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REOCCUPATION OF THE HEARD ISLAND

MAGNETIC STATION

Sept-Nov 1985

by

A P Hitchman

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Summary

A visit was made to Heard Island during the 1985-86 Antarctic summer. As part of a broad program of scientific work observations of the geomagnetic field were made, using variometer control. This was the first extended occupation at the site of the former magnetic observatory since it was moved to Mawson in January 1955. Reoccupations of the site since that time have been few and of short duration. The most recent of these had been in 1983 when the returning geophysicist from Mawson completed a set of D and F observations there (Silberstein 1984).

Observations of D, F and I were made for one month during October and early November 1985 while a self-contained three component variometer operated near by. Descriptions of the observatory site and reference marks, together with a table of observed values are given.

The collected data will be incorporated into a database which will be used in the production of the epoch 1990.0 magnetic field model and charts.

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1. Introduction

During the 1985-86 summer the Antarctic Division of the Department of Science landed a summer party of fourteen expeditioners on Heard Island. An extensive program of geophysical, biological and archaeological work was to be carried out. The party, comprising a doctor, seven biologists, four LARC operators, a radio operator and the author, was ferried to the island aboard the Nella Dan during September. It was divided into two groups, one, of four biologists, would sojourn at Spit Bay at the southeastern end of the island, and the remaining ten personnel were to be at Atlas Cove at the northwestern end of the island.

The visit afforded the first opportunity in 30 years to make extended observations of the magnetic field on the island. Earlier magnetic work began there in 1947 with the establishment by N.G. Chamberlain of a magnetic station (Chamberlain 1952). During 1950 work commenced on the construction of a magnetic observatory, consisting of a variometer hut, an absolute hut and a battery charging hut. Following the construction of the buildings and installation of variometers, full observatory operations began in March 1952, and continued until the station was moved to Mawson in January 1955 (Ingall 1953, Oldham 1958). Since that time only brief visits have been made to the island by Australian parties.

Two projects were to be carried out as part of the geophysics program. Dr F.H. Chamalaun of the School of Earth Sciences, Flinders University, Adelaide, had developed a self contained three component fluxgate variometer for use in measuring variations of the magnetic field. Three of these instruments were transported to Heard Island to be used to compare field variations from different parts of the island. The Geomagnetism Section of the BMR planned to reoccupy the former observatory site on the island to make an extended set of absolute observations of the field. One of the three magnetometers was to be used to provide variometer control for the absolute observations which were to be made during the visit. This report is concerned primarily with this aspect of the work.

2. Magnetometer Installation

The magnetometers developed by Dr Chamalaun were stand alone instruments using three orthogonal fluxgate sensors and a microprocessor to digitally record field variations. They were powered by batteries and had a working time of between one and three months, depending on the frequency of field sampling. Data was recorded digitally on standard 60 minute cassettes.

It was planned to station the magnetometers at three separate sites on the island during the visit. This was as part of a project to study the "Island Effect" at Heard. The magnetometers were configured to record three elements of the field every 20 seconds, and would be operational for one month

before batteries ran out. Their siting was selected before departing Australia, and required helicopter support. The preferred sites for each magnetometer were; magnetometer A - Red Island, Cape Cartwright, Rogers Head or ANARE station; magnetometer B - Fairchild Beach; magnetometer C - Winston Lagoon.

On arrival at Atlas Cove poor weather precluded flying so the first magnetometer could not be installed at Red Island as initially planned. Instead, the Rogers Head location was selected and the magnetometer established on October 3rd at 1004 UT. Later it was discovered that this site was a Macaroni Penguin rookery, with birds beginning to arrive for breeding at the end of October. This however did not cause any great inconvenience either to the birds or the instrument. The remaining two magnetometers were returned to the ship for transport to Spit Bay and deployment by the Spit Bay party.

At the time of disembarkation at the Spit weather conditions permitted helicopter operations so the magnetometers were depoted at Fairchild Beach and Winston Lagoon for later installation. At 0600 UT on October 8th the magnetometer at Fairchild Beach was switched on and at Winston Lagoon at 0430 UT on October 10th.

The field printer supplied with the magnetometers to monitor their operation during initialization had flat batteries at the time of their installation. Thus, operation could not be fully verified, however other indicators suggested the commencement of normal operation.

The magnetometer at Rogers Head was largely undisturbed. The penguin rookery was visited on 23/10 1100 UT, 25/10 0700 UT, 01/11 1100 UT, but no approaches to the magnetometer site were made. At Fairchild Beach the magnetometer was undisturbed throughout the recording and at Winston Lagoon it was visited only once on 28/10 when the rock cairn was built up.

The magnetometers were retrieved towards the end of the expedition to the island. On 11 November the Rogers Head instrument was exhumed, and from Fairchild Beach on 14 November. The Winston Lagoon magnetometer was collected by the Spit Bay party on 17 November.

Processing the data on return to Australia revealed that the Rogers Head magnetometer had recorded for 18 days, from 3 to 21 October; the Winston Lagoon instrument for 10 days, from 10 to 20 October; and the Fairchild Beach instrument had been inoperative.

3. Absolute Observations

Throughout the expedition absolute observations of the magnetic field were made on the piers of the old absolute hut. They are situated behind West Bay near the base of Mt Andree at the edge of a featureless rock-strewn plain. Figure 1 (Chamberlain 1952) shows magnetic station A and its

environs. In the general area are the ruins of a battery-charging hut, the variometer hut and absolute hut from the 1950's, and a brass plaque marking the 1947-48 magnetic station. The plaque is in a concrete plug flush with the ground, and is inscribed "1947-48 ANARE MAGNETIC STATION". Figure 2 shows the location of the station.

The piers of the old absolute hut were still usable. Pier A is 30 cm sq, 1.78 m high and is slightly tilted to the south. Pier D is upright, 29.5 cm sq and 1.63 m high. Both piers are too high for an observer to use whilst standing on the ground but there was sufficient lumber in the area to improvise a workable platform. Pier A was used as the primary pier since reference mark azimuths previously measured by Division of National Mapping (NatMap) surveyors are referred to it. Pier D was used as a secondary pier.

The absolute instruments were DIM No. 202/308887 for D and I, and PPM No. 193 for F. Sets of observations (FDIIDF) were made as often as the weather permitted. The DIM obs were done on pier A and the PPM obs on pier D. During the occupation a pier difference was measured to refer the PPM readings to pier A. Early in the occupation F readings were made on a temporary station marked by a cairn of rocks. This however gave spurious readings, perhaps because the rocks were magnetic. The pier differences measured are given in Table 1. A total of 69 sets of observations were completed during the occupation, largely confined to the infrequent windless and precipitation-free days. Values of the magnetic elements (observed field values with instrumental corrections applied) are listed in Table 2. QHM 174 was taken as a reserve absolute instrument to measure H and D should the DIM have failed, however this did not occur. The results of instrument comparisons are given in Table 3, together with the instrumental corrections used to convert the observed field values to values of the magnetic elements.

There are a number of features which can be used as reference marks for D observations. They are

- a pillar atop Mt Drygalski (MTD) to the southeast, installed by NatMap in 1980. This was used as the main reference mark, though it may sometimes be obscured by low cloud.
- in the east a NatMap pillar near the high right hand edge of Corinth Head (COR) may be used.
- the Automatic Weather Station (AWS) in the ANARE camp can be used as a mark. On warm days this mark can be obscured by heat haze.
- the 1947 station to the NNW is 100 m distant and may be used as a mark. From pier A it is possible to sight directly onto the brass plaque.

Table 4 lists the reference marks and their true azimuths. Figure 3 sets out this information diagrammatically.

There is no protection at the site from the weather. The wind blows from West Bay and is usually quite strong. Observations

were only possible in light wind conditions (< 20 knots) because the DIM vertical scale vibrated and became unreadable, and to prevent the instrument from being blown off the pier. Precipitation (snow/hail/rain) was frequent and limited the observing days. Although on occasions a tent fly would have provided sufficient protection to allow observations to be made, more often the high winds would have made the use of a fly difficult and dangerous. On average it was found that one day in three was reasonable for making observations. The weather changed every day and during each day. There were only two days when weather conditions were ideal for observing.

Following the return of the magnetometers to Australia the data was read from the cassettes onto computer at Flinders University. The data from the Rogers Head instrument, together with the absolute observations, was used to obtain mean hourly values for X, Y and Z. From these, mean hourly values for D, I, F and H were derived. Preliminary mean hourly values are given in Table 5.

Interesting fauna in the vicinity of the magnetic site during the October/November occupation were light mantled sooty albatrosses nesting on Mt Andree, gentoo (and stray king) penguins in a rookery at the base of Mt Aubert de la Rue, and a harem of elephant seals on West Bay. Sometimes elephant seals from West Bay visit the site and may have caused the tilt of pier A.

4. References

Chamberlain, N.G., 1952, Observations of Terrestrial Magnetism at Heard, Kerguelen and Macquarie Islands, 1947-1948. Bureau of Mineral Resources Australia, Report No. 5.

Ingall, L.N., 1953, Magnetic and Seismological Work, Heard Island, 1952-1953. Bureau of Mineral Resources Australia, Record 1953/54.

Oldham, W.H., 1958, Magnetic Results from Mawson, Antarctica, 1955. Bureau of Mineral Resources Australia, Record 1958/39.

Silberstein, R.P., 1984, Mawson Geophysical Observatory Annual Report, 1982. Bureau of Mineral Resources Australia, Record 1984/35.

Table 1 Pier Differences

Pier A - Pier T = -62 nT

Pier A - Pier D = -3 nT

Pier A is oregon pier A

Pier D is oregon pier D

Pier T is temporary pier (tripod)

Table 2 Value of Magnetic Elements

Heard Is A	UT	D	UT	F nT	UT	F nT	UT	I
04/10/85	0836	56 05.4W	0804	50293	0856	50289	0839	-68 59.9
	0930	56 04.8	0915	50311	0947	50320	0931	-68 59.9
05/10/85	0549	55 59.7	0538	50283				
08/10/85	0233	56 13.8	0206	50182	0246	50246	0232	-68 56.2
	0305	56 13.8	0249	50296	0325	50330	0306	-68 56.3
	0350	56 11.6	0331	50266	0414	50234	0350	-68 56.7
	0430	56 12.5	0416	50212	0447	50242	0430	-68 57.2
10/10/85	0332	56 08.8	0318	50211	0346	50217	0334	-68 57.2
	0403	56 08.4	0350	50211	0417	50221	0404	-68 56.5
	0435	56 08.4	0422	50210	0447	50209	0436	-68 56.0
	0504	56 08.8	0449	50236	0516	50242	0505	-68 56.1
	0535	56 09.2	0521	50238	0546	50267	0535	-68 56.9
	0602	56 09.5	0548	50285	0622	50225	0602	-68 56.9
	0633	56 10.0	0627	50207			0639	-68 57.2
11/10/85	0404	56 10.4	0349	50231	0419	50214	0406	-68 57.7
	0437	56 10.6	0421	50226	0452	50223	0441	-68 55.1
	0510	56 10.1	0458	50221	0520	50262	0510	-68 57.3
	0533	56 09.5	0522	50301	0544	50055	0533	-68 57.8
16/10/85	0322	56 10.1	0256	50196	0336	50173	0324	-69 00.4
	0351	56 08.9	0340	50177	0404	50173	0351	-69 00.6
	0426	56 07.8	0408	50174	0436	50185	0426	-68 59.2
	0450	56 06.7	0439	50186	0501	50193	0450	-68 58.5
	0515	56 06.7	0504	50195	0525	50209	0515	-68 57.6
	0538	56 04.7	0528	50210	0549	50221	0538	-68 57.0
	0608	56 06.4	0552	50223	0618	50229	0608	-68 57.2
	0632	56 07.5	0621	50230	0643	50233	0632	-68 58.1
	0705	56 06.5	0645	50235	0716	50233	0705	-68 59.1
	0738	56 08.8	0719	50237	0749	50239	0738	-68 59.8
18/10/85	0926	56 06.9	0918	50242			0930	-68 59.1
19/10/85	0445	56 09.9	0432	50238	0502	50236	0445	-68 57.6
	0517	56 07.8	0505	50237	0526	50242	0517	-68 56.8
	0542	56 08.1	0528	50243	0551	50239	0542	-68 56.9

	0612	56	08.5	0554	50238	0627	50235	0612	-68	57.7
23/10/85	0842	56	07.0	0827	50234	0854	50235	0842	-68	59.2
	0905	56	04.6	0857	50236			0910	-68	58.6
26/10/85	0352	56	10.1	0337	50256	0403	50255	0352	-68	56.1
	0435	56	10.2	0421	50255	0447	50255	0435	-68	56.3
28/10/85	0311	56	11.4	0305	50247			0321	-68	55.1
	0519	56	10.6	0507	50253	0530	50251	0519	-68	56.0
	0542	56	09.6	0532	50251	0554	50251	0542	-68	56.3
	1011	56	07.7	0959	50240	1019	50238	1011	-68	59.3
	1030	56	07.5	1021	50237	1038	50239	1030	-68	59.1
	1052	56	07.2	1042	50238	1059	50238	1052	-68	59.0
	1115	56	07.1	1104	50239	1123	50239	1115	-68	58.8
	1137	56	06.8	1126	50240	1146	50240	1137	-68	58.5
	1158	56	06.2	1148	50241	1209	50242	1158	-68	58.2
	1224	56	07.0	1211	50242	1232	50243	1224	-68	58.2
	1243	56	07.1	1234	50243	1251	50244	1243	-68	58.0
29/10/85	0213	56	07.0	0159	50212	0223	50211	0213	-68	59.1
	0240	56	08.8	0225	50212	0252	50206	0240	-68	59.0
	0307	56	10.5	0254	50208	0316	50207	0307	-68	57.1
	0329	56	08.1	0318	50206	0338	50208	0329	-68	57.0
	0352	56	07.1	0340	50210	0402	50206	0352	-68	57.0
	0416	56	07.8	0404	50207	0428	50211	0416	-68	56.8
	0518	56	06.1	0507	50213	0525	50218	0518	-68	56.6
	0542	56	07.6	0527	50215	0552	50216	0542	-68	56.7
	0609	56	07.6	0554	50216	0620	50216	0609	-68	57.0
	0633	56	06.3	0623	50215	0643	50216	0633	-68	57.8
03/11/85	0415	56	13.7	0400	50180	0425	50204	0415	-68	57.6
	0439	56	15.1	0428	50203	0447	50207	0439	-68	57.8
	0502	56	13.1	0449	50212	0512	50213	0502	-68	57.4
	0530	56	11.3	0519	50212	0538	50219	0530	-68	58.0
	0550	56	10.8	0540	50219	0600	50241	0550	-68	57.4
	0616	56	09.5	0605	50240	0624	50240	0616	-68	56.6
04/11/85	0858	56	06.6	0847	50240	0906	50241	0858	-68	58.1
	0919	56	06.8	0908	50241	0929	50240	0919	-68	58.4
	0942	56	06.9	0931	50240	0950	50239	0942	-68	58.5
	1002	56	07.7	0952	50240	1011	50241	1002	-68	58.8

Table 3 Instrument Comparisons and Preliminary Corrections

Station	Date	Instrument A	Instrument B	Difference A-B	
Declination-Inclination Magnetometer				minutes of arc	
Canberra	21/8/85	Ruska 4813	202/308887	`D`	-0.4`
		PVM/X/A	202/308887	`I`	0.0`
	29/5/86	Ruska 4813	202/308887	`D`	-0.1`
		PVM/X/A	202/308887	`I`	0.0`
Quartz Horizontal Magnetometer				nT	nT/H
Canberra	19/8/85	461	174	-43.0	-0.00181
Declinometer				minutes of arc	
Canberra	19/8/85	Ruska 4813	QHM 174	4° 04.2`	
				(a=15.1`)	
Proton Precession Magnetometer				nT	
Canberra	19/8/85	MNS2.3	Elsec 770/193	-1.6	
	16/6/86	MNS2.3	Elsec 770/193	-1.3	

Preliminary Corrections Adopted

DS = DIM 202/308887 - 0.2`
 IS = DIM 202/308887 + 0.0`
 HS = QHM 174 - 0.00196 H (reserve instrument)
 FS = Elsec 770/193 - 1 nT

Table 4 Reference Marks and Azimuths

Heard Island A		
Automatic Weather Station (AWS)		41° 19.95`
Corinth Head Pillar (COR)		47° 10.40`
Mt Drygalski Pillar (MTD)	(RM)	113° 09.00`
1947 magnetic station		293° 47.10`

Table 5 Preliminary Mean Hourly Values

		HEARD ISLAND																								MEAN HOURLY VALUES	
		(Geog: Lat = 53 1.9 S, Long = 73 21.9 E; Alt = 3 Metres)																								PRELIMINARY	
1985 OCTOBER		HORIZONTAL INTENSITY (H)																									
		18000 + tabular values in nanoTeslas.																									
Day	UT	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
01	Q																										
02																											
03												26	85	67	71	85	77	40	84	41	38	37	48	36	24		-
04		8	31	44	51	50	35	15	0	-2	12	18	26	43	106	130	78	66	45	41	11	-3	-204	-52	23		24
05	D	39	67	24	6	-22	-9	4	2	26	13	160	149	20	24	45											-
06	D	-129	-10	4	25	29	-20	3	25	67	30	28	80	65	112	78	87	58	-8	15	0	-82	-109	-121	-80		6
07	D	17	47	41	15	18	20	10	33	24	30	41	53	43	32	59	115	114	14	1	-8	-50	-21	-54	-62		22
08		-32	31	42	36	38	33	18	19	20	12	26	37	30	43	49	85	48	47	51	47	-5	33	42	46		33
09		46	46	47	43	41	34	23	17	11	12	16	25	31	32	33	34	40	38	0	47	44	44	46	38		33
10		38	38	39	45	49	43	22	1	7	15	20	27	28	39	37	39	39	41	46	44	60	37	24	21		33
11		29	42	40	39	40	30	3	-3	-9	0	7	29	24	33	65	186	75	46	7	9	-166	-33	4	-77		17
12		-234	-17	47	58	54	40	26	17	11	10	21	32	36	36	39	41	51	36	46	30	-6	33	36	34		20
13	D	50	54	11	0	34	43	26	9	-5	5	19	31	36	47	58	50	101	54	46	20	-31	22	19	34		31
14		50	55	53	57	44	38	25	15	10	14	26	33	39	40	39	40	46	51	47	45	36	44	45	54		39
15		56	62	64	28	-8	-17	-22	19	3	-3	5	18	29	30	36	52	55	46	43	47	42	33	-26	-73		22
16		-25	17	-19	-20	16	31	12	6	3	36	28	40	34	34	41	47	41	47	60	50	42	-23	-13	1		20
17		11	24	38	41	49	36	23	8	13	13	11	25	40	25	39	42	39	86	-16	29	39	10	-75	0		23
18	D	-131	3	42	52	45	28	12	6	10	18	27	50	44	40	46	66	72	42	36	-81	-81	18	11	-86		12
19		7	59	69	58	45	31	27	11	17	26	49	31	29	40	53	43	43	43	44	45	45	47	51	52		40
20		58	55	53	56	52	41	22	9	1	7	22	30	37	38	38	36	36	48	50	39	43	45	49	53		38
21		59	63	60	66	68	59	48	32	18	22																-
22																											
23																											
24																											
25																											
26	Q																										
27	Q																										
28	Q																										
29																											
30	Q																										
31																											

HEARD ISLAND

(Geog: Lat = 53 1.9 S, Long = 73 21.9 E; Alt = 3 Metres)

1985 OCTOBER

DECLINATION EAST (D)

MEAN HOURLY VALUES

-56 deg - tabular values in 0.1 min.

PRELIMINARY

Day	UT	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
01	Q																										
02																											
03												-37	-99	-78	-96	-15	60	92	60	127	107	99	104	89	90		-
04		82	109	122	113	105	97	57	41	33	9	-26	-14	-11	-46	-45	46	114	127	107	139	144	319	143	130		79
05	D	117	108	140	168	136	93	18	18	27	16	129	118	71	90	27											-
06	D	249	170	167	148	133	162	110	65	27	71	47	21	33	106	87	142	128	66	94	137	230	552	171	132		135
07	D	165	133	125	112	98	84	99	81	66	51	31	50	31	44	40	50	30	88	101	158	133	149	83	78		87
08		122	123	124	130	126	99	95	88	68	70	74	64	67	79	64	98	101	111	103	55	90	107	108	99		94
09		104	104	100	98	93	96	88	76	70	74	68	65	66	72	78	77	80	82	60	114	96	89	87	87		84
10		101	100	95	96	98	98	93	79	77	78	72	68	67	76	74	79	74	74	87	115	133	143	133	118		93
11		105	119	117	113	110	108	98	61	44	36	54	25	48	64	46	-40	79	110	201	170	169	150	121	196		96
12		211	126	111	124	116	106	88	80	73	65	51	51	61	68	77	96	124	88	80	59	53	87	88	97		91
13	D	84	82	92	56	35	70	85	79	62	58	56	50	40	18	73	68	114	96	99	102	76	92	81	75		73
14		95	97	94	76	69	79	80	75	67	63	55	57	62	70	72	99	92	100	105	82	75	77	64	81		79
15		93	99	109	129	109	98	88	50	56	61	68	74	80	72	73	86	77	87	81	91	73	82	164	136		89
16		173	154	133	88	65	66	81	73	54	32	53	52	65	77	104	107	93	100	124	88	90	77	62	87		88
17		123	92	105	104	67	69	72	44	43	36	49	52	14	65	69	69	69	116	229	140	98	109	91	63		83
18	D	216	124	97	114	109	94	86	46	48	43	17	7	62	63	74	166	146	119	109	156	42	96	89	65		91
19		107	100	117	110	89	82	72	77	66	48	48	47	59	119	104	80	81	88	90	82	72	73	71	79		82
20		80	84	79	91	100	104	103	71	46	47	55	67	74	75	79	81	93	88	86	91	86	75	69	80		79
21		89	96	91	95	99	100	81	58	52	44																-
22																											
23																											
24																											
25																											
26	Q																										
27	Q																										
28	Q																										
29																											
30	Q																										
31																											

(Geog: Lat = 53 1.9 S, Long = 73 21.9 E; Alt = 3 Metres)

VERTICAL INTENSITY (Z)

MEAN HOURLY VALUES

-46000 - tabular values in nanoTeslas.

PRELIMINARY

10

(Geog: Lat = 53 1.9 S, Long = 73 21.9 E; Alt = 3 Metres)

TOTAL INTENSITY (F)

PRELIMINARY

50000 + tabular values in nanoTeslas.

11

HEARD ISLAND

(Geog: Lat = 53 1.9 S, Long = 73 21.9 E; Alt = 3 Metres)

1985 OCTOBER

INCLINATION (I)

MEAN HOURLY VALUES

-68 deg - tabular values in 0.1 min.

PRELIMINARY

Day	UT	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
01	Q																										
02																											
03												604	556	561	549	533	537	581	553	588	595	600	598	604	610		-
04		609	593	584	580	580	589	601	609	609	599	593	585	568	519	493	525	537	564	571	601	616	744	650	606		588
05	D	589	566	593	609	628	616	598	601	590	595	495	496	588	588	574											-
06	D	707	610	595	581	576	604	583	567	540	560	566	531	540	506	531	524	553	611	597	607	673	702	715	679		594
07	D	606	577	576	593	590	587	592	576	581	578	568	557	564	568	545	501	508	595	606	609	645	630	659	669		587
08		644	592	580	582	579	581	590	588	587	590	581	575	577	565	559	535	562	561	561	572	619	591	580	573		580
09		578	577	577	579	581	584	591	594	597	598	596	590	586	585	583	583	578	577	609	575	578	578	576	581		585
10		578	579	579	576	573	576	589	601	598	593	590	585	583	577	577	576	577	576	572	572	568	587	598	601		583
11		584	573	572	572	572	579	595	600	603	597	592	577	578	573	546	461	535	563	595	597	722	644	615	678		589
12		777	626	574	562	563	571	580	585	588	589	582	575	572	573	569	565	558	571	566	584	616	587	582	582		587
13	D	571	567	596	605	582	575	585	595	603	597	588	581	577	562	548	562	527	567	572	600	644	602	601	587		583
14		576	571	573	570	577	581	587	594	598	594	586	582	579	578	578	575	573	571	574	576	585	579	578	571		579
15		568	563	561	584	608	612	613	585	597	602	598	589	582	581	576	563	556	567	572	572	576	595	649	686		590
16		640	597	620	623	598	583	592	594	594	570	573	567	572	571	561	558	566	563	557	567	574	629	630	613		588
17		606	591	580	577	569	576	584	592	589	589	589	580	569	578	570	568	566	533	614	586	576	598	673	619		586
18	D	703	612	578	568	571	583	591	595	591	585	578	554	553	563	554	540	538	564	575	678	686	605	604	672		593
19		615	576	567	572	581	589	591	601	596	588	568	581	583	575	568	576	577	576	576	577	577	576	574	573		580
20		570	573	575	573	575	582	593	601	607	603	593	585	581	581	582	583	581	574	575	582	580	578	575	573		582
21		560	558	560	557	557	563	570	581	588	586																-
22																											
23																											
24																											
25																											
26	Q																										
27	Q																										
28	Q																										
29																											
30	Q																										
31																											

HEARD ISLAND

(Geog: Lat = 53 1.9 S, Long = 73 21.9 E; Alt = 3 Metres)

1985 OCTOBER

NORTH COMPONENT (X)

MEAN HOURLY VALUES

10000 + tabular values in nanoTeslas.

PRELIMINARY

Day	UT	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
01	Q																										
02																											
03												96	156		137	147	120	82	48	86	33	40	43	47	47	40	-
04			34	35	37	45	48	43	49	48	50	68	87	86	94	145	158	89	53	35	42	11	1	-186	-26	22	45
05	D		36	56	18	-4	-6	20	60	59	68	66	211	200	46	40	79										-
06	D		-114	-14	-5	15	24	-16	19	51	91	51	61	101	87	82	71	52	42	32	33	6	-80	-235	-76	-36	10
07	D		3	34	34	25	33	40	28	49	50	60	75	73	76	64	81	108	116	35	22	-8	-20	-11	-1	-3	40
08			-5	29	35	29	32	41	34	38	47	42	48	58	53	55	65	70	48	43	49	68	24	37	42	48	43
09			46	46	48	47	48	43	40	42	41	40	45	51	54	52	50	51	53	51	39	42	48	51	53	49	47
10			43	43	46	49	50	47	37	32	36	40	45	51	52	54	54	53	55	56	53	40	41	24	21	26	44
11			36	37	37	38	40	35	25	37	41	50	46	71	58	56	82	187	73	43	-18	-3	-100	-18	15	-62	34
12			-156	1	43	44	45	42	42	40	40	43	55	61	59	56	54	47	40	47	56	57	39	46	47	42	37
13	D		57	60	32	41	69	59	43	36	36	43	52	61	68	84	66	64	72	54	48	32	15	38	41	52	51
14			52	54	54	64	60	52	45	41	42	46	56	59	60	57	56	45	51	50	46	55	53	57	63	60	53
15			56	57	54	25	14	13	15	54	43	37	39	43	47	51	54	57	63	53	54	52	57	48	-20	-34	39
16			-24	8	-3	16	46	54	37	37	44	72	58	65	56	51	43	45	48	48	45	55	50	19	31	28	39
17			18	39	41	43	64	56	47	51	54	57	50	57	82	51	57	59	57	63	-43	21	45	24	-16	38	42
18	D		-101	13	47	45	43	40	35	49	50	57	73	90	63	60	59	30	42	37	38	-47	2	34	33	-11	33
19			23	55	53	50	52	47	49	38	46	59	72	62	56	36	50	55	54	51	51	55	59	60	63	60	52
20			63	60	61	57	51	43	33	40	46	49	54	53	54	54	52	50	45	54	56	48	52	58	63	60	52
21			60	59	59	61	60	55	57	58	53	59															-
22																											
23																											
24																											
25																											
26	Q																										
27	Q																										
28	Q																										
29																											
30	Q																										
31																											

HEARD ISLAND

(Geog: Lat = 53 1.9 S, Long = 73 21.9 E; Alt = 3 Metres)

1985 OCTOBER

EAST COMPONENT (Y)

MEAN HOURLY VALUES

-14000 - tabular values in nanoTeslas.

PRELIMINARY

Day	UT	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
01	Q																										
02																											
03												933 964	955 953 989	1004 9831010	994 985 982	993 979 969											-
04		953 980 995	998 995 980	952 935 931	935 930 940	955 9971017	10011011 997	988 972 962	845 921 980	965																	
05	D	9891010 984	977 944 942	931 930 952	93810171011	960 969 968																					-
06	D	888 964 975	987 986 953	957 962 986	968 960 995	98610471013	10361008 935	963 963 921	991 872 895	967																	
07	D	9851001 993	968 966 964	960 974 962	962 966 981	967 962 983	10331026 960	953 962 920	949 902 894	966																	
08		932 984 994	991 991 979	965 964 959	953 966 972	967 981 982	1022 992 994	995 978 945	981 989 990	978																	
09		991 991 991	987 984 979	967 959 952	954 956 962	968 970 973	973 979 978	940 995 987	985 986 980	974																	
10		984 983 983	988 992 987	968 947 951	958 960 965	966 977 975	978 977 978	986 9931011	995 981 975	977																	
11		977 992 990	988 988 979	954 938 928	933 944 954	957 969 990	10651008 993	987 980 834	939 961 916	965																	
12		789 945 994	10071001 987	970 960 953	950 955 964	970 972 978	9851001 978	984 965 933	975 978 979	966																	
13	D	989 992 959	939 961 979	969 953 937	944 955 963	964 967 992	9841040 996	990 969 919	968 962 973	969																	
14		992 997 994	992 979 977	967 957 951	953 960 967	973 976 976	985 988 994	992 984 975	982 979 991	978																	
15		99610031008	984 948 937	930 953 942	938 947 959	970 969 974	991 991 986	982 988 979	974 949 902	967																	
16		952 982 946	932 955 968	956 949 941	962 961 971	970 973 987	993 984 991	1009 990 984	926 930 949	965																	
17		968 970 985	987 983 973	963 942 946	944 946 959	960 962 975	978 9751028	976 988 984	963 887 941	966																	
18	D	877 961 986	999 992 973	958 941 945	950 950 966	977 974 983	10261025 992	984 901 868	966 958 870	959																	
19		96010011014	1003 986 972	966 954 956	958 977 962	964 991 997	982 982 984	986 984 981	983 986 989	980																	
20		994 993 990	996 995 987	971 951 937	942 957 967	975 976 977	976 980 988	989 982 983	982 984 990	978																	
21		9981003 999	100510081001	986 966 953	954																						
22																											
23																											
24																											
25																											
26	Q																										
27	Q																										
28	Q																										
29																											
30	Q																										
31																											

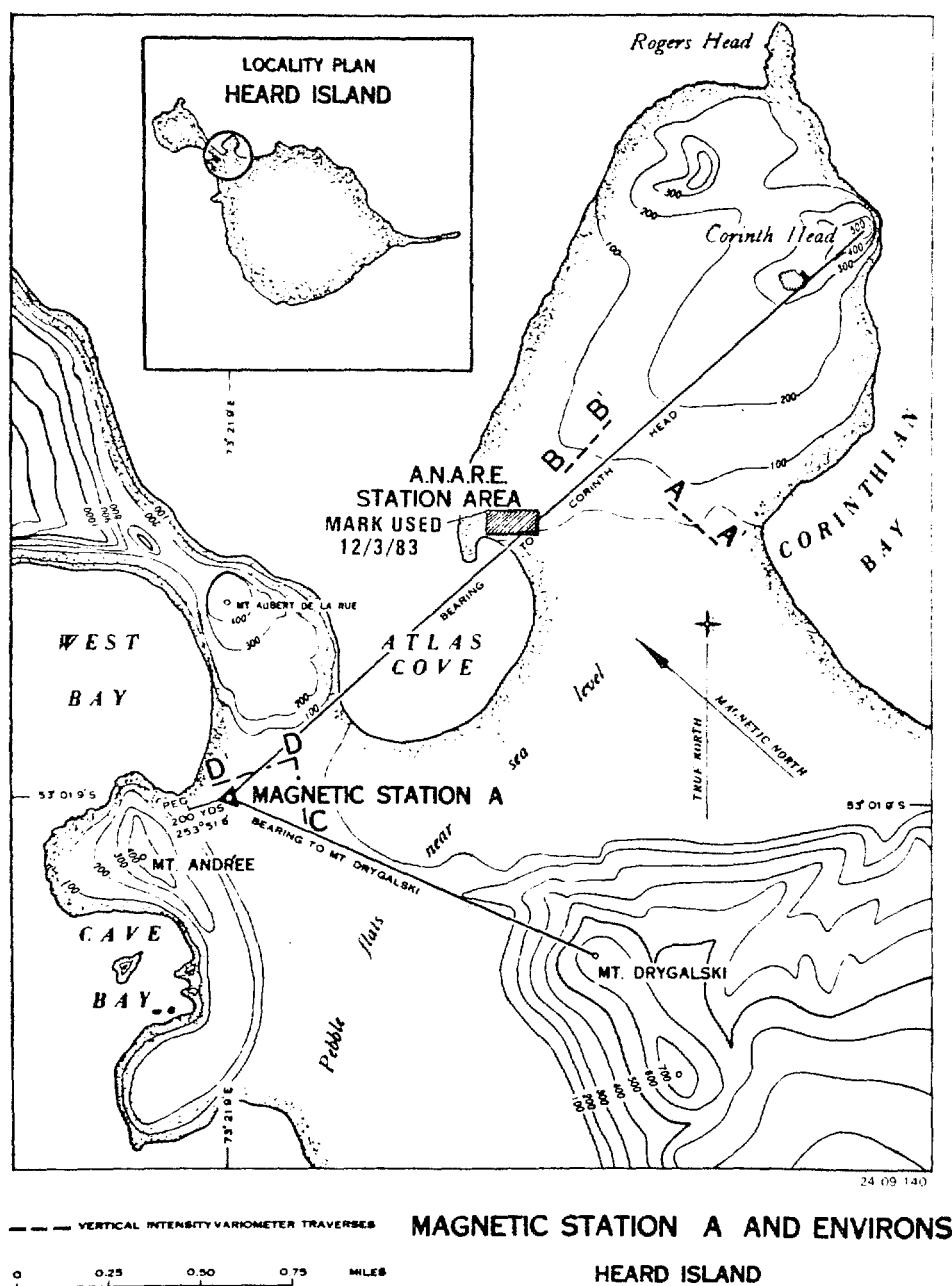


Figure 1. Magnetic station and environs

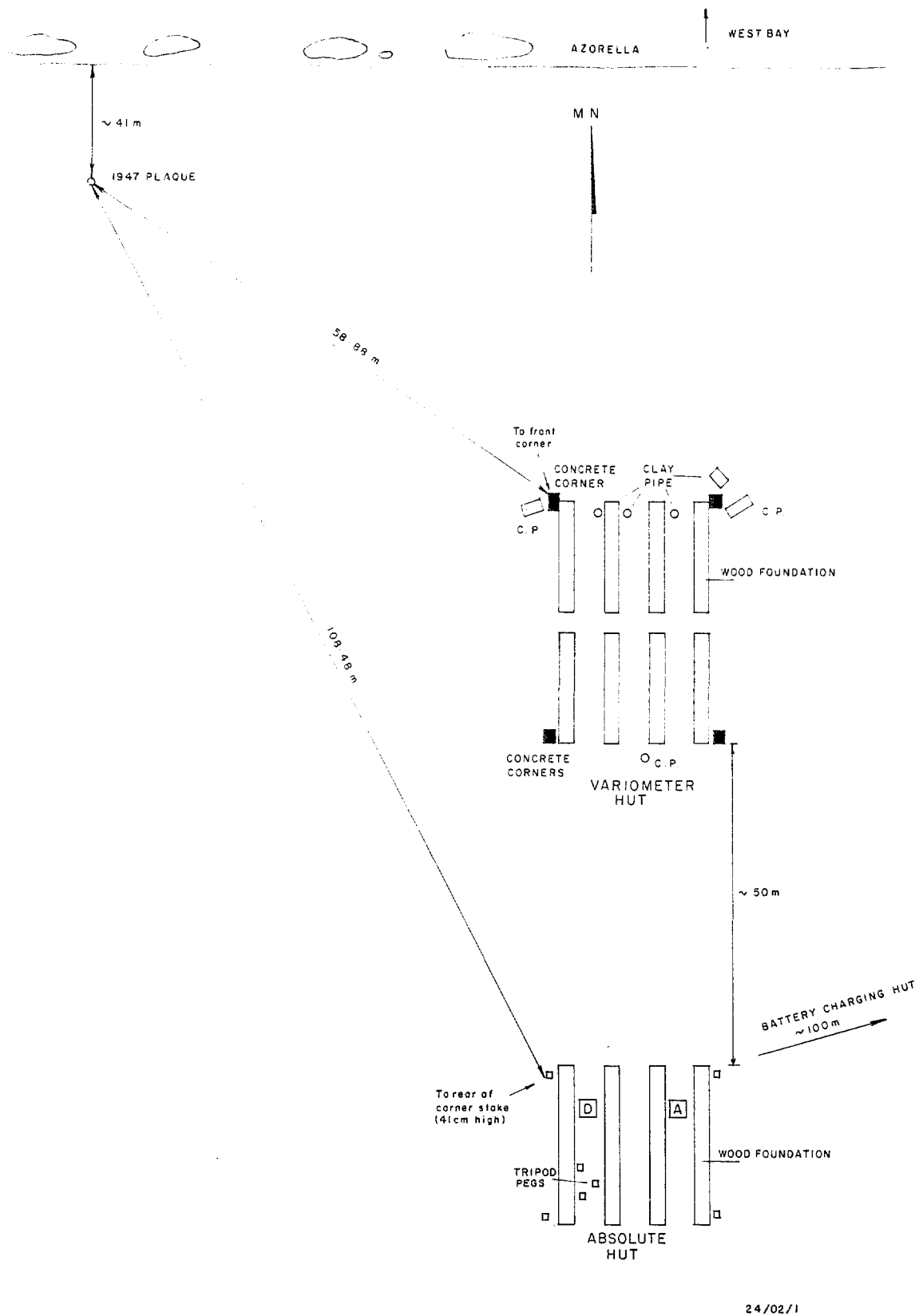


Figure 2. Station location

REFERENCE MARKS AND AZIMUTHS
 HEARD ISLAND A(HIA)

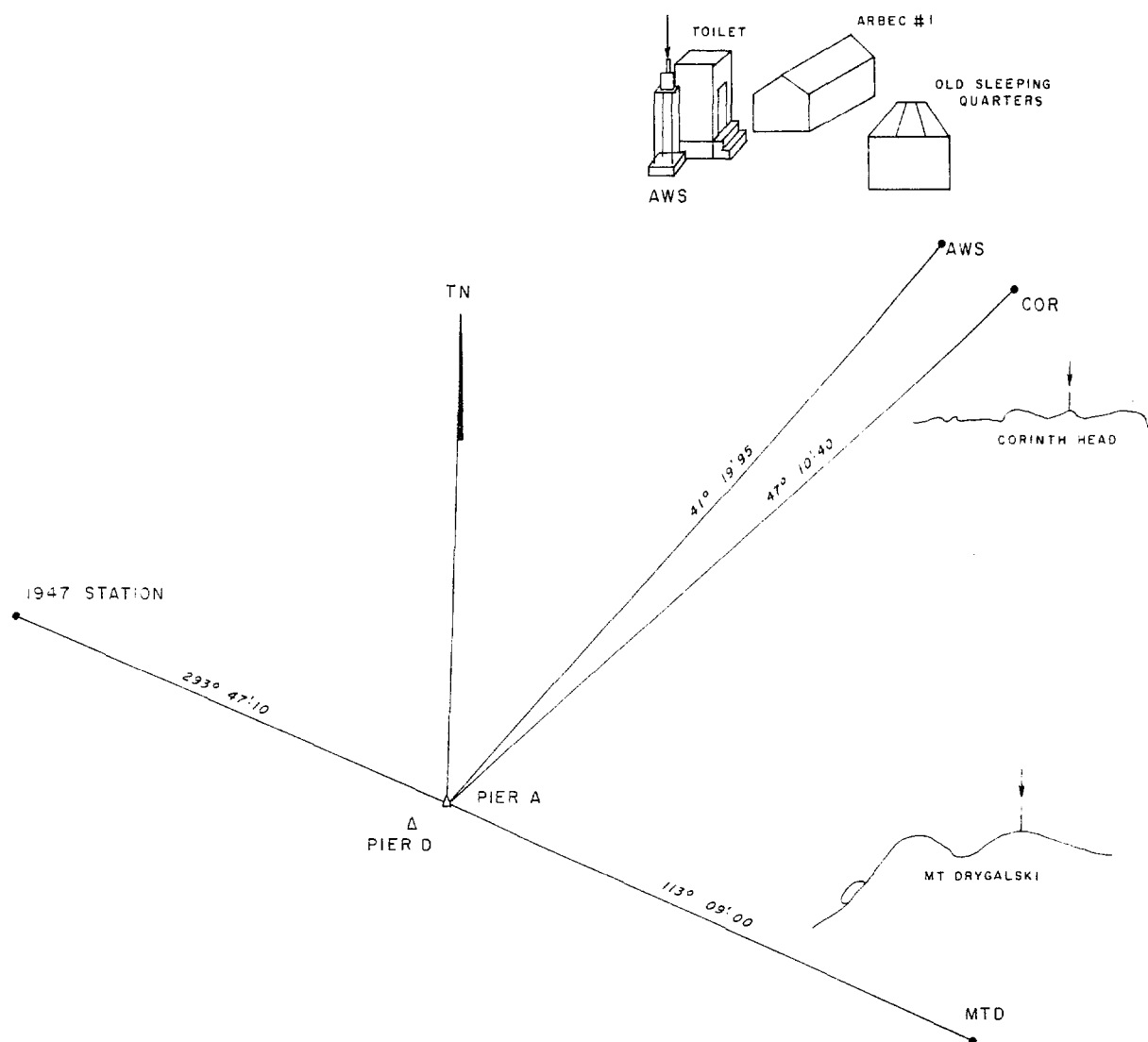


Figure 3. Reference marks and azimuths