COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1959 NO.68

PRELIMINARY REPORT ON UNDERWATER GRAVITY SURVEY HERVEY BAY, QUEENSLAND.

by

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ABSTRACT

As part of an underwater gravity survey of the Great Barrier Reef, Queensland, a traverse was carried out in Hervey Bay, south of Bundaberg. The traverse was not completed because of instrumental breakdown. The traverse shows small changes in gravity near the coast, and an increase in gravity at the eastern end.

1. INTRODUCTION

In October 1958, the Bureau of Mineral Resources, Geology and Geophysics commenced a gravity survey along the Great Barrier Reef area of Queensland extending from Thursday Island to Maryborough. The survey was undertaken by the Geophysical Section of the Bureau, in conjunction with Humber Barrier Reef Oils Pty.Ltd. and Lucky Strike Drilling Co., both of whom hold Authorities to Prospect for Oil in the area. The companies contributed the cost of the charter of the vessel, M.V. "Kano", while working in their respective Authorities, i.e. Authority 53P (Humber) and 42P (Lucky Strike).

The survey comprised a regional traverse approximately parallel to the coast with stations at 20 mile intervals, and eight cross-traverses from the coast towards the outer reefs, with stations at intervals ranging from one to five miles.

This report describes traverse 8 of the programme, off-shore from Woodgate, about 25 miles south of Bundaberg. This traverse lies wholly in Authority 42P. The earlier part of the work is described by Goodspeed and Williams (1959), and Dooley and Goodspeed (1959).

2. OPERATIONS

The equipment used was North American Marine Gravity Meter UW-2R-7, mounted on M.V. "Kano", a 60 ft. motor launch chartered from Mines Administration Pty.Ltd.

Traverse 8 was carried out by the writer during February, 1959. This was not the best season for marine work in this area. The vessel had put into Bundaberg for instrument repairs, and after these had been completed, several days elapsed before suitable weather permitted an attempt on traverse 8 on February 4th.

It was intended to carry traverse 8 through to Sandy Cape, at the northern end of Fraser Island. However at station BRS 40 the gravity meter received a severe jolt while landing on the bottom and no reading could be made. The symptoms suggested a broken ligature or main spring loop in the gravity meter. The vessel proceeded to Maryborough on 5th February and tests on shore confirmed this diagnosis. It was then decided to abandon any attempt to complete the programme, and to return the gravity meter to Melbourne for repairs. This decision was influenced by the delays already incurred, the probability of further delays due to bad weather, and the commitments for the boat and equipment for another survey in the Gulf of Papua.

A total of 14 stations was read at approximately two mile intervals. Readings were made at Bundaberg and Burnett River Heads before starting traverse 8. Owing to previous trouble with the equipment, these stations were not tied to the rest of the survey by the marine gravity meter. However values of gravity at these stations have since been established by a land connection to the pendulum stations at Maryborough and Rockhampton. This was done by B.C. Barlow with a Worden gravity meter in March, 1959.

Owing to the damage to the meter, no drift check reading could be made for traverse 8, and the regional traverse was not completed south of Gladstone.

3. SURVEYING AND CORRECTIONS

Positions were determined where possible by taking bearings on prominent landmarks with horizontal sextant, and plotting with station pointer, or by reading magnetic bearings. Between stations where these methods applied, dead-reckoning was used, and a check was made when landmarks or islands were sighted again. Positions were plotted on Admiralty Charts.

Depths measured with the equipment were corrected for zero error, and for height of the tide above mean sea level. No correction has been made for attraction of the water between sea level and mean sea-level. The gravity readings were corrected for tidal gravity forces.

The observed gravity values were corrected for normal gravity variation with latitude, and were corrected to mean sea-level by subtracting .0678d milligals (where d is depth in feet). The resulting anomaly is regarded as the Free Air anomaly. A simple Bouguer correction equal to .0209d was then added, corresponding to the difference in density between sea-water (1.03) and rock (assumed 2.67). No attempt has been made to correct for sea-bottom topography.

The gravity datum for traverse 8 was taken as BRS 25 (New Bundaberg Wharf) = 978,967.9 mgal; as a weighted mean of Barlow's observations near BRS 23 and BRS 25 and the difference between these two stations as measured by the Marine and the Worden gravity meters. In the absence of any drift check for traverse 8, zero drift was assumed. From previous readings it was apparent that, although a small regular upward drift in reading occurs (about 0.1 mgal. per day), this was generally masked for intervals shorter than a day by larger drifts of an erratic nature. The individual readings may be in error relative to the base by as much as 0.5 mgal.

At station BRS 40, measurements of depth and position only were made.

4. RESULTS

The locations and depths of the stations are tabulated together with the observed gravity, and Bouguer and Free Air corrections and anomalies in Table 1. The anomalies, together with sea depths, along traverse 8 have been plotted in profile form on Plate 2.

The adjacent land area forms part of the Maryborough Basin, where it is understood that a considerable thickness of sediments has been proved by seismic methods. Bouguer anomalies a few miles inland reported by Marshall and Narain (1954) are about 10-15 milligals positive. These are about the same as at the western end of traverse 8. This fact, combined with the slight fall in gravity from BRS 28-33, suggests that the sediments of the Maryborough Basin might continue under the sea for some distance.

The profiles show a rise in gravity off-shore at the eastern end. This is characteristic of the marginal areas between continents and oceans, where the M layer is shallower under the oceans. The continental shelf extends about 10-15 miles east of Fraser Island, and it is difficult to say to what extent the rise in gravity is due to this cause or to a more

local phenomenon such as thinning of the sediments.

An interesting feature is the change in gravity gradient at BRS 33, corresponding to a trough in the sea bottom. This suggests a fault or other structural feature. Further gravity work would be required to check whether the anomaly extends to the north or south. The Admiralty charts show that the topographic feature does not extend for any great distance.

Further interpretation should be undertaken in conjunction with the gravity traverse extending inland from Woodgate, carried out by Lucky Strike Drilling Corporation. The results of this are not available at the time of writing.

5. REFERENCES

DOOLEY, J.C., and GOODSPEED, M.J., 1959 - Preliminary report on underwater gravity survey, Great Barrier Reef area, Rockhampton to Gladstone. Bur.Min.Resour. Records 1959/69. (in preparation).

GOODSPEED, M.J., and WILLIAMS, L.W., 1959 - Preliminary report on underwater gravity survey, Great Barrier Reef area, Thursday Island to Rockhampton. Bur.Min.Resour. Records 1959/70. (in preparation).

MARSHALL, C.E., and NARAIN, H. 1954 - Regional gravity investigation in the Eastern and Central Commonwealth. Univ. Sydney, Dept. Geol. & Geoph., Mem. 1954/2.

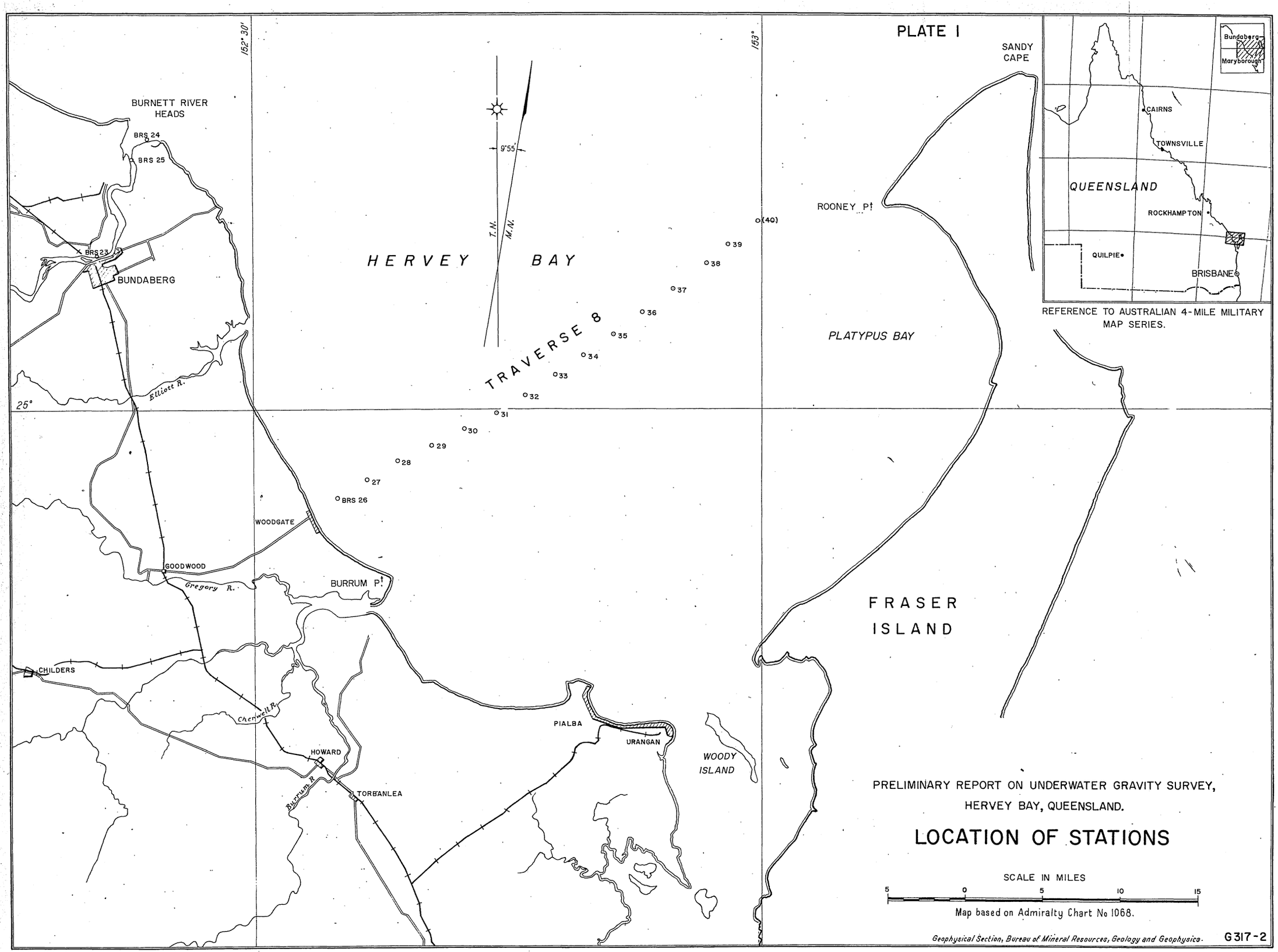
TABLE 1

Area: Gt.Barrier Reef Traverse: 8 Date of Survey: 4th February, 1959

Meter: UW-2R-7 Sensitivity: .12665 mgal/div.

Station	Latitude	Longitude	Elevation	Observed Gravity	Normal Gravity	Free Air Correction	Free Air Anomaly	Bouguer Correction	Bouguer Anomaly
BRS 23	24° 51.9'	152° 20.8'	6	978,975.7	978,960.2	+0.6	+16.1	-	+16.1
			Depth						
24	45.4	23.8'	14	965.9	952.7	-1.0	+12.2	+0.3	+12.5
25	46.5	23.0'	9	967,9	954.0	-0.6	+13.3	+0.2	+13.5
BRS 26	25° 04.8'	152° 34.8'	31	978,989.1	978,975.0	-2.1	+12.0	+0.6	+12.6
27	03.8	36.6	40	991.3	973.8	-2.7	+14.8	+0.8	+15.6
28	02.8	38.5	50	991.6	972.6	-3. 4	+15.6	+1.0	+16.6
29	01.9	40.5	58	990.3	971.6	-3.9	+14.8	+1.2	+16.0
30	01.0	42.4	63	989.1	970.6	-4.3	+14.2	+1.3	+15.5
31	00.2	44.3	67	988.0	969.7	-4.5	+13.8	+1.4	+15.2
32	24° 59.2	45.8	81	986.5	968.5	-5.5	+12.5	+1.7	+14.2
33	58.1	47.7	100	985.7	967.2	-6.8	+11.7	+2. 1	+13.8
34	57.2	49.4	65	984.9	966.2	-4.4	+14.3	+1.4	+15.7
35	56.0	51.2	68	985.4	964.8	-4.6	+16.0	+1.4	+17.4
36	54.8	52.9	69	983.0	963.5	-4.7	+14.8	+1.4	+16.2
37	53.5	54.8	77	983.2	962.0	-5.2	+16.0	+1.6	+17.6
38	52.1	56.8	73	985.4	960.4	-4.9	+20.1	+1.5	+21.6
39	51.1	58.0	80	987.1	959.2	-5.4	+22. 5	+1.7	+24.2
40	49.8	59.8	76						

PLATE I



REFERENCE TO AUSTRALIAN 4-MILE MILITARY MAP SERIES.

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LOCATION OF STATIONS

SCALE IN MILES

5 0 5 10 15

Map based on Admiralty Chart No 1068.

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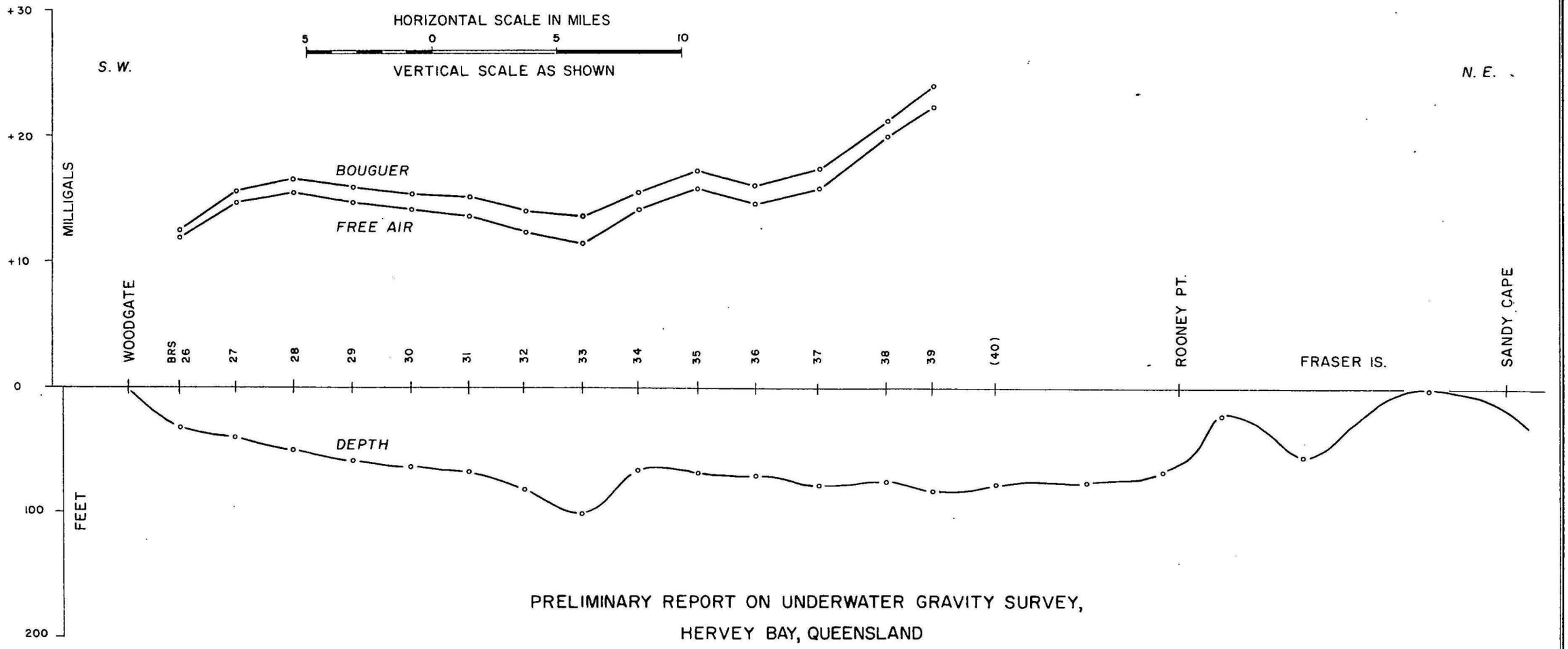
To accompany Records 1959, No. 68.



PRELIMINARY REPORT ON UNDERWATER GRAVITY SURVEY,
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PROFILE SHOWING GRAVITY ANOMALIES AND SEA DEPTH TRAVERSE 8

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics.

PLATE 2

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