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1958 No. 103.

PRELIMINARY REPORT

UNDERWATER GRAVITY SURVEY

GULF OF PAPUA

by

L.W. WILLIAMS.

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ABSTRACT.

This Report lists the values of gravity read on three traverses in the Gulf of Papua during an underwater gravity survey carried out in May, 1958.

An attempt has been made to tie the readings to a land survey conducted in the vicinity of the Gulf.

I. INTRODUCTION.

In response to an application by Mines Administration Pty. Ltd., the Bureau of Mineral Resources arranged to carry out underwater gravity readings along 6 traverses off the coast of Papua.

Because of unfavourable weather conditions only three of these traverses - off the Aroa River, Yule Island and Maiva Village - were completed.

Field work commenced on 24th. May, 1958, at Port Moresby, and the third line was completed on 29th. May, 1958.

II. FIELD WORK.

The underwater survey was commenced at a base station alongside a jetty in Port Moresby Harbour. A Worden gravity meter was used to tie this station to one at the Port Moresby Airport, which had been tied to Cairns Pendulum Station.

For calculation of gravity values along the three traverses, station A1, the first underwater station on the traverse off Aroa River, has been used as datum. Drift control was maintained by checking back to a base station at least once every day and the drift rate was found to be very close to constant.

The positions of the gravity stations were determined using a horizontal sextant and station pointer. It is estimated that the positions are correct to within $\pm \frac{1}{4}$ mile.

All anomalies have been reduced to M.S.L., and allowances have been made for tides using the Admiralty Tide Tables.

The results have been reduced twice:-

(a) for B.M.R. regional gravity requirements

(b) to fit in with Mines Administration land gravity survey.

For (a), an observed gravity value for A1 was determined from the measured interval from Port Moresby, and a density of 2.67 gm/cm^3 was used. Only the first station on each traverse was reduced.

For (b), a value for A1 was determined by assuming that it had the same Bouguer anomaly as S67, the Mines Administration station at the mouth of the Aroa River, and accepting the observed gravity value given for S67. A density of 2.0 gm/cm^3 was used in this reduction.

The two observed gravity values obtained for A1 differ by approximately 24 milligals.

The values obtained for B1 and C1 (the first underwater gravity stations on the other two traverses) by underwater gravity meter intervals from A1, have been compared with the values for S102 and S118, the land stations at the end of the respective traverses. The following table shows the results:-

Station.	Mines Administration Survey.			B.M.R. Survey.		
	Observed gravity.	Obs.Gravity corrected to M.S.L.	Interval	Observed Gravity.	Obs.Gravity Corrected to M.S.L.	Interval
S67(A1)	978 158.87	978 158.94	-21.66	978 159.50	978 158.[illegible]	-31.12
S102(B1)	137.28	137.28	- 7.49	128.50	127.82	- 5.92
S118(C1)	129.51	129.79		124.99	121.90	

The agreement between the stations at the ends of "B" and "C" traverses is reasonable, considering that B1 is not an exact reoccupation and that C1 is approximately 1 mile from S118, but the agreement between traverses "A" and "B" cannot be considered satisfactory.

Satisfactory checks were obtained with the underwater gravity meter on all reoccupations of base stations in the Gulf of Papua, and the tie from Port Moresby to Thursday Island was also satisfactory.

III. RESULTS.

The Bouguer anomalies on traverses "B" and "C" are very much more negative than those on traverse "A".

The anomalies on traverse A show a decrease of about 5 milligals going from the first station to the middle of the traverse, and then an increase of 3 milligals to the end.

On traverses "B" and "C" the anomalies become more positive going away from the coast. On traverse "B" the increase is 17 milligals and on traverse "C" 6 milligals.

TABLE I.

PRINCIPAL FACTS FOR GRAVITY STATIONS.

AREA: Gulf of Papua.

TRAVERSE: A, B and C - May 1958

GRAVITY METER: North American Marine

SENSITIVITY: 0.12665 milligal/div. ASSUMED ROCK DENSITY: 2.00

ELEVATION DATUM: Mean Sea Level. GRAVITY DATUM: Station A1

WATER CORRECTION = depth in feet x 0.05539.

Station.	Latitude.	Longitude.	Depth (feet)	Observed Gravity.	Normal Gravity.	Water Correction.	Bouguer Anomaly
				978	978		
A1	9°05.5'	146°48.5'	10.2	159.50	177.61	-0.56	-18.7
A2	06.1'	47.5'	49.3	159.85	177.90	-2.73	-20.8
A3	06.2'	46.9'	75.7	159.70	177.95	-4.19	-22.4
A4	07.2'	45.9'	96.9	160.56	178.43	-5.37	-23.2
A5	07.6'	45.0'	114.5	161.43	178.62	-6.34	-23.5
A6	08.0'	44.9'	108.1	162.46	178.60	-5.99	-22.3
A7	08.5'	44.0'	122.7	163.89	179.04	-6.80	-22.0
A8	09.0'	43.0'	112.7	164.90	179.28	-6.24	-20.6
A9	09.6'	42.4'	139.1	166.84	179.57	-7.70	-20.4
B1	8°46.9'	31.1'	12.2	128.50	169.08	-0.68	-41.3
B2	46.2'	27.4'	88.3	129.40	168.76	-4.89	-44.3
B3	47.2'	27.7'	111.8	131.30	169.21	-6.19	-44.1
B4	48.0'	26.7'	123.8	134.24	169.57	-6.86	-42.2
B5	48.8'	25.9'	131.6	137.27	169.93	-7.29	-40.0
B6	49.5'	25.2'	138.1	140.85	170.25	-7.65	-37.1
B7	50.0'	24.2'	150.9	145.04	170.47	-8.36	-33.8
B8	50.7'	23.5'	155.1	149.57	170.79	-8.59	-29.8
B9	51.6'	23.0'	156.8	152.55	171.19	-8.69	-27.3
C1	38.4'	25.2'	55.7	124.99	165.26	-3.09	-43.4
C2	39.5'	24.3'	84.9	127.64	165.75	-4.70	-42.8
C3	40.5'	23.8'	126.6	130.87	166.21	-7.01	-42.3
C4	40.7'	22.7'	155.9	134.07	166.30	-8.64	-40.9
C5	41.8'	22.2'	176.5	136.59	166.79	-9.78	-40.0
C6	43.0'	21.7'	190.3	139.04	167.33	-10.54	-38.8
C7	43.8'	21.2'	198.0	141.49	167.69	-10.97	-37.2

TABLE II.

PRINCIPAL FACTS FOR GRAVITY STATIONS.

AREA: Gulf of Papua.

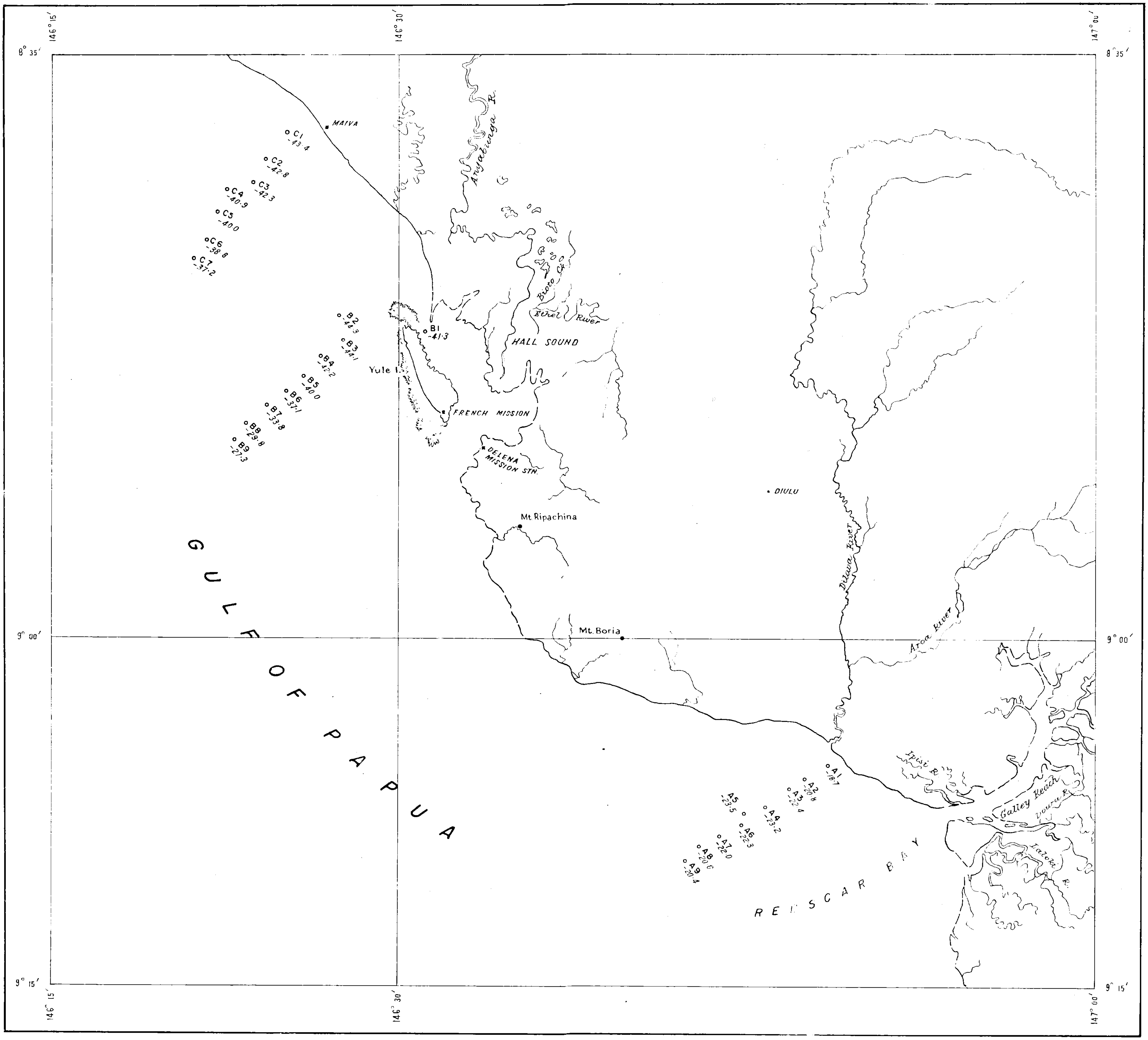
TRAVERSE: Port Moresby to A1, B1 and C1 - May 1958

GRAVITY METER: North American Marine

SENSITIVITY: 0.12665 milligal/div. ASSUMED ROCK DENSITY: 2.67

ELEVATION DATUM: Mean sea level GRAVITY DATUM: Port Moresby
Thursday Island.

Station.	Latitude	Longitude	Depth (feet)	Observed Gravity	Normal Gravity	Free Air Correction.	Free Air Anomaly	Bouguer Correction	Bouguer Anomaly
Pt. Moresby Jetty	9°29.0'	147°08.3'	11.8	978 229.77	978 188.81	-0.80	+40.16	+0.25	+40.4
A1	05.5'	146°48.5'	10.2	183.37	177.61	-0.69	+ 5.07	+0.21	+ 5.3
B1	8°46.9'	31.1'	12.2	152.36	169.08	-0.83	-17.55	+0.26	-17.3
C1	38.4'	25.2'	55.7	148.85	165.26	-3.77	-20.18	+1.17	-19.0



FOR THE CALCULATION OF BOUGUER ANOMALIES 1·03 GR/CM^3 HAS BEEN TAKEN AS THE SEA WATER DENSITY AND 2·0 GR/CM^3 AS THE AVERAGE ROCK DENSITY.

ELEVATION DATUM : M.S.L.

o C2 GRAVITY STATION

-20 6 BOUGUER ANOMALY (MILLIGALS)

REFERENCE - ADMIRALTY CHART 2028

UNDERWATER RECONNAISSANCE GRAVITY SURVEY (1958)
GULF OF PAPUA
BOUGUER ANOMALIES

SCALE IN MILES

4 0 4 8 12 16

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