1965/45
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1965/45

PORT MORESBY GEOPHYSICAL OBSERVATORY

ANNUAL REPORT, 1962

by

OBSERVATORY STAFF

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SUMMARY

Geophysical Observatory activities for the years 1957-61 are briefly summarised and those for 1962 are described in more detail. The Observatory became fully operational in 1961.

Commitments to distribute routine seismic, magnetic, and ionospheric data have been met.

Attention has been given to seismological research, notably seismicity, and a future investigation of regional crustal thickness variations is planned.

1. INTRODUCTION

This report deals mainly with Observatory activities in 1962. It is the first annual report to be prepared since the Observatory commenced to operate in 1957.

Observatory activities require operation of the town office and laboratory in Lawes Road and the Observatory equipment that is housed about 8 miles by road north of the town (Plates 1, 2, and 5) on the slopes of a hill known as Tabletop. The Tabletop geology is Eocene chert overlain by recent tuffs in the north-east (see Plates 3 and 4). The Observatory land covers about 50 acres and was set aside by the Territory Administration in 1955 for the use of the Department of National Development.

Construction of Observatory premises was begun early in 1957 and installation of magnetic and seismic recording equipment commenced towards the end of that year. Electrical reticulation to all Observatory buildings was completed in mid-1958. The town office was occupied in July 1959.

2. SEISMOLOGY FROM 1957 TO THE END OF 1961

The original set of seismographs did not include a medium-period (10-15 seconds) vertical instrument. This, and the lack of calibration data for the Sprengnether instruments, detracted from the value of records obtained. The short-period Sprengnether vertical instrument was less sensitive than expected. The Observatory was fortunate to secure, on permanent loan from the United States Coast and Geodetic Survey (USCGS), a Wilson-Lamison vertical seismometer, which proved to be more sensitive than the Sprengnether, for which it was substituted (Table 1).

TABLE 1

Equipment used up to the end of 1961

Equipment	In Operation	General characteristics
Seismographs horizontal (Sprengnether)	December 1957	N and E components T_o = 15 s, T_g = 15 s
Seismograph vertical (Sprengnether)	December 1957 (decommissioned June 1958)	T_o = 1 s, T_g = 1 s
Seismograph vertical (Wilson-Lamison)	June 1958	T_o = 1 s, T_g = 1.7 s
Seismographs horizontal (Wood-Anderson torsion)	July 1958	N and E components T_o = 0.8 s, V = 2600

(T_o = free period of seismometer, T_g = free period of galvanometer, and V = magnification)

Contrary to expectations, the general level of microseismic background noise recorded has been comparatively low. This has made it possible to operate recently installed standardised seismographs at relatively high sensitivities.

In 1958, the first enquiries were received seeking assessments of seismicity for construction purposes. Because of high regional seismicity and rapidly expanding construction programmes throughout the Territory, a detailed investigation into this problem became desirable. Accordingly, work was begun in 1959 and was stimulated by discussions with earthquake engineering authorities in California in 1961 (Brooks, 1963a).

Expansion of Observatory activities to include other specific research projects may follow proposals arising from Brooks' 1961 overseas visit to California and the Tenth Pacific Science Congress in Hawaii (Brooks, 1963a). It was agreed that, over a period of five to six years, a research project on coastal thickness determinations would be undertaken; this was justified by the geological and geophysical problems of the region and the importance of their solution.

3. SEISMOLOGY, 1962

Instrumentation

Table 1 lists the equipment in operation at the beginning of 1962.

Following the announcement that Port Moresby was to be incorporated in the worldwide standardised seismograph network (a project of the Vela Uniform research programme), arrangements were made to accommodate additional instruments.

A room 10 ft x 10 ft was designed and constructed by the Commonwealth Department of Works, adjacent to the existing vault and annexe, and the existing piers were enlarged. Late in 1962, construction of further additions was commenced. The completed building plan is shown in Plate 10, in which present and proposed dispositions of equipment are indicated.

As these operations required the discontinuation of existing recording in the vault, a section of the Lawes Road office store-room was partitioned to provide a recording room for one three-component seismograph. The Wood-Anderson seismometers were moved from Tabletop to the town office on February 26. Recording commenced on 9th March and proceeded with only occasional loss of record caused by trace lamp failure or timing system failure.

The instruments then remaining at Tabletop, i.e. Sprengnether horizontal-component seismometers and the Wilson-Lamison vertical-component instrument, continued in operation until April 1st, when construction work at the vault necessitated their removal.

The Wilson-Lamison instrument was brought into the town office, completing, with the two Wood-Anderson seismometers, a three-component system.

Records produced by this seismograph in its new location showed surprisingly little increase in microseismic level, despite the proximity of the site to local disturbances, roadways, coastline, etc.

The installation of the standard seismograph system began on Friday, 15th June, and was mostly completed by 5th July, but some final adjustments were made later after trial recordings, and equipment was officially received on July 11th.

The nominal constants of the instruments and nominal magnification settings were then as listed in Table 2.

TABLE 2

Standard seismograph constants

	T_o (s)	T_g (s)	Damping ratio	Magnification at T_o
Short-period seismograph				
N-S	1.0	0.75	17:1	50,000
E-W	1.0	0.75	17:1	50,000
Vertical	1.0	0.75	17:1	50,000
Long-period seismograph				
N-S	30	100	Critical	1500
E-W	30	100	Critical	1500
Vertical	30	100	Critical	1500

The complete installation was carried out by two geophysicists, who formed one of fifteen teams trained by the USCGS to install and test the equipment. One of the Observatory staff assisted this team in order to gain experience in all aspects of installation and operation. A report, circulated daily among the staff, summarised the activities of the previous day. When particularly significant stages were reached in the installation, an effort was made to have all staff members present in the vault.

Details of instrument calibrations, test records, etc. are available in a copy of the installation report held at Port Moresby.

Some early experiences with the system are worth noting:

1. Difficulty was experienced with units of the control console and a Technical Officer spent two days with the installation team tracing faults and observing wave forms on a test cathode ray oscilloscope. The experience he gained has been very useful in the servicing and modifying of the equipment.

2. Records from a thermo-hygrograph installed in the vault indicated a humidity of 98% consistently throughout the day, while the temperature was in the region of 85°F. These conditions caused problems, which have not yet been overcome. Although the instruments are constructed largely of corrosion-resistant metal, or have their exposed surfaces painted, portions of the long-period vertical and short-period instruments are subject to corrosion, which became evident within one or two months. A container of silica gel, fitted inside the sealed cover of the long-period vertical seismometer, was highly effective, and a de-humidifier was set up in the vault to protect the instruments generally. At first, two de-humidifiers were operated, but as air currents from these machines caused undesirable response of the long-period systems the unit nearest the long-period seismometers was shut down.

3. Stability of the long-period instruments is influenced by air currents, and movement in the vault must be kept to a minimum. Improved operating conditions in 1963 should result following transfer of the recorders and galvanometers to a separate recording room (Plate 10). The short-period instruments remain very steady and require adjustment only occasionally. After large local earthquakes, the galvanometers sometimes require recentring.

4. The control unit supplied with the standard system functioned normally apart from the frequency standard, which was replaced after a period of four months. The new unit settled down very quickly and provided excellent timing for the remainder of the year. The daily rate rarely exceeded 200 milliseconds per day.

5. Daily time corrections of the crystal-controlled clock are made by comparing impulses from the crystal clock with those from radio time signals. Difficulties experienced in obtaining sufficient signal strength from the radio were caused by simultaneous broadcasts from three time stations (JJY, BPV, WWVH). A crystal-tuned time-signal receiver with special filtering overcame the difficulty and allowed a better discrimination of the three time signals. In November, an improved comparison device became available. A neon pea lamp, rotating at one revolution per second around a circle of 10-cm diameter, is ignited either by one pulse every ten seconds from the crystal clock or by one pulse every second from the time station. The signal pulses can be brought into coincidence with the internal pulses by resetting the clock. Accuracy is ± 5 milliseconds. This technique so simplified the time correction procedure that it was no longer necessary to use the special time-signal receiver.

6. At one stage, the long-period north-south system lost sensitivity. The fault was eventually traced to the galvanometer, which was replaced by the spare held at Port Moresby. The galvanometer was dismantled and the fault appeared to result from poor contact between the wiper arm (external contact) and the torsion head (coil contact). The unit was partly dismantled, cleaned, and reassembled to be retained as a spare.

7. To keep trace density at an acceptable level at times of little trace movement, a mask was fitted centrally in front of each cylindrical lens of the short-period recorder, cutting off portion of the light beam while this remains stationary and centred.

8. The correct calibration of the system was maintained by checking the results of calibration tests carried out daily, and by making a complete series of visual and recorded tests at intervals of a month or so. The tests carried out were:

Long-period system

(a) Seismometer free period and linearity

(b) Galvanometer free period

(c) Galvanometer damping

(d) System magnification

Short-period system

(a) Seismometer centring and stability

(b) Seismometer free period

(c) System damping ratio

(d) System magnification

Following these tests, appropriate adjustments were made to keep the operating characteristics within prescribed limits.

Distribution of data

Routine. Seismic bulletins were airmailed to USCGS regularly on Tuesdays and Fridays. These bulletins represented a preliminary interpretation of recordings.

Weekly bulletins were sent to nineteen seismological stations.

Scaling of seismograms and compiling of bi-weekly bulletins normally required two man-days per week and were carried out weekly by each geophysicist in turn. The average number of earthquakes reported doubled following the installation of the standard equipment, because of the higher sensitivities.

Special requests. During the year, a number of requests for data were processed. Many of these related to studies of first motions for fault plane analyses and phases from nuclear explosions. In several other cases, copies of seismograms were required.

Correspondence was carried on with an enthusiastic amateur seismologist in Lae and, whenever possible, advice was given on the development and operation of his home-made equipment and on the interpretation of seismograms.

When earthquakes occurred in the region of mainland New Guinea with sufficient intensity to be widely felt, provisional epicentre, magnitude, and depth information was made available to the public. Requests for data telegraphed to other stations in the south-west Pacific and Australia normally provided sufficient data for a satisfactory determination to be made within a reasonable time; a brief report was then issued to interested authorities.

A series of earthquakes was felt in Wewak in July with intensity estimated as high as VIII, and reports describing damage to buildings, fall of water tanks, etc. were received from the Administration Department of Public Works. The two largest earthquakes were approximately of magnitude 7; the epicentres were out to sea, north of Wewak. At the request of the Public Works Department, general advice and comments were forwarded on the question of Territory seismicity and aseismic design principles.

Seismological research

1. A comprehensive draft report on the nature of Territory seismicity was completed during the year for publication in the Bureau of Mineral Resources report series. Significant aspects of the report included discussion of a proposed seismic intensity zoning system for the Territory, together with an analysis of regional strain fluctuation with time (Brooks, 1963b).

2. Results of investigations into upper mantle P and S velocities, presented at the Tenth Pacific Science Congress in 1961, were prepared for publication and submitted to the American Geophysical Union for publication in Monograph No. 6 (Brooks, 1962).

3. Intensity reports of earthquakes felt in New Guinea prompted an investigation of intensity distribution. Following a tremor that was felt widely in Port Moresby and which had intensities of up to V in the region of the epicentre, a questionnaire was compiled and circulated. The earthquake was fairly small and the data obtained from the questionnaire were somewhat incomplete, as the tremor was felt in too few populated centres to obtain a good distribution of reports. Nevertheless, the analysis led to results moderately consistent with theory and a brief report was compiled. This kind of data can usefully supplement seismicity studies by instrumental means. However, to be effective, a large number of voluntary reporting stations must be briefed and issued in advance with carefully prepared report forms or cards. It is hoped that these can be designed soon; the experience gained in this limited study will be useful in this regard.

4. Following publication of a paper (Bolt, 1962) on a theory explaining multiple arrivals of core phases in the epicentral range 110°-155°, analysis of these phases was placed on a routine basis to provide data for Dr Bolt.

5. A programme for the determination of the variations in crustal thickness throughout the Papua & New Guinea region was devised. Investigations are scheduled to last about five years. The proposals require the determination of Rayleigh wave phase-velocity dispersion curves (period range 10-60 seconds) across a triangular network of long-period vertical seismographs. The network location will be periodically changed to permit examination of different regions of the Territory. Many enquiries were made to determine the best type of equipment to use. Visual seismograph recording equipment manufactured by United Electro-Dynamics was chosen, and it is proposed that the Geophysical Laboratories of the Bureau of Mineral Resources construct timing and power units for each of the three stations.

4. GEOMAGNETISM, FROM 1957 TO THE END OF 1961

Recording of horizontal and vertical magnetic intensity components and declination commenced in March 1958. Standard record speed was nominally 15 millimetres per hour and sensitivities of the La Cour variometers were as follows:

H : 5.6 gammas per millimetre

Z : 7.2 gammas per millimetre

D : 10.0 gammas per millimetre

In October 1959, a 'rapid-run' La Cour set was put into operation. Record speed was nominally 180 millimetres per hour, with the La Cour variometer sensitivities as follows:

H : 2.0 gammas per millimetre

Z : 3.0 gammas per millimetre

D : 5.0 gammas per millimetre

Provisional baseline values have yet to be assigned to the normal-run records from September 1959. The rapid-run records have no baselines.

5. GEOMAGNETISM, 1962

Approximate mean values of the three field components at epoch 1962.5 are:

H : 0.36400 gauss, decreasing by about 20 gammas per annum.

D : 06° 04'.6E, increasing by about 2 minutes per annum.

Z : -0.22890 gauss, increasing (becoming more negative) by about 30 gammas per annum.

Instruments

1. The standard La Cour variometers were less sensitive than desirable for this latitude. The sensitivities were increased late in 1962. However, it has not yet been possible to stabilise the newly adjusted equipment, and scale values and H baselines are drifting slightly. Positive gains obtained are the considerable increase in K-scaling accuracy and the greater definition of effects on the normal-run records. All normal-run variometers have operated since September-October 1962 at approximately twice their former sensitivities:

   H : 2.8 gammas per millimetre

   D : 4.6 gammas per millimetre
   (0.4 minute per millimetre)

   Z : 3.0 gammas per millimetre

   The rapid-run variometers for D and Z operated at increased sensitivities from January 1962:

   H : 1.4 gammas per millimetre

   D : 4.2 gammas per millimetre
   (0.4 minute per millimetre)

   Z : 0.7 gamma per millimetre

2. Standardisation of absolute instruments has been accomplished for H by regular intercomparisons with the Toolangi standard, using QHM equipment. A nuclear precession magnetometer was used for the first time in February 1962 and provided a valuable check on the QHM data. Corrections to the three Observatory QHMs (Nos. 187, 188, and 189) since 1951 are listed in Appendix 1 and plotted in graph form in Plate 11. Although fewer intercomparisons with Askania declinometer No. 580333 (used for D) have been made, the index error (IMS correction) is known and is stable. Knowledge of the BMZ 68 correction to IMS at present rests on the single series of Z comparisons with the precession equipment. As doubts have subsequently been cast on the reliability of these results, repeat observations are regarded as a matter of urgency.

3. The Standard magnetogram is provided with time marks every 5 minutes as well as the minute before and after each hour. A La Cour pendulum clock with a rate of not more than ± 30 seconds per day, corrected daily, is used to operate contacts in the time-lamp circuit. The rapid-run magnetogram is time-marked as frequently as the standard, but the time-lamp circuit

is controlled by a slave clock operating on impulses received from a Synchronome master clock with a rate of ± 1 second per day. The dual system was necessary to reduce the effects of partial failures of either.

Distribution of data

1. Distribution of data on a routine basis followed the general worldwide pattern established during the International Geophysical Year. The nine recipients of our monthly data include the four World Data Centres and the de Bilt Permanent Service. Quarterly lists of principal magnetic storms were sent regularly to the Radio Warning Services section of the United States Bureau of Standards.

2. Dr Mayaud of Paris University corresponded with the Observatory on the subject of K-index scaling procedure. The main point at issue concerned the significance of K_Z in determining K at stations remote from the auroral zones. There is reason to believe that wherever K_Z is greater than K_H this is due rather to localised induction effects than to a vertical component of corpuscular solar disturbance.

3. At the time of the February solar eclipse, rapid-run recording by the stepped-trace method that is normally used was temporarily discontinued. Instead, 36-inch seismic paper was used and changed every 5 hours for a day before and after the eclipse. Unfortunately, a magnetic storm coincided with the period of eclipse. Results were made available to Professor Kato, who directed Japanese magnetic observations at Lae, where the eclipse was total.

4. A distinct effect was recorded on all components at 0900 hours GMT on 9th July 1962, the time of detonation of a thermonuclear device over Johnston Island. Copies of rapid- and normal-run records for this day were forwarded to Professor Kato, reporter for the working group on micropulsations of IAGA Commission 4.

5. The great Chilean earthquake of May 1960 generated free earth vibrations ('eigen vibrations'), which appear to have produced oscillations in the Earth's magnetic field. This is a provisional finding based on the power spectrum analysis of the H rapid-run trace for May 22nd 1960 by Winch, Bolt, and Slaucitajs (1963).

6. The Royal Navy Hydrographic Survey vessel 'Cook' is at present working in South Pacific waters. Lieutenant Cheshire is responsible for regional magnetic observations scheduled to be made at several islands visited during this voyage. He arrived without warning to calibrate his instruments in the midst of the variometer modifications made in September. The corrections found are therefore somewhat more uncertain than would normally be the case.

Regional magnetic surveys, 1962

The regional magnetic survey of the Territory of Papua and New Guinea 1962-1963 progressed to the stage where all stations specified on the main island have been occupied and the partly reduced results are being processed in Melbourne.

6. IONOSPHERICS

Equipment

The equipment in use is an Ionospheric Prediction Service Ionosonde Type IIIc, which has a frequency range of 1-25 Mc/s, a sweep of 30 seconds, and a peak power of 5 kw (Brooks, 1958).

Installation

In May 1961, staff of the Ionospheric Prediction Service completed installation of the Type IIIc Ionosonde, which became fully operational on 14th May. Initially, some trouble was experienced with sections of the equipment, mainly because of component failures and design weaknesses. As these were rectified, the incidence of failures decreased sharply and during the latter part of 1962 a failure rate that was considered normal for this type of equipment was being maintained.

Initial faults included:

1. Breakdown of 2500V v.h.t. transformers. This was apparently due to a manufacturer's fault, and with the installation of a properly designed transformer in the 2500V circuit, no further trouble was experienced.

2. There were several failures in 1961 of the high voltage bypass condensers (0.1μF/kV wkg) possibly because of a faulty batch. No failures occurred during 1962.

3. 50,000-ohm, 5-watt, bias-control potentiometers are incorporated in a circuit design that requires critical adjustment, otherwise the total current passing through one section becomes excessive. Failure rate of these potentiometers decreased with experience in transmitter adjustment.

4. There was considerable trouble with the regulated 500V h.t. supply, owing to circuit design, layout and overheating, and component failures. Over a period of time, these faults were eliminated.

A series of runs with high, medium, and low receiver-gains were made during September 1961, over a period of 24 hours.

Results showed that a high gain setting produced better overall records, although medium gain for night recording had some advantages.

Requests for information

Special observations for possible inclusion in a world ionospheric atlas were made in June, September, and December 1961.

A request was received from the Department of Civil Aviation for copies of ionograms recorded at times corresponding to teletype tests being made to determine the causes of faulty transmissions between Townsville and Port Moresby.

Professor Webster, of Queensland University, requested the loan of the ionograms for May-June 1961.

Occasional telephone requests have been received from amateur radio operators who have observed abnormal radio conditions, particularly in v.h.f. regions.

Operations in 1962

During the early part of the year, the performance of the ionosonde was unsatisfactory, particularly while critical frequencies of the F_2 layer were above 11 Mc/s. In March, a v.f.o. modification improved the high frequency performance, and subsequently, critical frequencies of the order of 15 Mc/s were satisfactorily recorded.

During the last quarter of the year, few breakdowns occurred. There were occasional fuse failures owing to transient current surges, and repeated intermittent failures of the camera motor, probably because of an inherent design fault, but by the end of the year a suitable alternative had not been installed.

Other minor modifications to the recorder included:

(a) Fitting chokes between the aerial-terminating resistors and earth to provide a low-resistance path for charges built up on the aerials but maintaining a high impedance to r.f. voltages.

(b) Minor circuit changes recommended in new circuit diagrams issued by the Ionospheric Prediction Service.

(c) Experimental modifications to the video/audio amplifier unit, the mixing unit, the receiver unit, the trigger generator and cathode ray oscilloscopes, etc. for test purposes.

Scaling of records

Ionograms were generally of satisfactory quality during the year, loss of information being mainly due to technical breakdowns, local mains supply failures, and processing faults.

After the introduction of the v.f.o. modification in March, the proportion of firm numerical values to 'uncertain' or 'unscaleable' values rose substantially.

An almost total solar eclipse occurred on 5th February and special continuous runs between 0600 hours and noon local time were made on the 4th, 5th, and 6th February. Copies of the soundings made were sent to Professor Kato.

Further requests from the Communications Section of the Department of Civil Aviation were made for data obtained between 0300 hours to 0600 hours daily from the 4th to 30th September.

7. MISCELLANEOUS

Communications equipment

Radio transmitting equipment was provided by the Ionospheric Prediction Service in 1960 to permit rapid and frequent interchange of information between all sounding stations in the network. The Observatory transmitter located in the Lawes Road office was duly licensed and assigned the call-sign VL9OF. Allocated frequencies were: 18,880, 15,965, 11,440, 6815, and 4525 kc/s.

A cubical quad antenna was constructed to suit the two highest frequencies.

Early in the year a number of attempts were made to establish radio contact with Canberra and Mundaring on a regular schedule basis, but these were generally unsuccessful, notwithstanding several contacts actually made. Later, listening tests were made at Tabletop and the Port Moresby office, and though inconclusive, indicated that a transmitter sited at Tabletop might be more successful. There is insufficient space to house the equipment at Tabletop and therefore attempts to maintain this type of contact with the Ionospheric Prediction Service have been abandoned.

Inter-building wiring

Following the installation of the standard seismic equipment, changes in the Observatory timing system were required for a variety of reasons. Ultimately, proposals were made (and approved) to provide a system linking all main buildings with six-pair PMG-type armoured cable. Concurrent rewiring of the magnetic vault was planned (see Plates 6, 7, 8, and 9).

The following changes are included in the proposals:

1. Removal of the Synchronome master clock from the seismic vault to the ionosonde room, which is air-conditioned.

2. Provision of a Synchronome slave clock to programme the ionosonde and to provide emergency time marks for the standard seismic equipment as well as one-second impulses to operate another slave clock in the magnetic vault.

3. Provision of a shelter for the batteries and battery-charger, external to the existing ionospheric building (Plate 9).

4. The removal of all lead-acid accumulators from the magnetic and seismic vaults, relocating them with charging facilities in the lower section of the existing instrument shelter, and the provision of a switchboard for battery charging and d.c. distribution. This move isolated them from the alkali batteries of the standard seismic system.

5. The redesign and reconstruction of the magnetic vault switchboard and wiring layout to permit:

   (a) the use of impulses originating at the master clock in the ionospheric building to operate a slave clock for magnetograph time-marking.

(b) the removal from the magnetic vault switchboard of one moving-coil milliammeter.

(c) the provision of a completely separate circuit for measuring scale values, relocated in the vault annex (Plate 8); the large meter used will be further from the magnetographs.

(d) the simplification of switching and control circuits for easier operation.

(e) the elimination of battery charging lines between the absolute building and the magnetic vault.

6. The use of the underground cable to extend existing telephone facilities.

Miscellaneous equipment

All communications receivers, test equipment, etc. operated satisfactorily, except for the mechanical drive on the Evershed & Vignoles recording voltmeter, which has been forwarded to Melbourne for repair or replacement.

A Kelvin & Hughes recorder and a 'Labtronics' time-signal receiver have been added to the existing equipment during the year. The 'Labtronics' instrument has given some trouble with drift in the tone-filter circuits, believed to be caused by drifts in the values of some of the filter components. This will be returned to the manufacturers for replacement of components.

Reports

In addition to the usual data, seismic bulletins, and monthly reports, the following Bureau of Mineral Resources Reports and Records were originated, or partly originated, by the Observatory staff during the first five years of operation:

1. "Seismic work at Melbourne, Macquarie Is., Mawson, and Port Moresby during the I.G.Y." by C.A. van der Waal, J.A. Brooks, J.R. Cleary, and J.D. Pinn. Record No. 1958/52.

2. "Magnetic Observatories operated by the Bureau of Mineral Resources, Geology and Geophysics during the I.G.Y." by W.D. Parkinson, C.A. van der Waal, J.A. Brooks, J.R. Cleary, and J.D. Pinn. Record No. 1958/53.

3. "Proposed ionospheric work, Port Moresby Geophysical Observatory" by J.A. Brooks. Record No. 1958/54.

4. "A Note on the Windward Islands earthquake of 8th January 1959" by J.A. Brooks. Record No. 1960/45.

5. "Tsunami effects of the Chilean earthquake of 22nd May 1960 in New Guinea and adjacent areas" by J.A. Brooks. Record No. 1961/3.

6. "Geomagnetic K-index scale at Port Moresby" by J.A. Brooks and J.D. Pinn. Record No. 1961/5.

7. "Seismic wave velocities in the New-Guinea/Solomon Islands region" by J.A. Brooks. Record No. 1963/38.

8. "Visit to the Tenth Pacific Science Congress, Hawaii, and to California, 1961" by J.A. Brooks. Record No. 1963/135.

9. "Earthquake activity and seismic risk in Papua & New Guinea" by J.A. Brooks. Record No. 1963/162.

Published Research Paper

"Seismic wave velocities in the New Guinea-Solomon Islands Region" by J.A. Brooks. THE CRUST OF THE PACIFIC BASIN, American Geophysical Union, Geophysical Monograph No. 6, 1962, pp. 2-10.

Visitors

Visitors to the Observatory have included:

Name	Date	Institution
Dr D.S. Carder	March 1958	USCGS
Sir Donald Cleland	January 1960	Administrator, T.P. & N.G.
Dr J.W. Joyce	November 1960	U.S. National Science Foundation
Dr M. Dobrin	September 1959	Consultant to Australian Petroleum Co.
Prof. H.C. Webster	June 1961	Brisbane University
Dr J.P. Webb		Brisbane University
Prof. Y. Kato	February 1960 June 1961	Tohoku University
Prof. V.V. Beloussov	May 1961	U.S.S.R. Acadamy of Sciences (UNESCO sponsored)
Mr G.A. Eiby	May 1961	D.S.I.R., Wellington, New Zealand
Prof. C.R. Allen	February 1962	Caltech
Mr J. Jordan	February 1962	USCGS
Messrs J. Burrell J. Minsch C. Morgan J. Hoffman	June-July 1962	USCGS

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1962 Seismic wave velocities in the New Guinea-Solomons Islands region. THE CRUST OF THE PACIFIC BASIN, Amer. Geophys. Un. Geophys. Monogr. 6

1963a Visit to the Tenth Pacific Science Congress, Hawaii, and to California, 1961. Bur. Min. Resour. Aust. Rec. 1963/135.

1963b Earthquake activity and seismic risk in Papua & New Guinea. Bur. Min. Resour. Aust. Rec. 1963/162 (unpubl.).

WINCH, D.E., BOLT, B.A., and SLAUCITAJS, L. 1963 Geomagnetic fluctuations with the frequencies of torsional oscillations of the Earth. J. Geophys. Res. 68(9), 2685-2693.

APPENDIX 1

Corrections to magnetic calibrating instruments

Results of intercomparisons, 1957-1962

Vertical intensity

Instruments used: BMZ 68 from 14th August 1957 to 31st December 1962

Intercomparison results:

August to September 1960: At Port Moresby with earth inductor Askania 5111081.

Mean reading E.I. = -22969 gammas

Standard deviation = 4.5 gammas (approx.)

Range = 15 gammas

Inferred correction:

Toolangi preliminary standard = BMZ 68 + 15 gammas

February 1962: At Port Moresby with proton precession magnetometer BMR 1.

Mean reading PPM = -23063 gammas

Standard deviation = 3 gammas (approx.)

Range = 13 gammas

BMZ 68 readings from 6th January 1962 to 28th February 1962

Mean = -23063 gammas

Standard deviation = 3 gammas

Range = 10 gammas

Inferred correction: $Z_{PPM} = Z_{BMZ\ 68}$

Declination

Instruments used: QHM 189 from 14th August 1957 to 30th December 1959

CIW No. 18 from 6th January to 3rd February 1960

Askania 580333 from 15th February 1960 to 31st December 1962

Intercomparison results:

14th October 1959 to 3rd February 1960: At Port Moresby CIW 18 (magnet 18S)

Average baseline = 05° 47'.9

15th February 1960 to 27th July 1960: At Port Moresby

Askania 580333

Average baseline = 05° 47'.1

$\therefore \quad D_{18S} - D_{580333} = +0.8$ minute

From previous results,

$D_{18S} - D_{IMS} = +1.4$ minutes

$\therefore$ By inference

$D_{580333} - D_{IMS} = +0.6$ minute

Horizontal intensity

Instruments used:

QHM 187 from 14th August 1957 to 31st December 1962

QHM 188 from 14th August 1957 to 31st December 1962

QHM 189 from 14th August 1957 to 20th December 1961

QHM 173 from 14th February to 7th November 1962

QHM 189 from 7th November to 31st December 1962

Intercomparison results: See Table 3

TABLE 3

Summary of comparison results for QHMs 187, 188, 189, and 173

Date	Instrument Corrections for								Number of ob-serv-ations	Remarks
	QHM 187		QHM 188		QHM 189		QHM 173			
	gammas (Port Moresby)	gammas per gauss	gammas (Port Moresby)	gammas per gauss	gammas (Port Moresby)	gammas per gauss	gammas (Port Moresby)	gammas per gauss		
Nov. 27-30, 1951	+1.5	+5	+11.3	+31	+6.5	+18			11/10/28	With Askania 813 at Toolangi
June 5, 1952					+5.6	+15			6	With Askania 813 at Toolangi
Mar. 10-12, 1953	-7.8	-20	-3.3	-9	-1.1	-3			12	With Askania 813 at Toolangi
Nov. 18-19, 1953	-15.6	-43	-8.9	-25	-8.9	-25			12	With Askania 813 at Toolangi
Jan. 16, 1957	-22.3	-62	-9.6	-26	-11.5	-32			4	With Toolangi baseline (QHMs 288, 289, and 290)
Dec. 4, 1958	-43.4	-119	-29.8	-82	-32.7	-90			24/26/22	With International QHMs 228, 229, & 230
Sept.2-Dec.16, 1959	-43.5	-120	-33.6	-93	-30.5	-84			9/8/16	With QHMs 460, 461, and 462 at Port Moresby
April 26-27	-47.9	-131	-37.4	-103	-34.1	-94			4/4/2	With QHM 462 at Port Moresby
June 8-July 6, 1960			-45.4	-125					20	With Toolangi baseline
May 4-19, 1961	-66.4	-183	-55.7	-154	-53.4	-147			11	With QHMs 460, 461, and 462 at Port Moresby
					Fibre broken					
Jan. 1962							-1.6	-4	?	With (?) at Toolangi
Feb. 2-7, 1962	-55	-151	-46	-126					9/9/0	With Proton precession magnetometer at Port Moresby
Apl. 4-5, 1962					+2.4	+7			32	With Toolangi baseline after return Rude Skov
Nov. 22, 1962							-11.6	-32	?	With (?) at Toolangi
Feb. 27-May 8, 1963	-71.8	-198		-147	-9.4	-26			11/11/11	With QHMs 460, 461, and 462 at Port Moresby

APPENDIX 2

Geophysical Staff, 1957-1962

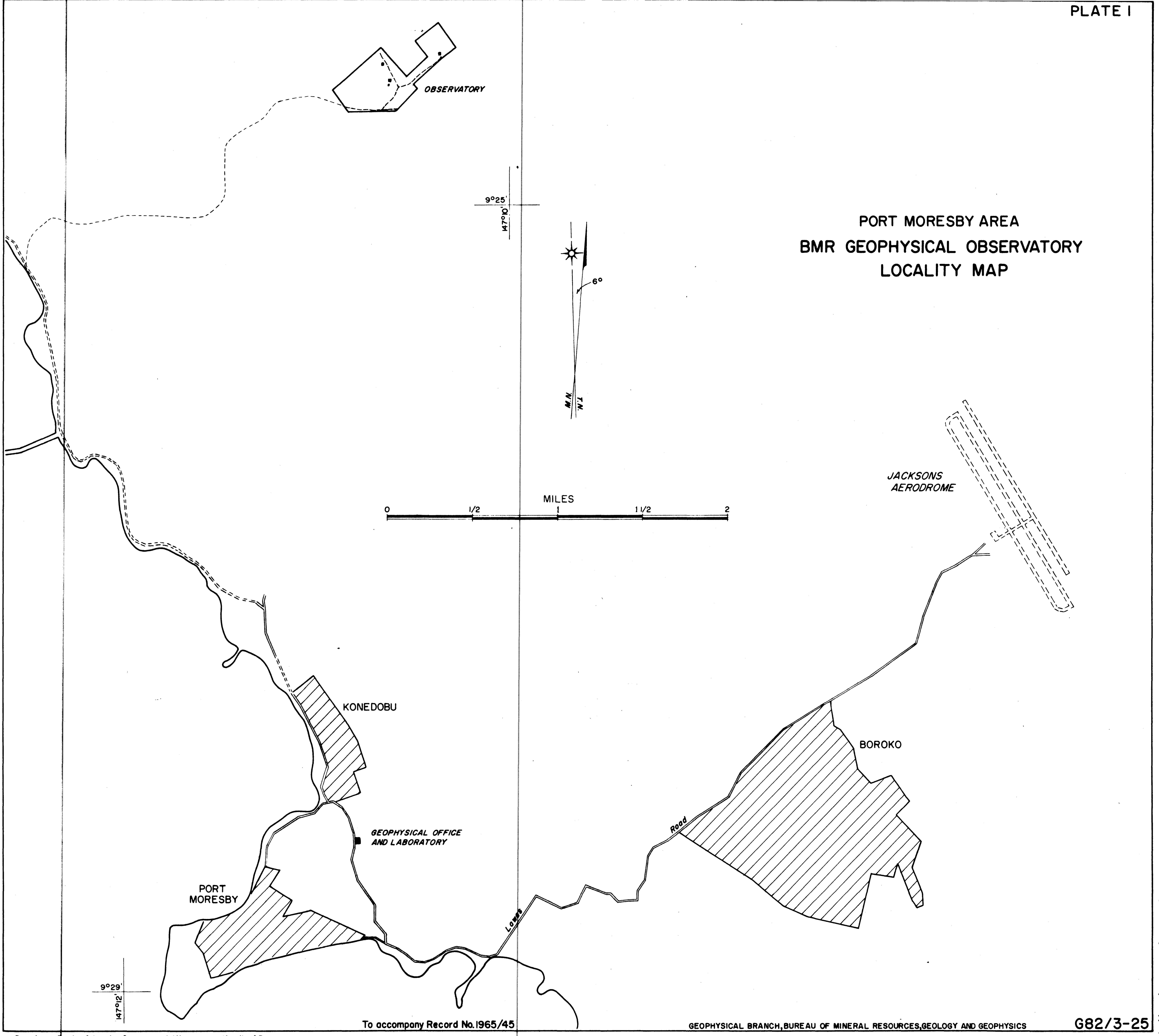
Name	Classification	Term of Appointment
Mann, P.E.	Geophysicist	January 1957 - June 1958 July 1961 - November 1961 (relieving)
Brooks, J.A.	Geophysicist	April 1958
Payne, D.A.	Geophysicist	June 1958 - December 1958
Noah, C.E.	Geophysical Assistant (seconded from T.P.N.G. Administration)	December 1958
Pinn, J.D.	Geophysicist	January 1959 - July 1960
Jones, W.K.	Geophysicist	August 1959 - October 1959
Sorensen, R.M.(Miss)	Geophysicist	August 1959 - December 1959
Bell, B.G.	Ionospheric Observer (on loan from Ionospheric Prediction Service)	November 1959 - September 1960
Van der Waal, C.A.	Geophysicist	February 1960 - May 1960 (relieving)
Milne, P.J.	Geophysicist	April 1960 - October 1960
Hollingsworth, R.J.	Geophysicist	May 1960 - September 1960
Cooke, R.J.S.	Geophysicist	June 1960 - October 1961
Jones, M.S.	Technical Officer	April 1961
Underwood, R.	Geophysicist	May 1961 - October 1961
Cookson, C.L.	Geophysicist	September 1961 - December 1964
Merrick, R.W.	Geophysicist	December 1961 - August 1963

APPENDIX 3

Coordinates of the stations

Seismograph vault	:	Latitude 09°24'33" S
		Longitude 147°09'14" E
		Height above M.S.L. 220 ft
Absolute magnetic building	:	Latitude 09°24'37" S
		Longitude 147°09'17" E
		Height above M.S.L. 230 ft
Ionospheric building	:	Latitude 09°24'26" S
		Longitude 147°09'31" E
		Height above M.S.L. 130 ft

Geomagnetic latitude	:	-18°.7
Geomagnetic longitude	:	218°.0



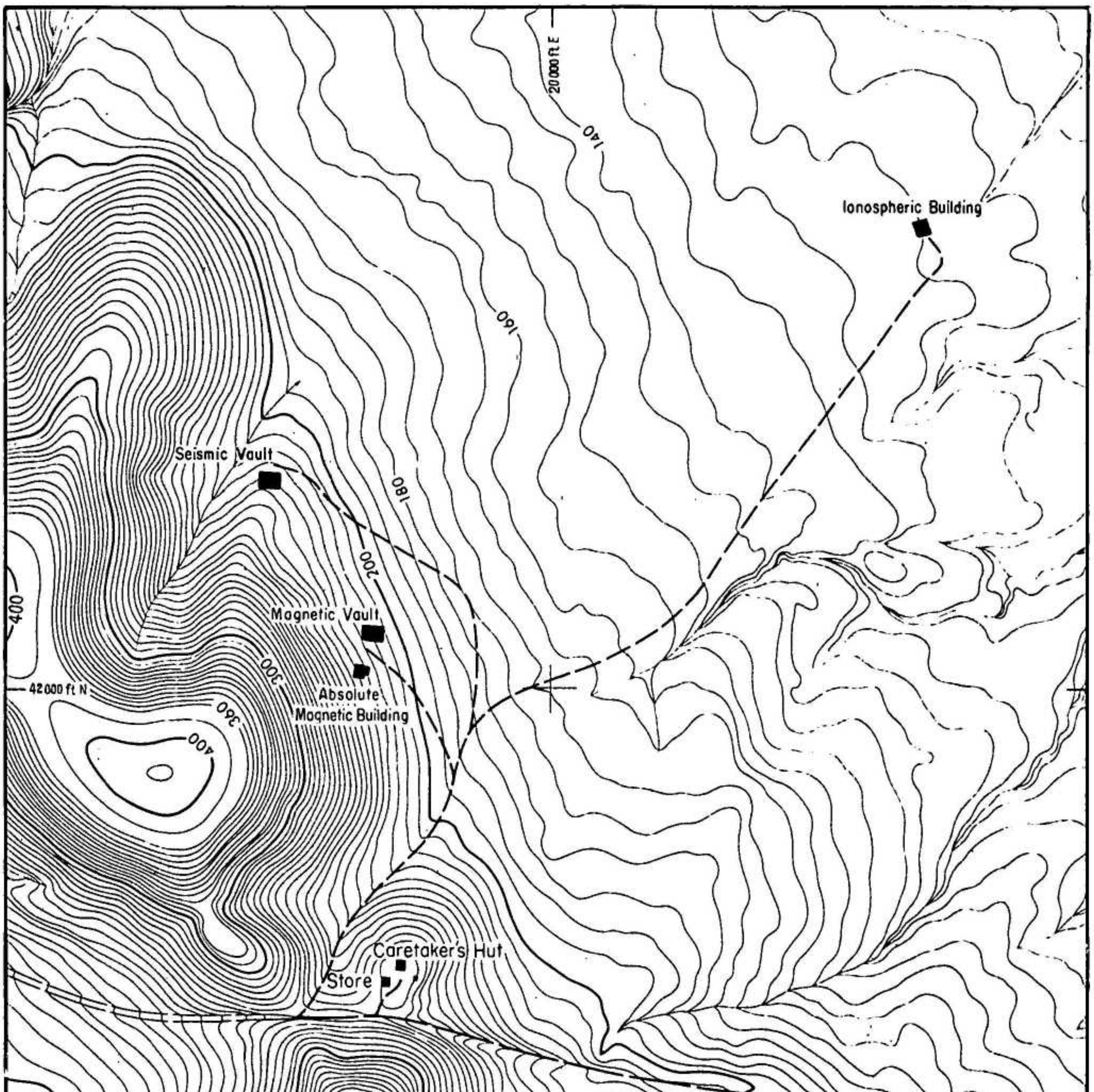
Based on Dept of Lands, Surveys and Mines map, Hamil of Bomana

OBSERVATORY OFFICE (right) and RESIDENCES (centre and left)
December 1963

Looking south-west (about 200°)

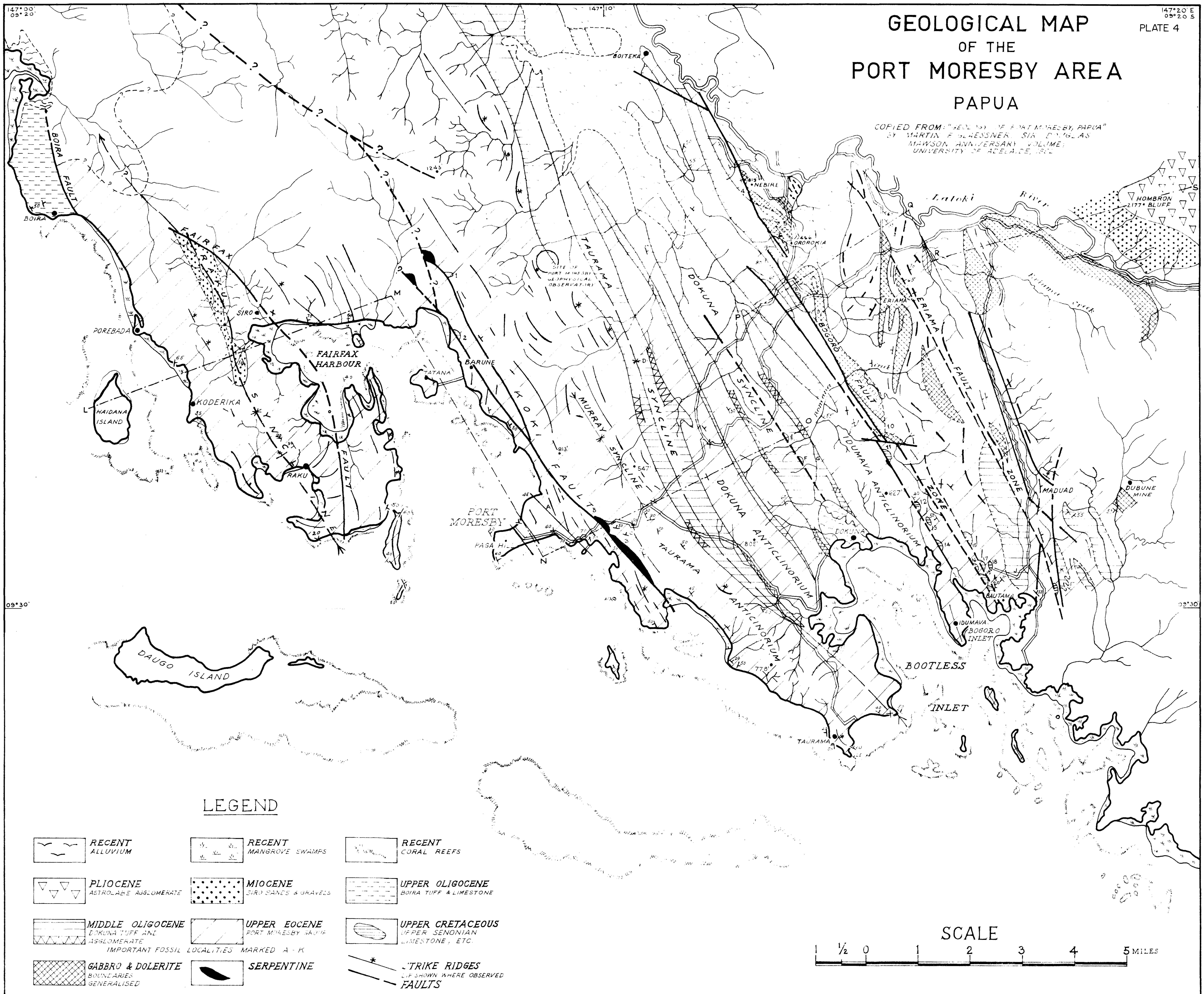
OBSERVATORY OFFICE December 1963
From Lawes Road

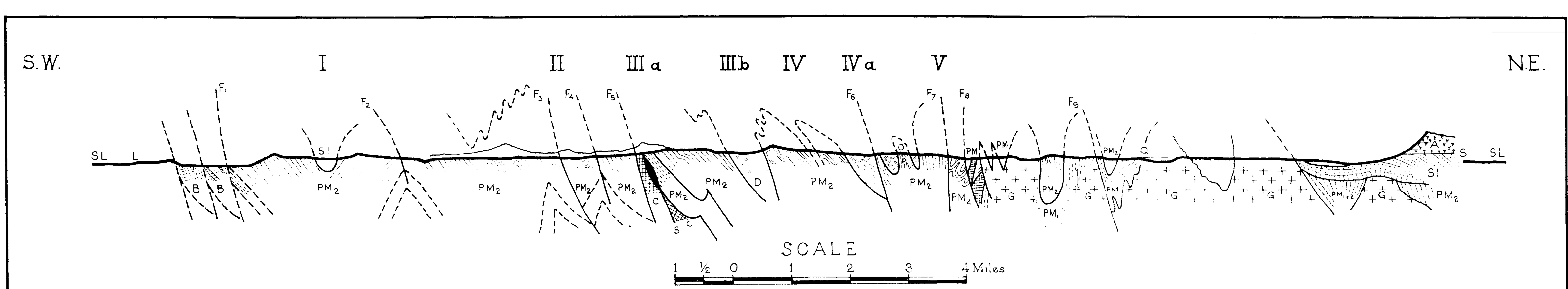
Looking east of north (about 30°)



Based on Department of Lands, Surveys and Mines map

To accompany Record No. 1965/45





A: ASTROLABE AGGLOMERATE, PLIOCENE
B: BOIRA TUFF AND LIMESTONE (UPPER OLIGOCENE) (Projected)
C: UPPER CRETACEOUS
D: DOKUNA TUFF AND AGGLOMERATE, MIDDLE OLIGOCENE
PM: PORT MORESBY GROUP, UPPER EOCENE (PM_1 - lower part; PM_2 - upper part)
SI: SIRO SANDS and GRAVELS, LOWER MIOCENE
I - V ANTICLINAL and SYNCLINAL FOLDS
F_1 - F_9 FAULTS

To accompany Record No. 1965/45

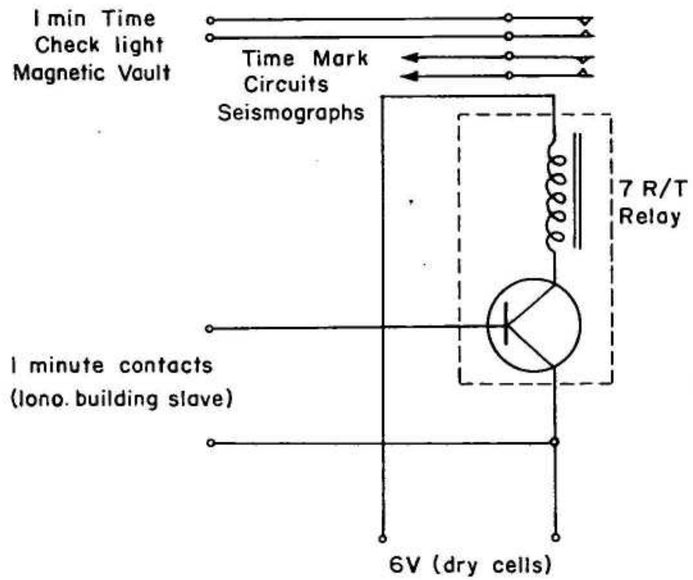
G82/3-32

IONOSPHERIC BUILDING
December 1963
Aerial mast and transmission lines
(white posts on right are for scintillation project)
Aspect slightly south of east (about 100°)

MAGNETIC VAULT and ABSOLUTE HUT December 1963
Photographed south of east (about 110°) from direction of seismic vault

SEISMIC VAULT December 1963
Magnetic vault and absolute hut right of centre background.
Looking eastward.

To accompany Record No. 1965/45 Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics, G 82/3-26



TIME MARKING RELAY
SEISMIC VAULT

BLOCK DIAGRAM
UNDERGROUND CABLING
TABLETOP OBSERVATORY, PORT MORESBY

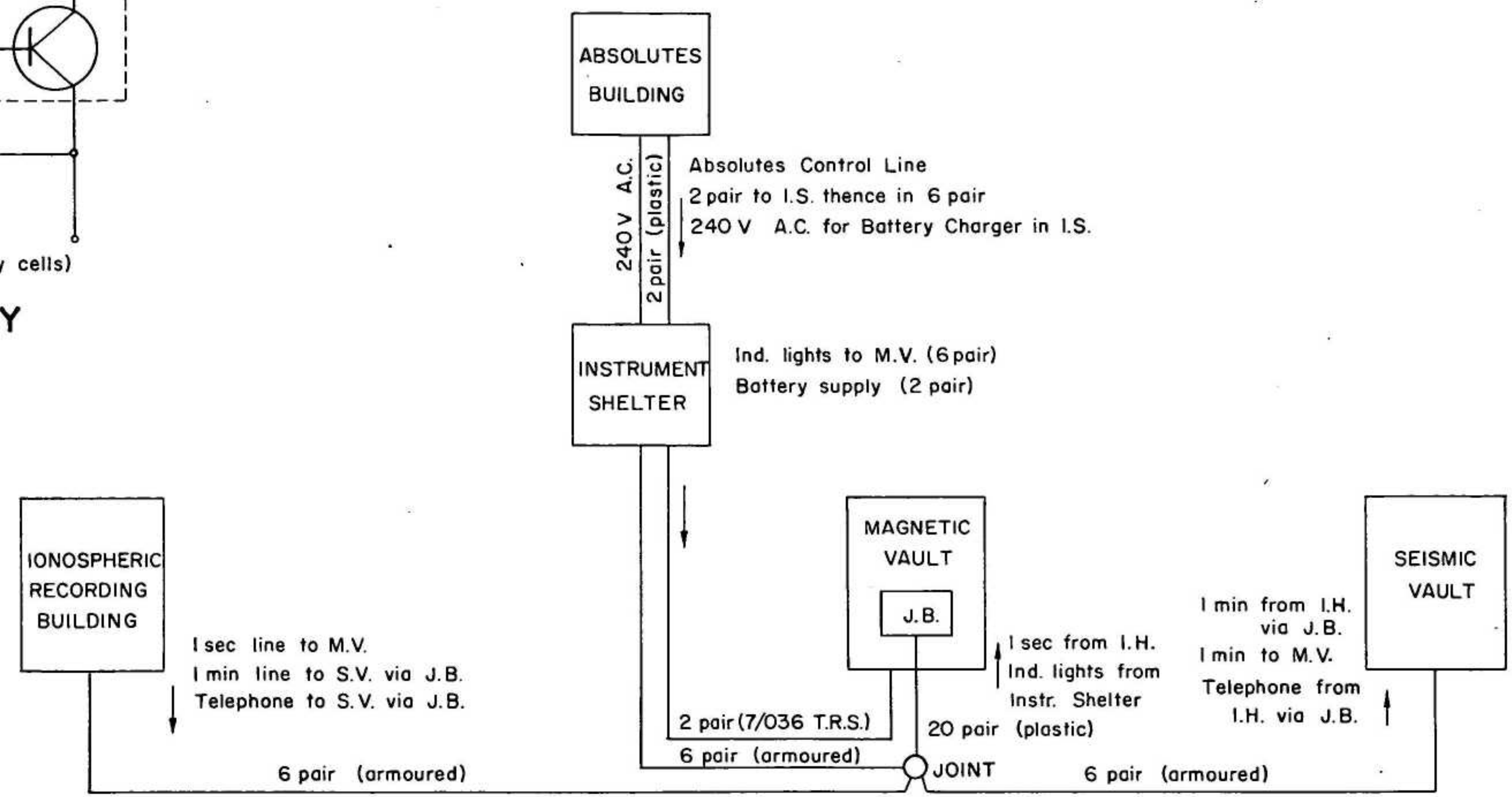


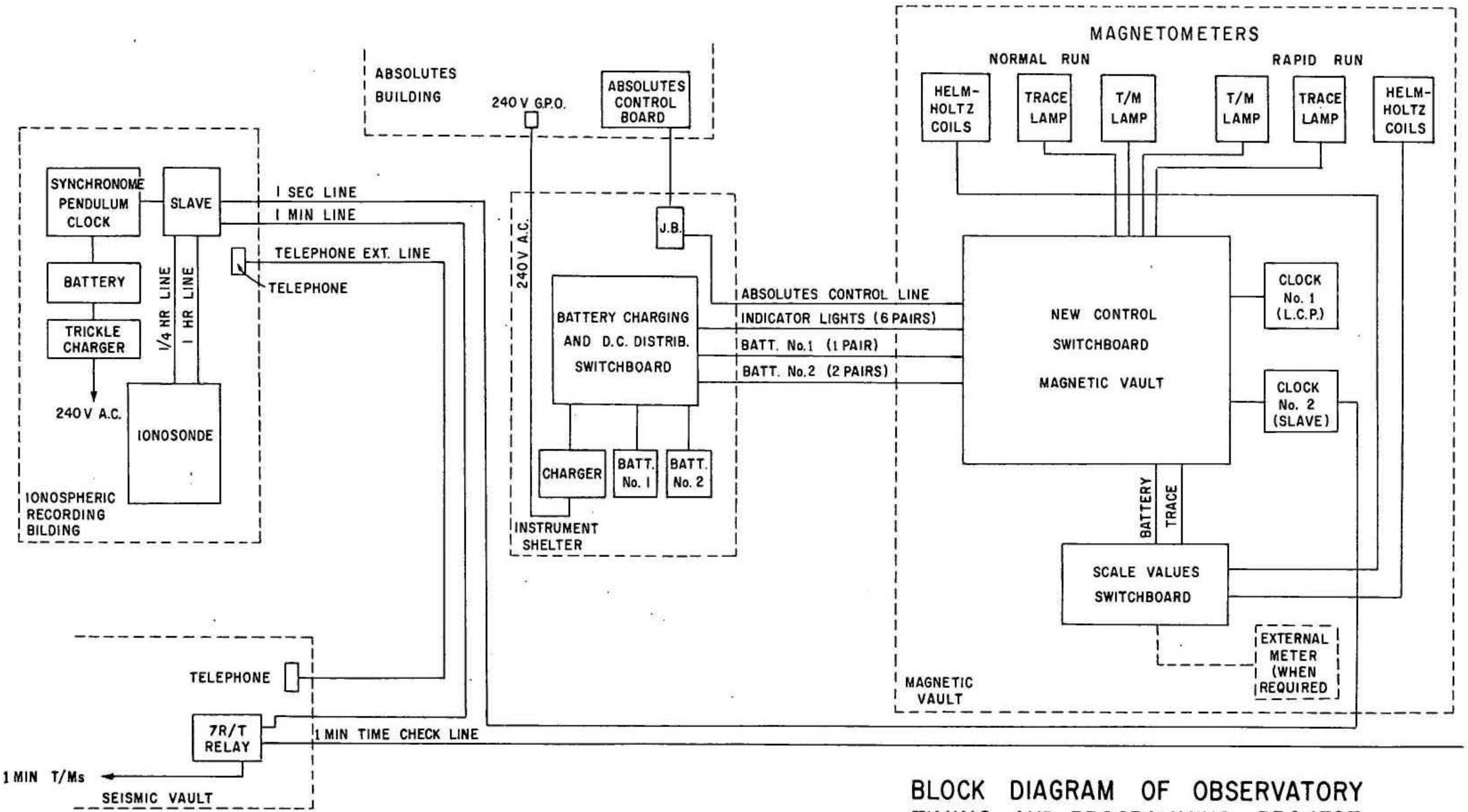
PLATE 6

To accompany Record No. 1965/45

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G 82/3-27

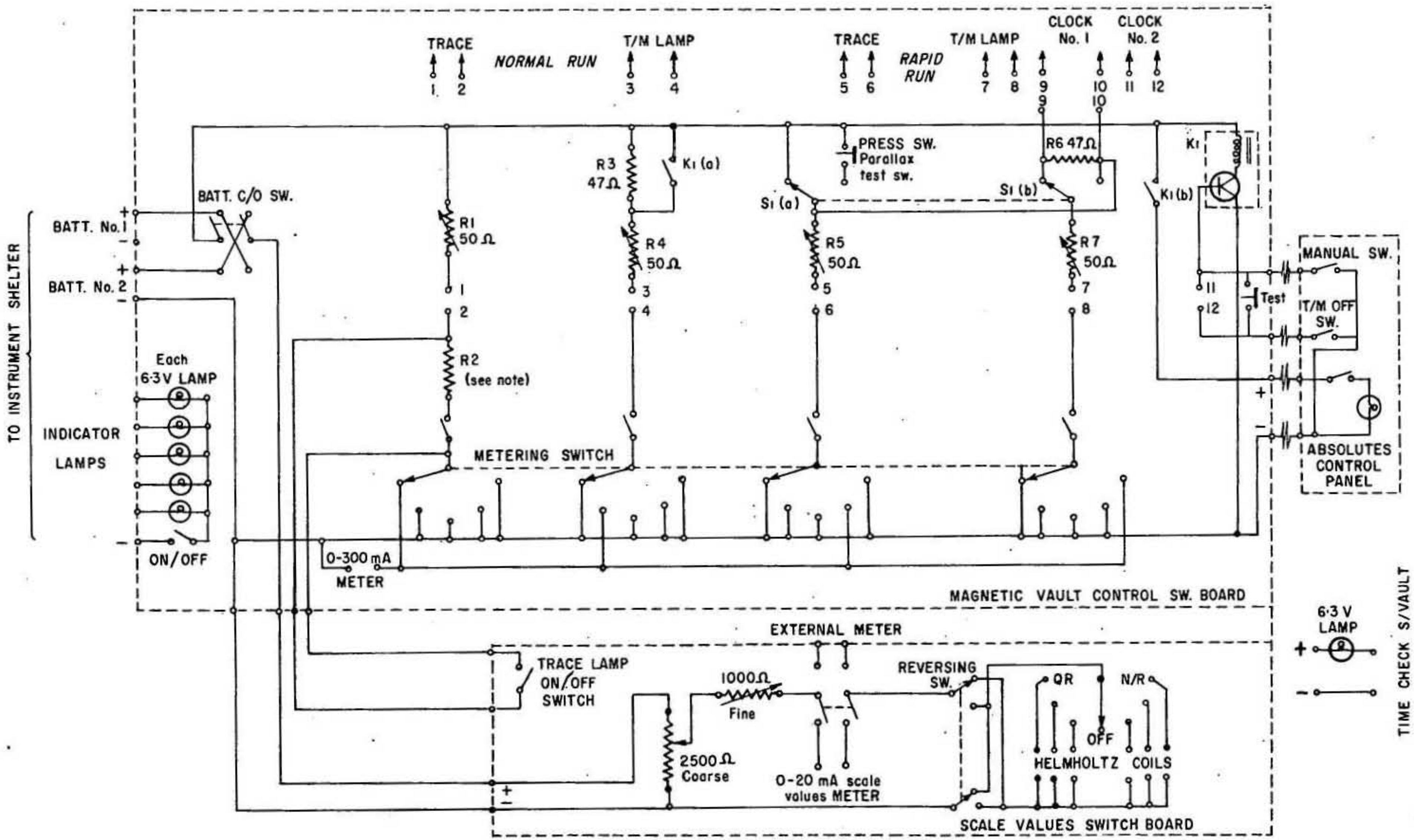
PLATE 7



BLOCK DIAGRAM OF OBSERVATORY TIMING AND PROGRAMMING PROJECT

(IN PROGRESS)

To accompany Record No.1965/45 *Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics* G 82/3-28

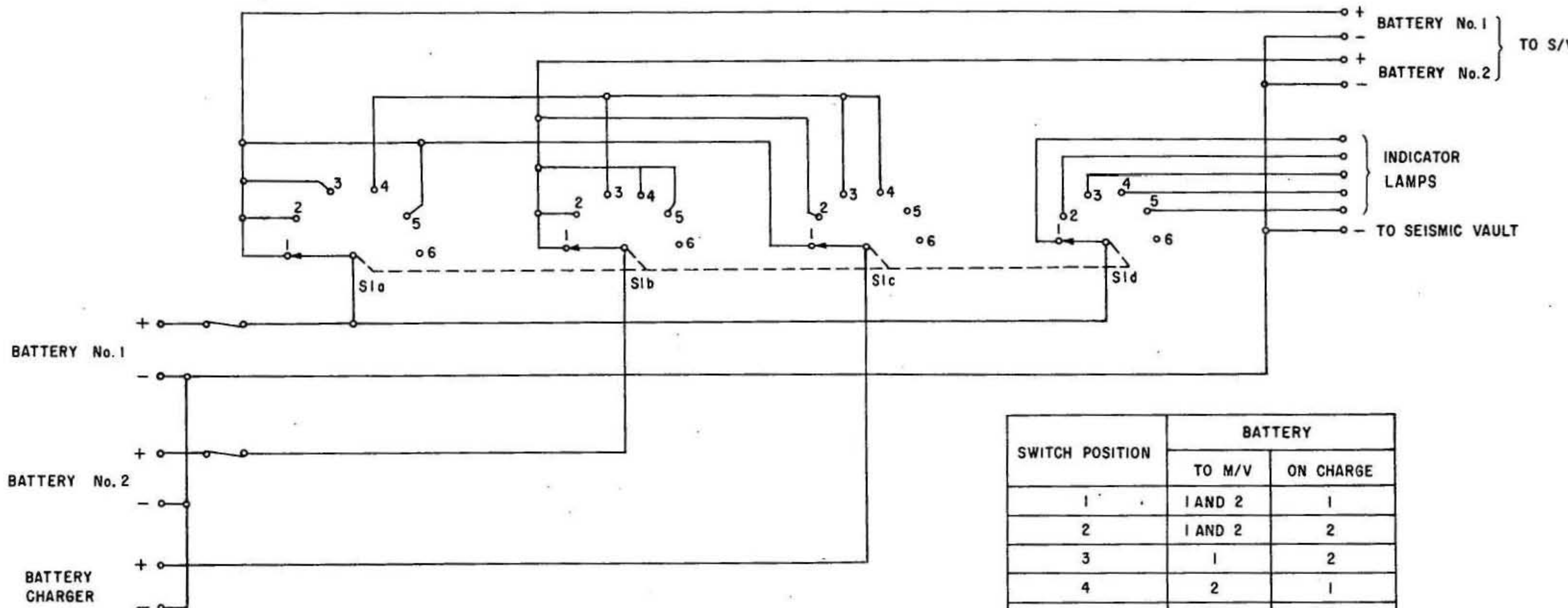


NOTE: R2 value selected to give required increase in lamp current for correct scale values lamp intensity.

MAGNETIC VAULT CONTROL AND SCALE-VALUE SWITCHBOARD

PLATE 8

To accompany Record No. 1965/45

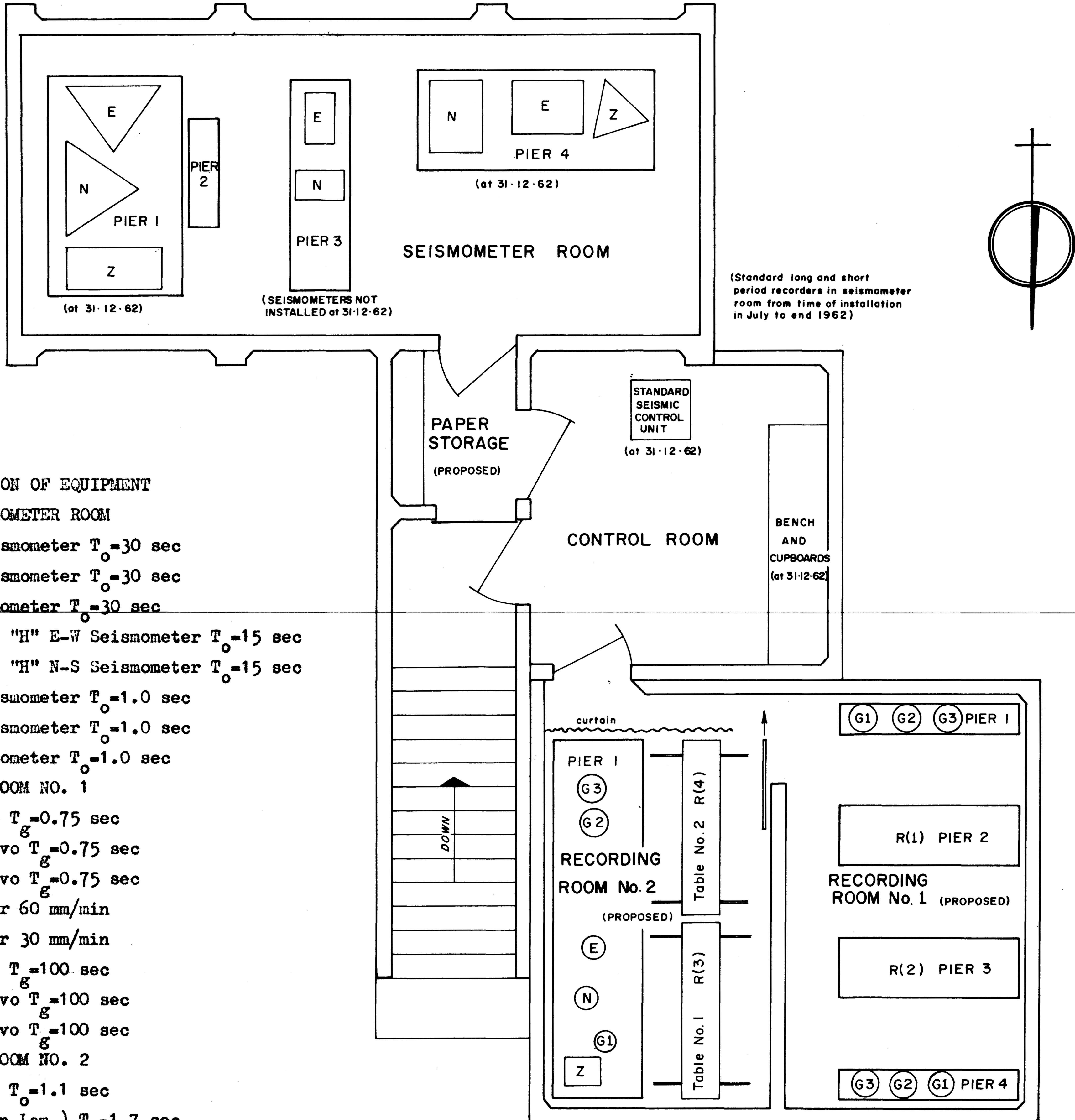


SWITCH POSITION	BATTERY	
	TO M/V	ON CHARGE
1	1 AND 2	1
2	1 AND 2	2
3	1	2
4	2	1
5	1 AND 2	OFF
6	OFF	OFF

BATTERY CHARGING AND D.C. DISTRIBUTION SWITCHBOARD, INSTRUMENT SHELTER TABLETOP OBSERVATORY, PORT MORESBY

PLATE 9

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G 82/3-29



DISPOSITION OF EQUIPMENT

SEISMOMETER ROOM

PIER NO. 1	E	Standard LP E-W Seismometer T_o=30 sec
	N	Standard LP N-S Seismometer T_o=30 sec
	Z	Standard LP Z Seismometer T_o=30 sec
PIER NO. 3	E	Sprengnether Series "H" E-W Seismometer T_o=15 sec
	N	Sprengnether Series "H" N-S Seismometer T_o=15 sec
PIER NO. 4	E	Standard SP E-W Seismometer T_o=1.0 sec
	N	Standard SP N-S Seismometer T_o=1.0 sec
	Z	Standard SP Z Seismometer T_o=1.0 sec

RECORDING ROOM NO. 1

PIER NO. 1	G1	Standard SP Z Galvo T_g=0.75 sec
	G2	Standard SP N-S Galvo T_g=0.75 sec
	G3	Standard SP E-W Galvo T_g=0.75 sec
PIER 2	R(1)	Standard SP Recorder 60 mm/min
" 3	R(2)	Standard LP Recorder 30 mm/min
PIER NO. 4	G1	Standard LP Z Galvo T_g=100 sec
	G2	Standard LP N-S Galvo T_g=100 sec
	G3	Standard LP E-N Galvo T_g=100 sec

RECORDING ROOM NO. 2

PIER NO. 1	Z	Wilson Lamison SP Z T_o=1.1 sec
	G1	GE Galvo (for Wilson Lam.) T_g=1.7 sec
	E	Wood Anderson E-W Torsion Seismometer T_o=0.8 sec
	N	Wood Anderson N-S Torsion Seismometer T_o=0.8 sec
	G2	L&N Galvo (Spreng. Ser H N-S) T_g=15 sec
	G3	L&N Galvo (Spreng. Ser H E-W) T_g=15 sec
TABLE NO. 1	R(3)	Sprengnether 3 Comp. Recorder
TABLE NO. 2	R(4)	Sprengnether 3 Comp. Recorder

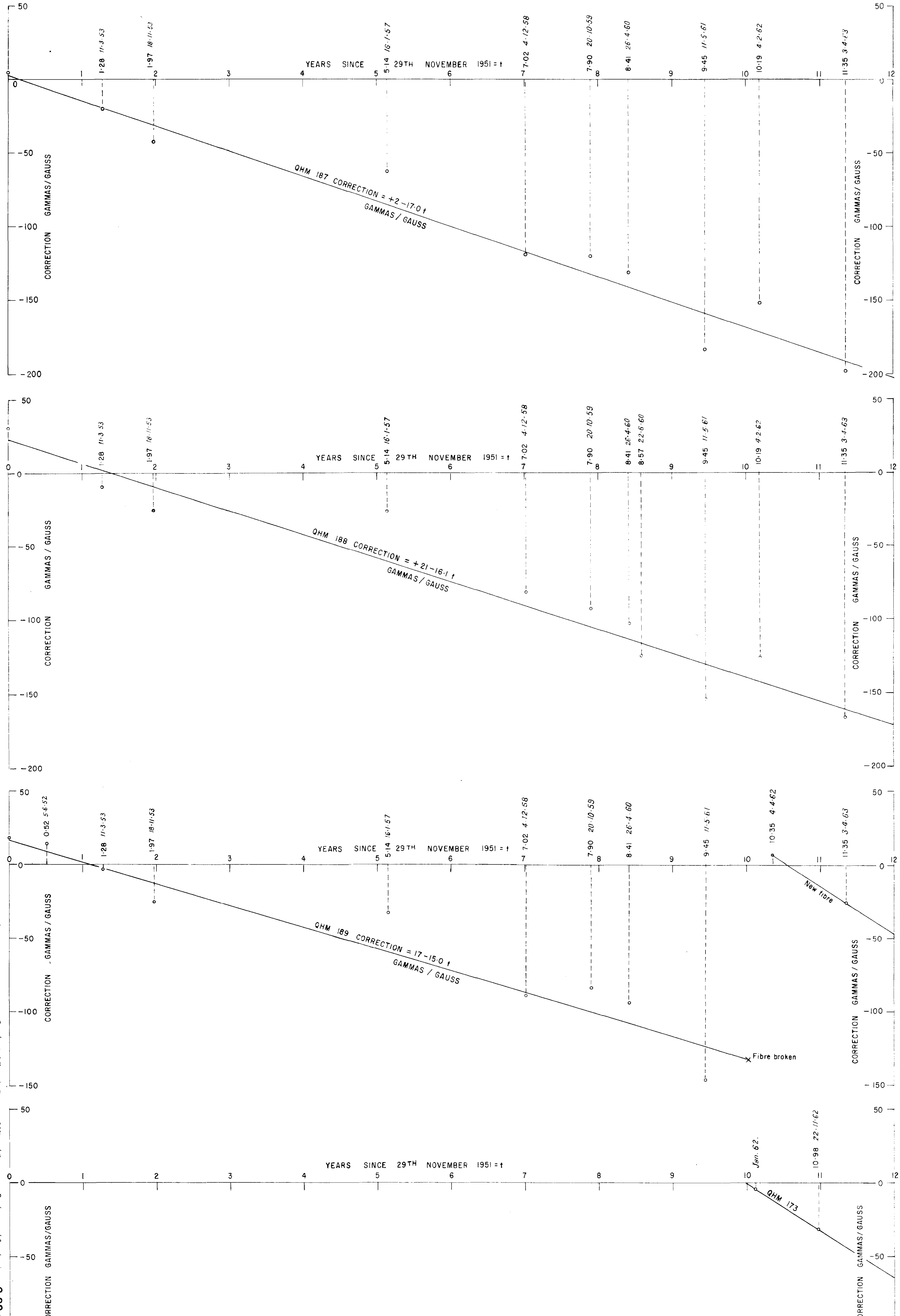
PORT MORESBY GEOPHYSICAL OBSERVATORY SEISMOGRAPH VAULT PLAN

SCALE: 1 inch to 4 feet

To accompany Record No 1965/45

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.

To accompany Record No. 1965/45
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G 82/3-30



CORRECTIONS FOR QHMs 187, 188, 189 AND 173

PLATE II