COPY III

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WELL COMPLETION REPORT

AMERADA HALE RIVER NO.1

O.P. 57

by

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LIMITED

December, 1966

ONSHORE

[redacted]

PR. 66/026A

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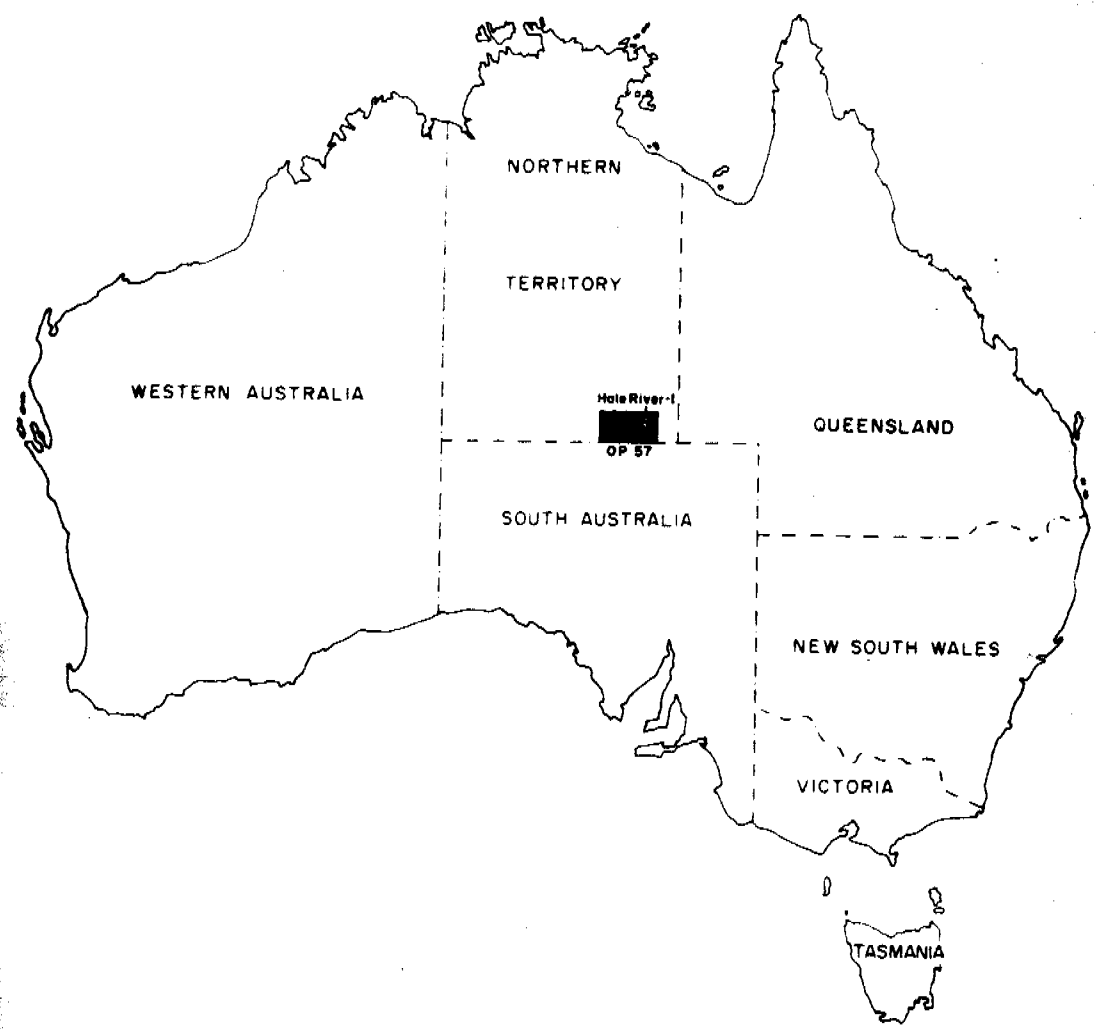


LOCATION MAP

Figure 1

I. SUMMARY

Hale River No.1 was drilled by Amerada Petroleum Corporation of Australia Limited in Oil Permit No.57, located in the Simpson Desert about 200 miles southeast of Alice Springs. The well tested a large pre-Permian anticlinal feature mapped by seismic methods.

Drilling was done by Reading and Bates Australia Pty. Ltd. Supervision of operations was by Amerada Petroleum Corporation of Australia Limited. Core Laboratories furnished gas detection and mud logging services and Welex conducted the electric logging program. Drilling was commenced October 14, 1966 and terminated November 10, 1966 in non-prospective rocks at a total depth of 5683 feet, following which the well was plugged and abandoned.

The Mesozoic section penetrated was a normal sequence of Cretaceous Winton Formation through the Jurassic sandstone series. Permian sediments were encountered beneath the Jurassic from a depth of 4162 feet to 4545 feet. A thin remnant of possible Devonian-Carboniferous "Finke" type beds was present from a depth of 4545 feet to 4704 feet. Below this the well entered a previously unknown sequence of tuffaceous volcanic conglomerates, agglomerates, claystones, volcanic flows and intrusives of probable Proterozoic age. Good porosity was encountered in Jurassic, Permian and (Devonian-Carboniferous?) sandstones.

The only indications of hydrocarbons were due to contamination by diesel fuel in the drilling mud.

Hale River No.1 tested a large anticlinal feature and found the pre-Permian sediments encountered to be non-prospective.

II. INTRODUCTION

Hale River No.1 was drilled to test the petroleum potential of a large pre-Permian anticlinal feature mapped by reflection seismic work conducted from May 1965 to August 1966 for Amerada Petroleum Corporation of Australia Limited by Austral Geo Prospectors Pty. Ltd. in Northern Territory OP57, an area subject to farmout between Amerada and Beach Petroleum No Liability. Pre-Permian seismic data were discontinuous, with angular discordance between shallow and deep data suggesting some truncation, as had been found in McDills No.1, a well drilled by Amerada to test a large anticlinal structure in OP57 lying about 65 miles to the southwest of the Hale River feature. It was hoped that any sedimentary section missing on the crest of the Hale River feature would be confined to the Devonian-Carboniferous Finke interval, but the drilling of the well demonstrated the existence of a pre-Permian hiatus(es) much greater than anticipated.

III. WELL HISTORY

1. GENERAL DATA

Well Name and Number:

Hale River No.1

Location:

Latitude	Longitude
25° 15' 48" South	136° 43' 36" East

Elevation:

Ground Level	Derrick Floor	Kelly Bushing
395'	410'	411'

Name and Address of Tenement Holder:

Beach Petroleum No Liability
68 Grenfell Street
Adelaide
South Australia

Amerada Petroleum Corporation of Australia Limited
380 Queen Street
Brisbane
Queensland

Name and Address of Operator:

Amerada Petroleum Corporation of Australia Limited
380 Queen Street
Brisbane
Queensland

Details of Petroleum Tenement:

Northern Territory Oil Permit 57

Total Depth:

5683' (-5272')

Date Drilling Commenced:

October 14, 1966

Date Drilling Completed:

November 10, 1966

Date Well Abandoned:

November 11, 1966

Date Rig Released:

November 11, 1966

Drilling Time in Days to Total Depth:

27 Days

Status:

Well abandoned

Total Cost:

See subsidy claim and statement of costs

2. DRILLING DATA

Name and Address of Drilling Contractor:

Reading and Bates (Australia) Pty. Ltd.
380 Queen Street
Brisbane
Queensland

Details of Rig, Plant and Equipment:

Drilling Plant

Make:	National
Type:	N-55
Rated Capacity:	10,000' with $4\frac{1}{2}$" OD drill pipe
Motors:	3 Superiors, type PTD6, BHP 325, Total 975

Mast/Derrick

Make:	Lee C. Moore
Type:	Cantilever
Rated Capacity:	550,000 lbs.

Pumps

Make:	National	Emsco
Type:	C-350	DA-500
Size:	$7\frac{3}{4}$" x 18"	$7\frac{1}{2}$" x 16"

Blow-out Preventor Equipment

Make:	Hydril	Cameron
Model:	G.K.	W.S.
Size:	12" Series 900	12" Series 900
Working Pressure:	3000 psi	3000 psi

Hole Sizes and Depths:

30" Hole from 0' to 20'
17½" Hole from 20' to 1345'
8¾" Hole from 1345' to 5683'

Casing and Cementing Details:

Size:	20"	13⅜"
Weight:	60 lbs.	48 lbs.
Grade:	Weld	H-40 Jap
Setting Depth:	36'	1342'
Cement Used:	66 sks.	1100 sks.
Cement To:	Surface	Surface
Method Used:		Plug
Float Collars:		Howco - 1306'
Shoes:		Howco - 1341'
Plugs:		Howco - 1305'
Centralizers:		6 - Howco
Scratchers:		None

Drilling Fluids:

Type:	Water Base Bentonite
Average Weight:	9.7 lbs./U.S. Gal.
Treatment:	Spersene, XP-20, Cellofas and caustic soda

Mud Additives Used:

Gel:
Spersene:
XP-20
Cellofas:
Caustic Soda:
Sodium Bicarbonate:
Soda Ash

Water Supply:

Water was hauled for camp purposes from Dakota Bore. Water for drilling was obtained from two water wells drilled near the location.

Plugging:

In plugging the well three abandonment plugs were set at depth intervals listed below:

Plug No.	Depth	Sacks Cement
1	4100'-4250'	75
2	1300'-1400'	95
3	0'- 50'	50

A plate was welded to top of the 13⅜" casing and marked according to regulations.

3. LOGGING AND TESTING

Ditch Cuttings:

Samples were collected at intervals of 30 feet from surface to 2,000 feet. From 2,000 feet to total depth samples were collected at intervals of 10 feet. Cuts were distributed to the Bureau of Mineral Resources in Canberra and Alice Springs and Beach Petroleum.

Examination of cuttings as they were collected over the shaker was maintained on a 24 hours-a-day basis. Drilling breaks were circulated up and examined.

Coring:

Cores Nos. 1 and 2 were taken for stratigraphic information at base of Jurassic and top of Permian. Core No.3 was taken to satisfy subsidy requirements. Cores Nos. 4 and 5 were taken to evaluate pre-Permian sediments. Core No.6 was taken to satisfy subsidy requirements. Core Nos. 7 and 8 were taken to evaluate the Proterozoic.

Samples were taken of each core as required by the Bureau of Mineral Resources and sent to their library at Fyshwick, A.C.T. The remaining core was deposited with the Resident Geologist of Bureau of Mineral Resources in Alice Springs.

Petrographic analysis of Proterozoic cores has been determined and is presented in another part of this report.

Core analysis of selected intervals is enclosed as Appendix III.

Coring equipment consisted of a 22 foot conventional core-barrel with a $7\frac{7}{8}$" corehead cutting a $4\frac{15}{16}$" core, also a 50 foot Denton and Spencer core-barrel with $6\frac{1}{8}$" diamond coreheads.

The following cores were taken:

Core #	Core Depth	Footage	Rec.	% Rec.
1	3844-3864'	20'	13'	65%
2	4170-4185'	15'	$4\frac{1}{2}$'	30%
3	4517-4532'	15'	15'	100%
4	4756-4763'	7'	7'	100%
5	4937-4968'	31'	30'	97%
6	5271-5288'	17'	15'	88%
7	5558-5570'	12'	12'	100%
8	5671-5683'	12'	12'	100%

Total footage cored: 129'
Total footage recovered: 108.5'
Percentage recovered: 84%

Deviation Surveys:

Depth	Deviation from Vertical
70'	¼°
170'	0°
290'	¼°
380'	¼°
499'	¼°
600'	¼°
700'	¼°
800'	¼°
920'	¼°
1011'	¾°
1100'	1°
1190'	¼°
1312'	¾°
1900'	1¼°
2400'	1¼°
2875'	1°
3376'	¼°
3844'	2½°
4275'	4°
4390'	2½°
4517'	1°
4756'	1¼°
4873'	1°
4937'	1°
5018'	1°
5130'	1°
5187'	¾°
5271'	1°
5420'	1°
5552'	1°

Electrical and Other Logs:

Welex Induction - Electric Logs

Run No.1 1320-5553'

Welex Acoustic Velocity - Gamma Ray

Run No.1 1300-5552'

Welex ForXo - Caliper

Run No.1 1320-5554'

Penetration Rate Log

A geolograph and a Core Laboratories Australia Limited drilling rate recorder were used for recording the penetration rate (see Composite Log).

Gas Log

Core Laboratories Australia Limited gas detection and analyzing equipment (hot wire detector and programmed hydrocarbon detector) were used for the preparation of a Hydrocarbon Log (see Composite Log).

Formation Testing:

None.

Temperature Surveys:

None.

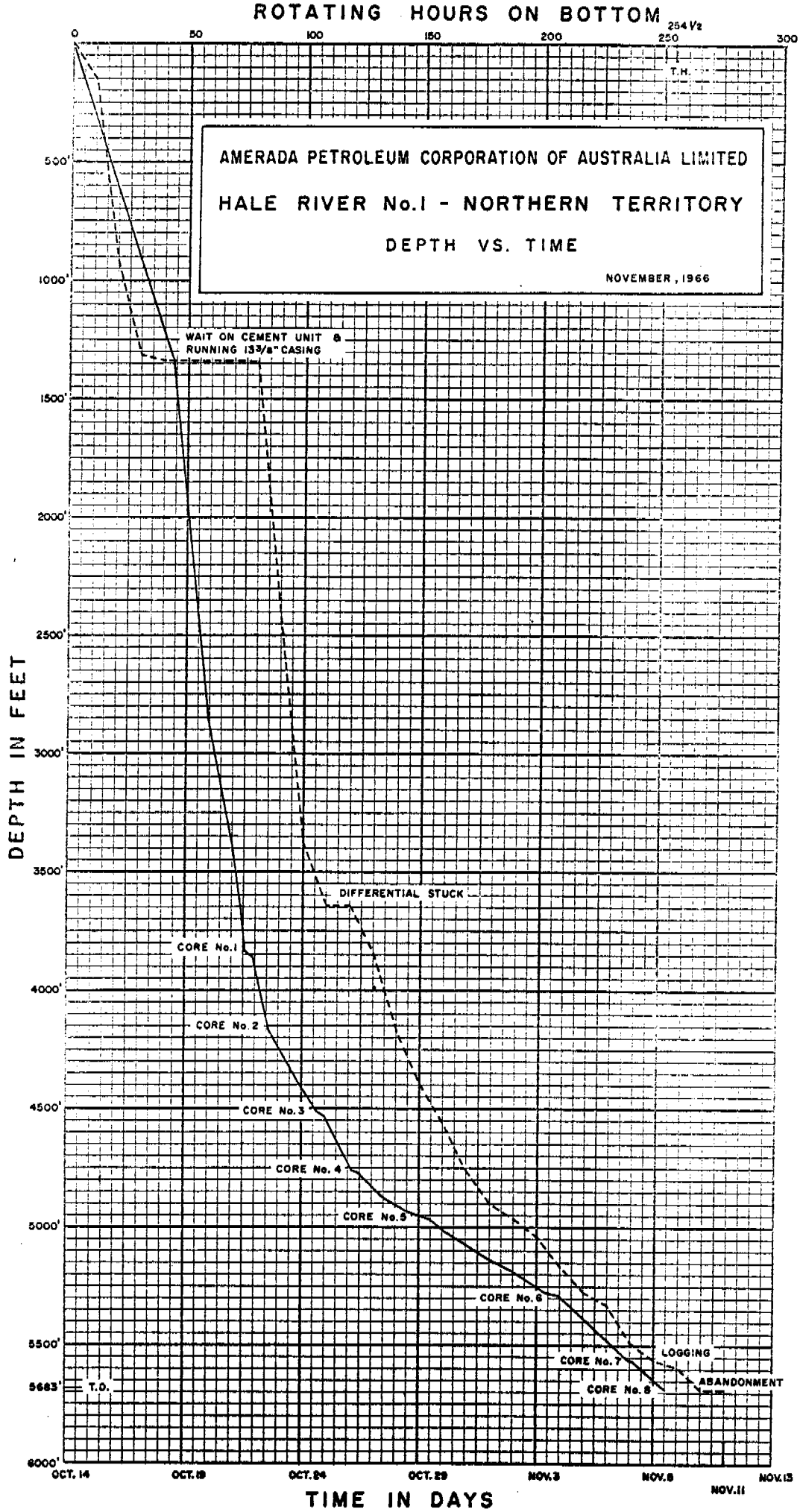
Velocity Surveys:

Austral Geo Prospectors Pty. Ltd. in conjunction with Welex, conducted Velocity Surveys. These appear as a separate appendix.

Drilling Observation:

A total of 254.5 rotating hours on bottom were required to drill the Hale River No.1 well, resulting in an average drilling rate of 22.19 feet per hour. Eighteen bits were used plus three conventional and two diamond coreheads.

No major drilling problems were encountered in drilling the well.


ROTATING HOURS ON BOTTOM
0
50
100
150
200
250
254 1/2
300
T.H.
AMERADA PETROLEUM CORPORATION OF AUSTRALIA LIMITED
HALE RIVER No.1 - NORTHERN TERRITORY
DEPTH VS. TIME
NOVEMBER, 1966
WAIT ON CEMENT UNIT &
RUNNING 13 3/8" CASING
DIFFERENTIAL STUCK
CORE No.1
CORE No.2
CORE No.3
CORE No.4
CORE No.5
CORE No.6
CORE No.7
CORE No.8
LOGGING
ABANDONMENT
T.D.
5683'
500'
1000'
1500'
2000'
2500'
3000'
3500'
4000'
4500'
5000'
5500'
6000'
DEPTH IN FEET
OCT. 14
OCT. 19
OCT. 24
OCT. 29
NOV. 3
NOV. 8
NOV. 11
NOV. 13
TIME IN DAYS

Figure

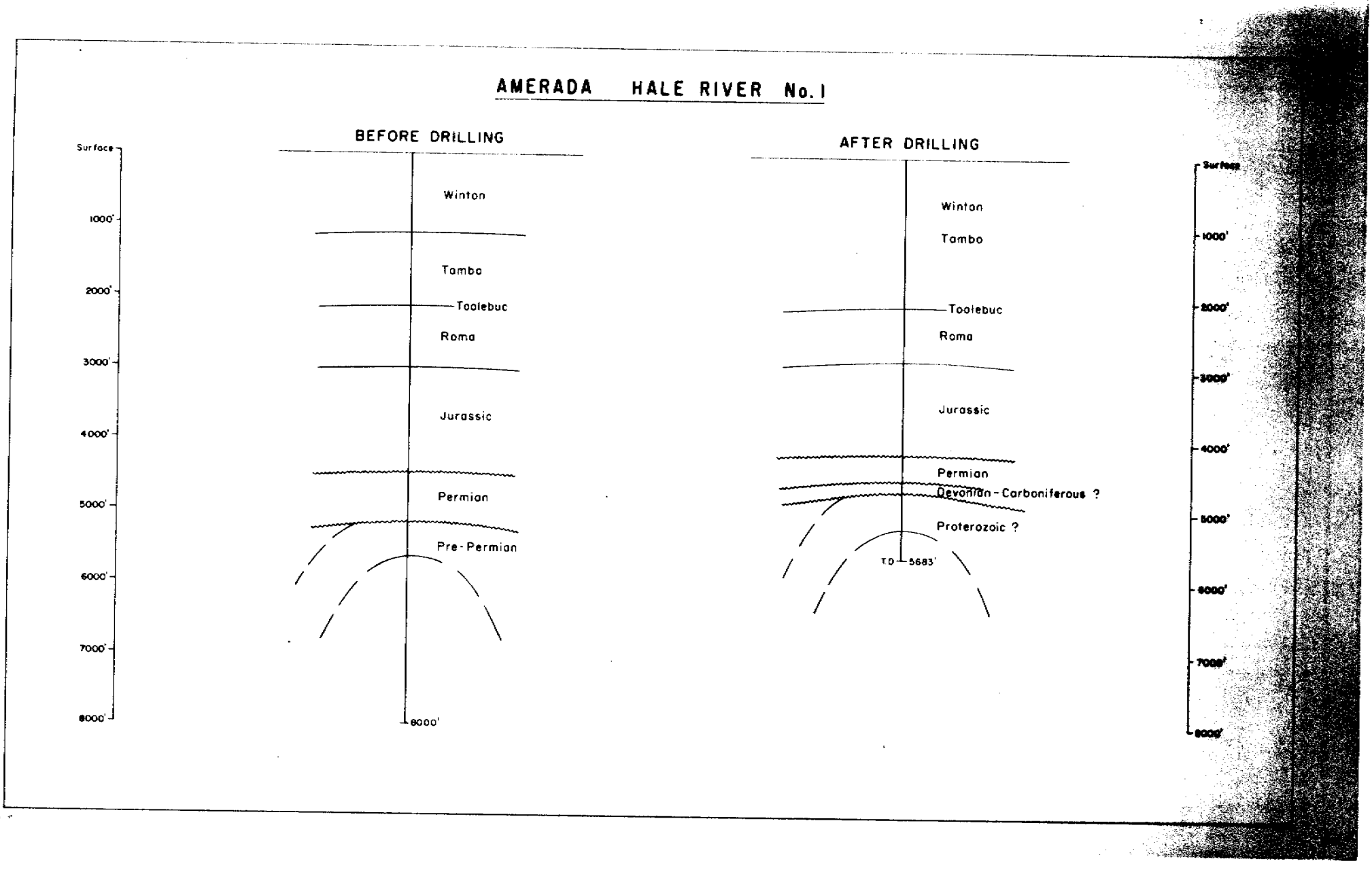

AMERADA HALE RIVER No. 1
BEFORE DRILLING
AFTER DRILLING
Surface
1000'
2000'
3000'
4000'
5000'
6000'
7000'
8000'
Winton
Tambo
Toolebuc
Roma
Jurassic
Permian
Pre-Permian
6000'
Winton
Tambo
Toolebuc
Roma
Jurassic
Permian
Devonian-Carboniferous ?
Proterozoic ?
TD 5683'

Figure 3

T I M E A N A L Y S I S

OPERATIONS	TIME - HRS	TIME - DAYS	PERCENTAGE
Drilling (Rotating on bottom)	228.75	9.531	34.14
Tripping	116.50	4.854	17.39
Coring	25.75	1.073	3.84
Surveying	9.50	.396	1.42
Reaming	17.25	.719	2.57
Casing & cementing	19.50	.812	2.91
Waiting on cement	33.75	1.406	5.04
Condition mud & hole	34.00	1.417	5.07
Circulate samples	3.00	.125	.45
Logging	18.00	.750	2.69
Spot abandonment plugs	3.00	.125	.45
Nipple up & down	19.25	.802	2.87
Lay down drill collars & pipe	15.00	.625	2.24
Wait on water	6.50	.271	.97
Wait on cementing unit	67.75	2.823	10.11
Differential stuck	32.75	1.365	4.89
Slip & cut drilling line	3.00	.125	.45
Rig maintenance	11.75	.490	1.75
Rig repairs	5.00	.208	.75
TOTAL:	670.00	27.917	100.00

SUMMARY	TIME - HRS	PERCENTAGE
Drilling (incl. reaming, trips & surveys)	372.00	55.52
Hole evaluation (coring, logging, samples)	46.75	6.98
Lost time (repairs, wait on HOWCO & water, stuck)	112.00	16.72
Other (maintenance, csg., cmt., aband., etc.)	139.25	20.78
TOTAL:	670.00	100.00

OPERATIONS: From spud time October 14, 1966 @ 10 a.m.
to time rig released November 11, 1966 @ 8 a.m.
equals a total of 27 days 22 hours - 670 hours.

Figure 4

BIT RECORD

Number	Size	Type	From	To	Footage	Hours	Ft/hr
1-A	17½	YT3A-R	36'	1345'	1309'	43¾	29.92
1	8¾	OSC3-J	1345'	2861'	1516'	15¾	96.25
2	8¾	OSC3-J	2861'	3376'	515'	10¼	50.24
3	8¾	OWC-J	3376'	3648'	272'	3½	77.71
4	8¾	OWC-J	3648'	3844'	196'	3½	56.00
1-C	7⅞	HFCH	3844'	3864'	20'	1	20.00
5	8¾	W7R-J	3864'	4170'	306'	8¼	37.09
2-C	7⅞	HFCH	4170'	4185'	15'	½	30.00
6	8¾	YS1-J	4185'	4396'	211'	12¼	17.22
7	8¾	YS1-J	4396'	4517'	121'	7¾	15.61
3-C(RR)	7⅞	HFCH	4517'	4532'	15'	1½	10.00
8	8¾	YS1-J	4532'	4756'	224'	13¼	16.91
4-C	7⅞	HFCH	4756'	4763'	7'	2½	2.80
9	8¾	YS1-J	4763'	4873'	110'	10¾	10.23
10	8¾	H7W-R	4873'	4937'	64'	10	6.40
5-C(RR)	6⅛	Dia.	4937'	4968'	31'	10	3.10
11	8¾	YHG-J	4968'	5018'	50'	7¼	6.90
12	8¾	YHWG-J	5018'	5130'	112'	16¼	6.69
13	8¾	YHWG-J	5130'	5187'	57'	11¼	5.07
14	8¾	YHWG-J	5187'	5271'	84'	13½	6.22
6-C(RR)	6⅛	Dia.	5271'	5288'	17'	6	2.83
15	8¾	YHWG-J	5288'	5426'	138'	15¼	9.05
16	8¾	YHWG-J	5426'	5558'	132'	14	9.43
7-C	6⅛	Dia.	5558'	5570'	12'	2½	4.80
17	8¾	YHWG-J	5570'	5671'	101'	11¾	8.60
8-C(RR)	6⅛	Dia.	5671'	5683'	12'	1¾	6.86
18 Bits					5647'	254½	22.19

3 conventional Core-heads

2 diamond Core-heads

Figure 4a

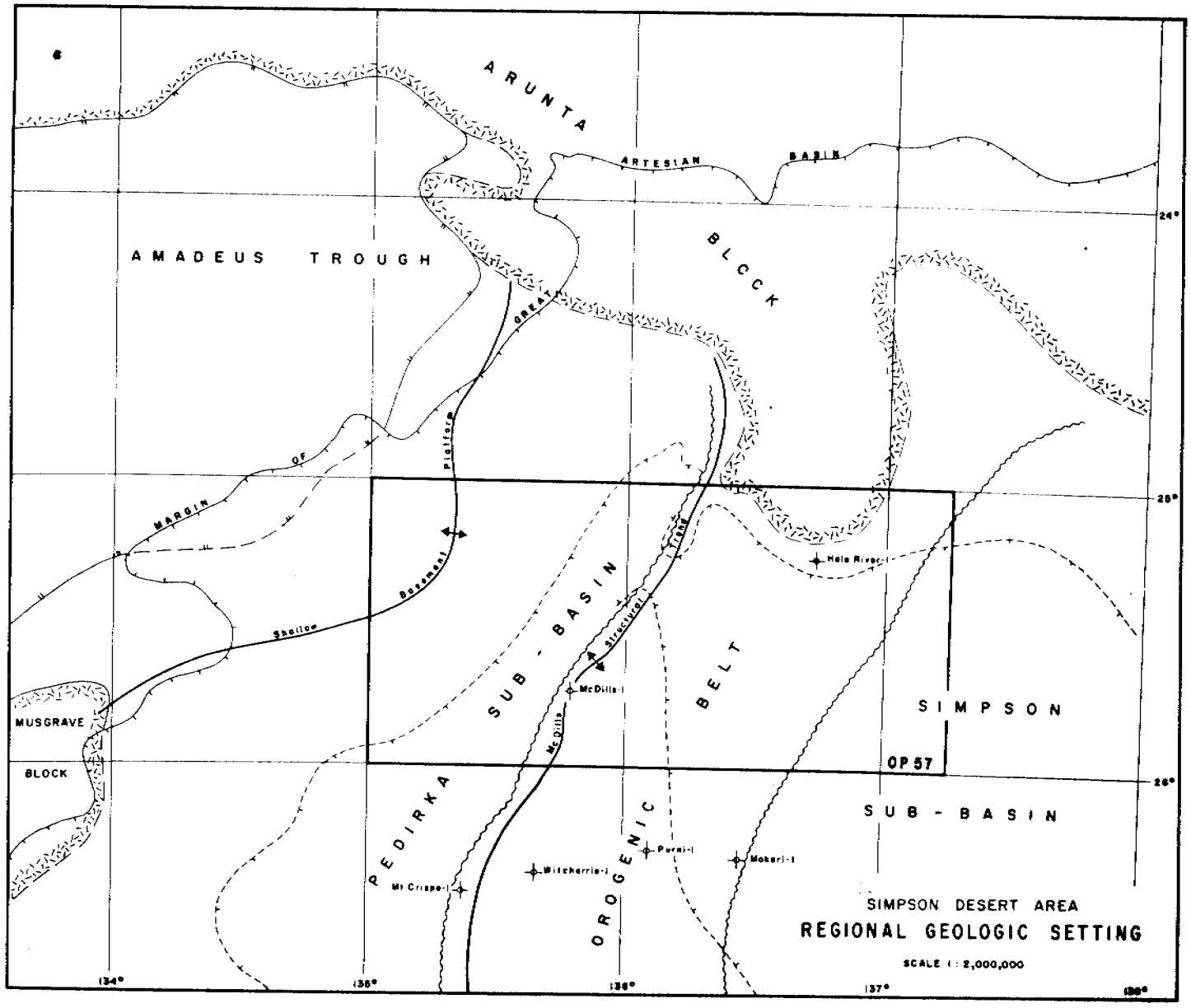

ARUNTA
ARTESIAN
BASIN
AMADEUS TROUGH
BLOCK
GREAT
MARGIN OF
Platform
Basement
Shallow
MUSGRAVE
BLOCK
SUB - BASIN
Structural
Trend
McDills-1
McDills
Hale River-1
SIMPSON
OP 57
SUB - BASIN
PEDIRKA
OROGENIC
BELT
Witcherrie-1
Purni-1
Mokari-1
Mt Crispe-1
24°
25°
26°
134°
136°
138°
137°
SIMPSON DESERT AREA
REGIONAL GEOLOGIC SETTING
SCALE 1 : 2,000,000

Figure 5

IV. GEOLOGY

1. SUMMARY OF PREVIOUS WORK

Aeromagnetic surveys of the Simpson Desert were conducted by the Bureau of Mineral Resources in 1962. A gravity survey by Geosurveys in the same year outlined the McDills anomaly which was further investigated in 1963 and 1964 by reflection seismic surveys. These seismic surveys, which were done by Geoseismic for Beach Petroleum N.L. and subsidized by the Commonwealth government, defined the structural feature on which McDills No.1 stratigraphic test was drilled by Amerada in 1965 to a total depth of 10,515 feet.

Additional reflection seismic work in OP57 was commenced by Austral Geo Prospectors Pty. Ltd. for Amerada in May 1965 and continued to August 1966. These surveys provided shallow reconnaissance coverage over most of the concession and included the delineation of closure on the pre-Permian structural anomaly on which Hale River No.1 was located.

2. SUMMARY OF REGIONAL GEOLOGY

Northern Territory Oil Permit 57 is located within the Simpson Desert, an area in the western part of the Great Artesian Basin which is covered by northwest trending longitudinal type Quaternary sand dunes with intervening clay pans. Only a few scattered outcrops of Mesozoic sediments protrude through the sand cover, therefore stratigraphic knowledge is based on extrapolation of sparse well data and remote outcrop information.

The area comprises a complex system of overlapping discordant depositional basins and remnants of basins.

The Simpson Desert part of the Great Artesian Basin is a broad shallow post-Triassic feature, containing several thousand feet of Jurassic-Cretaceous marine to continental rocks, which overlaps and obscures structural remnants of older depositional downwarps.

Preserved Devonian-Permian structural remnants occur as sub-basins beneath the Great Artesian Basin. Their presence is due to pre-Permian tectonic movements which are believed related to earlier depositional and structural elements established on the margin of the preceding Lower Paleozoic basin. These restricted sub-basins are filled by Permian marine and continal sediments and possibly some Triassic rocks which unconformably overlie a variable sequence of Devonian-Carboniferous "molasse" type sediments.

The Lower Paleozoic basin is represented by remnants of continental and marine shelf deposits which accumulated in shallow epeiric seas that covered the present Amadeus and Georgina Troughs and the contiguous Simpson Desert area. These remnants occur as transient orogenic welts separating the Devonian-Permian sub-basins, and are possibly related to an earlier mobile depositional hinge line. The stratigraphic sequence within these fold belts probably extends beneath the younger sub-basins but

is complicated by faulting and erosion which resulted in the beveling of structurally high areas prior to Devonian-Carboniferous and Permian onlap.

Basement rocks have not been observed in other than distant exposed outcrop areas but it is assumed that they consist of Archean igneous and metamorphic rocks similar to those in the adjacent Musgrave and Arunta cratonic blocks.

Major structural features in the area include the Archean Musgrave and Arunta Cratonic Blocks, the shallow basement platform which connects them and separates the Amadeus Trough from the Pedirka Sub-basin, the postulated northeast extension of the Peake and Denison fold belt, expressed in part by McDills anticline, and the contiguous Simpson Sub-basin. (Figure 5).

The Musgrave and Arunta blocks are part of the older crystalline mountain system of Australia which has been positive more or less constantly from at least Middle Proterozoic time. These areas have been transgressed by occasional Proterozoic and Lower-Paleozoic deposition but generally have been the principal source of sediment supplied to the adjacent basins. Archean granitized metasediments intruded by various acidic and basic igneous rocks comprise the bulk of the basement blocks.

A shallow basement platform located between the Amadeus Trough and the Pedirka Sub-basin is apparently a broad upwarp in the crystalline basement which may have been positive and acted as a barrier to normal marine circulation during the Upper Proterozoic and Lower Paleozoic. This is evidenced by the presence of evaporite beds within this sequence in the Amadeus Trough.

The present configuration of the ridge is most probably due to cyclic post Ordovician uplift which was renewed in the Permian. It does not appear to have been a barrier to Mesozoic marine incursion.

The Pedirka Sub-basin is a restricted Devonian? to Permian downwarp controlled in part by bordering positive areas. It represents the depositional site of thick locally derived fill type sediments which accumulated and were preserved during successive periods of pre- and post Permian erosion. The Permian section thickens toward the axis of the sub-basin by addition of section within the upper part of the sequence.

A fold belt, which is partially represented by McDills anticline, appears to be an extension of a regional tectonic element superimposed along an ancient hinge line that separated Upper Proterozoic and Lower Paleozoic shelf deposition on the west from geosynclinal accumulation on the east. Incipient movements along this orogenic belt may have commenced in the Cambrian or earlier but it appears that much of the synorogenic "molasse" type detritus found in the adjacent troughs was stripped from the rising highland during a period of maximum uplift in the Devonian-Carboniferous. Renewed near 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 new axis, the McDills structural trend, which is a prominent subsurface asymetric anticlinal feature generally bordered on the northwest by normal or high angle reverse faulting. It is a regional feature that can be traced in a north-south direction for a minimum of 200 miles and even further if it is considered to be related to the Peake and Denison fold belt. Continued structural growth during the Permian and Mesozoic is indicated by marked thickening of these stratigraphic units on the flanks of the McDills trend.

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 and associated orogenic belt. The Birdsville high probably marks its southeast border.

A narrow transverse saddle in the McDills anomaly at Permian level connects the Simpson and Pedirka Sub-basins.

Geologically the two areas have probably had similar histories, with comparable Devonian Carboniferous "molasse" type accumulation and Permian sections which thicken toward depositional axes.

AMERADA HALE RIVER No. 1
STRATIGRAPHIC TABLE

AGE	FORMATION	DEPTH	THICKNESS	NET POROSITY	RESERVOIR CHARACTERISTICS
QUATERNARY	DUNE SAND	SURFACE	200'		
UPPER CRETACEOUS LOWER	WINTON - TAMBO UNDIFFERENTIATED	200'	1906'		NIL
LOWER CRETACEOUS	TOOLEBUC MEMBER	2106'	118'		NIL
	ROMA FORMATION	2224'	531'		NIL
LOWER CRETACEOUS UPPER JURASSIC	TRANSITION ZONE	2755'	115'		NIL
JURASSIC	JURASSIC UNDIFFERENTIATED	2870'	1292'	540' >10%	GOOD
PERMIAN	PERMIAN UNDIFFERENTIATED	4162'	383'	145' >10%	GOOD
PRE - PERMIAN (DEVONIAN - CARBONIFEROUS)	FINKE ?	4545'	159'	18' >10%	FAIR
PROTEROZOIC ?	VOLCANICS AND SEDIMENTS	4704'	979'		NIL

4. STRATIGRAPHY

The stratigraphic succession penetrated in the Hale River No.1 has been established by lithologic samples and electric logs. Divisible stratigraphic units are described below:

Tertiary. 0' - 200'

Quaternary: Surface - 200'
Sand, reddish-orange, limonite stained, fine to coarse grained, subrounded, frosted, unconsolidated.

These sands form stabilized longitudinal type dunes which trend northwest and may be many miles long. Some reach heights in excess of 75 feet and may be spaced with a lateral density of 3 - 5 dunes per mile.

Cretaceous. 200' - 2755'

Winton-Tambo Formations: 200' - 2106'
Shale, light to medium grey, soft, slightly fissile, glauconitic, carbonaceous, pyritic with traces of fossil fragments, inoceramus prisms, and dark grey-brown argillaceous limestone.

The lithology of this sequence is suggestive of a paralic to shallow marine environment with much of the sedimentation occurring within inundated lagoons which contracted as the sea regressed.

Toolebuc Member: 2106' - 2224'
Shale, medium to dark grey, fissile, inoceramus prisms and fossil fragments, common grey-brown, dense limestone.

The depositional environment of the Toolebuc Member is not clearly understood but it is believed to represent a period of sedimentation when possible climatic changes allowed shallow seas to become temporarily less turbid.

Roma Formation: 2224' - 2755'
Shale, medium to dark grey-brownish grey, fissile, glauconitic and calcareous, interbedded with siltstone and fine grained sandstone, light to medium grey, glauconitic and slightly calcareous. Occasional pyrite, inoceramus fragments and dark brown, dense, argillaceous limestone.

This section is representative of deposition in a very shallow, transgressing sea with turbid marine conditions predominating.

Lower Cretaceous - Upper Jurassic. 2755' - 2870'

Transition Zone: 2755' - 2870'
Sandstone, light grey-white, fine to coarse grained, sub-rounded to well rounded, calcareous, unconsolidated, interbedded with shale, light grey, splintery, brittle.

Sediments of the Transitional Zone were deposited in a marginal environment on the periphery of the expanding embryonic Cretaceous sea. These accumulations probably include intertonguing, beach barrier bar and tidal flat facies.

Jurassic. 2870' - 4162'

Jurassic Undifferentiated: 2870' - 4162'
Sandstone, white, buff, amber, fine to coarse grained, sub-rounded to well rounded, frosted, unconsolidated, excellent porosity, interbedded with occasional grey carbonaceous shale and coal. Quartz pebbles, garnet and pyrite occur as accessory material.

This terrigenous to paludal clastic sequence accumulated as a result of gentle regional uplift of a featureless land surface, drained by a complex of actively eroding tributaries.

Permian. 4162' - 4545'

Permian Undifferentiated: 4162' - 4545'
Sandstone, white, fine to coarse grained, angular to rounded, occasionally kaolinitic, carbonaceous, pyritic, unconsolidated, with common beds of coal, brown lignite, and siltstone. Trace of grey, soft, glauconitic and carbonaceous shale and tan to brown micaceous and carbonaceous shale and siltstone.

The depositional environment of the clastic portion of this sequence was probably fluvio-glacial with possible transition to marine-glacial. Paralic conditions are suggested by the coals and lignites in the upper part of the section.

Devonian - Carboniferous? 4545' - 4704'

Finke Beds?: 4545' - 4704'
Shale, red-grey mottled, slightly micaceous, interbedded with sandstone, white, fine to medium grained, sub-rounded, kaolinitic, pebbly, micaceous and silty.

These beds probably represent a residual accumulation of once thicker synorogenic detritus shed from surrounding positive areas and deposited under predominantly fluvial conditions.

Proterozoic? 4704' - 5683'

Volcanics: 4704' - 5683'
Claystone, volcanic conglomerate and tuffaceous agglomerate, interstratified with basalt flows and intruded by felds-pathic dikes and possible andesitic sills.

This volcanic sequence is believed to be associated with the remnants of an ancient strato-volcanic feature. Stratification is probably due to alternating periods of explosive and quiet eruption. Dikes and sills were formed by lava injected into fissures and between layers of fragmental ejecta. Andesitic material penetrated at total depth in the well may be a cumulo-form plug dome in the extinct crater.

Reworking of agglomerates and mixing with plutonic fragments is responsible for volcanic conglomerates found in the upper part of the section.

5. STRUCTURE

The structure on which Hale River No.1 was drilled is a northwest trending subsurface anticline located on the southwest flank of a broad anomalous platform area. It was delineated by discontinuous deep seismic reflections. Structure is not apparent at or above the "P" horizon (near top of Permian) level. It has an inferred length of 15 miles and is about 5 to 6 miles wide. Vertical closure may be in excess of 4,000 feet based on dip segments of deep reflections.

Dip on the southwest flank extends uninterrupted for several miles compared to the critical dip on the northeast flank which is less prominent and apparently disrupted by faulting.

Pronounced truncation of seismic reflectors occurring below the "P" horizon and above a depth of 3 seconds (two-way reflection time) is apparent on the southwest flank of the structure.

A dipmeter survey was not run in the Hale River No.1 and no conclusive dip data was obtained from cores.

6. RELEVANCE TO THE OCCURRENCE OF PETROLEUM

Sediments encountered in wells drilled in the Simpson Desert area suggest the existence of a number of the favorable geologic parameters necessary for hydrocarbon accumulation but the geologic processes necessary for a major occurrence of hydrocarbons are apparently lacking in the vicinity of the structural feature that was tested by Hale River No.1.

Minor hydrocarbon shows detected by core analysis in cores Nos. 1 and 2 are not considered significant (refer Appendix III). Forty-eight barrels of diesel fuel were added to the drilling mud to facilitate freeing stuck drill pipe 36 hours prior to cutting core No.1 and it is believed that the shows were the result of contamination by the drilling fluid. This tends to be substantiated by the results of chemical analysis indicating the hydrocarbons present in the cores and the diesel fuel utilized to be similar.

7. POROSITY AND PERMEABILITY

Good porosity was found in the Jurassic, Permian and Devonian-Carboniferous? sandstones. Average porosity for clean sandstones calculated from the electric logs are as follows:

Jurassic Undifferentiated	:	15 - 25%
Permian	:	15 - 22%
Finke Beds?	:	20 - 25%

Results of core analysis by the Petroleum Technology Laboratory of the Bureau of Mineral Resources and Core Laboratories are included as Appendix III.

8. CONTRIBUTIONS TO GEOLOGIC CONCEPTS

The Cretaceous-Jurassic sequence penetrated in Hale River No.1

was similar to that found in other parts of the western Artesian Basin.

No Triassic was found and it is assumed to be the result of non-deposition rather than erosion.

The abbreviated Permian sequence penetrated was lithologically analogous to other sections in the area but the position within the Permian chronological series is indefinite.

The age of the thin pre-Permian interval consisting of red beds and porous sandstone is unknown but a correlation with parts of the Finke Beds is considered reasonable based on lithologic similarities and stratigraphic position.

A pre-Permian volcanic sequence penetrated from 4704 feet to 5683 feet is the first encountered in this area. It is probably of Proterozoic age and is assumed to rest on Archean basement.

Stratification of the effusive, ejected and intrusive volcanic rocks suggests that they may be associated with a strato-volcanic feature. Irregular dikes and other injection features may be related to volcanic doming formed in conjunction with ancient volcanoes.

Drilling of the well has established the loss, by pre-Permian truncation, of several thousand feet of Paleozoic and Proterozoic sediments along the southwest flank of the structure on which Hale River No.1 is located.

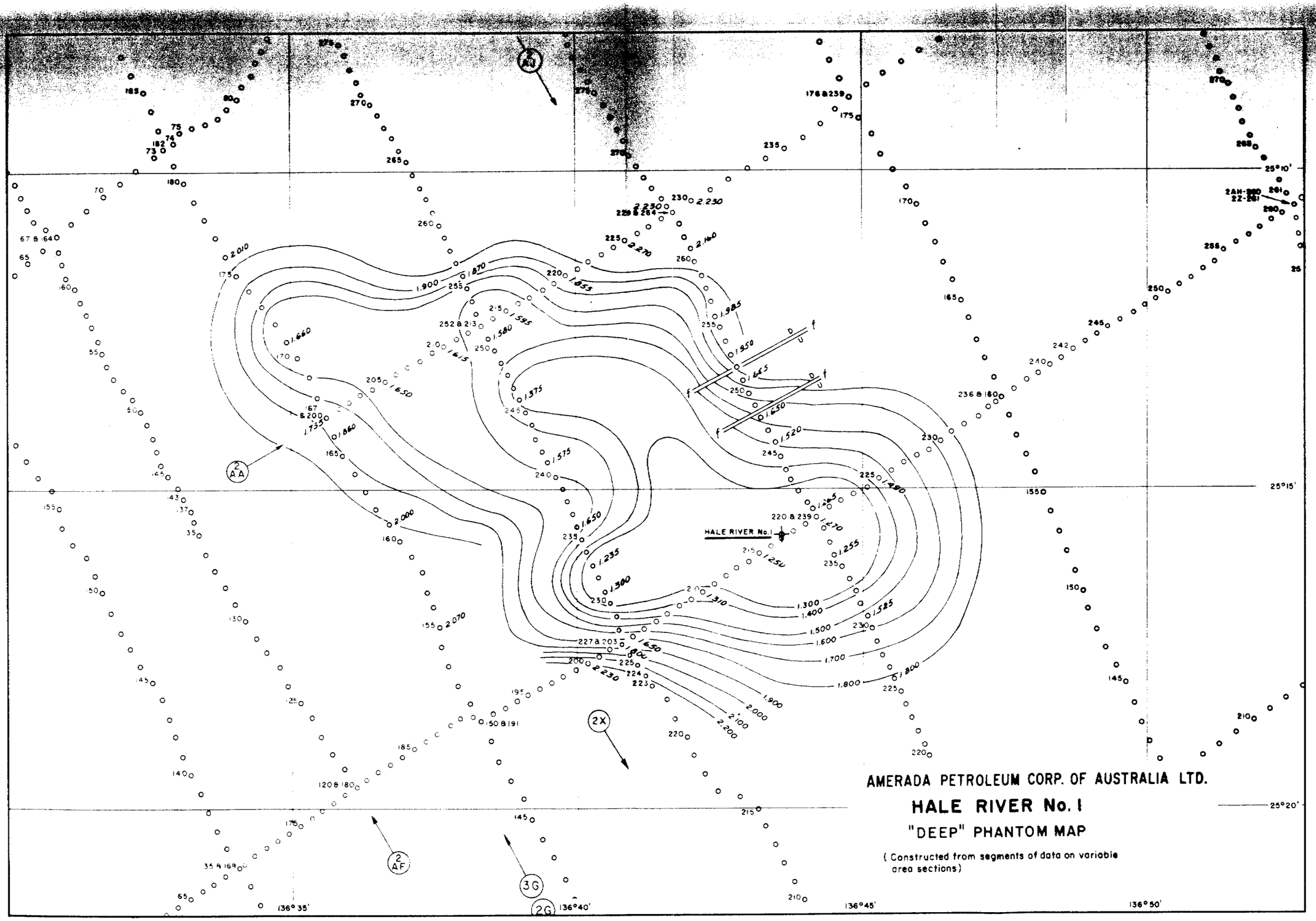

HALE RIVER No.1
AMERADA PETROLEUM CORP. OF AUSTRALIA LTD.
HALE RIVER No. 1
"DEEP" PHANTOM MAP
(Constructed from segments of data on variable area sections)
25°10'
25°15'
25°20'
136°35'
136°40'
136°45'
136°50'

Figure 6

V. REFERENCES

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Wells, A.T., Ranford, L.C., Stewart, A.J., Cook, P.J., and Shaw, R.D., 1965: The geology of the northeastern part of the Amadeus Basin, Northern Territory. B.M.R. Record No. 1965/108.

Well Reports:

Transoil No Liability	:	Mt. Charlotte No.1
French Petroleum Company	:	Witcherie No.1 Purni No.1 Mt. Crispe No.1 Mokari No.1
Amerada Petroleum Corporation of Australia Limited	:	McDills No.1

Seismic Surveys:

Beach Petroleum No Liability	:	Dakota Bore Seismic Survey
Amerada Petroleum Corporation of Australia Limited	:	Simpson Desert "A" Seismic Survey

APPENDIX I

CORE DESCRIPTIONS

Eight cores were cut for stratigraphic information and to satisfy subsidy requirements.

One hundred twenty-nine feet of formation was cored with one hundred eight and one-half feet recovered for an 84% recovery.

The following sheets provide a graphic and written description of each core.

CORE DESCRIPTION

DATE October 27, 1966 — CORE NO. 1

WELL Hale River No.1 — INTERVAL 3844-3864'

COMPANY Amerada — RECOVERY 13' or 60%

LOCATION 25°15'50"S; 136°43'35"E — FORMATION Jurassic

ELEVATION 411'KB — GEOLOGIST R.O. Witten

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
3845		3	Sandstone, white, occasional pinkish or rust colored garnet, fine to coarse grained, generally medium grained, angular to well rounded, generally subrounded, kaolinitic, good porosity, no show; occasional quartz or sandstone pebble imbedded, thin streaks of coal throughout
		5	
3846			
		3	
3847			* The seven feet of core not recovered is probably distributed throughout entire core. For graphic purposes it is considered as being lost from the bottom only.
		2	
3848			
		2	
3849			
		3	
3850			
		3	
3851			
3852			
		3	
3853			
		2	
3854			

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

DATE October 27, 1966

WELL Hale River No.1

COMPANY Amerada

LOCATION 25°15'50"S; 136°43'35"E

ELEVATION 411'KB

CORE NO. 1

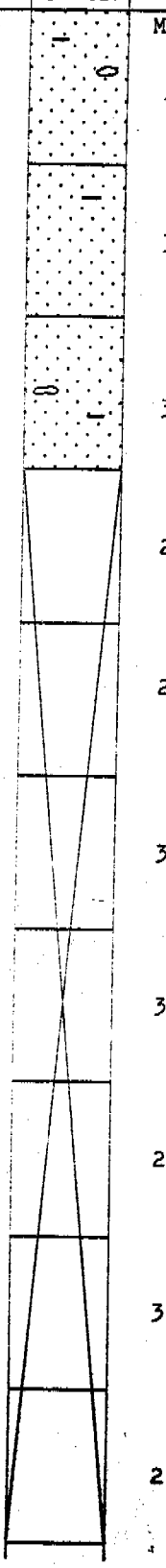
INTERVAL 3844-3864'

RECOVERY 13' or 60%

FORMATION Jurassic

GEOLOGIST R.O. Witten

DEPTH	LITHOL.	DESCRIPTION
3854		Min/Ft
		3
3855		
		3
3856		
		3
3857		
		2
3858		
		2
3859		
		3
3860		
		3
3861		
		2
3862		
		3
3863		
		2
3864		



* No recovery

CORE DESCRIPTION

DATE October 28, 1966
WELL Hale River No.1
COMPANY Amerada
LOCATION 25°15'50"S; 136°43'35"E
ELEVATION 411'KB

CORE NO. 2
INTERVAL 4170-4185'
RECOVERY 4[illegible]' or 30%
FORMATION Permian
GEOLOGIST R.O. Witten

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
4170			
		4	Sandstone, white, fine to medium grained, generally fine grained, subrounded to rounded, excellent porosity, very friable, no show: Coal and lignite splinters throughout. Dips up to 30° but probably cross bedding.
4171			
		3	
4172			
		2	
4173			
		2	
4174			
		2	
4175			No recovery, assumed bottom portion of core not recovered. Coring time indicates probably more friable than part recovered.
		1.5	
4176			
		1.5	
4177			
		1.5	
4178			
		1.5	
4179			
		1.5	
4180			

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

DATE October 28, 1966
WELL Hale River No.1
COMPANY Amerada
LOCATION 25°15'50"S: 136°43'35"E
ELEVATION 411'KB

CORE NO. 2
INTERVAL 4170-4185'
RECOVERY 4' or 30%
FORMATION Permian
GEOLOGIST R.O. Witten

DEPTH	LITHOL.	DESCRIPTION
		Min/Ft
		No recovery
		1.5
4181		
		1.5
4182		
		1.5
4183		
		1.5
4184		
		1.5
4185		

CORE DESCRIPTION

DATE October 30, 1966 — CORE NO. 3

WELL Hale River No.1 — INTERVAL 4517-4532'

COMPANY Amerada — RECOVERY 15' or 100%

LOCATION 25°15'50"S; 136°43'35"E — FORMATION Permian

ELEVATION 411'KB — GEOLOGIST R.O. Witten

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
4517			
		5	Shale, buff, creamy hard, minutely micaceous
4518			
		7	
4519			
		6	Siltstone, buff, cream, argillaceous, minutely micaceous, very slightly carbonaceous with thin streaks of shale as above.
4520			
		5	Sandstone, buff, cream, fine grained, tight, scattered dark grains, kaolinitic, very slightly carbonaceous, minutely micaceous.
4521			
		5	
4522			
		5	
4523			
		5	
4524			Slickensided fractures at 4524' and 4524½'
		4	
4525			
		4	
4526			
		3	Siltstone, tan, very argillaceous, minutely micaceous, arenaceous in part, very slightly carbonaceous
4527			

CORE DESCRIPTION

DATE October 30, 1966
WELL Hale River No.1
COMPANY Amerada
LOCATION 25°15'50"S; 136°43'35"E
ELEVATION 411'KB

CORE NO. 3
INTERVAL 4517-4532'
RECOVERY 15' or 100%
FORMATION Permian
GEOLOGIST R.O. Witten

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
		3	
4528			
		7	
4529			Slickensided fracture at 4529'
		8	
4530			
		6	Shale, dark brown, silty, micaceous, carbonaceous
4531			
		6	Shale, tan to light brown, hard, brittle, carbonaceous, with one slickensided fracture at 4531½'
4532			

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

DATE October 31, 1966 — CORE NO. 4

WELL Hale River No.1 — INTERVAL 4756'-4763'

COMPANY Amerada — RECOVERY 7' or 100%

LOCATION 25°15'50"S; 136°43'35"E — FORMATION Proterozoic

ELEVATION 411'KB — GEOLOGIST R.O. Witten

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
4756			
		11	* Arkosic tuff with the following minerals present, quartz, K feldspar, chlorite, glauconite, hematite, calcite, apatite and rock fragments. A 2" band of albite, oligoclase and apatite feldspars cuts through the rock in the form of a dike.
4757			
		8	
4758			
	M	25	Claystone, maroon with green mottling, occasional quartz grains and flakes of mica, becoming silty in part. Possible 10° dip.
4759	M		
		25	
4760			
	V	18	Conglomerate, maroon with maroon and green claystone pebbles from 3mm to ½" in diameter imbedded in a claystone matrix containing K feldspar, chlorite and kaolin. Possible 10° dip.
4761			
	V	35	
4762			
	V	35	
4763			

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

DATE November 2, 1966
WELL Hale River No.1
COMPANY Amerada
LOCATION 25°15'50"S; 136°43'35"E
ELEVATION 411'KB

CORE NO. 5
INTERVAL 4937-4968'
RECOVERY 30' or 97%
FORMATION Proterozoic?
GEOLOGIST R.O. Witten

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
4937			
	⊥	10	Claystone, maroon, red-brown, hard, brittle very slightly calcareous
4938	⊥		
	⊥	14	Claystone, green, hard, brittle with white calcite filled fractures, some weathered feldspar in thin streaks, random form inclusions of grey, dense to coarse crystalline secondary limestone. Possible 10° dip
4939	⊥		
	⊥	15	
4940	⊥		
		14	
4941	⊥		Claystone, dark maroon, red-brown, hard, brittle with streaks 1/16" to 2" thick of arkose, slightly calcareous. Possible 10° dip.
	⊥	16	
4942			
	⊥	17	
4943			
		12	Claystone, maroon, red-brown with minor green splotches, hard, brittle. No visible dip.
4944			
		13	
4945			
		18	
4946			
		12	Arkosic volcanic conglomerate, red-brown and green, consists of claystone matrix with pebbles of claystone, feldspar and a green mineral (chlorite, hornblend). Near vertical calcite filled fractures. No visible dip
4947			

CORE DESCRIPTION

DATE November 2, 1966
WELL Hale River No.1
COMPANY Amerada
LOCATION 25°15'50"S; 136°43'35"E
ELEVATION 411'KB

CORE NO. 5
INTERVAL 4937-4968'
RECOVERY 30' or 97%
FORMATION Proterozoic?
GEOLOGIST R.O. Witten

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
4947			
		17	
4948			
		17	
4949			
		16	
4950			
		15	
4951			
		15	
4952			
		18	
4953			Claystone, maroon, red-brown, hard, brittle with many streaks of arkose 1/16" to 3" thick, very slightly calcareous. Possible 15° dip.
		19	
4954			
		23	
4955			
		23	
4956			
		21	
4957			

CORE DESCRIPTION

DATE November 2, 1966 | CORE NO. 5 Cont'd

WELL Hale River No.1 | INTERVAL 4937-4968

COMPANY Amerada | RECOVERY 30' or 97%

LOCATION 25°15'50"S; 136°43'35"E | FORMATION Proterozoic?

ELEVATION 411'KB | GEOLOGIST R.O. Witten

DEPTH	LITHOL.	DESCRIPTION
4957		Min/Ft.
		20 Claystone, maroon, red-brown, hard, brittle with occasional thin streak of arkose. Two thin streaks of green claystone with random form secondary limestone inclusions. Green claystone has dip of 10° and 20°, no dip indicated by arkose streaks.
4958		20
4959		20 2" thick 10° dip
4960		21
4961		20
4962		21
4963		21 3" thick 20° dip
4964		21
4965		19
4966		19
4967		

CORE DESCRIPTION

DATE November 2, 1966
WELL Hale River No.1
COMPANY Amerada
LOCATION 25°15'50"S; 136°43'35"E
ELEVATION 411'KB

CORE NO. 5
INTERVAL 4937-4968'
RECOVERY 30' or 97%
FORMATION Proterozoic?
GEOLOGIST R.O. Witten

DEPTH	LITHOL.	DESCRIPTION
4967		Min/Ft
		20 No recovery
4968		

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

DATE November 5, 1966 — CORE NO. 6

WELL Hale River No.1 — INTERVAL 5271-5288

COMPANY Amerada — RECOVERY 15' or 88%

LOCATION 25°15'50"S; 136°43'35"E — FORMATION Proterozoic?

ELEVATION 411'KB — GEOLOGIST T.R. Pearson

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
			Tuff Agglomerate or lahar Poorly sorted, varicoloured, rounded - angular volcanic pebbles, cobbles and fragments within a felsitic tuffaceous matrix
5272		20	
		18	
5273			Volcanic pebbles - fragments are of polymict origin and are often partly weathered.
		15	Tuff varies from dark grey - maroon and contains abundant coarse crystals of fresh orange K feldspar. Tuff is siliceous in part.
5274			
		17	→ Approx. 10° dip
5275			Fractures are common, and exhibit dips from 45° to irregular. Secondary calcite enfills fractures and calcite inclusions are common. Rock resembles a polymict conglomerate or fillite but is of volcanic origin hence the name lahar (volcanic mudflow resembling unstratified glacial deposits)
		14	
5276			
		19	
5277			
		22	
5278			
		20	
5279			
		20	
5280			
		21	
5281			

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

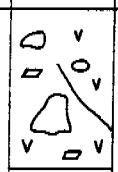
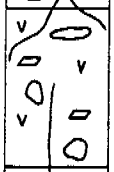
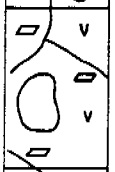
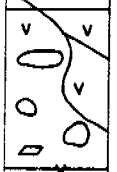
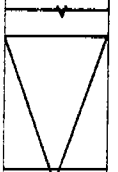
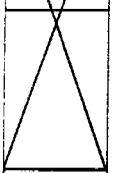
DATE November 5, 1966 — CORE NO. 6 Cont'd

WELL Hale River No.1 — INTERVAL 5271-5288

COMPANY Amerada — RECOVERY 15' or 88%

LOCATION 25°15'50"S; 136°43'35"E — FORMATION Proterozoic?

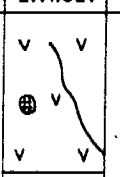
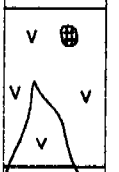
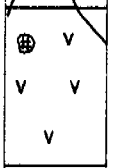
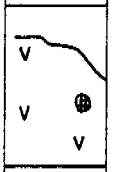
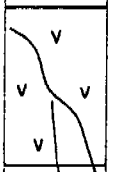
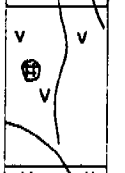
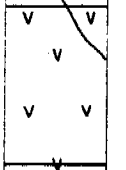
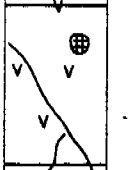
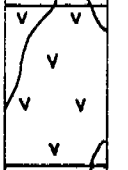
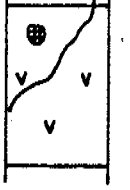
ELEVATION 411'KB — GEOLOGIST T.R. Pearson

DEPTH	LITHOL.	DESCRIPTION
		Min/Ft
5282		23
5283		25 Tuff Agglomerate or lahar
5284		23
5285		20
5286		22
5287		23 No recovery
5288		23

CORE DESCRIPTION

DATE November 8, 1966
WELL Hale River No.1
COMPANY Amerada
LOCATION 25°15'50"S; 136°43'35"E
ELEVATION 411'KB

CORE NO. 7
INTERVAL 5558-5570
RECOVERY 12' or 100%
FORMATION Proterozoic
GEOLOGIST T.R. Pearson

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
5559		13	
5560		10	Porphyritic Pyroxene Basalt Phenocrysts of dark green - black pyroxene are set in a dark green basalt matrix. Basalt is partly altered and fractures show chloritization. Fractures are very irregular. There is no trace of flow banding. Basalt is partly altered whilst phenocrysts appear fresh.
5561		16	
5562		14	
5563		14	
5564		12	
5565		12	
5566		11	
5567		11	
5568		11	

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

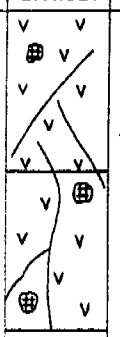
DATE November 8, 1966 — CORE NO. 7 Cont'd

WELL Hale River No.1 — INTERVAL 5558-5570

COMPANY Amerada — RECOVERY 12' or 100%

LOCATION 25°15'50"S; 136°43'35"E — FORMATION Proterozoic?

ELEVATION 411'KB — GEOLOGIST T.R. Pearson

DEPTH	LITHOL.	DESCRIPTION
		Min/Ft
		10
		Porphyritic Pyroxene Basalt
5569		
		14
5570		

CORE DESCRIPTION

DATE November 10, 1966
CORE NO. 8
WELL Hale River No.1
INTERVAL 5671-5683
COMPANY Amerada
RECOVERY 12' or 100%
LOCATION 25°15'50"S; 136°43'35"E
FORMATION Proterozoic?
ELEVATION 411'KB
GEOLOGIST T.R. Pearson

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
5672		7	
5673		7	Felsitic Andesite Orange black, consists of a very fine groundmass of sericitized feldspar with abundant magnetite crystals and some plagioclase phenocrysts. There are many irregular fractures. Fracture planes show alteration - giving a glossy, soapy partly calcareous surface
5674		8	
5675		8	
5676		6	
5677		9	
5678		6	
5679		7	
5680		8	
5681		7	

AMERADA PETROLEUM CORPORATION OF AUSTRALIA LTD.

CORE DESCRIPTION

DATE November 10, 1966 — CORE NO. 8 Cont'd

WELL Hale River No.1 — INTERVAL 5671-5683

COMPANY Amerada — RECOVERY 12' or 100%

LOCATION 25°15'50"S; 136°43'35"E — FORMATION Proterozoic

ELEVATION 411'KB — GEOLOGIST T.R. Pearson

DEPTH	LITHOL.	Min/Ft	DESCRIPTION
		8	Felsitic Andesite
5682			
		8	
5683			Total Depth

APPENDIX II

PETROGRAPHY

Thin sections of chips from five cores taken in the Proterozoic? volcanic sequence were examined by Mr. M.M. Wilson and Dr. W. Layton of the University of Queensland.

EXAMINATION OF FIVE THIN SECTIONS OF CORES

FROM HALE RIVER NO.1

Core No.8 (5679'). Meta-felsitic andesite

Mineralogy: Plagioclase-pyroxene-chlorite-sericite-apatite magnetite-haematite-leucoxene.

Description: Occasional plagioclase phenocrysts are set in a fine groundmass of mainly sericitized feldspar. Abundant megnetite-haematite constitutes the predominant part of the remainder of the rock. Occasional crystals of apatite are present. Minor leucoxene probably representing altered ilmenite also appears.

The alteration in the plagioclase suggests some low grade metamorphism of an originally felsitic andesite.

Core No.7 (5566'). Porphyritic Pyroxene Basalt

Mineralogy: Plagioclase-pyroxene-chlorite-iddingsite-magnetite ilmenite-serpentine.

Description: The rock is essentially basaltic, with porphyritic, euhedral, slightly pink augitic pyroxenes set in a fine pyroxene-plagioclase-magnetite-iddingsite groundmass. Iddingsite probably represents altered olivine. Veins of serpentine-plagioclase cut through the rock, and appear to have undergone minor movements during their crystallization.

Considerable chloritization of the groundmass of the basalt has occurred. This is probably a result of very low grade metamorphism. The plagioclase of the rock is quite fresh.

Core No.6 (5275'). Coarse Crystal Tuff-Agglomerate

Coarse (3-4 mm) crystals of quartz and K-feldspar along with corroded volcanic fragments up to 2cm long are set in a matrix of fine siliceous (chalcedonic?) material. It appears that the crystals, rock fragments and devitrified glass were loosly packed and later cemented with siliceous material. Most of the volcanic fragments are considerably haematized.

Core No.5 (4950'). Acid Tuff

Mineralogy: Quartz - K feldspar-chlorite-volcanic rocks fragments.

Description: The rock contains crystals of quartz, grains composed of crushed quartz fragments and

crystals of K-feldspar along with volcanic fragments of polymict origin. Both the fragments and the crystals are approximately the same size. The fragments are corroded or rounded and have perhaps been sorted. Secondary quartz has been deposited in pore spaces. The rock has been haematized.

Core No.4 (4756'). Arkosic Tuff

Mineralogy: Quartz - K feldspar-chlorite-glauconite-haematite-calcite-apatite-rock fragments.

Description: The rock is composed of a mixture of broken crystals of quartz-feldspar and rock fragments of diverse origins. Volcanic rock fragments occur, as well as granitic rock fragments in the form of graphic intergrowths of feldspar and quartz. The rock fragments are highly altered. A considerable amount of clay material is present. The rock appears to be a mixture of arkosic sediment and tuffaceous material.

A vein of feldspathic material cuts through the rock and is composed of a very fine grained plagioclase, probably albite-oligoclase and apatite. Apatite is abundant. The material is later cut by numerous veins of calcite as well as having large pods of calcite scattered throughout. The vein appears to be composite, but of the same material.

[signature]

[signature], M.D.

23rd November, 1966

APPENDIX III

RESULTS OF CORE ANALYSIS

Samples of cores were analyzed by the Petroleum Technology Laboratory of the Bureau of Mineral Resources and by Core Laboratories Australia Ltd.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V&H) cut at right angles from the core. Ruska porosimeter and permeameter were used with, air at 30 p.s.i.g. and dry nitrogene, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using soxhlet type apparatus. (iii) Acetone test precipitates are recorded as nil, trace, fair, strong or very strong.

NOTE: CORES RECEIVED UNSEALED

WELL NAME AND NO. HALE RIVER No. 1

DATE OF TEST. 28th NOVEMBER 1966

Core No.	Depth From:- To:-	Lithology	Average Effective Porosity from two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm./cc.)		Fluid Saturation (% of pore space)		Acetone Test	Core Water Salinity (P.P.M. NaCl)	Solubility in 15% HCl (% Bulk vol.)	Fluorescence of freshly broken core.
				V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	3849'3" 3849'7"	Sandstone, coal bands	18	16	802	2.19	2.65	37	3	Fair	N.D.	N.D.	Rare whitish yellow patches
1	3850'10" 3851'3"	Sandstone	19	9	1675	2.15	2.65	N.D.	N.D.	Strong	N.D.	N.D.	Nil
1	3854'6" 3854'10"	Sandstone	19	29	1141	2.19	2.68	51	3	Strong	13,700*	N.D.	Nil
2	4170'0" 4170'6"	Sandstone	25	632	2529	1.97	2.63	100	Trace only	Trace	N.D.	N.D.	Nil
2	4174'2" 4174'6"	Sandstone	25	582	836	1.98	2.64	100	Trace only	Strong	9900	N.D.	Nil
3	4517'0" 4517'5"	Siltstone	11	nil	Nil	2.40	2.69	N.D.	N.D.	N.D.	N.D.	N.D.	Nil
4	4762'2" 4762'7"	Conglomerate	15	Nil	Nil	2.51	2.95	74	Nil	Nil	N.D.	N.D.	Nil

Remarks:- Strong petroliferous odour was noted on breaking all segments of cores Nos. 1 and 2.
* This salinity was determined for the residual water saturation of 51%; it is actually lower under the true reservoir conditions.

General File No. 62/399.
Well File No. 66/4227

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V&H) cut at right angles from the core. Ruska porosimeter and permeameter were used with, air at 30 p.s.i.g. and dry nitrogene, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using soxhlet type apparatus. (iii) Acetone test precipitates are recorded as nil, trace, fair, strong or very strong.

WELL NAME AND NO. HALE RIVER No. 1 DATE OF TEST. 28th NOVEMBER 1966

Core No.	Depth From:- To:-	Lithology	Average Effective Porosity from two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% of pore space)		Acetone Test	Core Water Salinity (P.P.M. NaCl)	Solubility in 15% HCl (% Bulk vol.)	Fluorescence of freshly broken core.
				V	H	Dry Bulk	Apparent Grain	Water	Oil				
5	4937'0" 4937'6"	Shale	13	Nil	Nil	2.45	2.85	N.D.	N.D.	N.D.	N.D.	N.D.	Nil
5	4949'1" 4949'5"	Conglomerate	9	"	"	2.63	2.88	"	"	"	"	"	"
6	5278'4" 5278'8"	Conglomerate	6	"	"	2.67	2.84	"	"	"	"	"	"
7	5569'8" 5570'0"	Conglomerate	4	"	"	2.87	2.99	"	"	"	"	"	"
8	5671'0" 5671'7"	Basalt	4	"	"	2.66	2.75	"	"	"	"	"	"

Remarks:-

General File No. 62/399.
Well File No. 66/227

CL-511-2

CORE LABORATORIES AUSTRALIA LTD.

Petroleum Reservoir Engineering

BRISBANE, AUSTRALIA

Company AMERADA PET. CORP. OF AUST. LTD. Formation _____ Page 1 of

Well HALE RIVER NO. 1 Cores _____ File FL-

Field WILDCAT Drilling Fluid _____ Date Report 7 D

~~County~~ N.T. ~~State~~ AUSTRALIA Elevation _____ Analysts PS.

Location _____ Remarks _____

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS		POROSITY PERCENT	RESIDUAL SATURATION		PROBABLE PRODUCTION	REMARKS
		HORIZONTAL	VERTICAL		OIL % VOLUME	TOTAL WATER % PORE		
1	4175	2964		26.9	1.5	5.7	2.1	**
2	4852	977		21.1	0.0	0.0	2.0	**

** Analysis performed on weathered samples so Residual Saturations are invalid

NOTE:

(*) REFER TO ATTACHED LETTER.

(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.

(2) OFF LOCATION ANALYSES—NO INTERPRETAT

APPENDIX IV

WELL VELOCITY SURVEY

AMERADA PETROLEUM CORPORATION

OF AUSTRALIA, LIMITED

HALE RIVER NO.1

OP57

NORTHERN TERRITORY, AUSTRALIA

shot by

AUSTRAL GEO PROSPECTORS PTY. LTD.

(Crew No.2)

WELL VELOCITY SURVEY

AMERADA HALE RIVER NO.1

A velocity survey of the Amerada Hale River No.1, located in Oil Permit 57, Northern Territory at latitude 25°15'48" South, longitude 136°43'36" East, was conducted by Austral Geo Prospectors Crew No.2 on November 7, 1966.

The pressure sensitive well geophone was supplied by Austral Geo Prospectors and was lowered by Welex truck and cable. SIE type PT-100 amplifiers were used for making the records. The trace arrangement on the velocity survey records is as follows:

Trace No.1	Time break.
Trace No.2	Uphole geophone.
Trace No.3	Well geophone, high gain.
Trace No.4	Well geophone, medium gain.
Trace No.5	Well geophone, low gain.

An uphole velocity survey was shot to depth of 191 feet. The curve is included as Plate No.5 of the enclosures.

Shotpoint 2Z-217, located 427 feet south of Amerada Hale River No.1, is used as a reflection profile. The reflection profile and all calculations in the velocity survey are corrected to a +300 feet datum.

The Integrated Acoustic Log is plotted with the time-depth curve. These curves are tied together at 1346 feet, the depth of the shallowest check shot.

Respectfully submitted,

AMERADA PETROLEUM CORPORATION
OF AUSTRALIA LIMITED

E. H. Prigmore

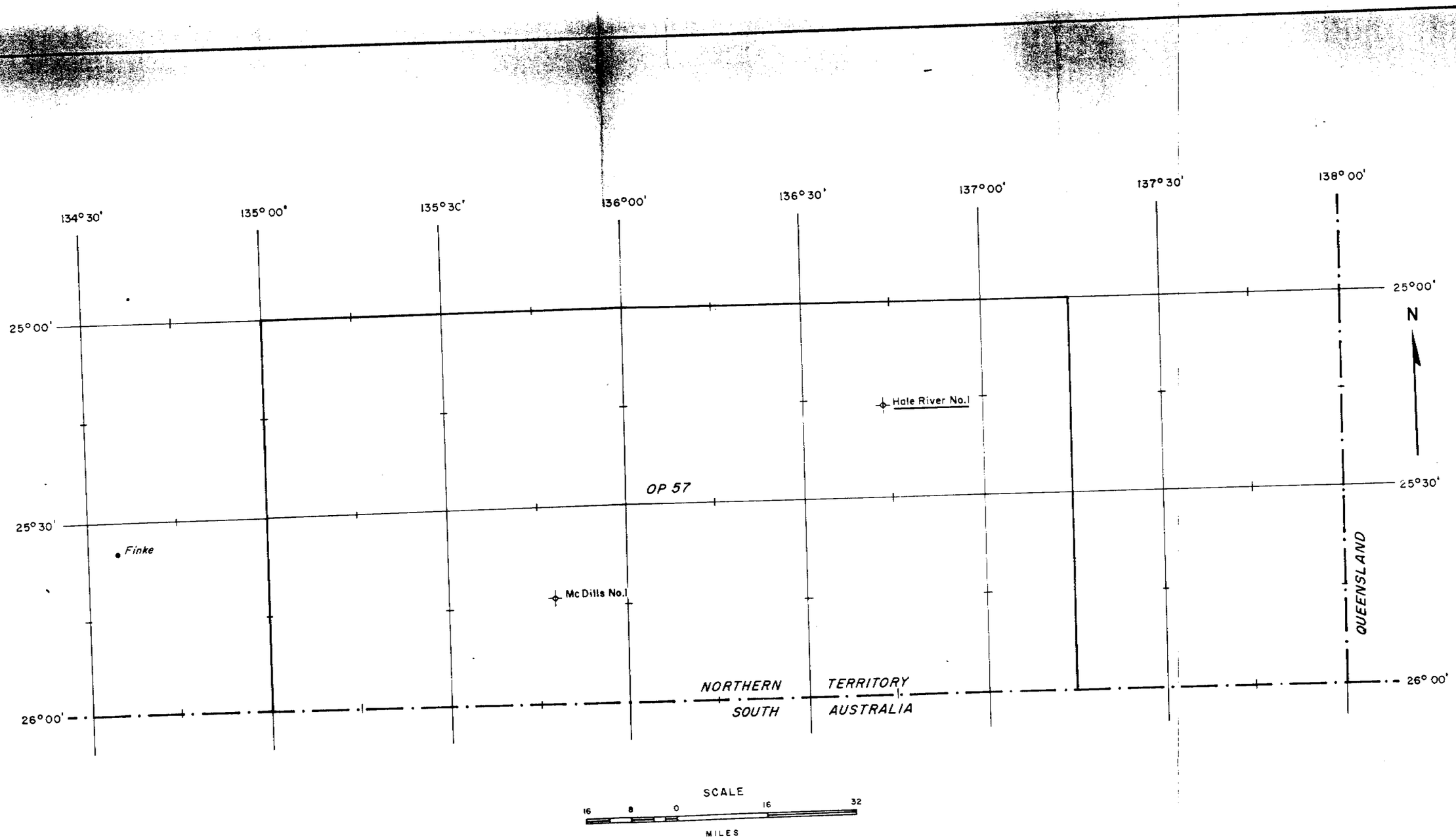
E.H. Prigmore, Chief Computer

J.T. Gilliam

J.T. Gilliam, Geophysical Supervisor

Enclosures

Plate	1	Location plat
	2	Layout of shot holes
	3	Computation sheet
	4	Well velocity curves
	5	Uphole velocity survey
	6	Reduced copies of records
	7	Reflection profile



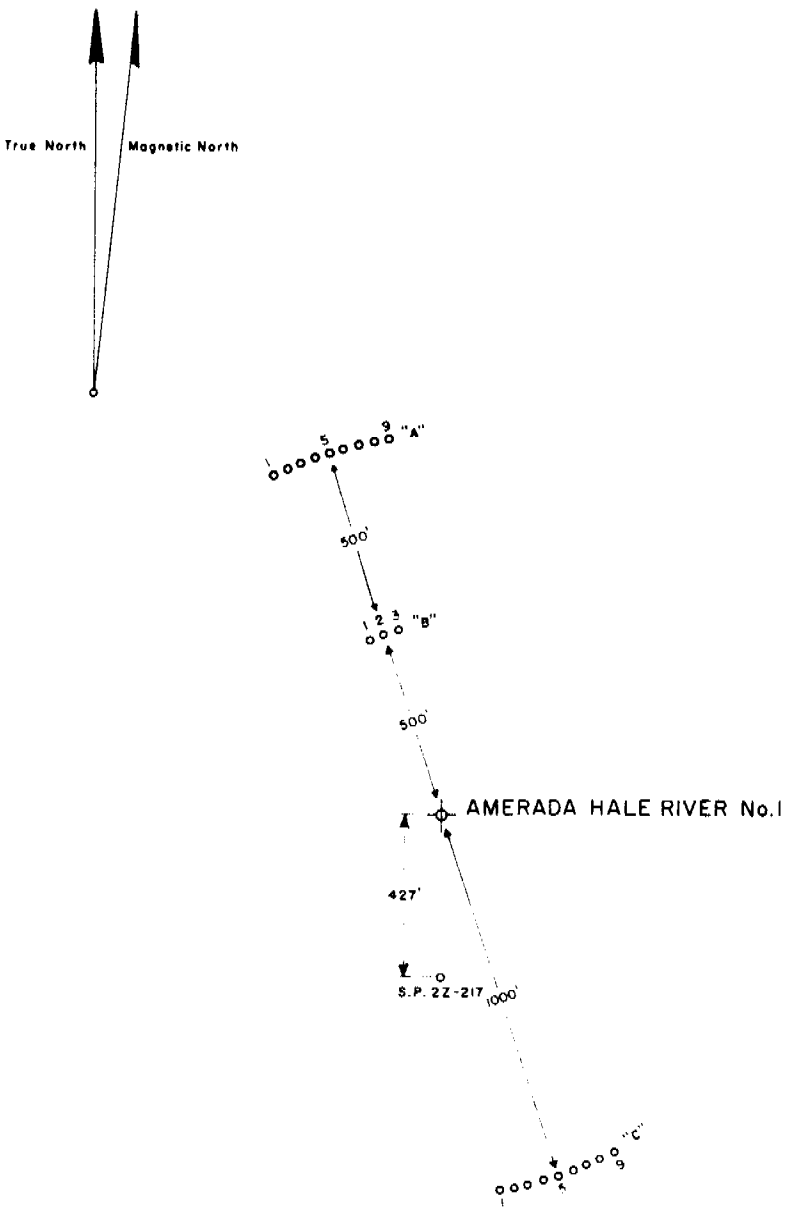
LOCATION MAP

AMERADA PETROLEUM CORP. OF AUSTRALIA, LTD.

HALE RIVER No.1

OP 57 NORTHERN TERRITORY

PLATE 1



LAYOUT OF SHOTHOLES

FOR

VELOCITY SURVEY

OF

AMERADA HALE RIVER No.1

SCALE : 1:5000

PLATE 2

SURVEY INFORMATION

Managed by E.M. Hoffman - J. Denham
Surveyed by A.G.P. Crew 2
Computed by E.H. Prigmore
Dates of survey Nov. 7, 1966

AMERADA PET. CORP. OF AUSTRALIA, LTD.

HALE RIVER No. 1

Well Elevations	Total Depth
K.B. = +411'	5683'
Gr. = +395'	
E_d = +300'	D_{wd} = 111'

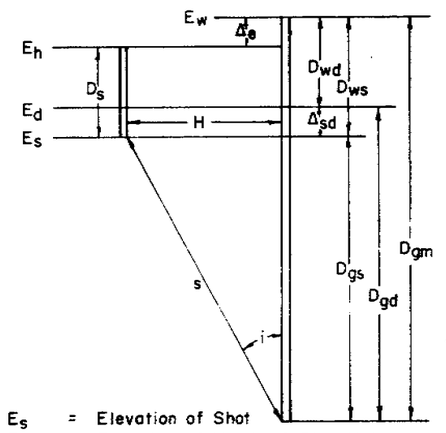
LOCATION

Co-ordinates: 25° 15' 48" S Lat.
136° 43' 36" E Long.

OP 57

Northern Territory, Australia

Record Nbr.	Shot Hole Nbr.	D_{gm}	t_{us}	D_s	Δ_e	Shot Hole Elev.	E_s	D_{ws}	Δ_{sd}	D_{gs}	H	Cot i	Cos i	T	Grade	T_{gs}	$\frac{\Delta_{sd}}{V_R}$	T_{gd}	T_{gd} Average	D_{gd}	ΔT_{gd}	ΔD_{gd}	V_i Interval Velocity	V_a Average Velocity
1	B-1	1346	.018	60	+27	384	324	87	-24	1259	500	2.518	.929	.231	G	.2146	-.0048	.2098						
2	B-2	1346	.020	60	+27	384	324	87	-24	1259	500	2.518	.929	.231	F	.2146	-.0048	.2098	.2098	1235				5887
																					.1901	1408	7407	
3	C-9	2754	.016	55	+27	384	329	82	-29	2672	1000	2.672	.937	.431	P	.4038	-.0058	.3980						
4	A-1	2754	.021	60	+33	378	318	93	-18	2661	1000	2.661	.936	.433	P	.4053	-.0036	.4017	.3999	2643				6609
																					.1256	.1406	11,194	
5	C-3	4160	.016	60	+26	385	325	86	-25	4074	1000	4.074	.971	.548	F	.5321	-.0050	.5271						
6	A-6	4160	.018	60	+29	382	322	89	-22	4071	1000	4.071	.971	.544	F	.5282	-.0044	.5238	.5255	4049				7705
																					.0397	454	11,436	
7	A-5	4614	.015	60	+31	380	320	91	-20	4523	1000	4.523	.976	.582	P	.5680	-.0040	.5640						
8	C-4	4614	.017	60	+28	383	323	88	-23	4526	1000	4.526	.976	.585	F	.5710	-.0046	.5664	.5652	4503				7967
																					.0201	226	11,244	
9	A-4	4840	.014	60	+32	379	319	92	-19	4748	1000	4.748	.979	.602	F	.5894	-.0038	.5856						
10	C-6	4840	.018	60	+29	382	322	89	-22	4751	1000	4.751	.979	.602	F	.5894	-.0044	.5850	.5853	4729				8080
																					.0212	295	13,915	
11	A-3	5135	.019	60	+33	378	318	93	-18	5042	1000	5.042	.981	.622	P	.6102	-.0036	.6066						
12	C-9	5135	.015	50	+27	384	334	77	-34	5058	1000	5.058	.981	.625	P	.6131	-.0068	.6063	.6065	5024				8284
																					.0315	423	13,429	
13	A-2	5558	.019	60	+33	378	318	93	-18	5465	1000	5.465	.984	.652	VP	.6416	-.0036	.6380	.6380	5447				8537



E_s = Elevation of Shot
E_h = Elevation of Mouth of Shot Hole
E_d = Elevation of Datum Plane = +300'
E_w = Elevation of Well
D_{gm} = Well Geophone Depth measured from Well Elevation
D_{gs} = Well Geophone Depth measured from Shot Elevation
D_{gd} = Well Geophone Depth measured from Datum Elevation.
D_s = Depth of Shot
H = Horizontal Distance from Well to Shot Hole
S = Straight Line Travel Path from Shot to Well Geophone
t_{us} = Uphole Time at Shot Hole
D_{wd} = Difference in Elevation between Well and Datum Plane = $E_w - E_d$
Δ_e = Difference in Elevation between Well and Shot Hole = $E_w - E_h$
D_{ws} = $D_s + \Delta_e$
Δ_{sd} = Difference in Elevation between Datum Plane and Shot = $D_{ws} - D_{wd}$ or $E_d - E_s$
D_{gs} = $D_{gm} - D_{ws}$
Cot i = $\frac{D_{gs}}{H}$
T_{gs} = T cos i = Vertical Travel Time from Shot to Well Geophone
T_{gd} = $T_{gs} + \frac{\Delta_{sd}}{V_R}$ = Vertical Travel Time from Datum Plane to Well Geophone
D_{gd} = $D_{gm} - D_{wd} = D_{gs} + \Delta_{sd}$ = Vertical Distance from Datum Plane to Well Geophone
V_i = Interval Velocity $\frac{\Delta D_{gd}}{\Delta T_{gd}}$
V_a = Average Velocity $\frac{D_{gd}}{T_{gd}}$
V_R = Replacement Velocity = 5000'/sec.
T = Observed Time from Shot to Well Geophone

PLATE 3

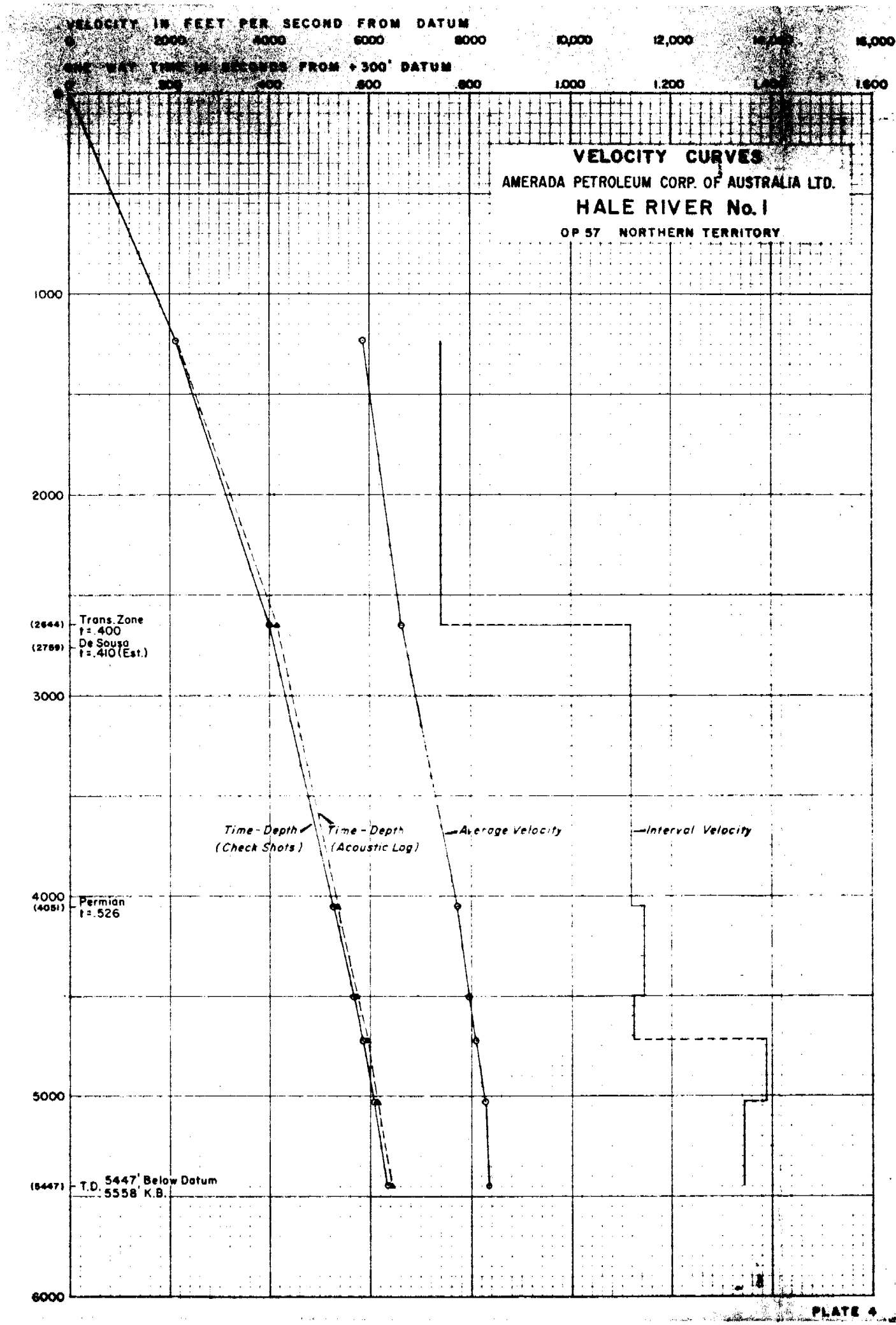

VELOCITY IN FEET PER SECOND FROM DATUM
2000
4000
6000
8000
10,000
12,000
16,000
ONE WAY TIME IN SECONDS FROM +300' DATUM
.400
.800
1.000
1.200
1.600
VELOCITY CURVES
AMERADA PETROLEUM CORP. OF AUSTRALIA LTD.
HALE RIVER No. 1
OP 57 NORTHERN TERRITORY
1000
2000
(2644)
Trans. Zone
t = .400
(2789)
De Sousa
t = .410 (Est.)
3000
Time - Depth
(Check Shots)
Time - Depth
(Acoustic Log)
Average Velocity
Interval Velocity
4000
(4051)
Permian
t = .526
5000
(5447)
T.D. 5447' Below Datum
5558' K.B.
6000

PLATE 4

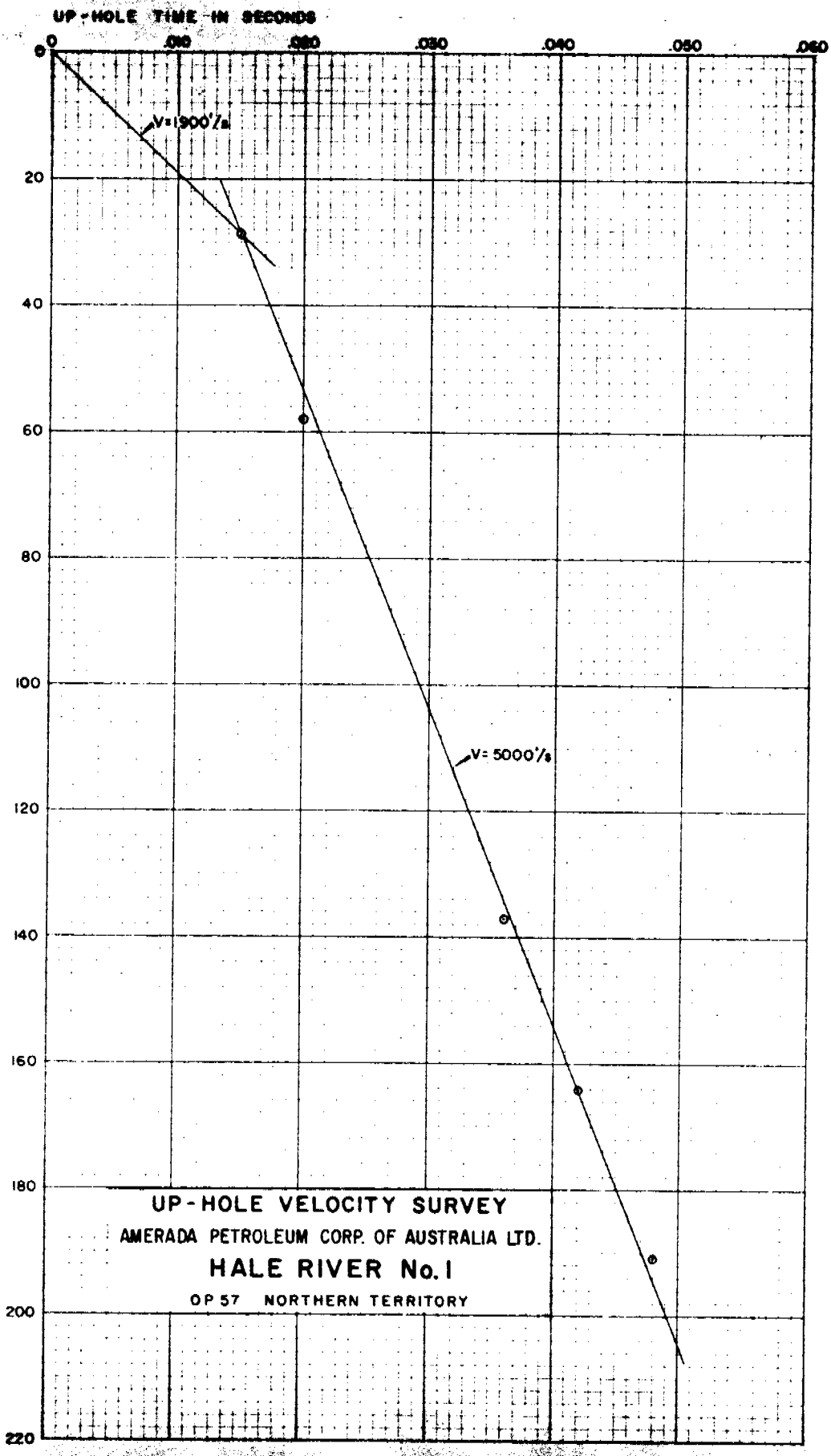

UP-HOLE TIME IN SECONDS
0
.010
.020
.030
.040
.050
.060
0
20
40
60
80
100
120
140
160
180
200
220
V=1900'/s
V=5000'/s
UP-HOLE VELOCITY SURVEY
AMERADA PETROLEUM CORP. OF AUSTRALIA LTD.
HALE RIVER No.1
OP 57 NORTHERN TERRITORY

PLATE 5

AMERADA HALE RIVER No.1

DATE: Nov.7, 1966 FILTER: F-OUT

Record No.13

S.P. A-3 (1000'N)

Well Geophone @ 5558'

40 lbs @ 44/60

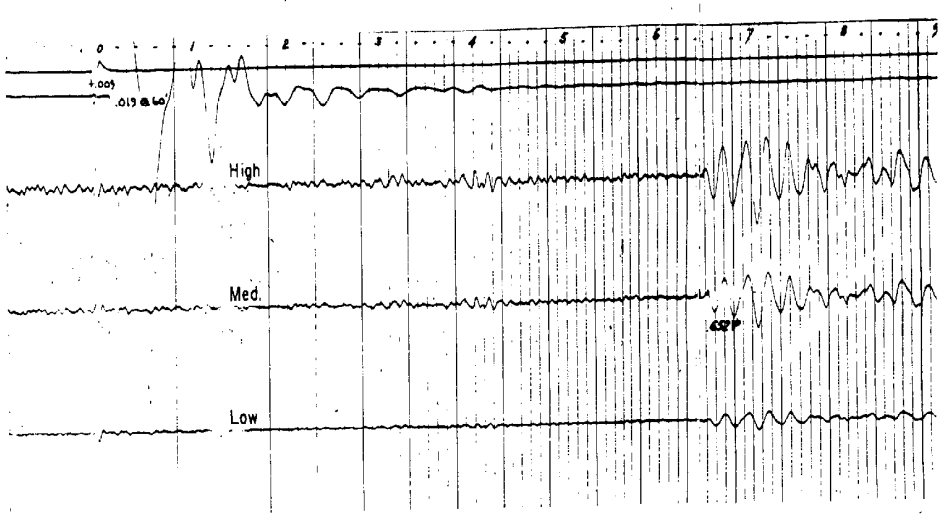


PLATE 6D

AMERADA HALE RIVER No.1

DATE: Nov. 7, 1966

FILTER: F-OUT

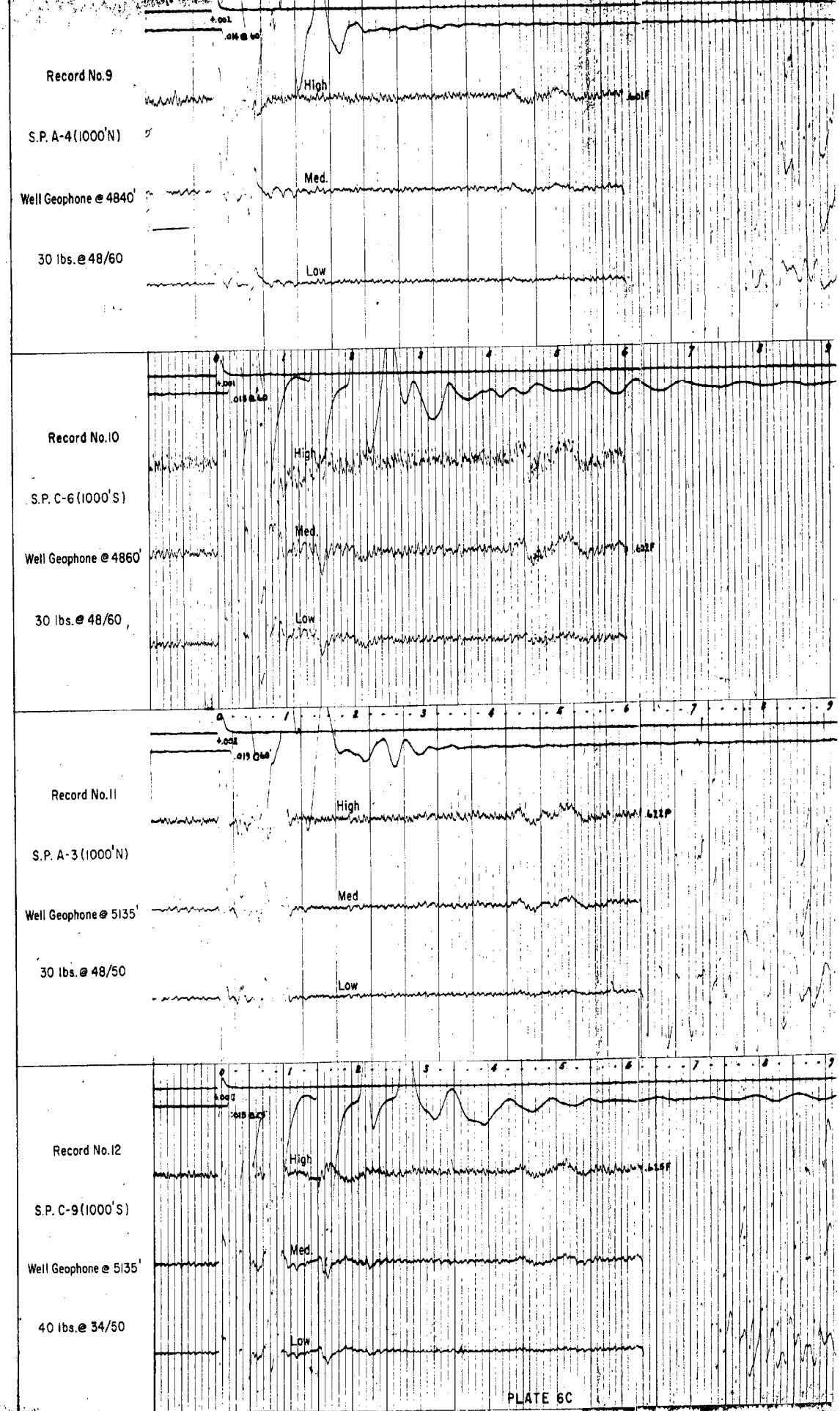


PLATE 6C

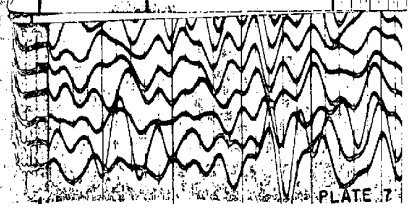


PLATE 7

AMERADA HALE RIVER No.1

DATE: Nov. 7, 1966

FILTER: F-OUT

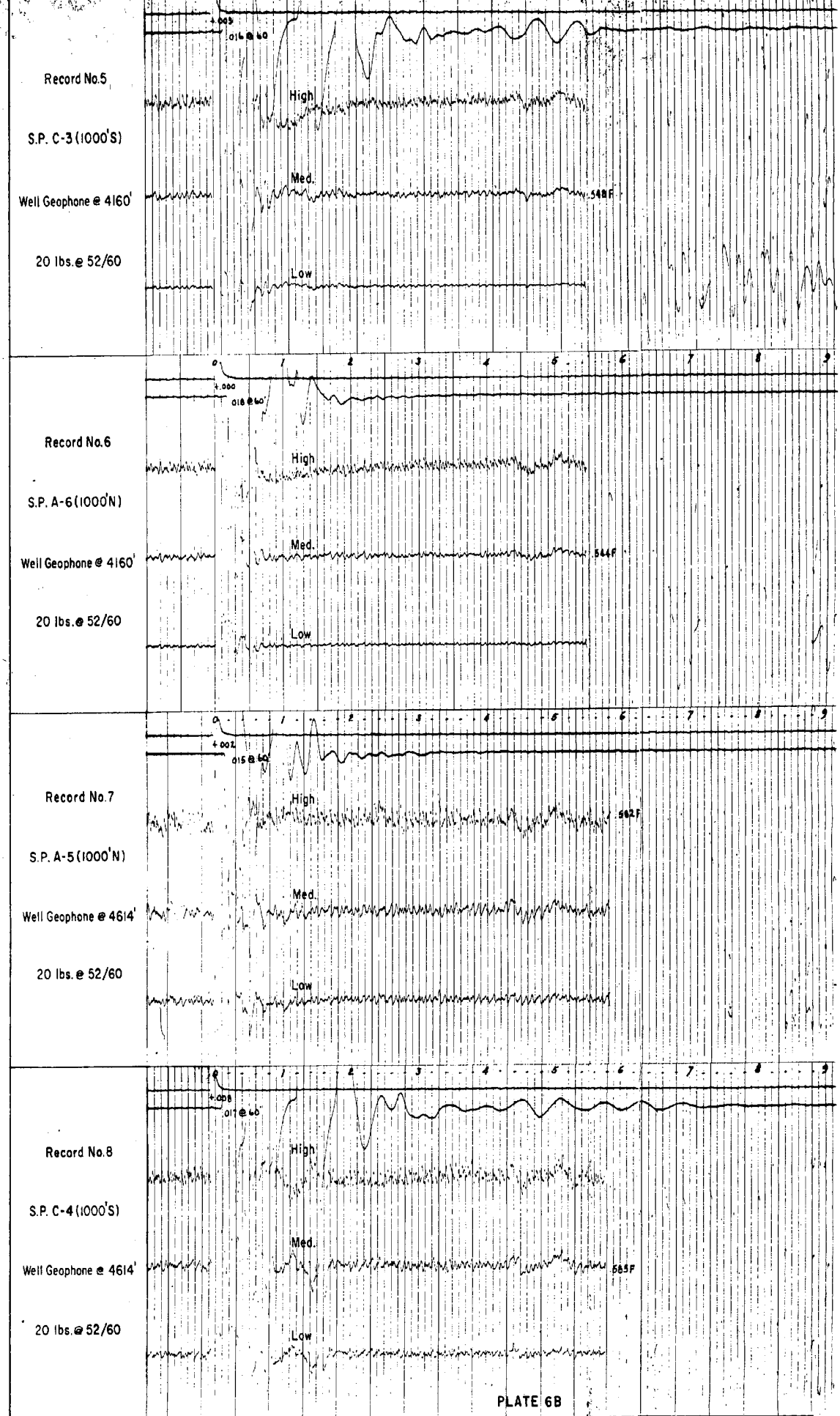


PLATE 6B

AMERADA HALE RIVER No.1

DATE: Nov.7, 1966

FILTER: F-OUT

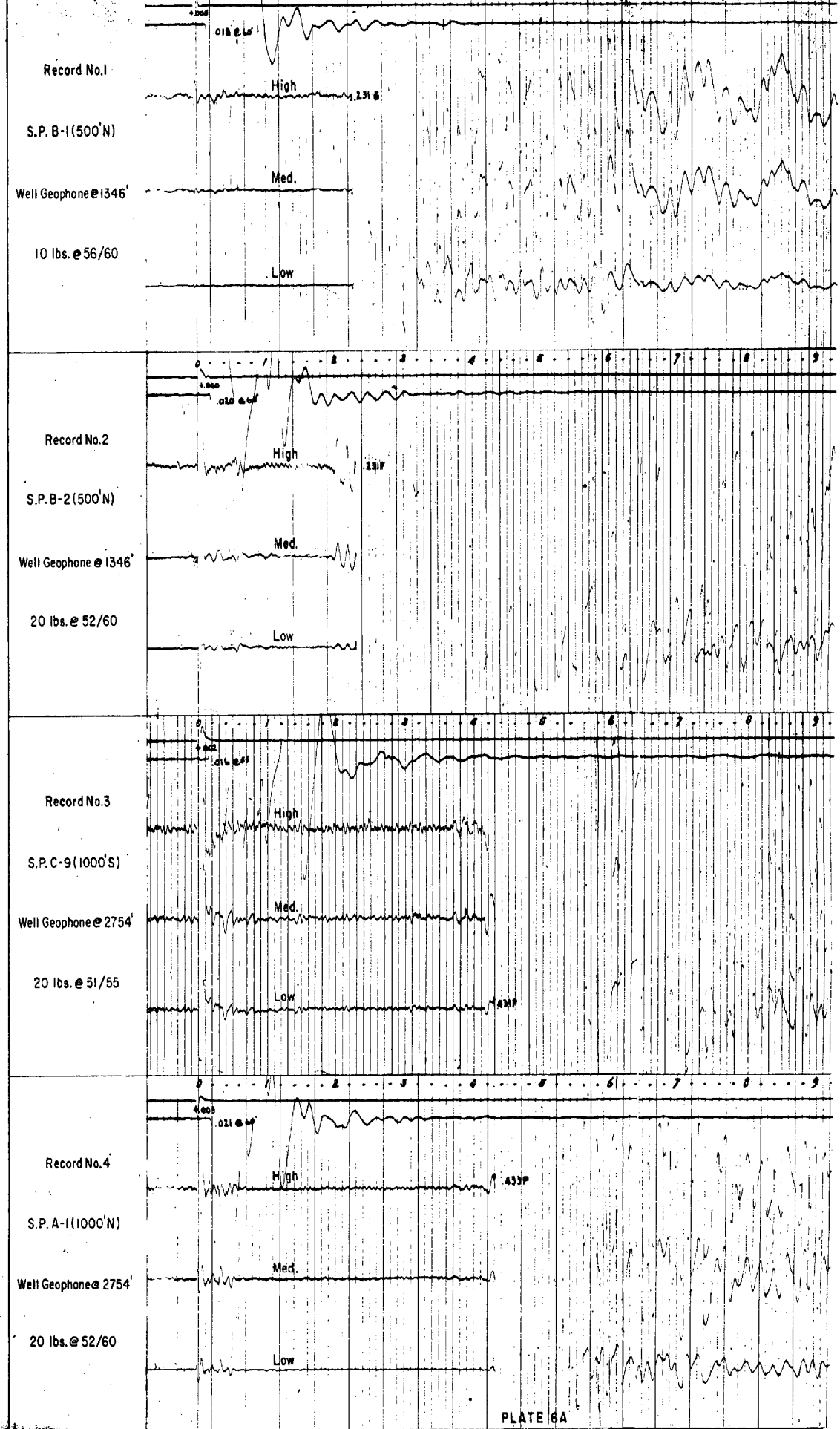


PLATE 6A