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GEOPHYSICAL WORK
AT
HEARD ISLAND
1953 - 1954

by

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CONTENTS

CONTENTS (continued)

ILLUSTRATIONS

A B S T R A C T

A brief resume is given of geophysical work done at Heard Island prior to February 1953. This is followed by a detailed account of all work done in connection with the operation and maintenance of the observatories from February, 1953 until January, 1954. An estimate is made of the time involved in the maintenance of these observatories.

Appended are:-

1. The absolute values of the magnetic elements as observed during the period February 5th to December 24th, 1953.
2. An analysis of all teleseisms recorded from February 1st to December 31st, 1953.
3. Gravity values determined at Heard and Kerguelen Islands.
4. Tabulated hours of magnetograph record loss per month from February to December inclusive.
5. Programme timetable.

1. INTRODUCTION

The operation of the magnetic and seismological observatories at Heard Island, latitude 53.0°S., longitude 73.4°E., is carried out by a geophysicist of the Bureau of Mineral Resources, Geology and Geophysics, temporarily attached to the Australian National Antarctic Research Expedition.

The writer was in charge of the two observatories from February 25th, 1953 until January 21st 1954, when they were handed over to the relieving geophysicist.

Magnetic and seismological instruments were installed in 1951. Readers are referred to the reports by Doyle (1953) and Ingall (1953) for details of the establishment of the observatories and the early history of the island.

2. OBSERVATORY HISTORY

(a) Magnetic observatory

The first absolute magnetic measurements at Heard Island were made in December, 1947 by Chamberlain (1952) at West Bay, the site of the present observatory. A re-occupation of this station was made by Schaefler and Doyle in February, 1950.

The observatory buildings were erected in 1951, and normal sensitivity La Cour variometers were installed by Doyle in that year. Further absolute observations were carried out.

Both the absolute and variometer huts are constructed of prefabricated insulated wooden panels, the absolute hut measuring twelve feet square and the variometer hut twelve feet by eighteen feet. (Doyle, 1953).

A small hut for battery charging and storage purposes was erected at West Bay in 1951.

Regular recording of the variometers commenced in 1952, and regular weekly absolute observations were made during that year (Ingall, 1953).

(b) Seismological observatory

The seismic hut was erected in 1950, is of similar construction to the magnetic huts, and measures twelve feet by twenty-four feet.

Provision was made for three pairs of concrete piers each two feet square, by laying the foundation for these piers when the hut was being built.

Installation of a two-component horizontal Wood-Anderson seismograph was completed in 1951.

3. WORK DONE ON OBSERVATORY BUILDINGS IN 1953

(a) Magnetic observatory

(i) Absolute hut

The building was completely re-painted inside and out in December, 1953 and early January, 1954. The greatest deterioration was discovered on the north and west walls. The outer edges of the windows were sealed with P.C.49 at the join with the window frame. A new handle was attached to the inside of the door.

(ii) Variometer hut

This was completely repairted outside and the clock-room was painted inside in December, 1953 and early January, 1954. Cracks in the outside edges of the eaves were sealed with P.C.49 and red lead during the year. The north wall was found to wear rapidly and old paint had to be burnt and scraped off and the surface periodically painted with red lead.

The "time mark" line between the huts was made permanent in August, 1953 by concreting a pole into the ground half-way between the two huts, to support the three-wire line. The first fixtures used to attach the line to the hut walls evertually broke during heavy gales, and had to be strengthened.

(iii) Battery charging hut

The building was completely re-covered with tarred canvas in April, 1953. Two 4 in.x 2in. wooden stays were fixed to the south and west sides to anchor the hut more firmly. Repairs were made to the bottoms of the north and south walls. In December, the hut was painted inside after installing a large shelf to hold the radio transceiver and attaching a cupboard to the wall. A shadow board was made to hold the tools.

For communication with camp, an SCR 694C transceiver was installed. The AR 7 receiver previously used for obtaining time signals was returned to the radio section on request

(b) Seismological observatory

Repairs to the paintwork were commenced in September, 1953 and continued periodically until the outside re-painting and the painting of the clock-room and porch were completed early in January, 1954.

A description of the 240V power line to the seismic hut, is given by Ingall (1953). This was completely replaced in June because water had accumulated in the pipeline. The new power line consists of two seven-strand, nylex-covered lines supported in the same way as the pipeline.

Construction of two concrete piers each two foot square to a height of two feet above the instrument room floor, was begun in October and completed in December. The bench in the south-eastern corner of the instrument room was moved to project out from the centre of the eastern wall. Two rectangular pieces were cut out of the floor, one on either side of the central lengthwise axis of the hut (Plate 2 and Plate 3, Fig.1). These holes exposed two pier bases which were built before the hut was erected. The bases underlay a cross bearer of the hut and therefore could only partly be used as foundations for the new piers. As the bearer passed close to the top of the old bases, extra pieces were cut from it to give a greater clearance before the new construction work was commenced.

The sand was excavated to expose the bedrock, and wooden box frames, the size of the new piers, were constructed to fit around the sides of the floor holes from bedrock upwards to a height of two feet above floor level. These acted as a mould for the concrete, and were removed when the concrete had set. The concrete was prevented from sticking to the frames by lining the latter with waterproof tarred paper. This also gave a smooth surface to the pier sides. The pier tops were surfaced with cement and a slate slab was cemented to bridge the two of them. Beading was fastened to the floor around the base of each pier.

A new red safelight was wired to hang directly above the new pier.

To assist in avoiding piers in the dark, both the new slate top, the tops of the Wood-Anderson piers, and the end of the Wood-Anderson recorder facing to the room were edged with white paint. N, E and Z letters to indicate component instruments were added in white paint to the pier tops in appropriate places.

4. GENERAL REMARKS ON THE CONDITION OF THE OBSERVATORY BUILDINGS.

(a) Magnetic huts

No serious defects are apparent in the construction of, or materials used in, these huts. The following minor points are noted:-

(i) The paintwork, particularly on the variometer hut, suffers on the north and west sides of the huts. If protective coats of red lead or other paint are not applied when necessary, the wooden panels suffer, as they are apt to become sodden.

(ii) Continual high winds, with rain, sleet, snow, and drifting sand in summer, force open the joint along the outer edge of the eaves where the roof and ceiling panels meet. This was overcome in 1953 by plastering the joints with P.C.49 and covering this with red lead. It was suggested to the relieving geophysicist in 1954, that malthoid strips be fixed along the joints.

(iii) Snow from the west and south-west is occasionally forced up through the tripod holes in the floor of the absolute hut. This happens very rarely but could be prevented by making the west wall of the hut weathertight below floor level.

(iv) Ingall's remarks concerning ice forming in the door jambs, and the painting of huts, still apply (Ingall , 1953).

(v) Since the necessary alterations were made, the battery-charging hut has withstood all weather very well. The use of petrol battery-chargers at West Bay has been discontinued (see section 7). However, if it is decided to use a charger again, it would be advisable to install an exhaust outlet and an air inlet to the hut to enable the hut door to be closed when the charger is left running. Otherwise, sudden changes in the weather would endanger the safety of the hut.

(b) Seismic hut

Ingall (1953) stated that the type of building used is unsuitable for the housing of seismographs. On the numerous occasions that winds from either the south-west, west or north-west reached velocities in excess of thirty miles per hour, the Wood-Anderson records became very blurred, and at times, when higher velocities were reached, microseisms could not be distinguished.

Careful consideration was given to methods of erecting windbreaks of varying types, but these were abandoned as impractical. The situation of the hut on the rough basalt slope makes transport of materials and the erection of any substantial construction extremely difficult.

For future observatories a more solid type of construction is necessary, and the building should be set into a hillside where possible, to afford maximum protection from weather.

5. SURVEYING

(a) Sun observations for azimuth determination

The azimuth, from pier A, of the mark used for declination measurements throughout the year, was checked by extra-meridian sunshots on 1st September, 1953. It differed by 0.2' from the value previously used.

(b) Transfer of magnetic meridian from absolute hut to variometer hut

As the hurricane of December, 1952 had moved both huts slightly, a re-transfer of a known azimuth into the variometer room was desirable, in order to check magnet alignments in the variometers. This was done in June, 1953, using the following method:-

The window north of pier A in the absolute hut was removed, and the variometer house door was opened. The magnetometer on pier A could then be sighted on to the wall of the instrument room. It was set pointing at the wall in the azimuth of 50°20'W and a 1" diameter hole was drilled in the wall in line with the vertical cross-hair. By sighting through the hole on to a lighted torch bulb held against the far wall of the instrument room, the azimuth line was fixed across the instrument room. A second hole was drilled in the far wall, so that when sighted through the magnetometer, both holes were in line. The holes were then plugged. A check on any suspected shift of the huts is obtainable simply by removing both plugs and sighting through the magnetometer to see if the holes are aligned in the field of view.

A check on the line, supposedly the 50°W azimuth transferred by Ingall in 1952, showed that it had changed by 3 minutes of arc.

6. INSTRUMENTS

(a) Recording variometers

La Cour magnetographs were installed by Doyle in 1951. They are normal sensitivity instruments, and record continuously at a rate of 15 mm per hour. Final adjustments to the instruments and recorder were made by Ingall in 1952.

Scale values in February, 1953 were:-

H variometer, 10.4 gammas/mm.
D variometer, 0.912'/mm.
Z variometer, 3.1 gammas/mm.

The H magnet is suspended with its north-seeking end east, and the Z magnet with its north-seeking end south.

Variometer temperature-compensation adjustments made by Ingall in 1952 were considered complete and no alterations to these settings were made in 1953.

(i) Variometer orientation

Adjustments for correct orientation were completed in September, 1952. During March, April and May of 1953, the H baseline varied by amounts up to 5 gammas from week to week. A baseline drop of 10 gammas occurred at the beginning of May.

Early in June the H magnet moved for no apparent reason, and tests on its alignment using a Helmholtz coil revealed an approximate 5° misorientation. The main spot had moved only 86 mm. It was returned to its normal position and further orientation tests were made after the new 50°20'W azimuth had been transferred into the variometer room. This confirmed the misorientation shown by the previous test. Early in August a torsion head adjustment was made to the H variometer to realign the H magnet as near as possible to the magnetic prime vertical. Further orientation tests showed a misorientation of 50 minutes. This was considered satisfactory, as no closer adjustment could be obtained because the adjustable prism in the variometer could not be rotated further in the necessary direction. Secular variation will cause the 50 minute misorientation to decrease progressively. A further check made in October, confirmed this result.

Tests on the alignment of the D variometer magnet in October revealed that it was in the meridian 50°37' west. As the magnetic meridian was then 50°19' west and increasing westerly at approximately 12 minutes per annum, this alignment was considered satisfactory.

The reason for the large misorientation of the H magnet is not clear, neither is the reason for its sudden movement in June. This latter movement can only be ascribed to a bump received by the instrument, but the position of the baseline spot was not altered. The movement occurred at the time of a record change.

The H baseline inconsistencies prior to June suggest that the magnet had been misaligned for some months, as declination changes could cause such inconsistencies. The most likely time that a sudden misalignment could have occurred was during the hurricane of 29th December, 1952. It is not possible to state definitely how the movement occurred.

(ii) Magnetograph recorder

The La Cour drum drive escapement periodically stopped, causing loss of trace. Whenever this occurred the escapement was replaced by the spare, and dismantled, cleaned and oiled. Loss of trace was reduced by replacing the escapement in use, by the spare, every two months.

(iii) Magnetograph pendulum clock

No trouble of any kind was experienced with the clock until July, when it stopped after an adjustment had been made to the position of the minute hand. A detailed examination and overhaul of the clock was made. The fine sheet steel suspension piece at the top of the pendulum was replaced. On reassembling, the clock started and continued satisfactorily for the rest of the year.

The following points need close attention when assembling the clock in future:-

(1) The pressure between the brass plates encasing the gear train must be even, and adjusted so that all cogs are free to move.

(2) The fit of the minute hand on the central cam must be tight.

(iv) Electrical wiring

The enamelled wiring from the switchboard to the Helmholtz coils was replaced in April by cotton-covered wiring.

The wire-wound potentiometers used in the scale value circuit and also the five-position ceramic switch needed replacing. Two new slide wire potentiometers, which were sent to replace the wire wound potentiometers in the scale value circuit, proved unsuitable after a few weeks' use because the windings were not on grooved formers, causing short circuits between windings of the potentiometer.

Photographic copies of electrical wiring diagrams in the magnetic observatory were made during the year (see Plate 4).

(b) Absolute and semi-absolute instruments

This equipment consisted of:-

(i) QHMs 173 and 174.
(ii) BMZ No.62.
(iii) Modified Kew pattern magnetometer (Elliott Bros.)
(iv) Dip Circle No.226.

(i) Both QHMs were used each week, a complete set of observations being made with each on pier D. Intercomparisons were made through baselines in January, 1954.

QHM 173 does not clamp tightly on the base and special care must be exercised while using this instrument. The clamp on the base could not be tightened, as this prevented the attachment of No.174 when required.

(ii) B.M.Z. No 62 was regularly used for vertical intensity measurements. Observations were made on pier D, and usually consisted of a set of 3 measurements. Checks on the "Disc Zero" position of the turn magnet were made every four months. This position remained stable throughout the year.

(iii) The magnetometer was used for declination measurements. Two fibres were broken early in March and since then the same fibre has remained in the instrument.

(iv) Occasional inclination observations were made with the dip circle during the year for familiarisation purposes.

In February, 1952, QHM 172 was intercompared on Heard Island with QHMs 187, 188, 189. These had previously been intercompared with Askania Magnetometer No.508813 at Toolangi. During 1952, QHMs 172, 173, 174 were intercompared, and after a special series on 3rd February, 1953, QHM 172 was returned to Melbourne for intercomparison with Askania Magnetometer No.508813 in June, 1953, November, 1953 and July, 1954. From these results, an I.M.S. correction for QHM 172 has been obtained, and corrections for Nos. 173 and 174 have been interpolated.

In February, 1952, BMZ No.62 was intercompared with Askania Earth Inductor No.5010174 on Heard Island. As these results were not satisfactory, no I.M.S. correction has yet been obtained for the instrument.

The modified Kew pattern magnetometer was intercompared with D.T.M.C.I.W. Magnetometer No.18 at Toolangi in January, 1951. It was also intercompared with Askania Magnetometer No.508810 on Heard Island in February, 1952. The I.M.S. correction used is that obtained from the first of these intercomparisons.

(c) Registration of instant of absolute magnetic observations on magnetograms

This apparatus was designed and installed by Ingall. Successful operation was continued throughout 1953. A refinement made during the year was the installation of a permanent line between absolute and variometer huts in August, 1953.

(d) Seismological instruments

A two-component, horizontal, Wood-Anderson seismograph was installed by Doyle in 1951. N-S and E-W components are recorded, instrument constants being:-

Rate of recording, 30 mm/minute
Free period, 0.75 secs.
Static magnification, 2800
Damping ratio, 20:1

During 1953, experiments were made using a free period of 1.5 seconds, which was the largest value obtainable with the suspensions in use. Larger amplitude microseisms were recorded, and at times were large enough to seriously inconvenience interpretation of records. After a month's trial recording, the free period was reduced to 0.75 seconds.

Free-period tests were made at the time of all alterations. The damping magnet was lowered below the level of the inertia weight and the weight set oscillating with small movements of one of the levelling screws. With the recording drum revolving at maximum speed, and the light source turned up, a photographic record of the swings could be obtained.

Ingall (1953) stated that the N-S light source blew a number of times. This was also experienced, in 1953, but to a lesser extent.

In October, 1953, the brass screw in the free roller of the recorder came loose inside the roller. The screw acted as a balance weight. The hole in the end of the recorder had to be drilled larger and the screw extracted and welded back in position.

Small pieces of nickel plating started peeling off the surface of this roller in places, but to date this has not affected the uniform spacing of the minute marks.

The hourly contacts affixed to the Mercer chronometer occasionally jammed the minute hand, causing loss of time marks. To overcome this problem, provision would have to be made inside the contact system of the clock for the minute contact to be shorted out on the hour.

The transformer in one of the selenium cell battery chargers burnt out in September. Repairs were attempted but were unsuccessful, as no transformer with the correct gauge windings was available. At intervals from September until the date of relief, one battery had to be charged in camp.

7. OBSERVATORY ROUTINE

(a) Magnetic observatory

(i) Daily routine

The variometer trace was changed daily throughout the year at 0300 G.M.T., i.e. 0800 local time. A daily log was kept of trace changes and variometer temperatures. Minor items such as pendulum clock time checking, cleaning and examination of huts, repairs to wiring, etc. were normally carried out at trace change time.

(ii) Absolute magnetic observations

Absolute observations were made once per week, usually on Thursdays. Eight values of H were obtained using QHMs, two values of declination using the magnetometer, and 3 or 6 values of Z with the B.M.Z.

The use of the "press-button system" for registering times of absolute observations, enabled particularly accurate baseline checks to be made each week, even under disturbed conditions.

(iii) Variometer scale values

H and Z variometer scale values were checked once per week when magnetically quiet conditions prevailed. Helmholtz coils placed over the variometers produced a known magnetic field to deflect the magnet.

D variometer scale values were made once every four months, deflection of the magnet being obtained by turning the torsion head.

(iv) Developing of records

This was done twice weekly, the day after carrying out scale-value tests and the day after carrying out absolute observations, so that either could be repeated if necessary.

(v) Battery charging

In February, 1953 two reconditioned petrol battery chargers were brought to the island to replace those in use. From the outset it was evident that this method of charging batteries was unreliable, due to frequent breakdowns. Much time was wasted in effecting repairs and adjustments, often at considerable personal inconvenience. It was found that the chargers would not work efficiently unless the door of the charging hut was left open, and this endangered the hut in high winds and allowed sand and snow to enter the building as it was left unattended for 24 hours at a time. This system of charging batteries was abandoned in June in favour of charging them two at a time in camp and transporting them $1\frac{1}{4}$ miles to the observatory once a fortnight by tractor. Thereafter, no further trouble was experienced.

(vi) Interpretation of records

Hourly scaling.

Mean hourly values of the three magnetic elements, and daily maximum and minimum values were regularly scaled.

Provisional monthly means.

At the end of each month, provisional mean values of H, D and Z for that month were evaluated using the hourly values and baseline values determined during the month. The scale value used to reduce the scalings was the mean value of the results of the scale-value tests made during the month.

K Index scaling.

Five quiet days were selected for each month when possible. From these hourly scalings, a mean set of 24-hourly values was computed and averaged with the mean set of the same month in 1952. The resulting 24-hourly values were plotted on celluloid to form the Sq curve for the month from which 3-hourly K indices were derived.

Magnetic storms.

Tabulation of magnetic storms was made at the end of each month.

(vii) Distribution of data.

Provisional monthly mean values, provisional scale values for each month, and K indices were transmitted to Head Office, Melbourne as soon as possible after the end of the month. Magnetic storm data was sent for the months of March, April and May. A general report covering all phases of observatory activities was also despatched to Melbourne.

In compliance with a request from the geophysicist at Kerguelen, the monthly average diurnal range of Z with time of maximum, a list of the ten quietest days in the month, and magnetic storm data were sent to him.

(b) Seismological observatory

(i) Daily routine

The record was changed daily at 1200 G.M.T. (1700 local time). Time signals were attempted daily, but poor radio conditions frequently prevented reception.

(ii) Maintenance

Routine maintenance of the seismograph recorder was carried our fortnightly. Tidying of the hut and repairs to it were done when necessary.

(iii) Developing of records

This was done twice per week at the same time as the magnetic records were developed.

(iv) Interpretation of records

Data revealed by the recorded teleseisms was extracted and despatched to Head Office, Melbourne, as soon as possible after developing the record.

Microseismic amplitudes and periods were scaled for July, August and September.

(c) Geophysicist's office

Office work was carried out in the biology hut during 1953. Desk space and room for the storage of office equipment was quite adequate.

The Odhner calculating machine, although manually operated, was found to be invaluable. It would be desirable for a semi-automatic or automatic, electrically-operated calculating machine to be included in the Heard Island equipment.

8. CAMP DUTIES

Camp duties were carried out by every member of the party, one day in twelve being spent doing mess duties. General maintenance about the station was always required, and with the larger jobs, assistance was given by all members of the party.

9. GENERAL TIMETABLE

The work at Heard Island can be subdivided into four main types:-

(a) Routine geophysical work, comprising:-

(i) Trace changes and absolute observations carried out at fixed times.

(ii) Reduction of records, writing of logs, answering correspondence, etc., carried out when possible.

(b) Non-routine geophysical work.

Checking and adjustment of instruments and electrical wiring, repairs to huts, etc., carried out when possible.

(c) Routine camp duties.

(d) Non-routine camp duties.

The table in Appendix has been drawn up tabulating the normal working hours and indicating the times of duties (a) (i), as these are fixed. The remaining $46\frac{3}{4}$ hours per week, indicated by the word "office", are taken up by duties (a) (ii), (b), (c) and (d).

Sections (a) (ii) and (c) can be allotted an estimated weekly time necessary for completion:-

Section (a) (ii):-

Developing records	2 hours per week
Scaling absolute observations, reduction to base and checking	3 " " "
Scaling magnetograms	5 " " "

End of month data reductions	3 hours per week
Daily logs (½hour per day)	3½ " " "
Magnetic storm analyses	1 " " "
Battery changes, West Bay	½ " " "
Total	18 hours per week

Section (c):-

Routine camp duties	5 hours per week
Total	23 " " "

Based on a seven day week from 7.00 a.m. to 7.00 p.m. with breaks for two meals per day, 23¾ hours per week remain, during which the remaining duties must be carried out. These include:-

1. Repeat absolute observations, if necessary.

2. Attention to instrument adjustments and absolute observations associated with this.

3. All work associated with the seismological observatory, except trace changes and developing of records.

4. Answering of correspondence and any extra duties thus entailed.

5. Repairs to huts.

6. Extra camp duties e.g. assistance with large station jobs etc. which are done only during the day.

As these jobs were done at indefinite times and for indefinite durations, usually upsetting scheduled timetables, a high percentage of actual office work was done after 8.00 p.m. The amount of this additional work was increased occasionally as time had to be set aside for recreation and short field trips.

10. RESULTS

Pending the publication of detailed results for the year 1953, tables of observed values of D,H and Z are given in Appendix 1. The final reduction of magnetic results for the year is in hand.

Phases of teleseisms recorded between 1st February and 31st December are listed in Appendix 2.

A brief explanation of gravity determinations at Heard Island, Kerguelen Island and Mawson accompanies the tabulation of values obtained (Appendix 3).

As an indication of the performance of the La Cour magnetograph, the number of hours of record lost each month have been tabulated, together with reasons for such loss (Appendix 4)

Appendix 5 sets out the general timetable of work done in order to operate and maintain the observatories.

11. CONCLUSIONS

The operation of the magnetic and seismological observatories on Heard Island proceeded smoothly throughout 1953.

The regular recording and accurate control of the La Cour variometers is enabling the distribution of magnetic data from this region to be continued.

A large amount of material is available for correlating microseismic and meteorological information (Ingall, 1953).

The recordings of teleseisms both in quality and quantity was disappointing. Since relief operations in January, 1954, longer period suspensions have been installed in the Wood-Anderson seismographs. It is hoped that these, together with a vertical component seismograph, will increase the value of the seismological information available.

12. ACKNOWLEDGEMENTS

It is desired to acknowledge the assistance given by the Observatories Group Staff, Geophysical Section, Bureau of Mineral Resources, with the preparation of this record, particularly Messrs. Prior and Van der Waal.

Thanks are also due to all members of the 1953 Australian National Antarctic Research Expedition, who provided invaluable help and assistance throughout the year.

13. REFERENCES

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Melbourne
May, 1955

APPENDIX 1

ABSOLUTE VALUES OF HORIZONTAL INTENSITY AT HEARD ISLAND

All values corrected to I.M.S.

Observations made on Station D.

Date 1953	G.M.T. h. m.	Observed Value (gammas)
5 Feb.	04 17	18499
	04 51	18496
12 Feb.	04 36	18498
19 Feb.	03 46	18504
	04 27	18506
25 Feb.	05 58	18474
	06 26	18453
5 Mar.	05 16	18494
	06 03	18486
12 Mar.	04 24	18495
	05 03	18490
19 Mar.	05 25	18481
	06 04	18485
25 Mar.	05 18	18455
	05 56	18462
2 Apr.	03 52	18487
	04 23	18488
9 Apr.	03 46	18483
	04 20	18484
16 Apr.	03 49	18438
	04 27	18416
23 Apr.	03 47	18347
	04 26	18331
29 Apr.	03 48	18488
	04 23	18492
7 May	04 07	18475
	04 44	18474
11 May	04 25	18479
14 May	04 02	18491
21 May	03 44	18472
	04 29	18468
28 May	04 27	18483
	05 05	18486
4 June	03 58	18448
	04 36	18444
10 June	03 49	18480
	09 52	18479

APPENDIX 1 (continued)

ABSOLUTE VALUES OF HORIZONTAL INTENSITY AT HEARD ISLAND

All values corrected to I.M.S.

Observations made on Station D

Date 1953	G.M.T. h. m.	Observed value (gammas)
12 June	10 26	18478
17 June	04 16 04 53	18492 18487
25 June	04 02 04 44	18474 18476
3 July	03 47 04 26	18478 18483
9 July	03 45 04 18	18482 18484
16 July	04 16 04 54	18478 18483
19 July	03 35 05 44	18490 18490
30 July	05 10 05 52	18467 18476
6 Aug.	03 40 05 20	18496 18496
13 Aug.	03 59 04 39	18444 18478
20 Aug.	03 57 04 33	18493 18498
27 Aug.	05 17 05 53	18483 18470
3 Sept.	03 38 04 13	18490 18496
10 Sept.	03 44 04 16	18500 18503
17 Sept.	03 37 04 13	18452 18481
24 Sept.	03 38 04 17	18487 18491
26 Sept.	03 33 10 09	18495 18452
1 Oct.	03 15 05 38	18476 18479
8 Oct.	03 37 06 05	18506 18485

APPENDIX 1 (continued)

ABSOLUTE VALUES OF HORIZONTAL INTENSITY AT HEARD ISLAND

All values corrected to I.M.S.

Observations made on Station D

Date 1953	G.M.T. h. m.	Observed value (gammas)
15 Oct.	03 58	18513
	04 29	18510
22 Oct.	03 43	18422
	04 27	18448
29 Oct.	03 36	18507
5 Nov.	03 37	18490
	04 15	18488
13 Nov.	04 09	18511
	04 44	18513
19 Nov.	04 01	18441
	04 38	18430
26 Nov.	03 37	18498
	04 16	18507
3 Dec.	03 35	18490
	04 09	18493
10 Dec.	04 12	18514
	04 52	18511
17 Dec.	03 51	18509
	05 06	18503
24 Dec.	03 56	18504
	04 34	18500

APPENDIX 1. (continued)

ABSOLUTE VALUES OF DECLINATION AT HEARD ISLAND

All values corrected to I.M.S.

Observations made on Station A

Date 1953	G.M.T. h. m.	Observed Value Degrees Minutes.
5 Feb.	09 41	-50 01.2
	09 54	-50 00.7
12 Feb.	05 13	-50 07.6
	05 28	-50 07.1
	05 28	-50 07.1
	05 47	-50 06.7
	06 00	-50 06.9
19 Feb.	05 55	-50 03.0
	06 09	-50 04.0
25 Feb.	07 18	-50 08.7
	07 27	-50 07.3
5 Mar.	06 51	-50 06.6
	07 12	-50 06.2
12 Mar.	06 39	-50 06.0
	06 54	-50 06.2
19 Mar.	04 20	-50 06.7
	04 47	-50 07.2
26 Mar.	04 08	-50 06.3
	04 32	-50 06.4
2 Apr.	04 56	-50 10.2
	05 18	-50 08.6
9 Apr.	04 59	-50 06.4
	05 20	-50 05.6
16 Apr.	05 09	-50 02.3
	05 33	-50 02.4
23 Apr.	05 08	-49 53.0
	05 32	-50 00.1
29 Apr.	04 59	-50 10.1
	05 20	-50 10.5
7 May	05 36	-50 09.1
	05 59	-50 10.5
14 May	04 42	-50 09.3
	05 04	-50 09.7
21 May	05 09	-50 08.8
	05 32	-50 07.7
	05 44	-50 07.4
28 May	06 04	-50 08.2
4 June	05 16	-50 11.4
	05 38	-50 07.3

APPENDIX 1. (continued).

ABSOLUTE VALUES OF DECLINATION AT HEARD ISLAND

All values corrected to I.M.S.

Observations made on Station A

Date 1953	G.M.T. h. m.	Observed Value Degrees	Minutes
10 June	04 29	-50	08.7
	04 51	-50	07.5
17 June	05 43	-50	08.3
	06 03	-50	07.8
25 June	05 28	-50	06.9
	05 46	-50	06.6
3 July	05 10	-50	10.7
	05 30	-50	10.3
9 July	04 52	-50	09.4
	05 14	-50	09.0
16 July	05 28	-50	10.1
	05 46	-50	10.1
23 July	04 40	-50	04.3
	04 59	-50	04.9
30 July	04 10	-50	12.3
	04 29	-50	12.3
6 Aug.	05 53	-50	11.3
	06 09	-50	10.6
13 Aug.	05 11	-50	07.0
	05 29	-50	08.4
20 Aug.	05 07	-50	10.2
	05 26	-50	10.3
27 Aug.	04 04	-50	14.5
	04 22	-50	12.3
	04 38	-50	12.0
3 Sept.	04 48	-50	13.3
	05 06	-50	13.7
10 Sept.	05 07	-50	09.1
	04 49	-50	09.4
17 Sept.	04 46	-50	13.2
	05 04	-50	13.1
24 Sept.	04 55	-50	14.9
	05 12	-50	17.0
1 Oct.	03 52	-50	11.1
	04 53	-50	09.0
8 Oct.	04 20	-50	15.0
	05 17	-50	13.0

APPENDIX [illegible]. (continued)

ABSOLUTE VALUES OF DECLINATION AT HEARD ISLAND

All values corrected to I.M.S.

Observations made on Station A

Date 1953	G.M.T. h. m.	Observed Value Degrees Minutes
15 Oct.	05 03	-50 14.5
	05 21	-50 14.2
22 Oct.	05 05	-50 14.1
	05 24	-50 12.3
29 Oct.	04 15	-50 16.5
	04 32	-50 16.2
1 Nov.	01 30	-50 13.6
	01 47	-50 14.0
5 Nov.	04 56	-50 15.9
	05 12	-50 15.7
12 Nov.	05 23	-50 15.6
	05 41	-50 15.1
19 Nov.	05 12	-50 13.3
	05 29	-50 13.1
26 Nov.	05 57	-50 13.2
	06 16	-50 11.8
3 Dec.	04 39	-50 15.5
	04 55	-50 14.2
10 Dec.	05 33	-50 14.4
	05 51	-50 15.5
	06 27	-50 14.4
24 Dec.	05 17	-50 14.3
	05 34	-50 16.9

APPENDIX 1. (continued)

ABSOLUTE VALUES OF VERTICAL INTENSITY AT HEARD ISLAND

All Values uncorrected to I.M.S.

Observations made on Station D

Date 1953	G.M.T. h. m.	Observed Value (gammas)
5 Feb.	03 43	-47158
12 Feb.	03 48	-47150
19 Feb.	05 09	-47148
25 Feb.	05 16	-47133
5 Mar.	04 09	-47182
12 Mar.	06 09	-47171
19 Mar.	07 12	-47162
26 Mar.	06 39	-47175
2 Apr.	05 53	-47157
9 Apr.	06 02	-47168
16 Apr.	06 18	-47152
23 Apr.	06 07	-47145
	08 08	-47184
	10 44	-47195
29 Apr.	05 58	-47181
	07 28	-47176
	10 50	-47176
7 May	06 43	-47201
14 May	06 13	-47186
21 May	06 12	-47190
28 May	06 42	-47192
4 June	06 21	-47185
10 June	05 46	-47182
	09 22	-47190
17 June	06 49	-47188
25 June	06 19	-47185
3 July	06 12	-47194
9 July	05 53	-47196
16 July	06 37	-47200
23 July	04 10	-47141
	05 36	-47160

<u>APPENDIX 3. (continued)</u>

ABSOLUTE VALUES OF VERTICAL INTENSITY AT HEARD ISLAND

<u>All values uncorrected to I.M.S.</u>

<u>Observations made on Station D</u>

Date 1953	G.M.T. h. m.	Observed Value (gammas)
26 July	03 40	-47173
27 July	03 51	-47175
30 July	03 41	-47194
6 Aug.	06 37 09 39	-47191 -47198
13 Aug.	06 10	-47196
20 Aug.	07 00	-47202
27 Aug.	03 36	-47116
3 Sept.	05 38	-47208
10 Sept.	05 43	-47210
17 Sept.	05 46	-47209
21 Sept.	02 59	-47178
26 Sept.	10 53	-47220
1 Oct.	04 28	-47185
8 Oct.	04 55	-47207
15 Oct.	06 03	-47210
22 Oct.	05 58	-47214
29 Oct.	05 09	-47209
31 Oct.	02 41 03 06	-47183 -47196
5 Nov.	06 20	-47200
6 Nov.	03 15	-47220
12 Nov.	03 30	-47197
16 Nov.	03 14	-47173
19 Nov.	03 28	-47199
26 Nov.	05 16	-47213
3 Dec.	05 35	-47208
4 Dec.	09 56 11 49	-47228 -47231

APPENDIX 1. (continued)

ABSOLUTE VALUES OF VERTICAL INTENSITY AT HEARD ISLAND

All values uncorrected to I.M.S.

Observations made on Station D

Date 1953	G.M.T. h. m.	Observed Value (gammas)
10 Dec.	03 31	-47229
17 Dec.	03 16	-47229
24 Dec.	03 18	-47209

APPENDIX 2.

TELESEISMS RECORDED BETWEEN FEBRUARY 1 AND DECEMBER 31, 1953

Latitude: 53° 01' S. Longitude: 73° 23' E.
Instrument: Two component (NS&EW) Wood Anderson
Instrumental Height above M.S.L.: 10m.
Foundation: Solid Basalt Rock
Period: 0.75 secs
Damping Ratio: 20 to 1
Static Magnification: 2800
Rate of Recording: 35 mm per minute

Date	Phase	Time (G.M.T.) h m s	Max. trace amplitude (mm) N.	E.	Period (secs)	Origin Time	Delta degrees	Depth Remarks etc.
March 18	(eL)NE	20 00	0.2	0.2	17			USCGS H 19 06 11 40°N 27½°E.
April 18	(eS)NE	03 20	0.6	0.4	9			No USCGS Report
April 23	ePNE	16 36 50	0.4	0.4		16 24 34	80.6	USCGS H 16 24 17 4°S 154°E
	eSNE	16 46 57	0.7	0.4	5			
	eLqN	16 59 42	0.6	0.2	32			
	MNE	17 07.3	1.0	1.1	20			
May 6	(eP)NE	17 29 13						
	(eS)	17 39 33	1.0	1.0	5	17 16 44	83.2	USCGS H 17 16 48 36½°S 73°W
	M	18 05.5	0.4		21			
June 25	(eP)NE	10 55 23	0.2		(0.6)	10 45 11	60.2	USCGS H 10 44 57 8½°S. 123½°E.
	(eS)E	11 03 36		0.4	6			
	MNE	11 19.8	0.3	0.3	20			
July 2	iP	07 08 43	* 0.6	0.6	(1)	06 57 05	77.8	Depth 200 Km USCGS H 06 56 51 18½°S 169°E.
	ipP	09 30	0.7					
	eSE	18 18		1.2				
Sept. 14	(eS)NE	10 27	0.5	0.5				No USCGS Record
	(eS)NE	11 24	1.3	1.0				USCGS H 11 12 06 52½°S 26°E.
Sept. 29	iP	01 47 24						300 Km USCGS H 01 36 45 36½° 177°E
	epP	01 48 26						
Nov. 4	(eP)NE	03 01 39						USCGS H 03 49 04 12½°S 166½°E
	LNE	04 38	0.5	0.9	15			
Nov. 25	LNE	(18 00)			20			USCGS H 17 48 49 34°N 141°E.

* Initial Amplitude

Date	Phase	Time (G.M.T.) h m s	Max. trace amplitude (mm) N. E.	Per iod (sec)	Origin Time	Delta (degrees)	Depth Remarks etc.
Dec. 12	LNE	18 40	0.4 0.5	19			USCGS H 17 31 22 $3\frac{1}{2}^{\circ}$S 81°W

APPENDIX 3.

GRAVITY DETERMINATIONS AT HEARD ISLAND, KERGUELEN ISLANDS, AND MAWSON, ANTARCTICA.

In January, 1954, the relief geophysicist brought a Norgaard gravity meter to Heard Island, and readings were taken at the gravity station established in 1953.

Subsequently, values were obtained at the gravity station at Port aux Francaise on the Kerguelen Islands, and at Mawson on the Antarctic Continent.

After returning from Mawson, repeat readings were made at Heard and Kerguelen Islands.

The value for Mawson is not given, as a satisfactory reading of the instrument could not be obtained.

Station	Latitude	Longitude	Elevation (above) (M.S.L)	Gravitational Force
Heard Island	53°01'11"S.	73°23'07"E.	10.0 ft.	981.475 galls
Kerguelen Island	49°21'08"S.	70°13'27"E.	6.6 ft.	981.075 galls

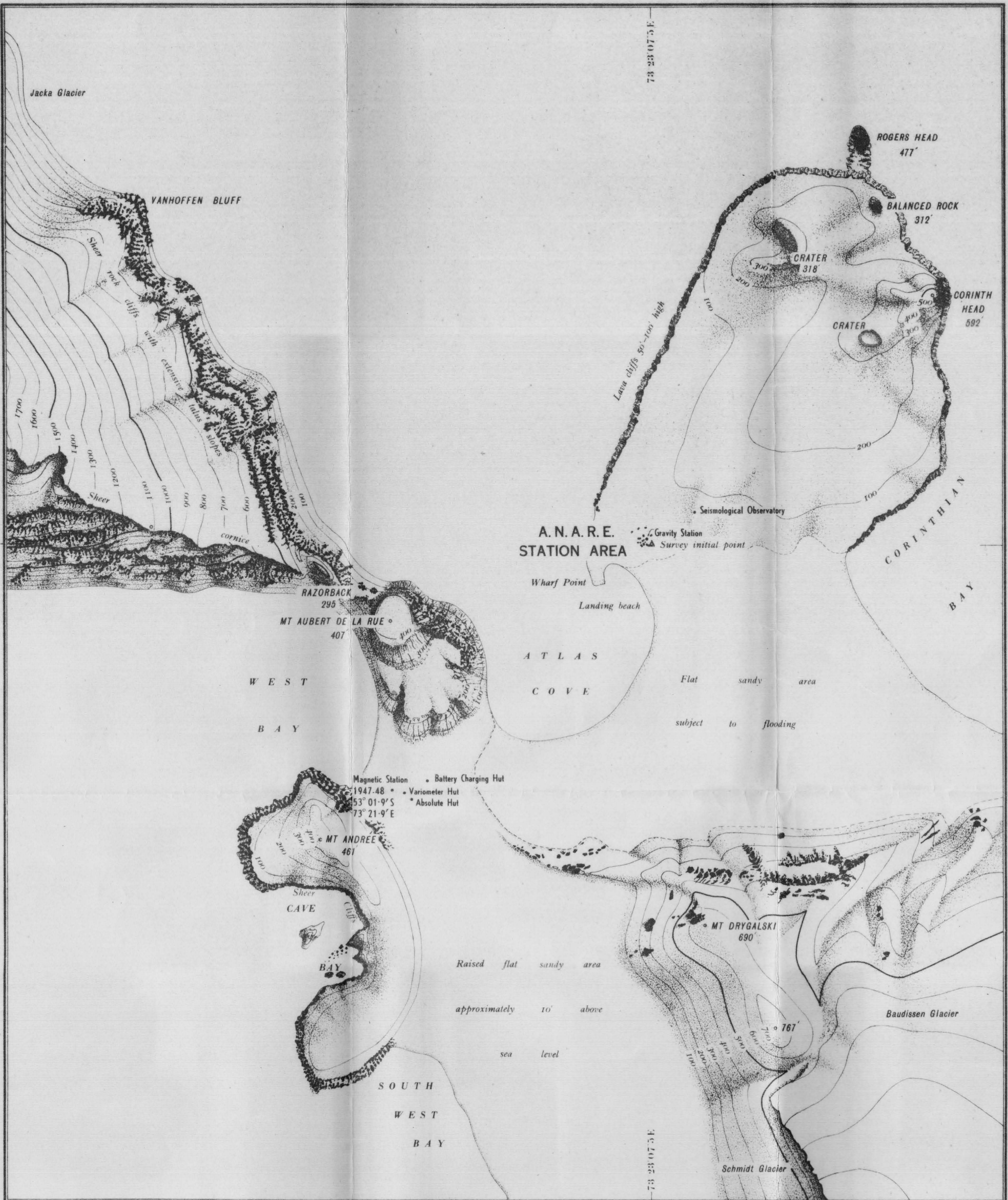
APPENDIX 4.

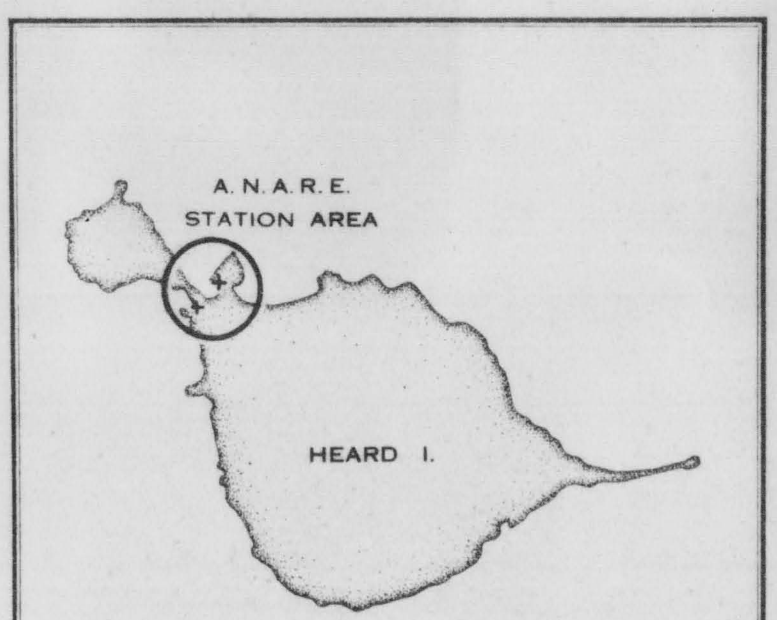
HOURS OF MAGNETOGRAPH RECORD LOSS

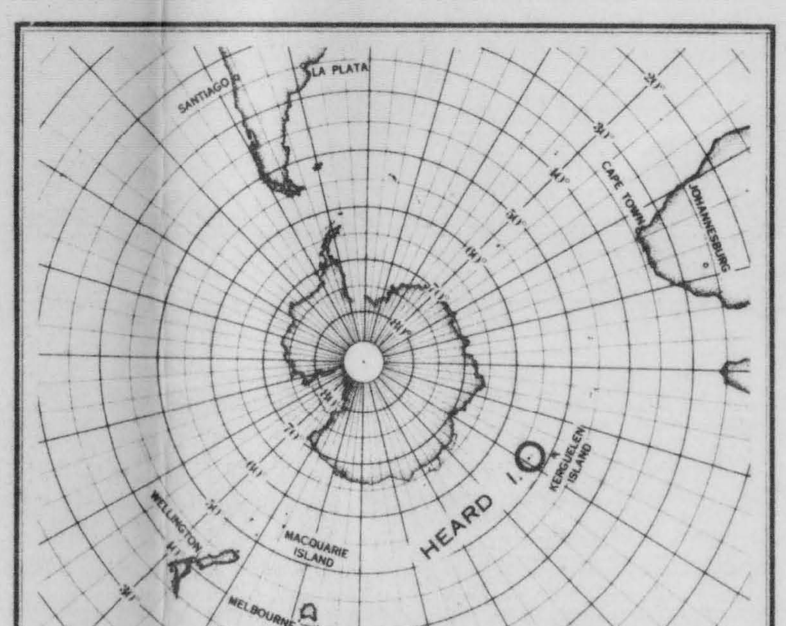
Month	Reasons for loss			Total Hours
	Failure of Escapement Drive	Instrumental Examination & Adjustment	Low Record Lamp Current	
Feb.	-	2	-	2
Mar.	1	2	-	3
Apr.	-	2	-	2
May	30	1	-	31
June	5	8	-	13
July	-	5	-	5
Aug.	30	2	3	35
Sept.	-	-	-	-
Oct.	10	2	-	12
Nov.	15	1	-	16
Dec.	-	-	-	-
Totals	91	25	3	119

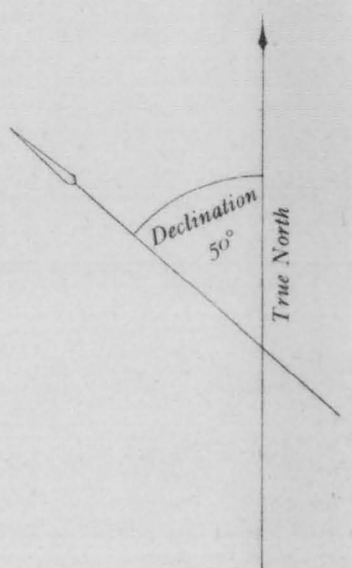
APPENDIX 5.

Time	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
07.15-09.00	Magnetic trace change, West Bay						
09.00-09-30	Break-fast	Scale values	Break-fast	Break-fast	Break-fast	Break-fast	Break-fast
09.30-10.15	Office	Break-fast	Office	Office	Absolute magnetic observat-ions	Office	Office
10.30-13.00	Office	Office	Office	Office		Office	Office
13.00-14.00	L u n c h						
14.00-16.45	O f f i c e						
16.45-17.15	S e i s m i c t r a c e c h a n g e						
17.15-18.45	O f f i c e						









SKETCH MAP
SHOWING LOCATION OF

MAGNETIC AND SEISMOLOGICAL OBSERVATORIES, AT HEARD ISLAND

LOCALITY DIAGRAMS

Reference:	*Survey Initial Point (Camp Area) 53° 01' 11".5S 73° 23' 07".5E*
Control:	*Based on Triangulation Control Survey by R. Dovers 1948.*
Detail:	*Sketched in from uncontrolled ground photography based on known stations by K. Summons and I. Mather, 1950.*
Reliability:	*Reliable sketch.*

0 0.25 0.50 0.75 1 MILES
0 500 1000 1500 2000 YARDS
SCALE
VERTICAL INTERVAL 100 FEET

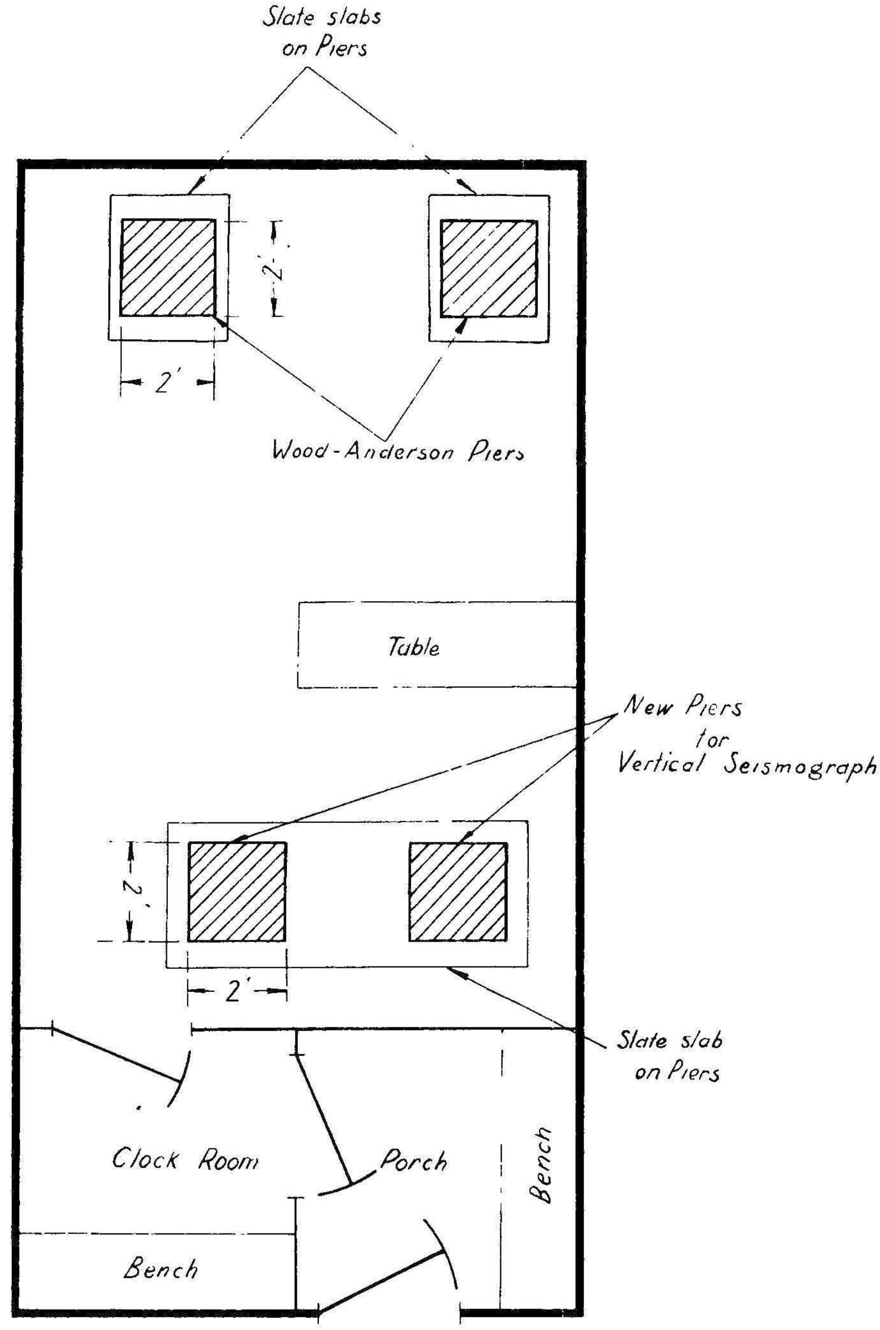
LEGEND

- *Cliffs*
- *Contours* (800)
- *Spot heights* (477')

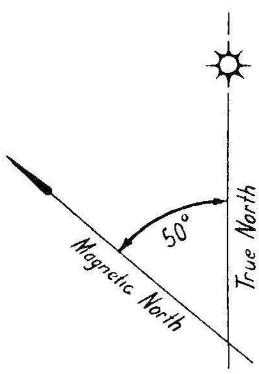
G 21-20

Compiled and drawn by Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics. 1950.

PLATE 2



SCALE
1" = 4'



FLOOR PLAN

SEISMOLOGICAL HUT HEARD ISLAND

G 21-21

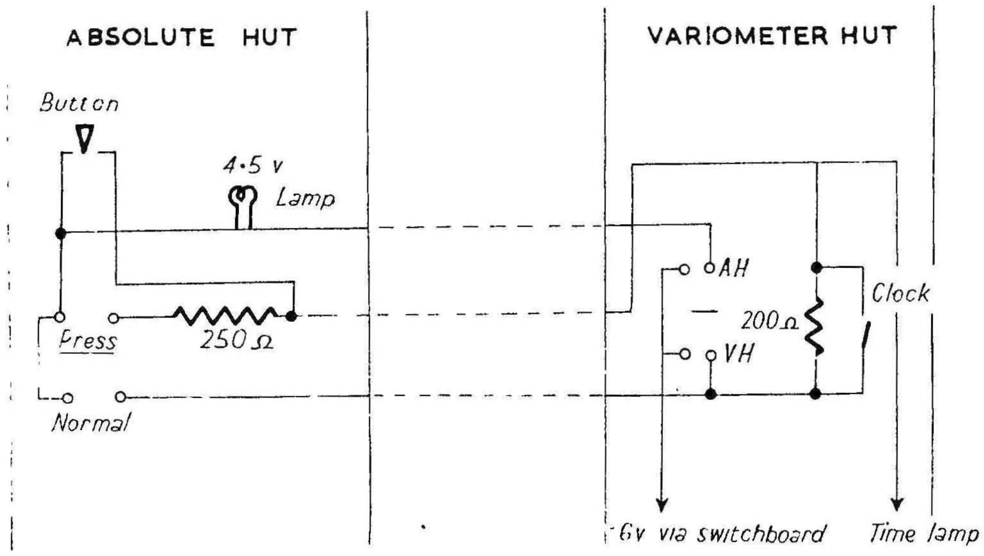
Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics

PLATE 3

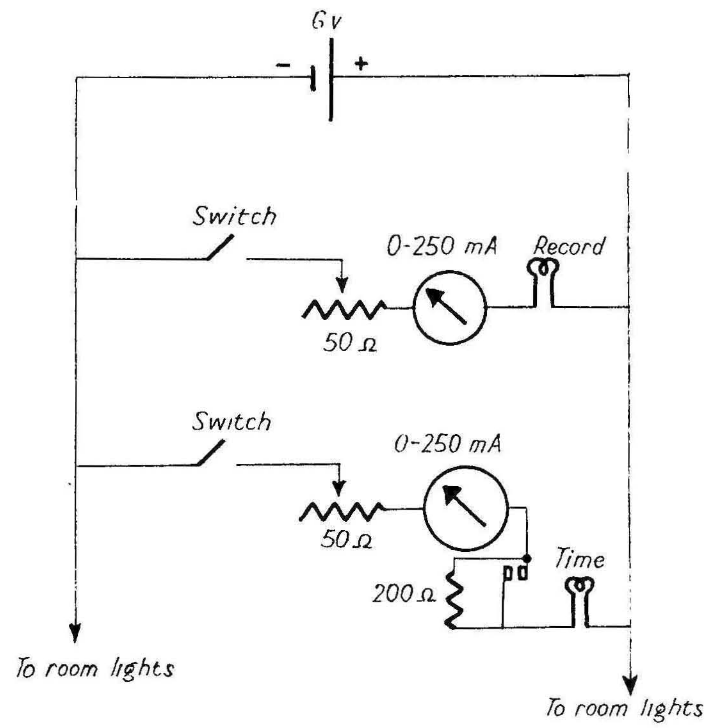
FIG. 1. PREPARATIONS FOR THE INSTALLATION OF NEW PIERS IN SEISMOGRAPH HUT

FIG. 2. CLOCK ROOM IN SEISMOGRAPH HUT

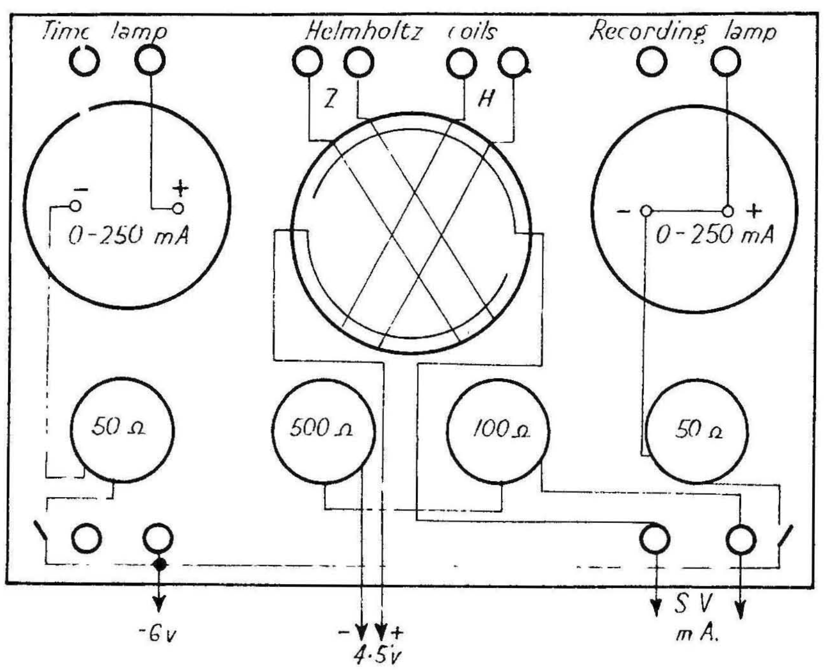
PLATE 4



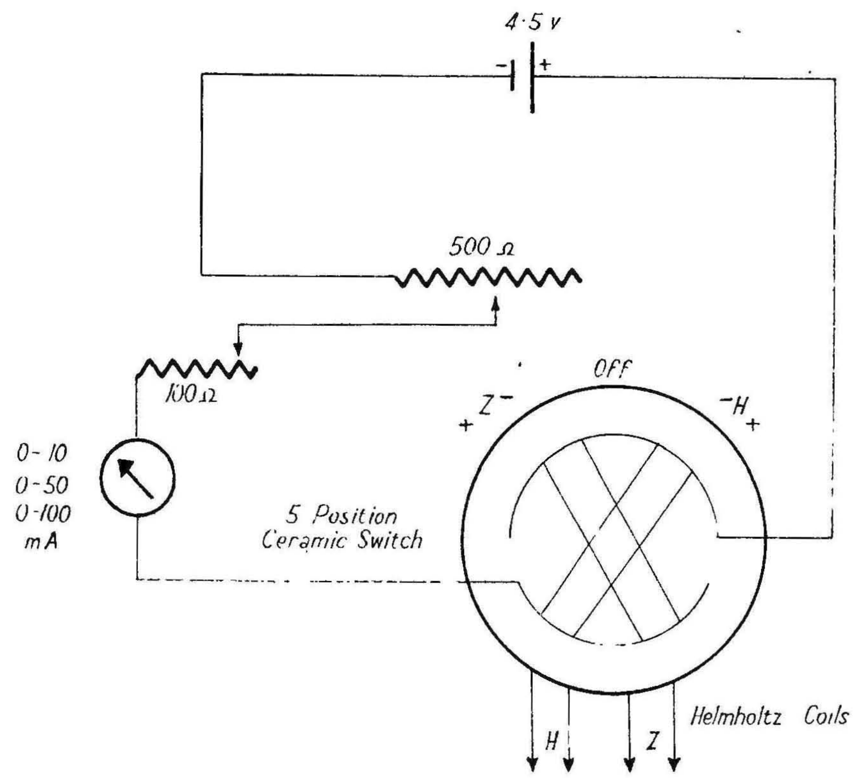
PRESS BUTTON TIME MARK CIRCUIT



MAGNETOGRAPH CIRCUIT



SWITCHBOARD DIAGRAM



SCALE VALUE CIRCUIT

WIRING DIAGRAMS
MAGNETIC OBSERVATORY
HEARD ISLAND