COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

REPORT No. 51

# FIELD MAGNETIC OBSERVATIONS IN ANTARCTICA

By

J. D. PINN


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Issued under the Authority of Senator the Hon. W. H. Spooner, M.M.,
Minister for National Development
1960

# LIST OF REPORTS

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13. The Geology of Dampier Peninsula, Western Australia - R. O. Brunnschweiler, 1957.
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## Department Of National Development

Minister—SENATOR THE HON. W. H. SPOONER, M.M.

Secretary—H. G. RAGGATT, C.B.E.

## BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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THIS REPORT WAS PREPARED IN THE GEOPHYSICAL BRANCH

Chief Geophysicist: **R. F. THYER.**

# C O N T E N T S



## T A B L E S



## P L A T E

## A B S T R A C T

This record presents, in tabular form, the results of magnetic observations made at field stations in Antarctica since 1954. The data is entirely observational; no attempt has been made to analyse it or to compile maps from it. It is intended that this data will contribute to the production of magnetic maps of Antarctica which will incorporate all the field magnetic observations made over the continent.

## 1. INTRODUCTION

The Australian National Antarctic Research Expedition (A.N.A.R.E.) established its station at Mawson on the coast of MacRobertson Land, on the Antarctic continent, in the summer of 1953-54. Since that time, as part of Australia's scientific programme in the Antarctic, members of the expedition have made measurements of the direction and intensity of the earth's magnetic field at many points along the coast of the Australian Antarctic Territory, and on two field traverses which reached about 350 miles southward from Mawson.

The majority of these observations have been made by geophysicists of the Bureau of Mineral Resources, Geology and Geophysics who were appointed to the expeditions. Other measurements of declination only have been made by various members of A.N.A.R.E. field parties. The results of these observations are summarised in Tables I - III. The positions of the field stations and Mawson Observatory are shown on Fig.1.

## 2. INSTRUMENTS

Determinations of horizontal intensity were made in most cases with a quartz horizontal magnetometer of either the La Cour type (QHM) or the Askania type (HTM). For a few observations it was necessary to use the method of oscillations and deflections with an Askania magnetometer to obtain the value of the horizontal intensity.

Declination was obtained at some places with a QHM, and at others with an Askania declinometer. The results recorded in Tables II and III were obtained with a high quality magnetic compass attached to a theodolite of either Watts or Wild make.

Descriptions of the QHM and the procedure for its use in determining the horizontal intensity and declination are to be found in reports by Ingall (1955) and McGregor (1956).

Vertical intensity was measured with a magnetometric zero balance (BMZ) at nearly all places. This instrument and procedure for its use are adequately described by Ingall (1955).

## 3. TREATMENT OF DATA

Instrument corrections to International Magnetic Standard (IMS) have not been applied to the values in Table I, but they are known to be less

than 1 minute for declination, and less than 10 gammas for horizontal and vertical intensity. The compasses used for the declination measurements recorded in Tables II and III were calibrated at Mawson, and appropriate corrections have been made.

The observed value of any magnetic element at a particular station may depart considerably from the mean value for that station, except in the case of Mawson Observatory. No attempt has been made to correct for time variations at the field stations, because it is uncertain to what extent time variations at an observatory are representative of neighbouring stations at high latitudes. In the tables the letters Q or D are used to indicate quiet or disturbed conditions at Mawson, and so indicate which data are likely to be unreliable because of disturbed magnetic conditions.

## 4. DISCUSSION

The distribution of the locations at which these observations have been made is not suitable for determining the field on a regional scale, except in the broadest way. Therefore no attempt has been made to present this information in the form of iso-magnetic maps. It is to be hoped that all the field magnetic results for the Antarctic region will be collected by one authority who will undertake the task of preparing iso-magnetic maps. This record has been prepared principally to provide basic data for such a project.

## 5. REFERENCES

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TABLE I

MAGNETIC OBSERVATIONS - ANTARCTICA

| station Long. E | station Lat. S | Name | Date | Declination G.M.T. | Declination Value | Horizontal Intensity G.M.T. | Horizontal Intensity Value γ | Vertical Intensity G.M.T. | Vertical Intensity Value γ | Conditions at Mawson | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 47°56' | 67°34' | Pinn I. (Casey Bay) | 10/10/57 | 12:41 | 49°46'W | 13:15 | 18244 | | | Q | |
| | | | 11/10/57 | | | | | 11:28 | 45030 | Q | |
| | | | | | | | | 06:00 | 44918 | Q | |
| 50°29' | 66°59' | Observation I. | 25/10/56 | | 49 39 | | 18785 | | 44670 | Q | |
| | | (Amundsen Bay) | 4/10/57 | 10:18 | 48 26 | | | | | Q | |
| 51°20' | 66°13' | Mt. Biscoe | 4/10/57 | 6:57 | 50 16 | | | | | Q | |
| 52°43' | 67°28' | McLeod Nunataks. | 4/11/58 | | | 08:11 | 19137 | 08:38 | 45936 | Q | |
| 53°42' | 65°51' | Proclamation I. | 4/10/57 | 4:33 | 42 42 | 04:59 | 25555 | | | D | 1) |
| 56°26' | 67°54' | Leckie Range | 6/10/58 | | | 07:14 | 18651 | 06:43 | 47080 | Q | |
| 57°20' | 66°56' | King Edward VIII | 7/11/54 | | 54 45 | | | | | | |
| | | Gulf | 2/11/56 | | 55 41 | | 18118 | | 48014 | Q | |
| | | | 13/ 9/58 | | | 08:58 | 18087 | 09:24 | 47141 | Q | |
| 59°20' | 67°21' | Transverse I. | 18/11/54 | | 55 50 | | | | | | |
| | | (Steffanson Bay) | 18/ 5/56 | | 48 45 | | 18550 | | 47506 | D | |
| 60°42' | 67°25' | Blake I. | 20/11/54 | | 56 45 | | | | | | |
| 60°54' | 67°27' | Taylor Station | 3/11/57 | 9:33 | 58 14 | 9:39 | 18954 | | | Q | |
| 61°07' | 67°28' | Byrd Head | 21/10/54 | | 57 50 | | | | | | |
| | | | 19/ 5/56 | | 50 10 | | 19190 | | 48540 | Q | |
| 62°53' | 67°36' | Mawson (Observatory) | 56 | | 59 15 | | 18261 | | 49009 | | 2) |
| | | | 57 | | 59 08 | | 18277 | | 49030 | | 3) |
| 65°53' | 70°16' | Mt. Jacklyn (Prince | 28/11/56 | | | | 18022 | | 51354 | D | |
| | | (Charles Range) | | | | | | | | | |
| 68°23' | 70°48' | Beaver Lake | 1/11/58 | 06:06 | 66 41 | 06:12 | 17487 | | 54800 | | 4) |
| | | | | 07:24 | 66 31 | 07:24 | 17468 | | | Q | |
| 76°00' | 69°22' | Island Group (near | 7/ 2/58 | 23:49 | 70 31 | | | | | Q | |
| | | Larsemann Hills) | | | | | | | | | |
| | | | 8/ 2/58 | | | 00:08 | 15960 | | | Q | |
| | | | | 01:54 | 70 28 | 01:33 | 16054 | 01:00 | 54600 | D | |
| 77°54' | 68°33' | Magnetic Island | 3/ 3/54 | 12:08 | 70 16 | 12:44 | 15600 | | 56270 | | 5) |
| | | | 31/ 1/55 | | 70 18 | | 15634 | | 56256 | | |
| 77°58' | 68°35' | Davis | 20/ 2/57 | | 72 13 | | 16940 | | 54704 | | |
| | | | 5/ 2/58 | 4:28 | 72 29 | 04:53 | 16608 | 05:40 | 55478 | D | 6) |
| | | | | 6:22 | 72 00 | 06:00 | 16614 | 05:49 | 55536 | D | |
| 110°11' | 66°13' | Nelly Island | 21/ 1/56 | 06:18 | 74 42 | 07:16 | 8530 | 05:57 | 67890 | Q | |
| | | | | 09:58 | 74 30 | 09:04 | 8487 | 10:11 | 67696 | Q | |

TABLE I - continued

| station Long. E | station Lat. S | Name | Date | Declination G.M.T. | Declination Value | Horizontal Intensity G.M.T. | Horizontal Intensity Value γ | Vertical Intensity G.M.T. | Vertical Intensity Value γ | Conditions at Mawson | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 111°07' | 66°01' | Thompson Island | 19/1/56 | 03:28 | 91°07'W | 04:23 | 8296 | 02:38 | 68424 | D | |
| | | | | 06:12 | 91 28 | 05:46 | 8146 | 06:42 | 68459 | D | |
| 134°22' | 66°06' | Lewis Island | 7/1/56 | 03:38 | 55 37 | 04:42 | 1301 | 02:57 | 69120 | Q | |
| | | | | 05:36 | 58 39 | 04:58 | 1358 | 06:32 | 69057 | Q | |
| | | | 11/1/58 | 03:25 | 74 09 | 03:55 | 970 | 06:42 | 68735 | Q | 7) |
| | | | | 22:48 | 92 28 | 22:43 | 1070 | 22:59 | 68877 | Q | |
| | | | 12/1/58 | 00:28 | 97 16 | 00:05 | 1195 | 00:31 | 68878 | Q | |
| 149°48' | 66°42' | Virik Bank | 15/1/58 | 23:54 | 59 54 | | | 23:56 | 68400 | Q | 8) |
| | | | 16/1/58 | | | 00:04 | 2650 | | | Q | |

Footnote:

1) = H value doubtful

2) = Annual mean

3) = Mean of first 4 months

4) = Z value approximate only

5) = Z derived from dip circle readings

6) = 1958 station is practical reoccupation of 1957

7) = 1956 and 1958 stations are in different places

8) = Values approximate; observations on moving ice floe

TABLE II

DECLINATION MEASUREMENTS ON ANTARCTIC TRAVERSES 1958-59

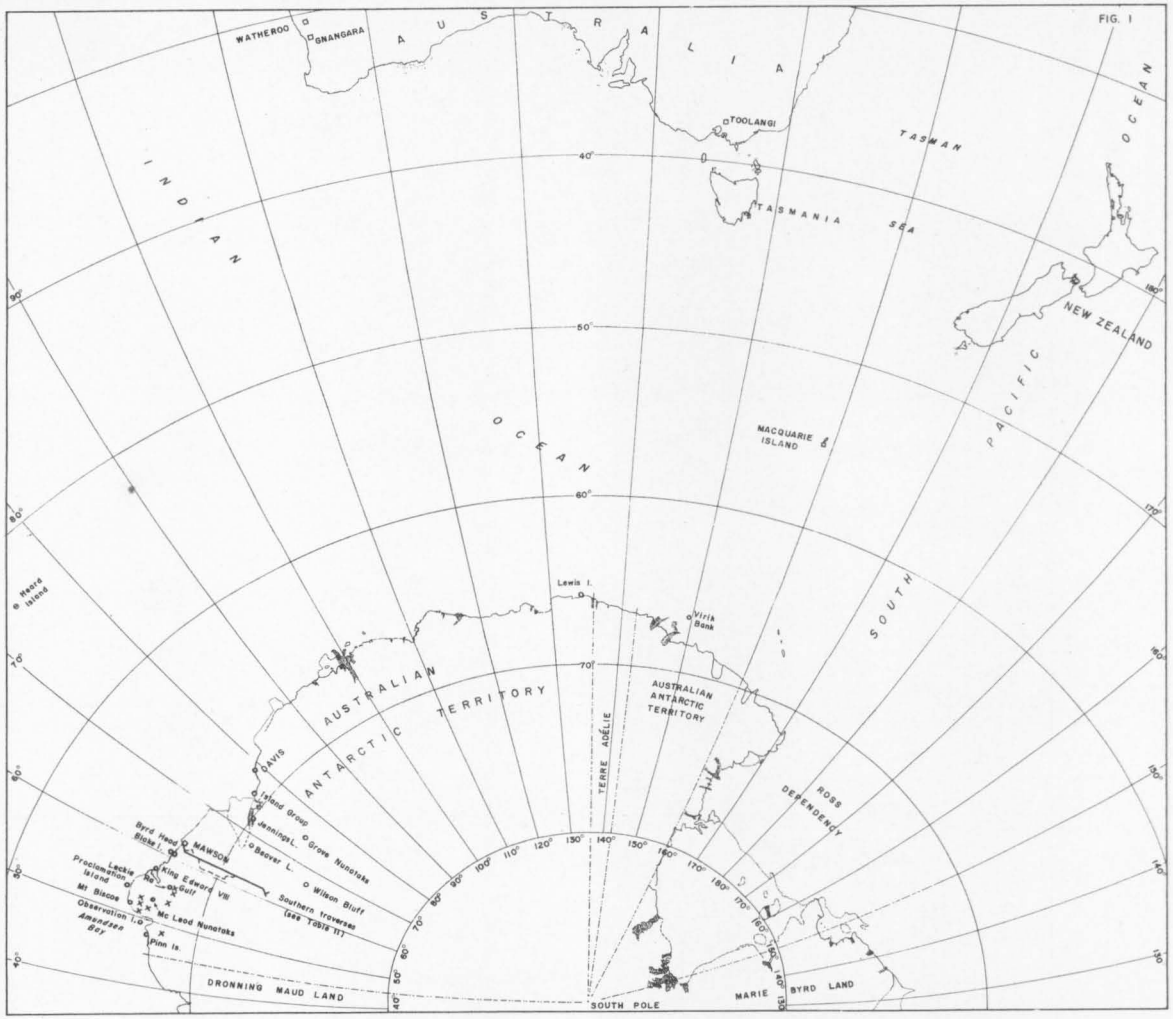
| Latitude | Longitude | Date | G.M.T. | Declination | Conditions at Mawson |
|---|---|---|---|---|---|
| 67°53'S | 62°30'E | 16 Feb. 1958 | 0515 | 59.0°W | Q |
| 67 55 | 62 12 | 8 Oct. 1958 | 1016 | 59.7 | Q |
| 68 01 | 62 22 | 3 Nov. 1958 | 1133 | 57.6 | Q |
| | | | 1311 | 57.6 | Q |
| 68 04 | 62 27 | 14 Jan. 1959 | 0616 | 57.3 | D |
| 68 07 | 62 07 | 15 Feb. 1958 | 0645 | 59.0 | Q |
| 68 14 | 62 42 | 13 Jan. 1959 | 0743 | 61.8 | D |
| | | | 0902 | 60.9 | Q |
| 68 25 | 62 10 | 14 Feb. 1958 | 1100 | 59.5 | Q |
| 68 33 | 62 06 | 14 Feb. 1958 | 0845 | 59.5 | D |
| 68 41 | 62 08 | 13 Feb. 1958 | 1440 | 60.0 | Q |
| 68 49 | 62 08 | 9 Nov. 1958 | 0918 | 59.7 | Q |
| | | | 0947 | 60.0 | Q |
| 68 52 | 62 06 | 13 Feb. 1958 | 1214 | 60.0 | D |
| 68 59 | 62 05 | 13 Feb. 1958 | 1015 | 60.5 | Q |
| 68 59 | 60 47 | 2 Jan. 1959 | 1314 | 62.5 | Q |
| | | 4 Jan. 1959 | 0617 | 61.6 | D |
| | | | 0805 | 61.3 | Q |
| 69 16 | 62 10 | 12 Feb. 1958 | 0215 | 60.5 | D |
| 69 17 | 60 48 | 1 Jan. 1959 | 1135 | 60.5 | Q |
| | | | 1206 | 60.6 | Q |
| 69 21 | 62 10 | 11 Feb. 1958 | 1345 | 61.0 | D |
| 69 35 | 62 03 | 15 Nov. 1958 | 0805 | 61.2 | D |
| | | | 1044 | 60.6 | Q |
| | | | 1300 | 60.8 | Q |
| 69 38 | 62 10 | 10 Feb. 1958 | 1515 | 61.0 | Q |
| 69 55 | 62 03 | 9 Feb. 1958 | 0510 | 61.5 | Q |
| 70 33 | 62 09 | 9 Feb. 1958 | 0930 | 61.5 | Q |
| 70 18 | 62 09 | 7 Feb. 1958 | 1400 | 61.5 | Q |
| 70 26 | 60 50 | 26 Dec. 1958 | 1228 | 63.3 | D |
| | | 27 Dec. 1958 | 0635 | 62.2 | D |
| | | | 0815 | 59.9 | D |
| 70 31 | 62 09 | 7 Feb. 1958 | 1115 | 62.0 | Q |
| 70 49 | 62 09 | 6 Feb. 1958 | 1350 | 63.0 | Q |
| 70 49 | 62 07 | 6 Dec. 1958 | 0957 | 63.4 | Q |
| | | | 1047 | 63.7 | Q |
| 70 50 | 61 38 | 11 Dec. 1958 | 1520 | 63.1 | Q |
| | | 13 Dec. 1958 | 1104 | 63.1 | Q |
| | | | 1326 | 63.5 | D |
| 71 08 | 62 07 | 2 Feb. 1958 | 0530 | 62.0 | Q |
| 71 22 | 62 07 | 1 Feb. 1958 | 1415 | 62.0 | Q |
| 71 46 | 62 08 | 1 Feb. 1958 | 0700 | 63.0 | Q |
| 72 13 | 62 08 | 28 Jan. 1958 | 1205 | 63.0 | Q |
| 72 36 | 62 08 | 23 Jan. 1958 | 1500 | 63.5 | Q |
| 72 51 | 61 21 | 18 Jan. 1958 | 0820 | 63.0 | D |

TABLE III

MISCELLANEOUS DECLINATION MEASUREMENTS BY COMPASS-THEODOLITE

| Station | Latitude | Longitude | Date | G.M.T. | Declination | Conditions at Mawson |
|---|---|---|---|---|---|---|
| Jennings Lake | 70°10'S | 72°31'E | 30 Oct. 1958 | 1227 | 71.3°W | Q |
| Beaver Lake | 70 48 | 68 23 | 1 Nov. 1958 | 0231 | 67.1 | Q |
| Grove Nunataks | 72 53 | 74 53 | 9 Nov. 1958 | 0942 | 75.1 | Q |
| Wilson Bluff | 74 17 | 66 56 | 31 Oct. 1958 | 0720 | 70.8 | Q |

FIG. 1




LEGEND

- ⊙ FIELD MAGNETIC OBSERVATION
- ⊡ MAGNETIC OBSERVATORY
- × COMPASS OBSERVATION OF DECLINATION

SCALE IN MILES

100 0 100 200 300 400 500 600 700 800

# AUSTRALIAN OBSERVATORY AND FIELD MAGNETIC STATIONS IN ANTARCTICA DURING 1957 AND 1958

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*To accompan Report No 51.*

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