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FINAL REPORT

WEST MEREENIE SEISMIC SURVEY

64/4548

AMADEUS BASIN

OP 43 AND OP 56 PART 1

NORTHERN TERRITORY

for

MAGELLAN PETROLEUM (N.T.) PTY. LTD.

Party 155
1964

UNITE
GEOPHYSIC

WEST MEREENIE

REFLECTION SEISMIC SURVEY

(64/4549)

in

OP 56 and 43

For

MAGELLAN PETROLEUM (N.T.) PTY. LTD.

By

UNITED GEOPHYSICAL CORPORATION

C O N T E N T S

C O N T E N T S
(CONT'D)

I. ABSTRACT

The West Mereenie Seismic Survey (64/4549) was conducted for Magellan Petroleum by United Geophysical Corporation for the purpose of delineating possible anticlines on the north and south flank of The Mereenie Anticline and to clarify the relationship between the Mereenie Anticline and the Glen Edith Hills Anticline. The results of the survey indicate a terracing with a low relief closure on the north flank of the Mereenie Anticline, large synclines to the north and south of the anticline, and a saddle separating the Mereenie structure from the Glen Edith Hills trend.

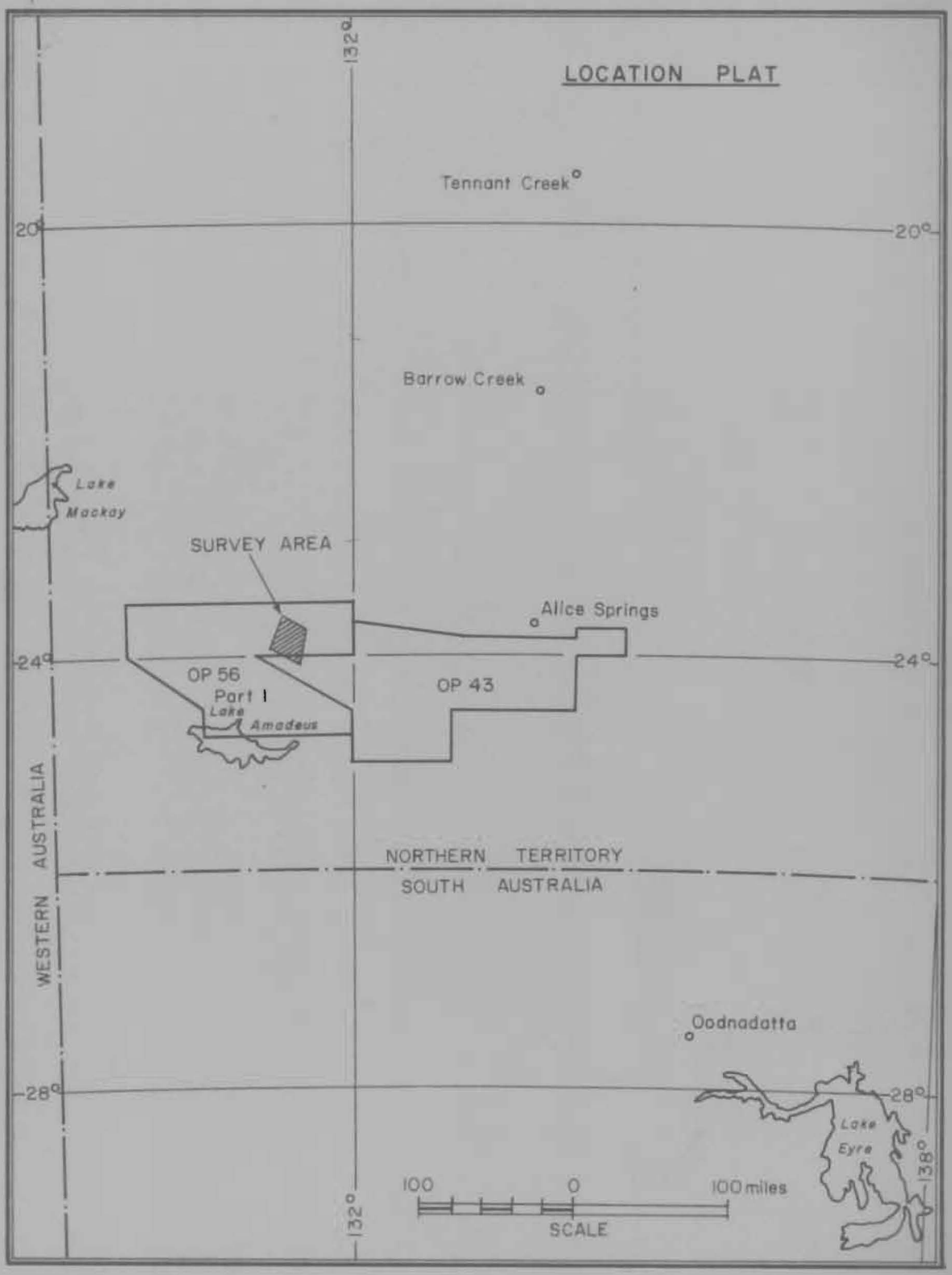

LOCATION PLAT
Tennant Creek
Barrow Creek
Lake Mackay
SURVEY AREA
Alice Springs
OP 56 Part 1
OP 43
Lake Amadeus
WESTERN AUSTRALIA
NORTHERN TERRITORY
SOUTH AUSTRALIA
Oodnadatta
Lake Eyre
20°
24°
28°
132°
138°
100 0 100 miles
SCALE

FIGURE 1

II. INTRODUCTION

The West Mereenie Seismic Survey (64/4549) was conducted for Magellan Petroleum (N.T.) Pty. Ltd. within Oil Permits 43 and 56, Northern Territory (See Figure 1).

The geophysical contractor was United Geophysical Corporation with main offices in Pasadena, California, U.S.A. and with Australian offices in Brisbane, Adelaide and Perth. Seismic Party Number 155 conducted the survey. Details of equipment and personnel are given in the Appendix.

A. Purpose of the Survey

Previous geological and geophysical work in the area indicated the possibility of two anticlinal structures, one between the Mereenie Anticline and the Gardiner Range to the north, and one between the Mereenie Anticline and the Johnny's Creek Anticline to the south. The primary purpose of this survey was to confirm or deny the presence of these structures and to clarify the structural relationship between the Mereenie Anticline and the Glen Edith Hills Anticline to the north-west.

B. Location and Access

The survey area is located in the Northern Territory near Latitude $24^{\circ}00'$, and Longitude $131^{\circ}30'$ as shown in Figure 1. Access is

from Alice Springs by a road which passes through Hermannsburg Mission, near Areyonga and to the Mereenie Area, approximately 190 miles west of Alice Springs.

C. Topography and Climate

Surface topography consists of gently rolling sand dunes with some scattered rock outcrops. No definite drainage pattern was observed. Vegetation consists of mulga, spinifex, other low bushes and a few pine and gum trees. The brush was very dense in some parts of the area.

The climate of the area is that of a semi-desert. The weather during the survey was generally clear; however, several rain-storms occurred but the water quickly soaked into the dry ground. Moderate to strong winds caused frequent dust storms.

III. PREVIOUS GEOPHYSICAL WORK

The West Mereenie Seismic Survey is an extension of the Mereenie Anticline Seismic Survey conducted for Exoil (N.T.) Pty. Ltd., by Namco International during September and October, 1962.

The first geophysical work in the area was a minor amount of gravity work performed by Century Geophysical Corporation in 1961. A more complete gravity survey was done over Mereenie Anticline for Magellan Petroleum by Adastra-Hunting Geophysics Pty. Ltd., in October, 1962.

IV. GEOLOGY

The Mereenie Anticline is in the Amadeus Basin which is located between the Musgrave-Mann Range to the south and the Arunta Igneous Complex to the north. The sediments in the basin are folded and become thinner toward the south. Formations of primary interest are the Stairway and Pacoota of Ordovician age and are known to contain hydrocarbons.

Locally the Mereenie Anticline is situated between the Johnny's Creek Anticline to the south and the Gardiner Range to the north-east. The axial trend of these structures is north-west south-east. The Mereenie formation, which overlies the Ordovician section, crops out along the south-eastern crest of the Mereenie structure; however, to the north-west it is covered by more recent deposits including sand dunes. Well logs of the Mereenie No. 1 and the Mereenie East No. 1 and No. 2 wells place the tops of the Stairway and Pacoota along the crest at depths of approximately 3,000 and 4,000 feet respectively.

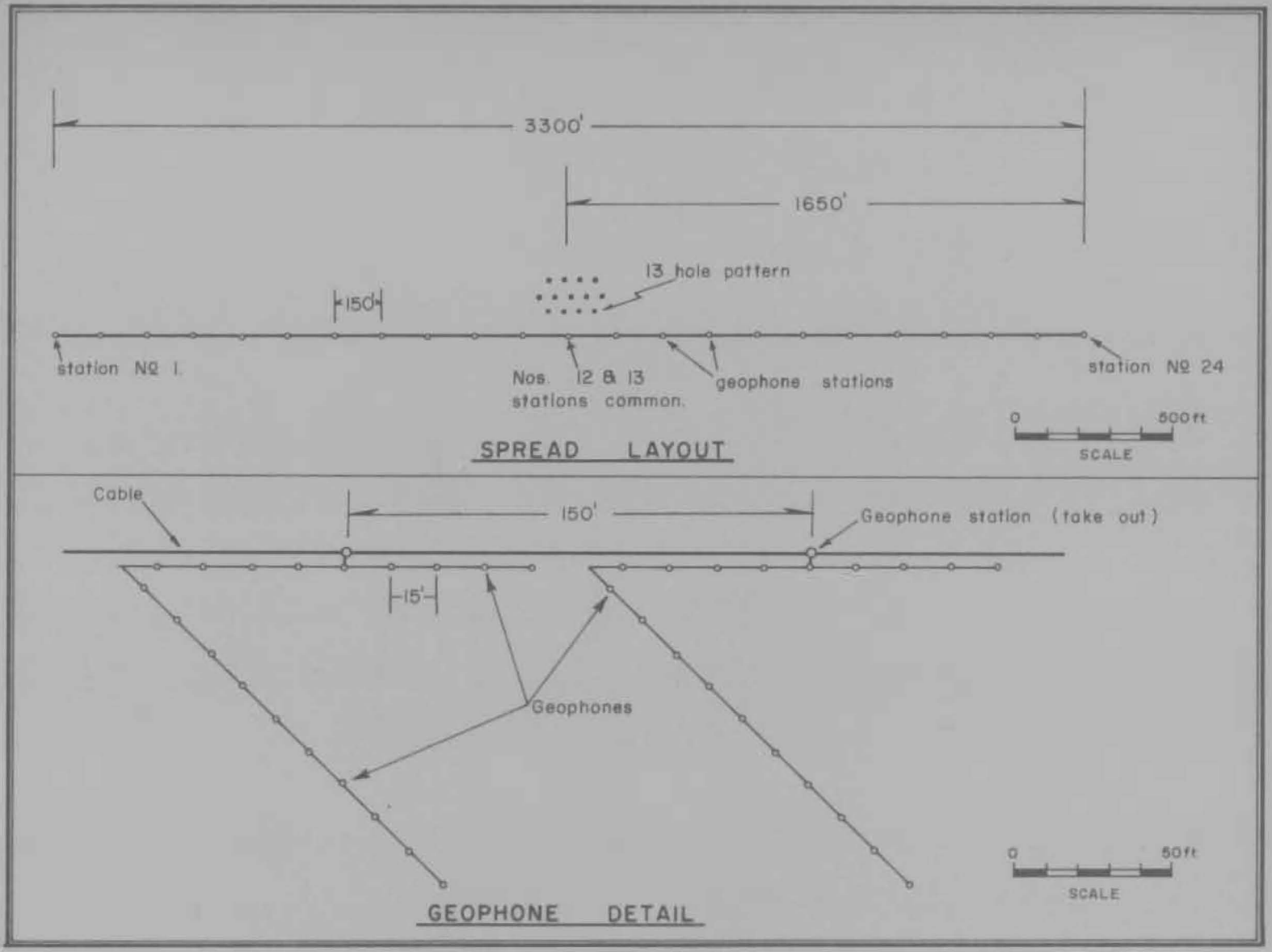

3300'
1650'
13 hole pattern
150'
station Nº 1
Nos. 12 & 13 stations common.
geophone stations
station Nº 24
0
500 ft
SCALE
SPREAD LAYOUT
Cable
150'
Geophone station (take out)
15'
Geophones
0
50 ft
SCALE
GEOPHONE DETAIL

FIGURE 2

V. OPERATIONS

A. Recording

The normal split-spread continuous-profiling reflection method was used. Spreads were 1650-0-1650 feet with 150 feet between trace centers. Twenty four traces were recorded with 12 and 13 being common at the center of the spread. Normally 18 geophones per trace were used with 15 foot spacing laid out in one of the two types of arrays shown in Figure 2.

The normal shot pattern was 13 holes drilled to Kelly depth (15 feet) as shown in Figure 2. A deep hole (about 150 feet) was shot every fifth or tenth shot point mainly for weathering control and formation sampling. Occasional patterns of three 60 foot holes were shot. Normal charges per hole were 5 pounds in the shallow, 15 pounds in the 60 footers and 30 pounds in the single deep holes.

United type 1-38B amplifiers with AGC and a filter by-pass were used for recording the data on a paper record through a T.I. camera and on magnetic tape with a Techno tape transport. Unmixed playbacks were made using 9-7 and 7-7 filter settings which at -6db pass 32-66 and 24-66 cycles per second respectively. The 9-7 filter setting gave a better response in areas of high frequency signal and was used over most of the area for computation.

B. Surveying

All horizontal positions were laid out with compass and chain then surveyed with a Wild transit and stadia. The stadia rod was graduated on one side in feet and on the other side in meters. Separate shots were taken on each side and traverses were calculated independently in feet and meters as a check.

Vertical control was based on an elevation supplied by the client of 2596 feet at the Mereenie No. 1 Well. A traverse to the Datum Peg (near Astrofix M1) checked the elevation there of 2352 feet within 3 feet.

Horizontal control was based on the Adastra-Hunting location of Astrofix M-1. United's survey tied horizontally and vertically within normal limits of accuracy to the Namco survey, and both are thought to be reliable.

This survey was an extension of previous work. Lines were scattered and could not be tied together until the latter part of the survey. Both Namco seismic and Adastra gravity locations were available for control for beginning new lines. As a gravity survey is generally more accurate than a seismic survey, elevations of these stations were used to initiate the new and scattered lines. When these were tied together, it was found that the gravity survey contained serious horizontal and vertical errors. As these errors

were confirmed near the end of this survey, it was necessary to put elevation correction notes on the cross-sections. Individual records have been re-computed to show correct elevation.

It is recommended that the Adastra gravity survey be reviewed.

C. Drilling

Shot holes were drilled with two Mayhew rigs equipped with mud pumps and air compressors. Drilling was done with air or water injection using blade type bits almost entirely.

D. Line Clearing

A crawler tractor equipped with a bulldozer type blade rear mounted and a "treepusher" bar in front was used to clear line and improve roads.

E. Progress Reports

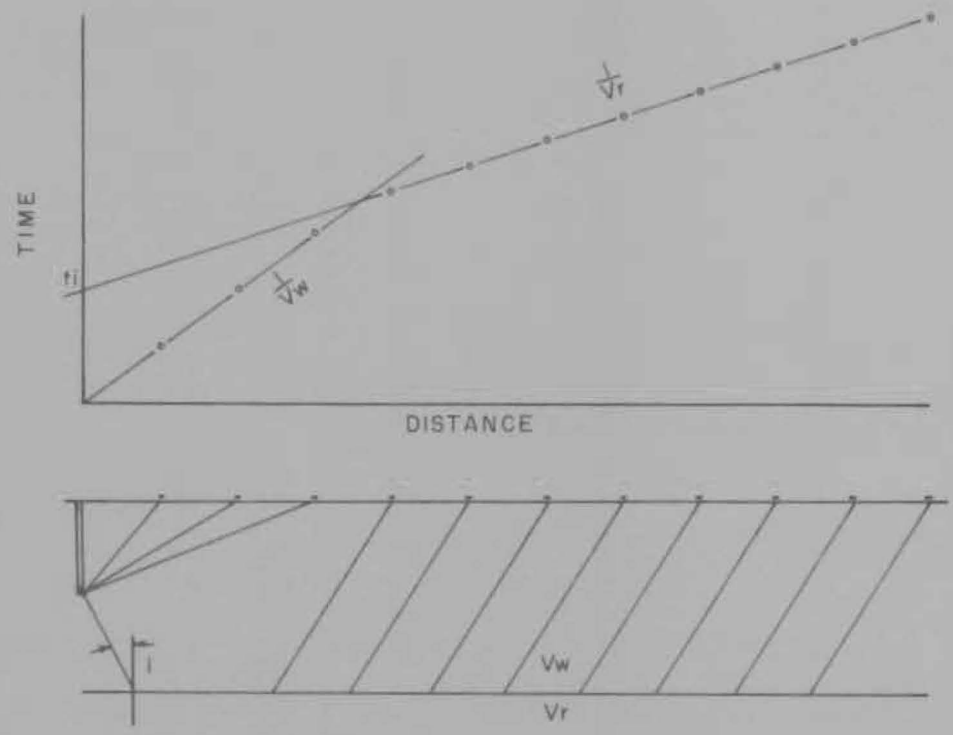
Production figures from the crew were reported by telegram semi-weekly to United's Adelaide office, and fortnightly written reports with maps were sent to the BMR and client, dated October 1, 15, 27 and November 11, 1964.

VI. EXPERIMENTATION

Extensive experimentation was carried out at the start of the survey. Variables included the number of holes, depth of holes, charge sizes, number of charges in a hole, number and arrangement of geophones, and playback filters. Lines were positioned to avoid crossing sand dunes where possible. A noise analysis spread on Line BN between shot points 50 and 51 indicated that noise was travelling both radially and transversely to the geophone line and that ground roll in a radial direction was not severe. Therefore the geophone array as shown in Figure 2 was used. In other areas radial ground roll became strong and the 18 geophones per trace were laid out in line.

As a result of all experimentation the following optimum parameters were determined: a pattern of thirteen shot holes fifteen feet deep, 18 geophones per trace in a "V" array, and a 9-7 playback filter passing 32 to 66 cycles per second at -6db.

Comparison shots were recorded throughout the survey with different filter settings, shot hole patterns, hole depths and varying charge sizes. The shallow multiple hole patterns were considered superior in nearly all cases.



CALCULATION OF DEPTH OF WEATHERING

$tw = \frac{ti + tuh}{2}$ (Assumes $i = 0$)

$Vw = 2000'/s$

$Dw = 2\,tw = 2\left(\frac{ti + tuh}{2}\right) = \underline{ti + tuh}$

Check using shot below the weathering

$Dw = \frac{Vw\ Vr\ (tuh) - Vw\ Ds}{Vr - Vw}$

tw = One way time in weathering

Dw = depth of weathering

ti = intercept time

tuh = uphole time

Vw = weathering velocity

Vw = subweathering velocity

Ds = depth of shot

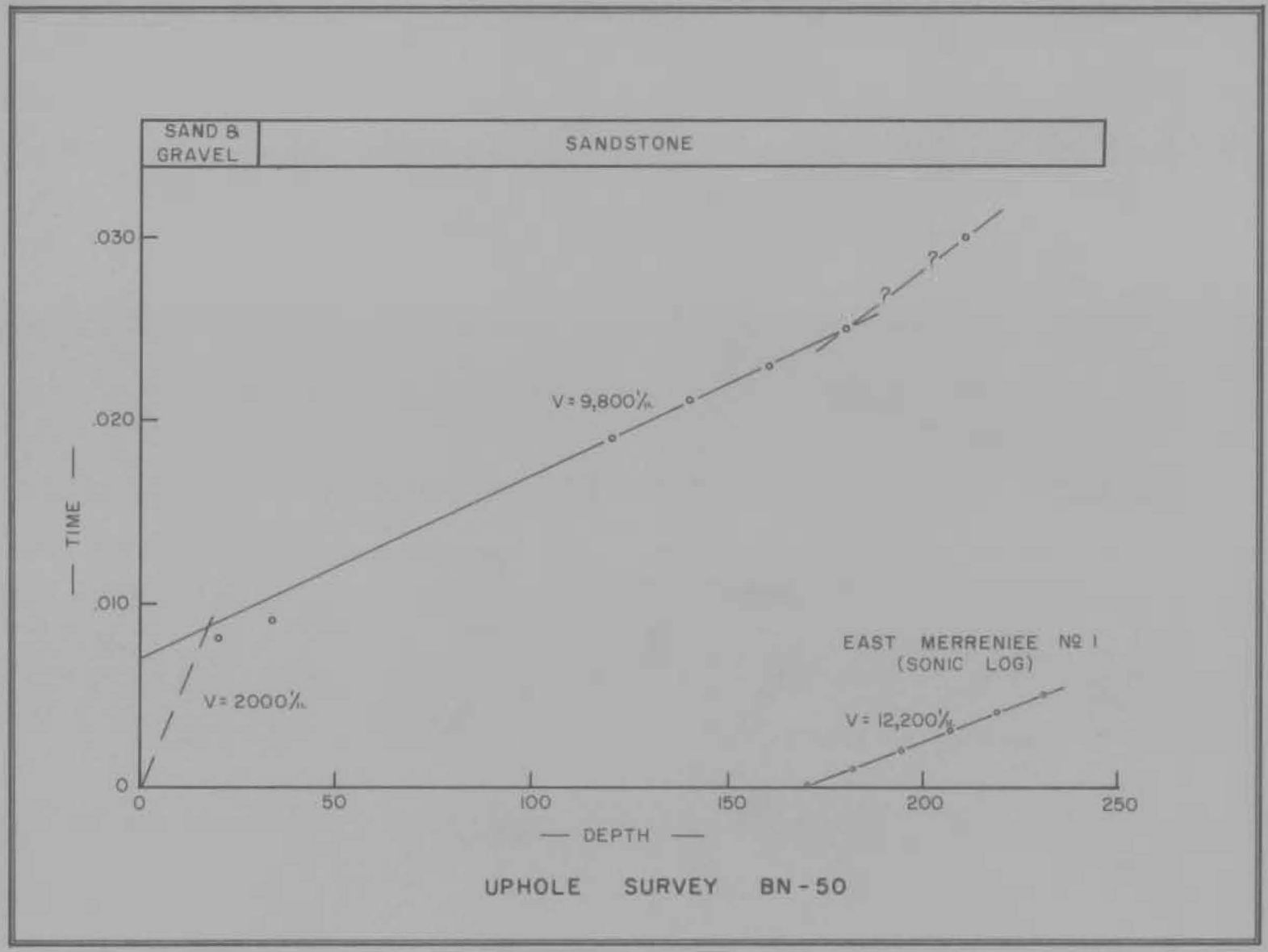
FIGURE 3

VII. COMPUTATION

Two methods of computation were used. The normal uphole method was used on the deep shots to check the results of applying the second method to the shallow pattern shots. This second is illutrated in Figure 3. It assumes that the intercept time (from the first breaks) and the uphole time is equal to twice the time through the weathering. Velocities used were 2,000 ft./sec. for the weathering and 10,000 ft./sec. for the sub-weathering as determined from the uphole survey shown in Figure 4. Agreement of the two methods was good.

Reflections were plotted on cross-sections using a wave-front chart at constant velocity of 14,000 ft./sec. from a datum of 2,200 feet above sea level. This velocity was obtained from the integrated sonic log of the Mereenie East No.1 Well.

Static and dynamic corrections were made and the magnetic tapes sent to United's Pasadena Playback Center where corrected variable density record sections were prepared.



UPHOLE SURVEY BN-50

FIGURE 4

VIII. INTERPRETATION

A. Record Quality

Record quality varied greatly. Good records were obtained on the flank of Johnny's Creek Anticline and in the syncline to the north of the Mereenie Anticline. Fair to very poor records were obtained on the crest of the structure. On both flanks quality was extremely poor, although some fair data were obtained on the north flank along Line F. Poor records occurred generally where shots were in a hard, high velocity sandstone which gave a high frequency signal. These signals lose energy rapidly and generate noise in the reflection frequency range.

B. Horizons Mapped

The "A" and "B" horizons mapped are thought to be reflections from near the top of the Stairway and near the bottom of the Pacoota respectively.

The interval between these horizons is shown by the Isochron Map. A regional southward thinning is present. A decrease in the rate of thinning is noted in the area of the Mereenie structure and immediately north of it.

The cross sections included in the report illustrate the structural relationship of the mapped horizons.

C. Method

The map values were taken from migrated cross sections. Times directly under the shot points were used rather than record times. Figure 5 is the migrated section on Line F which can be compared to the variable density section at the back of the report.

IX. RESULTS AND CONCLUSIONS

The results of the West Mereenie Seismic Survey show that the Mereenie Anticline is bounded to the north and south by major synclines which separate it from the Gardiner Range and the Johnny's Creek structure.

A major fault is indicated on the south flank of the Mereenie structure. The exact hade and throw of the fault are difficult to determine but the fault is reverse or thrust in nature. A smaller reverse fault is shown on the north flank.

The saddle mapped between the Mereenie and Glen Edith Hills Anticlines shows approximately 0.070 seconds or 490 feet of closure to the apex of the Mereenie Anticline.

No anticline is mapped to the south of the Mereenie structure where interpretation of data from the previous seismic survey had indicated one to be present. A secondary feature may lie south of the Glen Edith Hills structure and to the west of the present survey. Additional shooting would be necessary to map this area.

APPENDIX I.

EQUIPMENT

Recording

One Ford Model F-600 four wheel drive truck equipped with cable reels and instrument cab containing one set of 24 U.G.C. Model 1038 wide band amplifiers, techno tape recorder, camera and all associated control units.

Six 1800 foot geophone cables.

576 Electro Tech EVS-2 reflection geophones.

One landrover 109 inch wheel base with four wheel drive as cable vehicle.

One shooting truck, Ford-600 with Marmon-Herrington four wheel drive, front mount winch, explosive magazines, and water tank.

SIE Model 2000 AB high voltage blaster, cap tester, uphole geophone and loading poles.

Surveying

One complete set of survey equipment including a Wild transit.

Two four wheel drive landrovers.

Drilling

Two Mayhew 1000 drills with mud pumps and Gardner-Denver, Model WCQ air compressors for air-water drilling, mounted on Ford F-800 trucks with Marmon-Herrington, four wheel drive, front mount winches, and 200 feet of drill pipe for each drill.

One water truck, Ford F-600 with four wheel drive, front mounted winch, and 1000 U.S. gallon water tank.

Office and Camp

One 24 foot kitchen caravan with deep freezer, two refrigerators, etc.

One dining tent with all necessary utensils.

One 22 foot office caravan with all necessary office equipment.

One shower caravan.

One shop trailer with mechanics tools.

Sufficient tents and bedding to sleep all personnel.

Two 10 KW lighting plants.

Radio for communication with Flying Doctor Service.

One 500 gallon water tank trailer for Camp supply.

One supply truck, Ford F-600.

APPENDIX II

PERSONNEL

Party Chief	W.H. Doughty
Seismologist	W.D. Jones
Observer	N.L. Squires
Surveyor	P. Skelly
Drillers	R. Grierson B. Wayne

Additional personnel to a total of 23.

APPENDIX III

STATISTICS

Starting date first shot	September 21, 1964
Completion date last shot	October 25, 1964
Total number profiles shot	243
Total number shots	331
Total miles subsurface coverage	80.6
Total hours recording field time	310
Total hours recording drive time	79
Total hours recording time (including 48 hrs. experimental shooting)	389
Average profiles per hour (excluding experimental shooting)	.714
Total pounds dynamite used	19970
Average pounds dynamite per profile	47
Total number holes drilled	3511
Total number feet drilled	63750
Total hours drilling time (2 drills)	741
Average number feet drilled per hour	86
Total number finger bits used	13
Total number rock bits used	1
Total hours crawler tractor time	309½
Total hours all units move-in & move-out time	60
Time lost due to instrument trouble (not chargeable)	20

Respectfully Submitted,

UNITED GEOPHYSICAL CORPORATION

Party 155

J.R. Patch

PR64/029

FINAL REPORT - WEST MEREE IE SESMIC SURVEY

AMADEUS BASIN. N.T. for

MAGELLAN PETR.(N.T.)PTY.LTD.

INTERPRETATION

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PR 64/029

Summary:

FINAL REPORT.

West Mereenie Seismic Survey

64/4549.

Amadeus Basin OP 43 and OP56

Part 1.

Northern Territory for Australia

Magellam Petroleum (NT) Pty. Ltd.

Party 155 1964

United Geophysical

PURPOSE OF SEIRVEY.

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Note: Most shot holes are 15 deep with occasional holes 150ft deep.

Report includes maps and some profiles.