COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1970 / 101

First-Order Regional Magnetic Survey at Cocos Islands, Southern Cross, and Augusta 1970

by

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ILLUSTRATIONS

SUMMARY

First-order magnetic survey observations were made at Cocos Islands, Southern Cross, and Augusta during 1970 and the results are presented in this Record. Cocos Islands had been occupied previously, Southern Cross is a new first-order station, and Augusta is a successor to the site at Alexandra Bridge.

1. INTRODUCTION

The first-order survey work at Cocos Islands, Southern Cross, and Augusta was completed as part of the survey by the Bureau of Mineral Resources (BMR) of all stations in the Australian network (Plate 3). Most of these stations were surveyed in 1968-69 (Finlayson, 3 Records in prep.).

The Cocos Islands station had been occupied previously (van der Linden, 1964, 1968). No magnetic observations had been made at Southern Cross since 1921 (Fisk & Sverdrup, 1927). A new site was established at Augusta to replace the site at Alexandra Bridge which was last reoccupied in 1966 by van der Linden (1969), but which has been made unusable by recent road and bridge re-development.

The survey work at Cocos Islands was done by the author during the period 4-15 May 1970 using the Department of Civil Aviation charter service to the Island from Melbourne. The survey work at Southern Cross and Augusta was done during the period 2-10 July 1970 by the author and trainee geophysicists J. Petkovic and M. McDowell from Mundaring Geophysical Observatory.

2. METHODS AND EQUIPMENT

The methods and equipment used for the survey work were the same as those used during the 1968-69 first-order magnetic surveys (Finlayson, 3 Records in prep.) and reference should be made to reports of these surveys for details. Briefly, a three-component fluxgate variograph was operated at each station for not less than three nights and magnetic control observations were made at the magnetic station marker with a QHM magnetometer, an Askania declinometer, and an Elsec proton-precession magnetometer. The magnetometers and variograph used at the various stations are listed below.

Horizontal intensity (H)

Station	Instrument	Correction, gammas/oersted
Cocos Islands	QHM 305	-5
Southern Cross	QHM 292	-126
Augusta	QHM 292	-126

Declination (D)

Askania declinometer No. 509 320 used at all three stations; correction was +0.3 min (van der Waal, 1966).

Total intensity (F)

Elsec proton-precession magnetometer No. 424 used at all three stations (correction zero).

Variograph

BMR three-component variograph MFR1 was used at all stations. Detector coil constants are listed below:

Magnetic component	H	D	Z
Coil constant (gammas/microamp)	2.40	2.41	2.76

3. RESULTS

Sites

The main site at Cocos Islands was established within a few feet of the old site on West Island airfield. No previous station marker could be found. Observations were made at three subsidiary sites as well as at the main site in order to gauge the range of magnetic values in the region. One of these subsidiary sites was a close reoccupation of the old Direction Island site but no station marker was found because the island has been radically altered by hurricane damage and erosion. The locations of the various sites on Cocos Islands are shown in Plate 1.

No regional magnetic observations had been made at Southern Cross since the Carnegie Institute of Washington survey in 1921 and that site was no longer recognizable. A new site was located on the airfield operated by the local aero club.

The site at Alexandra Bridge was radically altered by road and bridge building in 1968 and the site was no longer recognizable. A new site was chosen on Augusta airfield, which was built during 1969. Although the site is disturbed magnetically because of local geology, it is thought to be more secure from re-development than other sites.

Magnetic observations

A summary of the observations made at each station is given in Table 1. The procedure for the reduction of the magnetic observations is the same as that applied on the 1968-69 first-order surveys and reference should be made to the reports of those surveys for details. The values for the adopted variograph scale values, adopted variograph baselines and the mean values are given in Tables 2, 3 and 4 respectively. The magnetic values at the Cocos Islands sites are given in Table 5. Mean hourly values of H, D, and Z at the three main subsidiary stations are shown in Plate 2.

The degree of magnetic disturbance during the observation period can be gauged from the C- and K-indices for the relevant days at Gnangara Magnetic Observatory (Table 6). The effect of magnetic disturbance on the observed mean values cannot be obtained from Table 6, so the difference between the Gnangara mean values of H, D, and Z for the Five International Quiet Days and the values on the days during which regional survey observations were made, are listed in Table 7.

4. ACKNOWLEDGEMENTS

The author would like to thank the Department of Civil Aviation and the Bureau of Meteorology for their assistance with the work at Cocos Islands, and the Southern Cross and Augusta Aero Clubs for allowing the use of their airfields.

5. REFERENCES

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TABLE 1

SUMMARY OF WORK AT THE MAGNETIC STATIONS

Station	Date	Hours recording	Sets of control observations	Remarks
Cocos Islands	6-10/5/70	94	7	Close reoccupation of old site on West Island airfield. Three subsidiary sites occupied.
Southern Cross	2-5/7/70	56	6	New site on airfield.
Augusta	7-10/7/70	65	6	New site on airfield. Successor to Alexandra Bridge site.

TABLE 2

ADOPTED VARIOGRAPH SCALE VALUES OF H, D, AND Z

Station	H	D		Z
	gammas/div.	gammas/div.	min/div.	gammas/div.
Cocos Islands	4.25	4.58	0.48	4.64
Southern Cross	4.49	4.39	0.61	5.14
Augusta	3.86	4.49	0.72	4.62

TABLE 3

ADOPTED VARIOGRAPH BASELINE VALUES OF H, D, AND Z

Station	Date	H gammas	D deg, min	Z gammas
Cocos Islands	7/5/70	33022	-2° 58.1'	33174
Southern Cross	3/7/70	24685	-0° 11.2'	53028
Augusta	8/7/70	21555	-4° 06.4'	56458

TABLE 4

MEAN VALUES OF H, D, AND Z

Station	Latitude S	Longitude E	Date	H gammas	D deg, min	Z gammas
Cocos Islands	12°11.9'	96°50.1'	7/5/70	33022	2°57.1'W	33177
Southern Cross	31°14.1'	119°21.3'	3/7/70	24694	0°17.7'W	53057
Augusta	34°19.3'	115°09.0'	8/7/70	21557	4°07.8'W	56430

TABLE 5

MEAN VALUES OF H, D AND Z
AT COCOS ISLANDS SUBSIDIARY SITES

Station	Latitude S	Longitude E	Date	H gammas	D deg,min	Z gammas
W 2	12°11.6'	96°51.8'	7/5/70	33035	3°15.6'W	33201
W 3	12°08.2'	96°49.3'	7/5/70	33213	3°25.9'W	33265
Direction Island	12°05.1'	96°52.6'	7/5/70	33308	3°05.2'W	33364

TABLE 6

DISTURBANCE LEVEL AT GNANGARA MAGNETIC OBSERVATORY

Station	Date	K-index sum	C-index	Reported	magnetic	phenomena
Cocos Islands	7/5/70	11	0		-	
Southern Cross	3/7/70	20	1	3/7/70	22.51	PPC
Augusta	8/7/70	12	0	8/7/70	23.16	PPC

TABLE 7

DISTORTION OF H, D, AND Z AT GNANGARA MAGNETIC OBSERVATORY

Station	Date	△H gammas	△D minutes	△Z gammas
Cocos Islands	7/5/70	1	0.2	0
Southern Cross	3/7/70	15	0.6	-2
Augusta	8/7/70	5	0.0	3

△ = Numerical Monthly Mean for 5 Quiet Days minus Numerical Daily Mean

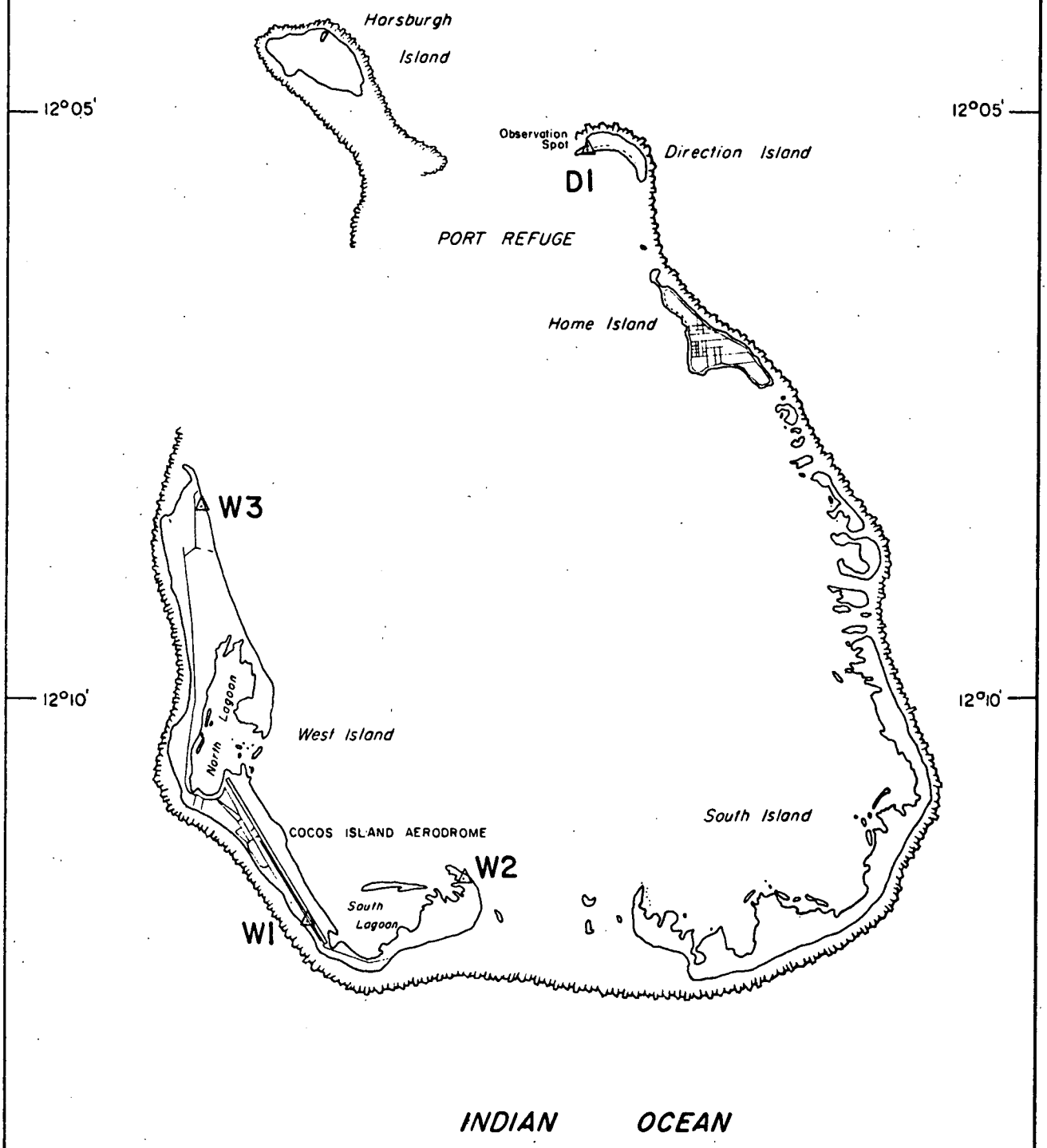
96°50'

96°55'

PLATE 1

LOCATION OF MAGNETIC SITES
COCOS ISLANDS

km 1 0 1 2 3 4 5 km.



96°50'

96°55'

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PLATE 2

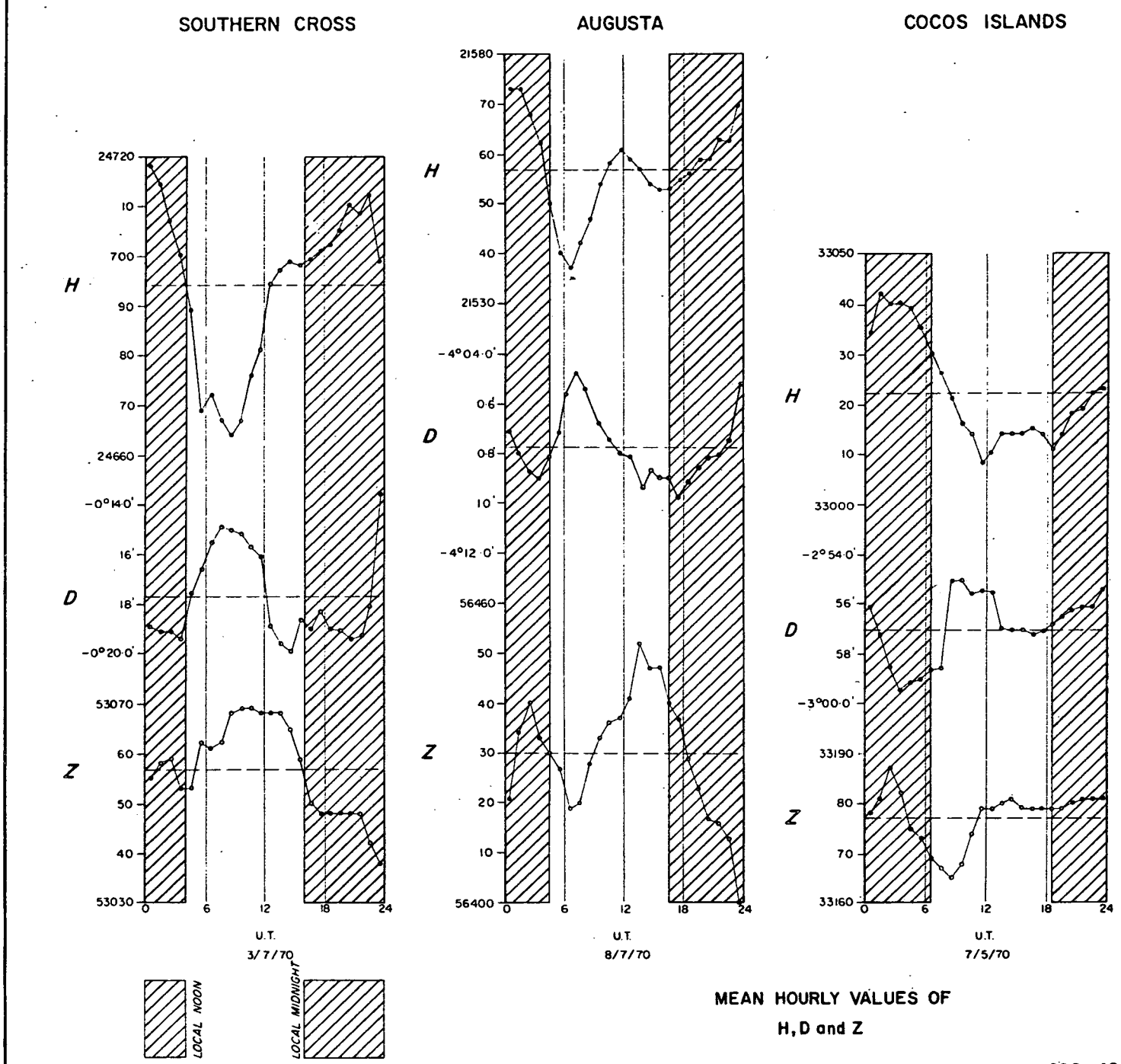
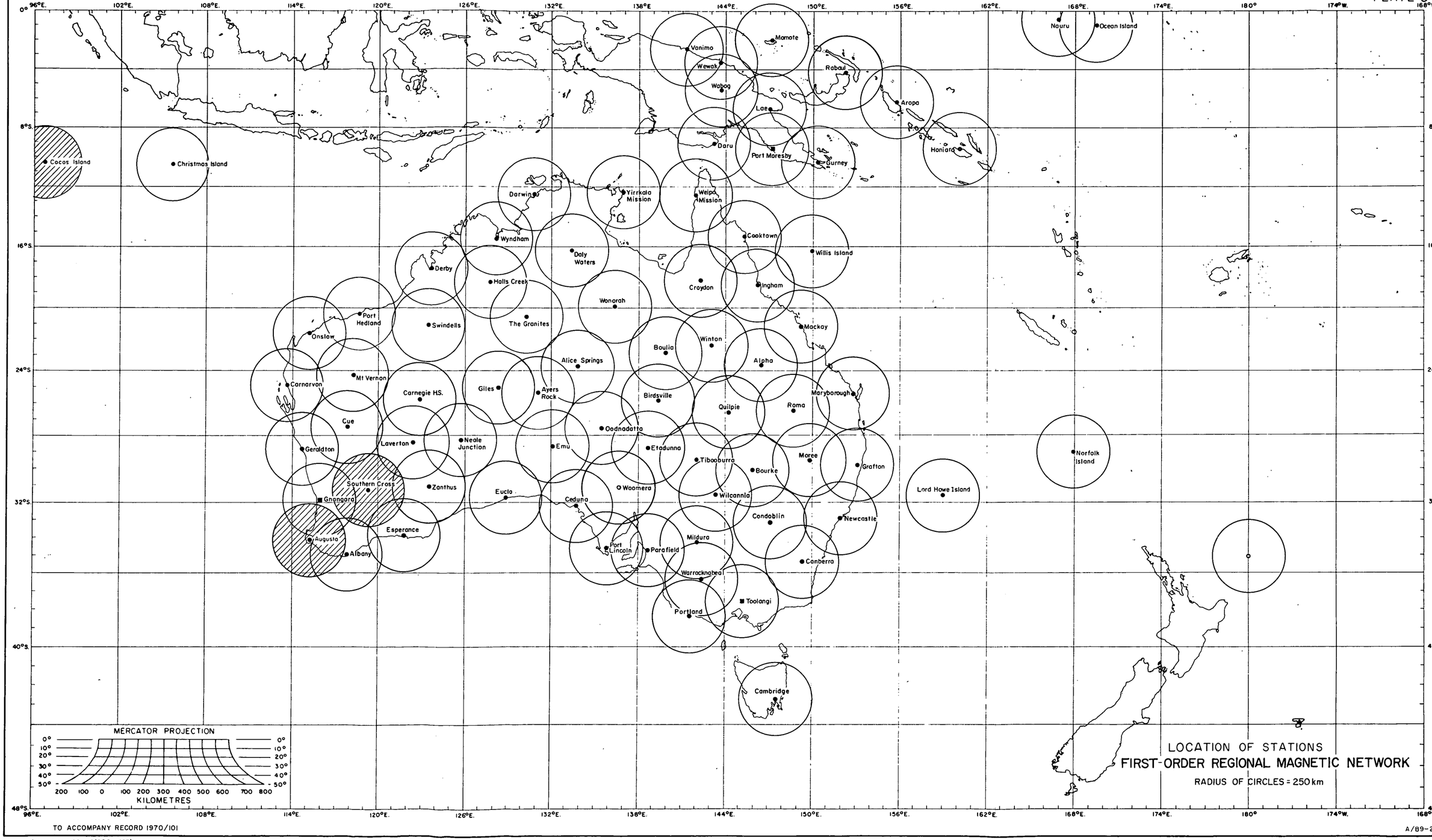

SOUTHERN CROSS
AUGUSTA
COCOS ISLANDS
H
D
Z
24720
10
700
90
80
70
24660
-0°14·0'
16'
18'
-0°20·0'
53070
60
50
40
53030
21580
70
60
50
40
21530
-4°04·0'
0·6'
0·8'
10'
-4°12·0'
56460
50
40
30
20
10
56400
33050
40
30
20
10
33000
-2°54·0'
56'
58'
-3°00·0'
33190
80
70
33160
0
6
12
18
24
U.T.
3/7/70
U.T.
8/7/70
U.T.
7/5/70
LOCAL NOON
LOCAL MIDNIGHT
MEAN HOURLY VALUES OF
H, D and Z
TO ACCOMPANY RECORD No 1970/101
G96-429

PLATE 3



TO ACCOMPANY RECORD 1970/101

A/89-20

(Based on G20-14)(G96-425)