|---|---|---|---|---|---|
| 16. 7.65 | 1855 | Buin | i-ii | 06°51' | 155°44' | | |
| 27. 7.65 | 1030 | Buin | i-ii | 06 51 | 155 44 | 110 | 5.5 |
| 27. 7.65 | 1554 | Torokina | iii | 06 14 | 155 03 | 130 | 5.5 |
| 27. 7.65 | 1700 | Buin | ii-iii | 06 51 | 155 44 | | |
| 10. 1.66 | 1547 | Buin | ii-iii | 06 51 | 155 44 | 150 | 5.2 |
| 11. 1.66 | 0955 | Torokina | ii | 06 14 | 155 03 | | |
| 11. 1.66 | 0953 | Buin | ii-iii | 06 51 | 155 44 | 180 | 5.0 |
| 11. 1.66 | 1615 | Torokina | iii | 06 14 | 155 03 | | |
| 5. 2.66 | 0415 | Torokina | ii | 06 14 | 155 03 | 130 | 5.0 |
| 5. 2.66 | 2215 | Torokina | iii | 06 14 | 155 03 | | |
| 5. 2.66 | 2215 | Buin | ii-iii | 06 51 | 155 44 | | |
| 28. 3.66 | 2315 | Buin | ii-iii | 06 51 | 155 44 | | |
| 22. 5.66 | 0253 | Buin | iv-v | 06 51 | 155 44 | 110 | 5.6 |
| 22. 5.66 | 0326 | Buin | iii | 06 51 | 155 38 | | |
| 14. 6.66 | 1208 | Piva | iii | 06 14 | 155 03 | | |
| 14. 6.66 | 1515 | Piva | iii | 06 14 | 155 03 | | |
| 24. 6.66 | 0257 | Piva | iv | 06 14 | 155 03 | | |
| 26. 8.66 | 1121 | Torokina | iii | 06 14 | 155 03 | | |
| 29. 8.66 | 1925 | Torokina | ii | 06 14 | 155 03 | | |
| 7. 9.66 | 1555 | Wakunai | iv | 05 52 | 155 13 | 130 | 5.5 |
| 1.10.66 | 0410 | Buin | ii | 06 51 | 155 38 | | |
| 23.10.66 | 0915 | Buin | ii | 06 51 | 155 38 | 80 | 5.0 |
| 23.10.66 | 0917 | Iaun | iii | 05 40 | 155 07 | 100 | 5.0 |
| 29.10.66 | 0710 | Konga | iv | 06 42 | 155 38 | 70 | 4.6 |

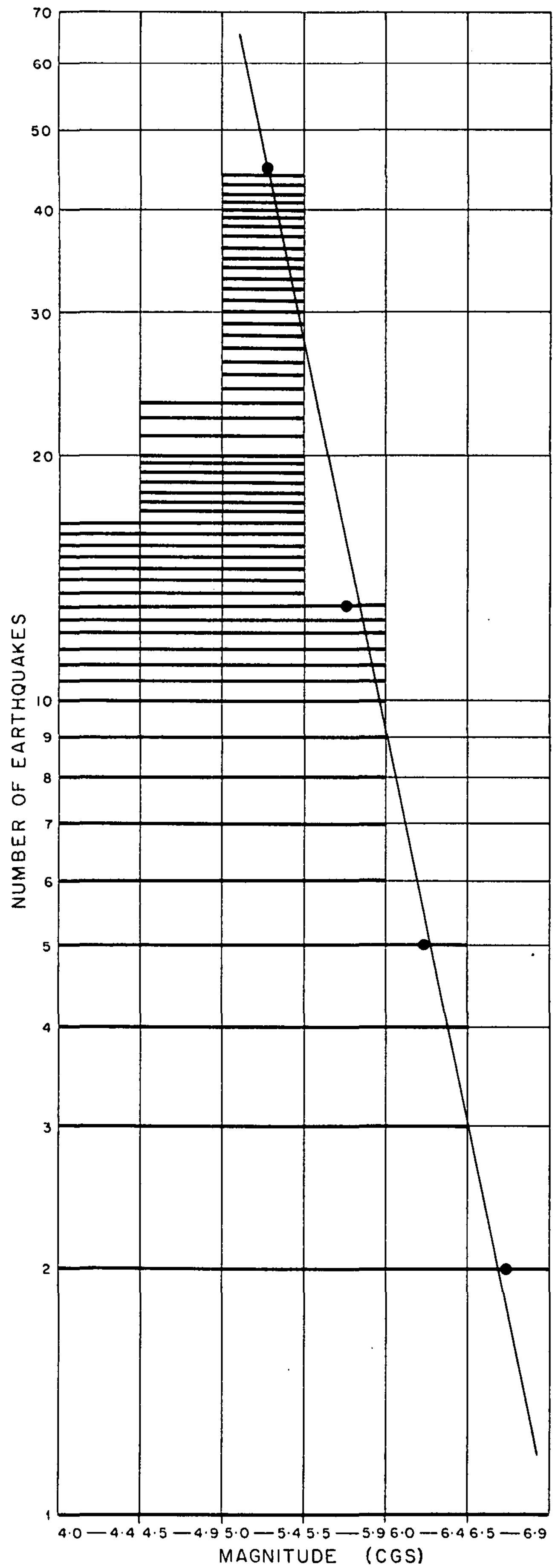



LOCATION OF EPICENTRES OF ALL BOUGAINVILLE EARTHQUAKES WITH MAGNITUDES GREATER THAN 5 BETWEEN 1960 and 1966

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G82/4-48

TO ACCOMPANY RECORD No.1968/11

PLATE 2




BOUGAINVILLE EARTHQUAKES
1960 – 1966

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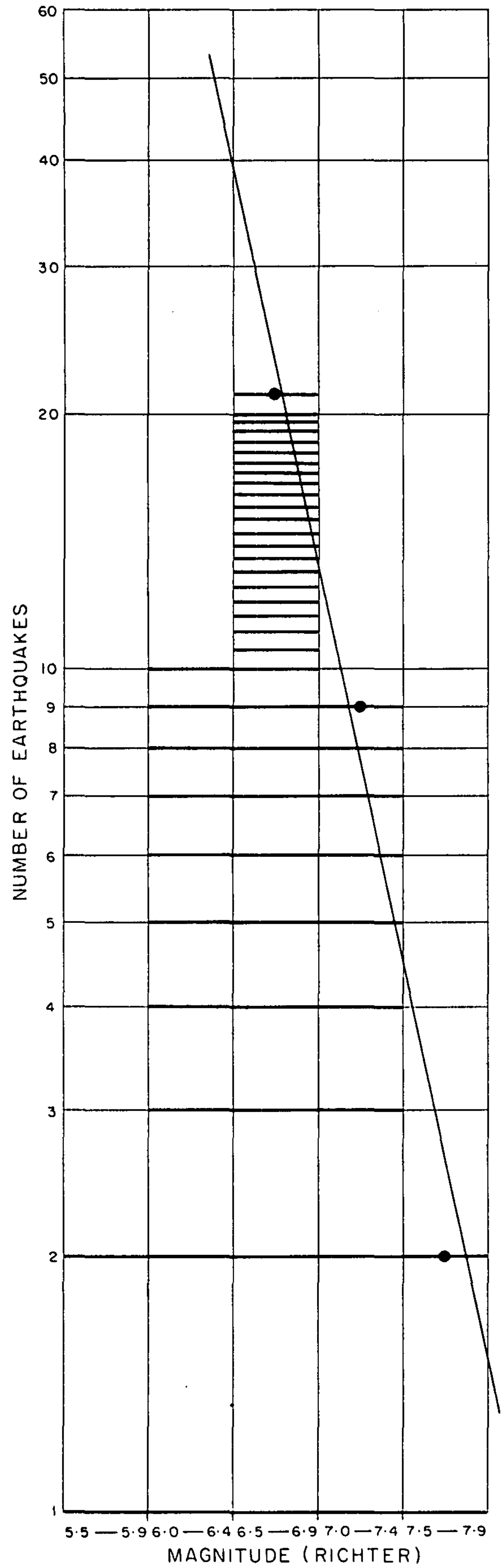
TO ACCOMPANY RECORD No 1968/11

PLATE 3

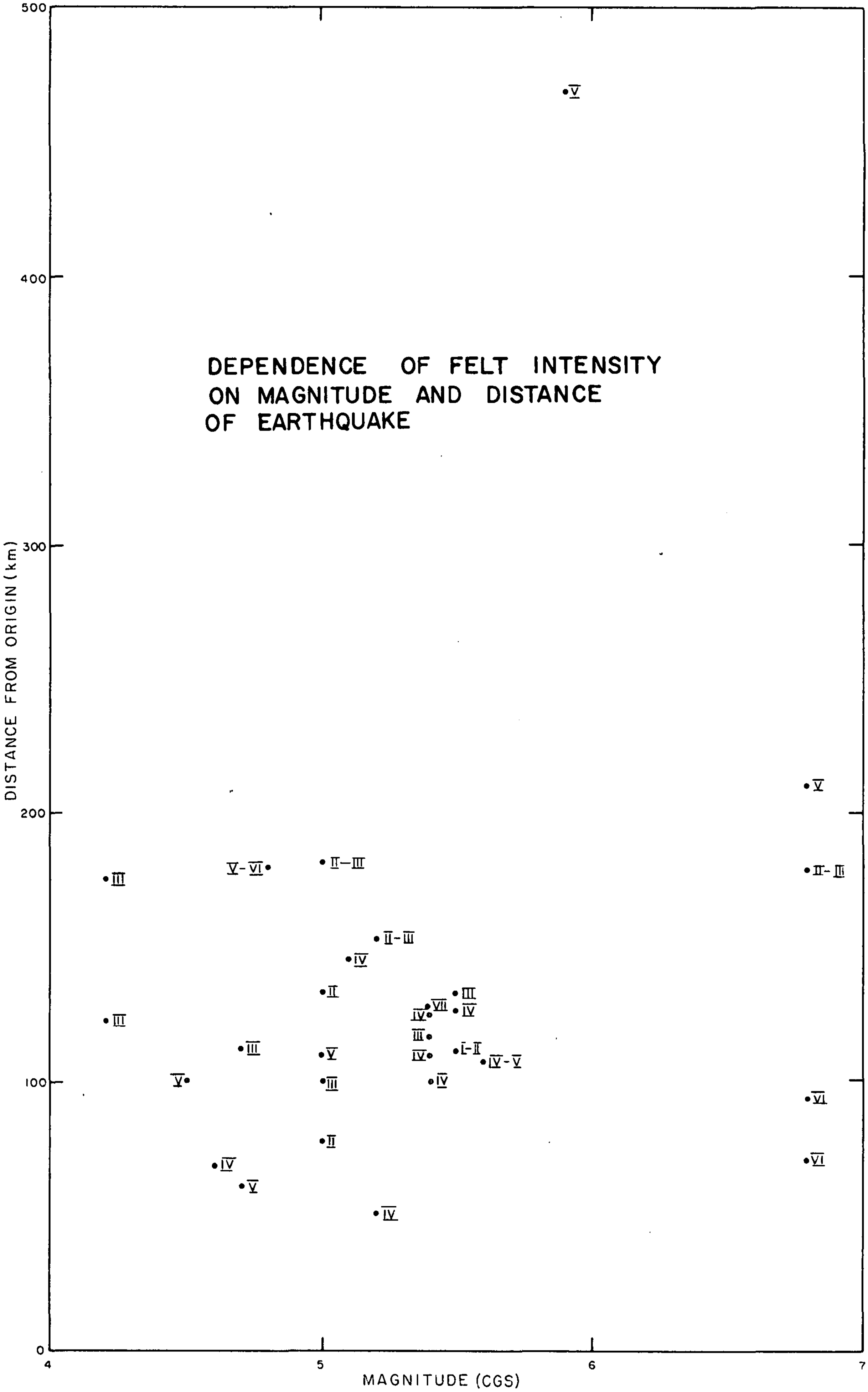



BOUGAINVILLE EARTHQUAKES 1906 - 1962
WITH MAGNITUDES GREATER THAN 6

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G82/4-50

TO ACCOMPANY RECORD No. 1968/11

PLATE 4




Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G82/4-51

TO ACCOMPANY RECORD No.1968/11

Bougainville, 1966