# NGALIA BASIN LAND GRAVITY SURVEY (1970)

## O P 165, NORTHERN TERRITORY



MAGELLAN PETROLEUM AUSTRALIA LIMITED

G P O BOX 455, BRISBANE, QUEENSLAND 4001



GEOPHYSICAL ASSOCIATES PTY LTD

399 HONOUR AVENUE, GRACEVILLE, QUEENSLAND

December, 1970


REGIONAL LOCATION MAP

Figure 1

# NGALIA BASIN GRAVITY SURVEY (1970)

## OPERATIONAL REPORT

### (a) Location and Date

Magellan Petroleum Australia Limited, Alexander Chambers, 201 Wickham Terrace, Brisbane, Queensland selected Geophysical Associates Pty. Ltd. 399 Honour Avenue, Graceville, Queensland to conduct a land gravity survey covering the Ngalia Basin area O P 165, Northern Territory.

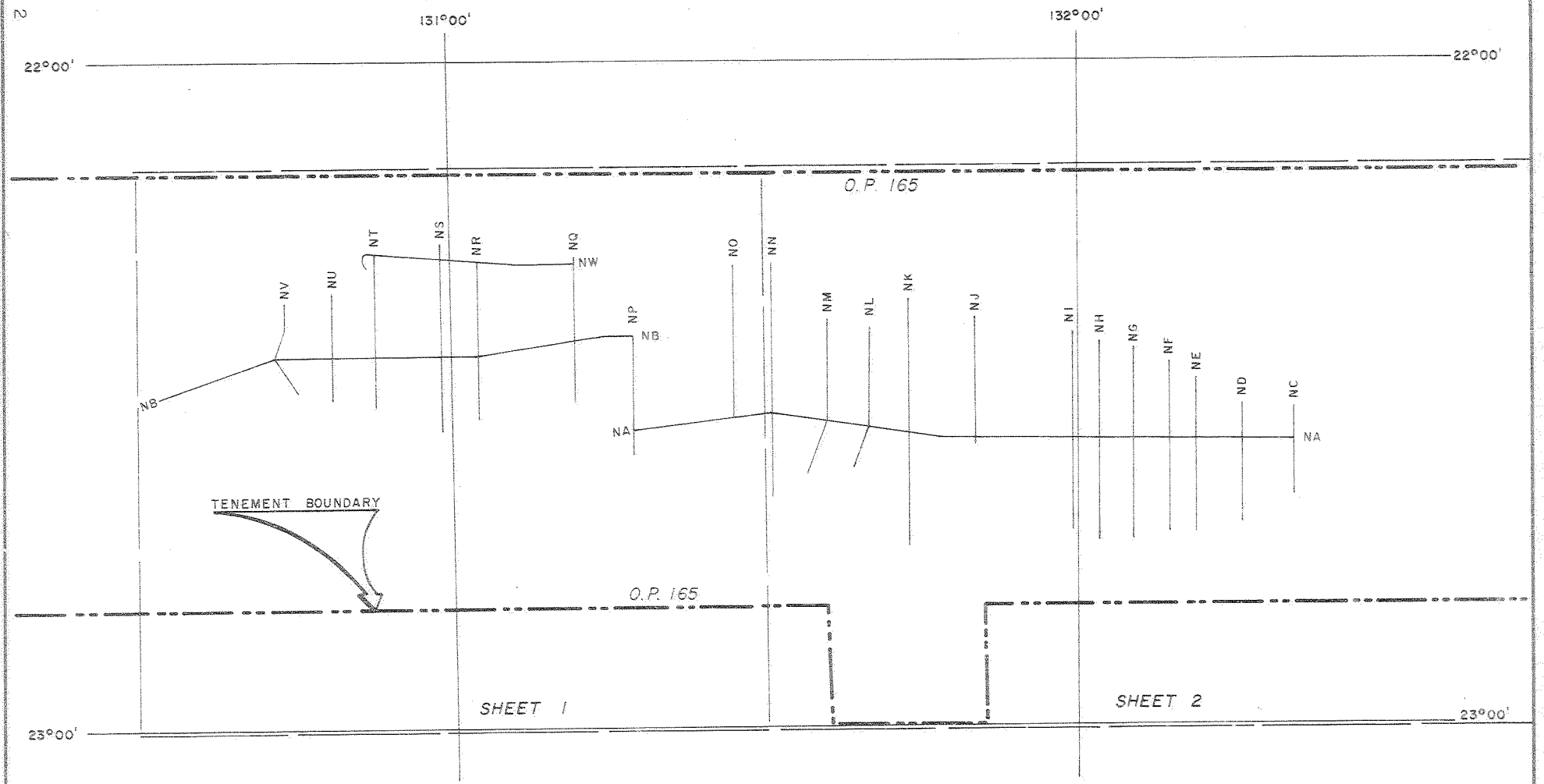
Geophysical Associates Pty. Ltd. personnel departed Brisbane August 11th 1970. Surveying, gravity metering and line clearing commenced August 18th and was completed on October 5th. The crew returned to Brisbane October 12th, 1970.

The Ngalia Basin Gravity Survey is located between 130°30' and 132°30' east longitude, 22°15' and 22°45' south latitude. The area is well served by the beef road from Alice Springs that crosses the extreme eastern programmed area and traverses through the Yuendumu aboriginal settlement to Vaughn Springs in the northwest portion of the permit. The eastern section, although reasonably flat have large tracts of thick mulga scrub. The middle area of the survey had been burnt out during the bush fires of 1969 and this made much easier going. Outcrops in the north and sand dunes to the south posed minor problems. Conditions in the western part of the area were variable, a portion was very heavily timbered mulga country and parts were covered with high sand hills. Temperatures varied from 105° F during the day to 45°F at night and there were periods where fairly heavy winds prevailed.

During the course of the survey 84 bases were established and 3325 stations metered.

Three campsites were occupied during the programme, the first between lines ND and NE, the second at the intersection of lines NA and NN and the third between

Figure 2




LINE LOCATION and SHEET INDEX

lines NS and NT on NB.

(b) Line Clearing

A Caterpillar D6 tractor was hired from Mr.F.Favaro of Alice Springs for line clearing. It became evident very early in the programme that the bulldozer would not provide sufficient line for the surveyors and meter operator to maintain a reasonable production rate so a D12 Caterpillar motor grader was engaged, again from Mr. Favaro. The dozer was utilized in areas of outcrop and heavy timber while the grader was put to good use in the more open spaces in spinifex and sand dune country. Down time for both machines was held to a minimum by good operational and maintenance practices.

(c) Field Procedures

A take-off point for line NA was established on the Alice Springs-Yeundumu road from topographical features. Range poles were set up to give the dozer directional control and the line cut to its eastern extremity. Lines NC and ND were cut on the return to the initiation point. Line NA was then cleared to the west, intersecting line 2 of the Pacific Napperby Survey at SP 132. An elevation tie was then facilitated to PM 6831 from bench mark BH 22. North - south lines NE,NF,NG,NH and NI were cut from this campsite before shifting further west on NA to what was to become line NN. At this juncture the grader was engaged, clearing lines NN, western NA,NO,NP and westward on NB while the dozer finished lines NJ,NK,NL and NM. The campsite was then shifted to its final position on line NB between NS and NT. From this site the dozer cut lines NQ,NR, and NS while the grader cleared the remainder of line NB and lines NT,NU and NV.

Station positions were set by stadia rod reading. Range poles were erected on the base lines NA and NB at their intersection with the proposed north-south lines, thus the grader and dozer were able to operate with a minimum of surveyor control.

(d) Surveying

The take off point for vertical control in the eastern permit was from bench mark BH 22. Loops were closed on bench marks EQ 32,33,34 and 35. Ties were made when encountered, to all bench marks established by the Bureau of Mineral Resources during their gravity and seismic operations and to stations set by Mr. Earl James of Darwin during the 1969 Ngalia Gravity Survey. These (James' bench marks) were 68/39 traverse L, 69/47 traverse K, 69/39 traverse O, shotpoint 1598 traverse A, 68/33 traverse K and the Vaughn Springs isogal station. The base line, 133 miles in length mistied between its extremities by only - 4.40 ft. Mr. James and BMR surveyors must be highly commended for the good and accurate surveying previously reported.

Vertical adjustments when required were made between bench marks. When loops were not closed lines were double run in feet and metres for closure.

Horizontal control was established from topographical features, by triangulation onto central Mt. Wedge and Mt. Davenport and from James' bench marks 68/39 traverse L and SP 1598 traverse A. Traverses K and J were repositioned 1100 yards north and 500 yards west when tied to the Mt. Davenport triangulation station. These had previously been located by James (1969) by control from Mt. Cockburn, thus casting some doubt on the accuracy of its reported position.

Lines 1 thru 6 of the Pacific Napperby Surveys were also repositioned on information from the present survey. Shotpoint 132 line 2 was correctly positioned and all other data were relocated by pivoting around this point and shifting SP 375 on the west end of line 2,750 yards south and 1800 yards east. Minor adjustments were necessary to the southern end of traverse A and to traverse F.

All gravity base stations, line-ends and intersections were permanently marked by a 5 ft. steel picket driven into the ground and attaching to it an

aluminium tag suitably inscribed with the contractors name, line and gravity station numbers.

(e) Gravity Metering

Two La Coste Romberg land gravity meters were used on this survey. These were checked in Brisbane on the Queensland University - Mt.Coottha range prior to and following the survey, to reaffirm their instrument calibration factors.

This is .08437 mgals per scale division for meter # 84 .08538 for meter # 73.

Gravity base station shotpoint 4515 traverse L was used as the initial take-off point for metering. Base stations were established at the ends and intersections of all lines, with closed loops being run where possible. The northern section of lines NC,ND, NE,NF,NG,NH and NI were closed by tying along line NA and the Yeundumu to Alice Springs road, returning to base station 4515. Bases on the southern section of these lines were closed back onto line NA. Base stations on lines NJ,NK,NL,NM,NN,NO,NU and the southern section of lines NQ,NR,NS,NT and NU were closed onto lines NA or NB. The northern section of lines NQ,NR,NS,NT and NU and line NW were closed by loops onto line NB. The base line consisting of lines NA,NB and NP was continually looped from base station 4515 to base station shot point 3796 traverse K and closed between these two points by 0.05 mgals. The Vaughn Springs isogal station located at the air strip, was tied to and closed by 0.01 mgals. All other loops were closed within 0.08 mgals.

A distance of 3,500 miles was travelled by the meter operator when setting 84 bases and running in 3325 stations.

(f) Bouguer Gravity Map and Computing

Gravity station values and base loop closures were calculated in the field to ensure their being within the survey tolerance. Adjustments were made for tidal and drift variations from Volume XVIII, supplement 1 of Geophysical Prospecting. These readings were reduced to gravity units by application of the calibration factor.

Bouguer values were then calculated from a knowledge of the latitude and elevation corrections. The density factor of 0.06599 mgals per foot was calculated from a density of 2.2 gms/cc. Latitude corrections were determined from the International Ellipsoid Equation :

$$G = 978.04900\ (1+0.0052884\ \sin^2\theta - 0.0000059\ \sin^2 2\theta)$$

Three density profiles, two at station 50 line NE (Plates III & IV) and one (Plate V) at station 89 line NB were made. These show that a density of 2.6 or 2.8 gms/cc would be more appropriate for the outcrop area at line NE while the 2.2 gms/cc is quite suitable at line NB.

Bouguer values from the BMR regional helicopter survey, BMR ground traverses, Pacific-Napperby Seismic and Gravity Survey, the 1969 Gravity Survey by Magellan on BMR seismic traverses were integrated with those from the current survey and are presented herein on Plate II sheets 1 and 2. The maps show the good agreement between the surveys, the only discrepancies appear at isolated helicopter stations.

Fortnightly progress reports were transmitted during the course of the survey to the Bureau of Mineral Resources - Canberra and to Magellan Petroleum Australia Limited, Brisbane.

GEOPHYSICAL ASSOCIATES PTY. LTD.

F. L. Hickey.



F. L. Hickey.

## APPENDIX II

## EQUIPMENT

| | |
|---|---|
| 1 | Toyota FJ 45 long wheel base, all wheel drive party managers vehicle |
| 2 | Toyota FJ 45 (Magellan) long wheel base, all wheel drive survey truck |
| 1 | Toyota FJ 45 (Magellan) long wheel base, all wheel drive metering truck |
| 1 | Toyota FJ 45 (Magellan) long wheel base, all wheel drive as survey and supply truck |
| 1 | Topcon AG 2 theodolite with tripod rods and all ancillary survey gear |
| 1 | K & E transit with tripod rods and all ancillary survey gear |
| 1 | Wild T2 theodolite with tripod rods and all ancillary survey gear |
| 2 | La Coste Romberg land gravity meters # 73 and 84 |
| 1 | Office caravan complete with Rotolite printer, calculators, drafting and computing equipment |
| 1 | Cook and sleeping trailer (Magellan) |
| 3 | Tents and camping gear (Magellan) |
| 1 | 7 1/2 KVA Lister Dunlite lighting plant |

## APPENDIX III

## PERSONNEL

| | |
|---|---|
| Party Manager | B. M. Warr |
| Field Computer | P. Mee |
| Meter Reader | P. Wade |
| Surveyors | J. Baxter |
| | G. Glover |
| Supply Driver | N. Johns (Magellan) |
| Rodmen | M. O'Connor (Magellan) |
| | A. Bohning (Magellan) |
| Cook | R. Appelt |
| BRISBANE OFFICE | F. L. Hickey |
| | A. Gell |
| | B. Talbot |
| Geophysical Supervisor for Magellan | A. Sabitay |

## APPENDIX IV

### STATISTICS

| | | |
|---|---|---|
| Bases metered | | 84 |
| Stations metered | | 3325 |
| Miles surveyed | | 480½ |
| Density profiles | 3 | (81 stations) |
| Days worked | | 48 |
| Days travel (To and from Brisbane) | | 10 |

## APPENDIX V

## TABLE OF PRINCIPAL FACTS

### BASES AND PERMANENTLY MARKED STATIONS

| Station Number | Latitude | Longitude | Elevation | Observed Gravity | Bouguer Gravity |
|---|---|---|---|---|---|
| NA 1 | 22°34'55" | 132°21'03" | 1908.2 | 602.07 | - 80.83 |
| NA12 | 22°34'58" | 132°15'56" | 1925.1 | 606.34 | - 75.49 |
| NA23 | 22°34'55" | 132°10'59" | 1932.8 | 606.45 | - 74.82 |
| NA29 | 22°34'56" | 132°08'00" | 1925.1 | 611.19 | - 70.60 |
| NA35 | 22°34'56" | 132°05'11" | 1932.3 | 617.98 | - 63.34 |
| NA41 | 22°34'57" | 132°02'19" | 1945.3 | 615.40 | - 65.08 |
| NA47 | 22°34'53" | 131°59'35" | 1942.3 | 617.24 | - 63.37 |
| NA56 | 22°34'46" | 131°54'43" | 1934.6 | 617.17 | - 63.85 |
| NA66 | 22°34'46" | 131°50'14" | 1926.9 | 620.59 | - 60.91 |
| NA72 | 22°34'47" | 131°47'09" | 1920.9 | 624.54 | - 57.38 |
| NA81 | 22°34'12" | 131°43'12" | 1932.6 | 625.49 | - 55.04 |
| NA87 | 22°33'45" | 131°40'25" | 1939.5 | 625.65 | - 53.94 |
| NA95 | 22°33'13" | 131°36'48" | 1950.7 | 626.67 | - 51.61 |
| NA106 | 22°32'24" | 131°31'27" | 1981.0 | 623.55 | - 51.87 |
| NA119 | 22°33'14" | 131°25'42" | 1963.1 | 627.09 | - 50.40 |
| NA136 | 22°34'19" | 131°17'53" | 1945.3 | 635.44 | - 44.38 |
| NB19 | 22°25'00" | 131°10'41" | 2065.6 | 581.32 | - 80.68 |
| NB44 | 22°26'24" | 131°02'43" | 2016.4 | 589.16 | - 77.56 |
| NB52 | 22°26'30" | 130°58'50" | 2003.8 | 588.72 | - 78.94 |
| NB64 | 22°26'28" | 130°53'00" | 1951.6 | 586.14 | - 84.93 |
| NB73 | 22°26'28" | 130°48'40" | 1956.7 | 579.31 | - 91.43 |
| NB85 | 22°26'27" | 130°42'58" | 1934.4 | 567.81 | -104.38 |
| NB107 | 22°30'04" | 130°32'02" | 1831.8 | 591.03 | - 91.75 |
| NC 1 | 22°31'21" | 132°21'03" | 1954.2 | 581.10 | - 94.96 |
| NC81 | 22°39'17" | 132°21'03" | 1869.0 | 627.20 | - 62.93 |
| ND 4 | 22°30'43" | 132°15'56" | 1983.8 | 584.90 | - 88.52 |
| ND111 | 22°41'39" | 132°15'56" | 1852.1 | 644.37 | - 49.40 |
| NE 1 | 22°28'39" | 132°10'42" | 2017.2 | 580.15 | - 88.89 |
| NE50 | 22°33'32" | 132°10'47" | 1995.2 | 595.50 | - 80.19 |
| NE145 | 22°43'01" | 132°10'48" | 1850.5 | 657.43 | - 37.90 |
| NF 1 | 22°27'36" | 132°08'00" | 2048.2 | 580.49 | - 85.41 |
| NF148 | 22°42'49" | 132°07'55" | 1855.0 | 657.08 | - 37.75 |
| NG 4 | 22°26'28" | 132°05'11" | 2059.3 | 582.35 | - 81.62 |
| NG164 | 22°43'10" | 132°05'08" | 1862.4 | 662.13 | - 32.59 |

| Station Number | Latitude | Longitude | Elevation | Observed Gravity | Bouguer Gravity |
|---|---|---|---|---|---|
| NH 1 | 22°25'27" | 132°02'11" | 2063.6 | 581.71 | - 80.88 |
| NH181 | 22°43'03" | 132°02'20" | 1869.2 | 663.78 | - 30.36 |
| NI 1 | 22°24'21" | 131°59'30" | 2061.3 | 581.57 | - 80.02 |
| NI179 | 22°42'01" | 131°59'30" | 1879.4 | 655.14 | - 37.23 |
| NJ 1 | 22°23'09" | 131°50'18" | 2128.8 | 580.42 | - 75.45 |
| NJ127 | 22°35'47" | 131°50'14" | 1914.1 | 624.84 | - 58.59 |
| NK 8 | 22°21'30" | 131°43'36" | 2146.3 | 574.84 | - 78.14 |
| NK226 | 22°43'00" | 131°43'25" | 1848.8 | 666.18 | - 29.26 |
| NL20 | 22°24'28" | 131°40'12" | 2135.6 | 587.86 | - 68.96 |
| NL154 | 22°37'46" | 131°38'49" | 1906.8 | 650.29 | - 35.73 |
| NM07 | 22°22'54" | 131°36'52" | 2128.3 | 582.38 | - 73.25 |
| NM163 | 22°37'56" | 131°34'41" | 1913.3 | 650.66 | - 35.11 |
| NN8 | 22°19'07" | 131°31'28" | 2090.2 | 573.48 | - 80.68 |
| NN60 | 22°24'31" | 131°31'28" | 2041.5 | 588.20 | - 74.88 |
| NN203 | 22°39'34" | 131°31'22" | 1910.3 | 647.44 | - 40.26 |
| NO 1 | 22°18'09" | 131°25'48" | 2202.9 | 561.50 | - 84.21 |
| NO 74 | 22°25'18" | 131°25'46" | 2077.7 | 590.34 | - 71.18 |
| NP 9 | 22°21'50" | 131°17'50" | 2199.9 | 567.17 | - 82.62 |
| NP36 | 22°24'24" | 131°17'50" | 2084.5 | 580.01 | - 80.11 |
| NP162 | 22°36'57" | 131°17'55" | 1908.5 | 646.44 | - 38.60 |
| NQ 3 | 22°18'34" | 131°10'38" | 2057.5 | 575.29 | - 80.46 |
| NQ127 | 22°30'25" | 131°10'42" | 1952.3 | 610.00 | - 65.20 |
| NR 1 | 22°16'37" | 131°04'08" | 2078.7 | 569.53 | - 82.77 |
| NR38 | 22°19'36" | 131°02'50" | 2142.1 | 566.94 | - 84.30 |
| NR172 | 22°32'16" | 131°02'46" | 1909.8 | 613.86 | - 66.12 |
| NS 1 | 22°16'36" | 130°58'46" | 2114.9 | 561.53 | - 88.36 |
| NS29 | 22°19'06" | 130°58'47" | 2060.3 | 566.87 | - 89.23 |
| NS180 | 22°33'00" | 130°58'50" | 1900.4 | 615.16 | - 66.21 |
| NT 4 | 22°18'09" | 130°52'58" | 2053.2 | 557.29 | - 98.30 |
| NT 6 | 22°18'27" | 130°52'58" | 2050.0 | 558.43 | - 97.68 |
| NT132 | 22°31'05" | 130°52'58" | 1890.9 | 607.35 | - 72.61 |
| NV14 | 22°21'12" | 130°48'40" | 2129.3 | 551.28 | -102.50 |
| NV108 | 22°30'15" | 130°48'40" | 1894.8 | 597.97 | - 80.84 |
| NV 1 | 22°21'43" | 130°44'08" | 2060.3 | 556.44 | -102.43 |
| NV81 | 22°29'34" | 130°45'24" | 1871.5 | 587.51 | - 92.12 |
| NW05 | 22°19'37" | 131°10'28" | 2063.0 | 574.92 | - 81.56 |

FROM PREVIOUS SURVEYS

| | OBSERVED GRAVITY |
|---|---|
| 6792/1216 | 561.28 |
| 6792/9216 | 563.97 |
| BH/22 | 600.98 |
| 68/48 | 578.48 |