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SEISMIC SURVEY REPORT FOR SIMPSON
DESERT "B" SEISMIC SURVEY - O.P.75
AND
SIMPSON DESERT NORTH SEISMIC
SURVEY - O.P. 64 (Part 1)
NORTHERN TERRITORY

1966

IMAGED

PETROLEUM

PR64/23

ONSHORE

Mr Adams.
Mr Shields -
Pls acknowledge receipt
at folio 97

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SIMPSON DESERT "B" SEISMIC SURVEY
OIL PERMIT 75
NORTHERN TERRITORY
AUSTRALIA
For
AMERADA PETROLEUM CORPORATION OF AUSTRALIA LIMITED

AND

SIMPSON DESERT NORTH SEISMIC SURVEY
OIL PERMIT 64
(Part 1)
NORTHERN TERRITORY
AUSTRALIA
For
AMERADA PETROLEUM CORPORATION OF AUSTRALIA LIMITED
and
EXOIL (N.T.) PTY. LIMITED

By

AUSTRAL GEO PROSPECTORS PTY. LTD.
BRISBANE, QUEENSLAND, AUSTRALIA

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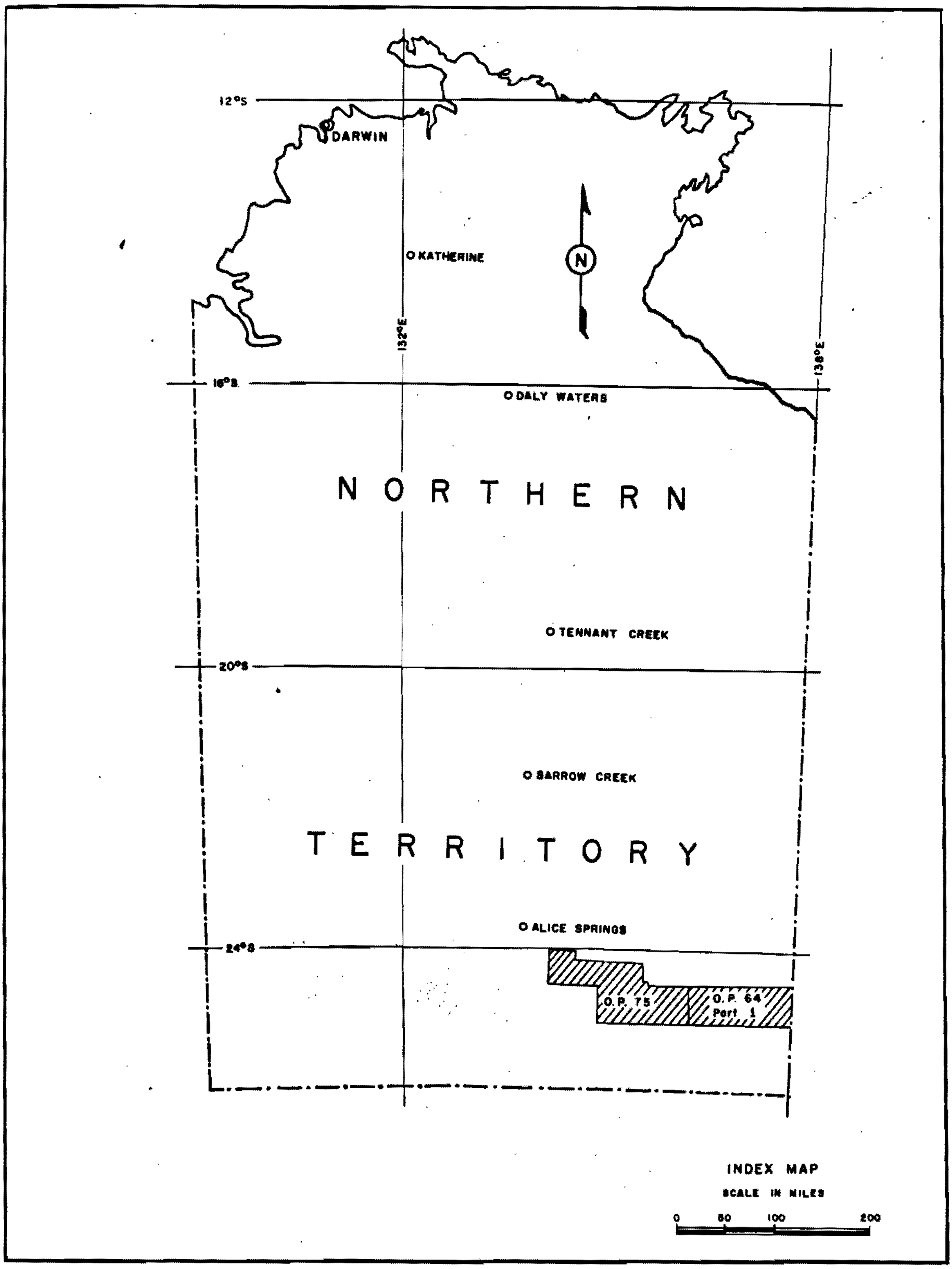


12°S
DARWIN
KATHERINE
N
132°E
138°E
16°S
DALY WATERS
NORTHERN
TENNANT CREEK
20°S
BARROW CREEK
TERRITORY
ALICE SPRINGS
24°S
O.P. 75
O.P. 64
Part 1
INDEX MAP
SCALE IN MILES
0
50
100
200

Figure 1

ABSTRACT

The Simpson Desert "B" and Simpson Desert North Seismic Surveys were conducted in Northern Territory OP75 and Northern Territory OP64 (Part 1), respectively, both located in the southeastern part of the Northern Territory, between May 2, 1966 and December 17, 1966. The surveys utilized continuous coverage reflection methods and while essentially reconnaissance in nature, included limited semi-detail work in OP75. A shallow probable Jurassic horizon was mapped with continuity throughout most of the area of the surveys and, in addition, deeper horizons were mapped in some areas. The surveys added significantly to the understanding of both regional and local structure and included the outlining of a large southwest-plunging feature believed to be associated with a northeastern extension of the McDills structural trend.

INTRODUCTION

The Simpson Desert "B" Seismic Survey was conducted in the southeastern part of Northern Territory OP75 for Amerada Petroleum Corporation of Australia Limited and the Simpson Desert North Seismic Survey in the southwestern part of Northern Territory OP64 (Part 1) was conducted for Amerada and Exoil (N.T.) Pty. Limited jointly by Austral Geo Prospectors Pty. Ltd. between May 2, 1966 and December 17, 1966. Northern Territory OP75 is a 5,746 square mile area subject to a farmout agreement between Amerada and Flamingo Petroleum Proprietary Limited, the tenement holder, and OP64 (Part 1) is an approximate 4,000 square mile area subject to a farmout agreement between Amerada and Exoil and Mercure International Pty. Limited, the tenement holder. The surveys utilized continuous coverage reflection seismic methods, with Austral Geo Prospectors' Crew No. 3 working intermittently from May 2, 1966 to August 16, 1966 and Crew No. 2 working from August 28, 1966 to December 17, 1966. Field headquarters were located at Alice Springs about 150 miles northwest of the area surveyed and the two crews operated from field camps that were relocated as the surveys progressed. Radio communications were maintained between Alice Springs and the field camps and the crews were supplied by road from Alice Springs.

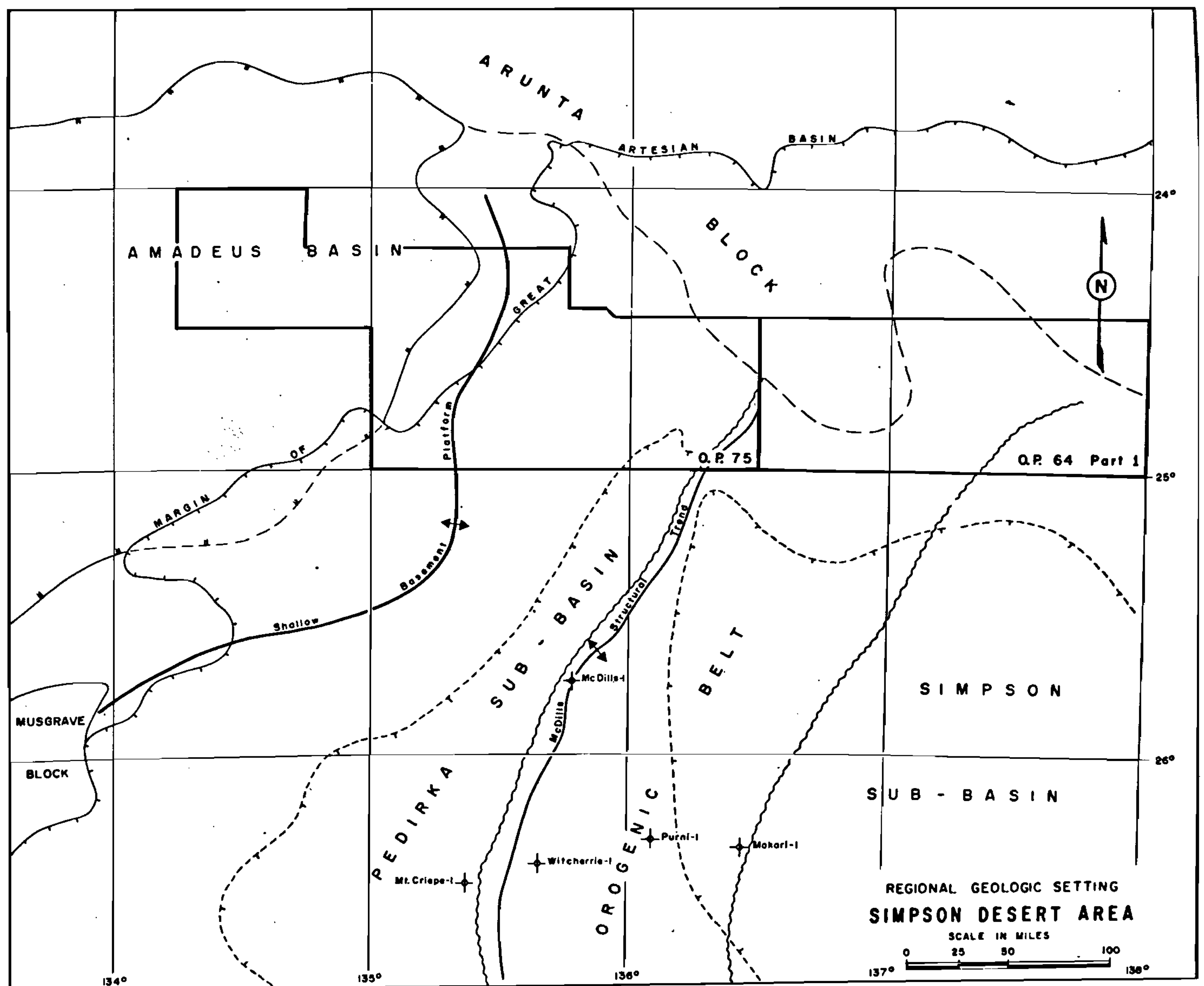
REGIONAL GEOLOGY

Northern Territory Oil Permits 75 and 64 (Part 1) lie within the Simpson Desert, an area in the western part of the Great Artesian Basin that is covered by northwest-trending stabilized longitudinal type sand dunes with intervening clay pans. Only a few outcrops of Mesozoic sediments protrude through the sand cover and therefore information concerning the stratigraphy of the area is based on limited outcrop information and sparse well data.

The Great Artesian Basin sediments consist of a sequence of Cretaceous and Jurassic marine and continental rocks up to several thousand feet in thickness which occupy a broad shallow depression and unconformably overlie local basins of preservation containing older sediments. Permian marine and continental beds and possibly rocks of Triassic age unconformably overlie a variable sequence of Devonian-Carboniferous "molasse" type sediments which fill restricted embayments beneath the Mesozoic of the Great Artesian Basin. These preserved embayments are separated by tectonic welts composed of folded Upper Proterozoic and Lower Paleozoic shelf-type marine and transitional sediments believed to be similar to those present in the eastern Amadeus Basin. The stratigraphic sequence within these fold belts is complicated by faulting and erosion, which resulted in the beveling of structurally high areas prior to Permian onlap. The basement consists of Archean igneous and metamorphic rocks comparable to those in the adjacent exposed cratons.

The major structural features in the area are the Simpson subbasin, the northeast extension of the Peake and Denison fold belt, which is expressed in part by McDills anticline, and the shallow basement platform which connects the Archean Musgrave and Arunta cratonic blocks and separates the Amadeus Basin from the Pedirka sub-basin, (Fig. 2).

The shallow basement ridge between the Amadeus Basin and the Pedirka sub-basin is apparently a broad upwarp in the base-



REGIONAL GEOLOGIC SETTING
SIMPSON DESERT AREA

Figure 2

ment which may have been active during the Proterozoic and Lower Paleozoic and acted as a barrier to normal marine circulation, as evidenced by the presence of evaporites within this sequence in the Amadeus Basin. The present configuration of the ridge is most probably due to post-Ordovician uplift, which was renewed in the Permian, but it does not appear to have acted as a complete barrier to Mesozoic incursions.

The Pedirka sub-basin is a restricted Devonian (?) - Permian downwarp controlled in part by bordering poritive areas. It is [illegible] preserved during successive periods of pre-Permian erosion. The Permian section thickens toward the axis of the sub-basin by addition of section at the top.

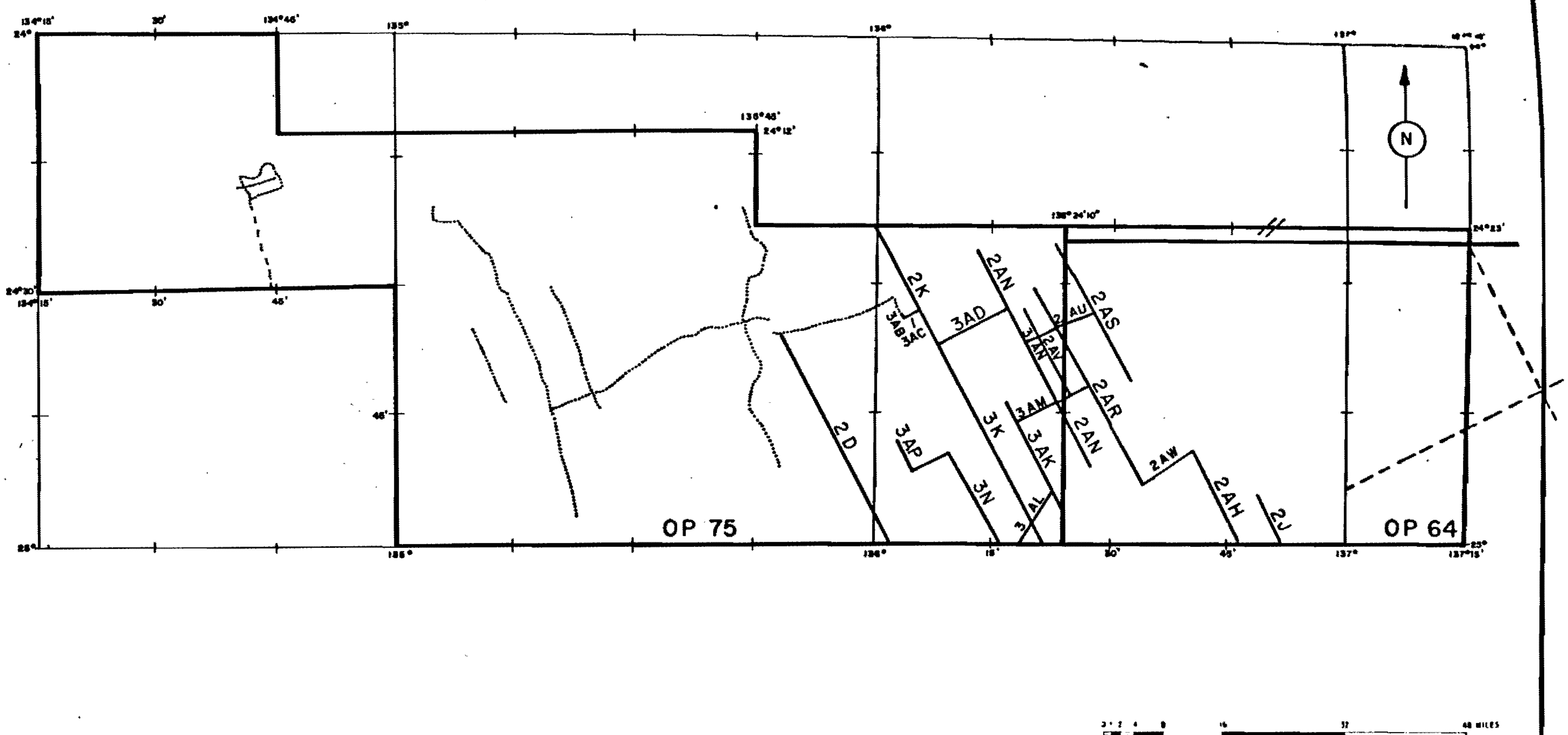
The Peake and Denison fold belt, which is partially represented by McDills anticline, appears to be an extension of a regional tectonic element superimposed along an older hinge line which separated shelf deposition on the west from geosynclinal deposition on the east during the Upper Proterozoic and Lower Paleozoic. Primary orogenic movements along this belt may have begun in the Ordovician but it appears that much of the "molasse" type detritus found in the adjacent troughs was stripped from the rising orogenic belt during maximum uplift in the Devonian-Carboniferous. Renewed vertical fault movement along the western margin of the fold belt during the Permian and Mesozoic accentuated the relief of this broad feature along a minor new axis, the McDills structural trend. Pronounced thickening of Permian and younger stratigraphic units on the flanks of the McDills structure are evidence of this period of uplift.

The Simpson sub-basin is a restricted local downwarp similar to the Pedirka sub-basin. It is limited on the northeast by the Arunta block and on the northwest by the McDills structural trend. A narrow transverse saddle in the McDills structural trend at Permian level may connect the Simpson and Pedirka sub-basins. Geologically they have probably had similar histories with comparable Devonian (?) - Carboniferous fill-type accumulations and Permian sections which thicken toward the depositional axes.

PREVIOUS WORK

Seismic surveys were previously conducted in OP64 (Part 1) by Mercure International Petroleum Pty. Ltd. and in OP75 by Flamingo Petroleum (Fig. 3).

Reflection seismic surveys conducted by Geoseismic for Beach Petroleum and by Austral Geo Prospectors Pty. Ltd. for Amerada Petroleum Corporation of Australia Limited in Northern Territory OP57, which adjoins OP75 and OP64 (Part 1) to the south, defined a prominent northeast-southwest structural trend designated McDills anomaly extending northeastward to the southern boundaries of OP75 and OP64 (Part 1). Other seismic work in neighboring areas included that of Australian Aquitaine Petroleum Pty. Ltd. in Northern Territory OP36, Finke Oil Company Pty. Ltd. in Northern Territory OP72 and French Petroleum Company (Australia) Pty. Ltd. in South Australia OEL21/22.



O.P. 75 and O.P. 64 Part 1

SEISMIC SURVEY INDEX

Simpson Desert "B" And Simpson Desert North Seismic Surveys

Previous Shooting by Flamingo

Previous Shooting by Mercure

OBJECTIVES OF THE SURVEYS

The original objective of the Simpson Desert "B" Seismic Survey was that of reconnaissance work to investigate the eastern part of OP75 while the objectives of the latter part of that survey were to determine the magnitude and extent of the large northeast-trending structural feature that had been found in the extreme southeastern portion of the concession. The objective of the Simpson Desert North Seismic Survey in Northern Territory OP64 (Part 1) was to investigate the possible northeastern extension of the foregoing feature and when this had been accomplished, the remainder of that survey consisted of regional reconnaissance work in the southwestern part of the block.

DISCUSSION OF RESULTS

Results of the Simpson Desert "B" and Simpson Desert North Seismic Surveys are presented on the following scale 1:100,000 seismic maps accompanying this report:

HORIZON "C"
(Approximate Jurassic De Souza Ss.)

HORIZON "P"
(Approximate Permian)

PRE-PERMIAN DATA
(Unidentified)

ISOTIME OF "C" TO "P" INTERVAL
(Approximate Jurassic De Souza Ss. to Approximate Permian)

Mapping horizons employed in the OP57 Simpson Desert "A" and "C" seismic surveys were carried into the area of the Simpson Desert "B" and Simpson Desert North seismic surveys. Identification of the stratigraphic units associated with the "C" and "P" horizons is based on seismic ties with the OP57 seismic work, including the velocity survey conducted by Amerada Petroleum Corporation of Australia Limited in the McDills No. 1 well. Information obtained from several expanded spreads shot during the OP57 surveys indicates that the velocities obtained at the McDills well are not valid regionally and consequently the seismic maps are presented on the basis of time.

Reflection quality ranged from good to poor with the majority of the data being of good quality. Areas of poor quality data are located in the extreme southeast portion of OP75 and are considered to be due to a thin sedimentary section on the crest of a major structural feature.

Seismic events other than the mapping horizons were picked and correlated on the record sections but none were as persistent as the "C" horizon.

The "C" horizon shows regional southeast dip interrupted by a relatively large northeast-southwest trending anticlinal fold believed to be associated with the McDills structural trend. The axis of the structure extends for a distance of about 50 miles, from approximately Lat. 25° 15'S., Long. 136° 10'E. in OP57 northeastward across OP75 to near Lat. 24° 35'S., Long. 136°25'E. in OP64 (Part 1). The feature is about ten miles wide at the widest point. Unfortunately, the "C" horizon is too near the surface to be carried along the crest of the structure and as only questionable seismic evidence of deeper sediments was obtained in this area, it is considered possible that Proterozoic or older rocks may be at shallow depth along the crest of the feature. The possibility of local closures are indicated along the crestal area even though the data are locally poor to non-existant. The highest structural point on the feature occurs on Line 2-AR at the common boundary of OP75 and OP64. Considerable critical north dip was recorded north of this point. Faulting on the northwest flank of this structure is downthrown to the west or northwest to give additional critical closure.

There is a pronounced southwest-plunging nose with indications of a considerable thickness of sediments located on the downthrown side of the normal fault on the northwest flank of the foregoing feature but the seismic work did not detect closure.

It is postulated that an unconformity representing a considerable geologic hiatus occurs between the "C" and "P" mapping horizons and that the "P" horizon is truncated and subcrops up-dip immediately north of the southern boundary of OP75, with the "P" horizon interpretation showing only general uninterrupted south dip in this area. Because of the limited area of "P" horizon data, the dependent "C" to "P" interval map is confined to OP75 sheet 2.

In general, reflections believed to originate in the pre-Permian section exhibit considerably more dip than at the "C" level, especially over structural anomalies, and tend to be either segmental or to subcrop within a relatively short distance.

One area of apparent continuous pre-Permian data was recorded along Line 2D, but an analysis of the seismic record section shows that most of the apparent pre-Permian data are concentrated in a band of reflected energy occurring at a time approximately equivalent to twice the travel time of the "C" reflection and that these reflections exhibit characteristics similar to that of the "C" zone. Therefore, it is suspected that these data are multiples between the "C" horizon and the surface or a near-surface interface. Seismic evidence of pre-Permian sediments along the crest of the large anticlinal feature is speculative, but it is believed that a considerable thickness of pre-Permian sediments is present on the downthrown (northwest) side of the large normal fault on the northwest flank of the fold.

Segmental reflection continuity and indefinite reflection characteristics of the discernible pre-Permian data preclude the preparation of conventional seismic structure maps contoured on a pre-Permian horizon or even a phantom horizon. Limited pre-Permian mapping was accomplished by utilizing the most outstanding event of each continuous segment of pre-Permian data. All inferred pre-Permian structure, including anticlinal and synclinal axes and faults, was employed for geologic interpretation of the non-correlative units to produce the map designated "Pre-Permian Data". Collectively the pre-Permian contour configuration agrees with the major structural units set forth by the "C" horizon, but the geology of the individual anomalies is believed to be much more complex, especially with respect to faulting. As noted on the legend of the pre-Permian map, pre-Permian data have not been migrated because of absence of three dimensional control. It is believed that in-line migration of these data would be no more accurate than the interpretation accompanying this report that is based on unmigrated data as none of the seismic control can be considered as strike or dip data with respect to the complex pre-Permian structure.

CONCLUSIONS

The reconnaissance coverage of the Simpson Desert "B" and Simpson Desert North Seismic Surveys accomplished the objective of mapping a large anticlinal fold suggested by the contour configuration along the northern boundaries of the Simpson Desert "A" and "C" Seismic Surveys conducted immediately to the south in OP57. The objective of obtaining pre-Permian data was successful to the extent that limited units of pre-Permian data were mapped.

Respectfully submitted,

AUSTRAL GEO PROSPECTORS, PTY. LTD.

A.J. Schisler

A. J. Schisler, Geophysicist

February, 1967

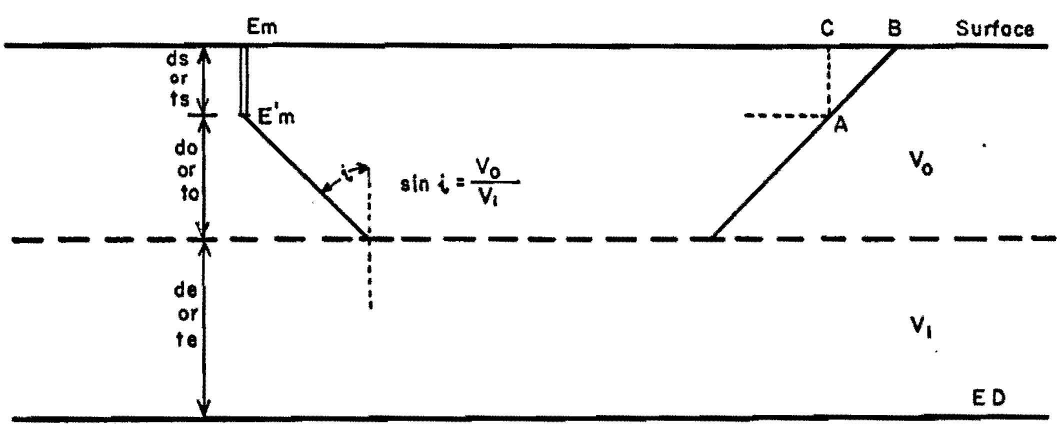
APPENDIX I

CALCULATION AND INTERPRETATION METHODS

Type Corrections Used:

Two layer weathering calculations were employed to determine the average thickness of the unconsolidated sediments present on the surface and to reduce the raw reflection times to a common datum plane. All near surface velocity data were obtained by plotting the refraction breaks recorded from each shotpoint.

Two Layer Weathering Correction



Assumption: Slant ray path AB = vertical ray path AC (uphole time) if ds is small.

APPENDIX I - Continued

CALCULATION AND INTERPRETATION METHODS - Continued

Legend

Em = Average elevation of shotpoint and offset phones

ds = Depth of shot

E'm = Em - ds = Elevation of shot

ts = Uphole time

ED = Elevation datum

Vo = Velocity in first layer

V_1 = Velocity in second layer

Ve = Elevation velocity

T = Intercept time of V_1 plot from refraction breaks

$$do = \frac{(T - ts)\,Vo}{2 \cos \left(\sin^{-1} \frac{Vo}{V_1}\right)}$$

de = E'm - do - ED

$$To = \frac{do}{Vc}$$

$$te = \frac{de}{Ve}$$

Σt = Total correction for two way travel time from surface to datum

CALCULATION AND INTERPRETATION METHODS - Continued

Corrections

Time Uphole = ts

Estimated weathering below E'm = 2 to

Elevation correction = 2 te

Total correction to datum = Σt = ts+2to+2te

Magnetic tapes were replayed with both static and dynamic corrections manually applied to produce corrected wiggle trace and variable area presentations of the seismic data.

Interlock Ties:	Datum to Datum
Elevation Datum:	300 feet A. S. L.
Weathering Velocity (Vo):	±3000 feet per second
Elevation Velocity (Ve):	6000 feet per second

Horizons Mapped:

Horizon:	"C"
Time Range:	From .057 to .860 seconds
Horizon:	"P"
Time Range:	From .874 to 1.054 seconds
Horizon:	"Pre-Permian Data"
Time Range:	From .272 to 1.520 seconds

Interval Mapped:

Interval	Horizon "C" to "P"
Time Range:	From .225 to .305 seconds

APPENDIX II

PERSONNEL

(1) Description of field party.

Crew 2 consisted of a party chief, junior party chief, computer, observer, junior observer, shooter, two drillers, two assistant drillers, surveyor, rodman, mechanic, cook, cook's assistant, and seven helpers.

Crew 3 consisted of a party chief, party manager, two computers, observer, junior observer, shooter, two drillers, two assistant drillers, surveyor, rodman, mechanic, cook, cook's assistant, and six helpers.

A drill supervisor and supply truck driver serviced both crews.

APPENDIX II - Continued

PERSONNEL - Continued

(2) List of personnel for each crew including each man's position:

POSITION	CREW 2	CREW 3
Party Chief	J. Denham	W. E. Moore, Jr.
Party Manager	-	T. Barnard
Jr. Party Chief	C. F. Kous	-
Computer	A. Murnicks	B. Carr
		A. MacGegor
		A. White
Observer	D. Laing	J. Simpson
Shooter	P. Connors	A. Young
Jr. Observer	R. Sargent	P. Stevens
Drillers	W. Withers	D. Seabrook
	G. White	P. Goode
Drill Helper	G. Sadler	J. Trott, Jr.
	G. Gregg	H. Ferguson
Surveyor	M. Van Der Boor	B. Llewelyn
Rodman	G. Smith	R. McGarry
Mechanic	N. Dean	R. Shea
Cook	A. Mayberry	K. Barden
Cook's Assistant	H. Reid	D. McNeil
Helpers	Seven	Six
Drill Supervisor	W. Scheihing	W. Scheihing
Supply Truck Driver	M. Smith	M. Smith

ALICE SPRINGS OFFICE

Supervisor	E. M. Hoffman
Computer	N. Musk

APPENDIX III

STATISTICS FOR OIL PERMIT 75

RECORDING TIME (CREW 2)

Month	Travel	Field	Record	Move	Holiday	Lost	Total
August 1966	3	34	37	14	-	-	51
September, 1966	23	165	188	-	-	-	188
October, 1966	19	99	118	-	-	-	118
November, 1966	18	83	101	-	-	-	101
December, 1966	6	23	29	30*	-	-	59
TOTALS:	69	404	473	44	-	-	517

*Moving crew 2 from OP 75 to Alice Springs. Note: Time spend (12.5 hours) shooting Hale River No. 1 velocity survey during September, 1966 not shown in above statistics.

RECORDING TIME (CREW 3)

Month	Travel	Field	Record	Move	Holiday	Lost	Total
May, 1966	28	199	227	20	-	-	247
July, 1966	33	237	270	32	-	-	302
August, 1966	11	89.5	100.5	6	-	-	106.5
TOTALS:	72	525.5	597.5	58	-	-	655.5
TOTAL BOTH CREWS	141	929.5	1070.5	102	-	-	1172.5

APPENDIX III - Continued

STATISTICS FOR OIL PERMIT 75 - Continued

		CREW 2	CREW 3	TOTAL
(1)	Miles traversed:			
	1320' hole spacing	77	76	153
	2000' hole spacing	15	39	54
(2)	Holes Shot:	348	419	767
(3)	Average depth and size of charges:	Seven hole patterns, hole spacing 20' 10 lbs. in each i.e., 70 lbs. total at 35 feet (average depth)		
(4)	Explosives Used:	25,352 lbs.	34,817 lbs.	60,169 lbs.
(5)	Drilling Hours:	523.25 hrs.	862 hrs.	1385.25 hrs.
(6)	Driving time (drillers):	105 hrs.	144 hrs.	249 hrs.
(7)	Move time (drillers):	44 hrs.	-	44 hrs.
(8)	Footage drilled:	79,612 ft.	88,658 ft.	168,270 ft.
(9)	Insert bits used:	34	29	63
(10)	Rock bits used:	8	-	8
(11)	Starting date:	August 28, 1966	May 2, 1966	
(12)	Completion date:	December 6, 1966	August 16, 1966	

APPENDIX III - Continued

STATISTICS FOR OIL PERMIT 64 PART 1

RECORDING TIME (CREW 2)

Month	Travel	Field	Record	Move	Holiday	Lost	Total
October, 1966	38	128	166	-	-	-	166
November, 1966	1	7	8	-	-	-	8
December, 1966	20	96	116	14*	-	-	130
TOTALS:	59	231	290	14	-	-	304

*Move from OP 64 back to OP 75.

(1)	Miles traversed:	
	1320' hole spacing	33.75
	2000' hole spacing	40.00
(2)	Holes Shot:	243
(3)	Average depth and size of charges:	Seven hole patterns, hole spacing 20', 10 lbs. in each i.e., 70 lbs. total at 35 feet (average depth).
(4)	Explosives used:	19,300 lbs.
(5)	Drilling hours:	356 hrs.
(6)	Driving time (drillers):	120 hrs.
(7)	Move time (drillers):	14 hrs.
(8)	Footage drilled:	59,260 ft.
(9)	Insert bits used:	21
(10)	Rock bits used:	2
(11)	Starting date:	October 10, 1966
(12)	Completion date:	December 17, 1966

APPENDIX IV - Continued

FIELD PROCEDURE AND EQUIPMENT - Continued

FIELD PROCEDURE:

(1)	Geophones per trace:	16
(2)	Geophone connections:	Series-parallel
(3)	Geophone spacing:	15 feet
(4)	Recording channels:	24 per crew
(5)	Filter settings for monitor record and tape:	Out-Out
(6)	Filter settings for field playback:	31 to 78 cps single section
(7)	Mixing:	Unmixed
(8)	Shothole spacing:	1320 and 2000 feet
(9)	Recording method:	Split spread continuous profiling.
(10)	Distance from shotpoint to close geophone station:	110' on 1320' spreads 150' on 2000' spreads
(11)	Number of geophone stations adjacent to shotpoint:	Two

(12) All time lost was made up at the end of each work period except as shown on recording time break-down.

APPENDIX IV - Continued

FIELD PROCEDURE AND EQUIPMENT - Continued

EQUIPMENT: - Continued

One 182 IHC two wheel drive water truck with a 1000 gallon tank.

Two Toyota flat-bed 4x4 used by drillers and drill supervisor.

One Toyota utility 4x4 for cables and geophones.

One Toyota utility 4x4 with closed-in overall cabin for surveyors.

One Toyota 4x4 station wagon for P.C. and personnel carrier.

Crew 3

One Zeligson 6x6 water truck with an 1800 gallon tank.

One IHC 180 two wheel drive water truck with a 1000 gallon tank.

Two Toyota flat-bed 4x4 used by drillers and drill supervisor.

One Toyota utility 4x4 for cables and geophones.

One Toyota 4x4 station wagon for P.C. and personnel carrier.

One Land Rover with over-all cabin for surveyors.

One Mack 6x6 water truck with 1500 gallon tank.

(7) Bulldozers: Three Caterpillar D7 dozers with cable-controlled pusher-blades.

APPENDIX IV

FIELD PROCEDURE AND EQUIPMENT

EQUIPMENT:

(1)	Type geophone:	EVS Electrotech 30 cps
(2)	Amplifiers:	24 SIE PT-100 (per crew)
(3)	Tape Units:	1 Fortune Unit (per crew)
(4)	Description of recording and shooting units:	International 160 trucks, conventional two wheel drive units on both crews.
(5)	Description of shot-hole drilling rigs:	Crew 2 Mayhew 1000 mounted on a 192 IHC 6x6 truck with a Gardner-Denver mud pump and 580 air compressor. Mayhew 200 mounted on a 160 IHC truck with a Gardner-Denver mud pump and Atlas Copco VG6 air compressor. Crew 3 Mayhew 1000 mounted on a 192 IHC truck with a Gardner-Denver 580 air compressor and a Wheatley mud pump. Failing CFD-2 mounted on a 160 IHC 4x4 truck with a Failing mud pump and Atlas Copco VG6 air compressor.
(6)	Description of other operating equipment:	Crew 2 One 192 IHC 6x6 water truck with a 1500 gallon tank.