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GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

OCTOBER 1970 TO JANUARY 1973

DATA QUALITY and DISTRIBUTION

COMPAGNIE GENERALE DE GEOPHYSIQUE
6 RUE GALVANI, 91301 - MASSY - FRANCE.

E R R A T A

Page 4 should read : Fig 3 to 7 Show histograms

Page 9 should read :

$$X = S_1 \text{ lat} + \frac{(S_2 \text{ lat} - S_1 \text{ lat}) \times (D \text{ lat} - D_1 \text{ lat})}{D_2 \text{ lat} - D_1 \text{ lat}}$$

Page 14 line 8 should read : Δ = 025 mile / 10 secondes

Page 15 line 27 should read : to obtain an accuracy of Δ per 10 secondes

Page 16 line 21 should read : ϕ instead of ϕ^1

Page 17 line 7 should read : ... the processing was ε = . 120

Page 27 line 2 should read : ... the ships was working far from station ...

Page 27 line 4 should read : .... onto the tape ...

Appendix 2 :

$$N\sigma^2 = \sum_m (N_m \sigma_m^2) + \sum_m (N_m d_m 2)$$

Record 1975/152

MARINE GEOPHYSICAL SURVEY OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARK SEA.

1970-1973

DATA QUALITY AND DISTRIBUTION

by

COMPAGNIE GENERALE DE GEOPHYSIQUE

BUREAU OF MINERAL RESOURCES

DEPARTMENT OF MINERALS AND ENERGY

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA GULF OF PAPUA AND THE BISMARCK SEA CAPO No. 560663 and 560585

September 1970 - January 1973

DATA QUALITY

COMPAGNIE GENERALE DE GEOPHYSIQUE
6 Rue Galvani - Massy FRANCE

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Gulf of Papua and the Bismarck Sea

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Appendix 2

SUMMARY

(by J. Pinchin, BMR)

Marine geophysical surveys of much of the Australian continental margin, the Gulf of Papua, and the Bismark Sea were conducted by Compagnie Generale de Geophysique (CGG) under contract to the Bureau of Mineral Resources (BMR) between September 1970 and January 1973. This report describes data quality and is one of a series written by CGG after the completion of the surveys; the others deal with data processing (Record 1974/110), equipment (Record 1974/111), systems performance (Record 1975/104), and operations and techniques (Record 1975/151). In this report maps show the distribution of good, poor, and missing data, misties and misclosures, and tables, histograms, diagrams, and sample strip-chart recordings provide samples and statistics of data quality.

Of the gravity data, 13 percent had a noise level greater than the acceptable limit of 6 mGal. The noise was mainly due to rough seas, which were experienced more continuously off the east coast where more noisy areas and larger-than-average misties resulted. The histogram of gravity misties for all cruises shows a mean intersection mistie of 4.4 mGal from 706 intersections.

The magnetic data generally fall within a 2 to 5 nT noise envelope. The strong local magnetic gradients that occur in the Bismark Sea were the cause of the large misties at line intersections in this region. Overall, the mean mistie is 18 nT from a total of 842 intersections.

The reliability of the sonar Doppler navigation system was excellent; it was out of operation for only 0.25 percent of the total survey time. The Chernikeeff log was also reliable, being inoperable for only 0.6 percent of the survey time. The pressure log broke down towards the end of the survey and was inoperable during the survey of the Timor Trough, and for much of

the survey off southwest Australia. Overall, the pressure log was out of operation for about 13 percent of the total survey time.

The satellite navigation system gave position fixes accurate to within ± 20 m when the boat was stationary in port; however errors of 0.2 knots in determining the boat's true velocity when underway can lead to additional errors of ± 90 m east-west and ± 30 m north-south.

Bathymetric misties are shown in maps and histograms. They are caused not only by errors of measurement but also and to a large extent by errors of navigation. Both of these types of error are increased by greater slope in the sea floor. From 911 intersections a mean bathymetric mistie of 19.3 m was calculated.

The chief factors affecting the reflection seismic data quality were the cable noise and the sparker energy and frequency spectrum. The noise level on each of the six seismic channels was monitored regularly, and the average level was about 25μV, the minimum about 10μV, and the maximum about 90μV. A correlation has not been made between ship speed and streamer noise level. The sparker electrode array was changed from 4 pairs to a single pair half-way through the survey with a consequent increase in low-frequency energy content of the signal.

The magnetic monitor shore station was operated with steadily improved equipment during the survey. The initial chart recorder gave very poor recordings and instrument noise marred recordings during the second one-third of the survey, but, the recordings made during the last one-third of the survey were good. Overall the monitor station was out of action for about 10 percent of survey time, the most noticeable gaps occurred whilst surveying off southeast Australia when the shore station was not operated for one-third of the survey time.

All estimations of accuracy have been based on preliminary hourly data values, final navigation processing was not applied, and the magnetic data were not corrected for diurnal variations.

This report contains the analyses and conclusions of CGG and are not necessarily those of BMR, which will be published in later reports.

INTRODUCTION

The combined marine geophysical surveys of the gulf of Papua, the Bismark Sea and the Continental Margins of Australia were carried out from September 4th, 1970 to January 6th, 1973 by Compagnie Générale de Géophysique for the Bureau of Mineral Resources, Department of National Development of the Commonwealth of Australia.

The aim of this report is to examine the quality of the data (gravity, magnetism, seismic, bathymetry) recorded throughout the surveys. When quoted in this report, the geophysical survey of the gulf of Papua and the Bismarck Sea will be called 05, the geophysical survey of the Continental Margins of Australia, will be represented by surveys 10 to 19 - Figures 1 and 2 give the breakdown of the different areas.

Some programmes of the processing of the surveys quoted in this report are described in detail in the "Processing report".

BMR FIG. 1

GEOPHYSICAL SURVEY OF THE GULF OF PAPUA AND THE BISMARCK SEA

9/1970 to 12/1970

LOCATION MAP

1st cruise	: lines	1	to	32
2nd	"	33	-	86
3rd	"	86	-	135
4th	"	136	-	188
5th	"	189	-	230

SCALE : 1 / 5,000,000

0 100 200 Km

CGG

SURVEY 05

BISMARCK ARCHIPELAGO

BISMARCK SEA

NINIGO GROUP

ADMIRALTY ISLANDS

MANUS Island

ST MATTHIAS GROUP

NEW HANOVER

NEW IRELAND

NEW BRITAIN

WITU Islands

RABAUL

PACIFIC OCEAN

SOLOMON ISLANDS

BOUGAINVILLE ISLAND

SOLOMON SEA

MADANG

KARKAR I

LONG I

UMBOI I

NEW GUINEA

PAPUA

LAE

IRIAN

WEST

PORT MORESBY

LINE 1

LINE 2

LINE 230

THE GREAT BARRIER REEF

TROBRIAND I

D'ENTRECASTEAUX ISLANDS

WOODLARK I

LOUISADE ARCHIPELAGO

CORAL SEA

AUSTRALIA

141° 144° 147° 150° 153° 156°

0° 3° 6° 9° 12°

FIG. 2

BMR

GEOPHYSICAL SURVEY OF THE CONTINENTAL MARGINS OF AUSTRALIA

12/1970 to 1/1973

SURVEYS AREA

SCALE: 1/20 000 000

0 200 400 600 km

CGG

SURVEYS 10 to 19

110° 120° 130° 140° 150° 160° 170°

5° 15° 25° 35° 45°

INDONESIA

WEST IRIAN

NEW GUINEA

PAPUA

NORTHERN TERRITORY

QUEENSLAND

WESTERN AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

VICTORIA

TASMANIA

CANBERRA

MELBOURNE

HOBART

10

11

12

13

14

15

16

17

18

19

I - GRAVITY DATA

* Two sets of maps called Gravity data and Gravity misclosures provide the information concerning the quality of the gravity data throughout the surveys.

I.1 - Gravity gaps and noise level (Encl. 1 to 8 and Appendix I, fig. A to E)

* A gravity gap is defined as follows : there is no gravity data when I.0EI0 is written on the magnetic output tape from GRANAV (see Processing Report, page 30).

* The noise level is output from a noise analysis performed in the GRANAV programme on the 10. second data in the following way :

- A Sinc filter with a dominant period of 12 minutes is applied to a one hour block of data to get a filtered trace in the one hour period at each ten second point.

- The filtered trace is subtracted from the original trace to give a noise trace (N) in the one hour period at each ten second point (i.e. 360 values, Ni, i = 1,360).

- The 360 Ni values are taken as a statistical sample of the noise, and the Mean, Range, Variance and Standard deviation of the Ni are determined. $2\sqrt{2}$ times the Standard deviation represent a good approximation of the noise level peak to peak of the trace.

* Since this analysis is performed every 8 hours (sometimes every 4 hours), the noise level in the interval not analysed is extrapolated from the value of the first hour.

* When the high level of the noise is due to a change of the east velocity of the ship (turn, change of speed), the value output is not taken

account ; then, the noise level is defined by consistency with the adjacent values.

* The thresholds used for the drafting of the maps of the noise level are :

0,2,6, 10 mGal.

I.2. - Misties and Misclosures

Preliminary remark : All locations of the crossings were computed daily on board the ship from raw navigationnal data ; the reference time of the crossing (and its location) is obtained by linear interpolation form the half-hourly post calculated Doppler position. This applies to Gravity, Magnetic and Bathymetric data.

* I.2.1. - Misclosure Maps (Enclosures 9 to 16)

On these maps, the following is put down for each crossing :

- either the two gravity values corrected for zero and Eôtvos effect (Area B to H)

- or the algebraic difference at the crossing between these two values computed in the following way : latest line value minus earliest line value (Area I)

* The misclosure is algebraically computed according to a loop in the counter clockwise direction.

I.2.2. - Statistical results

* Statistical analysis was carried out for four main areas :

- Gulf of Papua and Bismarck Sea (Survey 05)
- East coast of Australia.

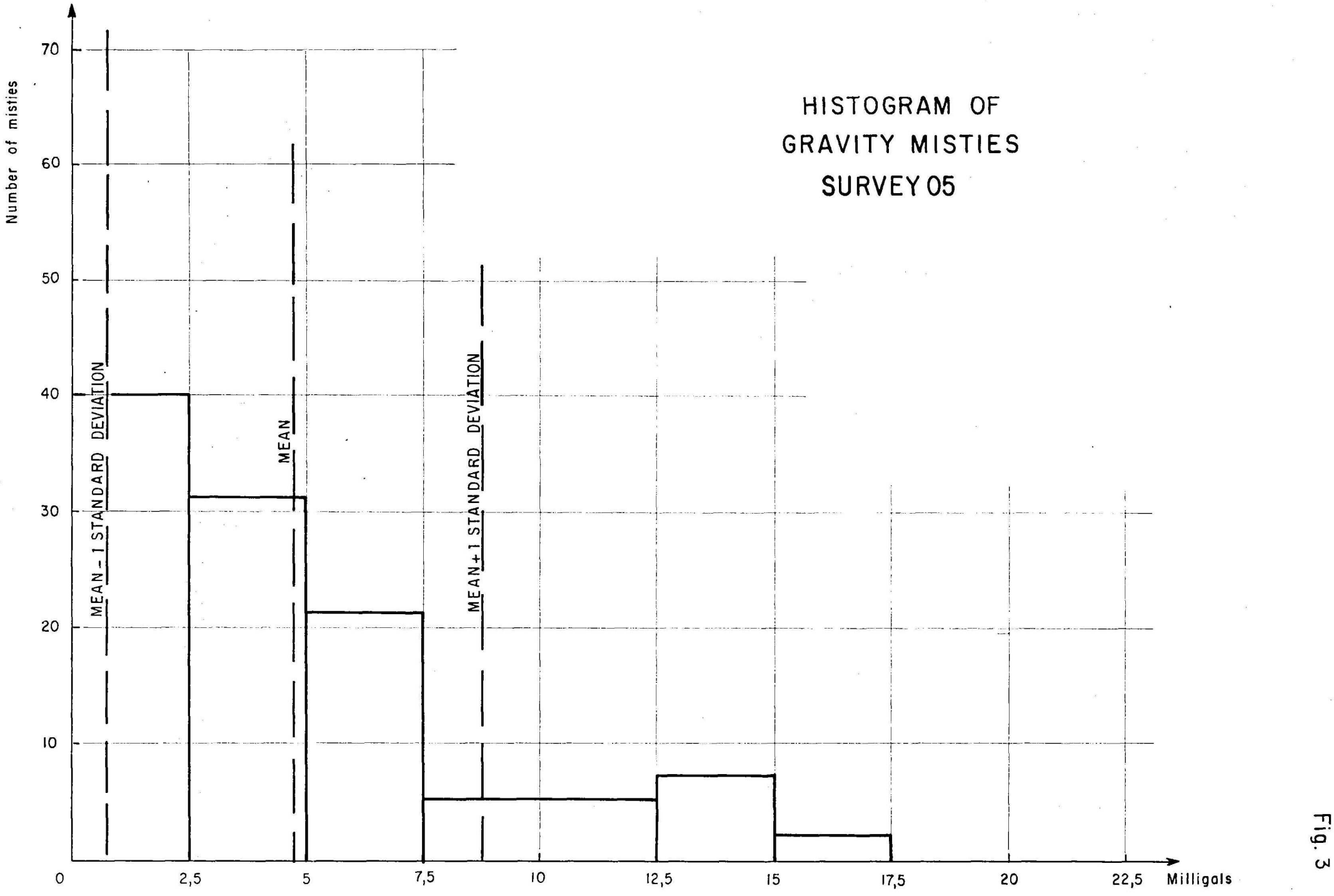

HISTOGRAM OF
GRAVITY MISTIES
SURVEY 05
Number of misties
70
60
50
40
30
20
10
0
2,5
5
7,5
10
12,5
15
17,5
20
22,5
Milligals
MEAN - 1 STANDARD DEVIATION
MEAN
MEAN + 1 STANDARD DEVIATION

Fig. 3

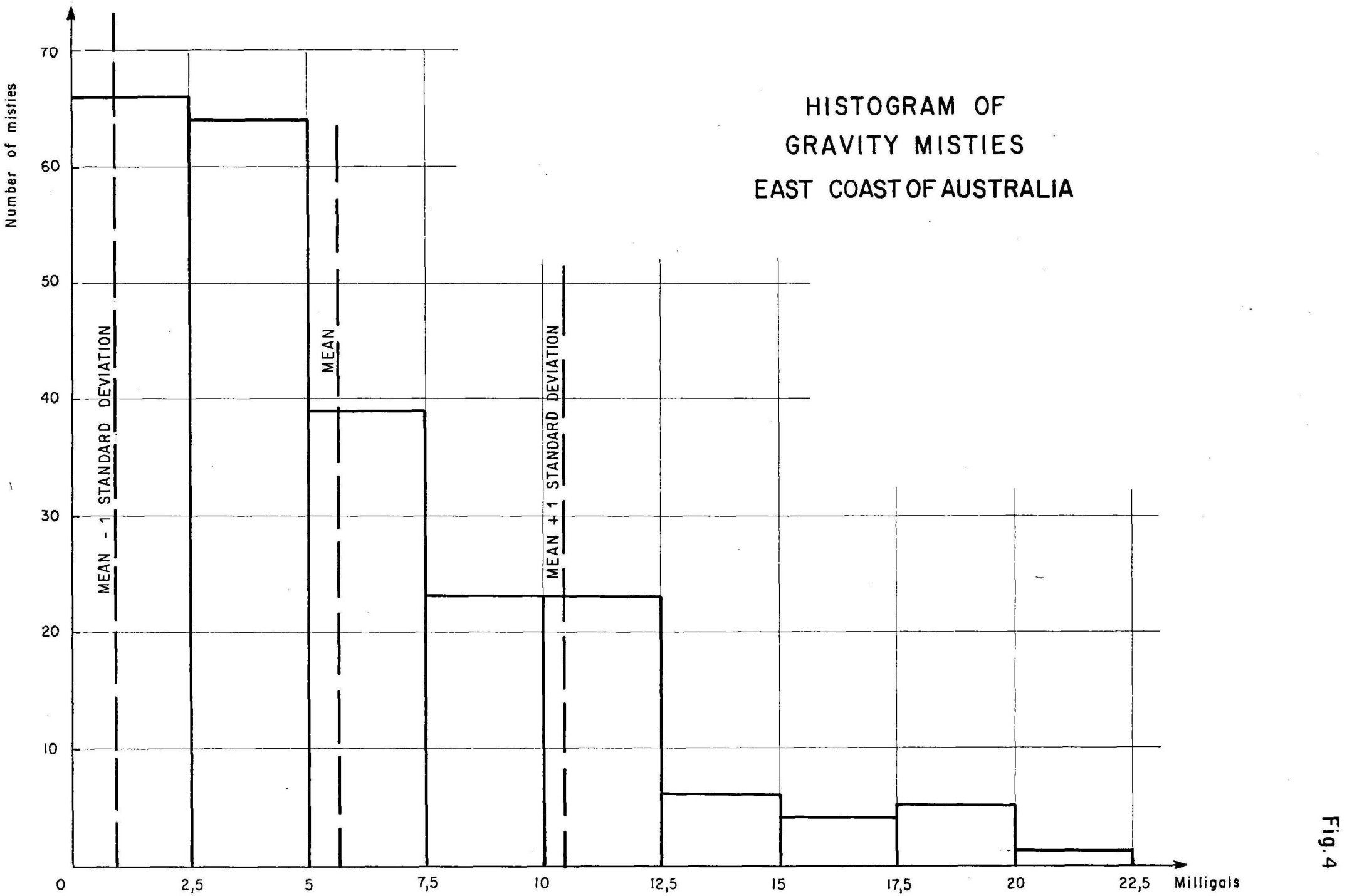

HISTOGRAM OF
GRAVITY MISTIES
EAST COAST OF AUSTRALIA
Number of misties
70
60
50
40
30
20
10
0
2,5
5
7,5
10
12,5
15
17,5
20
22,5
Milligals
MEAN - 1 STANDARD DEVIATION
MEAN
MEAN + 1 STANDARD DEVIATION

Fig. 4

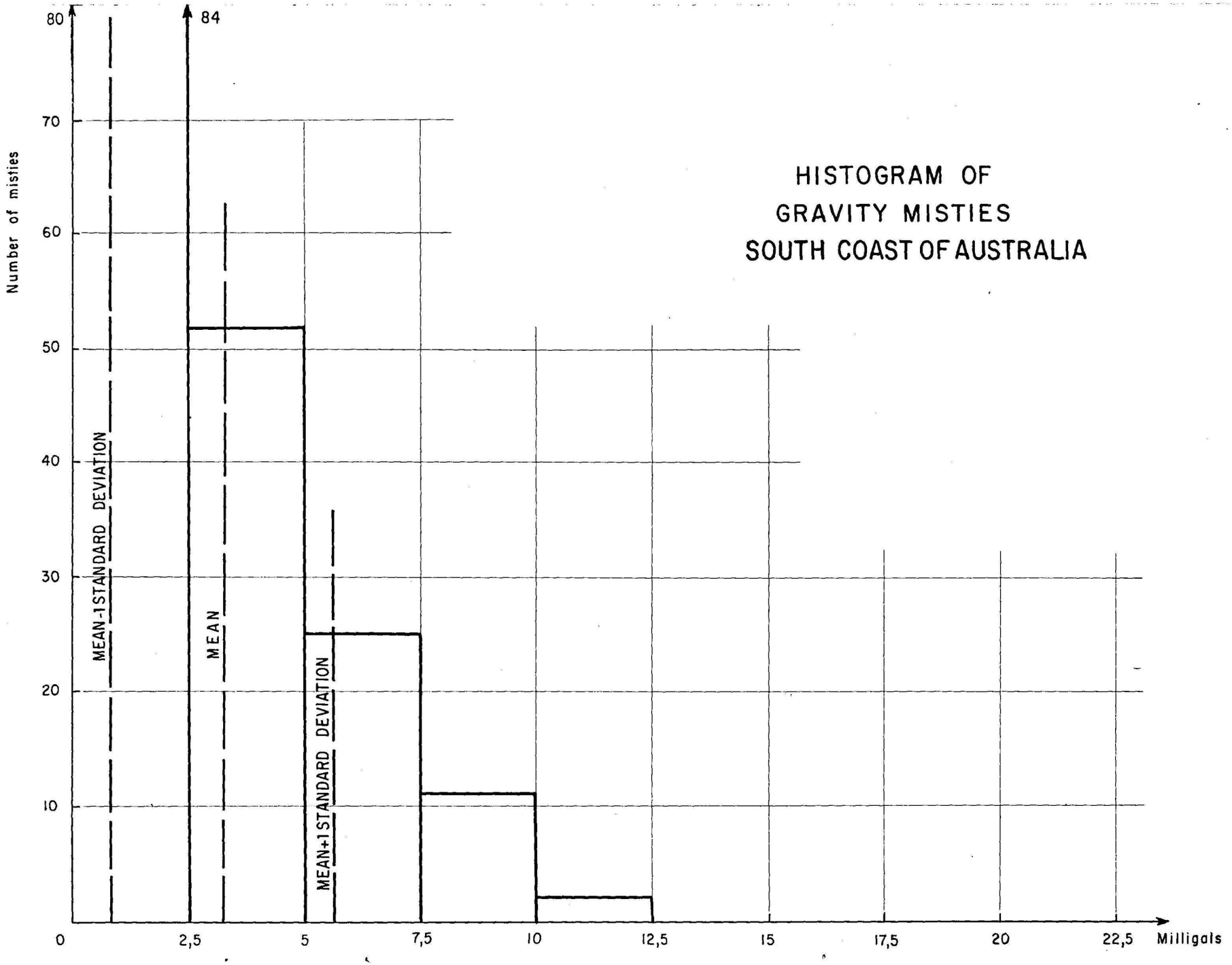

HISTOGRAM OF
GRAVITY MISTIES
SOUTH COAST OF AUSTRALIA
Number of misties
80
70
60
50
40
30
20
10
0
84
MEAN-1STANDARD DEVIATION
MEAN
MEAN+1STANDARD DEVIATION
2,5
5
7,5
10
12,5
15
17,5
20
22,5
Milligals

Fig. 5

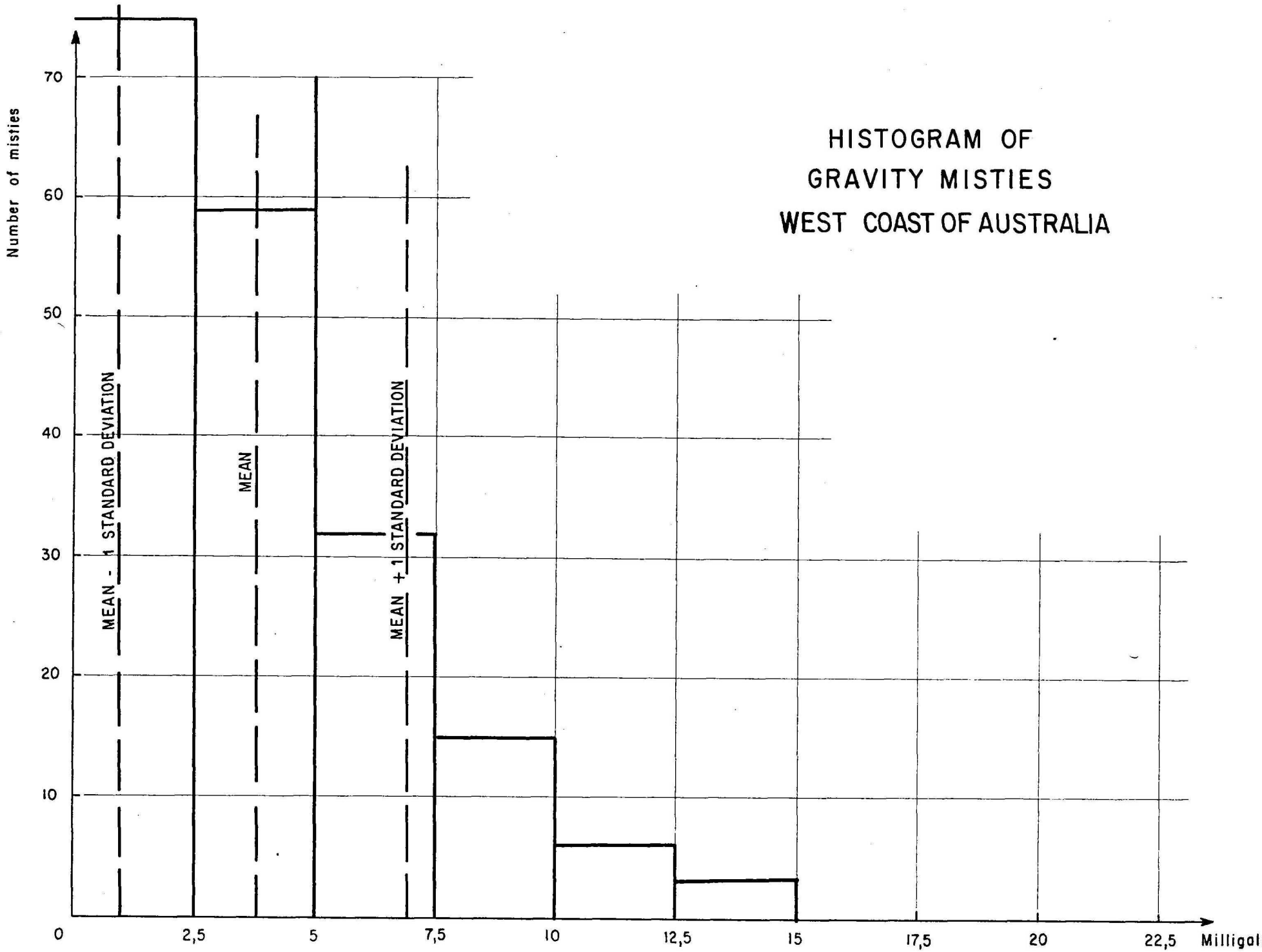

HISTOGRAM OF
GRAVITY MISTIES
WEST COAST OF AUSTRALIA
Number of misties
70
60
50
40
30
20
10
0
MEAN - 1 STANDARD DEVIATION
MEAN
MEAN + 1 STANDARD DEVIATION
2,5
5
7,5
10
12,5
15
17,5
20
22,5
Milligals

Fig. 6

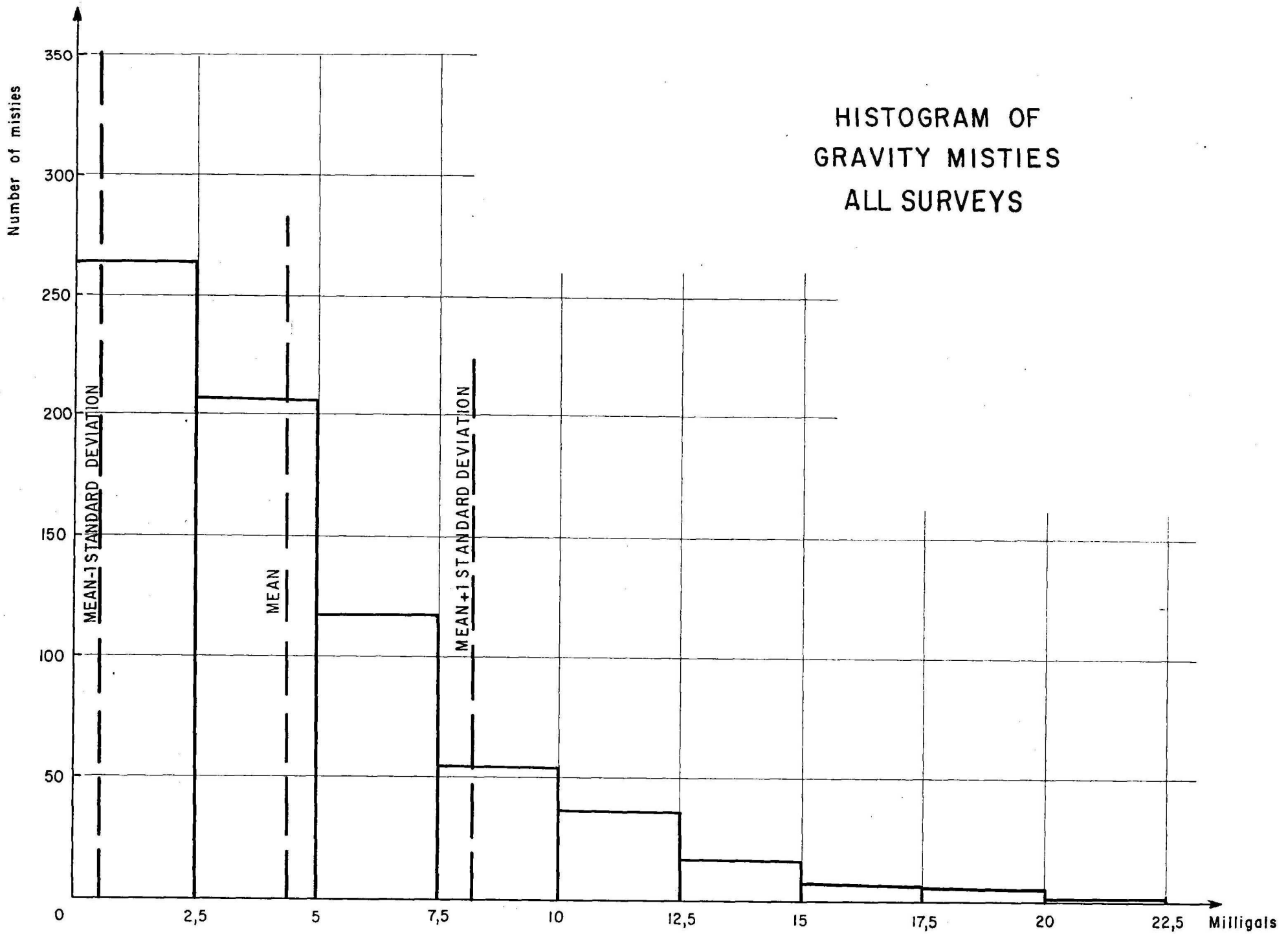

HISTOGRAM OF
GRAVITY MISTIES
ALL SURVEYS
Number of misties
350
300
250
200
150
100
50
0
MEAN-1 STANDARD DEVIATION
MEAN
MEAN+1 STANDARD DEVIATION
2,5
5
7,5
10
12,5
15
17,5
20
22,5
Milligals

Fig. 7

- South coast of Australia between 115° E longitude and Tasmania.

- West Coast of Australia.

(Note : the same areas are kept for the statistical analysis of the Magnetic and Bathymetric data).

* The results of the statistical analysis of the misties are as follows :

	Mean	Standard deviation	Minimum	Range	Population	SD/Mean
Survey 05	4.7	4.0	0	16.5	111	.84
East Coast	5.6	4.7	0	27	231	.84
South Coast	3.2	2.4	0	11	174	.77
West Coast	3.8	3.0	0	15	190	.78
All	4.4	3.8	0	27	706	.86

* Figures 3 to 7 histograms of Gravity misties for each area and for the whole Survey.

* The histograms and the statistical results call for the following comments :

- For survey 05, the high figures obtained are due to the fact that the gravity misties presented a strong gradient during the whole Survey.

- For the East Coast, the high figures obtained are due to the fact that the sea conditions were near limit most of the time, thus the gravity data was noisy.

- For the South Coast and the West Coast, the sea conditions were satisfactory most of the time.

SURVEY CRUISE	GRAVITY WITHIN CRITERIA Hours Minutes	% of W.T.	GRAVITY O.C. Hours Min.	% of W.T.	FAILURE Hours Min.	% of W.T.
12.1	217.40	65.3	115.20	34.6	00.20	0.1
12.2	190.45	57.2	109.40	32.9	33.10	9.9
12.3	213.40	64.7	115.47	35.1	00.33	0.2
12.4	417.10	99.7	01.20	0.3	00.00	0
S.12	1039.15	73.4	342.07	24.1	34.03	2.5
13.1	206.05	66.4	101.55	32.7	03.30	0.9
13.2	193.40	89.7	22.10	10.2	00.00	0
13.3	231.05	80.8	50.50	17.8	00.35	1.1
13.4	261.22	96.5	09.30	3.5	00.00	0
13.5	270.05	86.0	41.35	13.3	02.20	0.7
S.13	1162.17	85.1	226.00	16.2	06.25	0.7
14.1	254.57	79.3	64.20	20.0	02.23	0.7
14.2	434.55	97.8	02.00	0.4	07.35	1.8
14.3	147.05	40.9	213.15	59.0	01.20	0.4
S.14	836.57	74.2	279.35	24.8	11.18	1.0
15.1	181.35	89.9	17.40	8.7	02.50	1.4
15.2	NO GRAVITY DATA					
15.3						
15.4	204.10	93.2	15.00	6.8	00.00	0
S.15	385.45	91.6	32.40	7.7	02.50	0.7
16.1	304.20	89.2	37.00	10.8	00.00	0
16.2	430.03	98.0	07.35	1.7	01.32	0.3
16.3	319.20	93.1	23.50	6.9	00.00	0
16.4	274.20	98.3	04.50	1.7	00.00	0
S.16	1328.03	94.7	73.15	5.2	01.32	0.1

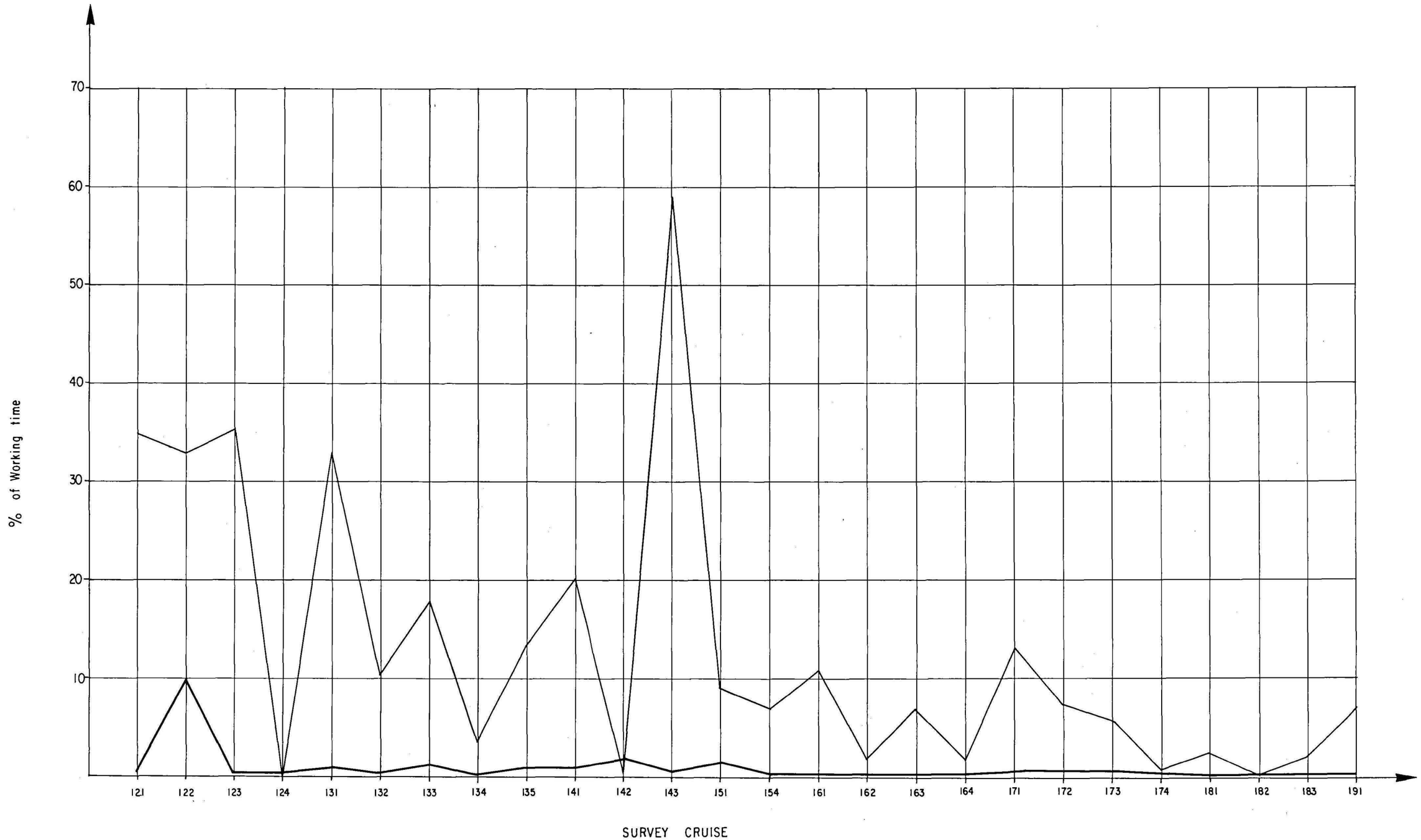
SURVEY CRUISE	GRAVITY OK	% of W.T.	GRAVITY O.C.	% of W.T.	FAILURE	% of W.T.
17.1	281.50	86.4	42.50	13.1	01.30	0.5
17.2	408.20	91.8	34.00	7.6	02.30	0.6
17.3	357.28	89.7	28.52	5.7	18.00	0.6
17.4	171.21	96.6	01.35	0.9	04.24	0.5
S.17	1218.59	90.5	101.17	7.5	26.24	2.0
18.1	199.30	97.7	04.40	2.3	00.00	0
18.2	507.05	100.	00.00	0.	00.00	0
18.3	466.47	97.9	09.30	2.	00.28	0.1
S.18	1173.22	98.8	14.10	1.2	00.28	0.0
S.19	433.45	92.8	32.10	6.9	01.20	0.3

S U M M A R Y

S.12	1 039.15	73.4	342.07	24.1	34.03	2.5
S.13	1 162.17	85.1	226.00	16.2	06.25	0.7
S.14	836.57	74.2	279.35	24.8	11.18	1.0
S.15	385.45	91.6	32.40	7.7	02.50	0.7
S.16	1 328.03	94.7	73.15	5.2	01.32	0.1
S.17	1 218.59	90.5	101.17	7.5	26.24	2.0
S.18	1 173.22	98.8	14.10	1.2	00.28	0.0
S.19	433.45	92.8	32.10	6.9	01.20	0.3
Total	7 578.23	86.47	1 101.14	12.57	84.20	0.96

Fig.8b

GRAVITY OUT OF CRITERIA AND BREAKDOWN



1.3 - Gravity data out of Criteria

The gravity data was defined out of criteria when the amplitude of the oscillations peak to peak was greater than 6 milligals over a period of between 4 and 10 minutes. This criterion was only used from Survey 12, Cruise 1. The sorting of data within or out of criteria was done on the spot by visual inspection of the analogue record on board the ship.

Generally, the "out of criteria" periods correspond to the line segments where the noise level is above 6 milligals as defined by the noise analysis performed in the programme GRANAV (Enc. 1 - 8). A few differences occur due to the different way of evaluating the noise figures.

* Figure 8A gives the duration of out of criteria periods and their percentage ratio to total working time for each Cruise, each Survey and for all the Surveys.

* Figure 8B presents these results in a graphic way.

These two figures also include quantitative information concerning the breakdowns of the gravitymeter.

II - MAGNETIC DATA

* Two sets of maps called Magnetic Data and Magnetic Misclosures provide the information concerning the quality of the magnetic data recorded throughout the Survey.

II.1 - Magnetic gaps and Noise Level (Encl. 17 to 24 and Appendix 1, Fig F to H)

* A "Magnetic gap" is defined as follows : there is no magnetic data when I.0EI0 is written on the magnetic output tape from GRANAV (See Processing Report, page 30).

* The noise level is output from a noise analysis performed in the GRANAV programme on 10. second data, in the same way as Gravity noise analysis, except for the numeric value of the dominant period which is 4 minutes. In addition, in order to distinguish between magnetic phenomena in shallow water and possible noise, depth values every 10 minutes during one hour recording are printed out with the result of the noise analysis.

* Since the analysis is performed every 8 hours (sometimes every 4 hours), the noise level in the interval not analysed is extrapolated from the value of the first hour.

* The thresholds uses in the drafting of the maps of noise level are :

- 0,2,5 gammas.

II.2 - MISTIES AND MISCLOSURES

II.2.1 - Misclosure maps (Encl. 25 to 32)

On these maps, the following items are put down for each crossing :

- either the two magnetic values at the crossing corrected for shore diurnal (Areas B to H).

- or the algebraic difference at the crossing between these two values computed in the following way : latest line value minus earliest line value (Area I).

* The misclosure is algebraically computed according to a loop in the counter clockwise direction.

II. II.2.2. - Statistical results

* The results of the statistical analysis of the misties are as follows :

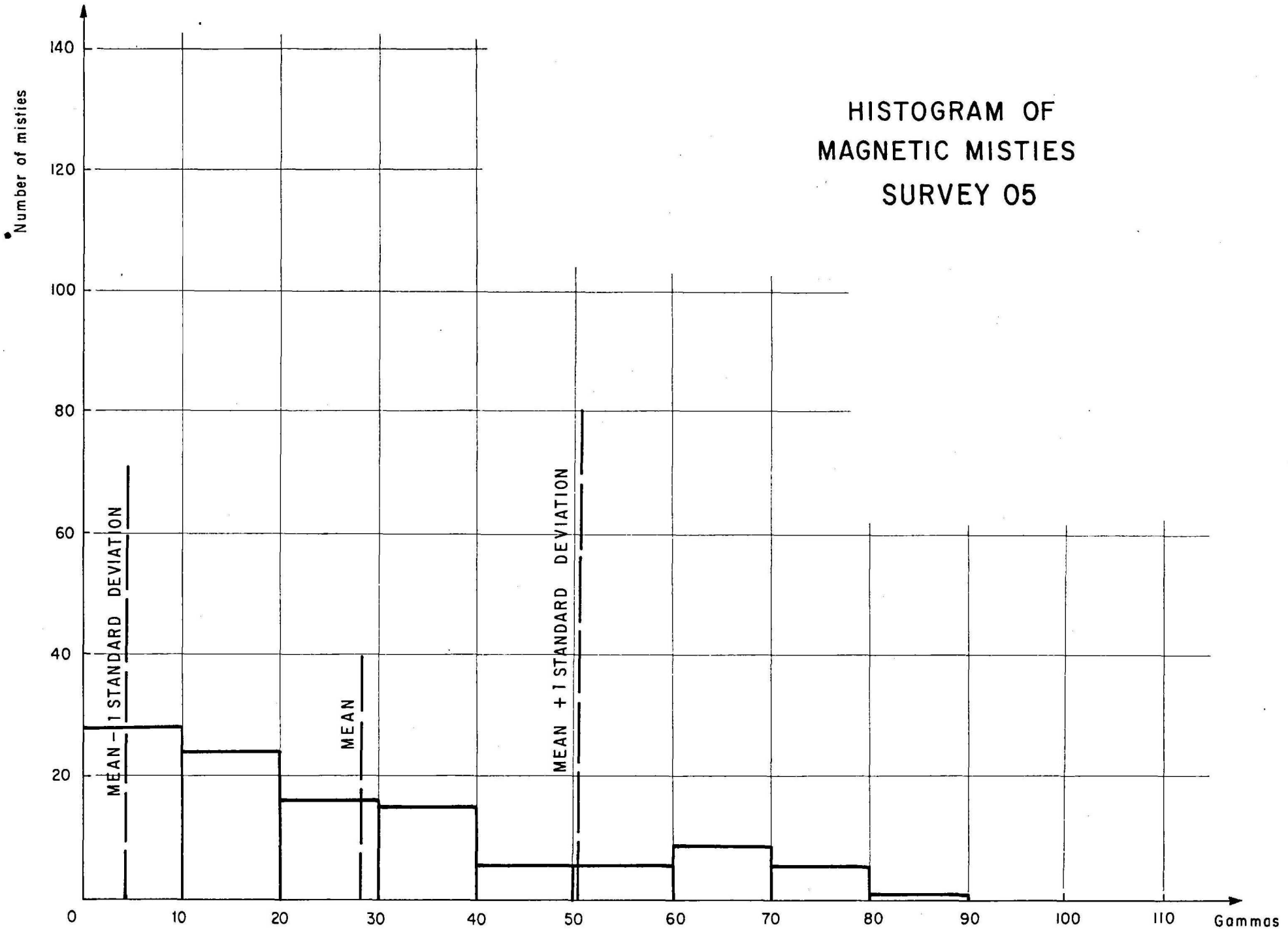

HISTOGRAM OF
MAGNETIC MISTIES
SURVEY 05
Number of misties
140
120
100
80
60
40
20
0
10
20
30
40
50
60
70
80
90
100
110
Gammas
MEAN - 1 STANDARD DEVIATION
MEAN
MEAN + 1 STANDARD DEVIATION

Fig. 9

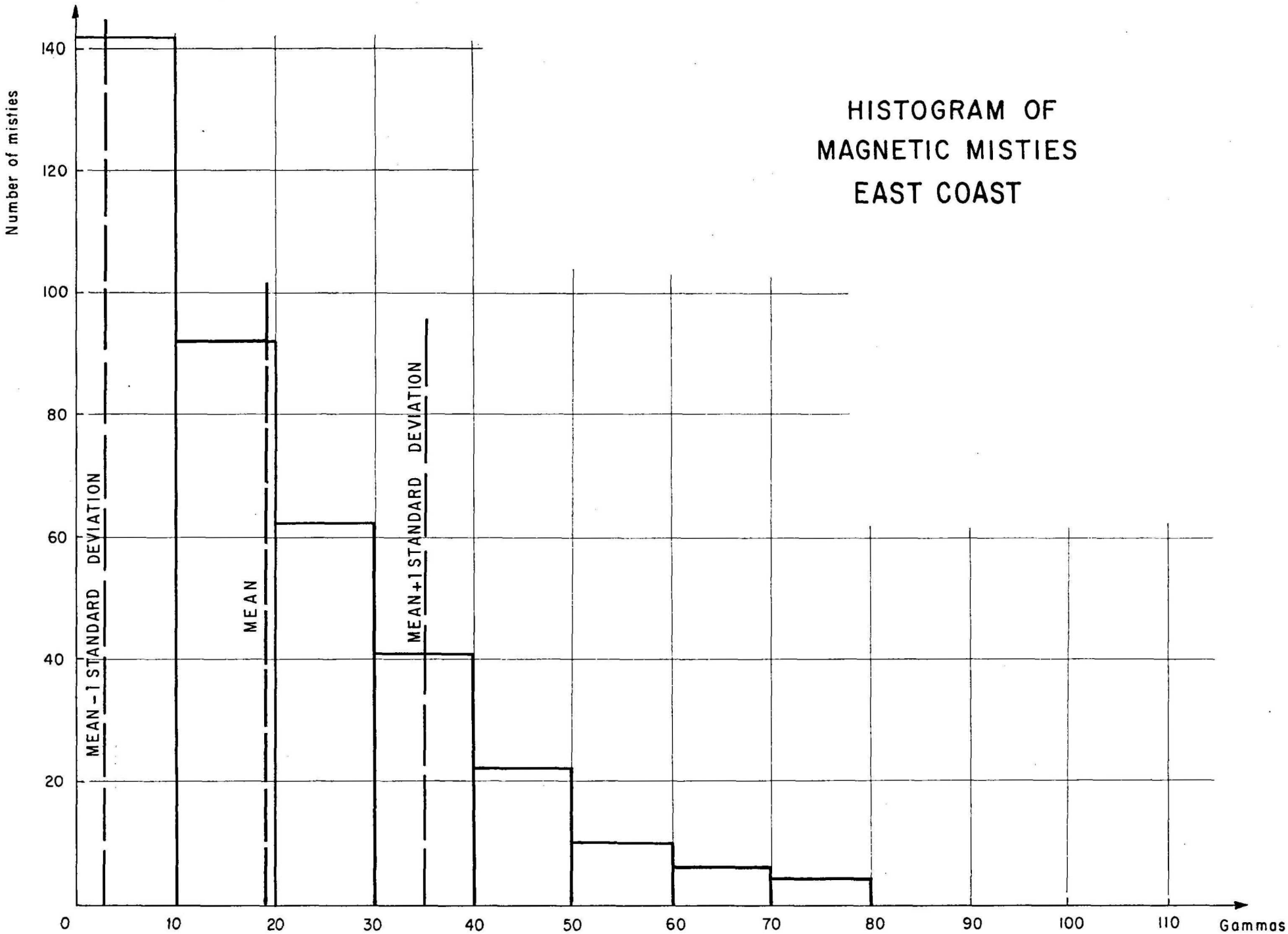

HISTOGRAM OF
MAGNETIC MISTIES
EAST COAST
Number of misties
140
120
100
80
60
40
20
0
10
20
30
40
50
60
70
80
90
100
110
Gammas
MEAN - 1 STANDARD DEVIATION
MEAN
MEAN + 1 STANDARD DEVIATION

Fig. 10

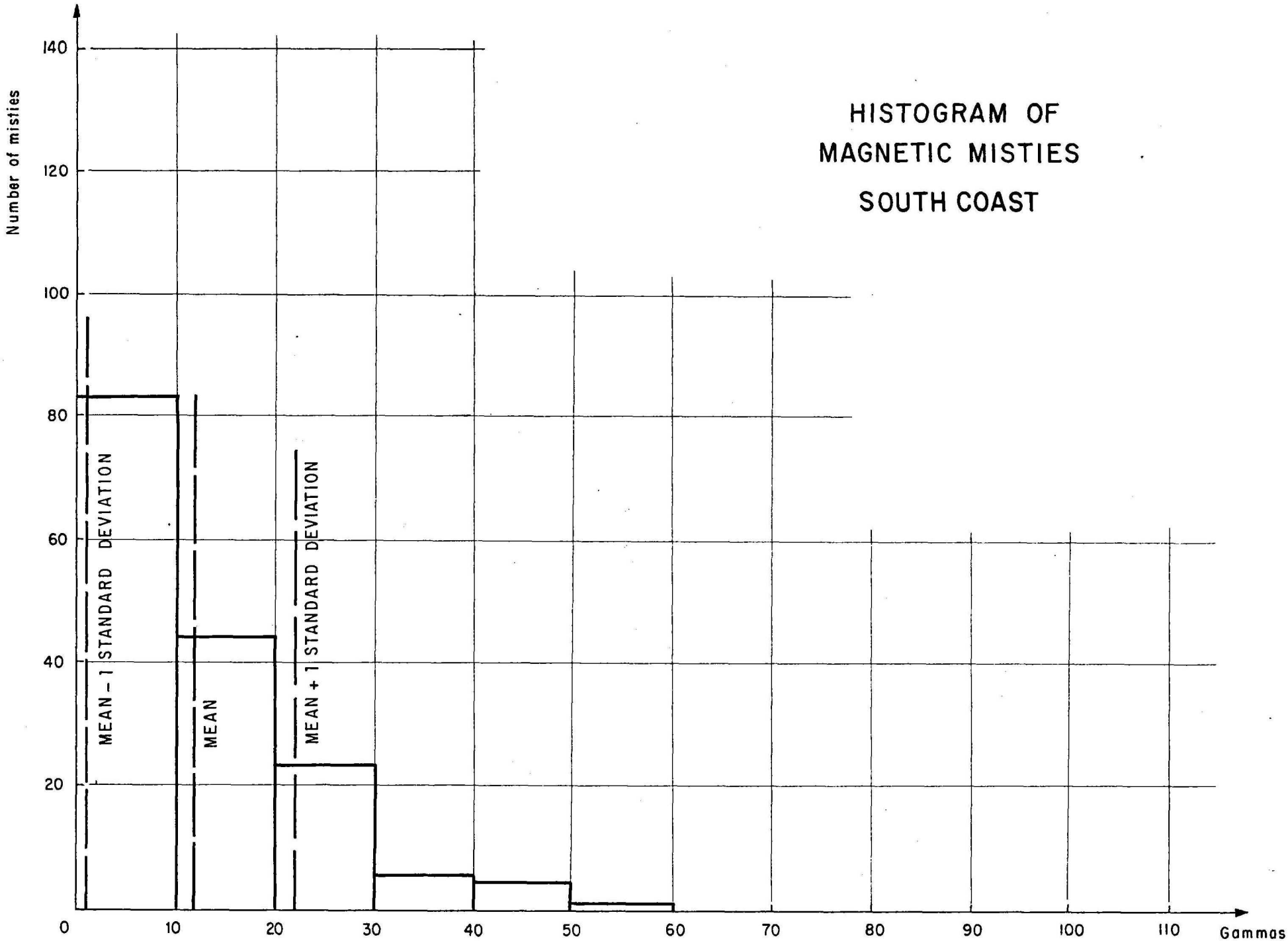

HISTOGRAM OF
MAGNETIC MISTIES
SOUTH COAST
Number of misties
140
120
100
80
60
40
20
0
MEAN - 1 STANDARD DEVIATION
MEAN
MEAN + 1 STANDARD DEVIATION
10
20
30
40
50
60
70
80
90
100
110
Gammas

Fig. 11

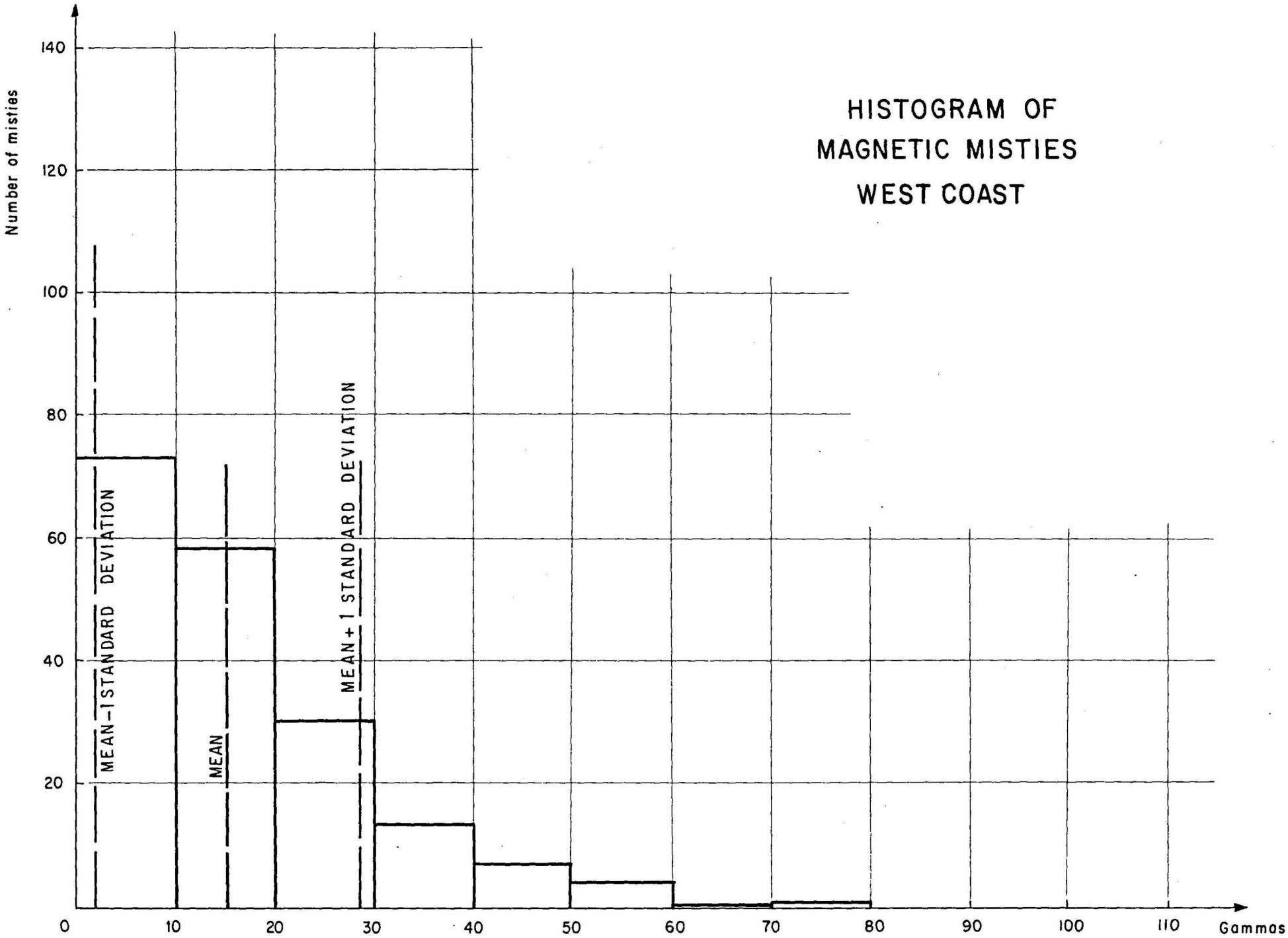

HISTOGRAM OF
MAGNETIC MISTIES
WEST COAST
Number of misties
140
120
100
80
60
40
20
0
10
20
30
40
50
60
70
80
90
100
110
Gammas
MEAN-1 STANDARD DEVIATION
MEAN
MEAN+1 STANDARD DEVIATION

Fig. 12

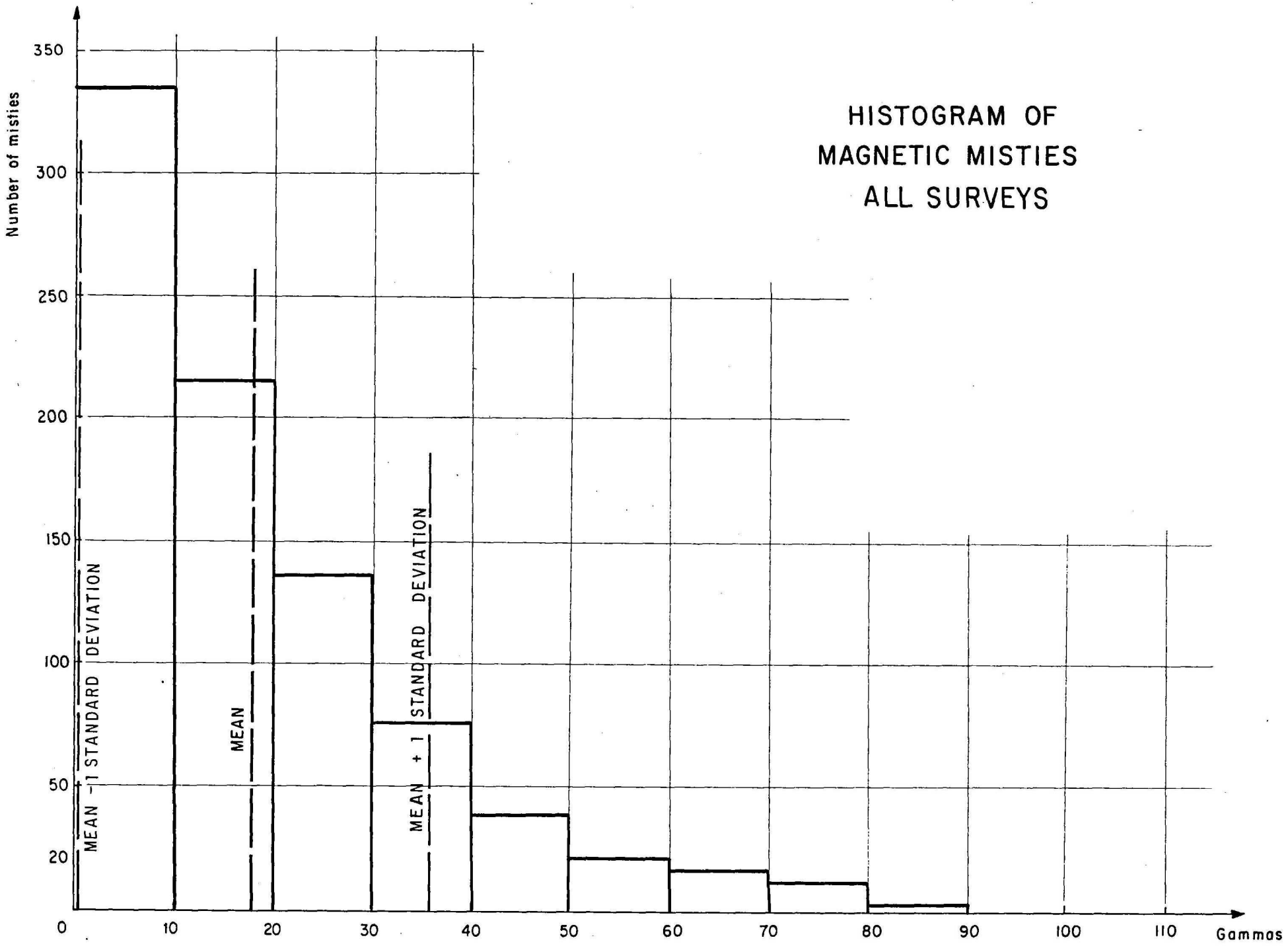

HISTOGRAM OF
MAGNETIC MISTIES
ALL SURVEYS
Number of misties
350
300
250
200
150
100
50
20
0
10
20
30
40
50
60
70
80
90
100
110
Gammas
MEAN -1 STANDARD DEVIATION
MEAN
MEAN + 1 STANDARD DEVIATION

Fig. 13

	Mean	Standard Deviation	Minimum	Range	Population	SD/Mean
Survey	28	23	0	84	104	.83
East Coast	19	16	0	77	378	.82
South Coast	11	10	0	53	170	.88
West Coast	15	13	0	80	190	.87
All	18	17	0	84	842	.99

* Figures 9 to 13 provide histograms of the magnetic misties for each area for the whole Survey.

* Comments about the statistical results.

- The Survey 05 was distinguished by magnetic misties affected by strong gradients.

- The following parameters reduced the data quality :

The ship was sometimes very far from the shore station. In this case, was the shore data applicable to the ship data ?

The longitude correction was not applied to the shore data ; thus when the ship was at 300 miles from the shore station, depending on the hour considered, the error introduced could become very important. (Only the low frequency component of the diurnal curve is concerned).

III - NAVIGATION DATA

* Three navigation systems were used during the Survey :

- Sonar Doppler
- Chernikeeff log plus compass
- Pressure log plus compass

The navigation reference for each system was the Satellite fix provided by the US Navy Transit Navigation System.

NAVIGATION SYSTEMS - CALIBRATION COEFFICIENTS

SURVEY CRUISE	SONAR DOPPLER MEAN	S.D.	CHERNIKEEF LOG MEAN	S.D.	PRESSURE LOG MEAN	S.D.
051	1.030	0.042	0.770 and 0.930	0.025 and 0.045	0.920	0.042
052	1.025	0.062	1.025	0.077	1.080	0.080
053	1.035	0.058	1.040	0.072	1.090	0.060
054	1.025	0.042	1.035	0.045	1.065	0.045
055	1.020	0.038	1.020	0.055	1.070	0.067
101	1.010	0.045	1.050	0.048	1.070	0.058
111	1.040	0.042	1.065	0.052	1.110	0.050
112	1.035	0.050	1.025	0.060	1.090	0.062
121	1.040	0.098	1.020	0.120	1.160	0.105
122	1.045	0.098	1.000	0.100	1.145	0.102
123	1.045	0.055	0.995	0.058	1.130	0.070
124	1.030	0.055	1.000	0.055	1.115	0.058
131	1.050	0.090	0.980	0.092	1.130	0.100
132	1.030	0.050	0.980	0.052	1.110	0.062
133	1.035	0.060	0.980	0.058	1.135	0.072
134	1.035	0.068	0.990	0.068	1.125	0.072
135	1.030	0.070	0.995	0.060	1.140	0.065
141	1.045	0.052	1.010	0.055	1.050	0.075
142	1.033	0.070	1.015	0.077	1.005	0.090
143	1.025	0.070	0.980	0.068	0.875	0.075
151	1.035	0.065	0.960	0.082	0.920	0.080
152	1.035	0.115	0.960	0.105	0.995	0.125
153	1.035	0.062	0.965	0.057	0.950	0.070
154	1.020	0.065	0.995	0.065	0.990	0.070
161	1.050	0.036	0.980	0.037	0.985	0.039
162	1.025	0.037	0.950 and 0.990	0.040 and 0.060	0.950 and 0.985	0.040 and 0.045
163	1.030	0.040	1.005	0.032	0.990	0.032
164	1.025	0.040	0.970	0.048	0.970	0.032
171	1.035	0.075	1.030	0.108	0.995	0.120
172	1.060	0.082	1.005	0.085	0.995	0.078
173	1.025	0.052	0.900	0.055	0.920	0.052
174	1.025	0.052	0.970 and 0.790	0.045	0.890 and 0.915	0.042 and 0.060
181	1.030	0.068	0.955	0.050	0.940	0.090
182	1.025	0.062	0.995	0.048	NV	NV
183	1.045	0.052	0.970	0.065	NV	NV
191	1.035	0.048	0.715 and 0.785	0.055	NV	NV

III.1 - Navigation data gaps (Enc. 33 to 40)

*A gap of navigation data is defined for each possible system, (Sonar Doppler, Chernikeeff log + Compass, Pressure Log + compass), when I.OEIO is written on the magnetic output tape from the programme GRANAV (See Processing Report, page 30). Enclosures 33 to 40 provide the location of these gaps throughout the Survey.

The most noticeable gaps occured on the NW and W coast because of the mechanical failure of the Pressure Log (leak of mercury and spare parts not easily available in the area).

The very good reliability of the Sonar Doppler should be noticed.

III.2 - Navigation Systems - Calibration Coefficients (Fig.14-enc. 41)

*Figure 14 and enclosure 41 provide respectively the values of the mean and standard deviation of the calibration coefficient for each navigation system and the plot of these two statistical data.

These were computed in the following way (for more details see Processing Report paragraph III.2.1) :

- For each navigation system, Ki is first computed, which is the ratio of the distance given by the system at the time of two consecutive satellite fixes to the distance between these two satellite fixes. (All distances being straight geodetic distances).

- Then $\ddot{K}$: mean calibration coefficient is the mean of Ki weighted as the square of the distance between satellite fixes.

- Simultaneously standard deviation of K is output.

- When a change of calibration of system occurs, a split of the data is carried out and several coefficients (and SD) are output. (survey 051 for instance).

DUMMY FIXES FOR CALNAV

FIG. 15

SURVEY 5		SURVEY	
TIME	REASON	TIME	REASON
01.04.40	Official start		
12.04.10	Official stop		
18.07.40	Official start		
25.21.20	Official stop		
26.04.30	Official start		
33.07.10	Official stop		
37.16.30	Official start		
53.19.35	Official stop		
63.06.04	Navigation data gap		
63.12.04	"		
63.18.04	"		
64.00.04	"		
64.06,04	"		
64.11.50	Official start		
72.11.20	Official stop		
81.12.10	Official start		

DUMMY FIXES FOR CALNAV

FIG. 16

SURVEY 10		SURVEY	
TIME	REASON	TIME	REASON
01.13.20	Official start		
03.11.40	Official stop		
03.19.40	Official start		

DUMMY FIXES FOR CALNAV

FIG. 17

SURVEY 11		SURVEY	
TIME	REASON	TIME	REASON
01.18.20	Official start		
03.07.10	Official stop		
04.15.00	Official start		
09.04.50	Official start		
14.05.30	Official stop		
18.04.40	Official start		
18.18.10	Official start		
19.00.10	Official stop		
19.06.10	Official start		
19.15.00	Official stop		
20.04.10	Official start		
20.16.00	Official stop		
21.09.50	Official start		
23.23.20	Official stop		
27.00.00	Navigation data gap		
27.08.00	"		
27.16.00	"		
28.00.00	"		
28.08.00	"		
28.16.00	"		
29.00.00	"		
29.08.00	"		
29.16.00	"		
30.00.00	"		
30.08.00	"		
30.16.00	"		
31.00.00	"		

DUMMY FIXES FOR CALNAV

FIG. 18

SURVEY 12		SURVEY	
TIME	REASON	TIME	REASON
01.18.20	Official start		
12.08.50	Official start		
13.15.10	Official stop		
14.02.00	Official start		
20.04.30	Official start		
25.17.20	Official stop		
26.00.00	Navigation data gap		
26.08.00	"		
26.16.00	"		
27.00.00	"		
27.08.00	"		
28.01.00	Official start		
29.14.40	Official stop		
29.16.00	Navigation data gap		
30.00.00	"		
30.08.00	"		
30.16.00	"		
31.00.00	"		
31.12.00	Official start		
31.22.40	Official stop		
32.13.00	Official start		
38.20.00	Official stop		
45.21.10	Official start		
46.12.20	Official stop		
47.04.20	Official start		
84.01.20	Official stop		

DUMMY FIXES FOR CALNAV

FIG. 19

SURVEY 13		SURVEY 13	
TIME	REASON	TIME	REASON
01.17.30	Official start	73.09.00	Official start
03.05.50	Official stop	73.14.50	Official stop
03.17.00	Official start	82.13.20	Official start
04.16.10	Official stop	83.04.10	Official stop
04.20.10	Official start	83.17.30	Official start
15.07.10	Official stop	86.02.10	Official stop
19.18.20	Official start	88.12.50	Official stop
23.18.00	Official stop	88.16.00	Official start
24.00.00	Navigation data gap	89.01.10	Official stop
24.08.00	Navigation data gap	89.06.10	Official start
24.16.00	Navigation data gap	93.14.10	Official stop
25.01.20	Official start	94.14.40	Official start
29.23.50	Official stop	97.21.10	Official stop
38.02.00	Official start		
38.11.20	Official stop		
38.16.00	Navigation data gap		
39.00.00	Navigation data gap		
39.16.00	Navigation data gap		
40.00.00	Navigation data gap		
40.08.00	Navigation data gap		
40.16.00	Navigation data gap		
41.00.00	Navigation data gap		
41.08.00	Navigation data gap		
41.13.50	Official start		
45.01.40	Official start		
47.02.50	Official stop		
47.05.00	Navigation data gap		
47.12.00	Navigation data gap		
47.18.00	Navigation data gap		
48.00.00	Navigation data gap		
54.17.50	Official start		
55.11.00	Official stop		
67.02.30	Official start		
69.08.40	Official start		
69.13.50	Official stop		
69.21.50	Official start		
70.22.20	Official stop		

DUMMY FIXES FOR CALNAV

FIG. 20

SURVEY 14		SURVEY 14	
TIME	REASON	TIME	REASON
06.12.20	Official start	64.00.00	Navigation data gap
06.23.20	Official stop	64.08.00	Navigation data gap
07.05.50	Official start	64.16.00	Official start
12.09.20	Official stop	66.06.50	Official stop
12.16.00	Navigation data gap	73.16.00	Navigation data gap
13.00.00	Navigation data gap	74.00.00	Navigation data gap
13.08.00	Navigation data gap	74.08.00	Navigation data gap
13.16.00	Official start	74.20.50	Official start
13.23.50	Official stop		
14.02.32	Official start		
20.02.50	Official stop		
20.12.30	Official start		
21.21.50	Official stop		
28.21.30	Official stop		
29.09.40	Official start		
29.23.50	Official stop		
30.04.50	Official start		
33.02.00	Official stop		
40.03.10	Official stop		
40.05.40	Official start		
41.04.30	Official stop		
41.11.20	Official start		
59.00.30	Official stop		
59.08.00	Navigation data gap		
59.16.00	Navigation data gap		
60.00.00	Navigation data gap		
60.08.00	Navigation data gap		
60.16.00	Navigation data gap		
61.00.00	Navigation data gap		
61.08.00	Navigation data gap		
61.16.00	Navigation data gap		
62.00.00	Navigation data gap		
62.08.00	Navigation data gap		
62.16.00	Navigation data gap		
63.00.00	Navigation data gap		
63.08.00	Navigation data gap		
63.16.00	Navigation data gap		

DUMMY FIXES FOR CALNAV

FIG. 21

SURVEY 15		SURVEY 15	
TIME	REASON	TIME	REASON
02.04.10	Official start	32.04.10	Official start
02.09.10	Official stop	50.10.10	Official start
03.01.30	Official start	51.21.00	Official stop
03.09.10	Official stop	52.00.00	Official start
03.12.00	Navigation data gap	54.06.00	Navigation data gap
03.18.00	Navigation data gap	54.12.00	Navigation data gap
04.00.00	Navigation data gap	54.18.00	Navigation data gap
04.06.00	Navigation data gap	55.00.00	Navigation data gap
04.12.00	Navigation data gap	55.06.00	Navigation data gap
04.18.00	Navigation data gap	55.12.00	Navigation data gap
05.00.00	Navigation data gap	55.18.00	Navigation data gap
05.06.00	Navigation data gap	56.00.00	Navigation data gap
05.12.00	Navigation data gap	56.06.00	Navigation data gap
05.18.00	Navigation data gap	56.12.00	Navigation data gap
06.00.00	Navigation data gap	56.18.00	Navigation data gap
06.06.00	Navigation data gap	57.00.00	Navigation data gap
06.12.00	Navigation data gap	57.06.00	Navigation data gap
06.18.00	Navigation data gap	57.11.40	Official start
06.22.00	Official start	58.18.00	Navigation data gap
09.03.20	Official stop	59.00.00	Navigation data gap
09.09.10	Official start	59.06.00	Navigation data gap
10.06.20	Official stop	59.12.20	Official start
10.07.00	Official start	65.01.10	Official stop
11.13.30	Official start	65.06.20	Official start
12.15.20	Official stop	69.21.50	Official stop
15.09.30	Official stop	72.09.20	Official start
15.16.20	Official start	80.10.40	Official start
24.21.40	Official stop	86.24.00	Official stop
25.03.00	Official start		
25.13.00	Official stop		
25.18.30	Official start		
29.18.40	Official stop		
30.04.00	Navigation data gap		
30.12.00	Navigation data gap		
30.20.00	Navigation data gap		
31.02.10	Official start		
31.22.40	Official stop		

DUMMY FIXES FOR CALNAV

FIG. 22

SURVEY 16		SURVEY 16	
TIME	REASON	TIME	REASON
02.08.10	Official start	35.23.50	Official stop
04.00.00	Navigation data gap	46.09.20	Official stop
04.08.00	Navigation data gap	47.01.40	Official start
04.15.00	Navigation data gap	48.02.00	Official stop
04.18.20	Official start	52.16.10	Official start
13.06.20	Official stop	53.17.20	Official stop
13.09.30	Official start	53.21.10	Official start
15.20.20	Official stop	57.23.20	Official stop
16.00.00	Navigation data gap	59.17.20	Official start
16.08.00	Navigation data gap	68.05.20	Official stop
16.16.00	Navigation data gap	68.16.40	Official start
17.04.30	Official start	69.03.10	Official stop
19.01.20	Official stop	69.14.30	Official start
22.15.10	Official start	69.22.10	Official stop
23.04.00	Official stop	74.19.50	Official stop
23.06.10	Official start	75.00.10	Official start
24.10.50	Official stop	81.23.50	Official stop
24.17.50	Official stop	82.09.00	Official start
24.23.20	Official start	83.05.10	Official stop
25.16.00	Navigation data gap	83.13.00	Official start
26.00.00	Navigation data gap	85.16.00	Navigation data gap
26.08.00	Navigation data gap	86.00.00	Navigation data gap
26.16.00	Navigation data gap	86.08.00	Navigation data gap
27.00.00	Navigation data gap	86.16.00	Navigation data gap
27.08.00	Navigation data gap	87.00.50	Official start
27.16.00	Navigation data gap	88.13.00	Official stop
28.00.00	Navigation data gap		
28.08.00	Navigation data gap		
28.16.00	Navigation data gap		
29.00.00	Navigation data gap		
29.08.00	Navigation data gap		
29.16.00	Navigation data gap		
30.00.00	Navigation data gap		
30.08.00	Navigation data gap		
30.16.00	Navigation data gap		
31.00.00	Navigation data gap		
33.03.50	Official stop		

DUMMY FIXES FOR CALNAV

FIG. 23

SURVEY 17		SURVEY 17	
TIME	REASON	TIME	REASON
02.15.20	Official start	63.16.00	Navigation data gap
04.09.10	Official stop	64.00.00	Navigation data gap
04.16.00	Navigation data gap	64.08.00	Navigation data gap
05.00.00	Navigation data gap	64.16.00	Navigation data gap
05.08.00	Navigation data gap	65.00.00	Official start
05.16.00	Navigation data gap	71.10.30	Official stop
06.00.00	Navigation data gap	75.00.50	Official start
06.08.00	Navigation data gap	77.08.00	Navigation data gap
06.16.00	Navigation data gap	77.16.00	Navigation data gap
07.00.00	Navigation data gap	78.00.00	Navigation data gap
07.08.00	Navigation data gap	78.08.00	Navigation data gap
07.16.00	Navigation data gap	78.16.00	Navigation data gap
08.00.00	Navigation data gap	79.00.00	Navigation data gap
08.08.00	Navigation data gap	79.08.00	Navigation data gap
08.14.30	Official start	79.16.00	Navigation data gap
20.09.50	Official stop	80.00.10	Official start
25.19.30	Official start	85.04.50	Official stop
26.06.50	Official stop		
28.17.50	Official stop		
29.21.10	Official start		
33.17.50	Official stop		
34.08.50	Official start		
38.04.10	Official stop		
38.06.40	Official start		
42.03.50	Official stop		
42.15.40	Official start		
46.21.20	Official stop		
50.12.10	Official start		
54.05.20	Official stop		
54.14.00	Official start		
57.22.50	Official stop		
58.06.30	Official start		
62.00.00	Navigation data gap		
62.08.00	Navigation data gap		
62.16.00	Navigation data gap		
63.00.00	Navigation data gap		
63.08.00	Navigation data gap		

DUMMY FIXES FOR CALNAV

FIG. 24

SURVEY 18		SURVEY 18	
TIME	REASON	TIME	REASON
02.18.00	Official start		
11.05.50	Official stop		
32.02.10	Official stop		
32.08.00	Navigation data gap		
32.16.00	Navigation data gap		
33.00.00	Navigation data gap		
33.08.00	Navigation data gap		
33.16.00	Navigation data gap		
34.00.00	Navigation data gap		
34.08.00	Navigation data gap		
34.16.00	Official start		
43.08.00	Navigation data gap		
43.16.30	Official start		
45.20.20	Official stop		
50.19.10	Official start		
53.21.40	Official stop		
54.08.00	Navigation data gap		
54.16.00	Navigation data gap		
55.00.00	Navigation data gap		
55.08.00	Navigation data gap		
55.16.00	Navigation data gap		
56.00.00	Navigation data gap		
56.03.20	Official start		
56.20.30	Official stop		
57.02.20	Official start		
60.05.20	Official stop		
60.08.00	Navigation data gap		
60.16.00	Navigation data gap		
61.00.00	Navigation data gap		
61.08.00	Navigation data gap		
61.16.00	Navigation data gap		
62.00.00	Navigation data gap		
62.04.40	Official start		
62.23.10	Official stop		
74.09.50	Official start		
75.16.50	Official stop		

DUMMY FIXES FOR CALNAV

FIG. 25

SURVEY 19		SURVEY	
TIME	REASON	TIME	REASON
02.03.40	Official start		
09.00.00	Navigation data gap		
09,08.00	Navigation data gap		
09.16.00	Navigation data gap		
10.00.00	Navigation data gap		
10.08.00	Navigation data gap		
10.16.00	Navigation data gap		
11.00.00	Navigation data gap		
11.04.10	Official start		
21.08.20	Official stop		
21.16.00	Navigation data gap		
22.00.00	Navigation data gap		
22.01.50	Official start		
24.16.50	Official stop		

III.3 - "Dummy fixes" OF CALNAV (Fig. 15 to 25)

* Two different types of "Dummy fixes" are input in the CALNAV programme (See Data Processing Report, page 33).

- First = dummy fixes input when work stops for longer than 10 hours during a cruise. This data only allow for a continuity in the processing and the data created is deleted in the following stages of the processing.

- Second : As official "start" and "stop" of work do not always correspond to satellite fixes, it is necessary to compute "dummy fixes" from existing data, in the following way =

- Let time T_1 be last satellite fix before official start
  - satellite location at this time = S_1 lat, S_1 long
  - Doppler values at this time = D_1 lat, D_1 long

- Let time T be official start
  - Ship position (unknown) : X, Y.
  - Doppler values at this time D lat, D long

- Let time T_2 be first satellite fix after official start
  - Satellite location at this time S_2 lat, S_2 long
  - Doppler values at this time : D_2 lat, D_2 long

- Location of the ship at time T is given by

$$X = S_1 \text{ lat} + \frac{(S_2 \text{ lat} - S_1 \text{ lat}) \times (D \text{ lat} - D_1 \text{ lat})}{D \text{ lat} - D_1 \text{ lat}}$$

$$Y = S_1 \text{long} + \frac{(S_2 \text{ long} - S_1 \text{ long}) \times (D \text{ long} - D_1 \text{ long})}{D_2 \text{ long} - D_1 \text{ long}}$$

Similar computation is made for official stop.

* Figures 15 to 25 provide the list of dummy satellites used in CALNAV processing.

III.4 - Navigation systems : quality analysis

III.4.1 - Sonar Doppler

This system operates on the doppler frequency shift principle ; a pulsed transmission mode of operation provides a signal amplitude sufficient to supply accurate signal data to the vessel over the bottom in depths up to 200 metres. Operation beyond 200 metres is performed by utilizing signal return from water mass, i.e. volume reverberation or scattering operation.

* During the BMR Survey, the Sonar Doppler was used in the North oriented mode, the system provided the distance to the nearest one hundredth of a nautical mile and the velocity components in the North-South and East-West direction to the nearest one hundredth of a knot. Only the first set of data was recorded every 10 seconds, both in analogue and digital way.

* The system increments every .001 mile ; thus the theoretical maximum inaccuracy on the speed in knots is ;

$$\frac{.001}{1/360} = 0.36 \text{ knot.}$$

* Quality variation due to the processing.

* The sonar Doppler data is recorded in a cumulative way. It is put in increments in the first phase of the processing. This allows an easy despiking of the traces.

In case of gaps in the data recorded, there are two possible ways of filling the gaps :

- to input points on punched cards.
- Automatic interpolation.

Data points : to keep the performance of the system, their accuracy must be within at least 10^{-4} mile/10 seconds, i.e. 6.10^{-3} mile for 10 minutes.

Automatic interpolation : in this case, the values at the extremities of the gap are not known at 10^{-4} mile/10 seconds ; subsequently if these values are too small or too large, an error can result on the integrated distance. (For example, if these values are too large by .001 mile/10 seconds, after integration on a 10 minutes gap, the resulting error is :

$$.001 \times 60 = (.12 \text{ nautical miles.})$$

III.4.2 - Chernikeeff Log

This system increments every .01 mile ; thus, the theoretical maximum error on the speed in knots is :

$$\frac{.01}{1/360} = 3.6 \text{ knots}$$

and the total distance recorded is always smaller than the real distance.

* The Chernikeeff data is recorded in a cumulative way. It is put in increments in the first phase of the processing. For a normal working speed, the increments are .020 mile/10 seconds or .030 mile/10 seconds ; for example :

Speed Knots	Speed mile / 10 sec.	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 (10 sec)	
7.20	.020	i i i i i i i i i i i i i i i i i i i	i= .020
7.56	.021	i i i i i i i i i I i i i i i i i i I	I= .030
7.92	.022	i i i i I i i i i I i i i i I i i i I	
8.28	.023	i i i I i i I i i I i i i I i i I i I	
8.64	.024	i i I i I i i I i I i i I i I i i I I	
9.00	.025	i I i I i I i I i I i I i I i I i I I	
9.36	.026	i I i I I i I i I I i I i I I i I I I	
9.72	.027	i I I i I I i I I I i I I I i I I I I	
10.08	.028	i I I I I i I I I I i I I I I i I I I I	
10.44	.029	i I I I I I I I I I i I I I I I I I I I	
10.80	.030	I I I I I I I I I I I I I I I I I I I I	

In the above table, speeds are increasing by .020 mile/10 seconds to .030 mile per 10 seconds by increment of .001 mile per 10 seconds. It must be pointed out that one needs 10 samples to define the speed (a difference of speed of .01 mile/10 seconds changes only 1 sample out of 10).

In general, to obtain an accuracy of Δ miles per 10-second, one must average n samples defined as follows :

$$n = \frac{0.01}{\Delta} \quad \text{or} \quad n = \frac{3.6}{Vp} \quad (Vp \text{ knots : accuracy desired on the speed})$$

In the case of phase II processing of the survey, (See data Processing Report, page 25), the accuracy obtained is .6 knots (n= 6).

- Problem of change of speed in a system working by increment

A change of speed is not recorded instantly by the chernikeeff log but with a certain delay function of the value "in memory" in the meter at the time of the measurement. Let $V_1 - V_2$ be the change of speed in miles per 10-seconds ; the change of speed will only be recorded by one of the n samples which follows after the time of change of speed, n being defined by $n = \frac{.01}{|V_1 - V_2|}$

$|V_1 - V_2|$ in miles / 10 seconds

or

$n = \frac{3.6}{|V_1 - V_2|}$, $|V_1 - V_2|$ Knots.

Hence, if a change of speed does not last long enough (for instance, less than 6 minutes for a variation of .1 knot), it may not yield any change on the recording but only increase the value in memory in the meter. This may be the case for the change of speed due to the change of heading.

* Problem of gaps in data and automatic interpolation

Let us consider that the ship is sailing at a speed of 9 knots (.025 miles/10 seconds). If there is no gap in the data, the record is as follows :

i I i I i I i I i I i I i I i I i I i I i I i I etc i= .020
I= .030

If there is a gap, it will be filled automatically as follows :

1) i I i I J J J J J J I i I i I i I i I i I i I i J= interpolation= .30

2) i I i j j j j j j j j i I i I i I i I i I i I i j= interpolation= .25

3) i I i ~~~

III.4.3 - Pressure log

* This system increments every . 1 mile ; thus, the theoretical maximum error on the speed in knots is :

$$\frac{.1}{1/360} = 36 \text{ knots.}$$

and the total distance recorded is always smaller than the real distance.

* The Pressure Log data are recorded in a cumulative way. They are put in increments in the first phase of the processing. The increments are .0 or .1 mile. For instance for a working speed of 9 knots (= .025 mile/ 10 seconds).

P. Log (Real values)	Field tape	First phase of the processing
.0		
.025	0	0
.050	0	0
.075	0	.1
.100	.1	0
.125	.1	0
.150	.1	0
.175	.1	.1
.200	.2	0
.225	.2	0
.250	.2	0
.275	.2	.1
.300	.3	0

* MISDAT processing of "Pressure Log" data, (See Data Processing Report, page 20)

When the meter is incrementing by .1 miles, the value is written onto the magnetic tape to one decimal point with a maximum error equal to the average increment per 10 seconds. To get closer to the true speed, MISDAT inputs the average increment on 10 seconds from these values (although an oscillation around the true value remains).

Example for a speed of 10.8 knots (.03 miles/10 seconds).

Real Value			PRE	MISDAT
Value	recorded		tape	tape
.0	0		0	.0250
.030	0		0	.0250
.060	0		0	.0250
.090	0		.1	.0250
.120	.1	*	0	.0333
.150	.1		0	.0333
.180	.1		.1	.0333
.210	.2	*	0	.0333
.240	.2		0	.0333
.270	.2		.1	.0333
.300	.3	*	0	.0250
.330	.3		0	.0250
.360	.3		0	.0250
.390	.3		.1	.0250
.420	.4	*	0	

In this case, the maximum oscillation around the true increment is .005 miles/10 seconds - (1.8 knots)

* Problems of gaps in the data

The values at the two ends of the gaps are not known with enough accuracy to allow for an automatic interpolation from these values. Consequently MISDAT fills the gap by an average value computed from the previous block or from the block with the gap (if it is smaller than 10 minutes). In the case of a speed of 10.8 knots, the error avoided could be I.8 knots).

* Accuracy provided by averaging of samples of data. (constant speed)

To obtain an accuracy of miles per 10 seconds, it is necessary to average a number n of samples defined as follows :

$$n = \frac{.1}{\quad} \quad \text{or} \quad n = \frac{36}{V_p} \left(V_p \text{ knots : accuracy desired on the depth).} \right.$$

i.e, an averaging from 1 hour of data gives an accuracy on the average speed of .1 knots.

N.B When the digitized pressure data was missing for a long time, it was input by V cards in MISDAT (See Data Processing Report, page 20), from an average on 30 minutes (accuracy of .2 mile).

* Problem of change of speed

A change of speed $|V_1 - V_2|$ may only be recorded by one of the n samples which follows the change of speed, n being defined by :

$$n = \frac{36}{|V_1 - V_2|} \quad |V_1 - V_2| \text{ in knots.}$$

i.e, a change of speed of .1 knot (turn for instance), may be recorded until 1 hour later.

III.4.4 - Heading (Appendix I - Fig. I)

The heading was not processed directly but its sine and cosine. The essence of this method is that a discontinuous function (the heading) is replaced by two continuous functions (the sine and the cosine).

* Problem caused by interpolation : if a gap occurs during a change of course, it is necessary to enter a sufficient number of data points in order that the sine and cosine can be assimilated to lines between the data points. For example, let us suppose a 9 mn gap during a turn from 40° to 130°.

Time minute	Heading	Sin ϕ	Cos ϕ	ϕ'	True value for sin ϕ
		calculated by interpolation			
0	40	.6427	.7660	40	.642
1	50	.6564	.6095	47.1	.766
2	60	.6701	.4529	55.9	.866
3	70	.6838	.2964	66.6	.940
4	80	.6975	.1399	78.7	.984
5	90	.7112	-.0167	91.3	1.0
6	100	.7249	-.1732	103.4	.984
7	110	.7386	-.3297	114.1	.940
8	120	.7523	-.4863	122.9	.866
9	130	.7660	-.6428	130	.766

SATELLITE FIXES IN HARBOUR = STATISTICAL DATA

STATIONS	DATE	Number of points	metres	metres	metres	metres	RMS radical position accuracy	MEAN POINT LOCATION	
Adelaide Wharf 2	18.05.72	18	34	58	8	14	67	34.842085	138.504711
Adelaide Wharf 10	27.04.72	16	40	41	10	10	57	34.839984	138.507161
Albany	21.12.72	5	38	25	17	11	45	35.035556	117.896192
Brisbane (Bretts Wharf)	6/8.02.72	19	46	62	11	14	77	27.440636	153.063614
Brisbane (Hamilton Wharf)	8/13.02.72	21	42	69	9	15	81	27.441357	153.067530
Brisbane	20/21.02.72	13	89	62	25	17	108	27.441331	153.066468
Brisbane Mary St Wharf	7/9.06.72	24	36	58	7	12	68	27.470524	153.030835
Brisbane (Eagle St Wharf)	17/19.06.72	15	43	25	11	6	50	27.467631	153.031020
Broome	14.09.72	8	40	55	14	19	68	18.000896	122.217955
Fremantle	10.12.72	34	42	44	7	8	61	32.051588	115.738414
Gladstone (Location A)	28.06.71	7	124	73	47	28	144	23.831686	151.255567
Gladstone (Location B)	29.06.71	8	32	79	11	28	85	23.832819	151.259056
Gladstone (Location C)	01.07.71	5	122	42	55	19	129	23.832750	151.259478
Hobart (Princes Wharf)	23/27.12.71	22	45	45	10	10	64	42.885908	147.336472
Hobart - Macquarie Wharf	04/09.01.71	30	58	51	11	9	77	42.882304	147.335990
Hobart	14/15.01.71	12	41	39	12	11	57	42.885749	147.335057
Hobart	16/18.01.71	16	29	24	7	6	38	42.885739	147.334791
Hobart	7/14.02.71	29	26	27	5	5	37	42.885761	147.334664
Launceston	13/19.03.72	41	41	31	6	5	50	41.432563	147.126838
Launceston	26/30.03.72	19	34	31	8	7	46	41.432382	147.126804
Madang	07/09.10.70	10	75	69	24	22	103	05.208468	145.803524
Madang	16.09.70	10	29	83	9	26	10	05.207902	145.803312
Newcastle	07/10.03.72	44	46	58	7	9	74	32.906507	151.770508
Newcastle	18/19.05.71	9	43	30	14	10	52	32.925427	151.765202
Port Hedland	18.08.72	15	31	47	8	12	56	20.315775	118.572481
Portland	16/19.04.72	13	34	47	9	13	58	38.344808	141.615098
Port Lincoln	06.06.72	15	53	34	14	9	63	34.720697	135.870312
Port Moresby - Main Wharf	11.12.70	11	23	68	7	20	72	9.476640	147.145424
Port Moresby	27/30.08.70	15	54	57	14	15	78	9.476163	147.146464
Port Moresby	16/18.11.70	7	51	81	19	31	96	9.475645	147.146820
Port Moresby	19/23.11.70	21	49	69	11	15	84	9.470630	147.151230
Rabaul	30.10.70	10	71	96	22	30	119	4.202972	152.164030
Sydney Darling Harbour	07/15.08.70	26	63	43	12	8	76	33.872340	151.201790
Townsville	26/29.08.70	11	44	33	13	13	61	19.249630	146.835550

FIG. 26 A

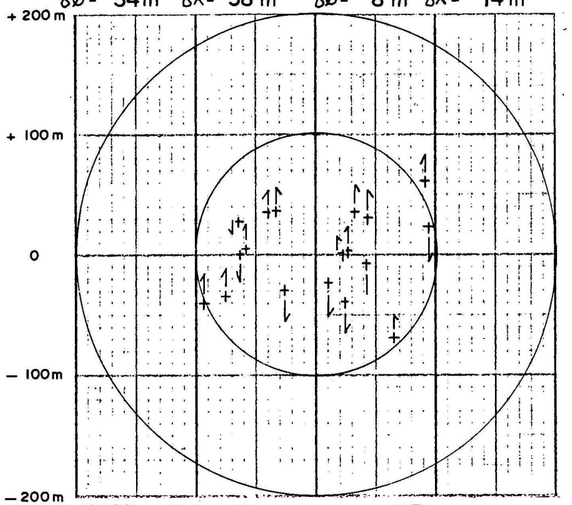
SATELLITE FIXES IN HARBOUR : STATISTICAL DATA

STATIONS	DEVIATION OF LAT (METRES)	DEVIATION OF LONG (METRES)	DISTANCE IN METRES
Adelaide Wharf 2	149	121	191
Brisbane (Bretts Wharf)	140	102	172
Brisbane	68	69	98
Brisbane (Eagle St Wharf)	160	106	191
Brisbane (Hamilton Wharf)	68	83	107
Brisbane (Mary St Wharf)	139	94	168
Gladstone (A)	172	75	187
Gladstone (B)	113	80	139
Gladstone (C)	120	118	169
Hobart 14.02.71	173	99	199
Hobart 18.01.71	177	89	198
Hobart 15.01.71	175	116	211
Hobart Princes Wharf	166	103	195
Hobart Macquarie Wharf	192	73	205
Launceston 19.03.72	160	87	182
Launceston 30.03.72	177	86	196
Madang 09.10.70	124	93	155
Newcastle 10.03.72	133	57	145
Newcastle 16.09.70	149	65	162
Port Lincoln	145	121	189
Port Moresby 30.08.70	150	60	162
Port Moresby 23.11.70	167	86	188
Port Moresby 18.11.70	200	99	223
Sydney	165	140	216

BULLS-EYE PLOTS OF SATELLITE FIXES

STATION: ADELAIDE : Wharf 2

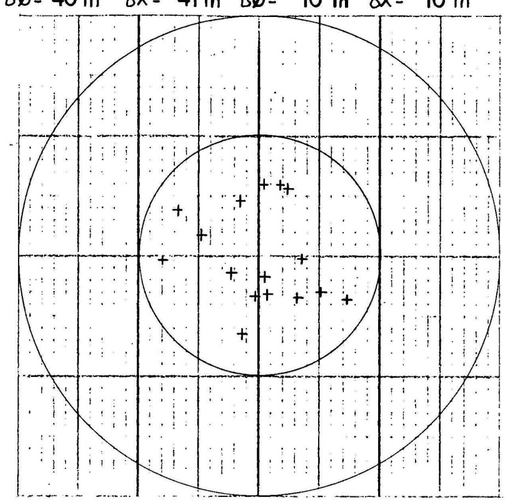
$\delta\phi$= 34 m $\delta\lambda$= 58 m $\delta\bar{\phi}$= 8 m $\delta\bar{\lambda}$= 14 m



RMS radial position accuracy = 67 m

STATION: ADELAIDE : Wharf 10

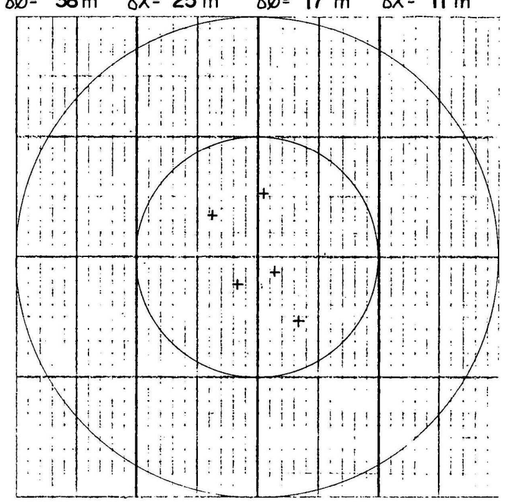
$\delta\phi$= 40 m $\delta\lambda$= 41 m $\delta\bar{\phi}$= 10 m $\delta\bar{\lambda}$= 10 m



RMS radial position accuracy= 57 m

STATION: ALBANY : 21. 12. 72

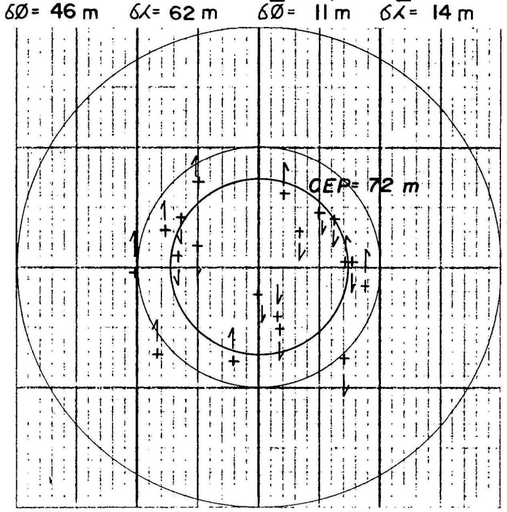
$\delta\phi$= 38 m $\delta\lambda$= 25 m $\delta\bar{\phi}$= 17 m $\delta\bar{\lambda}$= 11 m



RMS radial position accuracy = 45 m

STATION: BRISBANE : 06 to 08. 02. 72

$\delta\phi$= 46 m $\delta\lambda$= 62 m $\delta\bar{\phi}$= 11 m $\delta\bar{\lambda}$= 14 m

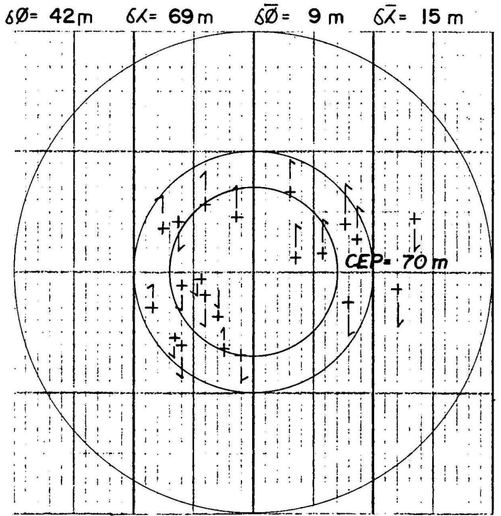


RMS radial position accuracy= 77 m

N

STATION: BRISBANE : 08 to 13. 02. 72

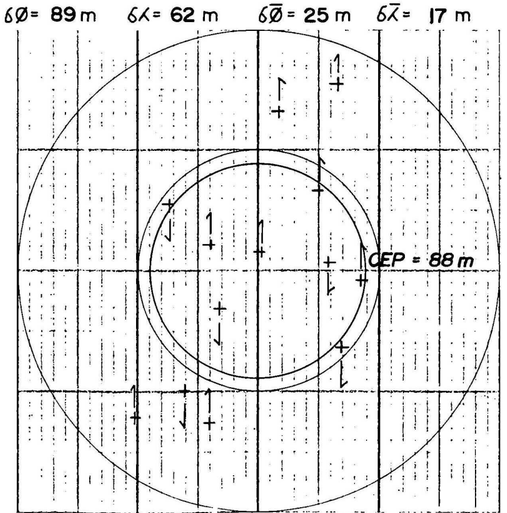
$\delta\phi$= 42 m $\delta\lambda$= 69 m $\delta\bar{\phi}$= 9 m $\delta\bar{\lambda}$= 15 m



RMS radial position accuracy = 81 m

STATION: BRISBANE : 07 to 09. 06. 72

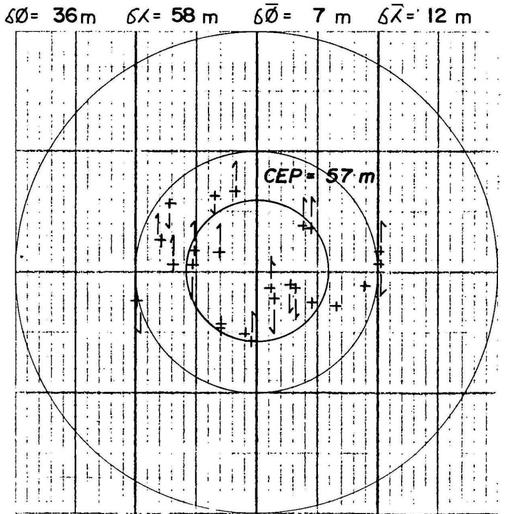
$\delta\phi$= 89 m $\delta\lambda$= 62 m $\delta\bar{\phi}$= 25 m $\delta\bar{\lambda}$= 17 m



RMS radial position accuracy = 108 m

STATION: BRISBANE : 07 to 09. 06. 72

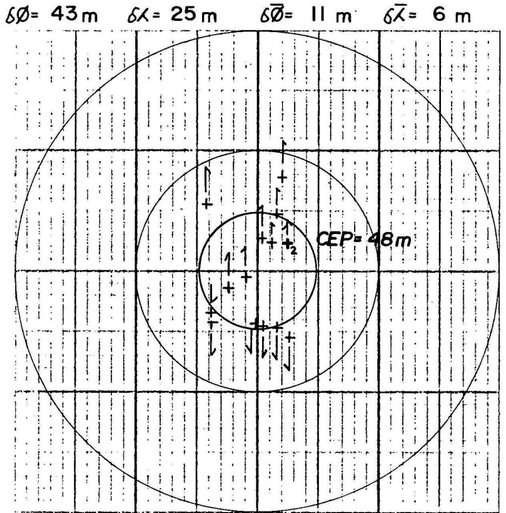
$\delta\phi$= 36 m $\delta\lambda$= 58 m $\delta\bar{\phi}$= 7 m $\delta\bar{\lambda}$= 12 m



RMS radial position accuracy = 68 m

STATION: BRISBANE : 17 to 19. 07. 72

$\delta\phi$= 43 m $\delta\lambda$= 25 m $\delta\bar{\phi}$= 11 m $\delta\bar{\lambda}$= 6 m



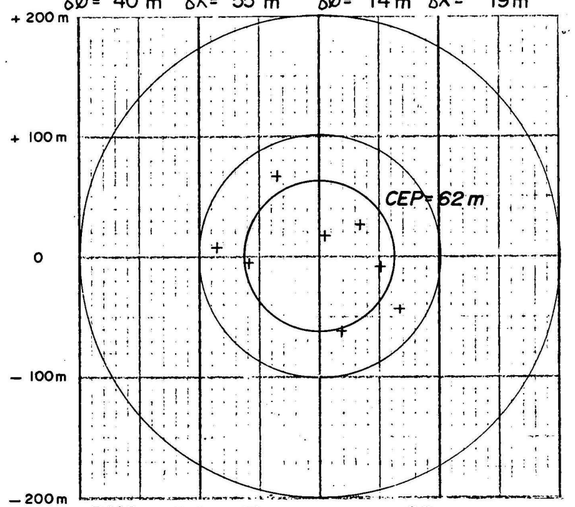
RMS radial position accuracy= 50 m

LEGEND : $\delta\phi$ = (LATITUDE) STANDARD DEVIATION, $\delta\lambda$ = (LONGITUDE) STANDARD DEVIATION, $\delta\bar{\phi}$ = STANDARD ERROR OF MEAN (LATITUDE), $\delta\bar{\lambda}$ = STANDARD ERROR OF MEAN (LONGITUDE)

BULLS-EYE PLOTS OF SATELLITE FIXES

STATION: BROOME : 14. 09. 72

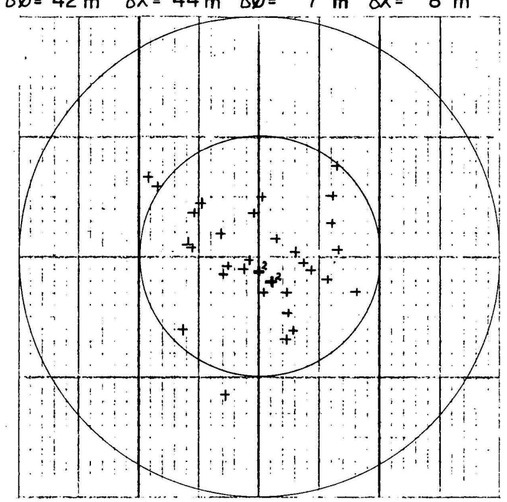
$\sigma\phi$ = 40 m $\sigma\lambda$ = 55 m $\sigma\bar{\phi}$ = 14 m $\sigma\bar{\lambda}$ = 19 m



RMS radial position accuracy = 68 m

STATION: FREMANTLE : 10. 12. 72

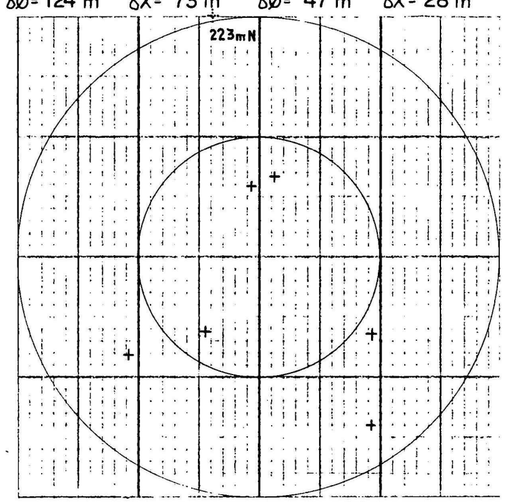
$\sigma\phi$ = 42 m $\sigma\lambda$ = 44 m $\sigma\bar{\phi}$ = 7 m $\sigma\bar{\lambda}$ = 8 m



RMS radial position accuracy = 61 m

STATION: GLADSTONE : Location A

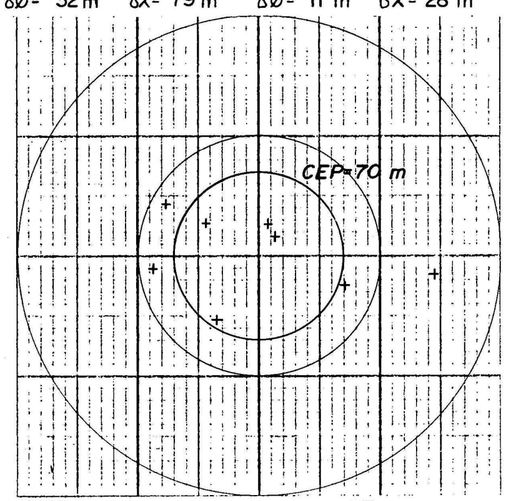
$\sigma\phi$ = 124 m $\sigma\lambda$ = 73 m $\sigma\bar{\phi}$ = 47 m $\sigma\bar{\lambda}$ = 28 m



RMS radial position accuracy = 144 m

STATION: GLADSTONE : Location B

$\sigma\phi$ = 32 m $\sigma\lambda$ = 79 m $\sigma\bar{\phi}$ = 11 m $\sigma\bar{\lambda}$ = 28 m

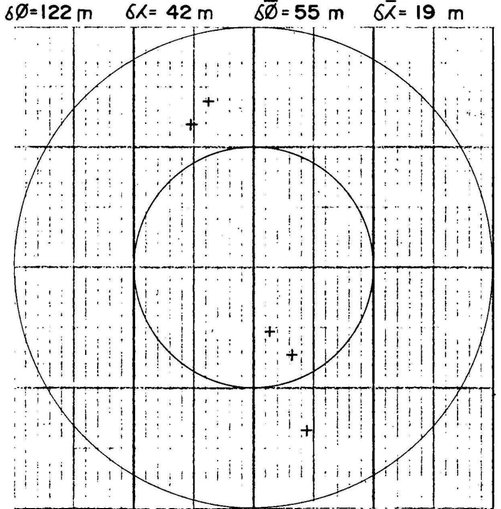


RMS radial position accuracy = 85 m

N

STATION: GLADSTONE : Location C

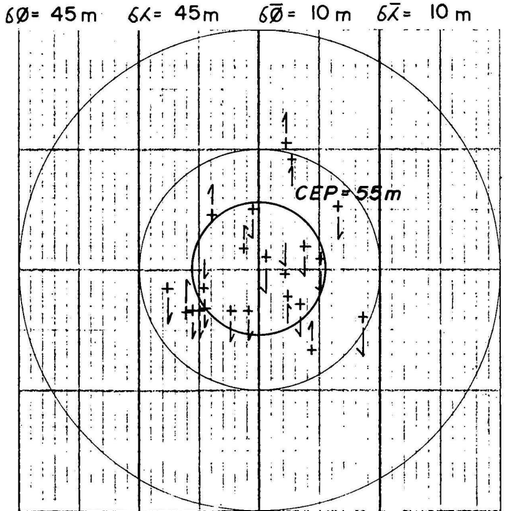
$\sigma\phi$ = 122 m $\sigma\lambda$ = 42 m $\sigma\bar{\phi}$ = 55 m $\sigma\bar{\lambda}$ = 19 m



RMS radial position accuracy = 129 m

STATION: HOBART : 23 to 27. 12. 71

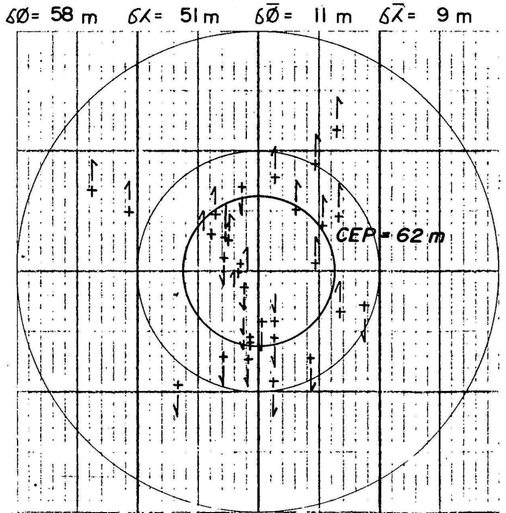
$\sigma\phi$ = 45 m $\sigma\lambda$ = 45 m $\sigma\bar{\phi}$ = 10 m $\sigma\bar{\lambda}$ = 10 m



RMS radial position accuracy = 64 m

STATION: HOBART : 04 to 09. 01. 71

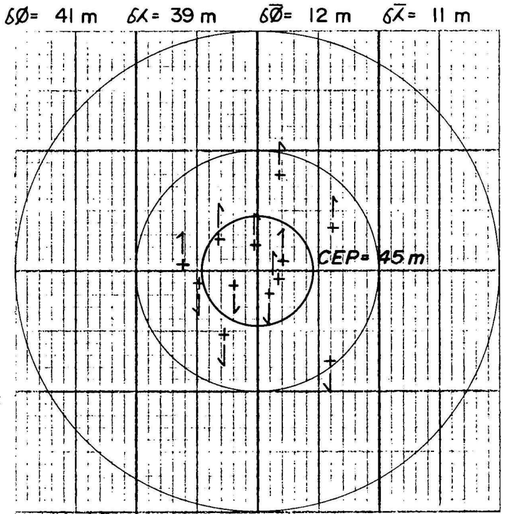
$\sigma\phi$ = 58 m $\sigma\lambda$ = 51 m $\sigma\bar{\phi}$ = 11 m $\sigma\bar{\lambda}$ = 9 m



RMS radial position accuracy = 77 m

STATION: HOBART : 14 to 15. 01. 71

$\sigma\phi$ = 41 m $\sigma\lambda$ = 39 m $\sigma\bar{\phi}$ = 12 m $\sigma\bar{\lambda}$ = 11 m



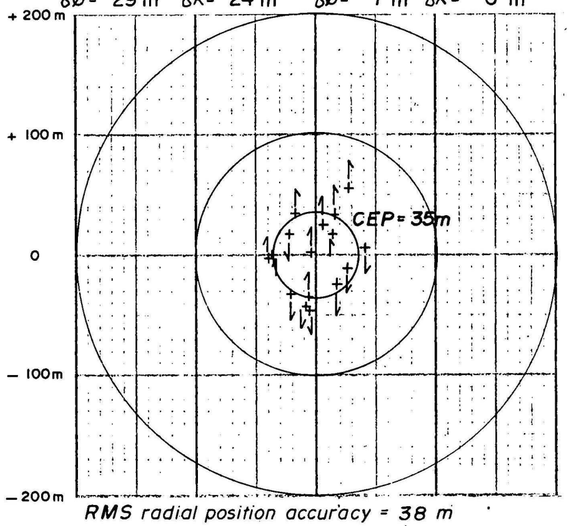
RMS radial position accuracy = 57 m

LEGEND : $\sigma\phi$ = (LATITUDE) STANDARD DEVIATION, $\sigma\lambda$ = (LONGITUDE) STANDARD DEVIATION, $\sigma\bar{\phi}$ = STANDARD ERROR OF MEAN (LATITUDE), $\sigma\bar{\lambda}$ = STANDARD ERROR OF MEAN (LONGITUDE)

BULLS-EYE PLOTS OF SATELLITE FIXES

STATION: HOBART : 16 to 18. 01. 71

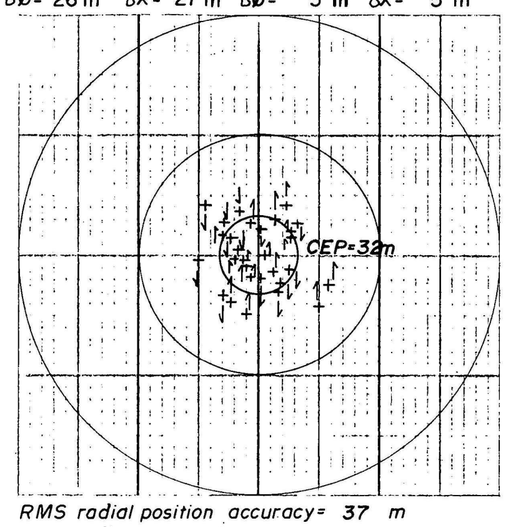
$\delta\phi$= 29 m $\delta\lambda$= 24 m $\delta\bar{\phi}$= 7 m $\delta\bar{\lambda}$= 6 m



RMS radial position accuracy = 38 m

STATION: HOBART : 07 to 14 . 02. 72

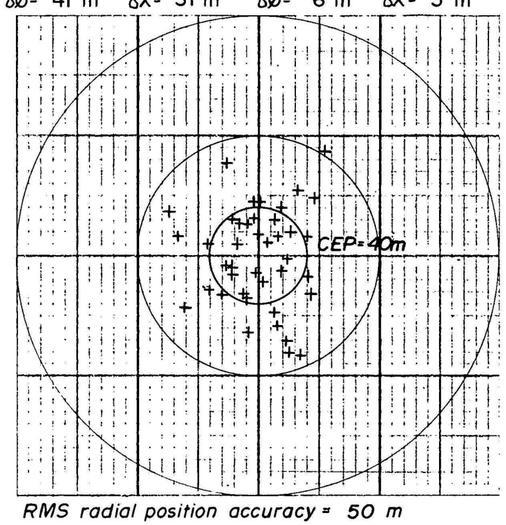
$\delta\phi$= 26 m $\delta\lambda$= 27 m $\delta\bar{\phi}$= 5 m $\delta\bar{\lambda}$= 5 m



RMS radial position accuracy= 37 m

STATION: LAUNCESTON : 13 to 19 . 01. 72

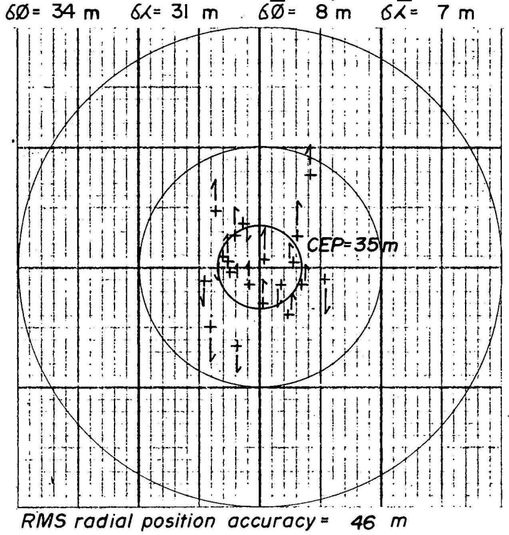
$\delta\phi$= 41 m $\delta\lambda$= 31 m $\delta\bar{\phi}$= 6 m $\delta\bar{\lambda}$= 5 m



RMS radial position accuracy = 50 m

STATION: LAUNCESTON : 26 to 30. 03. 72

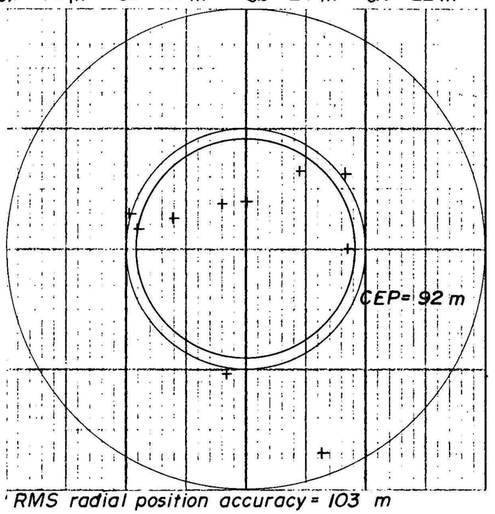
$\delta\phi$= 34 m $\delta\lambda$= 31 m $\delta\bar{\phi}$= 8 m $\delta\bar{\lambda}$= 7 m



RMS radial position accuracy = 46 m

STATION: MADANG : 07 to 09. 10. 70

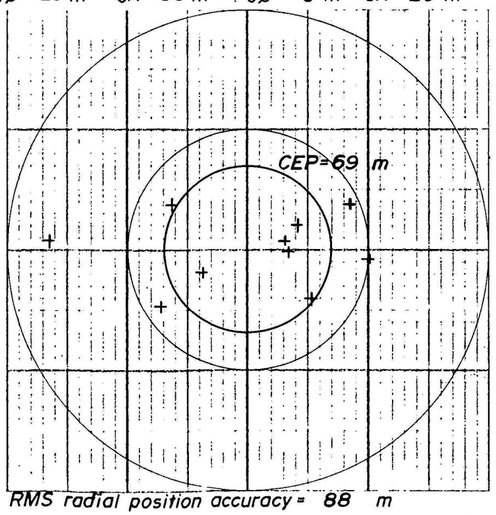
$\delta\phi$= 76 m $\delta\lambda$= 69 m $\delta\bar{\phi}$= 24 m $\delta\bar{\lambda}$= 22 m



RMS radial position accuracy = 103 m

STATION: MADANG : 16. 09. 70

$\delta\phi$= 29 m $\delta\lambda$= 83 m $\delta\bar{\phi}$= 9 m $\delta\bar{\lambda}$= 26 m



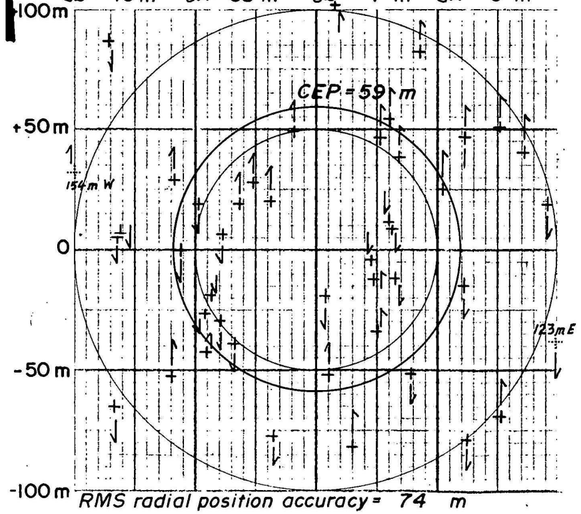
RMS radial position accuracy = 88 m

N

STATION: NEWCASTLE : 07 to 10. 03. 72

plot at double scale

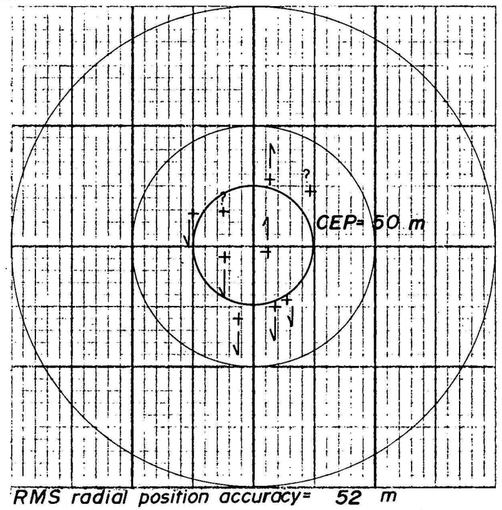
$\delta\phi$= 46 m $\delta\lambda$= 58 m $\delta\bar{\phi}$= 7 m $\delta\bar{\lambda}$= 9 m



RMS radial position accuracy = 74 m

STATION: NEWCASTLE : 18 to 19. 05. 71

$\delta\phi$= 43 m $\delta\lambda$= 30 m $\delta\bar{\phi}$= 14 m $\delta\bar{\lambda}$= 10 m



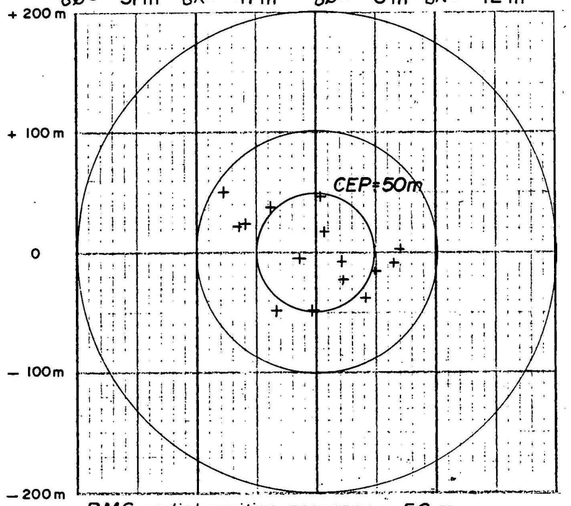
RMS radial position accuracy= 52 m

LEGEND : $\delta\phi$ = (LATITUDE) STANDARD DEVIATION, $\delta\lambda$ = (LONGITUDE) STANDARD DEVIATION, $\delta\bar{\phi}$ = STANDARD ERROR OF MEAN (LATITUDE), $\delta\bar{\lambda}$ = STANDARD ERROR OF MEAN (LONGITUDE)

BULLS-EYE PLOTS OF SATELLITE FIXES

STATION: PORT HEDLAND : 18. 08. 72

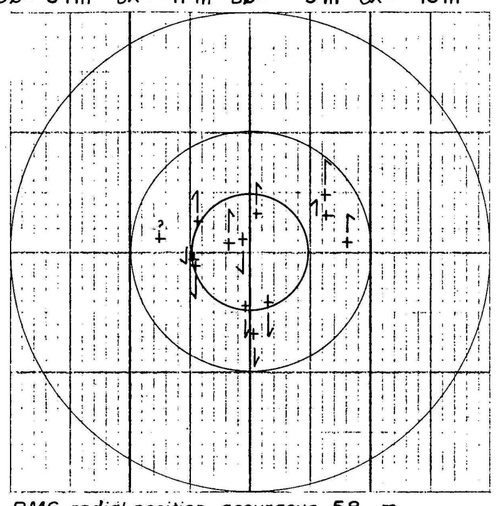
$\delta\phi$= 31 m $\delta\lambda$= 47 m $\delta\bar{\phi}$= 8 m $\delta\bar{\lambda}$= 12 m



RMS radial position accuracy = 56 m

STATION: PORTLAND : 16 to 19. 04. 72

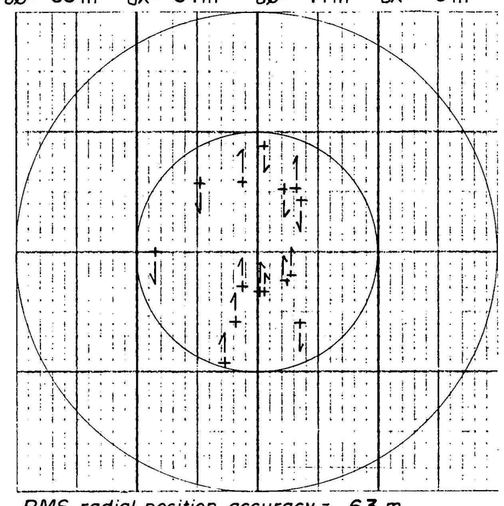
$\delta\phi$= 34 m $\delta\lambda$= 47 m $\delta\bar{\phi}$= 9 m $\delta\bar{\lambda}$= 13 m



RMS radial position accuracy= 58 m

STATION: PORT LINCOLN : 06. 06. 72

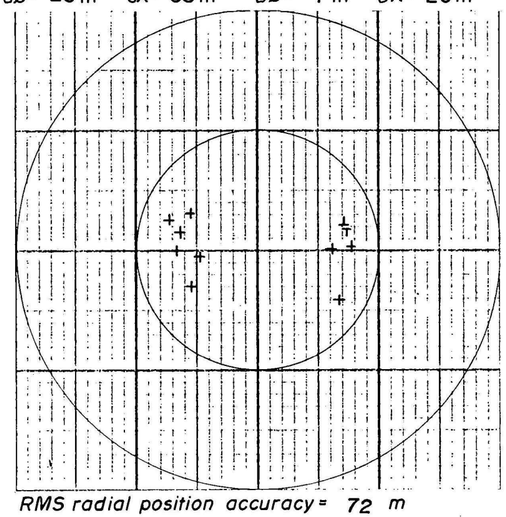
$\delta\phi$= 53 m $\delta\lambda$= 34 m $\delta\bar{\phi}$= 14 m $\delta\bar{\lambda}$= 9 m



RMS radial position accuracy = 63 m

STATION: PORT MORESBY : Main Wharf

$\delta\phi$= 23 m $\delta\lambda$= 68 m $\delta\bar{\phi}$= 7 m $\delta\bar{\lambda}$= 20 m

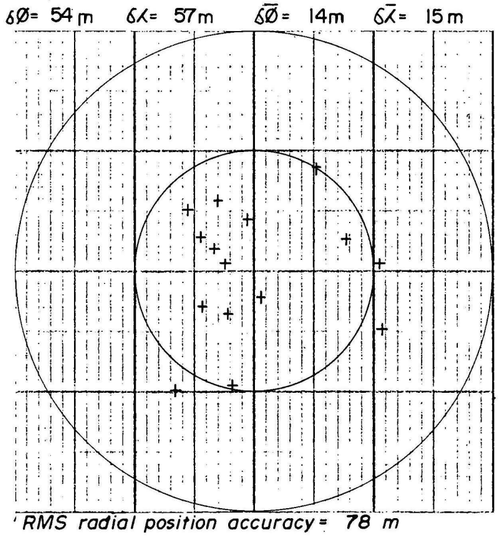


RMS radial position accuracy = 72 m

N

STATION: PORT MORESBY: 27 to 30.08. 70

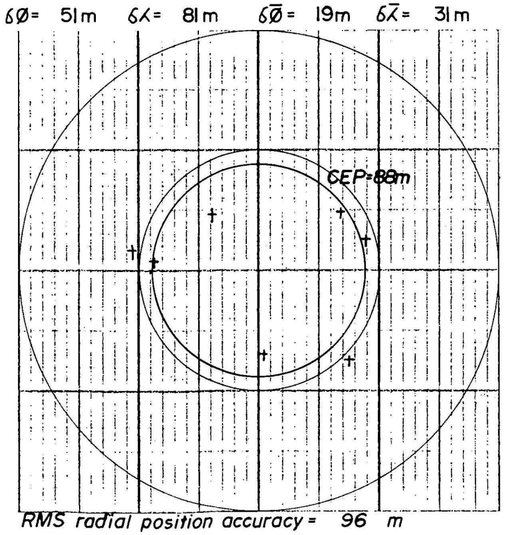
$\delta\phi$= 54 m $\delta\lambda$= 57 m $\delta\bar{\phi}$= 14m $\delta\bar{\lambda}$= 15 m



RMS radial position accuracy = 78 m

STATION: PORT MORESBY: 16 to 18. 11. 70

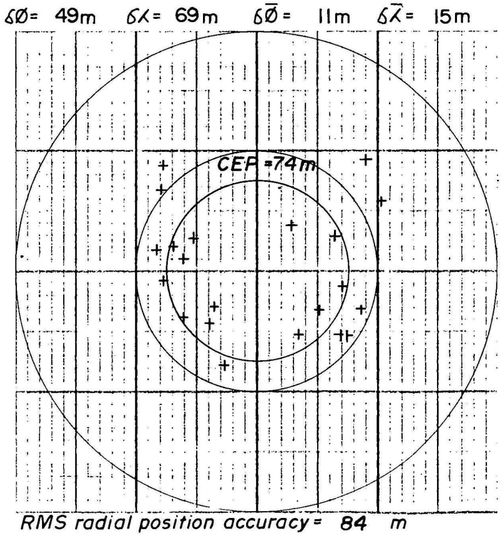
$\delta\phi$= 51m $\delta\lambda$= 81m $\delta\bar{\phi}$= 19m $\delta\bar{\lambda}$= 31m



RMS radial position accuracy = 96 m

STATION: PORT MORESBY: 19 to 29. 11. 70

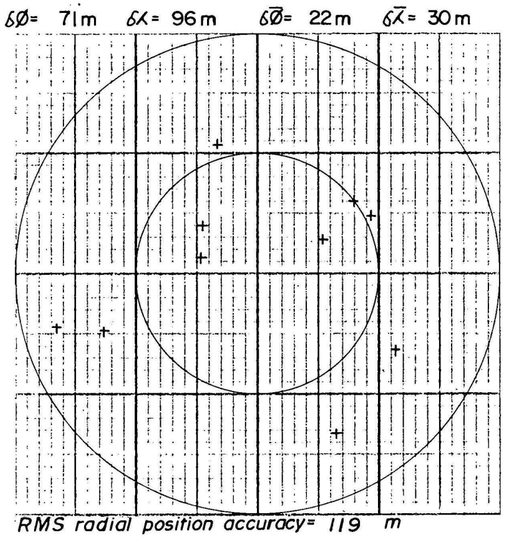
$\delta\phi$= 49m $\delta\lambda$= 69m $\delta\bar{\phi}$= 11m $\delta\bar{\lambda}$= 15m



RMS radial position accuracy = 84 m

STATION: RABAUL : Shell Station

$\delta\phi$= 71m $\delta\lambda$= 96 m $\delta\bar{\phi}$= 22m $\delta\bar{\lambda}$= 30 m



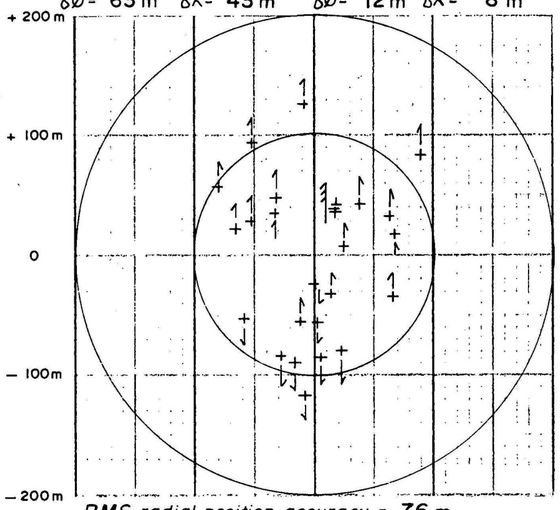
RMS radial position accuracy = 119 m

LEGEND : $\delta\phi$ = (LATITUDE) STANDARD DEVIATION, $\delta\lambda$ = (LONGITUDE) STANDARD DEVIATION, $\delta\bar{\phi}$ = STANDARD ERROR OF MEAN (LATITUDE), $\delta\bar{\lambda}$ = STANDARD ERROR OF MEAN (LONGITUDE)

BULLS-EYE PLOTS OF SATELLITE FIXES

STATION: SYDNEY : 07 to 15. 08. 71

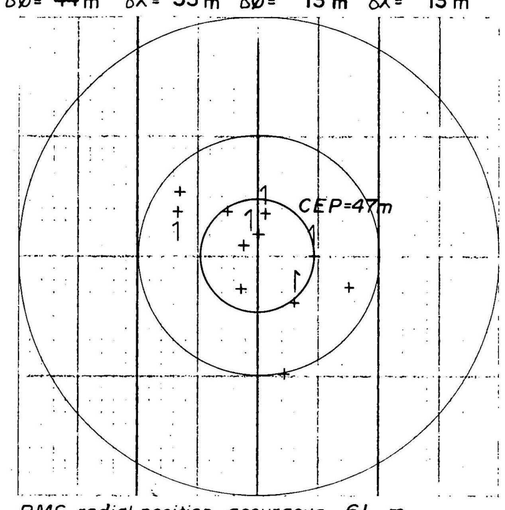
$\delta\phi$= 63 m $\delta\lambda$= 43 m $\delta\bar{\phi}$= 12 m $\delta\bar{\lambda}$= 8 m



RMS radial position accuracy = 76 m

STATION: TOWNSVILLE : 26 to 29. 08. 71

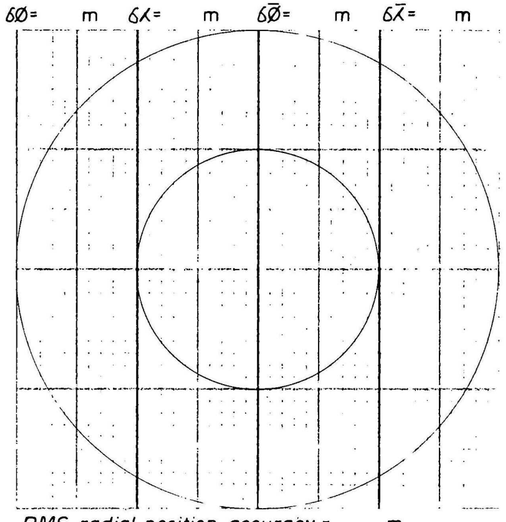
$\delta\phi$= 44 m $\delta\lambda$= 33 m $\delta\bar{\phi}$= 13 m $\delta\bar{\lambda}$= 13 m



RMS radial position accuracy= 61 m

STATION:

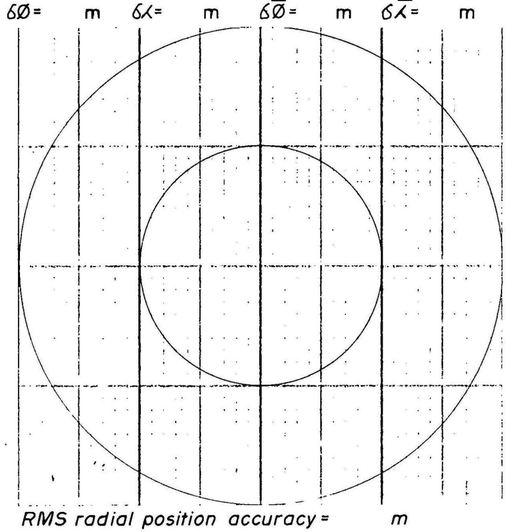
$\delta\phi$= m $\delta\lambda$= m $\delta\bar{\phi}$= m $\delta\bar{\lambda}$= m



RMS radial position accuracy = m

STATION:

$\delta\phi$= m $\delta\lambda$= m $\delta\bar{\phi}$= m $\delta\bar{\lambda}$= m

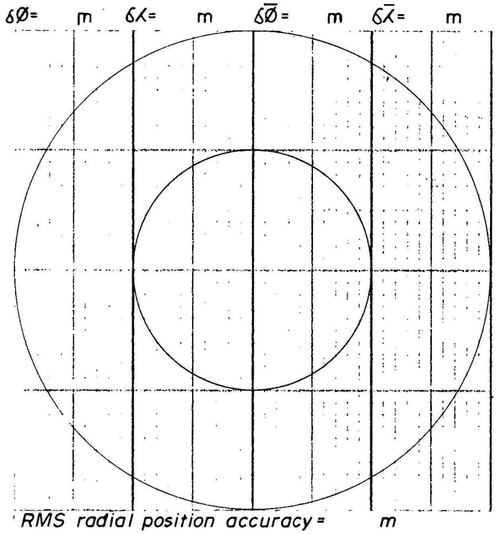


RMS radial position accuracy = m

N

STATION:

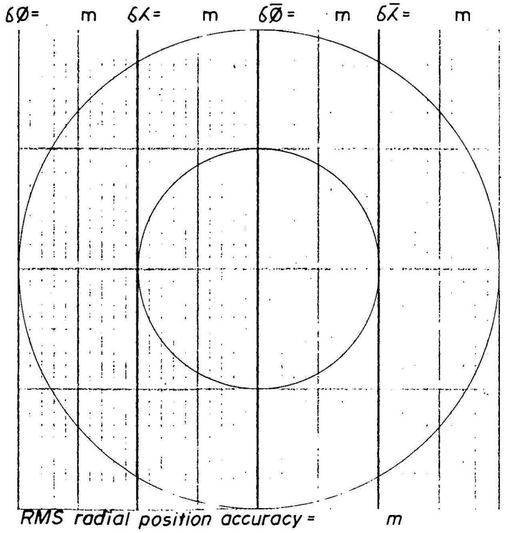
$\delta\phi$= m $\delta\lambda$= m $\delta\bar{\phi}$= m $\delta\bar{\lambda}$= m



RMS radial position accuracy = m

STATION:

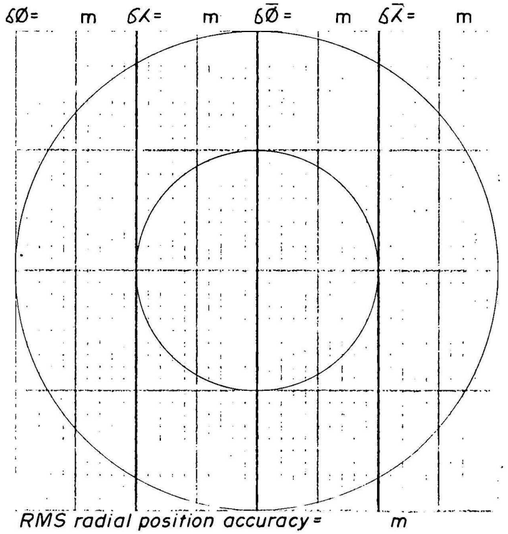
$\delta\phi$= m $\delta\lambda$= m $\delta\bar{\phi}$= m $\delta\bar{\lambda}$= m



RMS radial position accuracy = m

STATION:

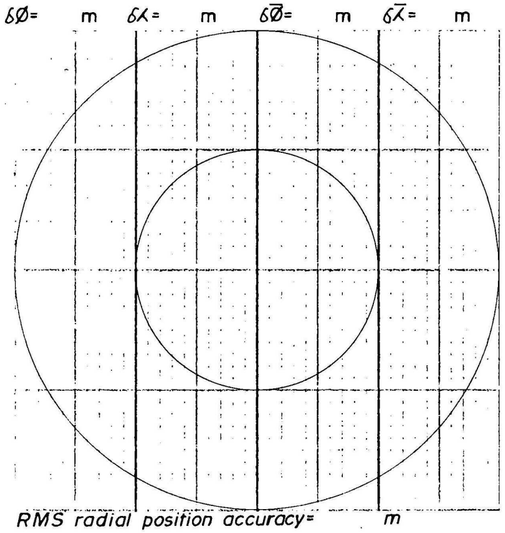
$\delta\phi$= m $\delta\lambda$= m $\delta\bar{\phi}$= m $\delta\bar{\lambda}$= m



RMS radial position accuracy = m

STATION:

$\delta\phi$= m $\delta\lambda$= m $\delta\bar{\phi}$= m $\delta\bar{\lambda}$= m



RMS radial position accuracy = m

LEGEND : $\delta\phi$ = (LATITUDE) STANDARD DEVIATION, $\delta\lambda$ = (LONGITUDE) STANDARD DEVIATION, $\delta\bar{\phi}$ = STANDARD ERROR OF MEAN (LATITUDE), $\delta\bar{\lambda}$ = STANDARD ERROR OF MEAN (LONGITUDE)

An error on the sine $\sim$. 3 yields an error of $\sim$3 knots on the East velocity.

* Problems caused by the de-spiking : let us suppose a heading of 7° = ϕ (Sin ϕ = .122 ; cos ϕ = .992) and a spike with a value of 21°. The corresponding spike on the sine is .347 and on the cosine. 109.

The automatic de-spiking totally eliminates the spike on the sine but, on the cosine, the spike remains because the threshold adopted during the processing was = .120. Thus, when the heading is reconstituted from the sine and the cosine, it still remains a spike of 0° 86 on the heading trace.

The resulting error from the non elimination of a spike of .120 on Sin ϕ yields a spike of .120 x V on the East velocity, i.e. $\sim$7.5 mGal on the Eotvos.

III.5 - Satellite navigation system

* This system is the basic reference of all navigational system used during the survey.

III.5.1 - Fixes in Harbour

* During the calls between cruises, satellite passes were recorded and fixes computed ; this allows to find the mean location of ship's antenna in the Transit - I T T system. Simultaneously, surveyors of the Department of the Interior located this position with regard to the Australian geodesy.

Means locations are shown in the "bull eyes" of figures 26 to 31 where :

ϕ is the latitude,

λ is the longitude,

$\sigma\phi$ and $\sigma\lambda$: standard deviations of latitude and longitude,

$\sigma\bar{\phi}$ and $\sigma\bar{\lambda}$: standard error of mean of latitude and longitude.

RMS radial position accuracy : $\sqrt{\sigma^2_\lambda + \sigma^2_\phi}$

The arrow with a half tip shows the heading of the satellite and its location with regard to the receiver ; for instance, an arrow

with the half tip on the right toward the top of the figure means ; Satellite heading north, East of receiver.

* Criticism of results : It must be noticed on some bull eyes a symmetrical dispersion of the points with regard to the mean point. (Example : New-castle 07 to 10 - 03 - 72). This is due to the fact that the antenna height introduced for the computation of the fix was too low. (The fix is too near to the plane of the orbit, thus the satellites passing East of the receiver give points which are gathered on the right side of the bull eye). However, one may consider that the position of the mean point is not affected.

* Distance, centre Transit spheroïd - Centre Australian spheroïd : Vector $C_2 C_1$.

The three components of the vector $C_2 C_1$ are :

D U : Greenwich Meridian
D V : 90° East of Grenwich
} Projections in the equatorial plane

D W North

Using all the data collected in port, the calculation yields :

DU = - 97 metres.
DV = - 48 metres.
DW = + 140 metres.

The values generally admitted are :
- 105, - 44 and + 94 metres.

To check for homogeneity of both the field measurements and the results found, the figures DDN, DDE and DDH (in meters) have been calculated. DDN represents the difference between the real offset in Latitude (difference of the two input coordinates) and the offset calculated in using DU, DV, DW previously determined. The definition is the same for DDE

COMPARISON AUSTRALIAN - TRANSIT/ITT SPHEROID

LOCATION	DATE	AUSTRALIAN		TRANSIT ITT		DDN metres	DDE metres	DDH metres
		LAT.	LONG.	LAT.	LONG.			
Newcastle	18/19.05.71	32.9268	151.7645	32.9254	151.7652	1.882	23.675	- 6.608
Hobart	14/15.01.71	42.8873	147.3335	42.8858	147.3347	- 33.962	- 6.017	- 37.410
Hobart	16/18.01.71	42.8873	147.3337	42.8857	147.3348	- 37.294	3.786	- 37.410
Hobart	14/15.01.71	42.8873	147.3336	42.8857	147.3350	- 36.183	- 23.989	- 37.410
Brisbane	06/08.02.72	27.4419	153.0626	27.4406	153.0636	13.420	- 15.073	9.647
Brisbane	20/21.02.72	27.4419	153.0658	27.4413	153.0665	86.558	17.549	9.651
Brisbane	08/13.02.72	27.4420	153.0667	27.4414	153.0675	85.451	3.707	9.652
Brisbane	07/09.06.72	27.4718	153.0299	27.4705	153.0308	13.393	- 7.101	9.523
Port Moresby	27/30.08.70	9.4775	147.1459	9.4761	147.1465	- 3.697	32.616	48.102
Port Moresby	19/23.11.70	9.4721	147.1505	9.4706	147.1512	- 20.289	7.353	48.123
Hobart	04/09.01.71	42.8840	147.3351	42.8823	147.3360	- 52.842	20.119	- 37.400
Port Moresby	16/18.11.70	9.4775	147.1459	9.4756	147.1468	- 53.469	- 6.917	48.102
Madang	07/09.10.70	5.2096	145.8027	5.2085	145.8035	20.076	1.170	56.753
Sydney	07/15.08.70	33.8738	151.2003	33.8724	151.2018	- 15.684	- 50.879	- 9.816
Brisbane	17/19.06.72	27.4691	153.0300	27.4676	153.0310	- 6.553	- 18.964	9.530
Adelaide	18.05.72	34.8434	138.5034	34.8421	138.5047	- 11.577	- 20.380	- 29.618
Port Lincoln	06.06.72	34.7220	135.8690	34.7207	135.8703	- 10.798	- 18.767	- 33.154
Gladstone	28.06.72	23.8332	151.2548	23.8317	151.2556	- 19.528	13.376	16.763
Gladstone	29.06.71	23.8338	151.2583	23.8328	151.2590	39.175	8.279	16.766
Gladstone	01.07.71	23.8338	151.2583	23.8328	151.2595	31.423	- 29.418	16.766
Launceston	13/19.03.72	41.4340	147.1258	41.4326	147.1268	- 19.480	6.107	- 34.111
Newcastle	07/10.03.72	32.9077	151.7699	32.9065	151.7705	17.422	31.140	- 6.551
Hobart	23/27.12.71	42.8874	147.3352	42.8859	147.3365	- 26.183	- 10.103	- 37.408
Launceston	26/30.03.72	41.4340	147.1258	41.4324	147.1268	- 36.140	6.943	- 34.111
Townsville	26/29.08.70	19.2508	146.8344	19.2488	146.8355	- 65.294	- 18.128	22.288
Madang	16.09.70	5.2079	145.8033	5.2096	145.8027	- 42.957	24.451	56.753

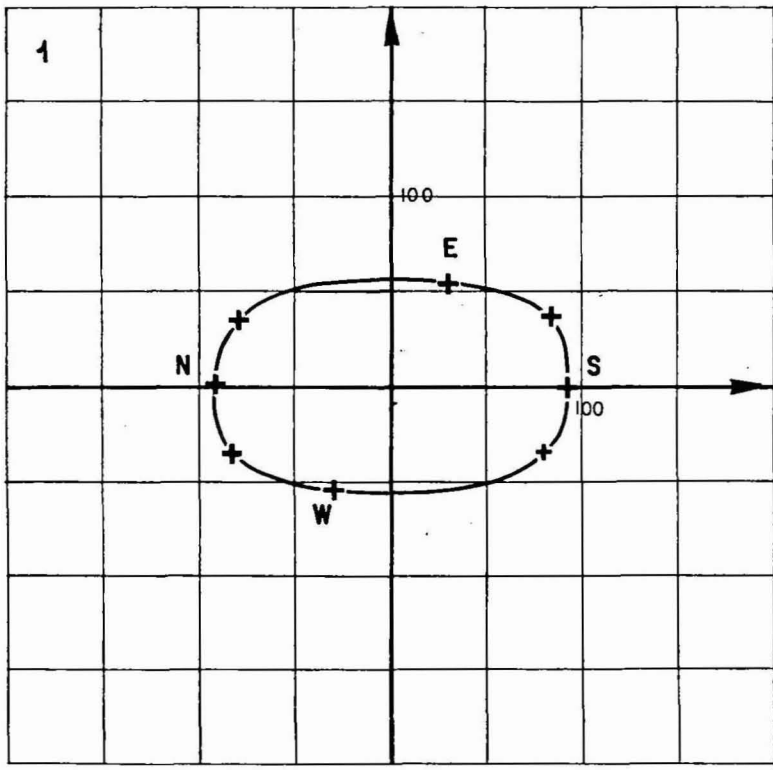
FIG. 32

INFLUENCE OF SHIP'S SPEED ERROR - DATA

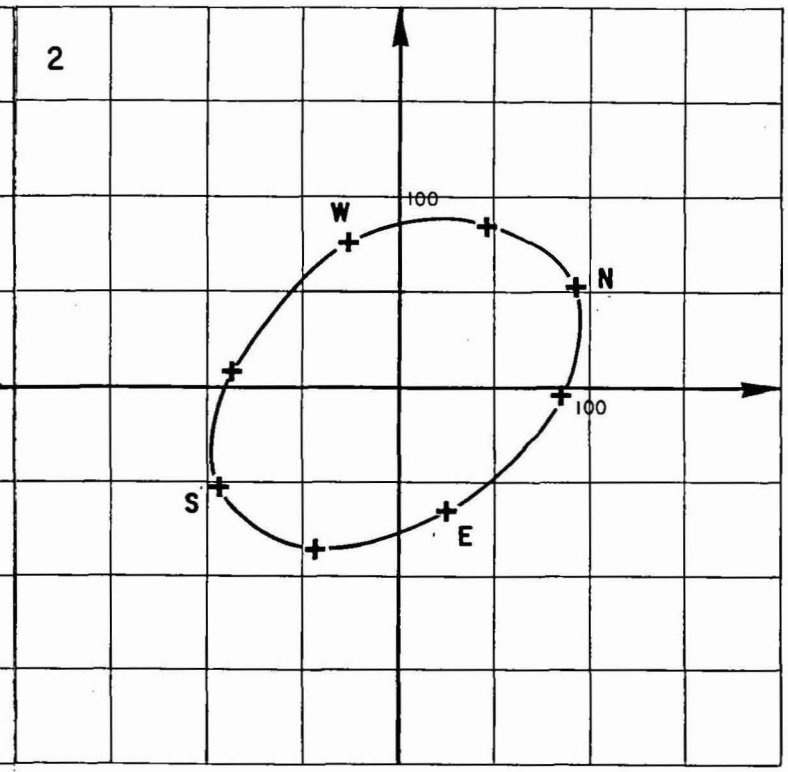
ORDER NUMBER	HEADING	POSITION /RECEIVER	CULMINATION C	DOPPLER COUNTS	SYMMETRY OF THE PASS	FREQUENCY	HEADING SHIP
1	North	West	7	3	centered	. 34	91
2	South	West	5	4	centered	. 14	180
3	South	West	7	3	no data	. 11	248
4	South	East	8	3	1 before C	. 46	180
5	South	East	9	3	1 before C	. 19	180
6	South	East	12	6	centered	. 03	263
7	North	East	12	5	centered	. 09	?
8	North	West	12	4	1 before	. 07	358
9	North	West	15	7	centered	. 14	250
10	North	West	17	6	4 before C	. 17	180
11	South	East	17	5	1 before	. 17	70
12	South	East	21	4	centered	. 30	73
13	South	West	37	8	sym.	. 01	355
14	North	West	37	7	4 before C	. 09	178
15	South	West	42	8	centered ?	no data	no data
16	South	East	50	7	3	. 01	180
17	North	East	58	7	4 before C	. 01	265
18	South	East	60	4	1 before C	. 09	177
19	North	East	66	4	1 before C	. 02	95
20	South	West	81	4	not centered	. 18	180
21	South	East	85	3	no information	. 18	271

INFLUENCE OF SHIP'S SPEED ERROR

Heading North, West of receiver, culmination angle = 7°

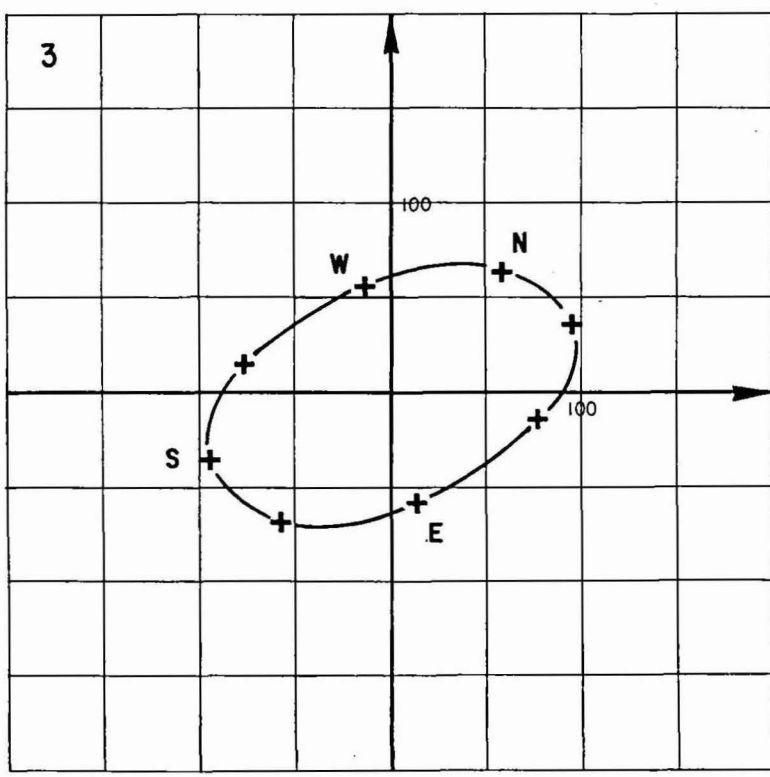


Heading South, West of receiver, culmination angle = 5°

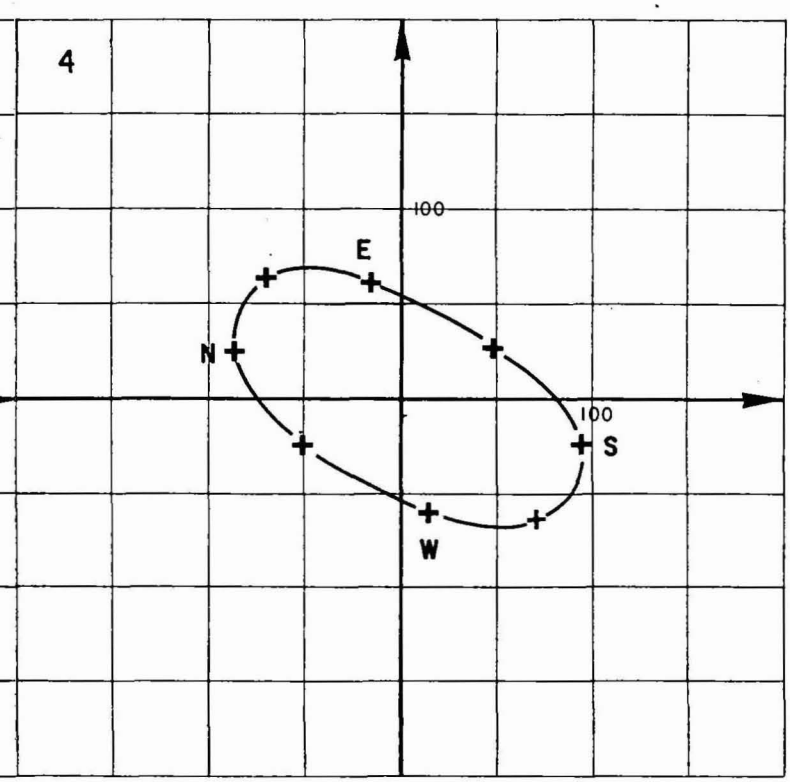


All scales in meters

Heading South, West of receiver, culmination angle = 7°

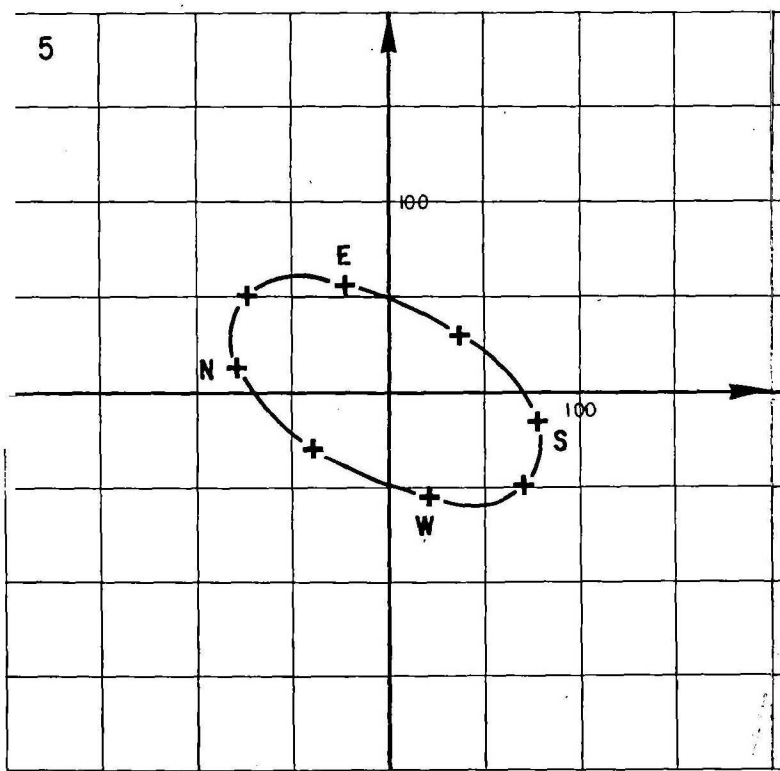


Heading South, East of receiver, culmination angle = 8°

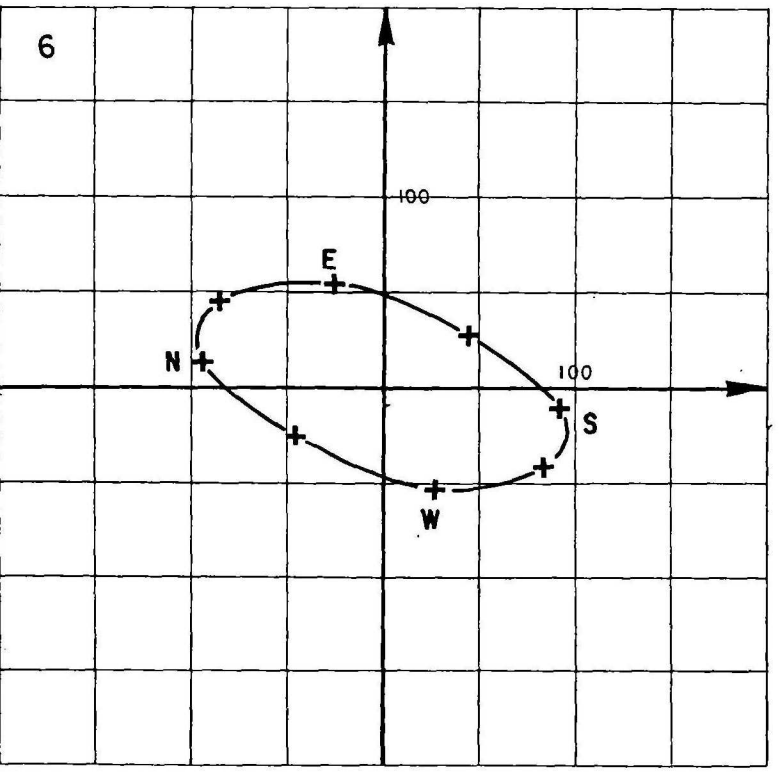


INFLUENCE OF SHIP'S SPEED ERROR

Heading South, East of receiver, culmination angle = 9°

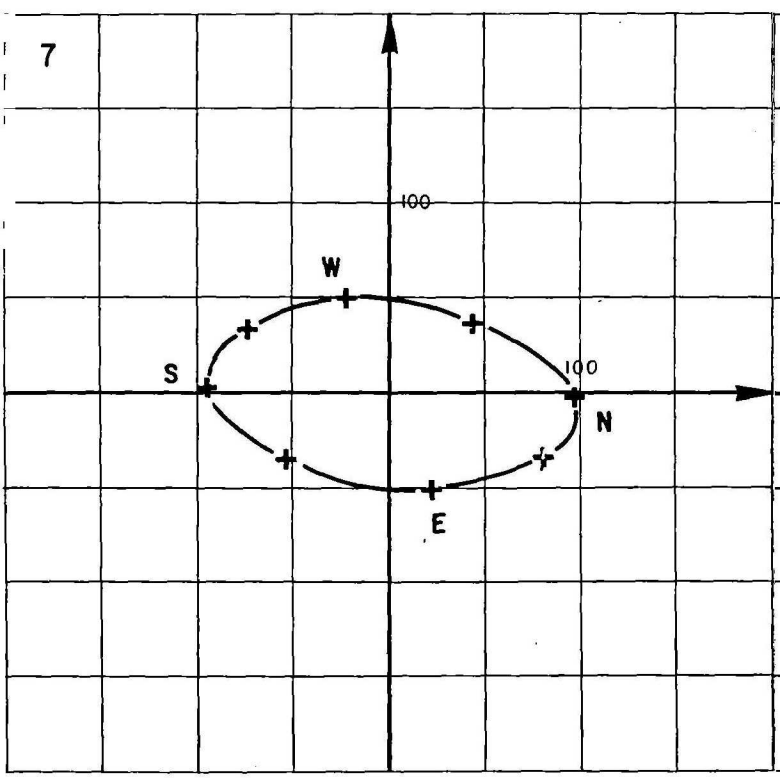


Heading South, East of receiver, culmination angle = 12°

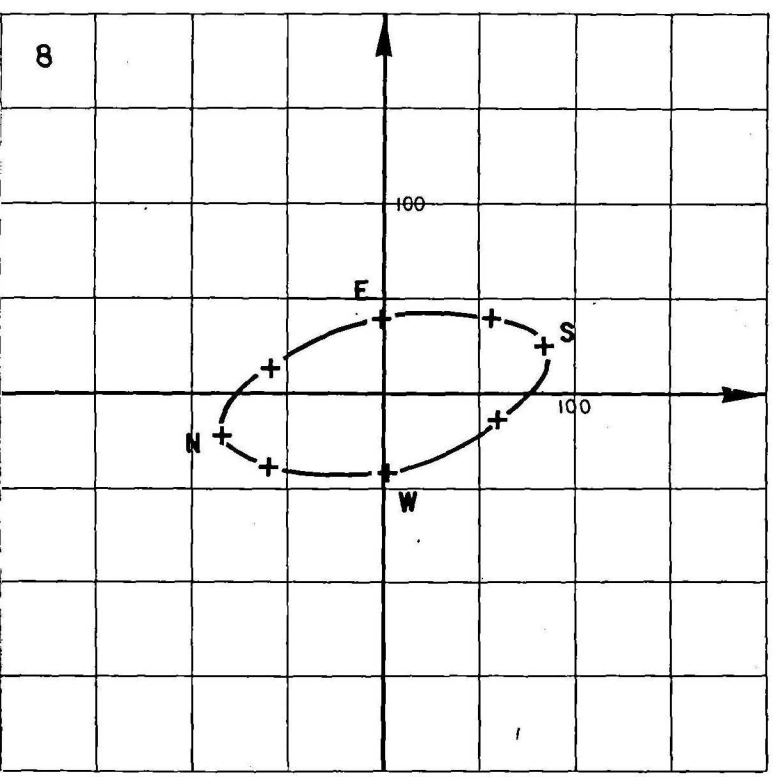


All scales in meters

Heading North, East of receiver, culmination angle = 12°

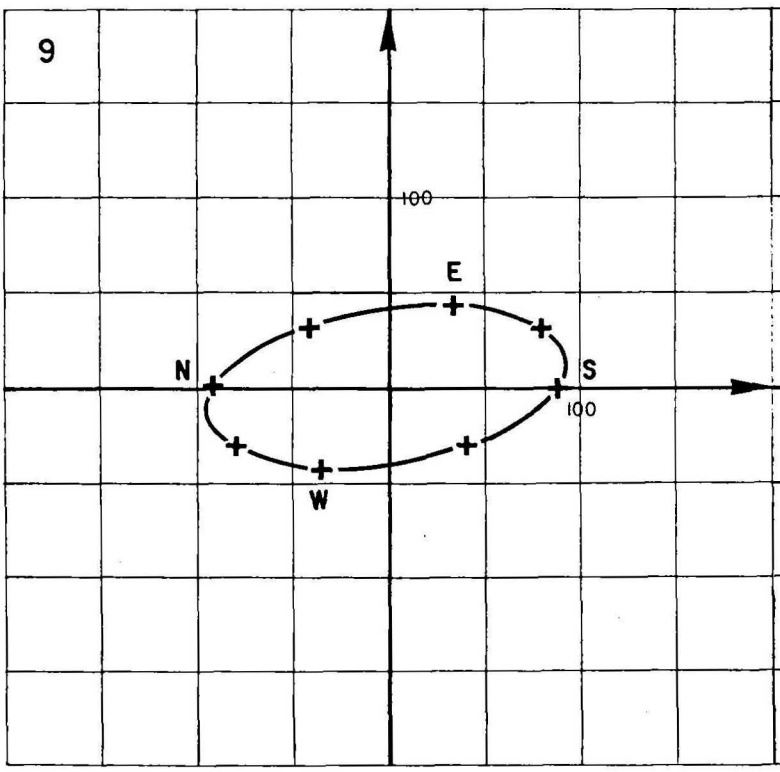


Heading North, West of receiver, culmination angle = 12°

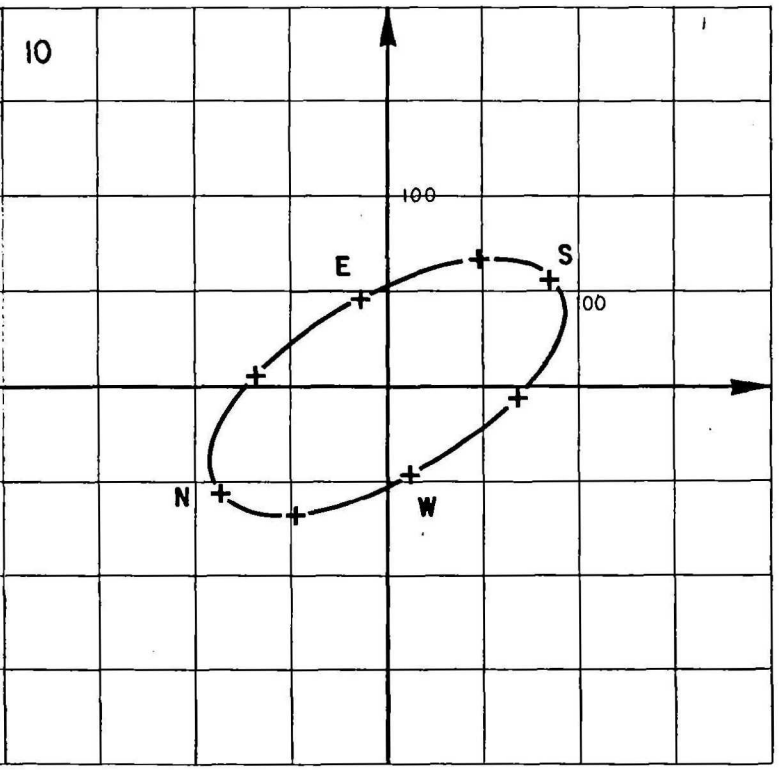


INFLUENCE OF SHIP'S SPEED ERROR

Heading North, West of receiver, culmination angle = 15°

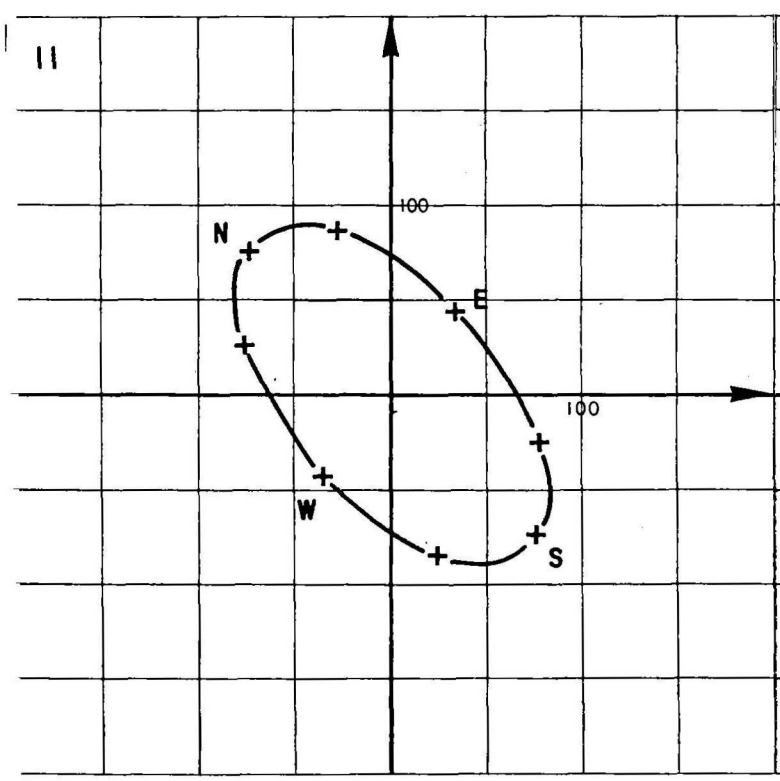


Heading North, West of receiver, culmination angle = 17°

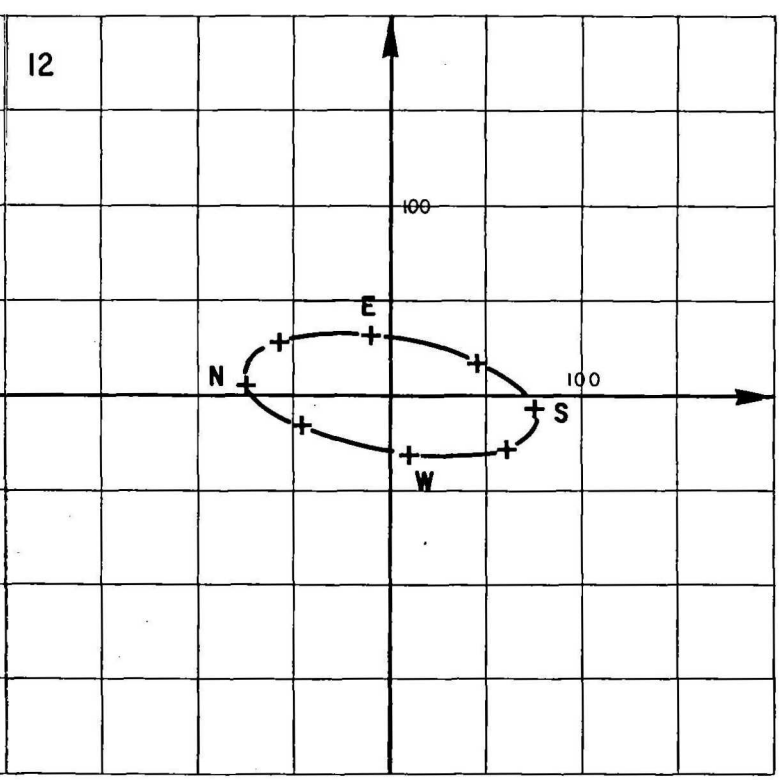


All scales in meters

Heading South, East of receiver, culmination angle = 17°

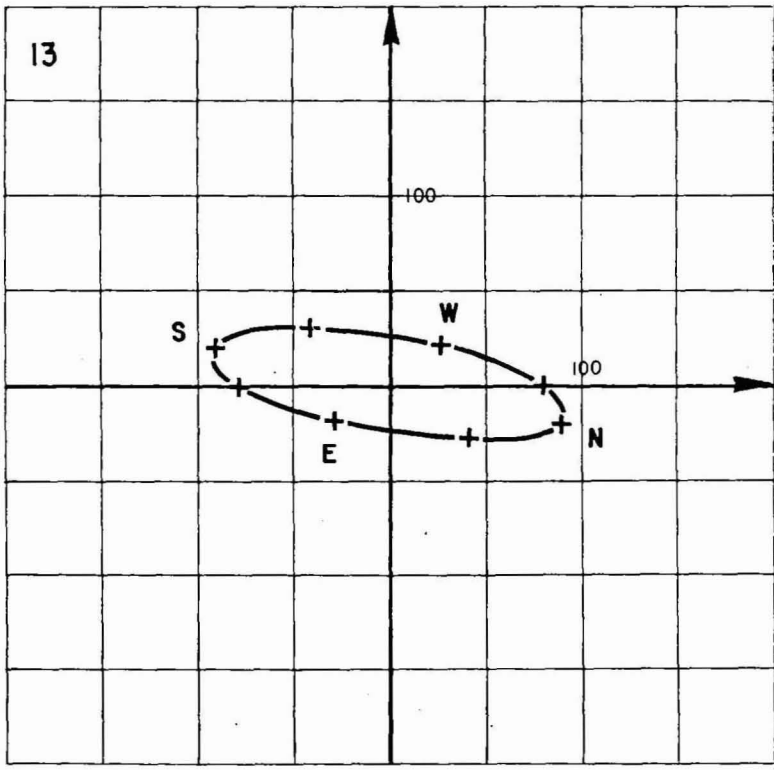


Heading South, East of receiver, culmination angle = 21°

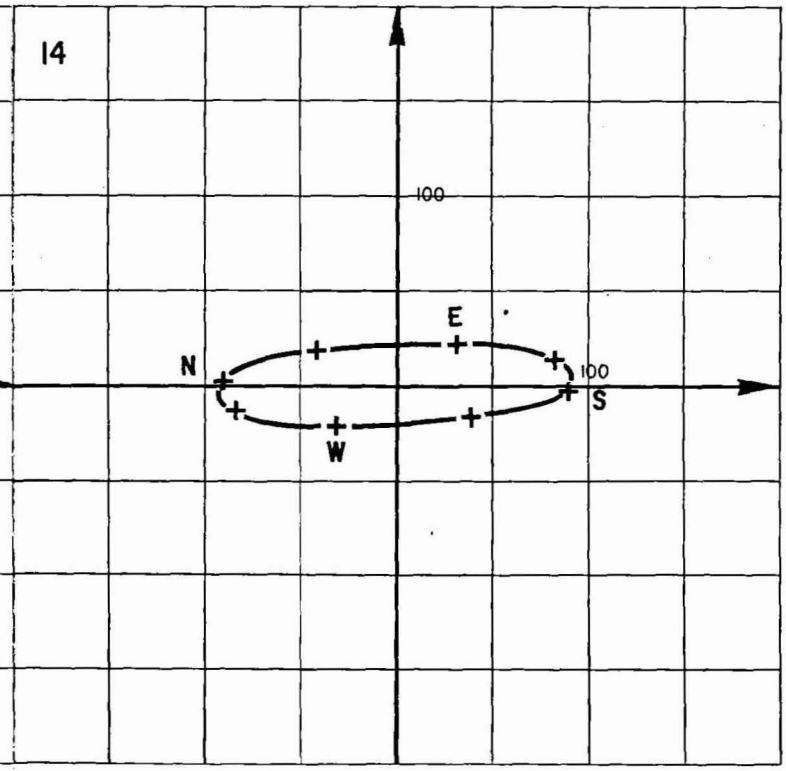


INFLUENCE OF SHIP'S SPEED ERROR

Heading South, West of receiver, culmination angle = 37°

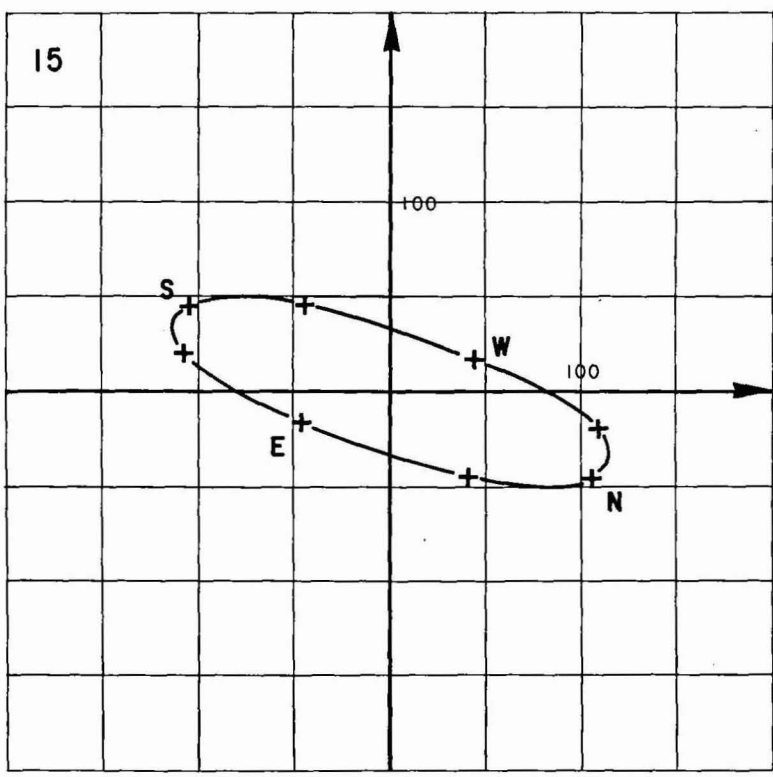


Heading North, West of receiver, culmination angle = 37°

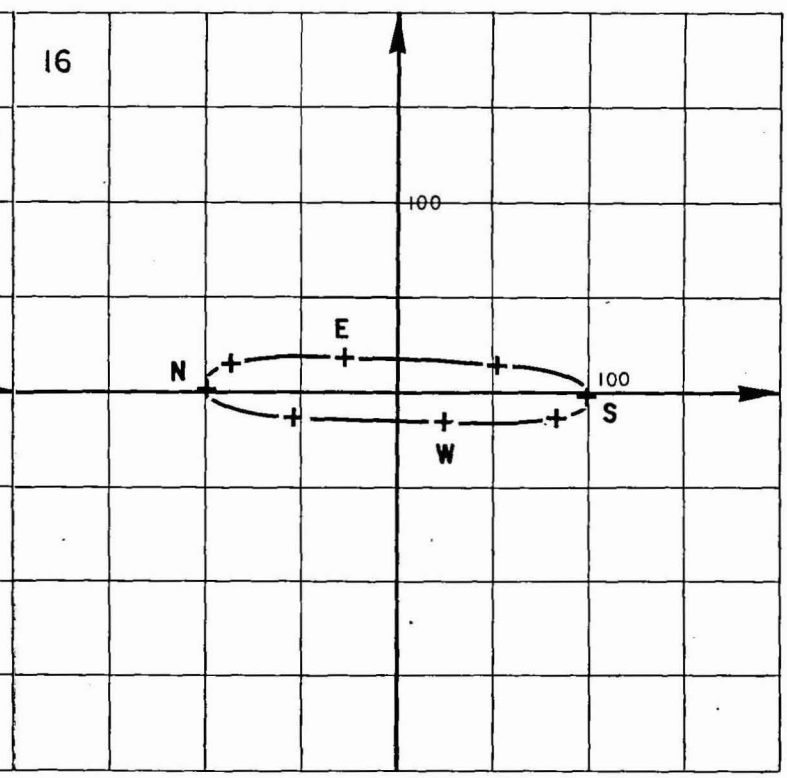


All scales in meters

Heading South, West of receiver, culmination angle = 42°

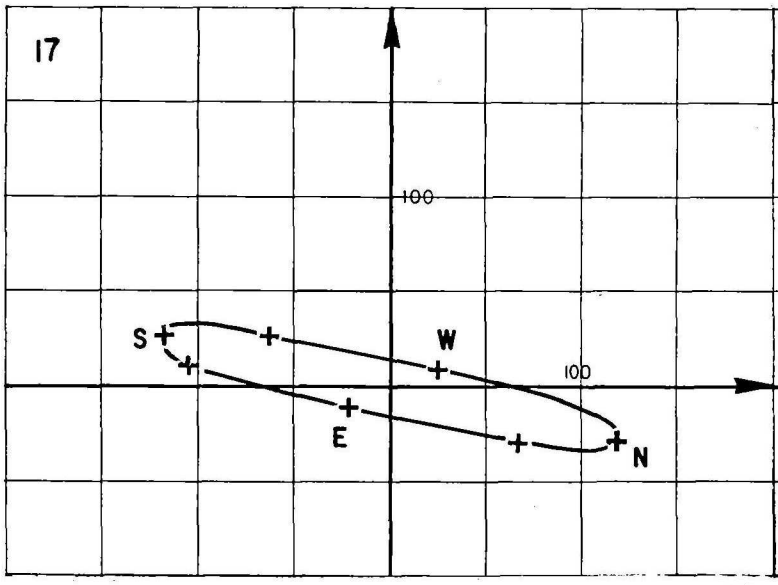


Heading South, East of receiver, culmination angle = 50°

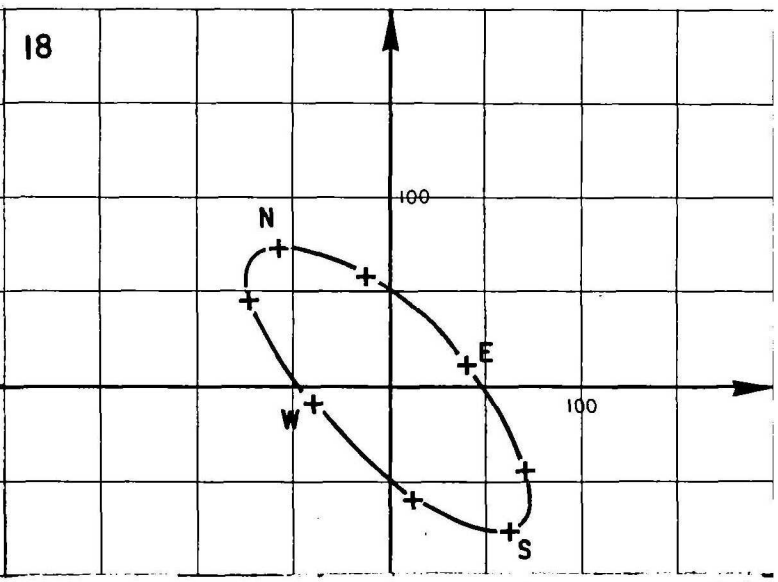


INFLUENCE OF SHIP'S SPEED ERROR

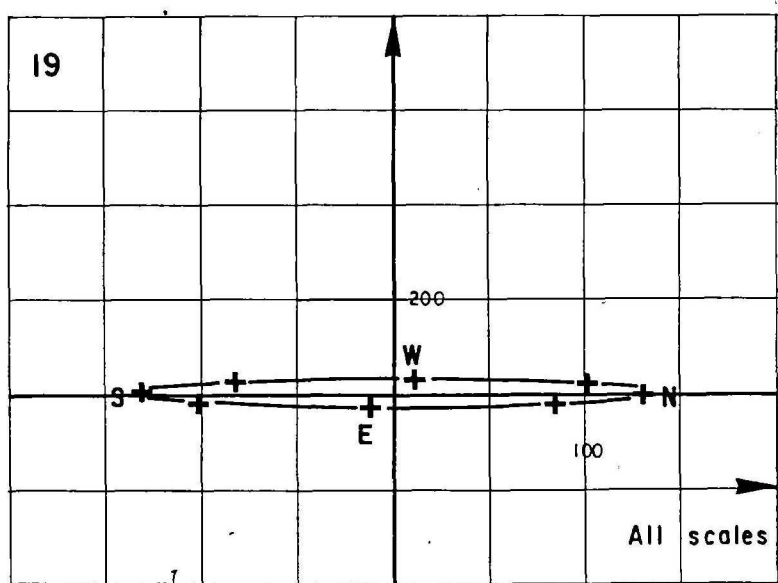
Heading North, East of receiver, culmination angle = 58°



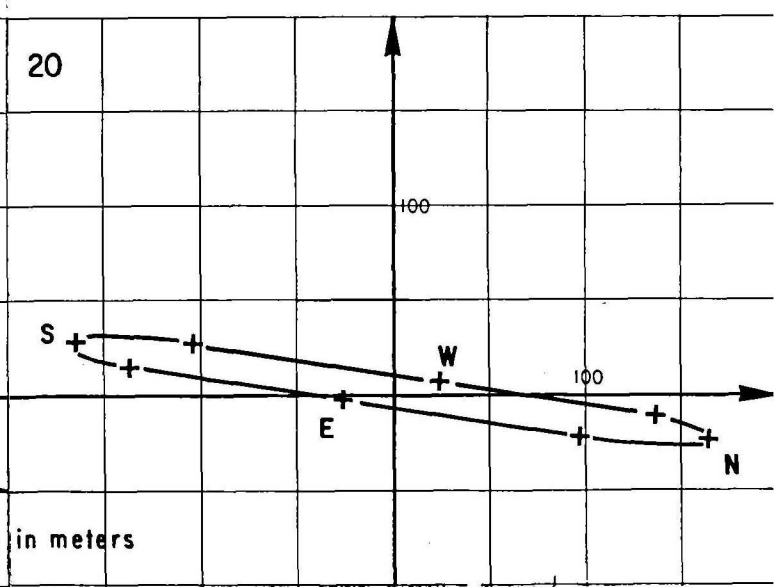
Heading South, East of receiver, culmination angle = 60°



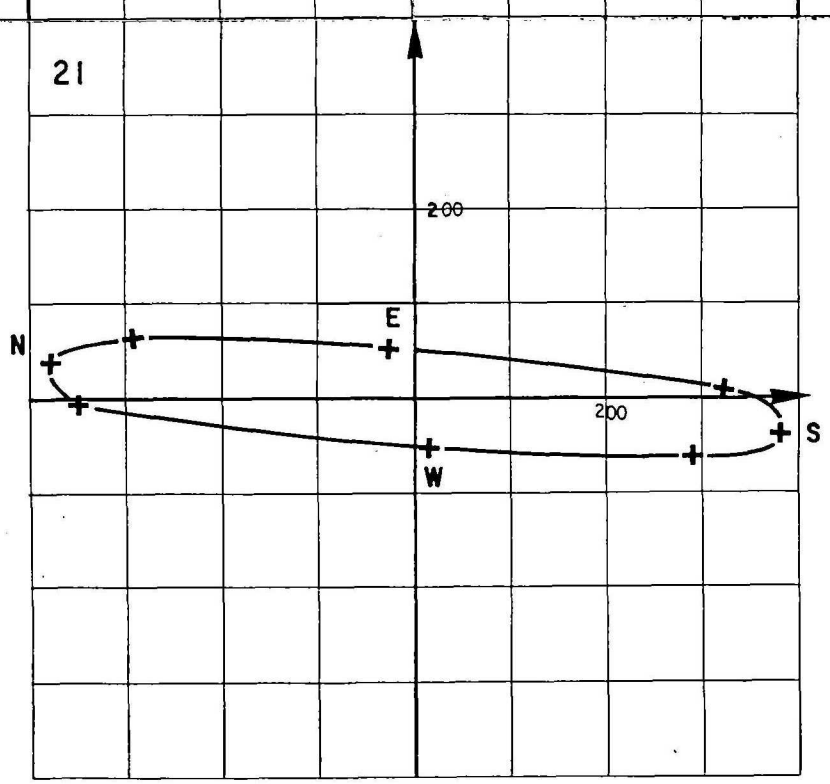
Heading North, East of receiver, culmination angle = 66°



Heading South, West of receiver, culmination angle = 81°



All scales in meters



Heading South, East of receiver, culmination angle = 85°

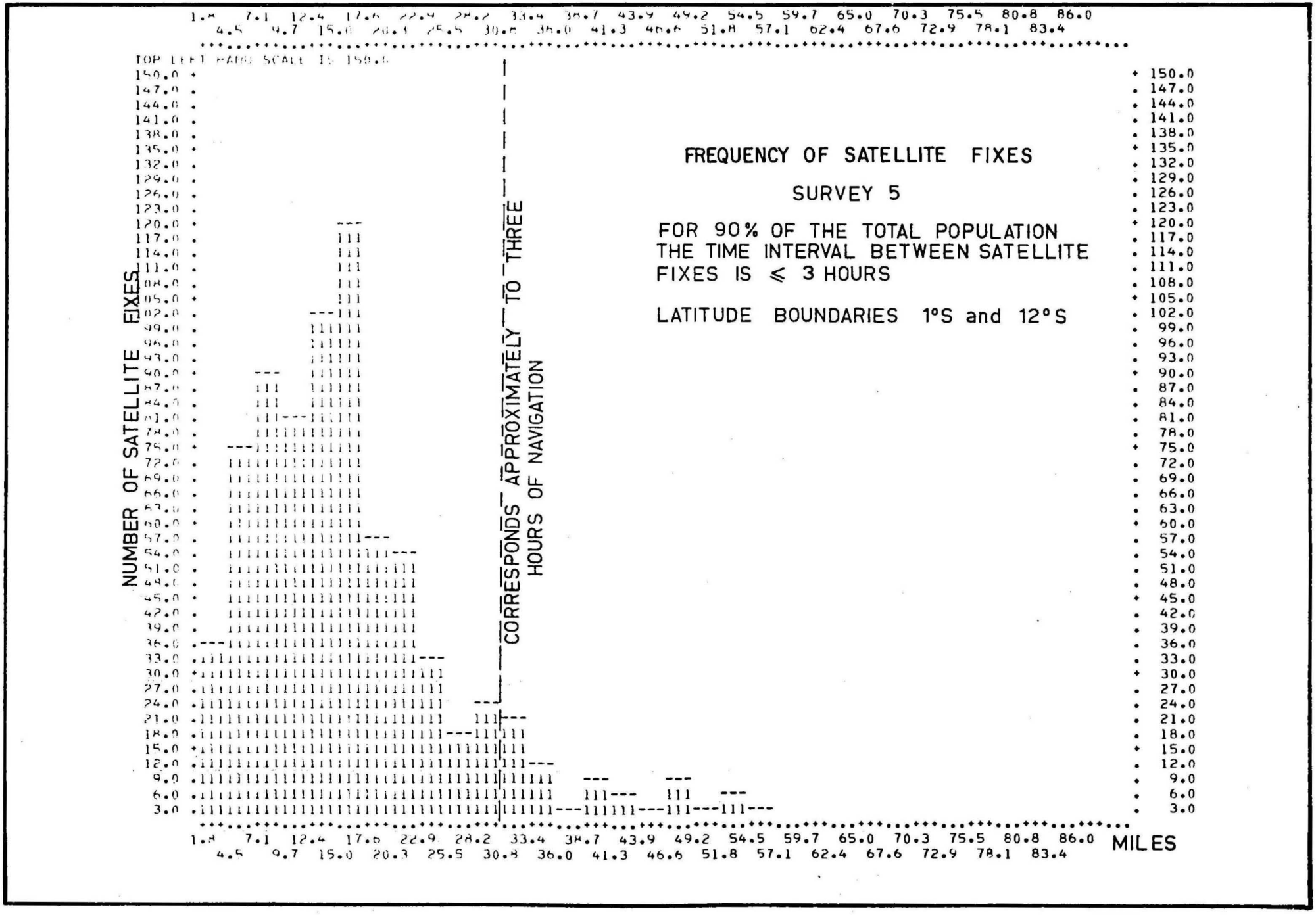

FREQUENCY OF SATELLITE FIXES
SURVEY 5
FOR 90% OF THE TOTAL POPULATION
THE TIME INTERVAL BETWEEN SATELLITE
FIXES IS ≤ 3 HOURS
LATITUDE BOUNDARIES 1°S and 12°S
NUMBER OF SATELLITE FIXES
CORRESPONDS APPROXIMATELY TO THREE
HOURS OF NAVIGATION
MILES

Fig.39

(longitudes) and DDH (altitudes). Results are summed up in (Fig. 32). A part from few points (Brisbane : 2 locations, Launceston : 1 location, Port Moresby : 2 locations and Hobart : 1 location) probably due to doubtfull measurements, the values remain reasonable (approximately 20 metres).

Note : Given : D U, D V, D W coordinates of C_1 C_2, and :
Da (metres) = Semi major axis of Spheroïd 2 - Semi major axis of Spheroïd 1
Db (metres) = Semi minor axis of Spheroïd 2 - Semi minor axis of Spheroïd 1.

Then, the formula used to pass from a system 1 to a system 2 are :

$$DL = .0324 (D U \sin L \cos G + D V \sin l \sin G - D W \cos L + (Da - Db) \sin 2 L)$$
$$DG = .0324 (D U \sin G - D V \cos G) / \cos L$$

DL and DG (sexagesimal seconds) being the corrections to add to the geographical coordinates L Latitude and G Longitude of System 1 to pass to the coordinates of System 2.

III.5.2. - Fixes at Sea. (Figure 33 and Figures 34 to 38).

* The ellipses (Fig. 34 to 38) show the deviations in metres in Latitude and Longitude for a change of .2 knot in North or East velocity.

Statistics on more than one thousand fixes at a fixed site show that generally satisfactory fixes lead to the following figures (metres RMS) :

.2 knot North velocity, deviation East 90, deviation North 30.
.2 knot East velocity, deviation East 30, deviation North 30.

The fix is rejected if the actual deviations exceed 175, 75 ; 75 and 75 metres respectively.

III.5.3 - Frequency of the fixes (Fig. 39)

In a general way, passes are more frequent near the poles than the equator. Statistical data have been computed for the satellite fixes

recorded diurng survey 05 between 1° South and 12° South (Fig. 39) : For 90 % of the total population, the time interval between satellite fixes is inferior to 3 hours. In high latitudes area, the frequency of passes, although larger, is affected by the simultaneous passes of several satellites which does not allow any reception.

IV - BATHYMETRIC DATA

* Several different systems provided the bathymetric data for the BMR Survey :

- Atlas Echo Sounder (shallow data)
- Elac Echo Sounder (data till 4000 m).
- Seismic cable + Digitrack System.
- Raytheon Sounding System.
- Seismic cables (after computation).

* Generally, the Bathymetric data was redigitized from the selected analogue record according to the depth, except for the shallow water of the Great Australian Bight where the Atlas digital output was used, and for flat area of the West Coast where the Raython digital output was used.

* Generally, the misties were computed with data from analogue records, except when Atlas digitized data was known to be reliable (Great Australian Bight).

IV.1 - Misties and Misclosures

IV.1.1. - Misclosure Maps (Enclosures 42 to 49)

* On these maps are put down for each crossing :

- either the two depth values (Areas B to H)
- or the algebraic difference at the crossing between these two values computed in the following way ; latest line value minus earliest line value.

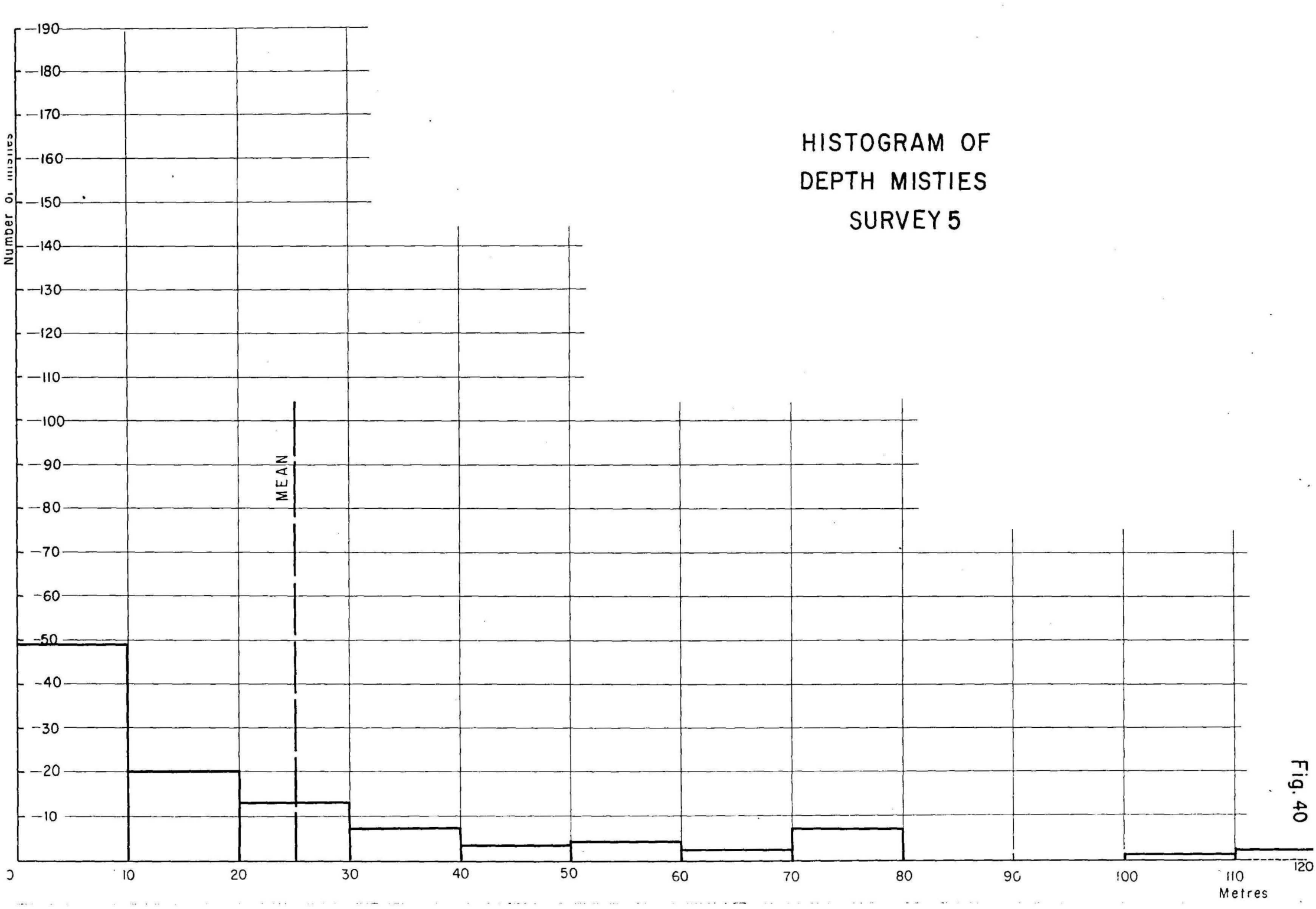

HISTOGRAM OF
DEPTH MISTIES
SURVEY 5
Number of mistics
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
MEAN
0
10
20
30
40
50
60
70
80
90
100
110
120
Metres

Fig. 40

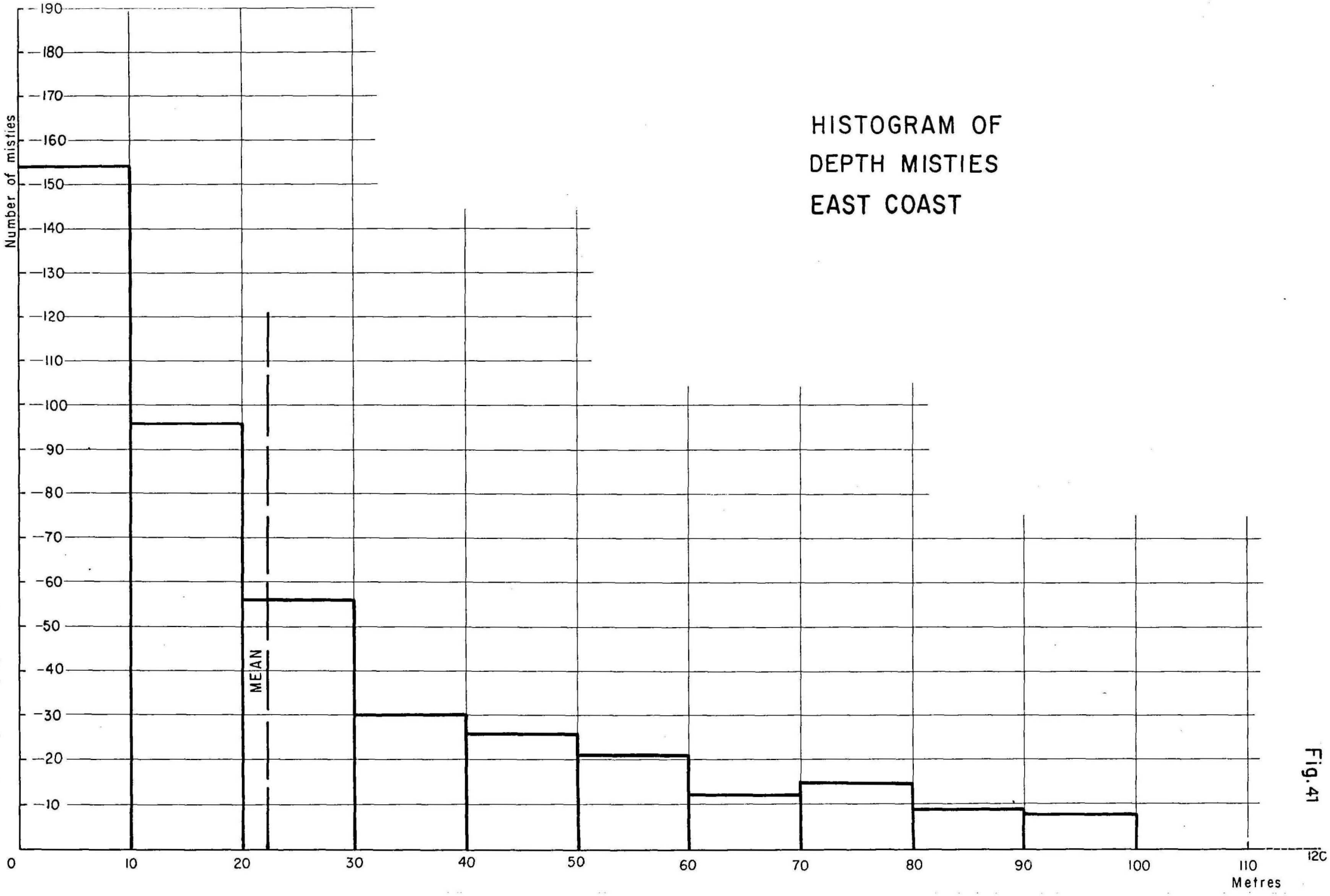

HISTOGRAM OF
DEPTH MISTIES
EAST COAST
Number of misties
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
MEAN
0
10
20
30
40
50
60
70
80
90
100
110
120
Metres

Fig. 41

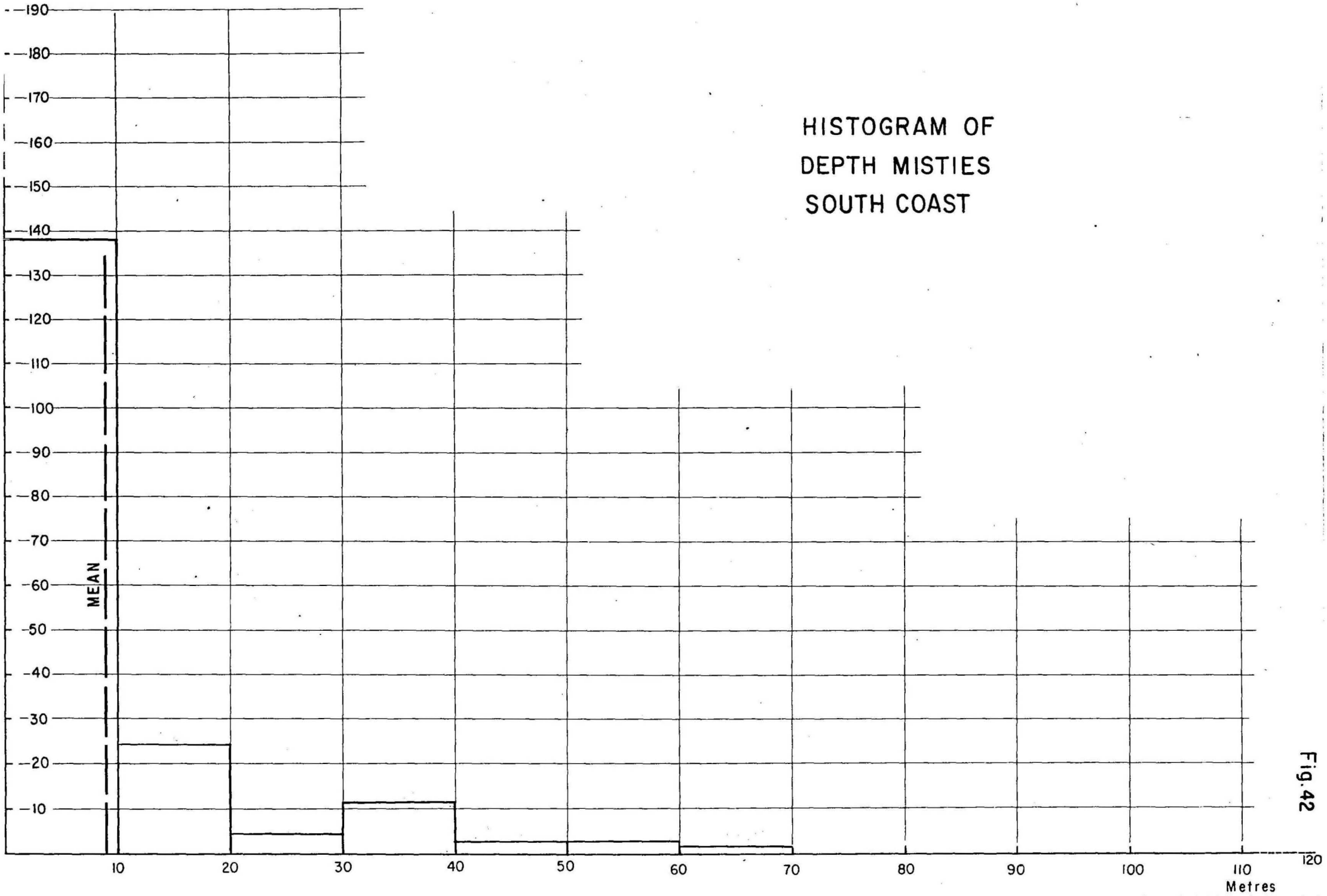

HISTOGRAM OF
DEPTH MISTIES
SOUTH COAST
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
MEAN
10
20
30
40
50
60
70
80
90
100
110
120
Metres

Fig. 42

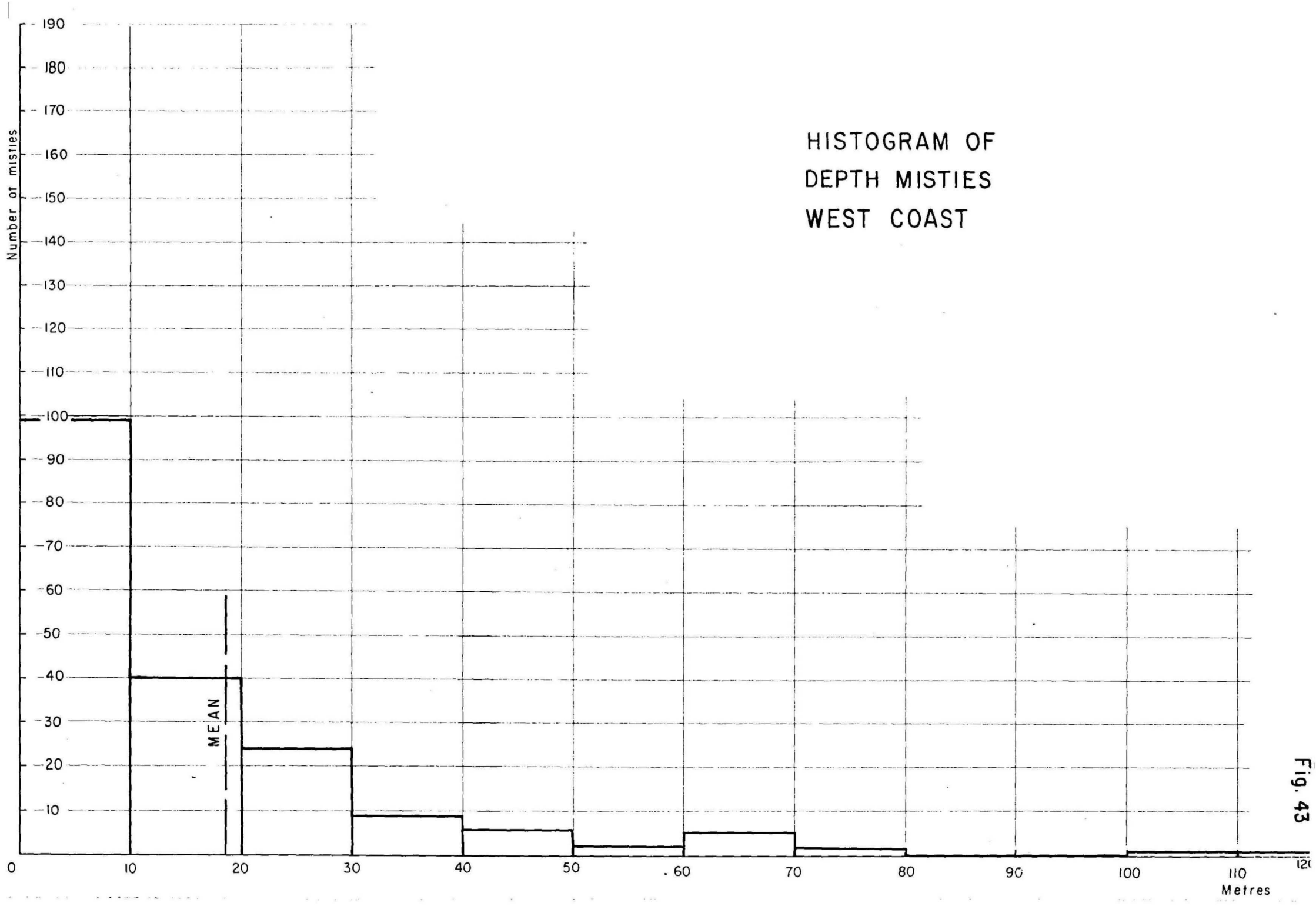

HISTOGRAM OF
DEPTH MISTIES
WEST COAST
Number of misties
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
MEAN
0
10
20
30
40
50
60
70
80
90
100
110
120
Metres

Fig. 43

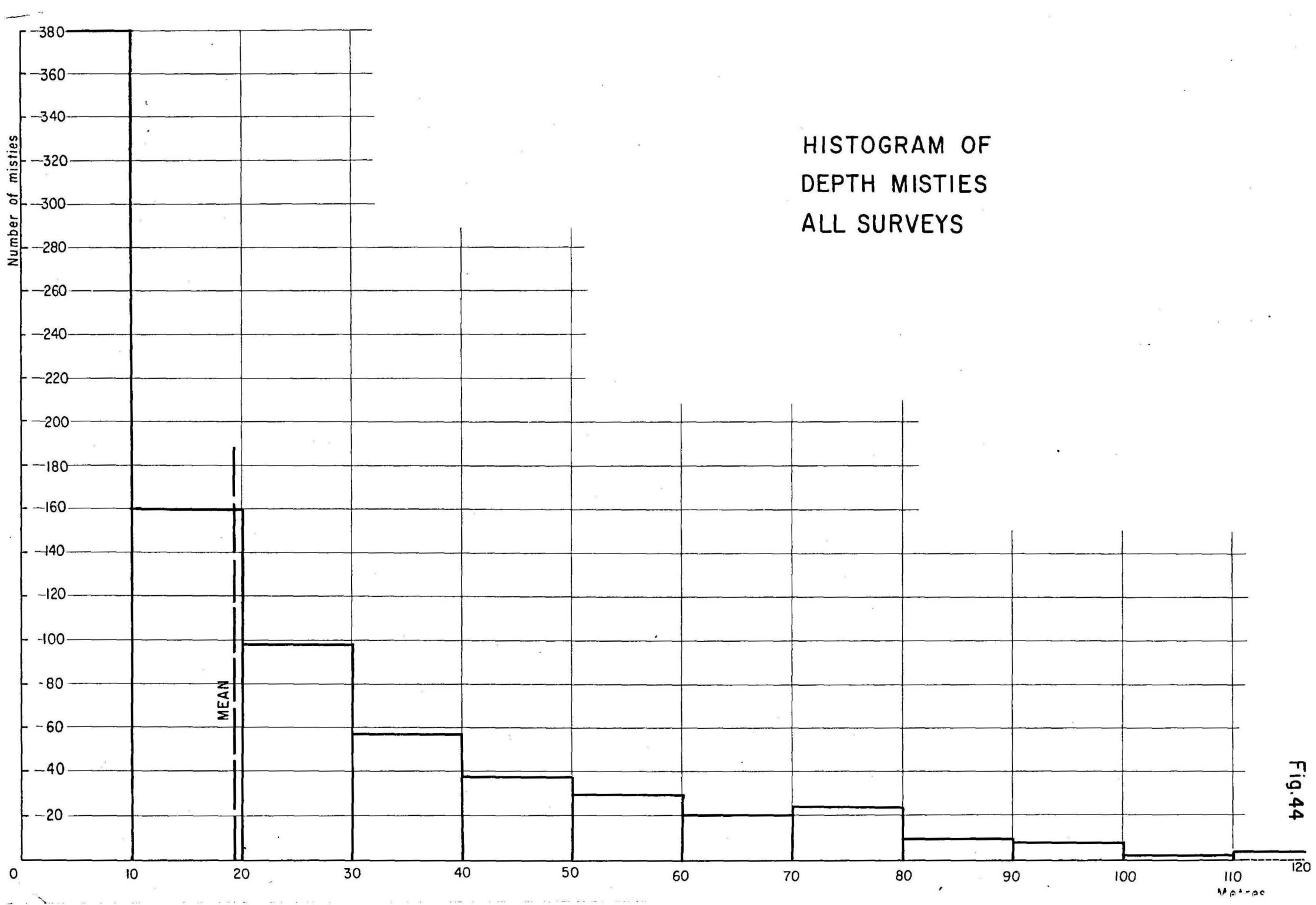

HISTOGRAM OF
DEPTH MISTIES
ALL SURVEYS
Number of misties
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
MEAN
0
10
20
30
40
50
60
70
80
90
100
110
120
Metres

Fig. 44

The misclosure is algebraically computed according to a loop in the counter clockwise direction.

IV.1.2. - Statistical results

* A statistical analysis of the misties was performed for the four main areas :

- Survey 05 (gulf of Papua and Bismarck Sea).
- East coast of Australia
- South coast of Australia between 115° longitude West and Tasmania.
- West coast of Australia.

	Mean	St. Dev.	Mini.	Range	Population	SD/Mean
Survey 05	25.5	31.0	0	150	110	1.2
East Coast	22.2	23.6	0	98	428	1.0
South Coast	9.2	13.6	0	70	182	1.5
West Coast	18.9	22.9	0	140	191	1.2
All Surveys	19.3	23.5	0	150	911	2.2

* Statistical results are summed up in histograms of Figures 40 to 44. These results call for the following comments :

- The bathymetric misties from Survey 05 were affected by strong gradients.

- The bathymetric misties obtained on the East coast correspond to deep waters and strong gradients in the South.

- The bathymetric misties collected on the South Coast correspond to shallow waters, thus, the errors are minimised.

- The bathymetric misties collected on the West Coast are very little affected by gradients.

To all this must necessarily be added the errors committed in hand digitizing the bathymetric data and the errors due to the passage from one bathymetric system to one other, and in reverse.

IV.2 - Digitization of the data.

* The basic reference for the depth digitization was the Elac analogue record, because it was the only system working in a satisfactory way from the beginning to the end of the BMR Survey. For shallow water areas, the Atlas analogue records were used when they were satisfactory, and for deep waters (below 4000 m), seismic sections from the Geotech cable or from trace 1 of the main cable were used. From Survey 17, satisfactory digital records of the Raytheon system were kept after a calibration coefficient had been applied, gaps being filled with data from suitable documents (either Elac or Seismic Sections).

* The main sources of inaccuracy were :

- the poor quality of the Elac analogue recordings,
- the inaccurate scales used to read the Elac analogue recordings. (Problem encountered during Survey 14)
- a different water velocity used for the Elac and the Raytheon reductions.
- the problems encountered by working with the digitizing table.
- the different working frequencies of the different systems used.

* Atlas - Elac data

Figure J (appendix 1) shows 2 recordings (at real size) output from Atlas and Elac system at the same time of recording. From these documents the following values of the depth can be picked :

Time	Atlas (metres)	Elac
25.18.51	39	35
25.18.52	39	35
25.18.53	36	31
25.18.54	40.5	34
25.18.55	40.1	33.6
25.18.56	36.5	31
25.18.57	38	32
25.18.58	39	34
25.18.59	41	35

It should be considered that the zero point gives an inaccuracy ± 1.4 metres and that 10 minutes of recording represents 3 000 metres of traversing.

* Elac analogue data

Figure K (appendix 1) is an example of ELAC recording in a rough area :

- the scale used is 1600/4000 metres : i.e 1 mm in vertical scale represente 14.7 metres ;
- the paper speed : 1 mm represents 522 metres ; 10 minutes of recording correspond to 5.36 mm on the record.

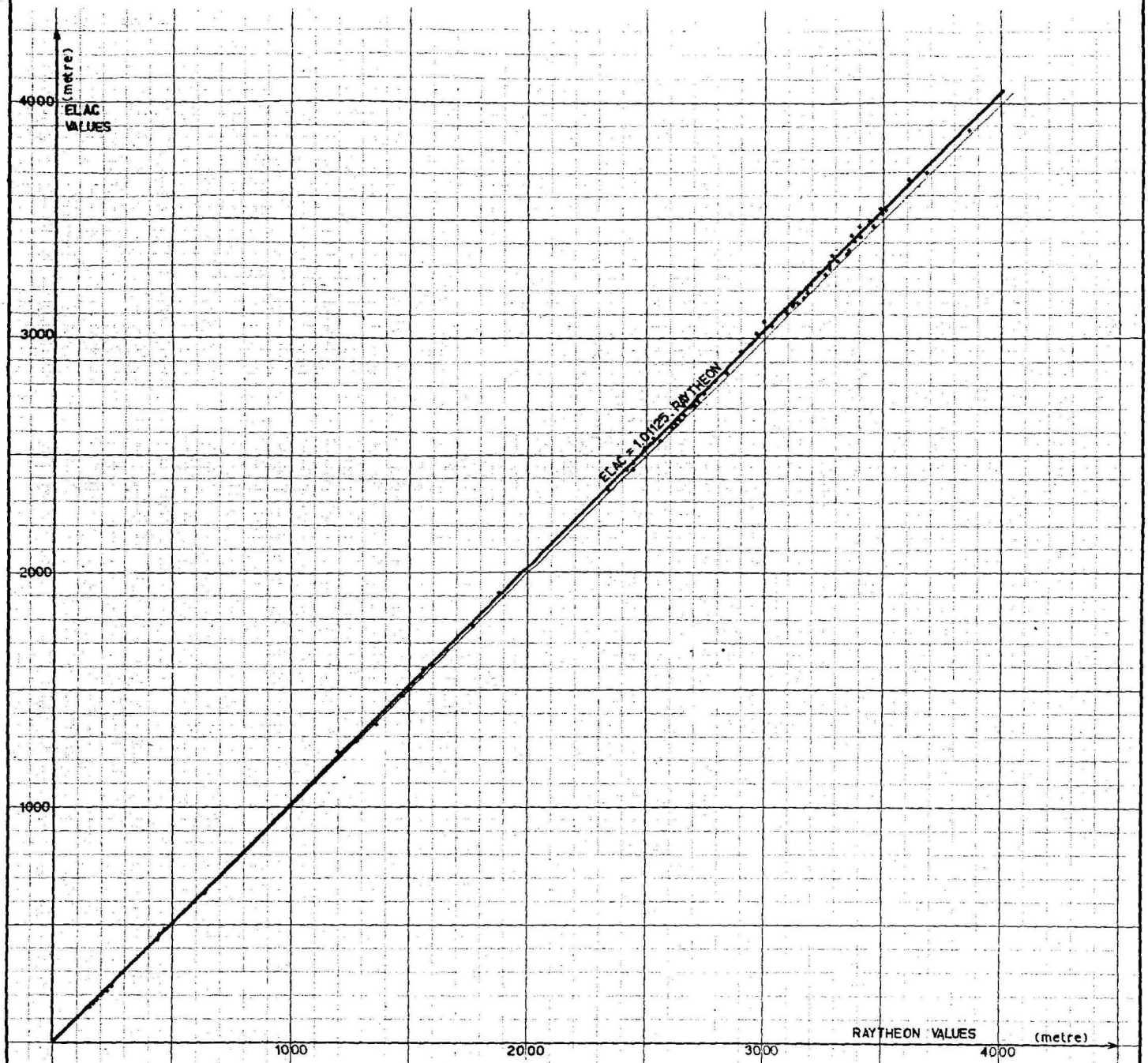
This figure obviously shows the difficulty sometimes encountered in identifying both the right depth and the right time.

* Raytheon digital data

Figure L (appendix 1) is an example of data from the digitized output of the Raytheon PDD (Precision Depth Digitizer).

The plot is made from the PRP tape (see Processing Report, pages 17 and 24), at two different scales :

0 - 1000 metres and
0 - 5000 metres.



CALIBRATION CURVE :
ELAC/RAYTHEON

NOTE : IF THE ENVELOPE CURVES, OF THE SET OF POINTS, ARE DRAWN, THIS LEADS TO AN UNCERTAINTY OF ± 40 m. AT A DEPTH OF 4000 m.

1 < calibration coefficient < 1.020

The difficulties of the system in following the bottom should be pointed out : loss at 58.19.43 for instance. All these losses of bottom must be corrected by input cards in the MISDAT programme (see Processing Report, page 20).

As the missing data was coming from ELAC analogue records, it was necessary to recalibrate all the Raytheon digitized data, i.e. a calibration coefficient of 1.01125 was input in the PREVEW programme (see Processing Report, page 11) to adjust all the depths recorded from Survey 17 on the ELAC data. This coefficient was determined and checked as follows :

- First, a comparison between ELAC and RAYTHEON values was carried out ; then, the coefficient 1.01125 was determined. (Fig. 45).

- A checking of the crossings, when they exist, was carried out between the ELAC and the calibrated RAYTHEON.

* Seismic Data

The seismic data was used when no other data was available from the other Systems.

The seismic depths were adjusted in such a way as to be consistent with the Elac data.

* Digitizing table

In theory, the system provides exact value of a point belonging to a plot as for as : origin point, abscissa and ordinate are known without ambiguity. The main source of inaccuracy was linked to the poor quality of the analogue document :

- paper speed variable
- inaccurate change of scale
- difficulties, sometimes, in following the trace.

V - SEISMIC DATA

V.1 - Reflection data

* The data quality was defined by the noise level recorded on each trace.

* The noise level, from Survey 12, and the corresponding statistical figures are summarized in the plots of (Enclosure 50)

V.2 - Refraction data

* Independently of the shortcomings of the sonobuoy system (already described in the Equipment Performance Report), the main parameter responsible for the generally unsatisfactory results obtained was :

- the SPARKER Source, poorly adapted in frequency content, to the refraction work ; situation slightly improved when it was decided to shoot with one electrode only : indeed, shooting with one electrode enhances the low frequency part of the signal ; the bubble period being proportional to the cube root of the energy, the change from four to one electrode enhances the low frequency part of the signal by $\sqrt[3]{4}$.

VI - SHORE STATION - MAGNETISM

* The quality of the magnetic data recorded at the shore station was a function of the quality of the equipment used. Thus, three periods of time may be distinguished :

- Surveys 05 and 10,
- From Survey 11 to Survey 14, Cruise 2,
- From Survey 14, Cruise 3 to Survey 19.

* Data from Surveys 05 and 10 :

The data quality is poor due to the graphic recorder used. Subsequently, numerous records where not used and data was hand digitized from recordings from the Port-Moresby Observatory (which was located near the C.G.G. shore Station).

* Data from Survey 11 to Survey 14, Cruise 2.

The data is noisy and had to be hand smoothed before being digitized (Appendix I, Fig. M).

* Data from Survey 14, Cruise 3 to Survey 19.

The recordings are of very good quality. (See Appendix 1, Fig.N).

VI.1 - Magnetic phenomena

* Figure P of Appendix 1 shows the good correlation which existed between the shore recordings and ship recordings. (Example taken during the magnetic storm of August 8th 1972).

* Figure O of Appendix 1 shows the hand digitization of a very disturbed period of November 1972 with a 10 minutes sampling.

* The tables below provide the disturbed magnetic days and quietest days for the period covering the BMR Survey (from KNMI, De Bilt).

VI.2 - Hand digitization

* Digitization of the analogue data was carried out by taking a sample every 10 minutes.

This sampling is adequate for the flat and smooth recordings of the quiet days.

For the magnetic storm showed in Figure P of Appendix 1, this sampling seems too large and should be replaced by a 1 minute sampling.

VI.3 - Shore station data gap.

* Enclosure 51 to 58 provides gaps in digitized data from the shore station. It must be looked at :

- During survey 14 cruise 3, the station was not running because the ship was working for from station location.

- During survey 05 cruise 2 and 3, surveys 17 cruise 1, data from geomagnetic was input into the tape.

These gaps are the gaps on the magnetic tape created from the programme SHOMAG (See Processing Report, page 65).

	5 most disturbed days	5 quietest days	10 quietest days
1970			
August	08 09 17 18 26	01 03 04 05 24	08 09 17 18 26
September	01 13 14 21 27	06 09 11 12 29	01 13 14 21 27
October	04 16 17 18 23	07 08 09 15 21	04 16 17 18 23
November	07 11 21 22 23	01 15 20 29 30	07 11 21 22 23
December	08 14 15 24 28	01 10 11 17 31	08 14 15 24 28
1971			
January	03 20 27 28 30	07 08 09 12 26	03 20 27 28 30
February	14 15 16 25 26	03 04 05 13 22	14 15 16 25 26
March	08 13 14 15 31	21 22 23 28 29	08 13 14 15 31
April	04 09 10 14 15	08 20 24 25 26	04 09 10 14 15
May	06 07 17 18 30	12 13 27 28 31	06 07 17 18 30
June	01 02 03 25 29	07 09 12 19 20	01 02 03 25 29
July	01 02 21 26 31	07 10 17 20 25	01 02 21 26 31
August	02 11 18 23 31	03 06 14 20 27	02 11 18 23 31
September	07 18 25 27 30	02 03 21 22 23	07 18 25 27 30
October	01 02 08 09 29	17 18 19 26 27	01 02 08 09 29
November	22 23 24 25 26	03 14 15 16 17	22 23 24 25 26
December	17 18 22 29 30	06 07 08 10 14	17 18 22 29 30
1972			
January	16 22 23 26 28	06 07 08 13 14	16 22 23 26 28
February	13 14 17 24 25	09 12 22 27 29	13 14 17 24 25
March	07 16 24 29 30	10 12 14 19 21	07 16 24 29 30
April	04 18 21 28 29	3 9 24 25 26	8 10 11 16 17
May	01 02 15 16 28	07 08 19 20 21	04 05 22 24 25
June	04 17 18 19 27	09 10 11 12 30	01 08 13 21 25
July	07 23 24 25 26	05 13 14 21 29	01 04 06 28 30
August	04 05 06 09 27	03 13 23 24 25	02 16 17 30 31
September	13 14 15 17 29	01 05 20 21 22	03 04 07 12 19
October	13 14 19 29 31	03 05 06 08 17	02 04 09 10 25
November	01 02 15 16 20	05 10 13 14 30	04 07 08 12 24
December	13 15 16 23 30	05 06 10 21 27	04 09 11 20 25

APPENDIX

APPENDIX 1

The purpose of this appendix is to show a sample of the recording carried out thoughout the survey :

Figure A Gravity analogue record (calm sea)

Figure B Effect of a turn on a gravity recording.

Figure C Gravity recording in choppy seas (record out of criteria)

Figure D Cross coupling components of gravity correction by choppy sea (same time as figure C.)

Figure E Cross coupling components of gravity correction by calm sea.

Figure F Magnetic analogue record in deep water.

Figure G Magnetic analogue record in shallow water.

Figure H Noise analysis of magnetic data slightly noisy.

Figure I Heading : analogue record.

Figure J Atlas : analogue record. Comparison with Elac analogue record.

Figure K Elac analogue record.

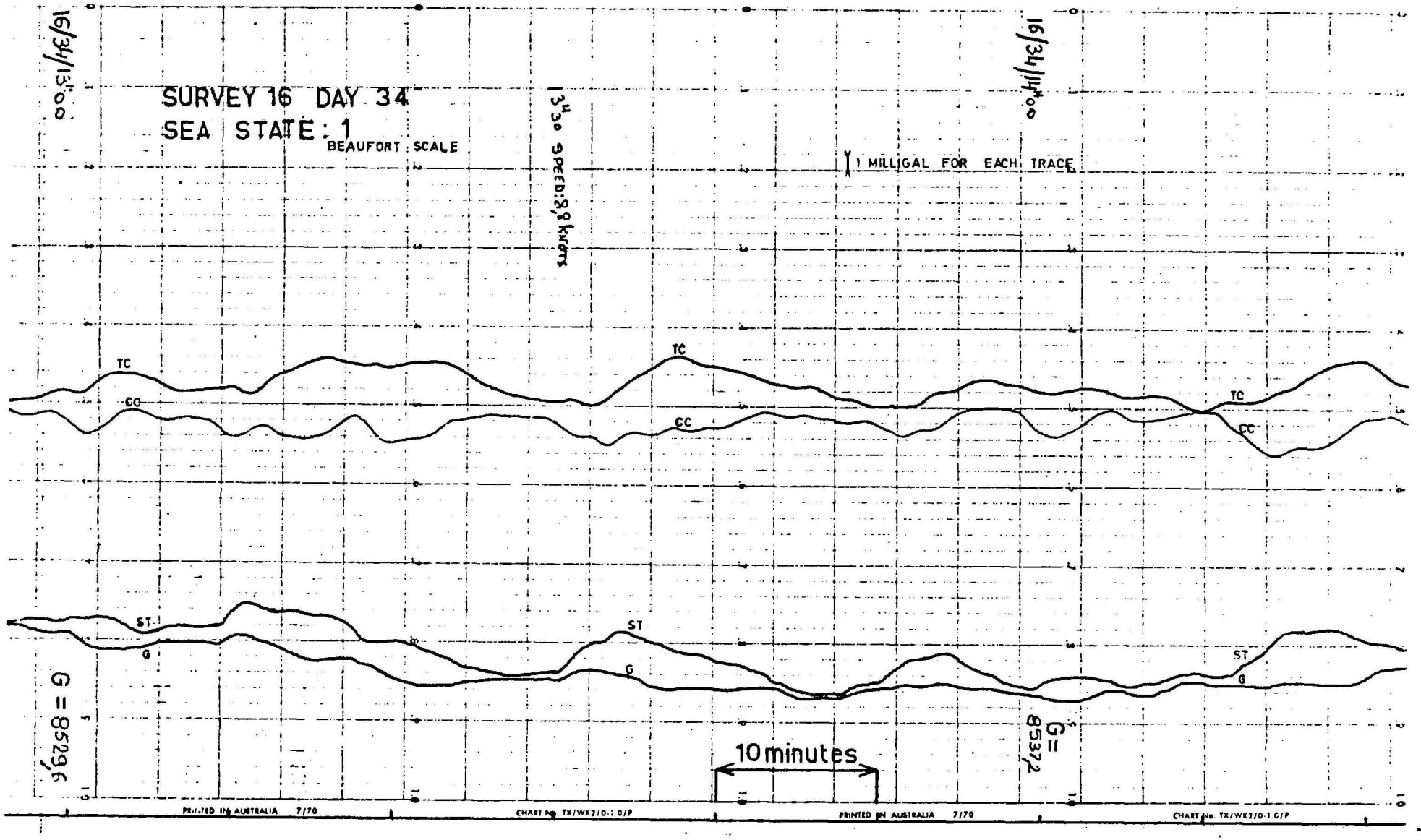
Figure L Plot of Raytheon data

Figure M Analogue record of the magnetic shore station : the recorder used is a VARIAN G1000.

Figure N Analogue record of the magnetic shore station on the WESTRONICS.

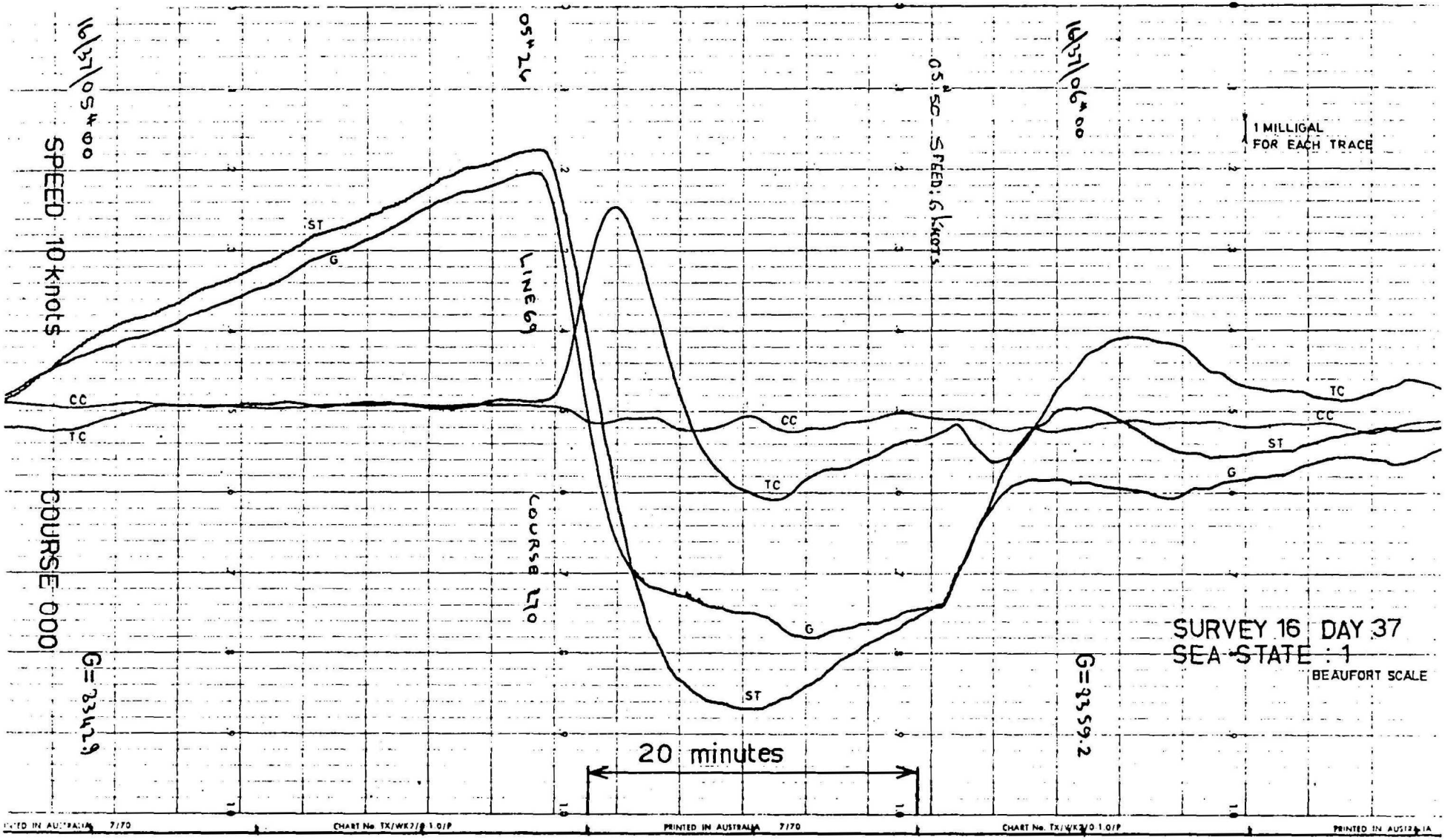
Figure O Digital plot of the shore magnetic diurnal on a disturbed day.

Figure P Comparison of shore and ship recordings on a day of magnetic storm.



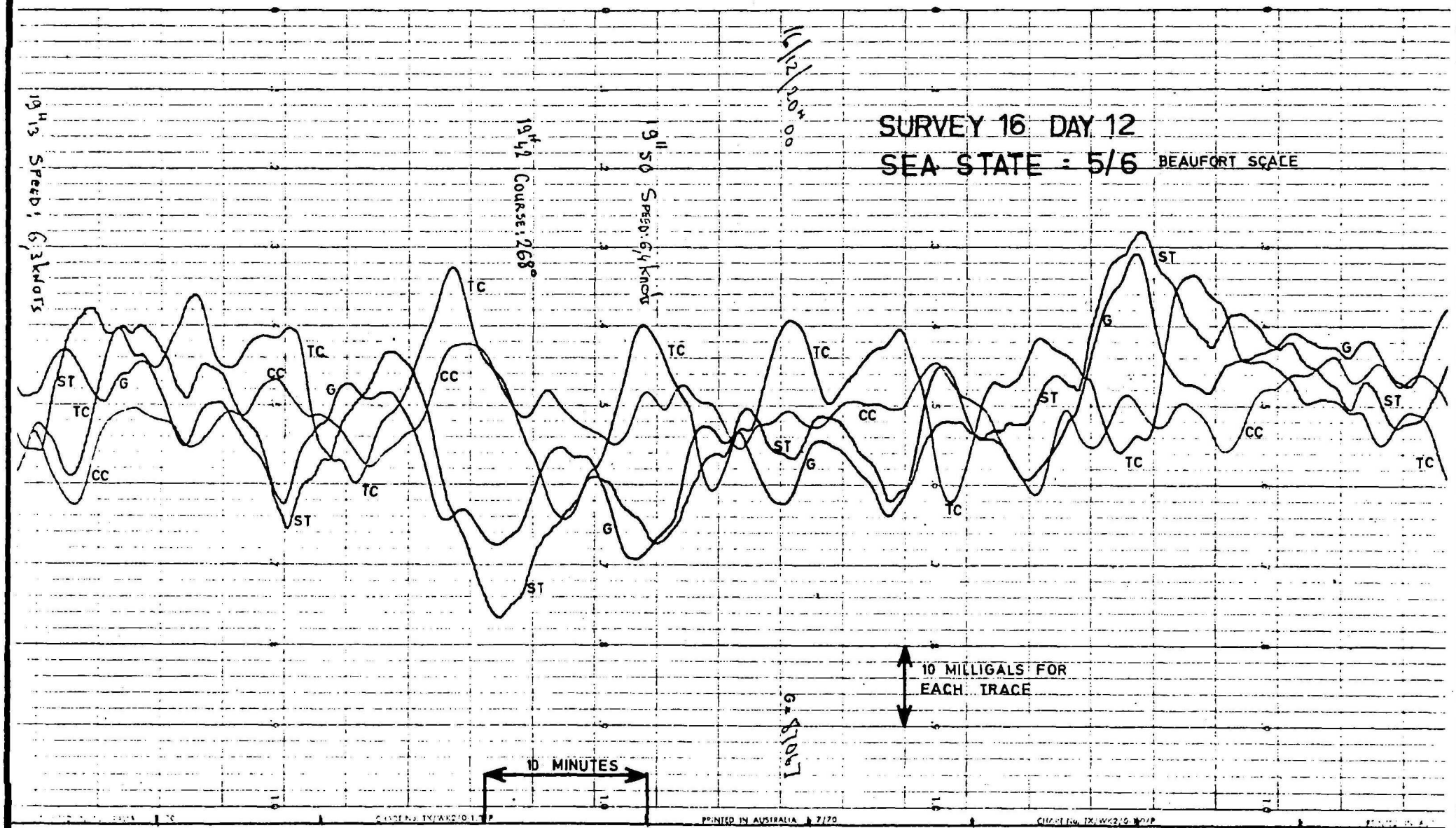
GRAVITY ANALOGUE RECORD

Fig.A



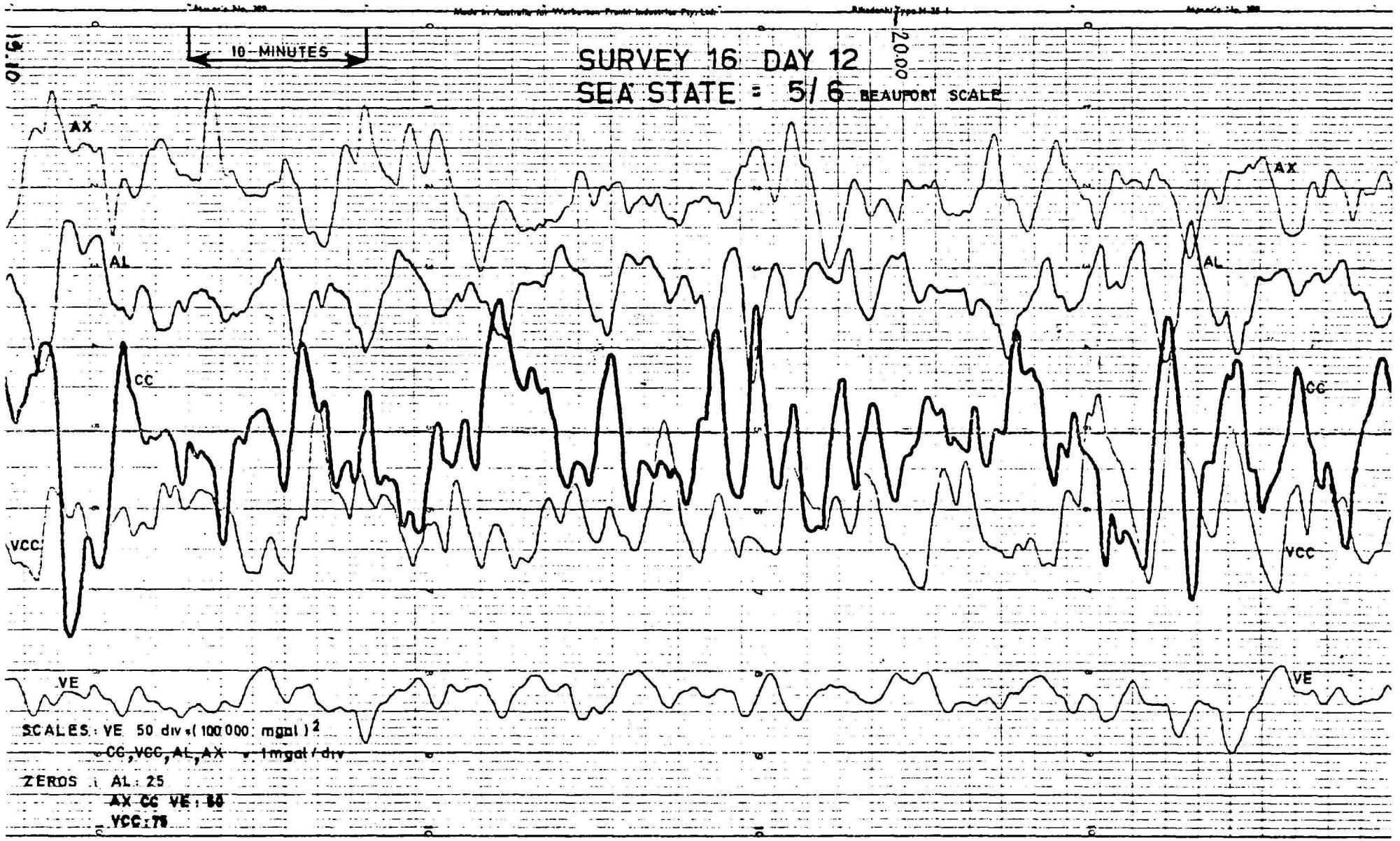
GRAVITY ANALOGUE RECORD (TURN)

Fig. B



GRAVITY ANALOGUE RECORD

Fig.C



CROSS COUPLING COMPONENTS ANALOGUE RECORD

Fig.D

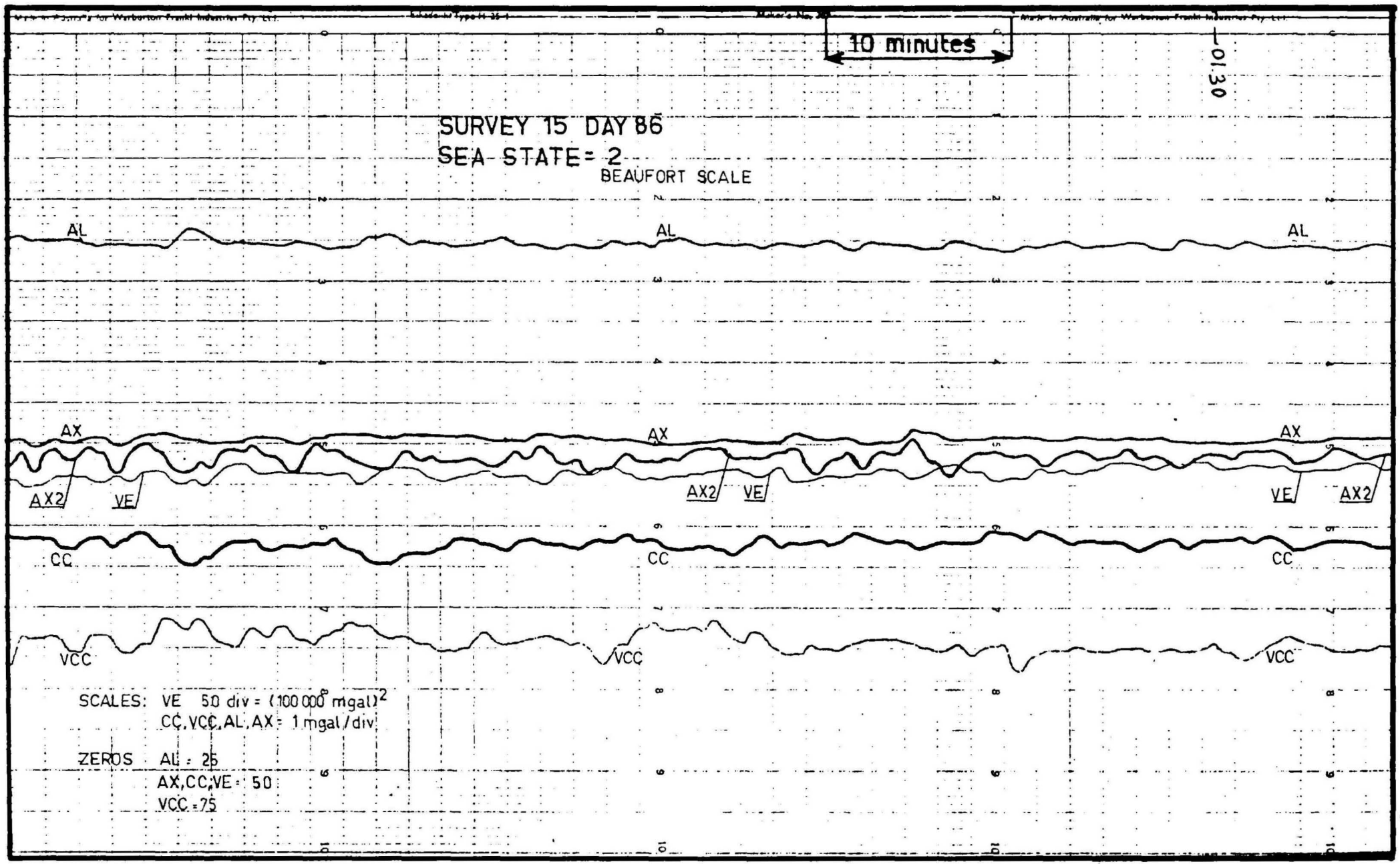
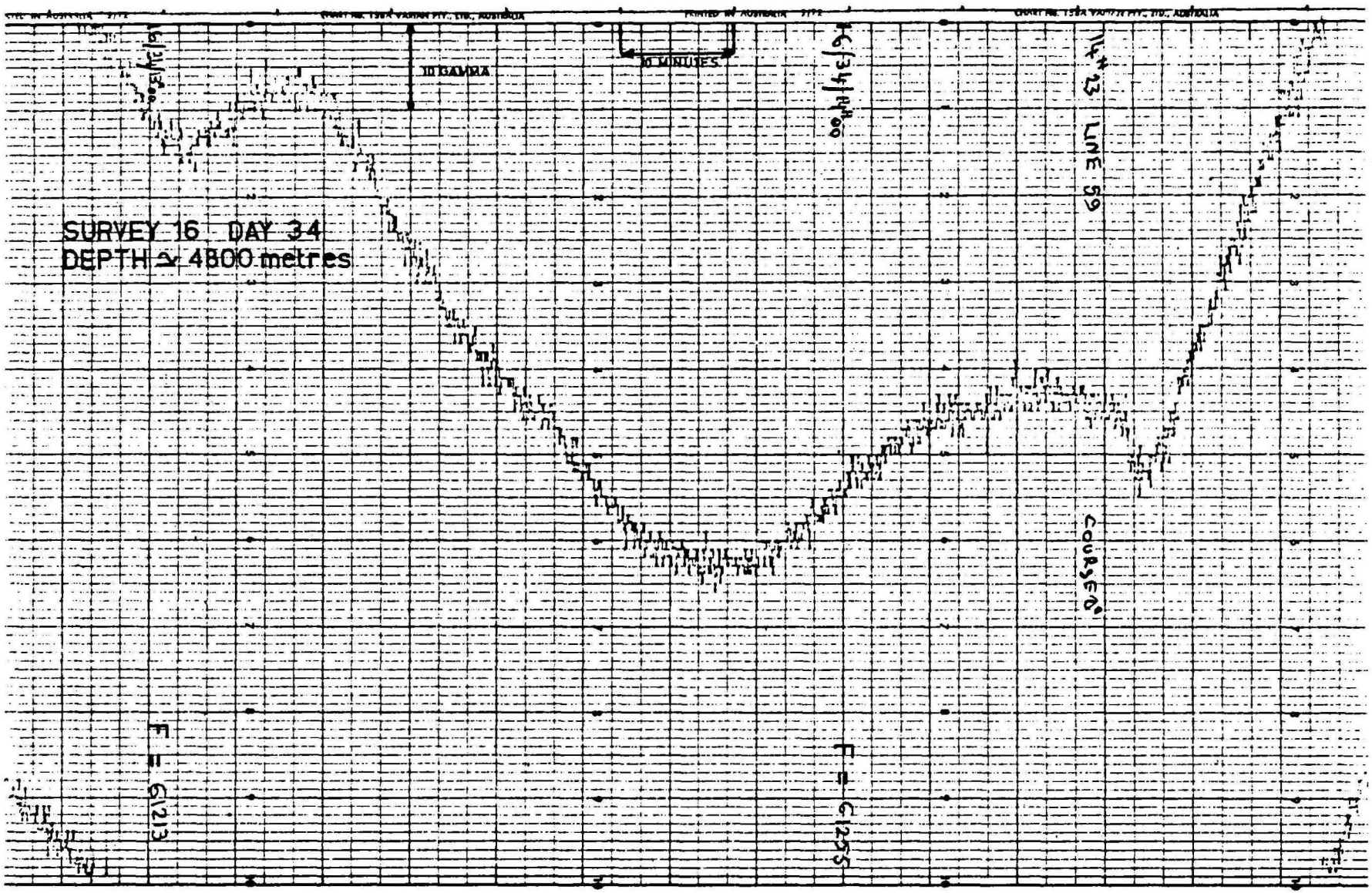


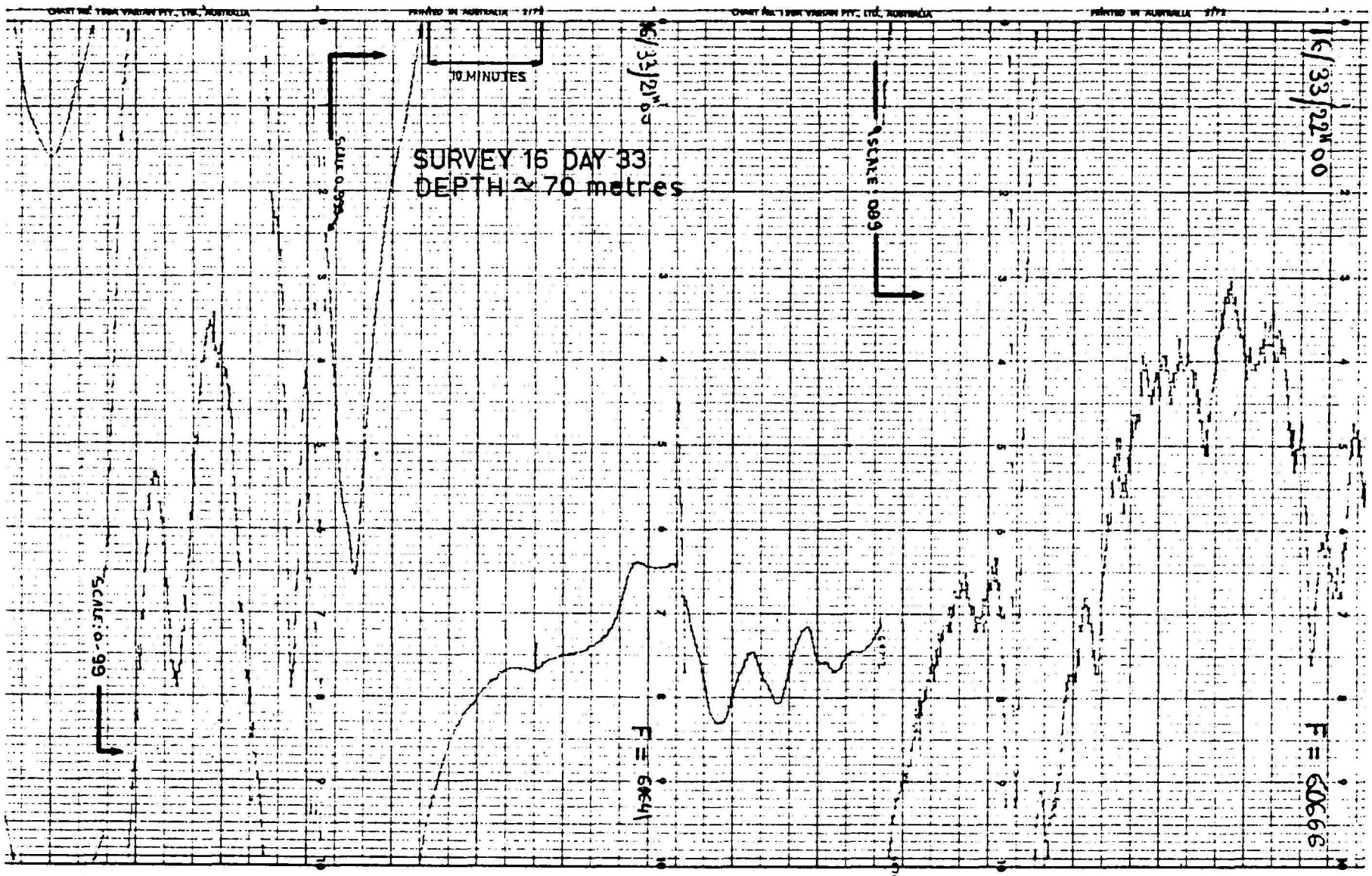
Fig. E

CROSS COUPLING COMPONENTS ANALOGUE RECORD



MAGNETIC ANALOGUE RECORD (DEEP WATER)

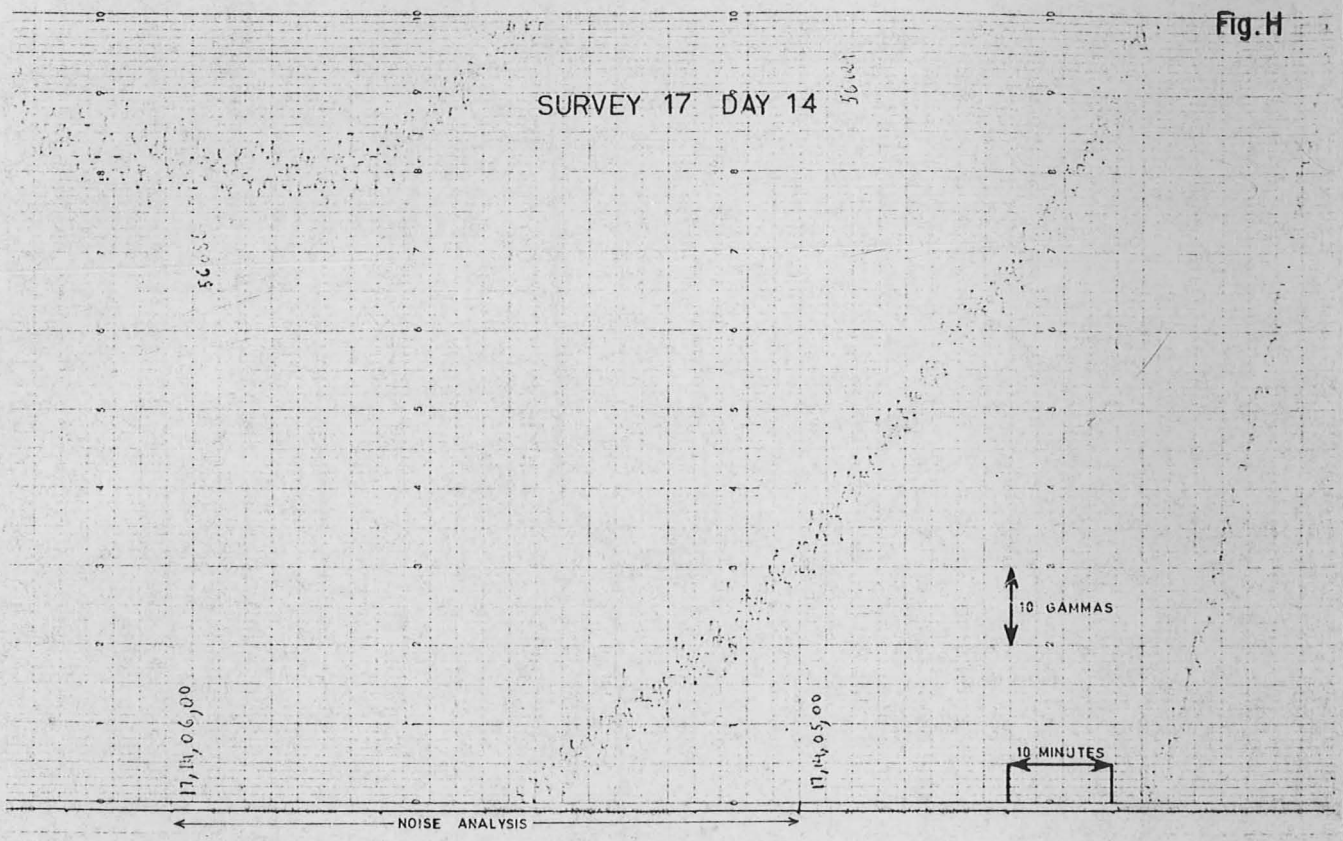
Fig.F



MAGNETIC ANALOGUE RECORD (SHALLOW WATER)

Fig. 6

Fig. H



SURVEY 17

NOISE ANALYSIS ON CHANNEL NO. 4 OF ONE HOUR BLOCK STARTING AT TIME 14.0500

NOISE IS THOSE FREQUENCIES OF PERIOD LESS THAN NOMINALLY 240 SECONDS.

NOISE RANGE = -44.4 TO 44.4

MEAN = .0

VARIANCE = 2.2

R.M.S. = 1.5

NOISE HISTOGRAM -

RANGE (GAMMAS)	PERCENT IN RANGE	CUMULATIVE	HISTOGRAM - ONE PRINT POSITION = 1 PERCENT.
-99.	0.0	0.0	
-40.	0.0	0.0	
-35.	0.0	0.0	
-30.	0.0	0.0	
-25.	0.0	0.0	
-20.	0.0	0.0	
-15.	0.0	0.0	
-10.	0.0	0.0	
-5.	48.1	48.1	
0.	51.9	100.0	
5.	0.0	100.0	
10.	0.0	100.	
15.	0.0	100.0	
20.	0.0	100.0	
25.	0.0	100.0	
30.	0.0	100.	
35.	0.0	100.0	
40.	0.0	100.	
45.	0.0	100.	
50.	0.0	100.	

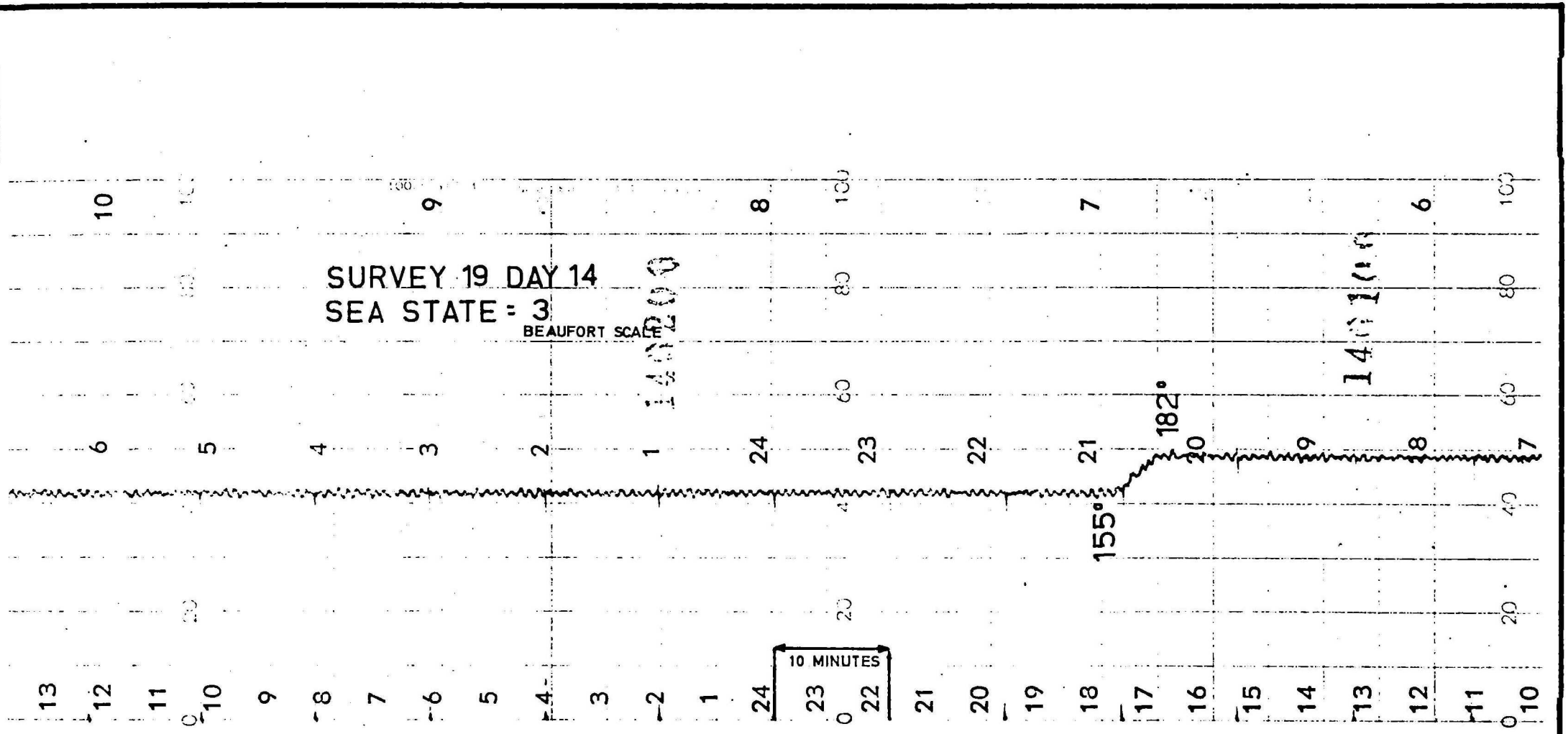
DEPTHS AT 10 MIN TO INTERVALS - 4402. 4867. 5001. 5013. 5200. 5233.

SINE OF COURSE AT 10 MINUTE INTERVALS - -.99985 -1.00000 -1.00000 -1.00000 -.99939 -.99985

COSINE OF COURSE AT 10 MINUTE INTERVALS - -.01745 -.00000 -.00000 -.00000 -.03490 -.01745

MAGNETIC ANALOGUE RECORD

AND NOISE ANALYSIS OF THE TIME OF RECORDING

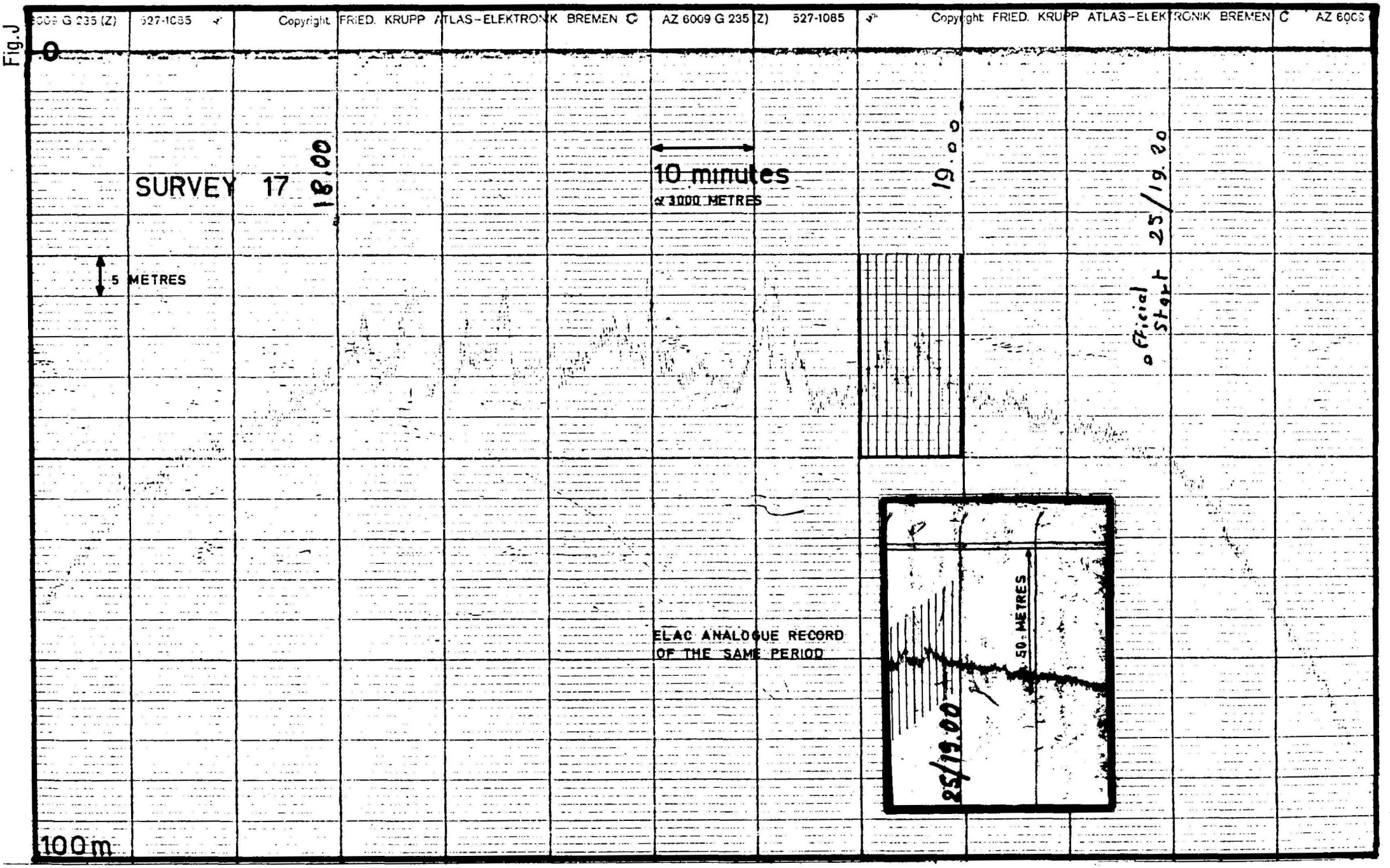


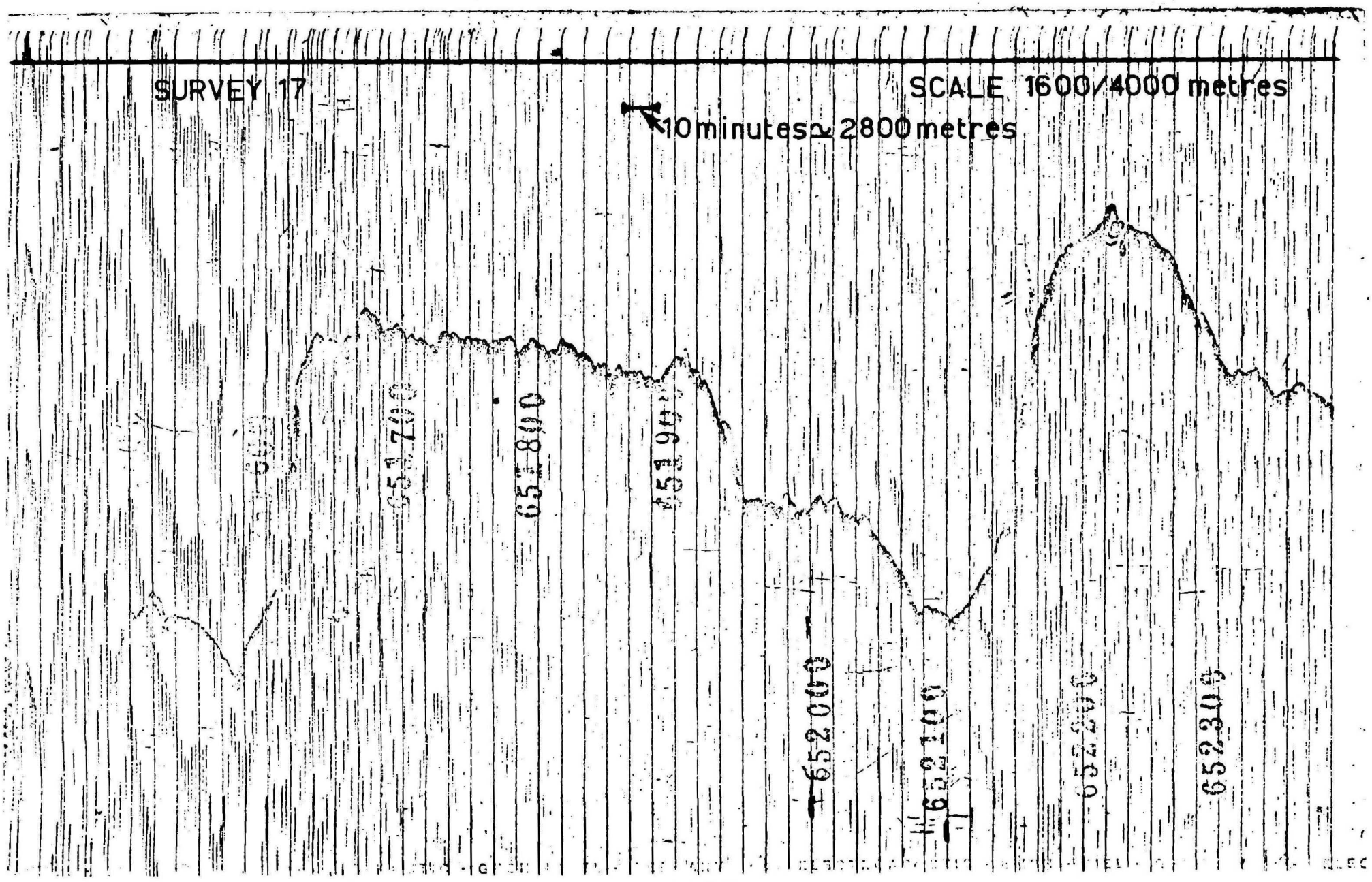
HEADING ANALOGUE RECORD

Fig. 1

ATLAS ANALOGUE RECORD

Fig.J

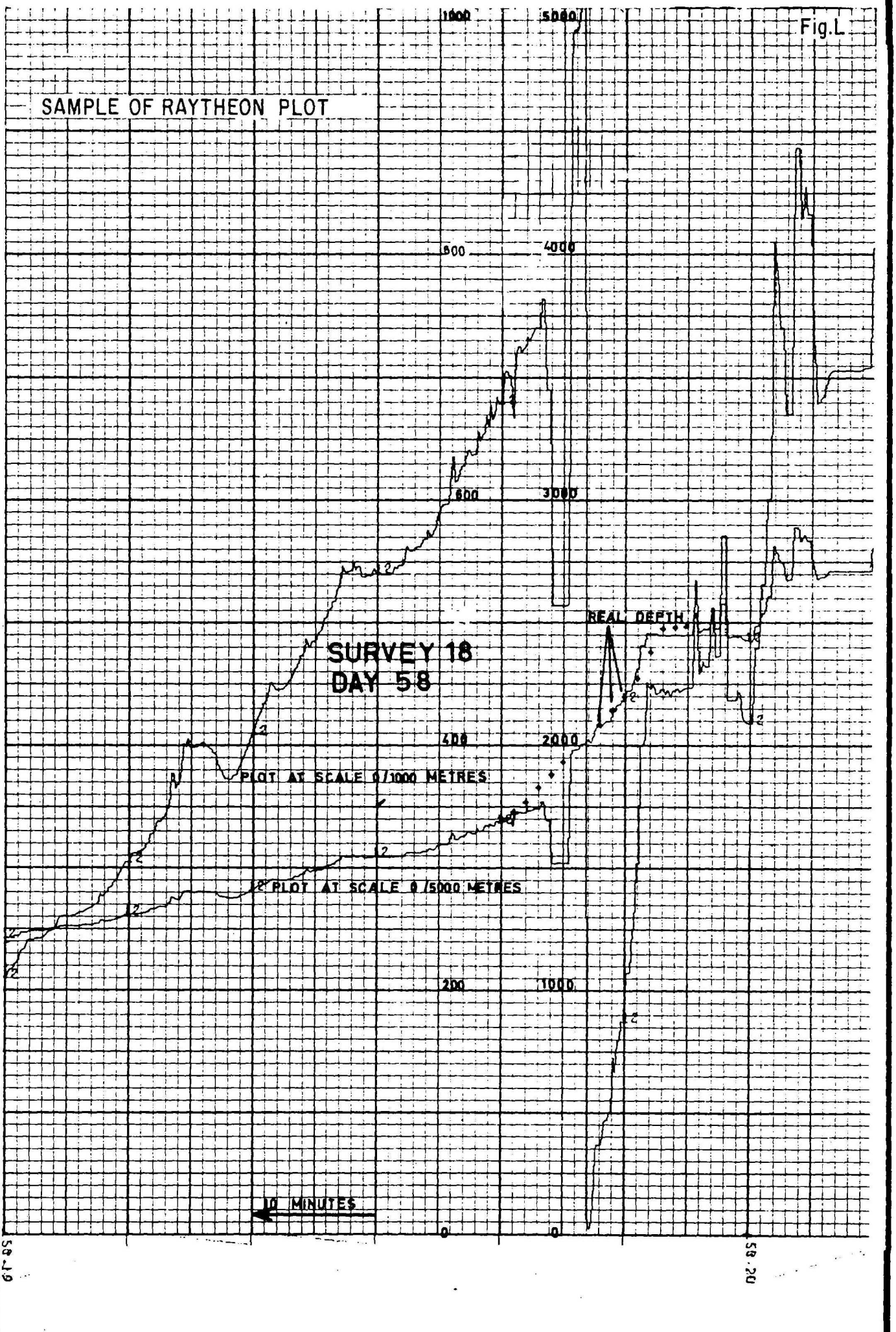


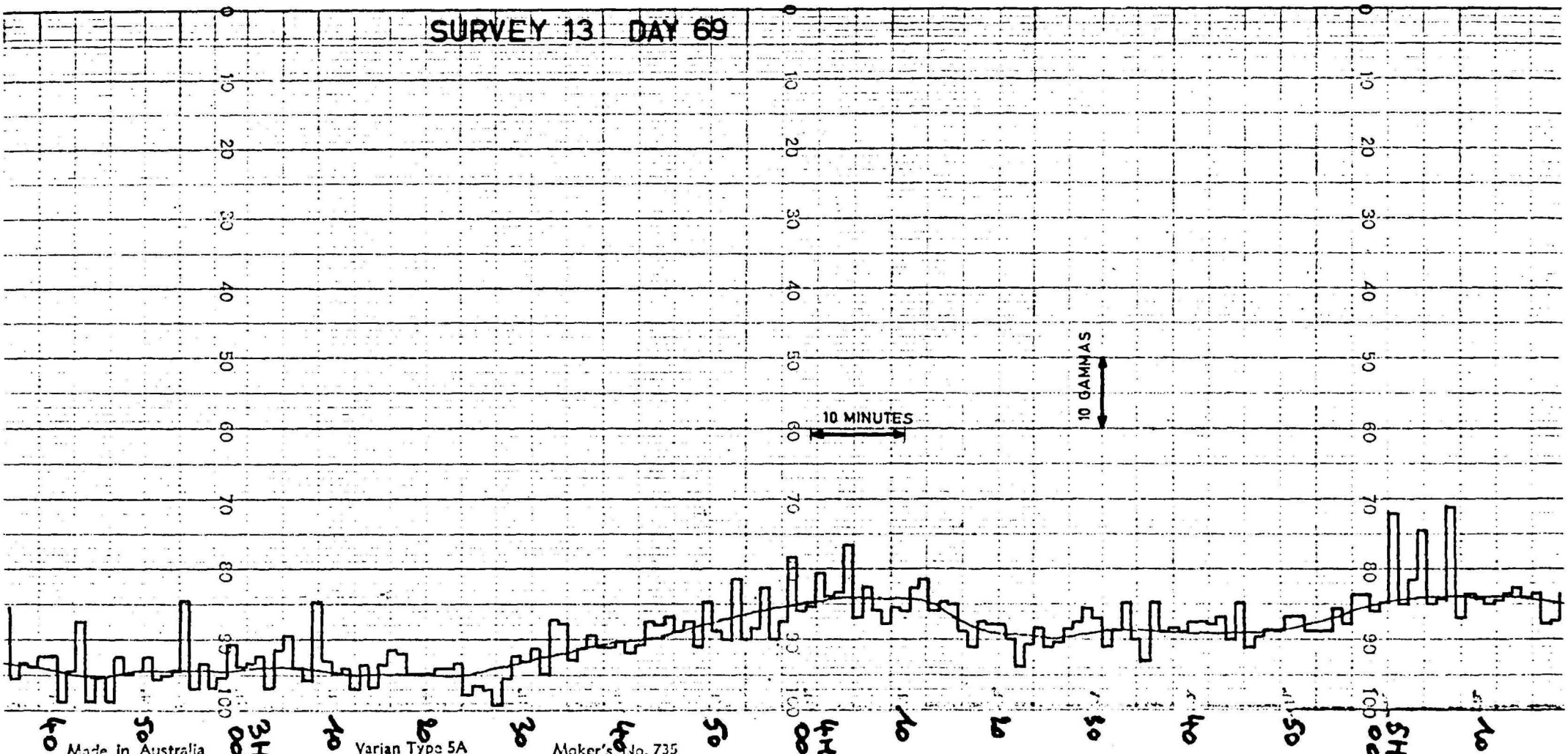


ELAC ANALOGUE RECORD

Fig.K

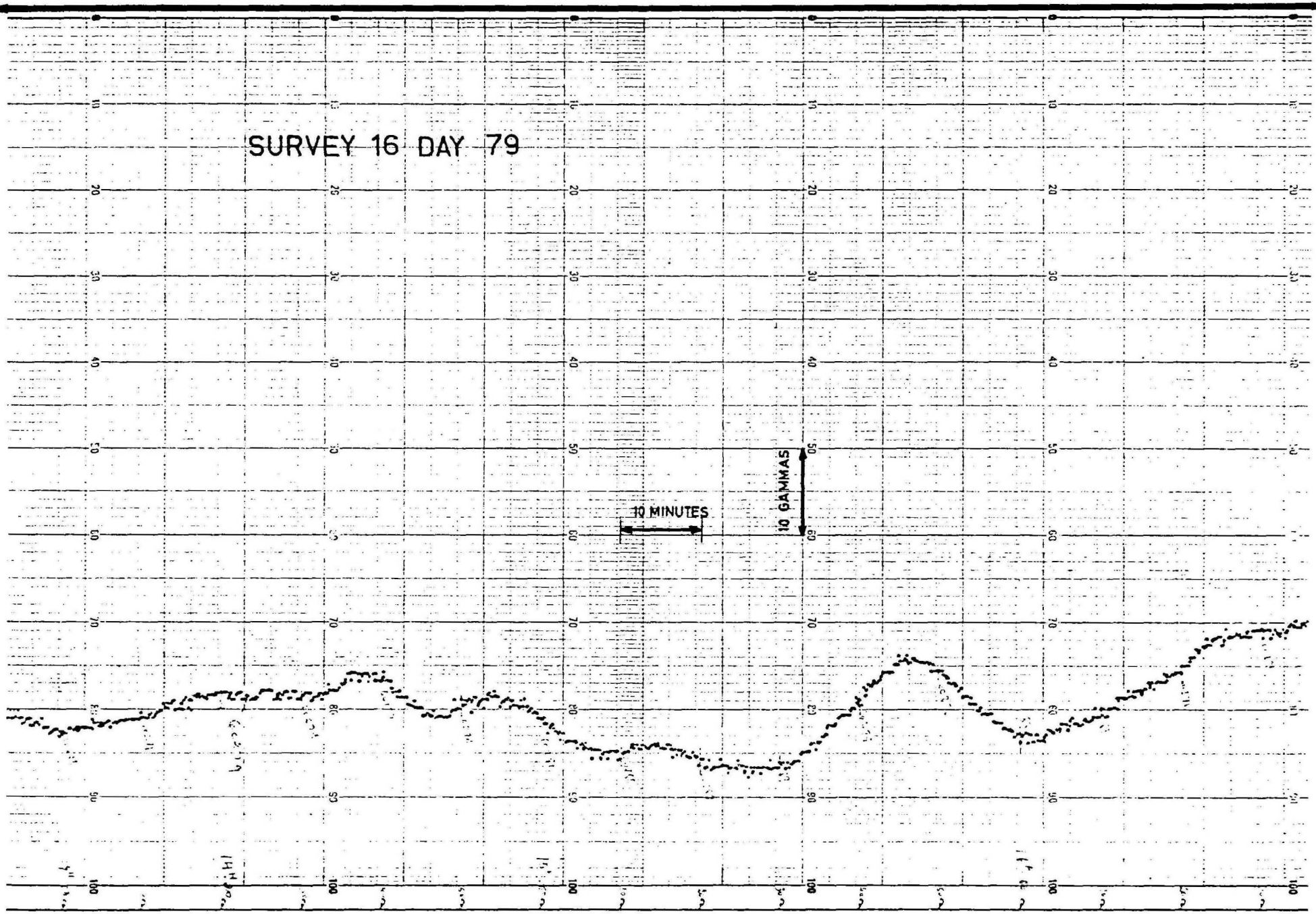
Fig.L


SAMPLE OF RAYTHEON PLOT
1000
5000
800
4000
600
3000
400
2000
200
1000
0
0
REAL DEPTH
SURVEY 18
DAY 58
PLOT AT SCALE 0/1000 METRES
PLOT AT SCALE 0/5000 METRES
10 MINUTES
58.19
58.20



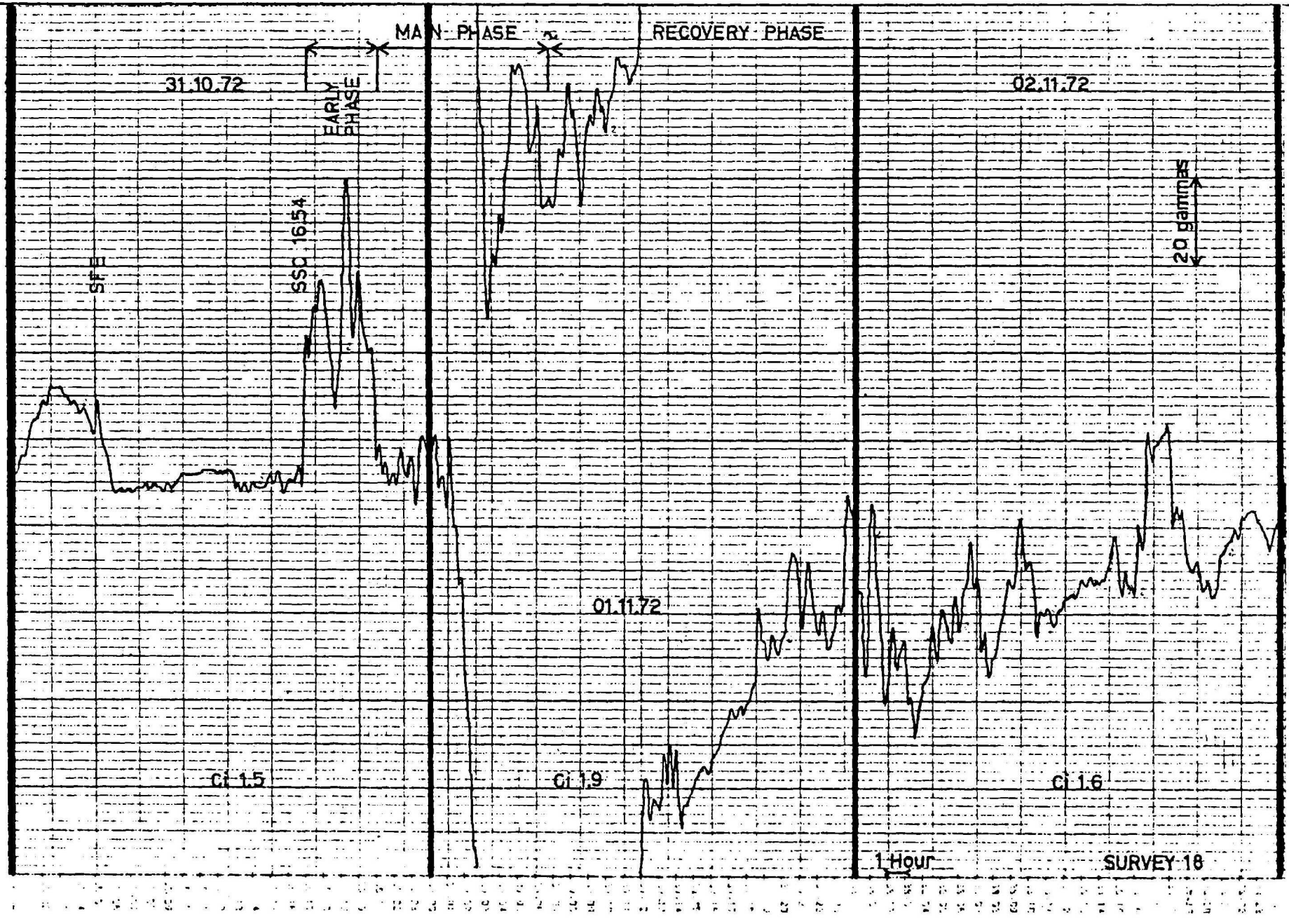
SHORE STATION MAGNETIC ANALOGUE RECORD

Fig.M



SHORE STATION MAGNETIC ANALOGUE RECORD

Fig. N

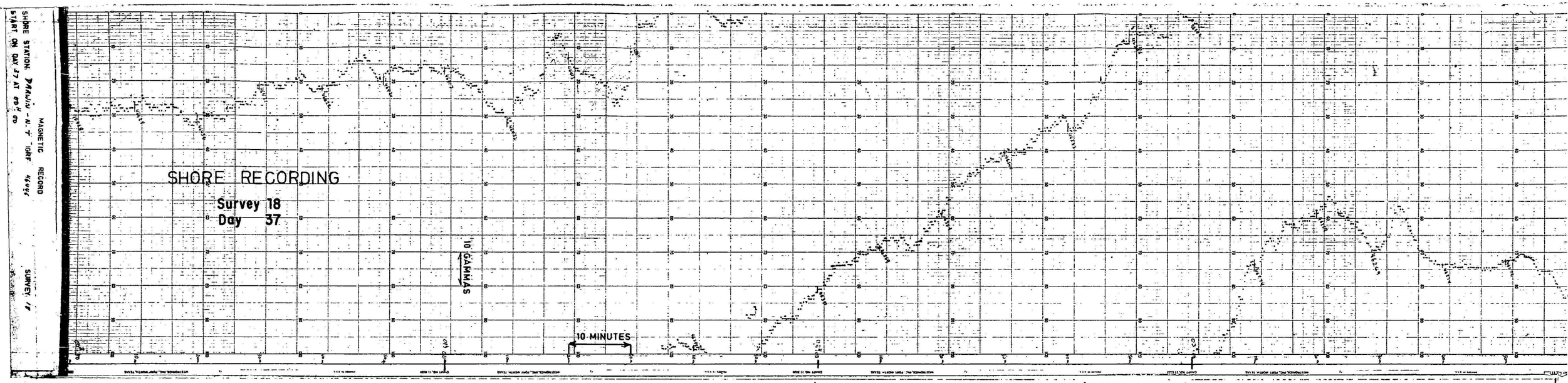


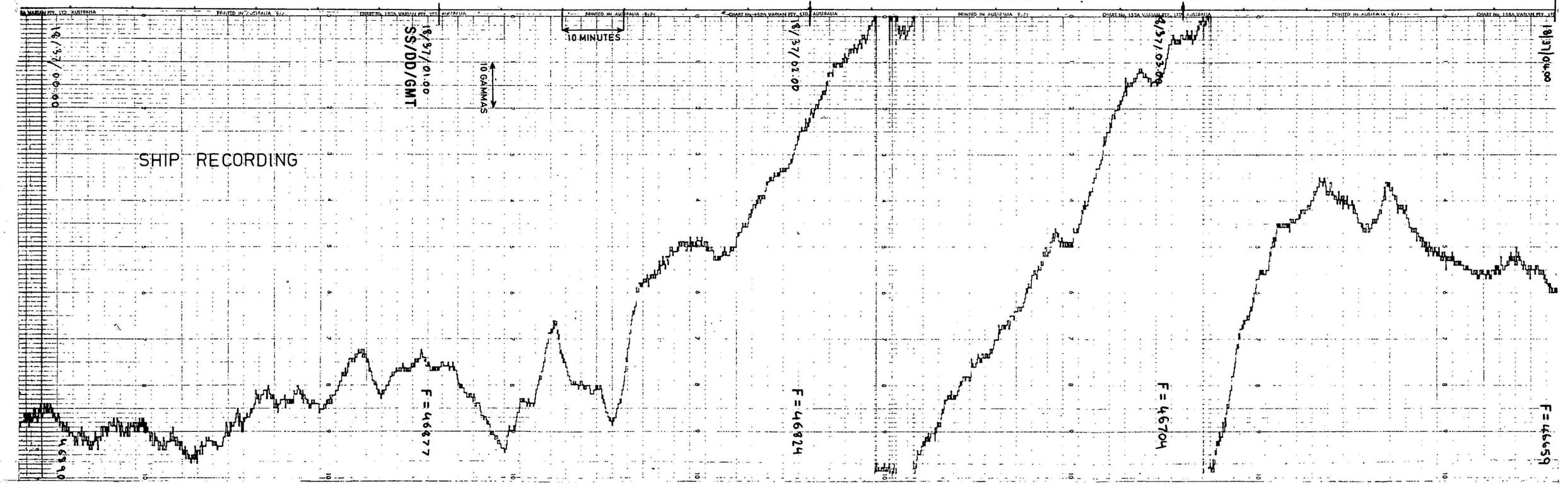
SHOPLOT (MAGNETIC SHORE - STATION • DARWIN)

Fig. 0

Fig. P

MAGNETIC STORM RECORDED ON THE SHIP AND SHORE STATIONS





APPENDIX 2

The purpose of this appendix is to remind the reader of how to calculate standard deviation in the following case : if a series of observations consists of n component series with standard deviations σ_1, σ_2, ... σ_n and means diverging from the general mean of the whole series by d_1, d_2, ... d_n, the standard deviation of the whole series given (using m to denote any subscript) by the equation.

$$N\sigma^2 = \sum_m (N_m \sigma_m^2) + \sum_m (N_m d_m^2$$

This formula has been used to compute the standard deviation of the misties of the whole survey, from the standard deviation of each area.

The mean is computed as follows :

$$NM = \sum_m N_m M_m$$

PLOTTED 73/07/17

AUSTRALIA 1: 2500000

BISMARCK SEA
AND GULF OF PAPUA



Based on PNG/80-46

KILOMETRES 50 0 50 100 150 200 250

NAUTICAL MILES 0 50 100

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BISMARCK SEA

AND GULF OF PAPUA

AREA 1

PNG/B8-72-1

BUREAU OF MINERAL RESOURCES ENCL. 1

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY DATA

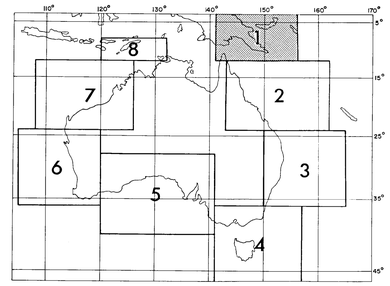
DISTRIBUTION OF DATA QUALITY
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- 2 mGAL < NOISE LEVEL ≤ 6 mGAL
- 6 mGAL < NOISE LEVEL ≤ 10 mGAL
- 10 mGAL < NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

H-3000 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

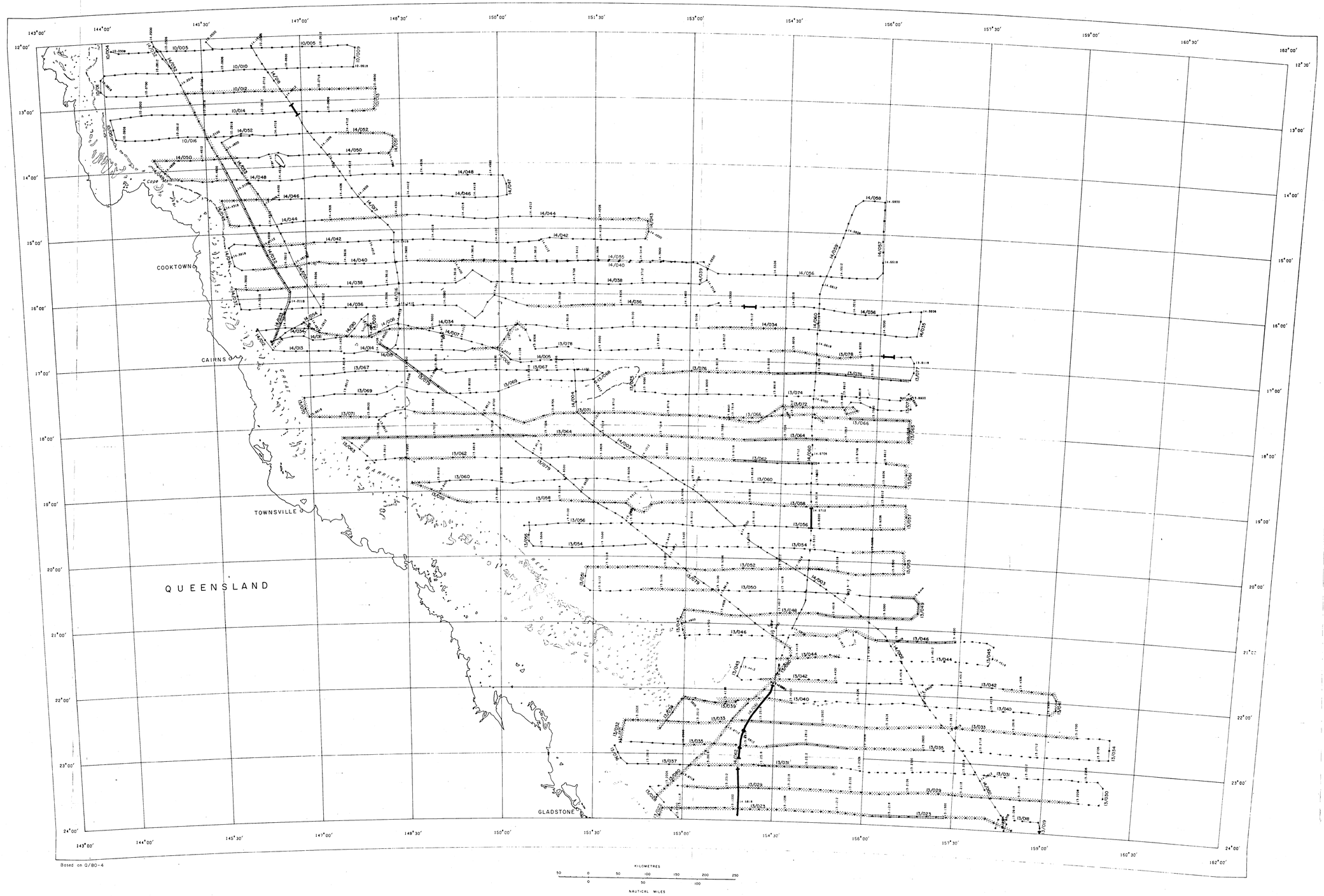


COMPAGNIE GENERALE DE GEOPHYSIQUE

CORAL SEA

PLOTTED 73/08/14

AUSTRALIA 1: 2500000



Based on Q/80-4

KILOMETRES 50 0 50 100 150 200 250

NAUTICAL MILES 0 50 100

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

CORAL SEA

AREA 2

Q/88-21-1

BUREAU OF MINERAL RESOURCES ENCL. 2

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY DATA

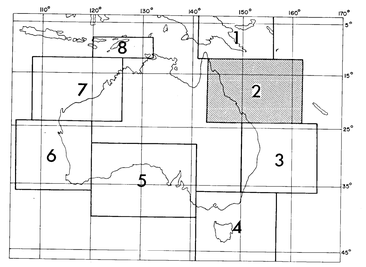
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DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

H.3404 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

TASMAN SEA

PLOTTED 73/08/14

AUSTRALIA 1 : 2500000



Based on N/80-4

BUREAU OF MINERAL RESOURCES ENCL. 3

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY DATA

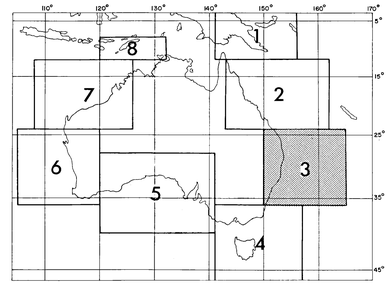
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DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

H-3400 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0 AND 36° 0 SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

TASMAN SEA

AREA 3 N/88-2-1

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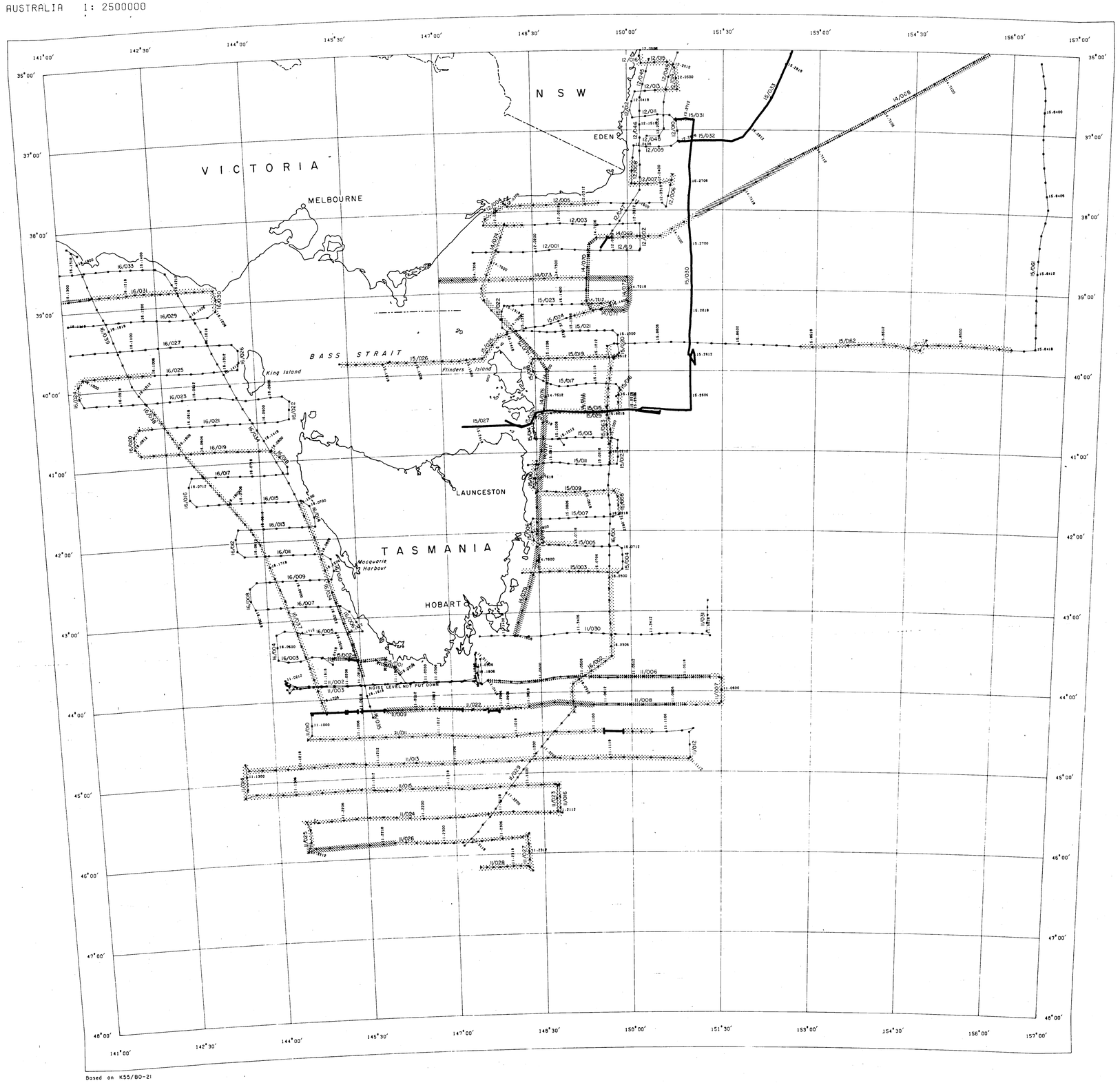
NAUTICAL MILES 0 50 100

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a lineal interpolation between these hourly positions. No adjustments have been applied for mistries at traverse intersections.

TASMANIA

PLOTTED 73/09/12

AUSTRALIA 1: 2500000



Based on K55/80-21

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TASMANIA

TRACK CHART

AREA 4

K55/88-25-1

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KILOMETRES 50 0 50 100 150 200 250
NAUTICAL MILES 0 50 100

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY DATA

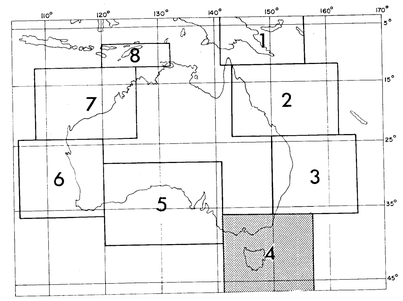
DISTRIBUTION OF DATA QUALITY
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- 2 mGAL < NOISE LEVEL ≤ 6 mGAL
- 6 mGAL < NOISE LEVEL ≤ 10 mGAL
- 10 mGAL < NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

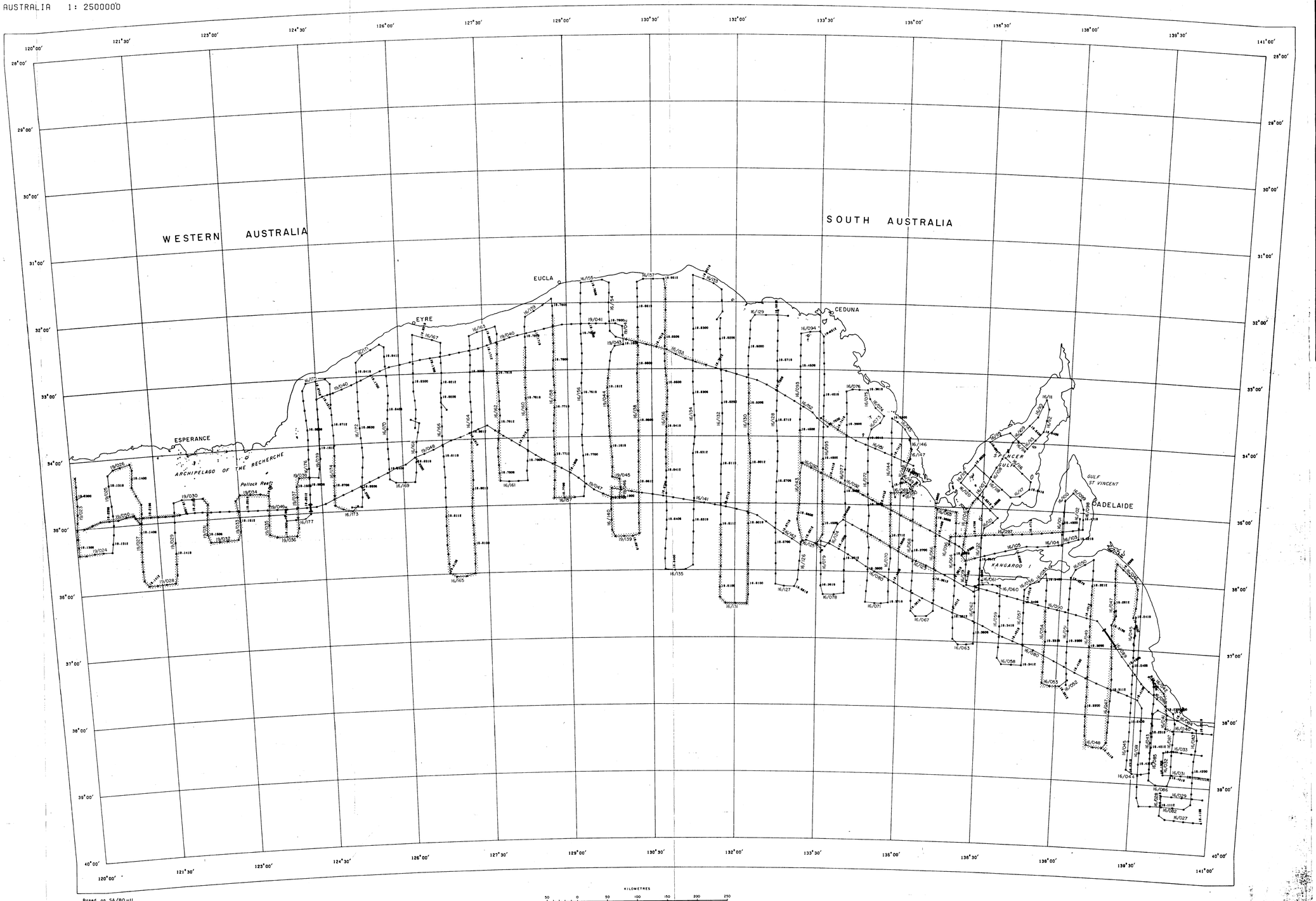


COMPAGNIE GENERALE DE GEOPHYSIQUE

GREAT AUSTRALIAN BIGHT

PLOTTED 73/07/26

AUSTRALIA 1 : 2500000



AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

GREAT AUSTRALIAN BIGHT

AREA 5

SA/88-18-1

BUREAU OF MINERAL RESOURCES ENCL. 5

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY DATA

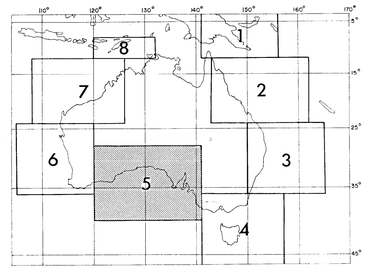
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- 6 mGAL < NOISE LEVEL ≤ 10 mGAL
- 10 mGAL < NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

14.3003 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

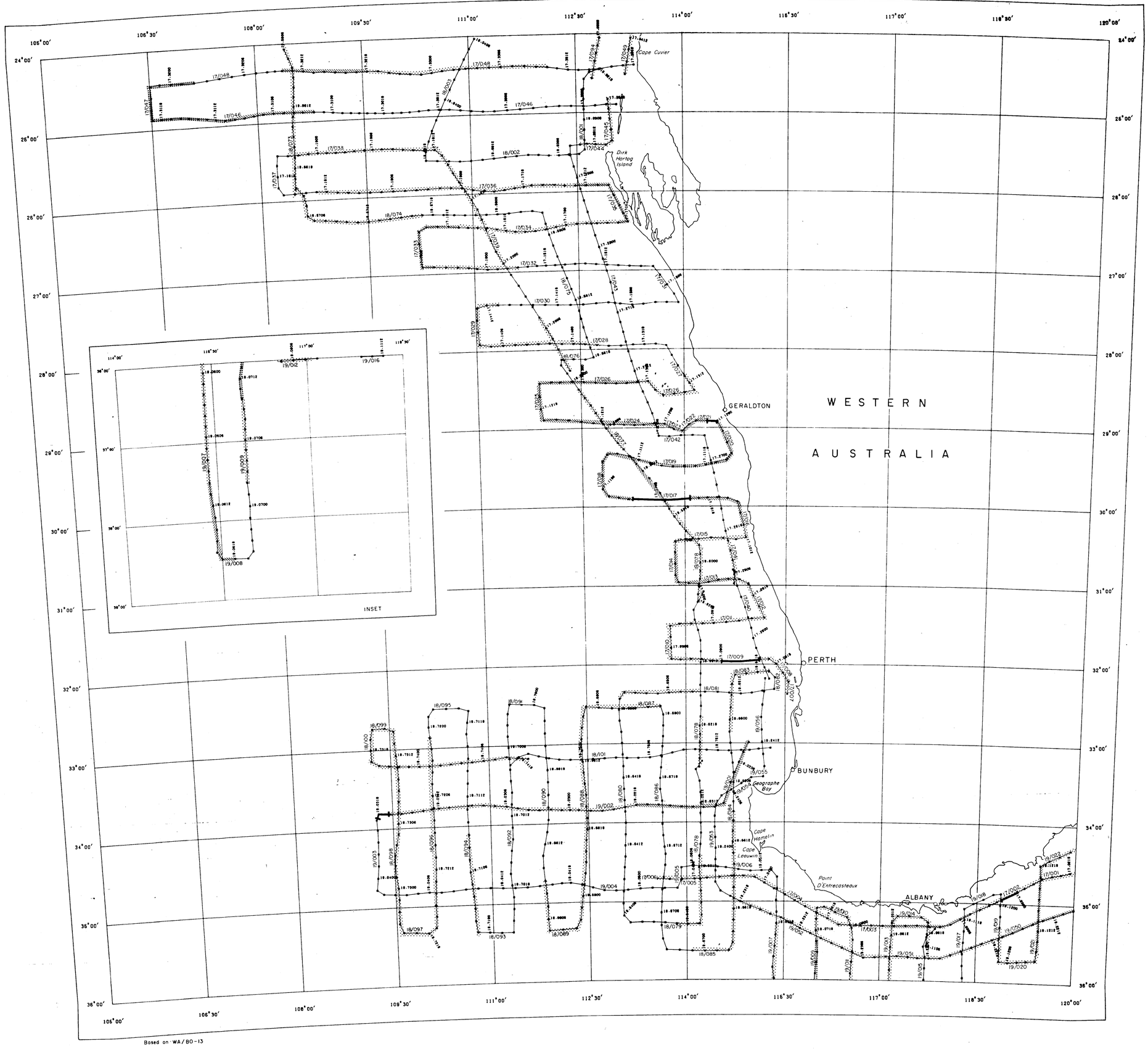


COMPAGNIE GENERALE DE GEOPHYSIQUE

SOUTHWESTERN MARGINS

PLOTTED 73/07/26

AUSTRALIA 1: 2500000



Based on WA/80-13

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY DATA

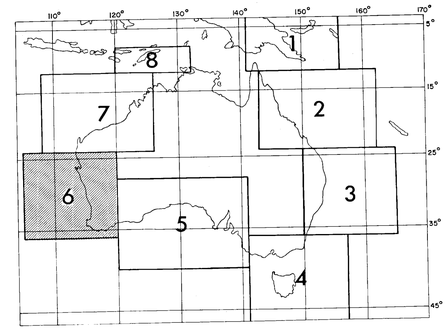
DISTRIBUTION OF DATA QUALITY
- 0 mGAL < NOISE LEVEL ≤ 2 mGAL
- 2 mGAL < NOISE LEVEL ≤ 6 mGAL
- 6 mGAL < NOISE LEVEL ≤ 10 mGAL
- 10 mGAL < NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

14.3906 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

B.M.R. 1970-73 MARINE SURVEYS

SOUTHWESTERN MARGINS

TRACK CHART

AREA 6

WA/80-33-1

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

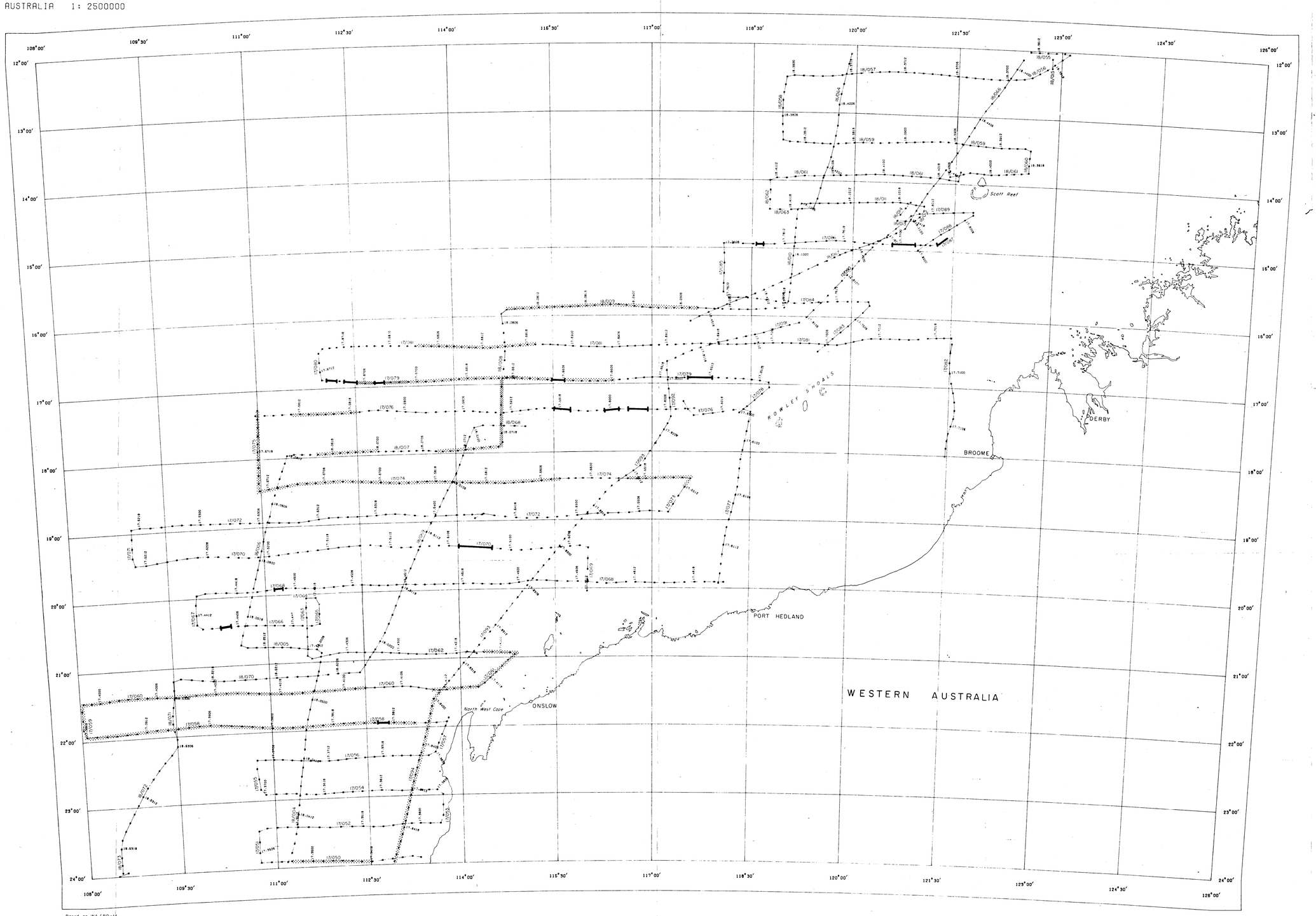
The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

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NORTH WESTERN MARGINS

PLOTTED 73/08/08

AUSTRALIA 1: 2500000



Based on WA/80-14

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

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NORTH WESTERN MARGINS

AREA 7

WA/B8-34-1

BUREAU OF MINERAL RESOURCES ENCL. 7

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY DATA

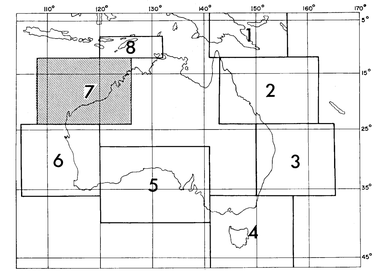
DISTRIBUTION OF DATA QUALITY
- 0 mGAL < NOISE LEVEL ≤ 2 mGAL
- 2 mGAL < NOISE LEVEL ≤ 6 mGAL
- 6 mGAL < NOISE LEVEL ≤ 10 mGAL
- 10 mGAL < NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

M.3900 EVERY 6 HOURS - SURVEY NUMBER, B.M.R DAY, TIME

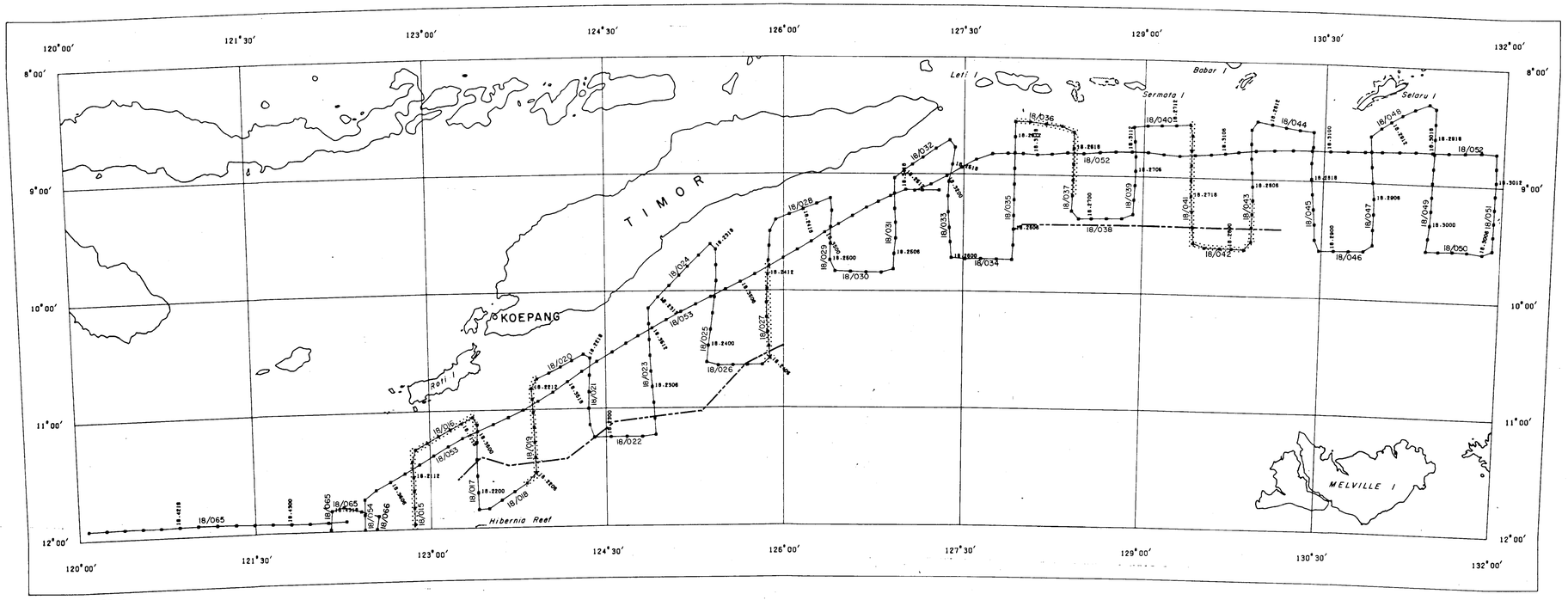


COMPAGNIE GENERALE DE GEOPHYSIQUE

TIMOR TROUGH

PLOTTED 73/08/08

AUSTRALIA 1: 2500000



Based on WA/80-15

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TIMOR TROUGH

TRACK CHART

AREA 8

WA/B8-32-1

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

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The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BUREAU OF MINERAL RESOURCES ENCL.8

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

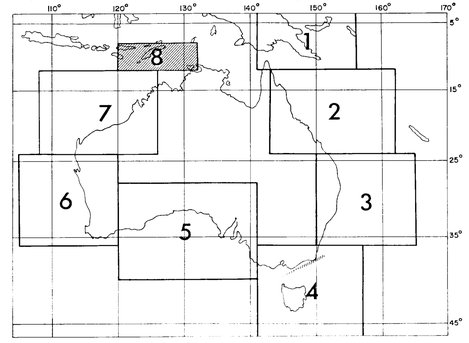
GRAVITY DATA

DISTRIBUTION OF DATA QUALITY
- 0 mGAL < NOISE LEVEL ≤ 2 mGAL
- 2 mGAL < NOISE LEVEL ≤ 6 mGAL
- 6 mGAL < NOISE LEVEL ≤ 10 mGAL
- 10 mGAL < NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
14.3006 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

PLOTTED 73/07/17

AUSTRALIA 1: 2500000

BISMARCK SEA
AND GULF OF PAPUA



Based on PNG/80-46

KILOMETRES 50 0 50 100 150 200 250

NAUTICAL MILES 0 50 100

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BISMARCK SEA
AND GULF OF PAPUA
AREA 1

PNG/B8-72-1

BUREAU OF MINERAL RESOURCES Encl.9

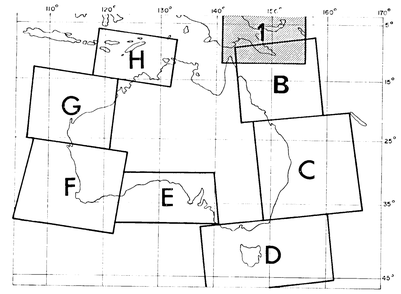
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS



COMPAGNIE GENERALE DE GEOPHYSIQUE

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

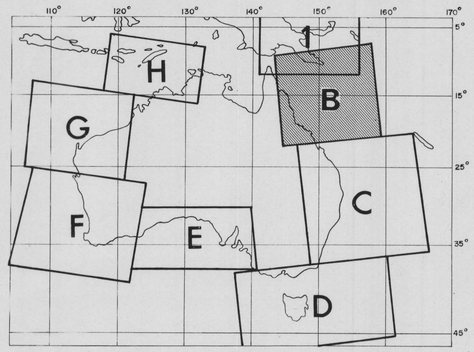
GRAVITY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS

NV+VALUE = DATA OUT OF CRITERIA ON AT LEAST ONE PROFILE OF THE CROSSING



COMPAGNIE GENERALE DE GEOPHYSIQUE

144° 147° 150° 153° 156°

12° 16° 20°

CORAL SEA

D'ENTRECASTEAUX ISLANDS

SUDEST

ROSSEL

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

GRAVITY MISCLOSURES

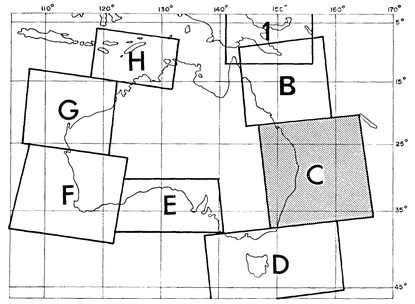
LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS

NV = VALUE = DATA OUT OF CRITERIA ON AT LEAST ONE PROFILE OF THE CROSSING

PROFILES OF SURVEY IS NOT DRAWN (NO GRAVITY DATA RECORDED)



COMPAGNIE GENERALE DE GEOPHYSIQUE

BUREAU OF MINERAL RESOURCES Encl. 12

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

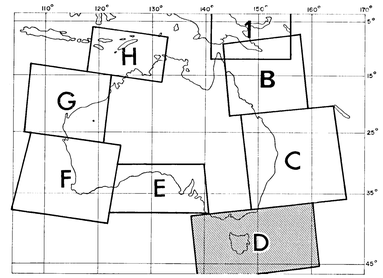
GRAVITY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS

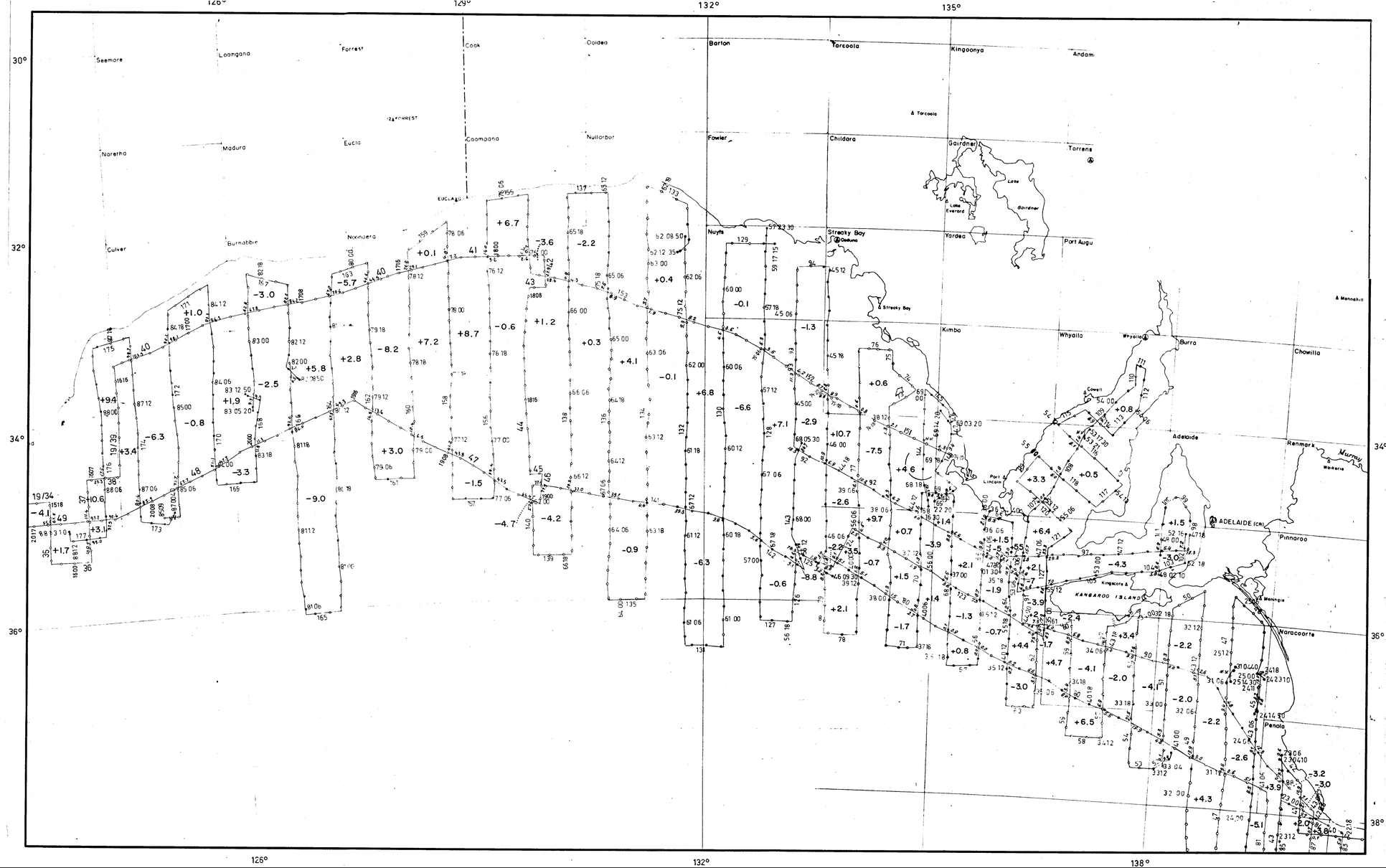
NV = VALUE + DATA OUT OF CRITERIA ON AT LEAST ONE PROFILE OF THE CROSSING



COMPAGNIE GENERALE DE GEOPHYSIQUE

SURVEY II lines 01 to 32
12 01 to 10, 46 to 49
14 66 to 79
15 01 to 30, 32, 33, 61 to 63
16 01 to 34 (no lines 35-36) 37 to 40, 43 to 45, 47 to 49 81 to 83, 85 to 87

138° 144° 150° 156° 40° 44° 38° 43°S 43°27.5 43°46 43°35 43°49 43°42.5 43°52 43°50 43°55 144°36 145° 145°30 146° 146°30 147° 147°10 147°40 144° 150° 156°



BUREAU OF MINERAL RESOURCES

Encl.13

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

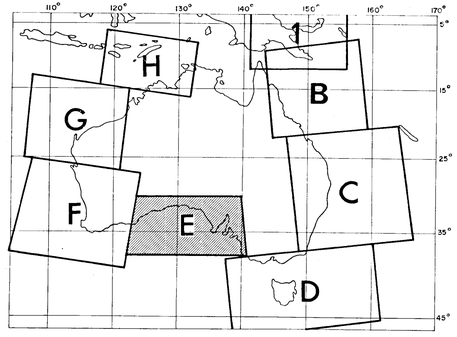
GRAVITY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS

NV+VALUE = DATA OUT OF CRITERIA ON AT LEAST ONE PROFILE OF THE CROSSING



COMPAGNIE GENERALE DE GEOPHYSIQUE

BUREAU OF MINERAL RESOURCES

Encl. 14

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

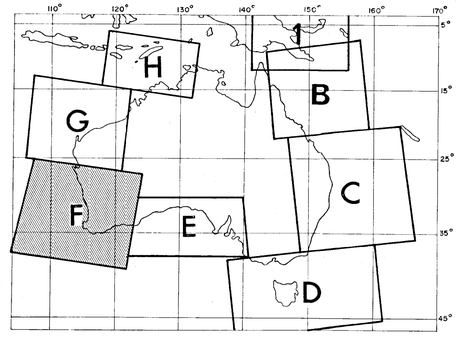
GRAVITY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS

NV = VALUE = DATA OUT OF CRITERIA ON AT LEAST ONE PROFILE OF THE CROSSING



COMPAGNIE GENERALE DE GEOPHYSIQUE

108°
114°
117°
120°
123°
28°
32°
36°
Duketon
Sandstone
Sir Samuel
Murgoo
Cue
Austin
Loverton
Rason
Kirkalocka
21 MT MAGNET
Yowanmi
Leonora
Yalgoo
15 LAVERTON
Edjudina
Minigwal
Menzies
Mullewa
Geraldton
Ninghan
Barlee
L. Ballard
Perenjori
L. Moore
Kurnalpi
Gundeelee
Jackson
Kalgoorlie
Bencubbin
Moora
19 MOTHERCOO
KALGOORLIE 34
BOULDER
Zanthus
Widgemooltha
Southern Cross
Boorabbin
Keller berrin
16 MERREDIN
L. Cowan
Norseman
Balladonia
Lake Johnston
Hyden
NORTHAM
Corrigin
Johnston Lakes
PERTH
FREMANTLE
Esperance
Malcolm
Ravensthorpe
Newdegate
Dumbleyung
13 ESPERANCE
Mondrain Island
Collie
BUNBURY
Busselton
Bremer Bay
BRIDGETOWN
Mount Barker
Pemberton
Augusta
ALBANY
Albany
Hill River
Perth

BUREAU OF MINERAL RESOURCES

Encl. 15

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

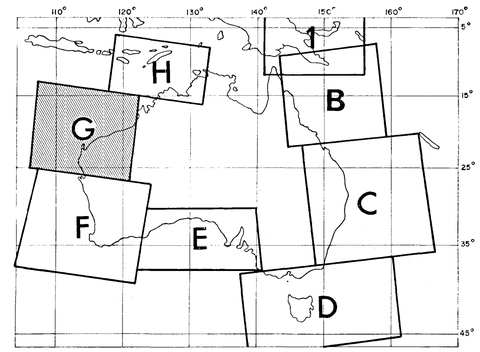
GRAVITY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS

NV+VALUE = DATA OUT OF CRITERIA ON AT LEAST ONE PROFILE OF THE CROSSING



COMPAGNIE GENERALE DE GEOPHYSIQUE

111°
114°
117°
120°
17°
20°
23°
26°
108°
Pander
Broome
La Grange
Bedout Island
Munro
Mandora
Anketell
Yarrie
Port Hedland
Roebourne
Dampier
Barrow Island
BARROW I.
Marble Bar
Nullagine
Pyramid
Yarraloola
Onslow
Wyloo
Mt Bruce
Roy Hill
Balfour Downs
HAMERSLEY RANGE
Fortescue River
Ashburton
Turee Creek
Newman
Robertson
Edmund
Mining Pool
Minilya
Mt Egerton
Mt Phillips
Kennedy Range
Ningaloo
Yanrey
Gascoyne River
Glenburgh
Robinson Range
Cornerson Is
Shark Bay
Woorarnel
Byro
Belele
Yaringa
Carnarvon
Anna Plains
Munduwindi
Butler
+8.8
+4.9
+10.1
+7.4
+1.8
-5.0
+2.2
-4.1
+5.7
+5.1
-1.1
+4.7
-6.2
+6.6
+7.2
+1.4
-7.0
-4.5
+1.5
+4.2
-6.9
+0.8
-7.0
+3.3
-0.4
+0.9
-7.9
+6.0
+6.5
-9.7
+7.9
+7.5
+5.2
-5.2
+6.4
+4.0
-16.1
+4.0
+5.0
-2.8
-14.0
+11.7
-3.3
-6.4
+4.1
+4.8
-8.8
-8.2
-3.6
+11.1
-10.3
-0.5
-3.4
-8.2
+1.1
+3.2
-0.2
+0.3
-5.4
+8.1
-0.8
+10.6
-8.1

BUREAU OF MINERAL RESOURCES

Encl. 16

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

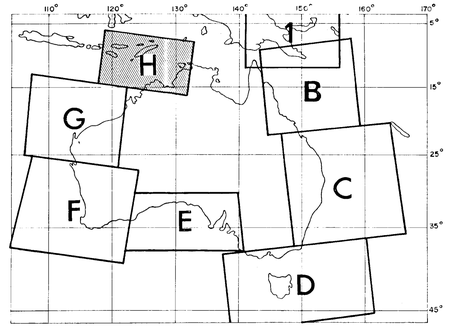
GRAVITY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN MILLIGALS

NV = VALUE = DATA OUT OF CRITERIA ON AT LEAST ONE PROFILE OF THE CROSSING

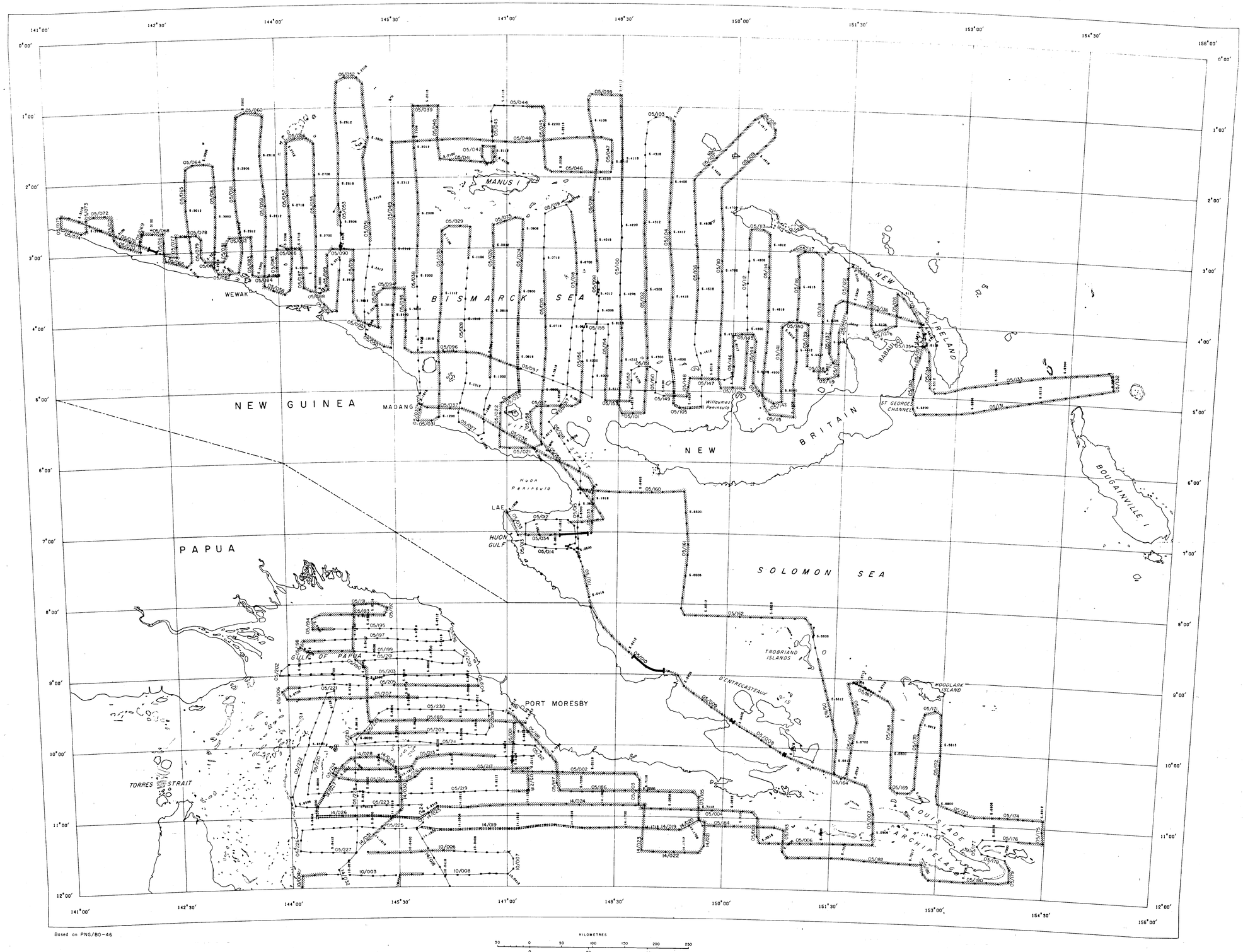


COMPAGNIE GENERALE DE GEOPHYSIQUE

PLOTTED 73/07/17

AUSTRALIA 1: 2500000

BISMARCK SEA
AND GULF OF PAPUA



Based on PNG/80-46

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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BISMARCK SEA
AND GULF OF PAPUA
AREA 1

PNG/B8-72-1

BUREAU OF MINERAL RESOURCES ENCL. 17

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC DATA

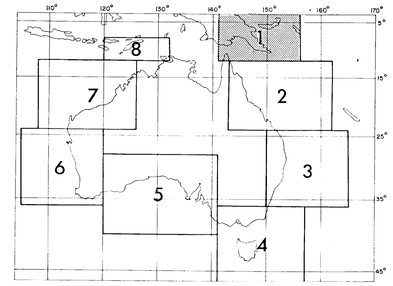
DISTRIBUTION OF DATA QUALITY
- 0 GAMMA < NOISE LEVEL < 2 GAMMAS
- 2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
- 5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

16.3404 — EVERY 6 HOURS - SURVEY NUMBER, B.M.R. DAY, TIME

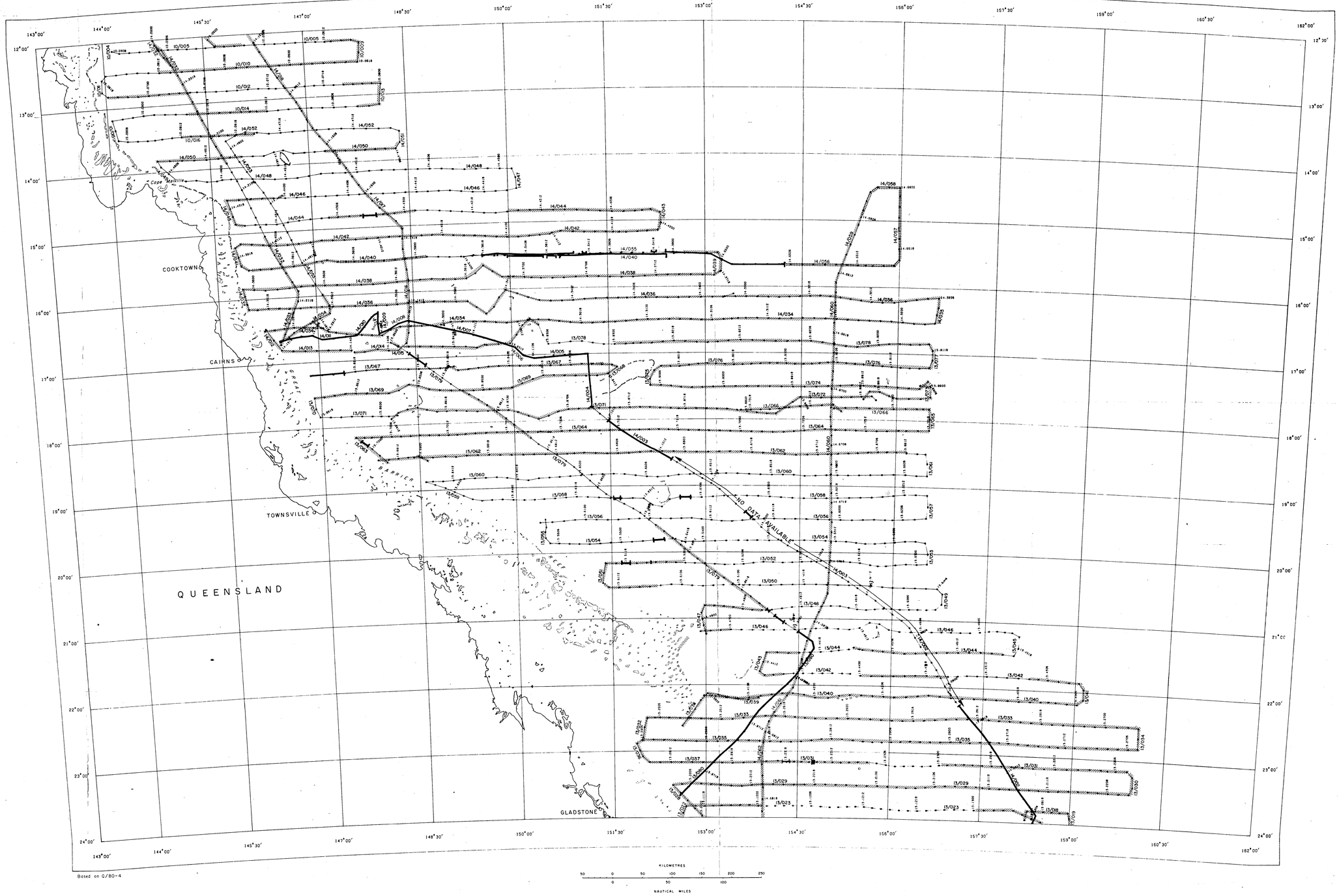


COMPAGNIE GENERALE DE GEOPHYSIQUE

CORAL SEA

PLOTTED 73/08/14

AUSTRALIA 1: 2500000



BUREAU OF MINERAL RESOURCES ENCL. 18

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC DATA

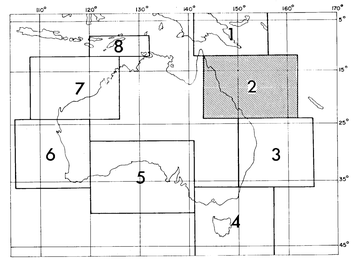
DISTRIBUTION OF DATA QUALITY
- 0 GAMMA < NOISE LEVEL < 2 GAMMAS
- 2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
- 5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

14.3004 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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CORAL SEA

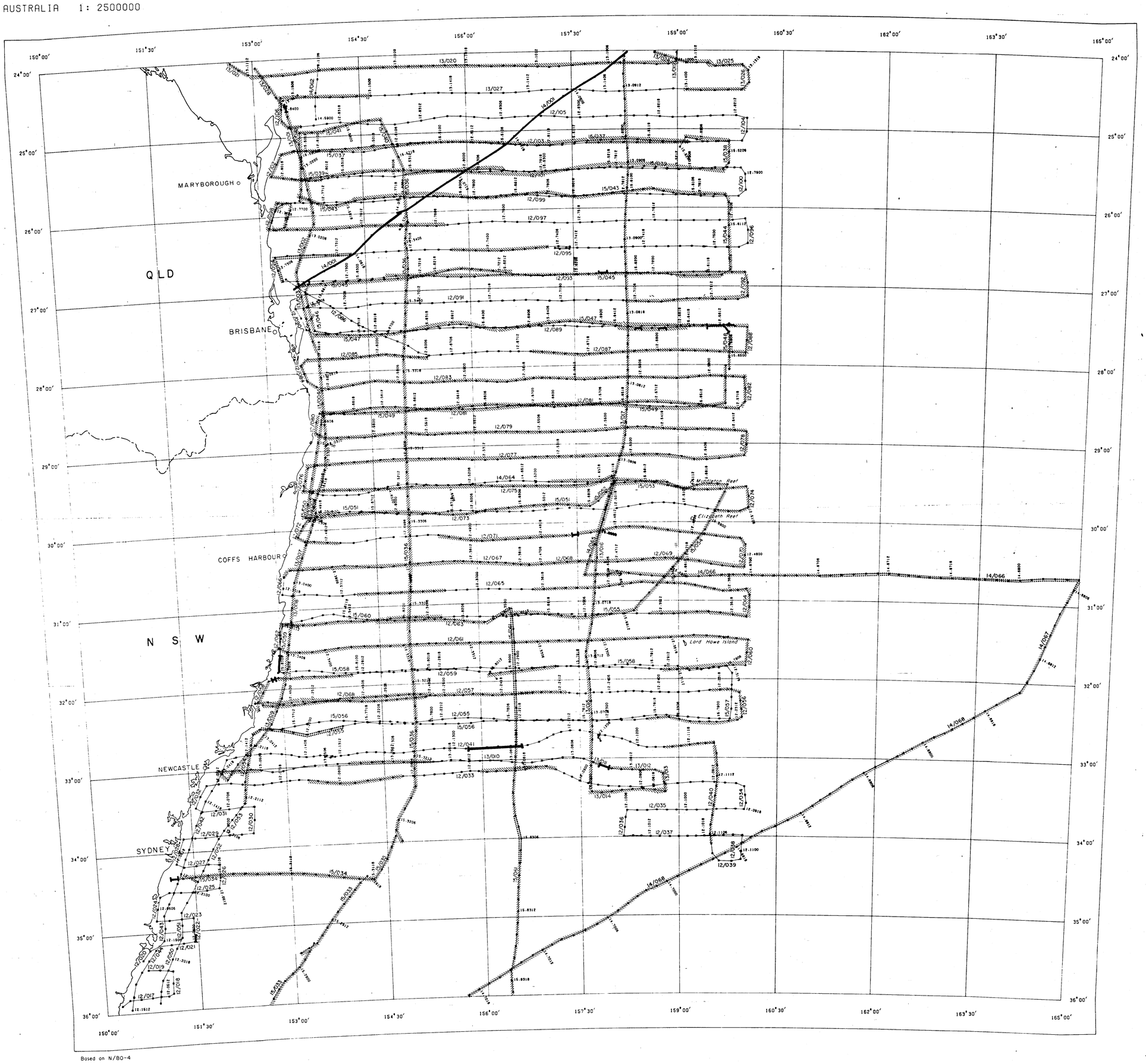
AREA 2

Q/88-21-1

TASMAN SEA

PLOTTED 73/08/14

AUSTRALIA 1: 2500000



Based on N/BO-4

BUREAU OF MINERAL RESOURCES ENCL.19

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC DATA

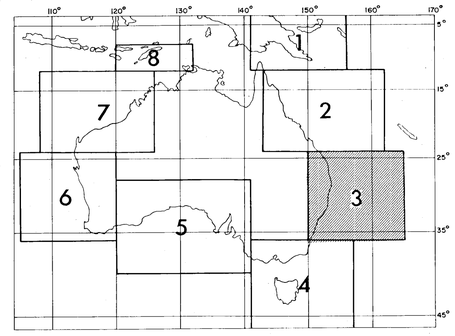
DISTRIBUTION OF DATA QUALITY
- 0 GAMMA < NOISE LEVEL < 2 GAMMAS
- 2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
- 5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

M. 24061 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TASMAN SEA

TRACK CHART

AREA 3 N/B8-2-I

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

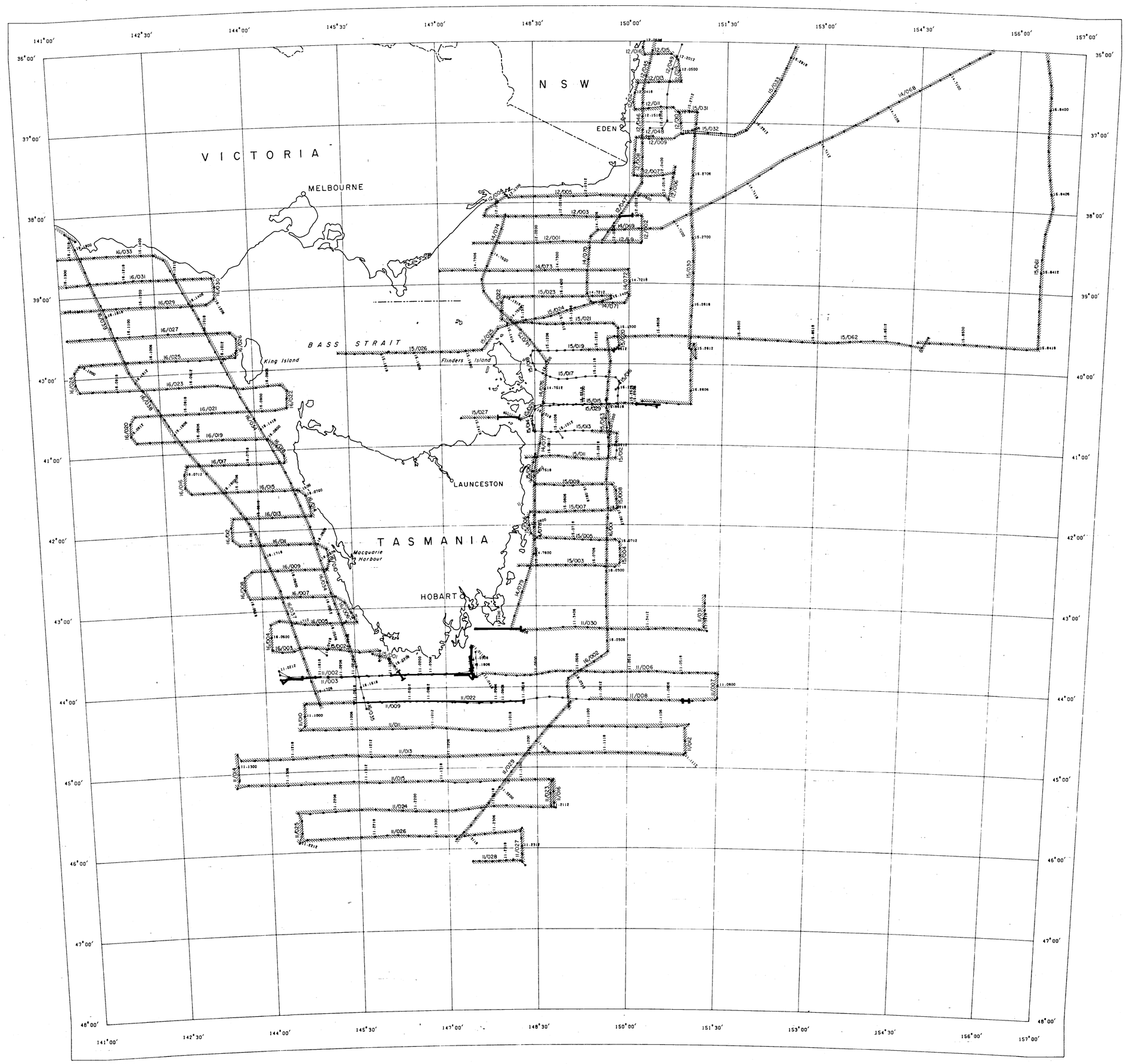
NOTE: The information contained in this map has been obtained by the Department of Minerals and Energy, as part of the policy of the Australian Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

TASMANIA

PLOTTED 73/09/12

AUSTRALIA 1: 2500000



Based on K55/80-21

BUREAU OF MINERAL RESOURCES ENCL. 20

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC DATA

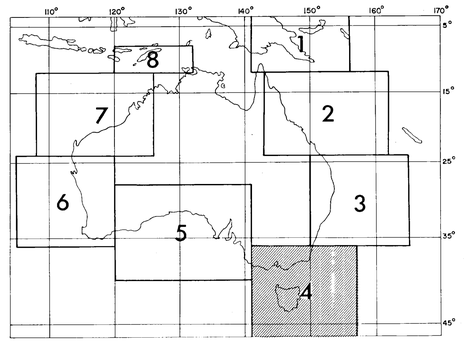
DISTRIBUTION OF DATA QUALITY
- 0 GAMMA < NOISE LEVEL < 2 GAMMAS
- 2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
- 5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

16.3004 — EVERY 6 HOURS - SURVEY NUMBER, B M R DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TASMANIA

TRACK CHART

AREA 4

K55/B8-25-1

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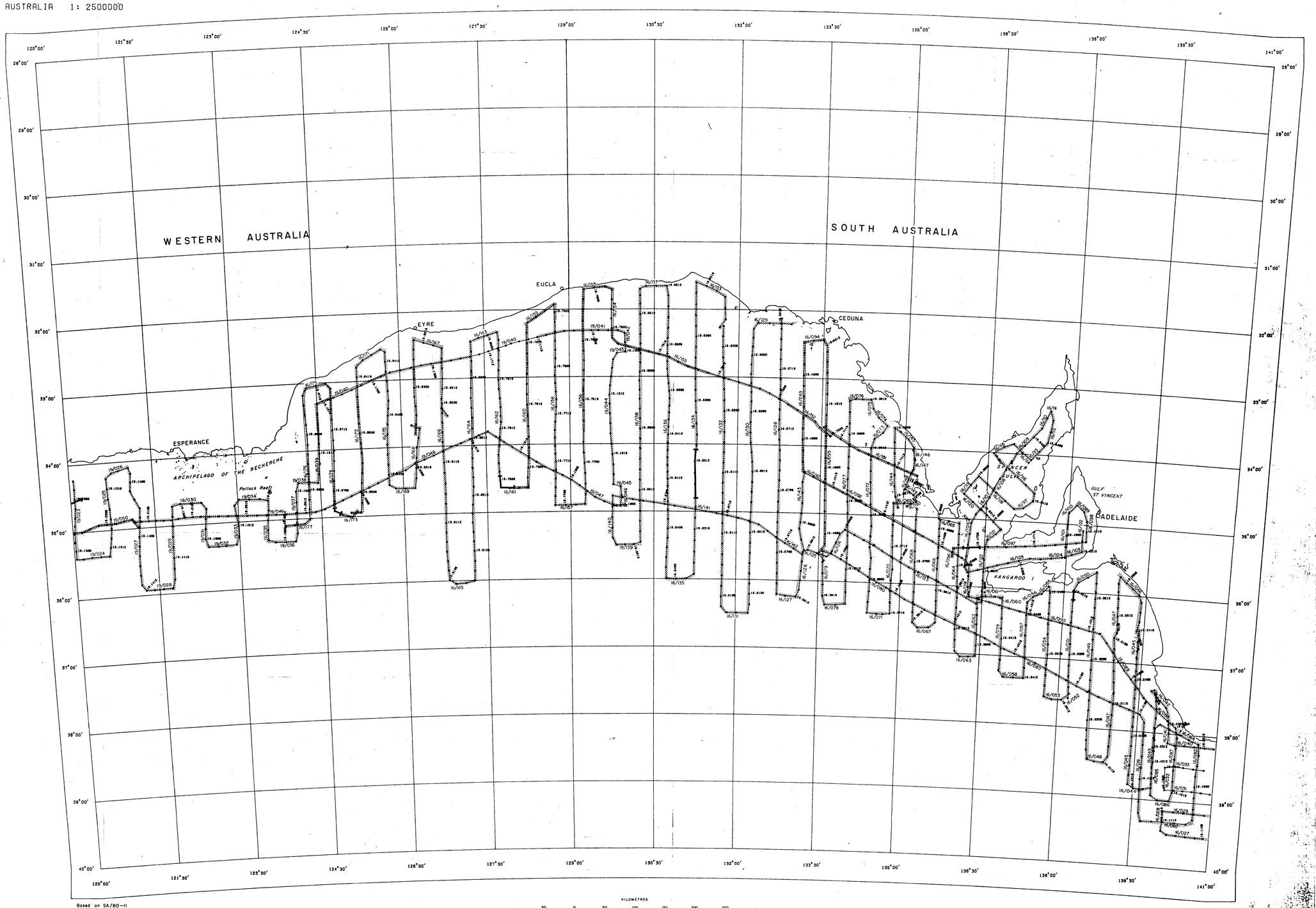
KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

GREAT AUSTRALIAN BIGHT

PLOTTED 73/07/26

AUSTRALIA 1: 2500000



Based on SA/80-11

KILOMETRES 50 0 50 100 150 200 250

NAUTICAL MILES 50 0 100

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

GREAT AUSTRALIAN BIGHT

AREA 5

SA/88-18-1

BUREAU OF MINERAL RESOURCES ENCL. 21

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

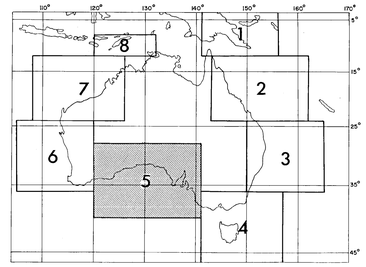
MAGNETIC DATA

DISTRIBUTION OF DATA QUALITY
- 0 GAMMA < NOISE LEVEL < 2 GAMMAS
- 2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
- 5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

16.3064 — 14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

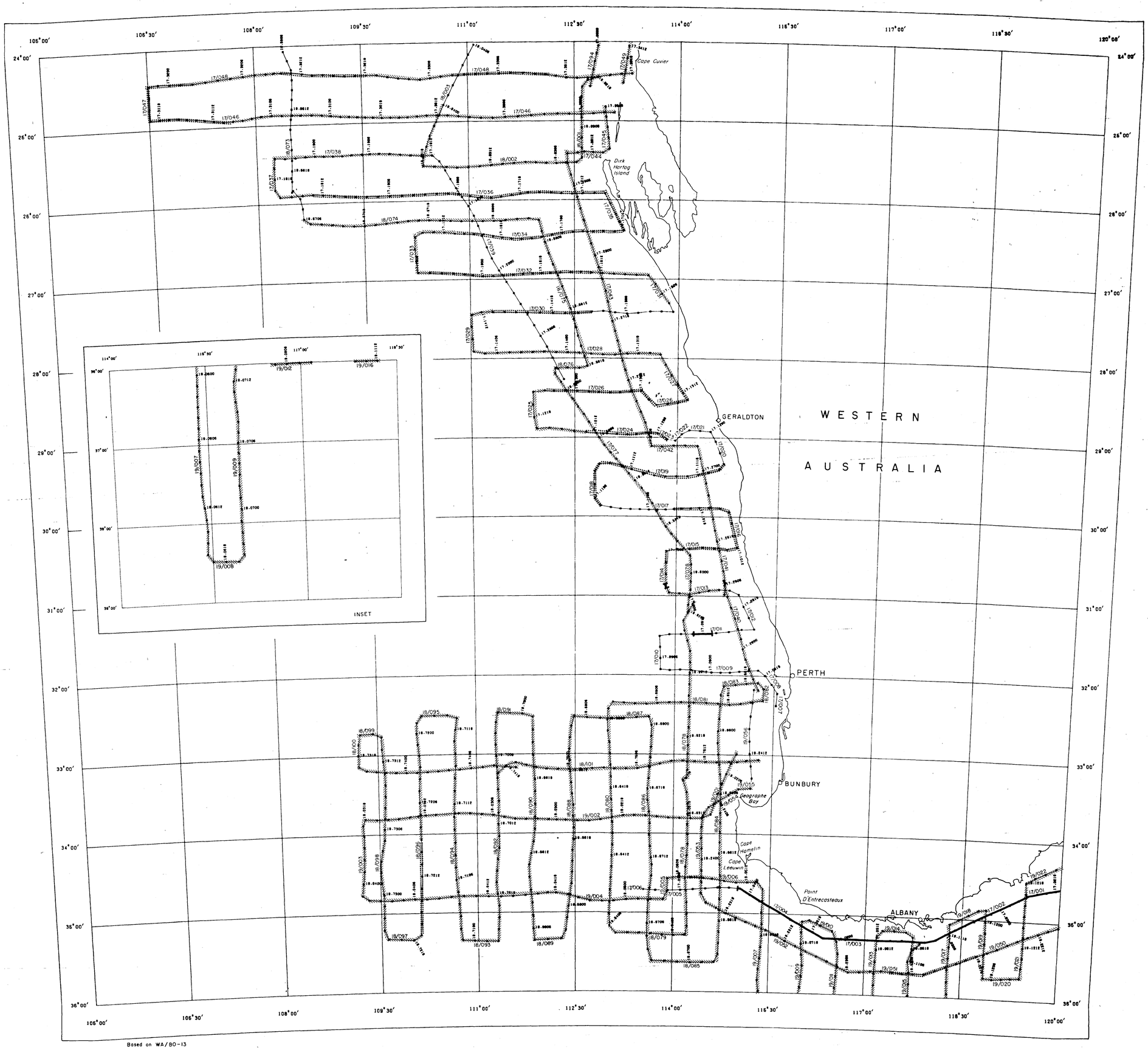


COMPAGNIE GENERALE DE GEOPHYSIQUE

SOUTHWESTERN MARGINS

PLOTTED 73/07/26

AUSTRALIA 1: 2500000



Based on WA/80-13

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC DATA

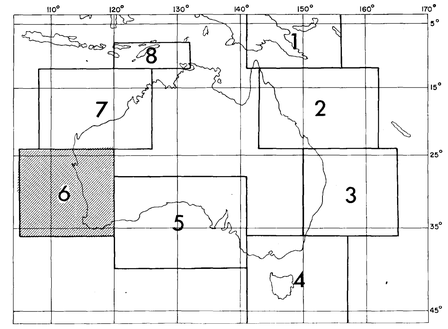
DISTRIBUTION OF DATA QUALITY
- 0 GAMMA < NOISE LEVEL < 2 GAMMAS
- 2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
- 5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

SOUTHWESTERN MARGINS

TRACK CHART

AREA 6

KILOMETRES 50 0 50 100 150 200 250

NAUTICAL MILES 0 50 100

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

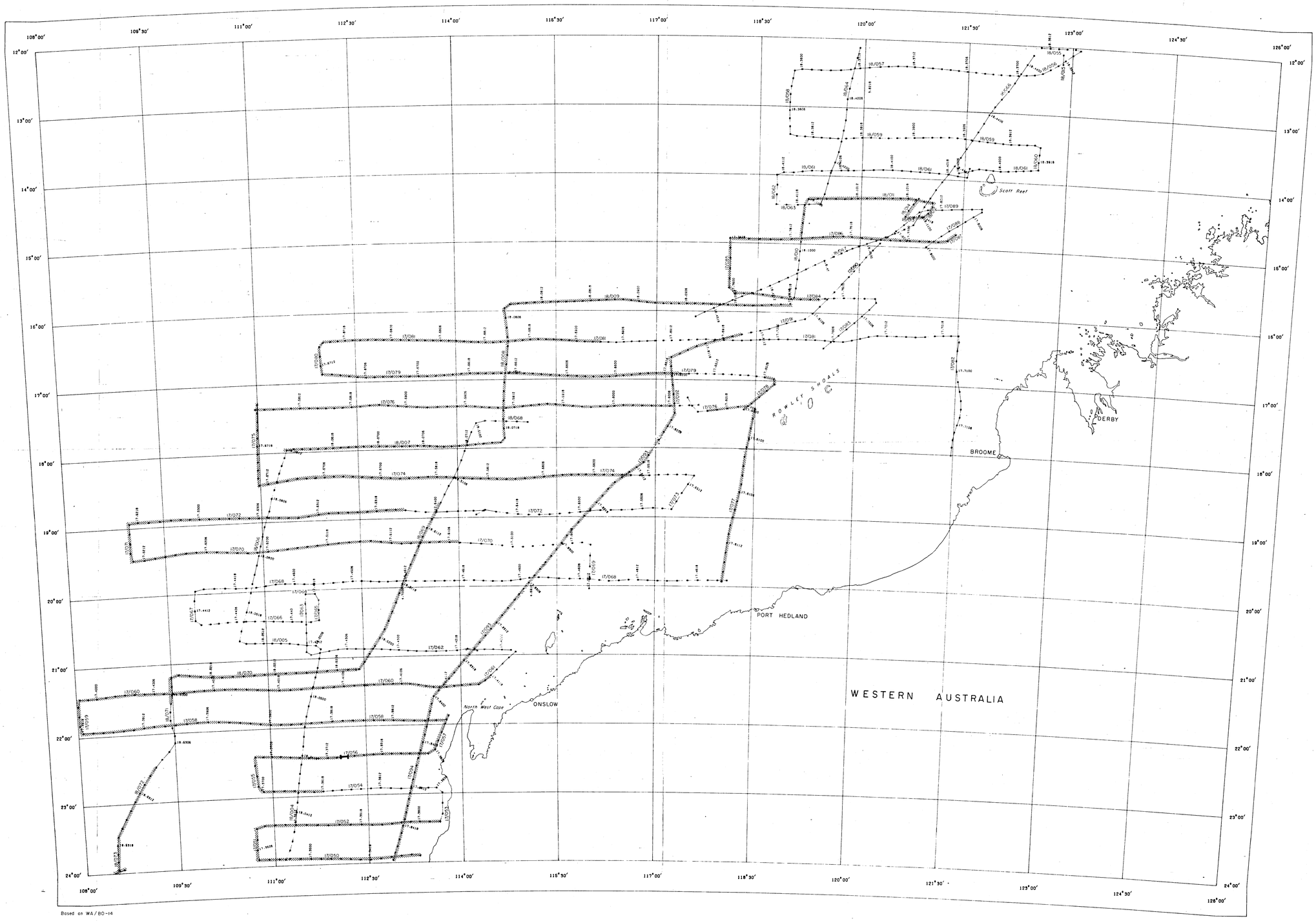
WA/88-33-1

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NORTH WESTERN MARGINS

PLOTTED 73/08/08

AUSTRALIA 1 : 2500000



Based on WA/80-14

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

BUREAU OF MINERAL RESOURCES ENCL. 23

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

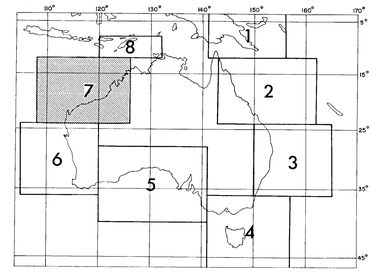
MAGNETIC DATA

DISTRIBUTION OF DATA QUALITY
- 0 GAMMA < NOISE LEVEL ≤ 2 GAMMAS
- 2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
- 5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
EVERY 6 HOURS - SURVEY NUMBER, B.M.R. DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

NORTH WESTERN MARGINS

AREA 7 WA/88-34-1

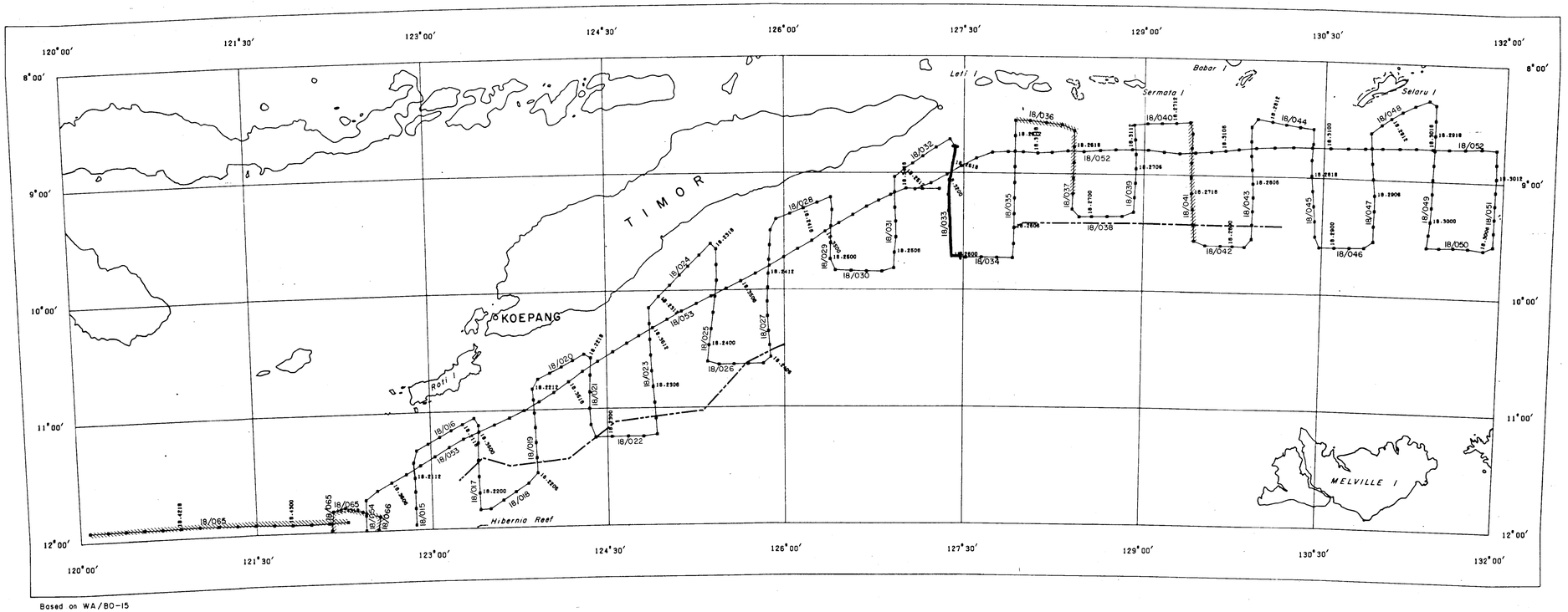
The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

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TIMOR TROUGH

PLOTTED 73/08/08

AUSTRALIA 1: 2500000



Based on WA/80-15

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

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TIMOR TROUGH

AREA 8

WA/B8-32-1

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BUREAU OF MINERAL RESOURCES ENCL.24

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

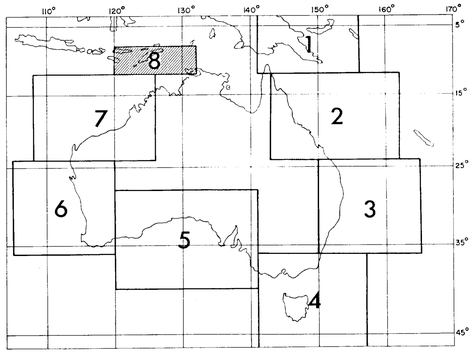
MAGNETIC DATA

DISTRIBUTION OF DATA QUALITY
0 GAMMA < NOISE LEVEL < 2 GAMMAS
2 GAMMAS ≤ NOISE LEVEL < 5 GAMMAS
5 GAMMAS ≤ NOISE LEVEL

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
14.3006 EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

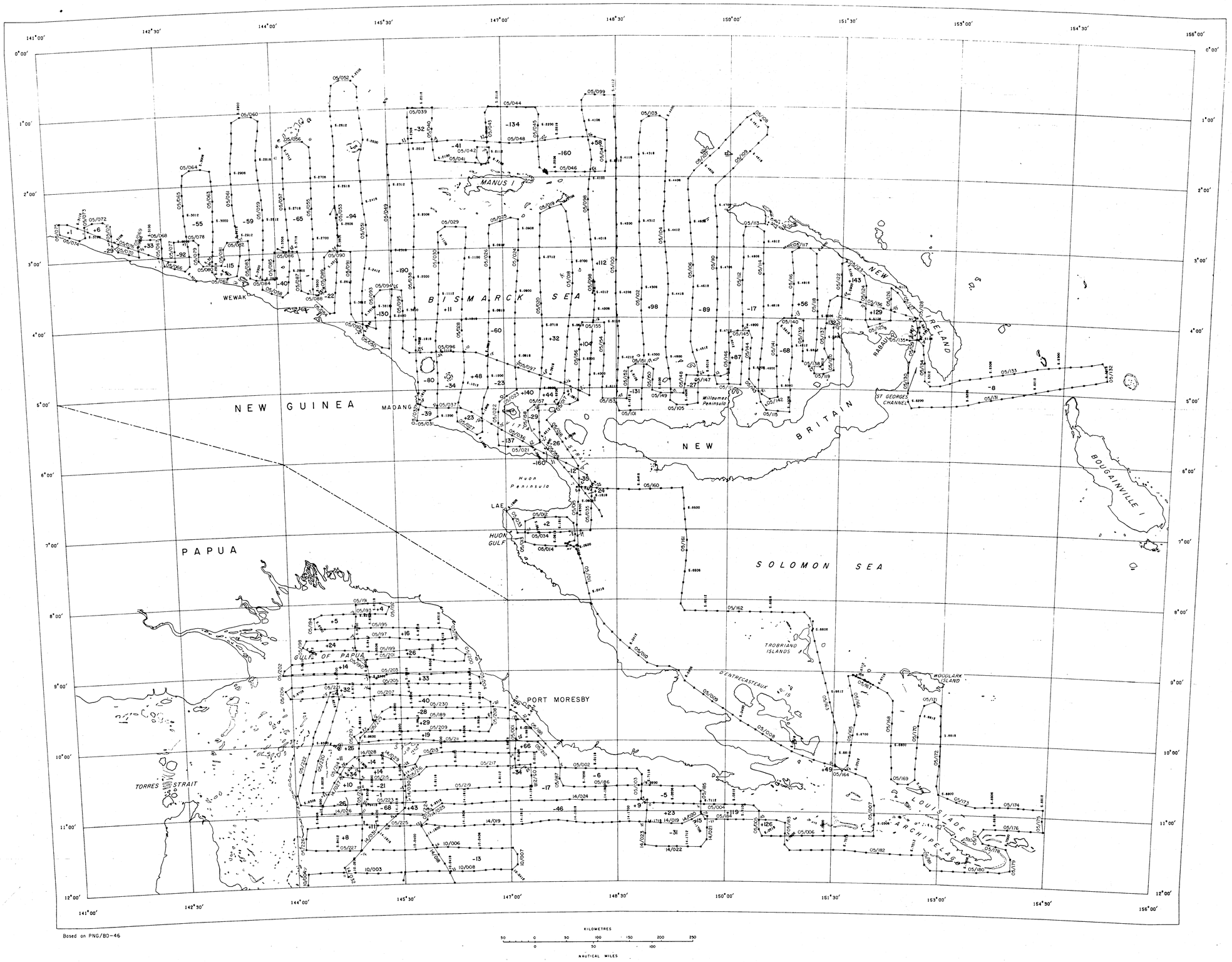


COMPAGNIE GENERALE DE GEOPHYSIQUE

BISMARCK SEA
AND GULF OF PAPUA

PLOTTED 73/07/17

AUSTRALIA 1: 2500000



Based on PNG/80-46

KILOMETRES 50 0 50 100 150 200 250
NAUTICAL MILES 0 50 100

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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BISMARCK SEA
AND GULF OF PAPUA
AREA 1

PNG/88-72-1

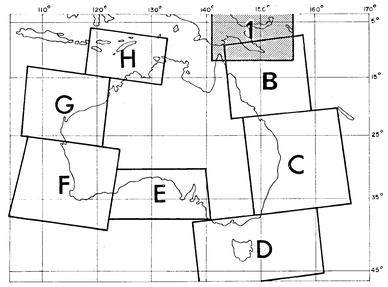
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS



COMPAGNIE GENERALE DE GEOPHYSIQUE

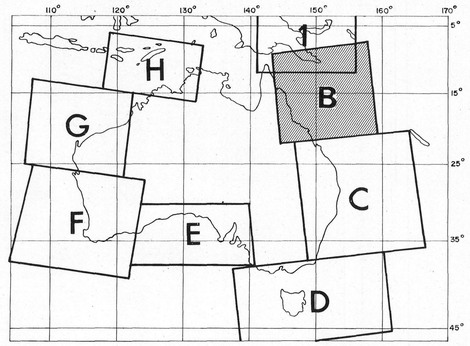
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS



COMPAGNIE GENERALE DE GEOPHYSIQUE

144° 147° 150° 153° 156°

12° 16° 20°

PAPUA

CORAL SEA

Cape Melville

Cooktown

Cairns

Mossman

Atherton

Innisfail

Einasleigh

Georgetown

Clarke River

Townsville

Ayr

Ingham

Hughenden

Charters Towers

Bowen

Tangorin

Buchanan

Mt Coolon

Mackay

Proserpine

Percy Isles

Mutta Burra

Galilee

Clermont

St Lawrence

Fort Denison

Iron Range

Weipa

Wrotham Park

Torres Creek

Torrens Creek

HINCHINBROOK ISLAND

MAGNETIC I.

BUREAU OF MINERAL RESOURCES

Encl. 27

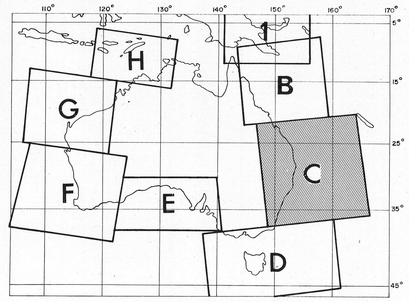
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS



COMPAGNIE GENERALE DE GEOPHYSIQUE

BUREAU OF MINERAL RESOURCES

Encl.28

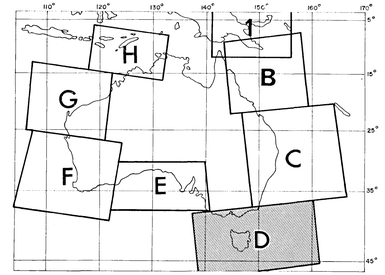
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS



COMPAGNIE GENERALE DE GEOPHYSIQUE

SURVEY II lines
- 01 to 32
- 12: 01 to 10, 46 to 49
- 14: 68 to 79
- (15): 01 to 30, 32, 33, 61 to 63
- 16: 01 to 34 (no lines 33-36), 37 to 40, 43 to 45, 47 to 49, 81 to 83, 85 to 87

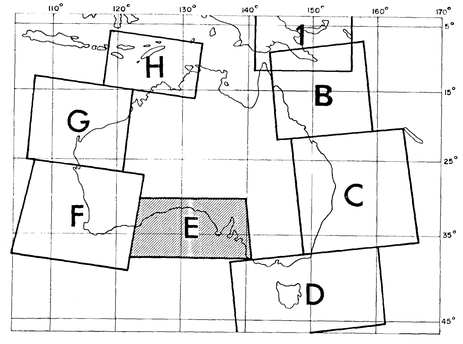
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS



COMPAGNIE GENERALE DE GEOPHYSIQUE

126°
129°
132°
138°
30°
32°
34°
36°
38°
Seemore
Laongana
Forrest
Cook
Oolded
Barton
Tarcoola
Kingoonya
Andam
Naretha
Madura
Eucla
Coompana
Nullarbor
Fowler
Childara
Gairdner
Torrens
Lake Everard
Lake Gairdner
Culver
Burnabbie
Nornderg
Nuyts
Streaky Bay
Yardea
Port Augu
Kimba
Whyalla
Burra
Chowilla
Cowell
Adelaide
Renmark
Murray
Wakeria
Port Lincoln
ADELAIDE (CR)
Pinnaroo
KANGAROO ISLAND
Kingscote
Naracoorte
Penola
Monnehill
Menngie
EUCLASE
FORREST
19/34
19/39
+24
+92
+94
-123
+55
-75
+48
+53
-53
+51
+10
+13
+37
-5
-10
-25
+49
-22
+34
+27
+33
+9
-5
-15
-1
-2
-79
+138
-24
-7
-3
-4
+30
+28
+21
+1
-8
-5
-36
-49
+20
-16
-46
-100
-32
+6
-9
+8
+31
-24
-17
-4
-29
+2
+14
+15
-13
+25
+36
+7
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+99
+100

BUREAU OF MINERAL RESOURCES

Encl.30

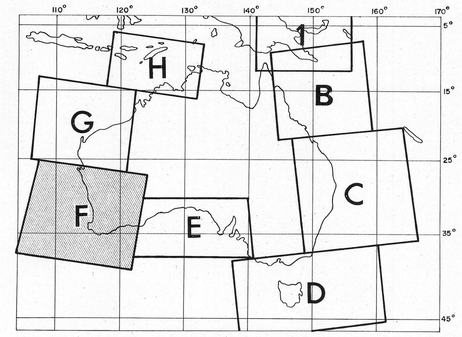
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS



COMPAGNIE GENERALE DE GEOPHYSIQUE

108°
114°
117°
120°
123
28°
32°
36°
Sandstone
Sir Samuel
Duketon
Cue
Murgoo
Austin
Youanmi
Leonora
Loverton
Rason
Kirkalocka
Yalgoo
Edjudina
Minigwal
Menzies
Lake Barlee
Ninghan
Perenjori
Kurnalpi
Cundeelee
Jackson
Kalgoorlie
Bencubbin
Moora
Widgemooltha
Zanthus
Southern Cross
Baaraabin
Keller berrin
Norseman
Balladonia
Lake Johnston
Hyden
Esperance
Malcolm
Newdegate
Ravensthorpe
Dumbleyung
Mondrain Island
Pemberton
Mount Barker
Breaker Bay
Albany
Augusta
Perth
Fremantle
Bunbury
Collie
Busselton
Bridgetown
Northam
Merredin
Corrigin
Laverton
Boulder
Kalgoorlie
Esperance
Carey
Minigwal
Lake Cowan
Johnston Lakes
Lake Bellaire
Lake Moore
Hill River
Irwin Inlet
Gen. Station
Gen. Station
Gen. Station

BUREAU OF MINERAL RESOURCES

Encl.31

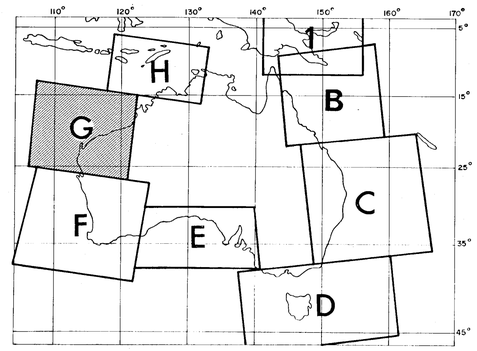
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS



COMPAGNIE GENERALE DE GEOPHYSIQUE

111°
114°
117°
120°
17°
20°
23°
26°
108°
111°
114°
117°
120°
Pender
Broome
La Grange
Bedout Island
Mandora
Munro
Anketell
Yarrie
Port Hedland
Roebourne
Dampier
Barrow Island
Marble Bar
Nullagine
Pyramid
Yarraloola
Onslow
Wyloo
Mt Bruce
Roy Hill
Balfour Downs
HAMERSLEY RANGE
Fortescue River
Ashburton River
Turee Creek
Newman
Robertson
Edmund
Winning Pool
Mt Egerton
Buller
Mt Phillips
Kennedy Range
Gascoyne River
Glenburgh
Robinson Range
Carnarvon
Quobba
Shark Bay
Woorarnel
Byro
Belele
Yaringa
Ningaloo
Minilya
Yanrey
Muchea
Mundaring
Perth
Geraldton
Kalbarri
Meekatharra
Wiluna
Leonora
Laverton
Kalgoorlie
Esperance
Albany
Augusta
Margaret River
Bunbury
Busselton
Collie
Harvey
Pinjarra
Mandurah
Rockingham
Fremantle
Northam
Merredin
Narrogin
Wagin
Katanning
Kojonup
Boyup Brook
Manjimup
Pemberton
Nannup
Donnybrook
Bridgetown
Greenbushes
Dardanup
Australind
Boddington
Williams
Brookton
Beverley
Quairading
Cunderdin
Tammin
Kellerberrin
Bruce Rock
Corrigin
Dumbleyung
Lake Grace
Newdegate
Ravensthorpe
Hopetoun
Jerramungup
Gnowangerup
Mount Barker
Denmark
Walpole
Northcliffe
Augusta
Margaret River
Busselton
Bunbury
Collie
Harvey
Pinjarra
Mandurah
Rockingham
Fremantle
Northam
Merredin
Narrogin
Wagin
Katanning
Kojonup
Boyup Brook
Manjimup
Pemberton
Nannup
Donnybrook
Bridgetown
Greenbushes
Dardanup
Australind
Boddington
Williams
Brookton
Beverley
Quairading
Cunderdin
Tammin
Kellerberrin
Bruce Rock
Corrigin
Dumbleyung
Lake Grace
Newdegate
Ravensthorpe
Hopetoun
Jerramungup
Gnowangerup
Mount Barker
Denmark
Walpole
Northcliffe

BUREAU OF MINERAL RESOURCES

Encl.32

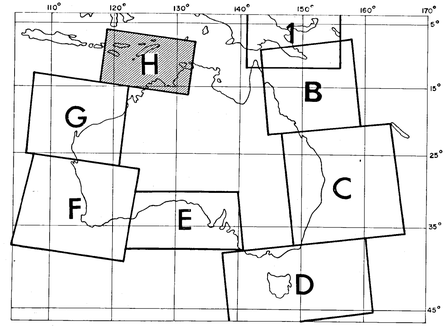
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAGNETIC MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN GAMMAS

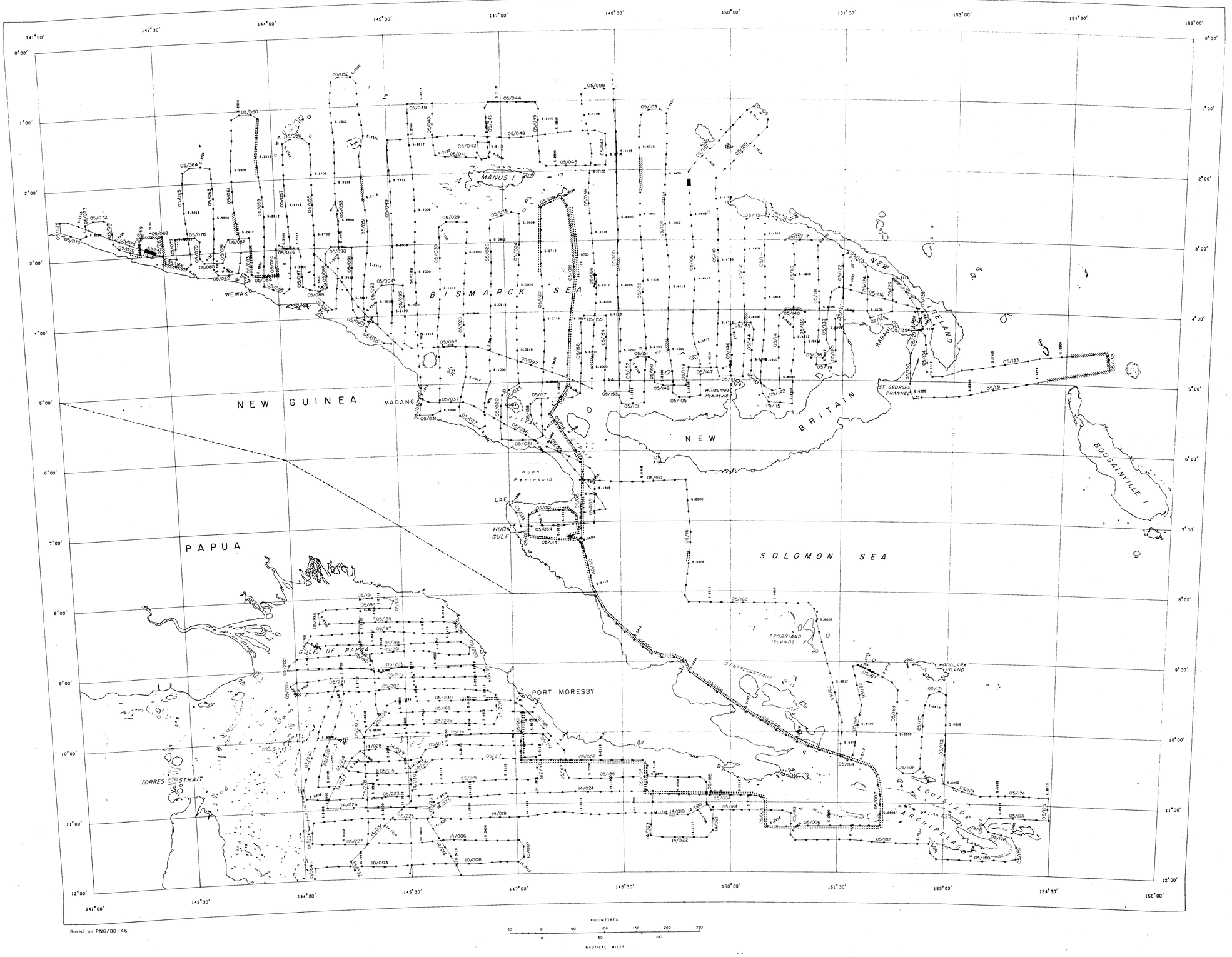


COMPAGNIE GENERALE DE GEOPHYSIQUE

BISMARCK SEA
AND GULF OF PAPUA

PLOTTED 73/07/17

AUSTRALIA 1: 2500000



Based on PNG/80-46

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BISMARCK SEA
AND GULF OF PAPUA
AREA 1

PNG/88-72-1

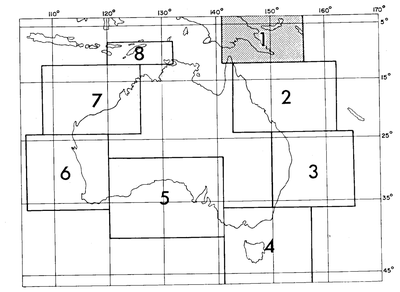
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

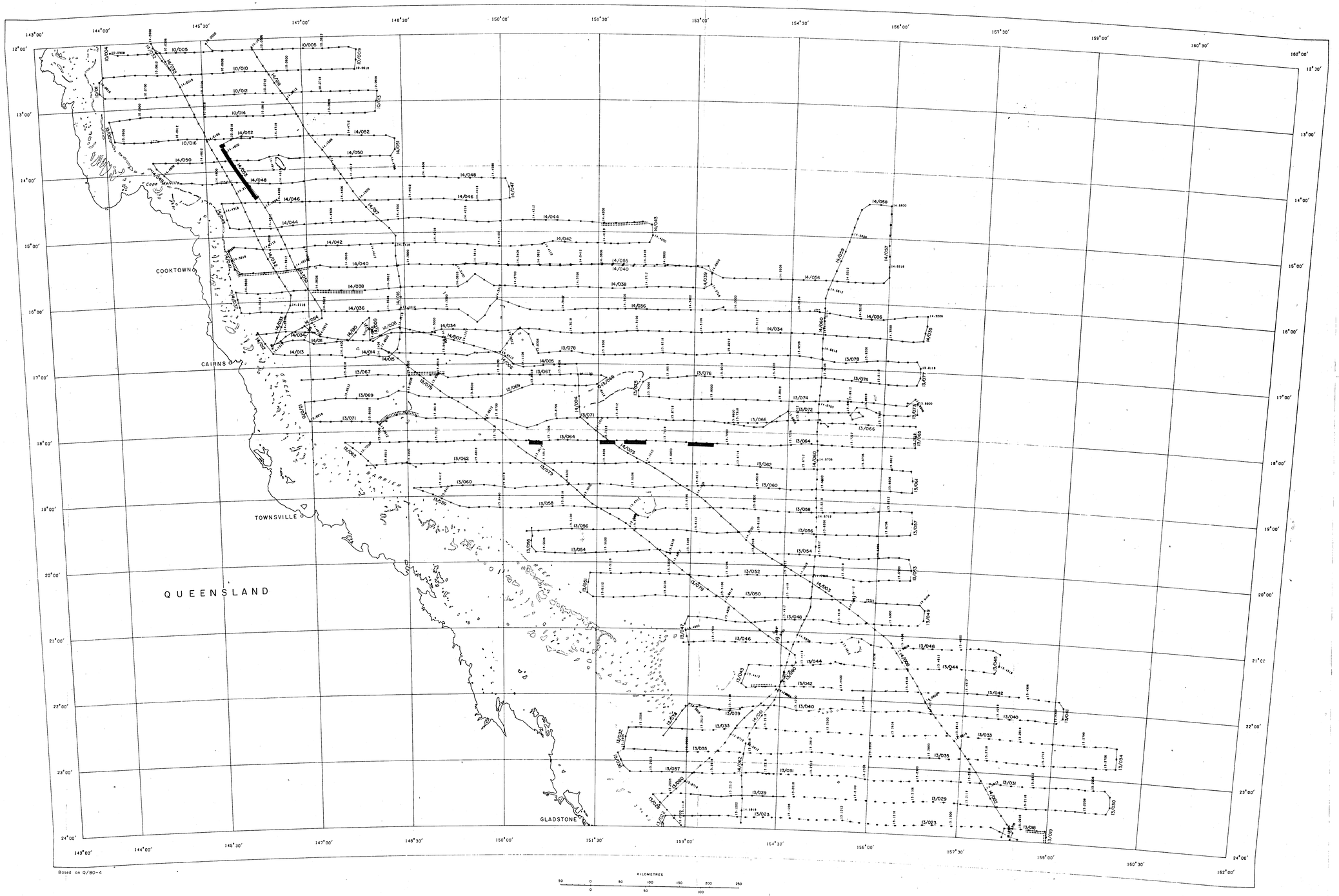


COMPAGNIE GENERALE DE GEOPHYSIQUE

CORAL SEA

PLOTTED 73/08/14

AUSTRALIA 1: 2500000



AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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CORAL SEA

AREA 2

Q/88-21-1

BUREAU OF MINERAL RESOURCES ENCL.34

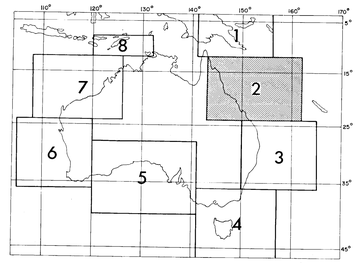
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
16.2004 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

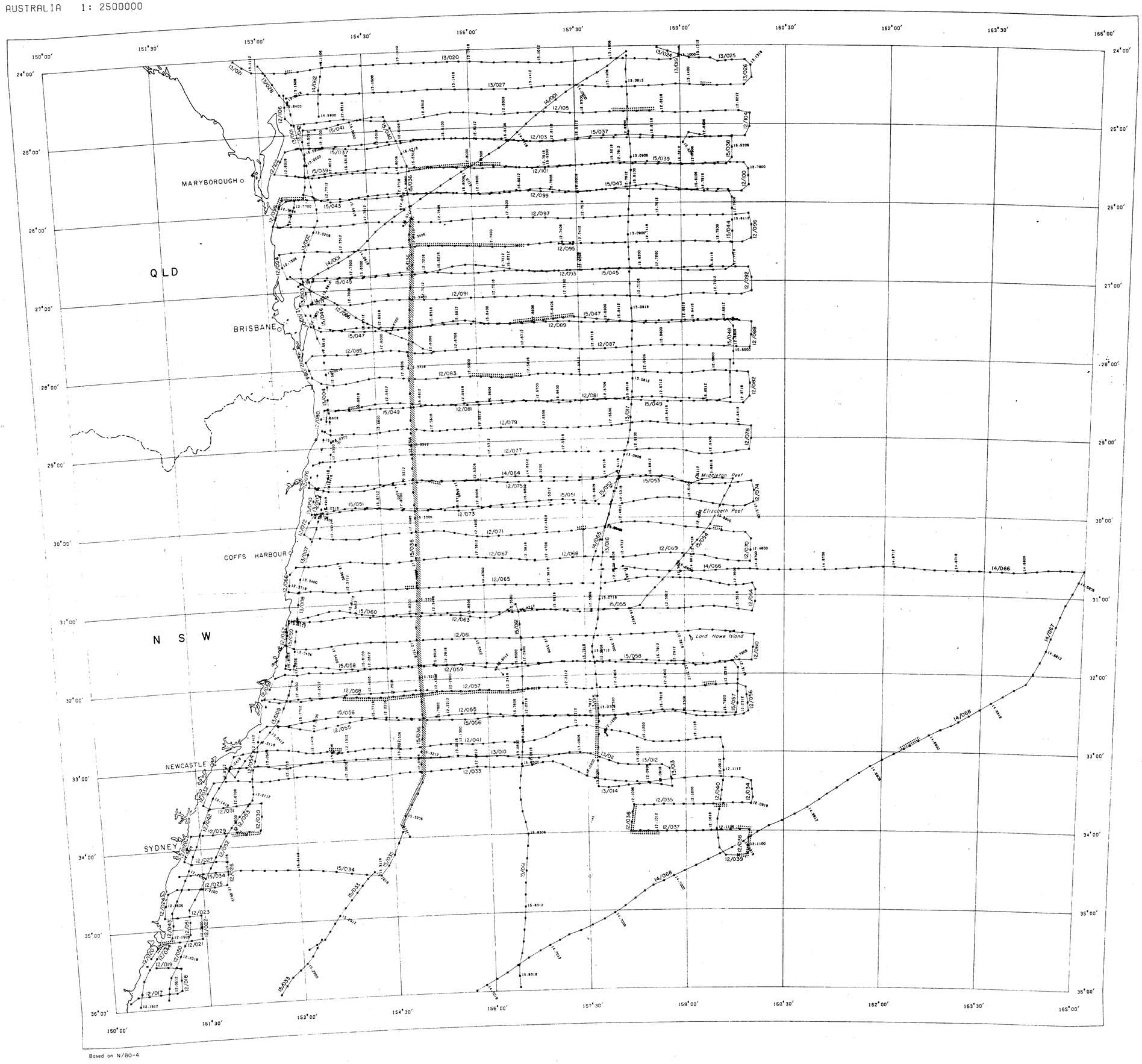


COMPAGNIE GENERALE DE GEOPHYSIQUE

TASMAN SEA

PLOTTED 73/08/14

AUSTRALIA 1: 2500000



Based on N/80-4

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0 AND 36° 0 SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

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TASMAN SEA

AREA 3

N/88-2-1

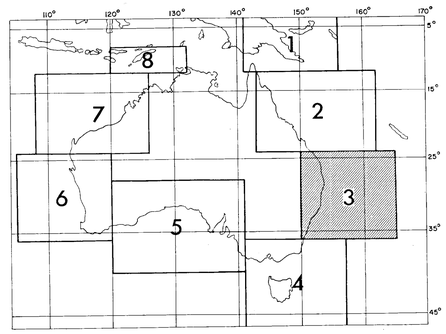
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 ← HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
14.3406 EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

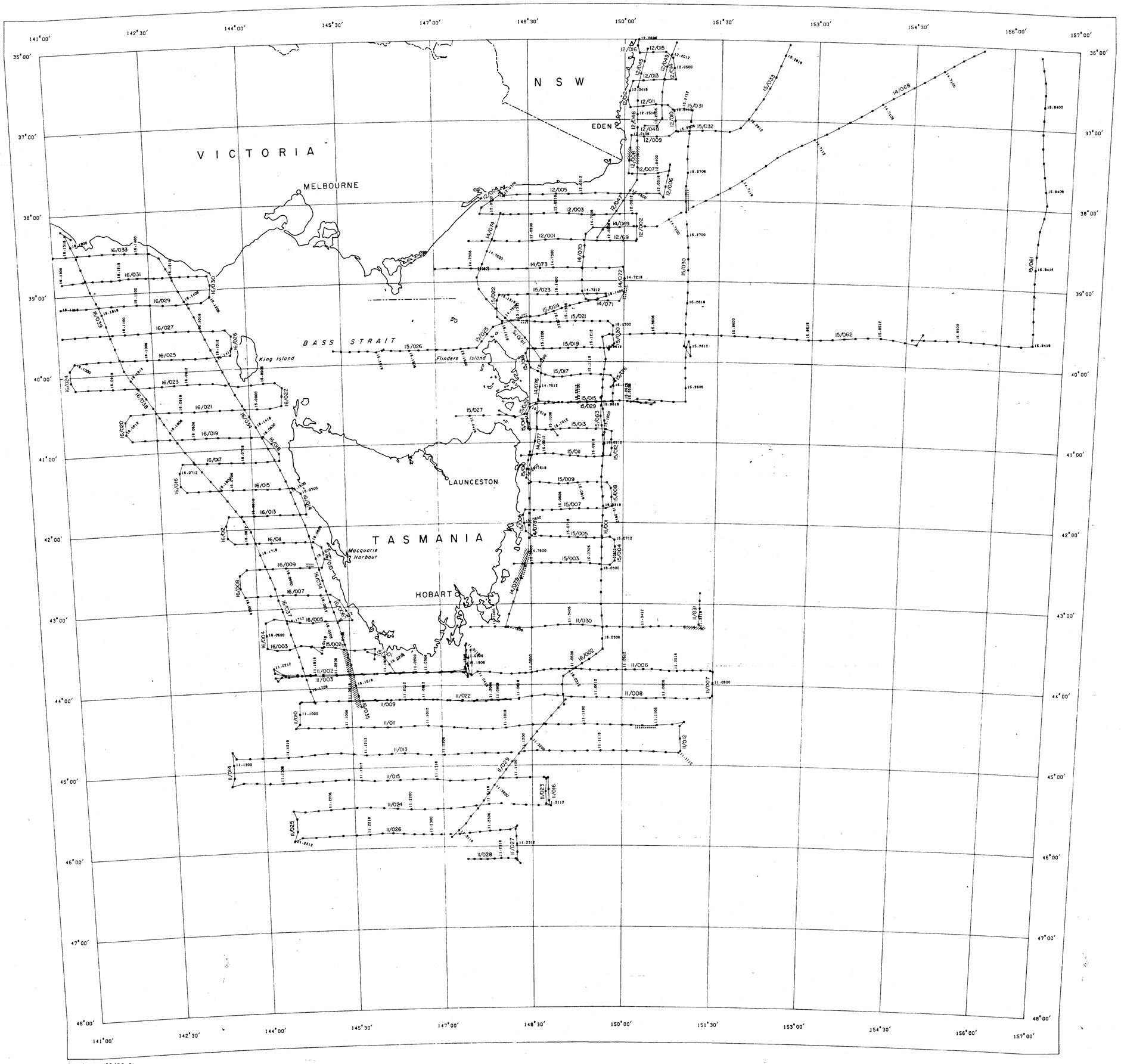


COMPAGNIE GENERALE DE GEOPHYSIQUE

TASMANIA

PLOTTED 73/09/12

AUSTRALIA 1: 2500000



Based on K55/80-21

BUREAU OF MINERAL RESOURCES ENCL.36

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

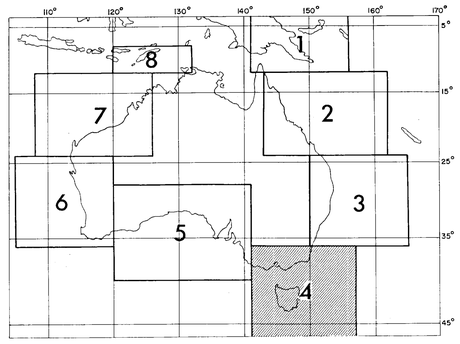
NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TASMANIA

TRACK CHART

AREA 4

K55/B8-25-1

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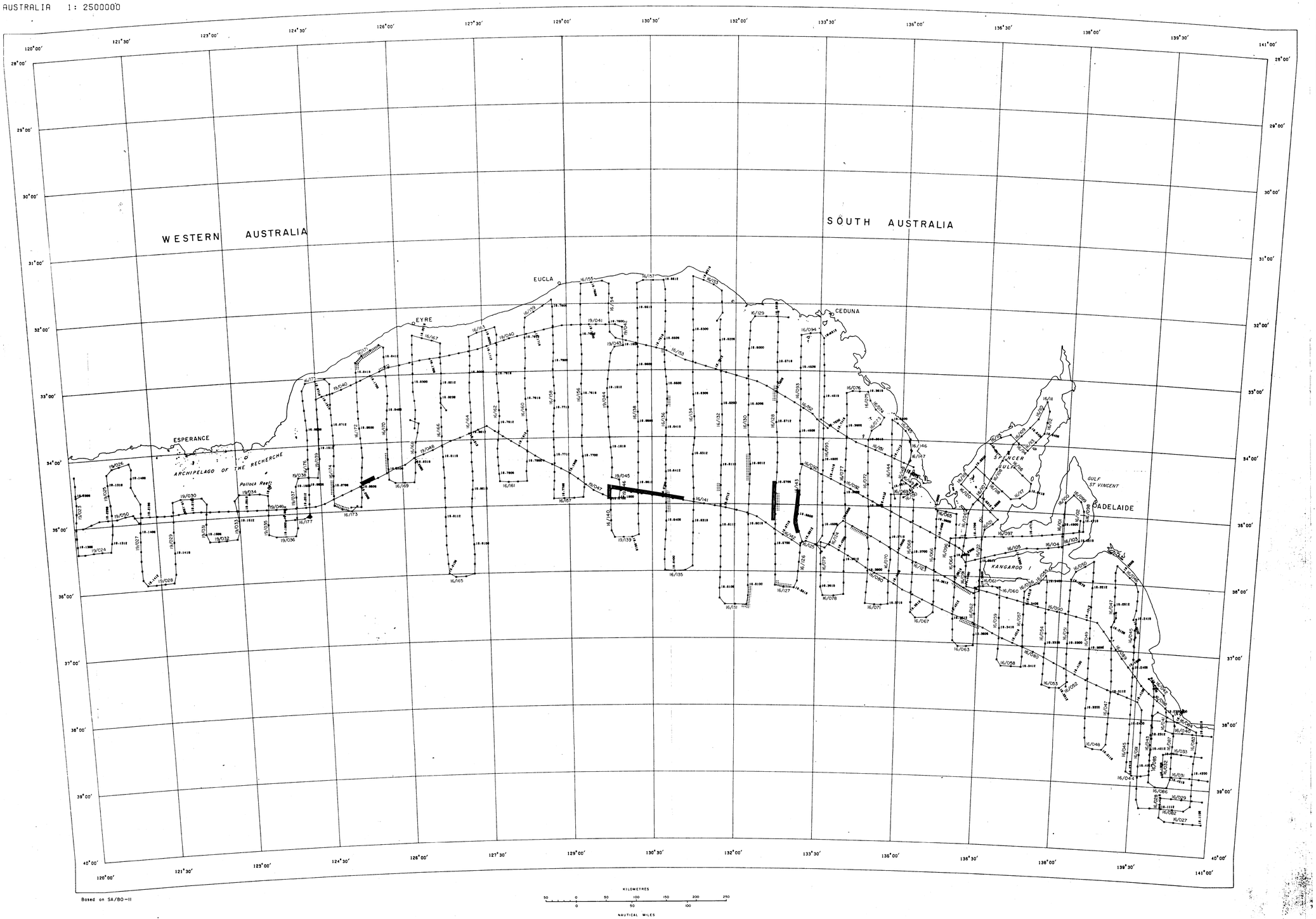
KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

GREAT AUSTRALIAN BIGHT

PLOTTED 73/07/26

AUSTRALIA 1: 2500000



Based on SA/80-11

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

GREAT AUSTRALIAN BIGHT

AREA 5

SA/88-18-1

BUREAU OF MINERAL RESOURCES ENCL. 37

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

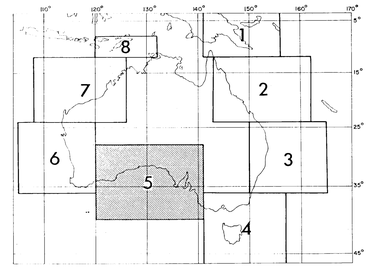
NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

14.3404 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

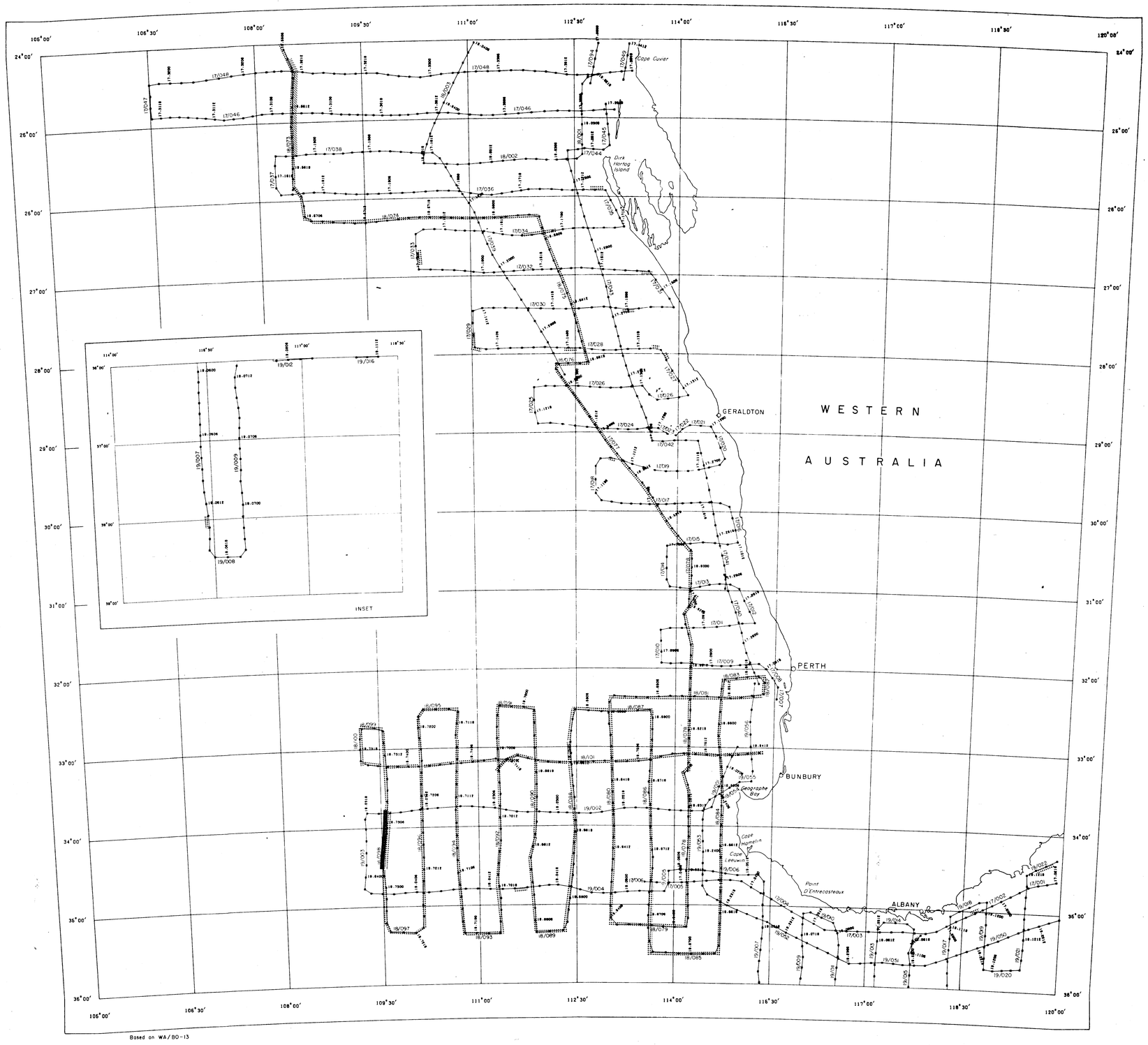


COMPAGNIE GENERALE DE GEOPHYSIQUE

SOUTHWESTERN MARGINS

PLOTTED 73/07/26

AUSTRALIA 1 : 2500000



AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

B.M.R. 1970-73 MARINE SURVEYS

SOUTHWESTERN MARGINS

TRACK CHART

AREA 6

WA/BB-33-1

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections

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BUREAU OF MINERAL RESOURCES ENCL.38

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

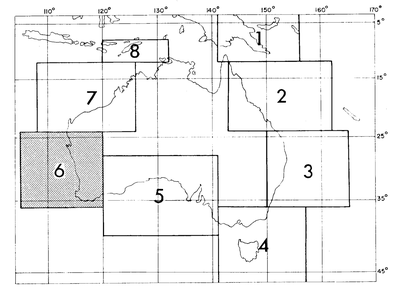
NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

H.3006 — EVERY 6 HOURS - SURVEY NUMBER, B.M.R DAY, TIME

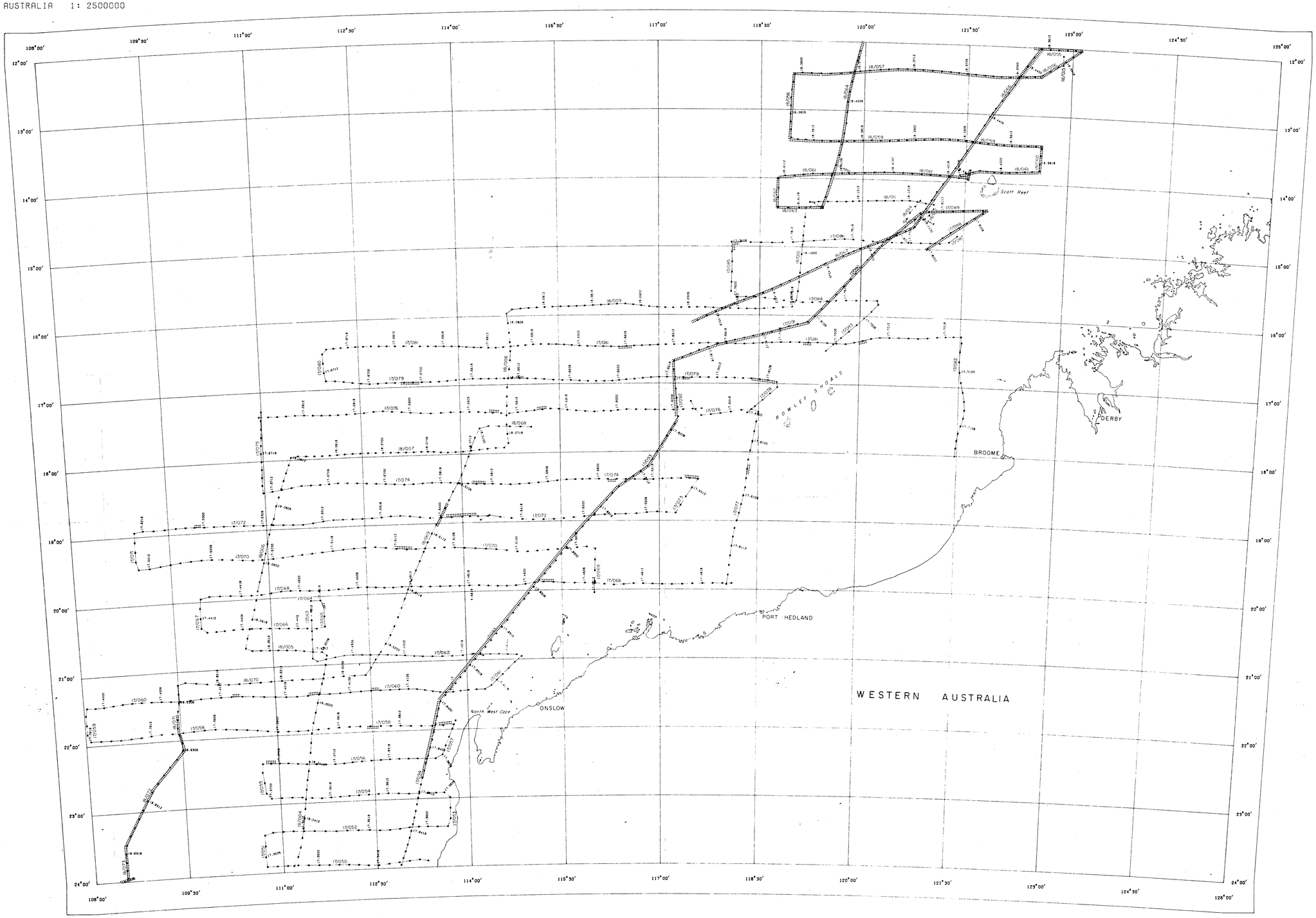


COMPAGNIE GENERALE DE GEOPHYSIQUE

NORTH WESTERN MARGINS

PLOTTED 73/08/08

AUSTRALIA 1 : 2500000



Based on WA/80-14

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

NORTH WESTERN MARGINS

AREA 7

WA/80-34-1

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KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BUREAU OF MINERAL RESOURCES ENCL. 39

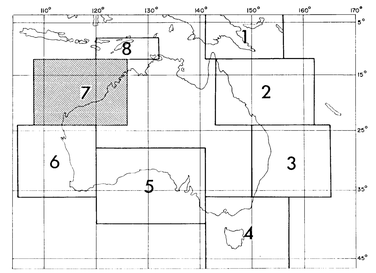
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
M.3400 — EVERY 6 HOURS - SURVEY NUMBER, B.M.R DAY, TIME

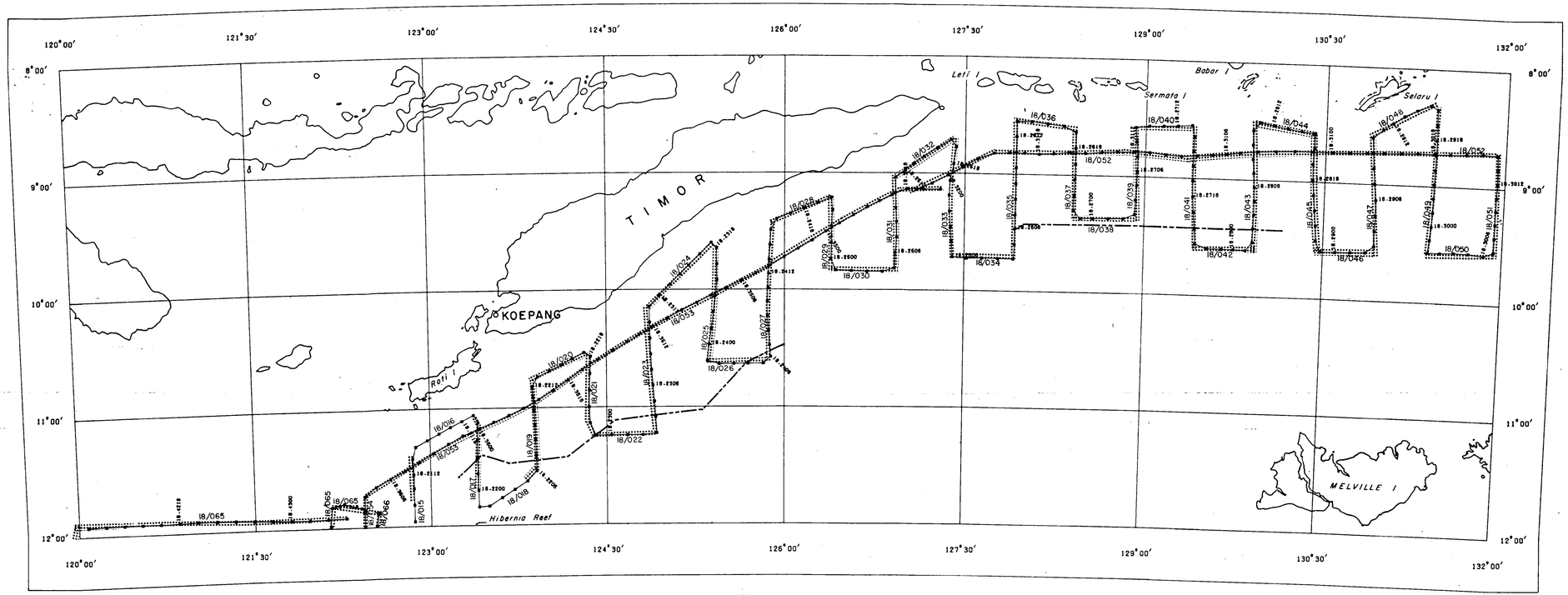


COMPAGNIE GENERALE DE GEOPHYSIQUE

TIMOR TROUGH

PLOTTED 73/08/08

AUSTRALIA 1: 2500000



Based on WA/80-15

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TIMOR TROUGH

TRACK CHART

AREA 8

WA/88-32-1

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KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BUREAU OF MINERAL RESOURCES ENCL.40

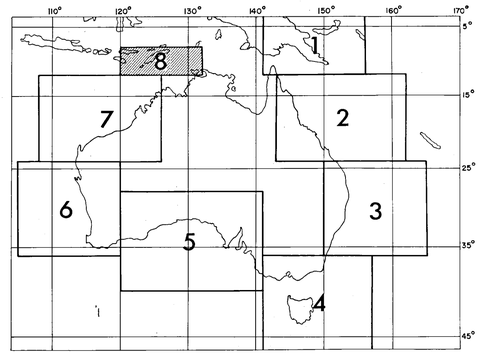
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

NAVIGATION DATA

DISTRIBUTION OF MISSING DATA
- NO SONAR DOPPLER DATA
- NO CHERNIKEEFF LOG DATA
- NO PRESSURE LOG DATA

LEGEND

14/036 HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
14.3004 EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

BUREAU OF MINERAL RESOURCES

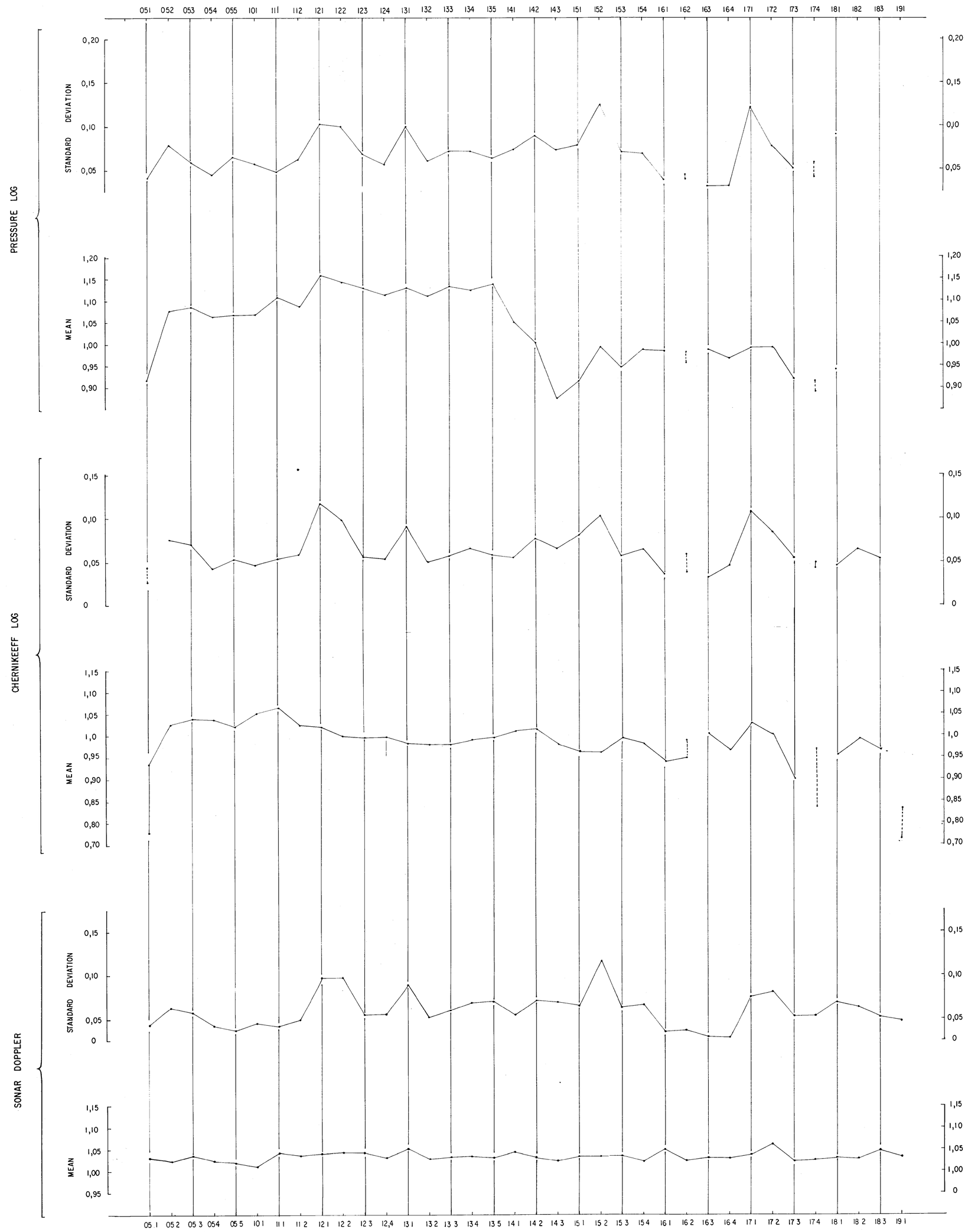
Encl. 41

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

NAVIGATION SYSTEMS

CALIBRATION COEFFICIENTS

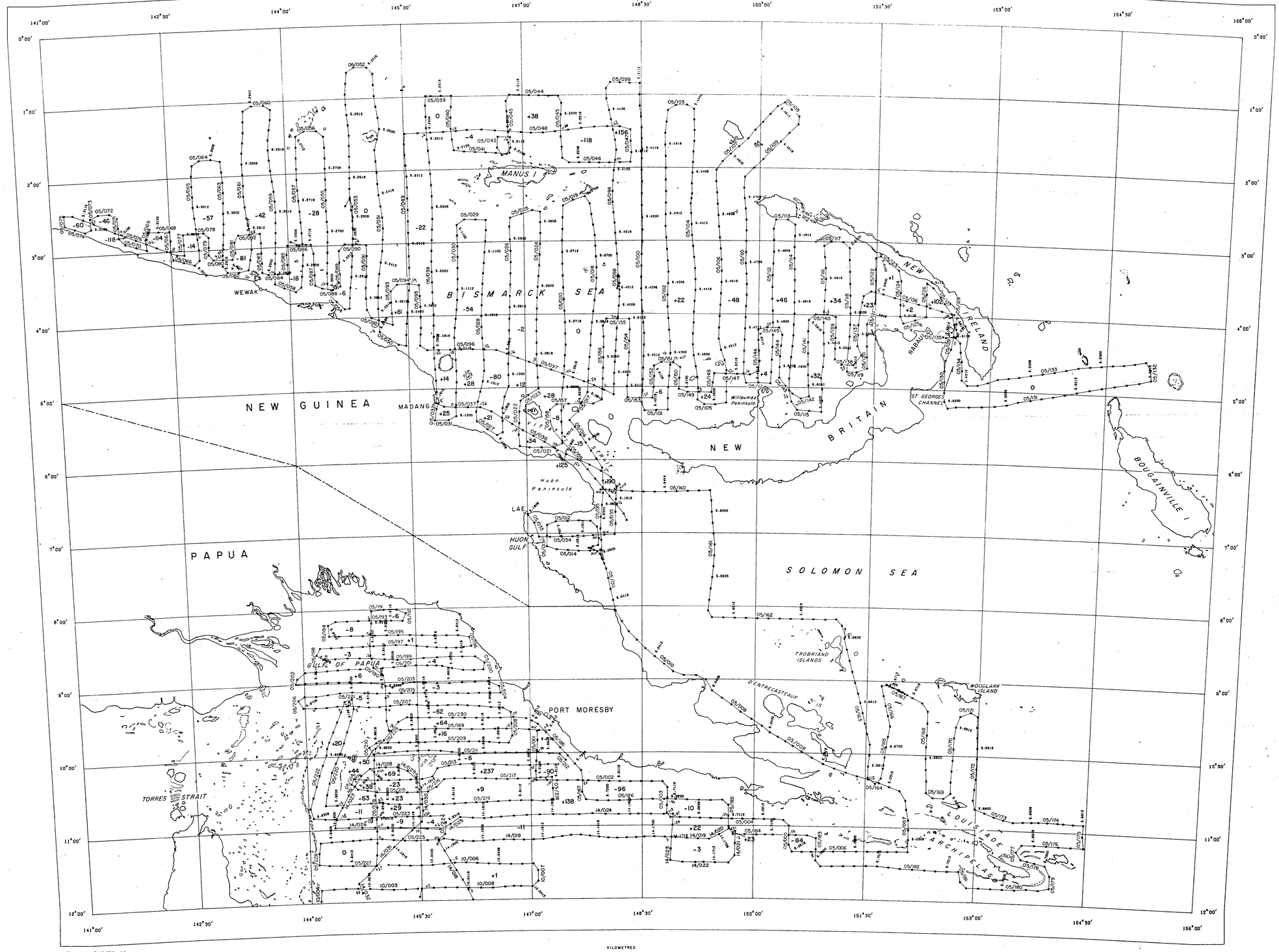
COMPAGNIE GENERALE DE GEOPHYSIQUE



PLOTTED 73/07/17

AUSTRALIA 1: 2500000

BISMARCK SEA
AND GULF OF PAPUA



Based on PNG/80-46

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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BISMARCK SEA
AND GULF OF PAPUA
AREA 1

PNG/88-72-1

BUREAU OF MINERAL RESOURCES

Encl. 42

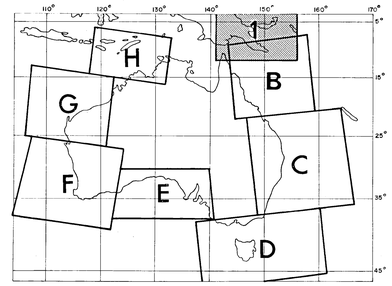
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

BUREAU OF MINERAL RESOURCES

Encl.43

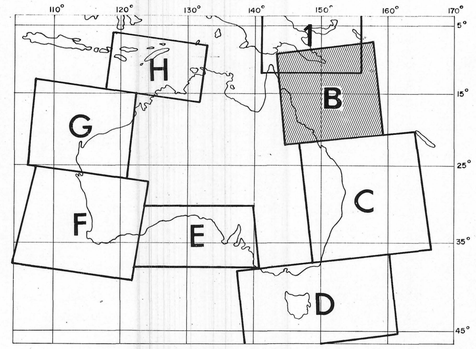
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

144° 147° 150° 153° 156°

12° 16° 20°

PAPUA

D'ENTRECASTEAUX ISLANDS

CORAL SEA

SUDEST I. ROSSEL

Cape Melville

Cooktown

Cooktown Δ

Mossman

Cairns

Wrotham Park Δ

Atherton

Cairns Δ

Innisfail

Einasleigh

Georgetown Δ

Ingham

HINCHINBROOK ISLAND

Clarke River

Townsville

MAGNETIC I.

Ayr

Townsville Δ

Hughenden

Charters Towers

Charters Towers Δ

Bowen

Proserpine

Hughenden Δ

Torrens Creek Δ

Tangorin

Buchanan

Mt Coolon

Mackay

Mackay Δ

Percy Isles

Muttaburra

Galilee

Clermont

St Lawrence

Port Clinton

HERVEY BAY

BUREAU OF MINERAL RESOURCES

Encl.44

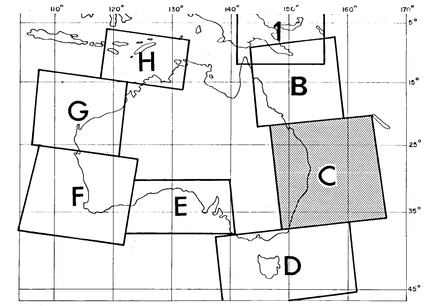
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

150°
156°
162°
24°
28°
32°
36°
SOUTH PACIFIC OCEAN
TASMAN SEA
Jericho
Emerald
Clermont
Duaringa
Rockhampton
Tambo
Springsure
Barcaldine
Monto
Curtis I.
Bundaberg
Eddystone
Taroom
Mundubbera
Maryborough
Wide Bay
Fraser Island
Mitchell
Roma
Chinchilla
Gympie
Charleville
Homebush
Surat
Dalby
Ipswich
Brisbane
BRISBANE (CR)
Dirranbandi
St George
Goondiwindi
Warwick
Tweed Heads
Angledool
Moree
Inverell
Grafton
Macleay
Walgett
Narrabri
Manilla
Dorrigo
Nyngan
Coonamble
Gilgandra
Tamworth
Hastings
Narromine
Dubbo
Singleton
Newcastle
Forbes
Bathurst
Sydney
Cootamundra
Goulburn
Wollongong
SYDNEY (CR)
Wagga Wagga
Canberra
Uiladulla
CANBERRA (CR)
Bega
Mallacoota
Bombala
Merimbula
Orbost
Lakes Entrance
Bairnsdale
Sale
Traralgon
Morwell
Warragul
Dandenong
Melbourne
Geelong
Ballarat
Hamilton
Portland
Mount Gambier
Naracoorte
Bordertown
Keith
Murray River
Darling River
Murrumbidgee River
Lachlan River
Macquarie River
Namoi River
Gwydir River
Condamine River
Balonne River
Warrego River
Paroo River
Barwon River
Castlereagh River
Bogan River
Lake Eyre
Lake Frome
Lake Torrens
Lake Gairdner
Lake Callabonna
Lake Blanche
Lake Hope
Lake Tyrrell
Lake Buchanan
Lake Galilee
Lake Dunn
Lake Elphinstone
Lake Lindsay
Lake Nash
Lake Mackay
Lake Amadeus
Lake Macdonald
Lake Nash
Lake Mackay
Lake Amadeus
Lake Macdonald

BUREAU OF MINERAL RESOURCES Encl.45

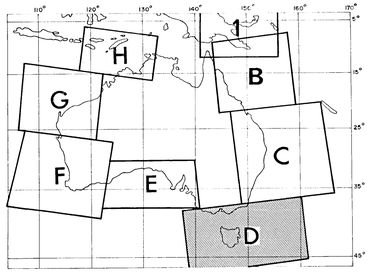
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

SURVEY II lines 01 to 32
12 01 to 10, 46 to 49
14 68 to 79
15 01 to 30, 12, 33, 61 to 63
16 01 to 34 (no lines 35-36) 37 to 40, 43 to 45, 47 to 49 61 to 83, 85 to 87

138° 144° 150° 156°
40° 44°

BUREAU OF MINERAL RESOURCES

Encl.46

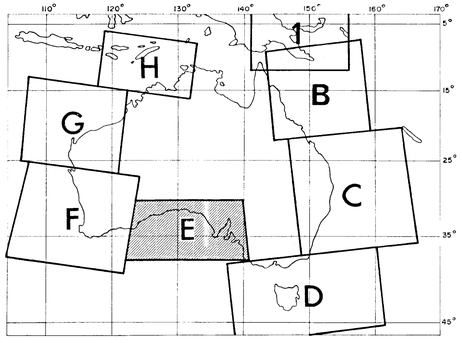
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

126°
129°
132°
135°
138°
34°
36°
38°
Seemore
Laongana
Forrest
Cook
Oodea
Barton
Tarcoola
Kingoonya
Andam
Noretha
Madura
Eucla
Goompana
Nullarbor
Fowler
Childara
Gardner
Torrens
Lake Gardner
Lake Everard
Culver
Burnabbie
Nullarbor
Nuyts
Streaky Bay
Yardea
Port Augusta
Kimba
Whyalla
Burra
Chowilla
Adelaide
Renmark
Murray
Waikerie
Port Lincoln
ADELAIDE (CR)
Pinnaroo
KANGAROO ISLAND
Naracoorte
Penola
EUCLA
19/34
19/39

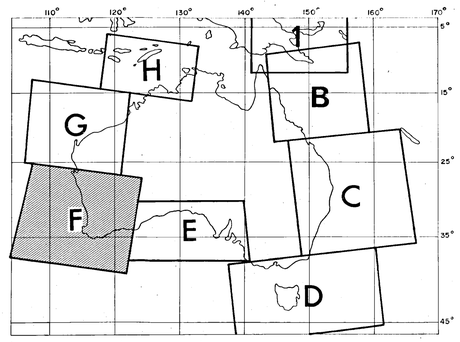
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

108°
114°
117°
120°
28°
32°
36°
Sandstone
Sir Samuel
Duketon
Cue
Murgoo
Ajana
Yalgoo
Mullewa
Perenjori
Geraldton
Ninghan
Leonora
Yuanmi
Kirkalocka
Mt Magnet
Loverton
Rason
Laverton
Edjudina
Minigwal
Menzies
Kurnalpi
Cundeelee
Kalgoorlie
Boulder
Jackson
Bencubbin
Moora
Hill River
Widgemooltha
Zanthus
Southern Cross
Baoraobin
Keller berrin
Norseman
Balladonia
Lake Johnston
Hyden
Northam
Corrigin
Perth
Fremantle
Esperance
Malcolm
Newdegate
Dumbleyung
Bunbury
Collie
Busselton
Pemberton
Bridgetown
Mount Barker
Bremer Bay
Albany
Mondrain Island
Irwin Inlet
Augusta

BUREAU OF MINERAL RESOURCES

Encl.48

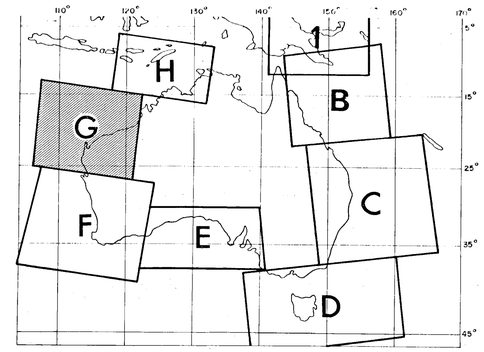
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

111°
114°
117°
120°
17°
20°
23°
26°
108°
Pender
Broome
La Grange
Mandora
Bedout Island
Munro
Anketell
Yarrie
Port Hedland
Roebourne
Dampier
Barrow Island
Nullagine
Marble Bar
Pyramid
Yarraloola
Onslow
Wyloo
Mt Bruce
Roy Hill
Balfour Downs
Newman
Robertson
Turee Creek
Edmund
Mt Phillips
Mt Egerton
Butler
Kennedy Range
Glenburgh
Robinson Range
Woorarnel
Carnarvon
Shark Bay
Byro
Belele
Yaringa
Ningaloo
Yanrey
Minilya
Learmonth
Exmouth
Gascoyne River
Ashburton River
Hamersley Range
Fortescue River
Barrow I.
Muiron I.
North West Cape
Peak Hill
Meekatharra
Wiluna
Leinster
Leonora
Laverton
Warburton Range
Gibson Desert
Great Sandy Desert
Tanami Desert
Great Victoria Desert
Nullarbor Plain
Eucla
Madura
Forrest
Kalgoorlie
Boulder
Coolgardie
Norseman
Esperance
Ravensthorpe
Hopetoun
Albany
Bremer Bay
Augusta
Busselton
Bunbury
Mandurah
Perth
Geraldton
Northampton
Kalbarri
Shark Bay
Carnarvon
Onslow
Dampier
Roebourne
Port Hedland
Marble Bar
Nullagine
Broome
Derby
Wyndham
Kununurra
Halls Creek
Fitzroy Crossing
Great Sandy Desert
Tanami Desert
Gibson Desert
Great Victoria Desert
Nullarbor Plain
Eucla
Madura
Forrest
Kalgoorlie
Boulder
Coolgardie
Norseman
Esperance
Ravensthorpe
Hopetoun
Albany
Bremer Bay
Augusta
Busselton
Bunbury
Mandurah
Perth
Geraldton
Northampton
Kalbarri
Shark Bay
Carnarvon
Onslow
Dampier
Roebourne
Port Hedland
Marble Bar
Nullagine
Broome
Derby
Wyndham
Kununurra
Halls Creek
Fitzroy Crossing

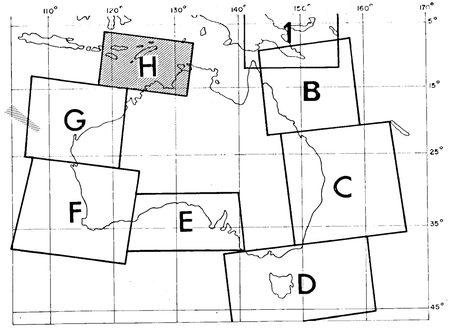
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

BATHYMETRY MISCLOSURES

LEGEND

HOURLY POSITION

POSITIVE MISCLOSURE DIRECTION IN METRES



COMPAGNIE GENERALE DE GEOPHYSIQUE

BUREAU OF MINERAL RESOURCES

Encl. 50

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

MAIN CABLE

NOISE LEVEL

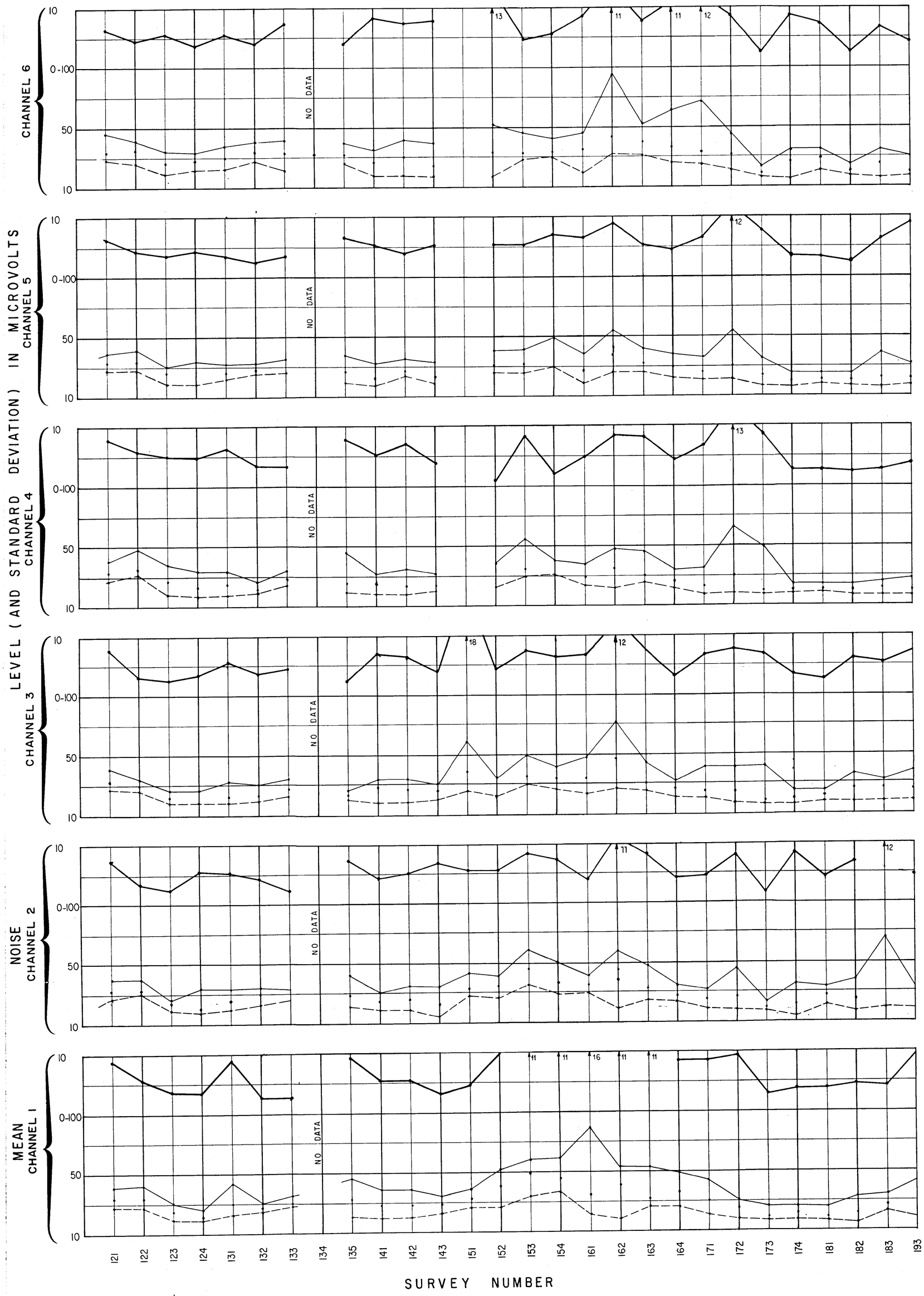
STANDARD DEVIATION _____

MAXIMUM _____

MINIMUM _____

MEAN _____ •

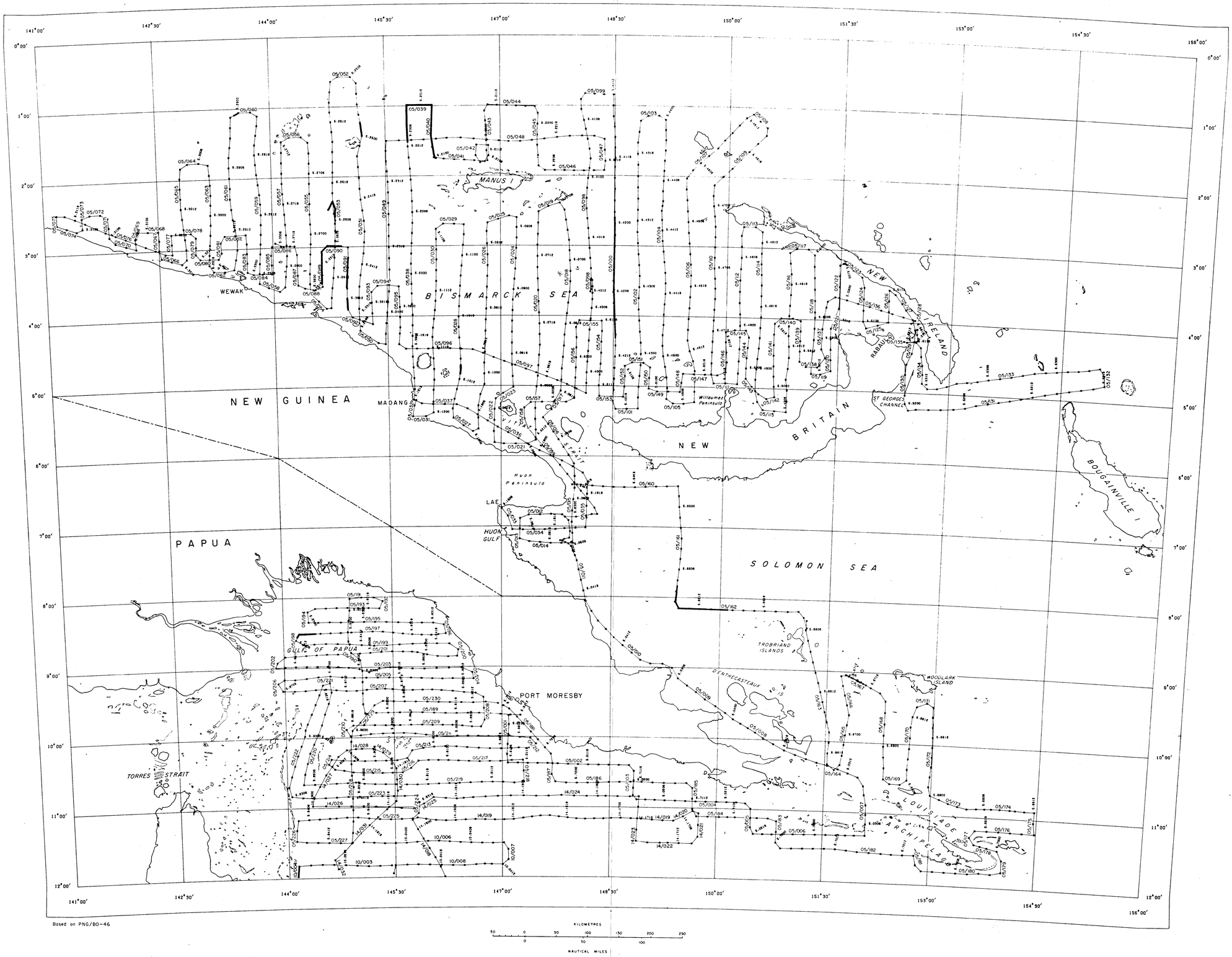
COMPAGNIE GENERALE DE GEOPHYSIQUE



PLOTTED 73/07/17

AUSTRALIA 1: 2500000

BISMARCK SEA
AND GULF OF PAPUA



Based on PNG/80-46

KILOMETRES 50 0 50 100 150 200 250

NAUTICAL MILES 0 50 100

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BISMARCK SEA
AND GULF OF PAPUA
AREA 1

PNG/88-72-1

BUREAU OF MINERAL RESOURCES ENCL. 51

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

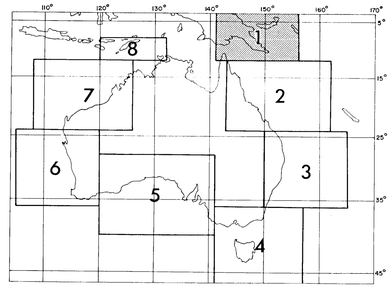
SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

CORAL SEA

PLOTTED 73/08/14

AUSTRALIA 1: 2500000

COOKTOWN

CAIRNS

TOWNSVILLE

QUEENSLAND

GLADSTONE

Cape Melville

KILOMETRES

50 0 50 100 150 200 250

0 50 100

NAUTICAL MILES

Based on Q/80-4

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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CORAL SEA

AREA 2

Q/88-21-1

BUREAU OF MINERAL RESOURCES ENCL. 52

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

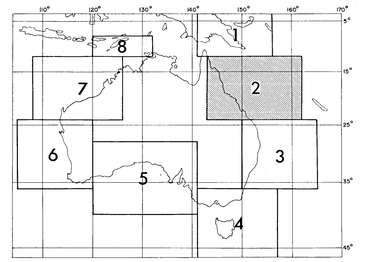
SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

14.3004 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

TASMAN SEA

PLOTTED 73/08/14

AUSTRALIA 1: 2500000



Based on N/80-4

BUREAU OF MINERAL RESOURCES ENCL. 53

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

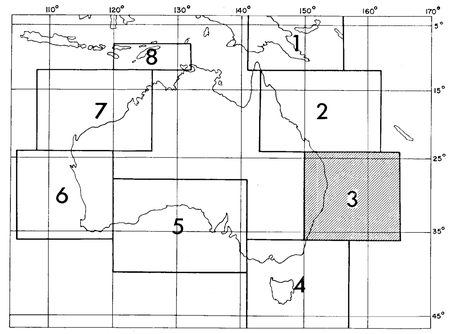
SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA ——

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

14.3006 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TASMAN SEA

TRACK CHART

AREA 3

N/88-2-1

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

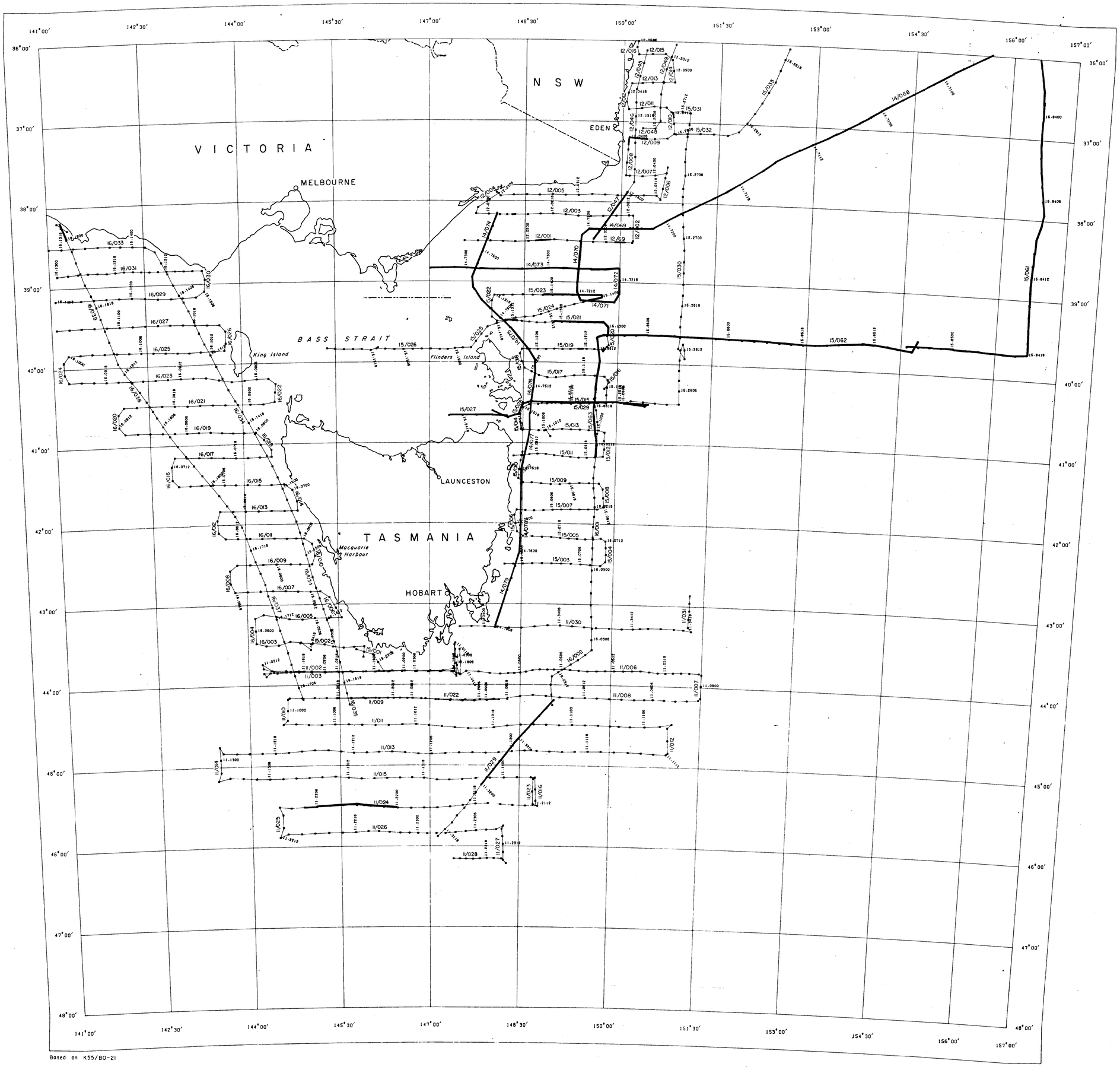
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The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

TASMANIA

PLOTTED 73/09/12

AUSTRALIA 1 : 2500000



Based on K55/80-21

BUREAU OF MINERAL RESOURCES ENCL. 54

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

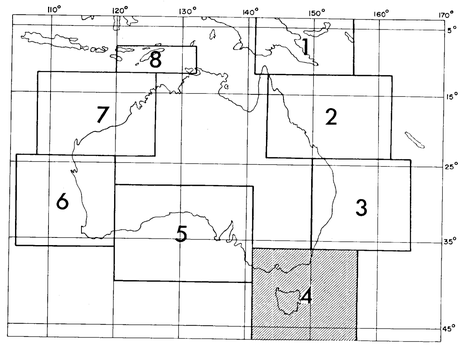
SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA ____ ——

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TASMANIA

TRACK CHART

AREA 4

K55/B8-25-1

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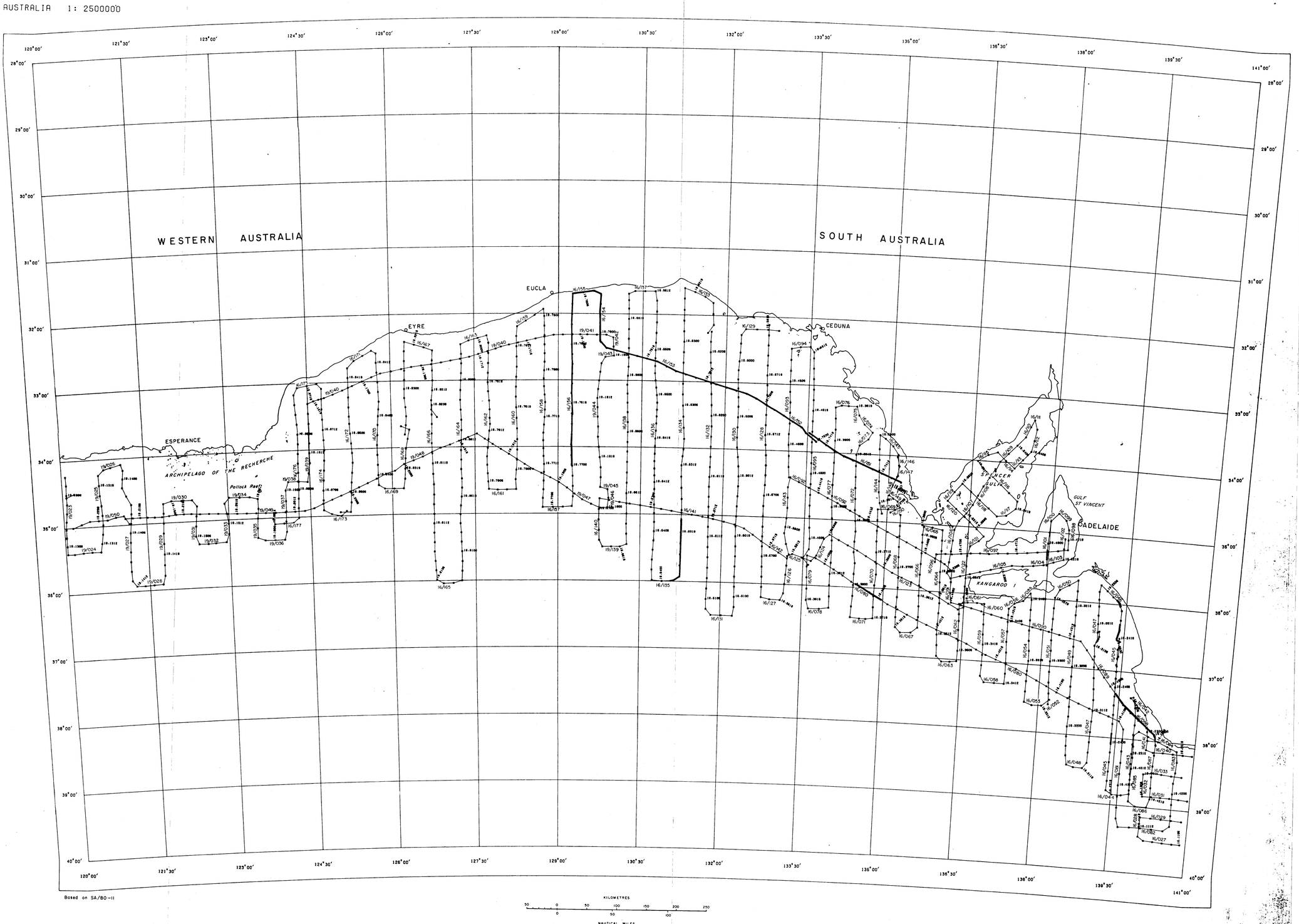
KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

GREAT AUSTRALIAN BIGHT

PLOTTED 73/07/26

AUSTRALIA 1: 2500000



Based on SA/80-11

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

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B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

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GREAT AUSTRALIAN BIGHT

AREA 5

SA/88-18-1

BUREAU OF MINERAL RESOURCES ENCL. 55

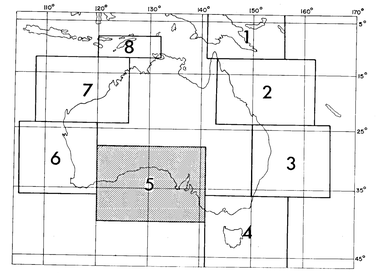
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA ___ ——

LEGEND

14/036 ← HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
H-3004 EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME

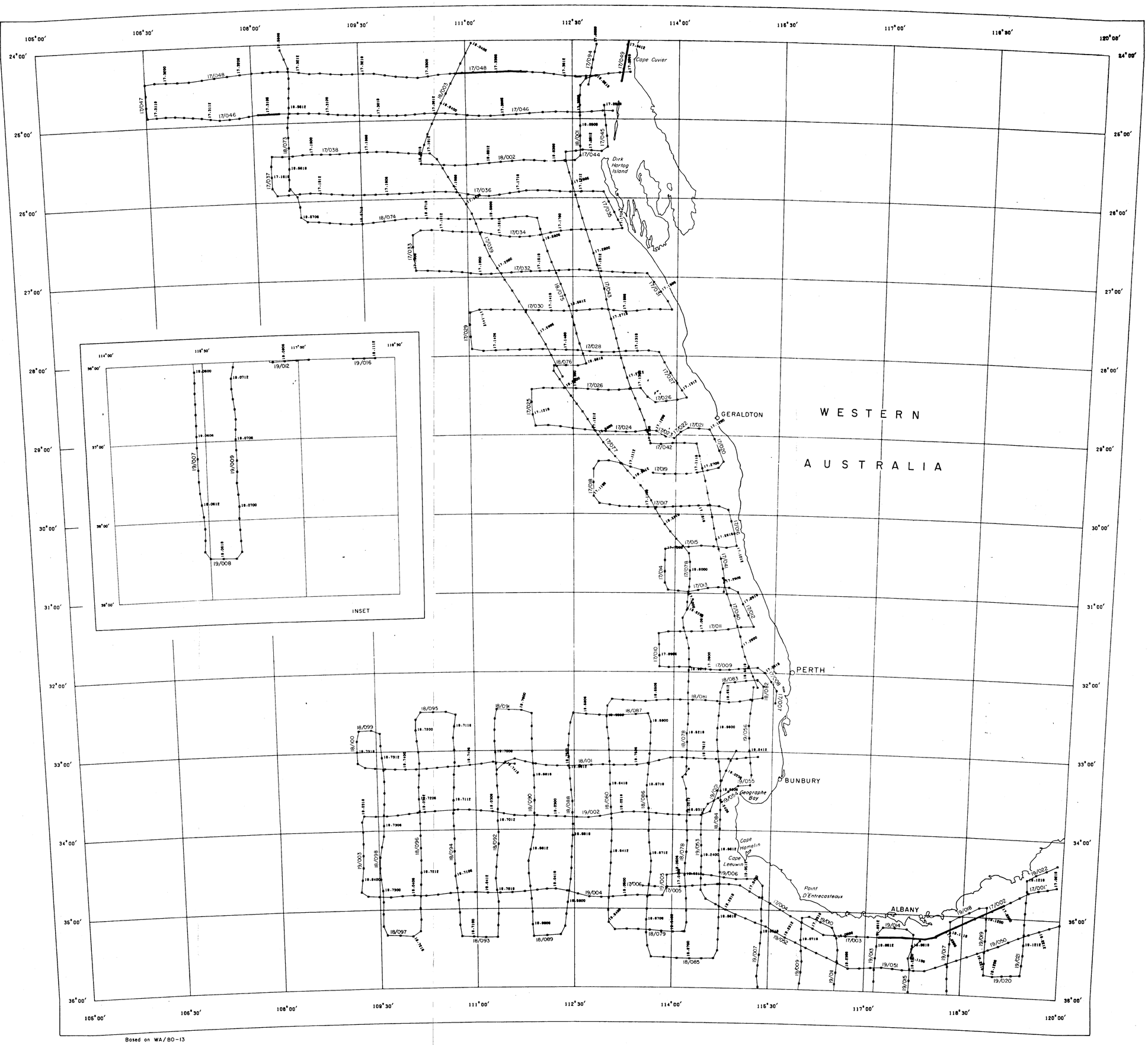


COMPAGNIE GENERALE DE GEOPHYSIQUE

SOUTHWESTERN MARGINS

PLOTTED 73/07/26

AUSTRALIA 1: 2500000



Based on WA/80-13

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

B.M.R. 1970-73 MARINE SURVEYS

SOUTHWESTERN MARGINS

TRACK CHART

AREA 6

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

WA/88-33-1

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BUREAU OF MINERAL RESOURCES ENCL. 56

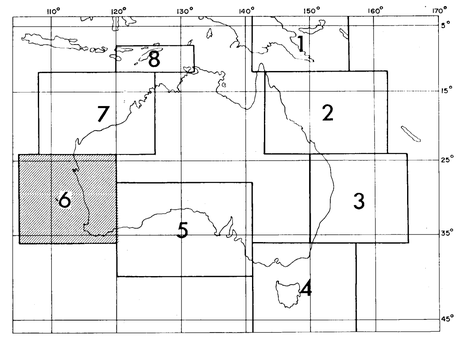
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA ___ ——

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
14.3400 — EVERY 6 HOURS - SURVEY NUMBER, B.M.R. DAY, TIME

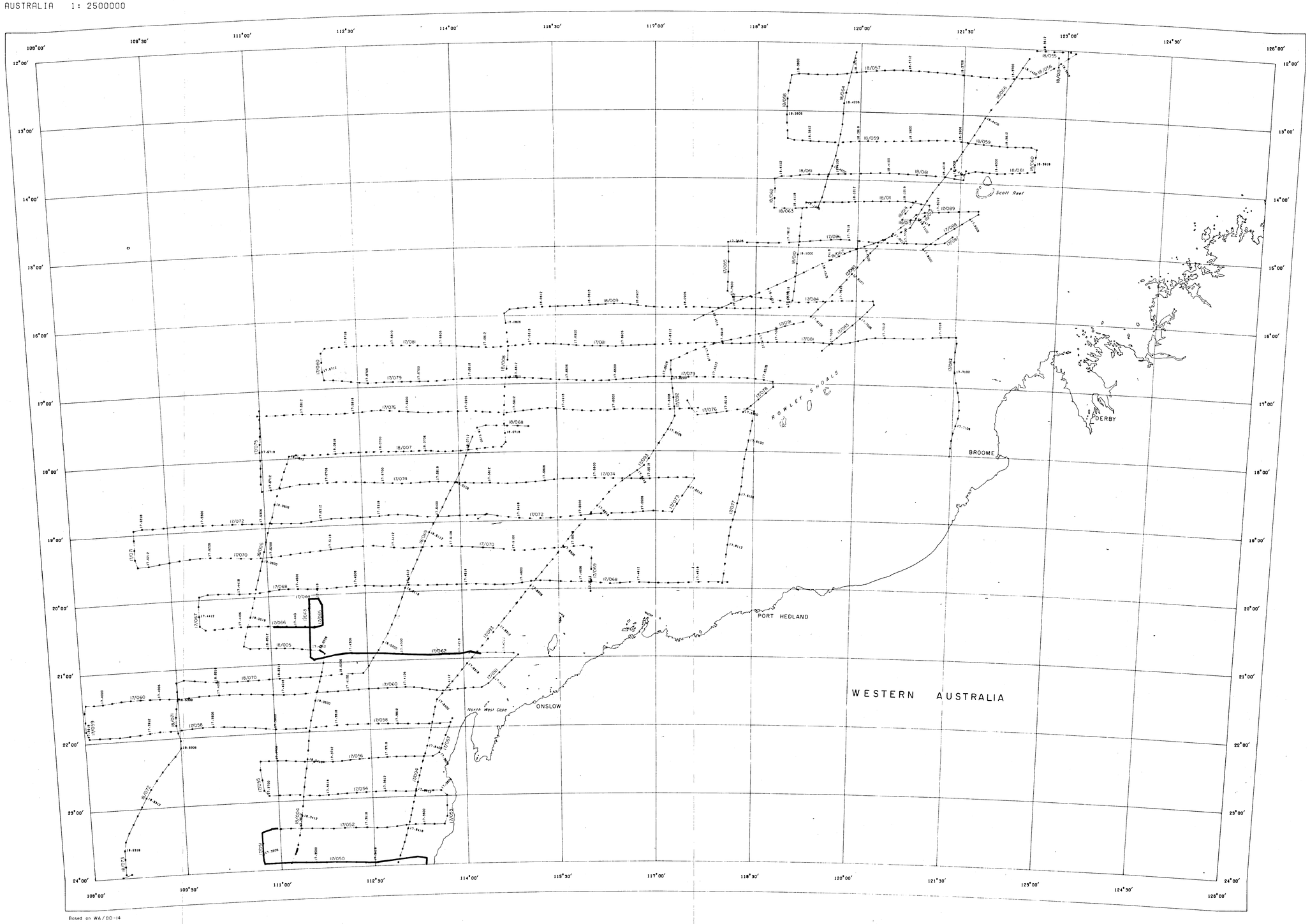


COMPAGNIE GENERALE DE GEOPHYSIQUE

NORTH WESTERN MARGINS

PLOTTED 73/08/08

AUSTRALIA 1: 2500000



Based on WA/80-14

BUREAU OF MINERAL RESOURCES ENCL. 57

GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

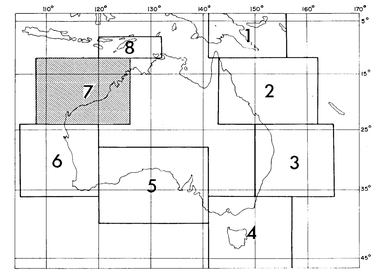
SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA ___ ———

LEGEND

14/036 HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER

18.3064 EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0' AND 36° 0' SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TRACK CHART

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

NORTH WESTERN MARGINS

AREA 7 WA/80-34-1

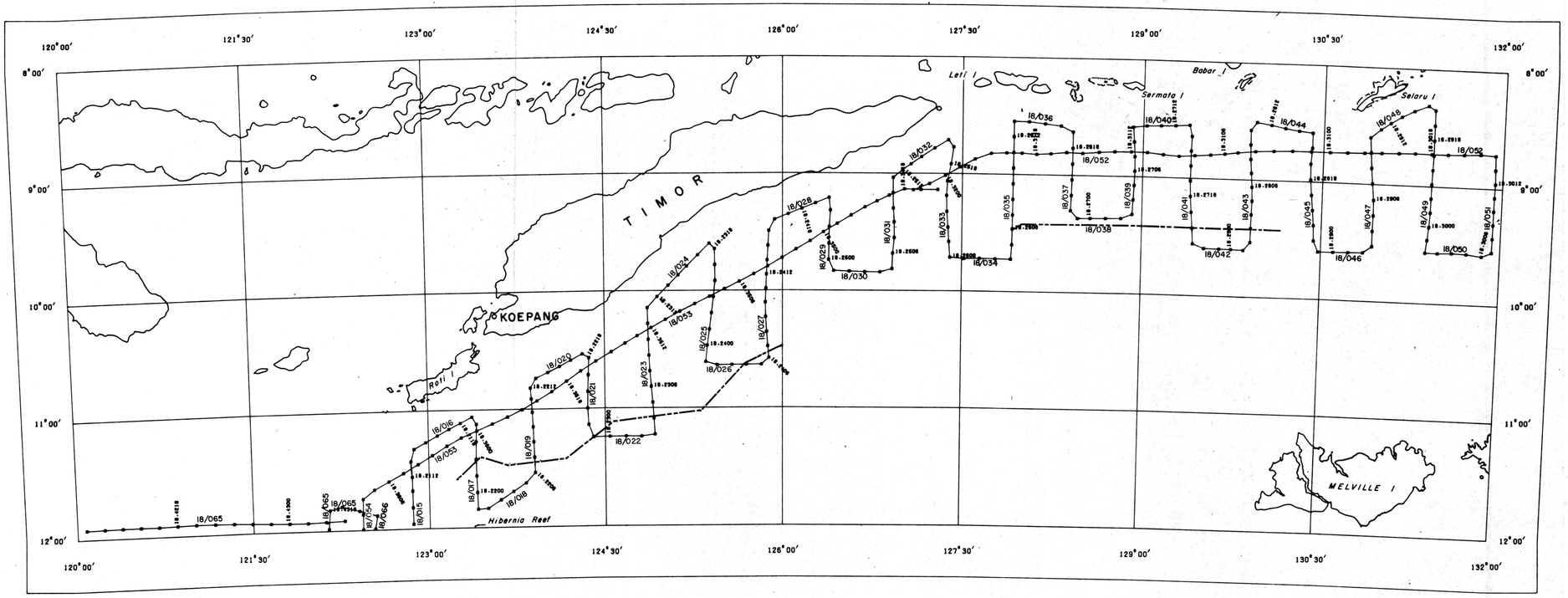
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TIMOR TROUGH

PLOTTED 73/08/08

AUSTRALIA 1: 2500000



Based on WA/80-15

AUSTRALIAN NATIONAL SPHEROID
SIMPLE CONICAL PROJECTION
WITH TWO STANDARD PARALLELS
AT 18° 0′ AND 36° 0′ SOUTH

B.M.R. 1970-73 MARINE SURVEYS

TIMOR TROUGH

TRACK CHART

AREA 8

WA/88-32-1

NOTE: *The information contained in this map has been obtained by the Department of Minerals and Energy, as part of the policy of the Australian Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.*

KILOMETRES
50 0 50 100 150 200 250
0 50 100
NAUTICAL MILES

The ship's position is plotted from hourly values based on preliminary data and tied to the satellite navigation fixes. The track line is a linear interpolation between these hourly positions. No adjustments have been applied for misties at traverse intersections.

BUREAU OF MINERAL RESOURCES ENCL.58

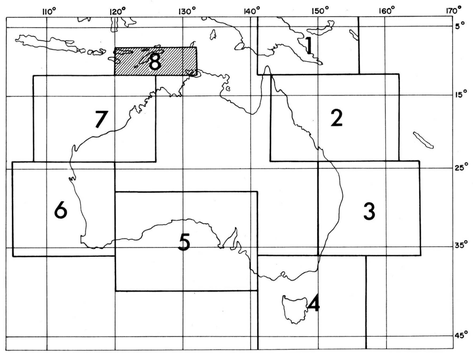
GEOPHYSICAL SURVEYS OF THE CONTINENTAL MARGINS OF AUSTRALIA, GULF OF PAPUA AND THE BISMARCK SEA

SHORE MAGNETIC DATA

DISTRIBUTION OF MISSING DATA ____ ——

LEGEND

14/036 — HOURLY POSITIONS - SURVEY NUMBER / PROFILE NUMBER
14.3006 — EVERY 6 HOURS - SURVEY NUMBER, BMR DAY, TIME



COMPAGNIE GENERALE DE GEOPHYSIQUE