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Andado seismic survey for Beach Petroleum N.L.,
by Geoseismic (Aust.) Pty. Ltd.
BMR Petroleum Search Publication No .
A. Yakunin.
1964.

D1-26

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

PETROLEUM SEARCH SUBSIDY ACT

DRAFT REPORT

ANDADO SEISMIC SURVEY

by

A. YAKUNIN

of

GEOSEISMIC (AUSTRALIA)PTY.LTD

for

BEACH PETROLEUM N.L.

DATE AVAILABLE FOR RELEASE Twenty-ninth day of October, 1964.

The information contained in this report has been obtained, under the provisions of the Petroleum Search Subsidy Act, by the Department of National Development, as part of the policy of the Commonwealth Government to assist in the exploration for petroleum.

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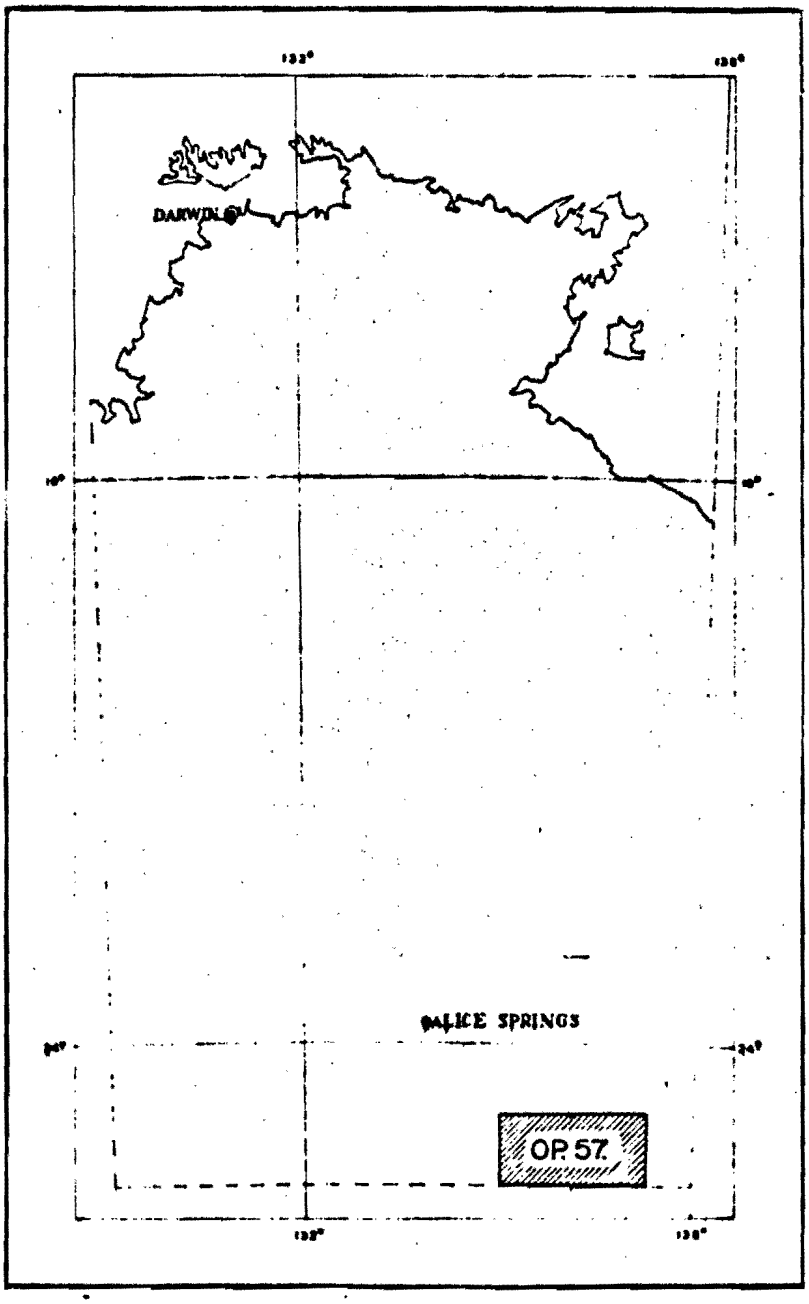

INDEX & LOCATION MAP
NORTHERN TERRITORY
AUSTRALIA
SIMPSON DESERT AREA
FOR
BEACH PETROLEM NL.
SCALE
100 50 0 100 200 300 MILES

BP 158

ABSTRACT

A seismic survey was completed in the central western portion of the Simpson Desert in O.P. 57 Northern Territory.

Indications of a major anticlinal structural trend was confirmed. One of these, the McDills Anticline, was examined more closely and appears to be of particular interest as a promising area for the accumulation of petroleum.

Buried anticlinal structure previously predicted as the result of gravity survey, has been confirmed. The newly named McDills Anticline has been outlined in regional detail, and related structurally to known sub-surface (drilling) data.

Permian sediments which underlie gently-dipping Mesozoic artesian basin sediments thin out in crestal regions over deeper-lying anticlinal structure, but thickening markedly in the synclines. The major structure is asymmetrically revealing steeper dips to the north-northwest (viz. 15 to 20 degrees), compared with 10 to 12 degrees on the south.

The structure has been tied satisfactorily in with the shallowing Permian (Malcolms water bore) in the north.

I INTRODUCTION.

A three month seismic survey was conducted in O.P. 57 Northern Territory by Geoseismic (Australia) Pty. Ltd. for Beach Petroleum N.L.

The survey was conducted in two phases.

a. 50 line miles in the Andado Area.
b. 100 line miles in the Anacoora - East Bore Area.

Both phases of the survey were extensions of geophysical work previously completed in the area. In the Andado area a broader regional picture was presented. In the Anacoora area a previously mapped positive Bouguer gravity anomaly was confirmed to represent fold structure extending to relatively shallow stratigraphic levels.

II FIELD PROCEDURES.

See Appendix I - Personnel and Equipment
Appendix II - Table of Operations

The seismic work on the Simpson Desert prospect commenced on October 2nd, 1963 at Peebles Bore in the Andado area. This position could be approached with reasonable ease. Shooting was completed in this area on November 27th, and a three day move was made 120 miles southeastwards further into the desert beyond Anacoora flowing bore. The work in this desert area was principally over previously bulldozed gravity lines. In this region the primary survey lines trended NNW-SSE along interdune corridors (Lines D, G and K), and these were connected by a cross-dune line (AB). Loops were not shot in the area because of the terrain which made cross-dune travel impractical. Where dunes had to be crossed a TD-14 tractor was used to assist equipment and to clear sand mounded spinifex grass. Generally, travelling west to east was easier, owing to the sharp sand avalanche fronts of the dunes facing the east.

Comparing areas, the Andado area was much easier to work. Most of the lines here were across a flat shaley plain, interspersed with loose sand areas causing little impediment to the movement of trucks.

Drilling in each area was adapted to the local conditions, although air was used as the basic circulatory agent. Heavy wet clays (Peebles Bore and East Bore) and loose sand (Anacoora Bore) encountered in deep holes were the main obstacles to air drilling. Where water was necessary, but impractical to cart due to the long distances involved, multiple holes were resorted to. This problem was encountered on the K and J lines where three hole patterns drilled 40 to 50 feet in depth were usually found to provide sufficient energy returns. The formations encountered in the region consisted mainly of clay and shale beneath loose sand cover.

The recording instrumentation on crew suffered numerous breakdowns. These instrument failures were due mainly to conditions found in the desert summer heat commonly attaining 120°F, rough jolting over dunes and dust entering the tape recorder. The instruments were taken out of the field at Christmas break and were overhauled. Eleven days were lost owing to instrument failure.

The elevation survey was carried out by level and theodolite from established Bench Marks in the two areas. The markers in the Andado area consisted of a line of Northern Territory Bench Marks extending past Peebles Bore, northeast to Old Andado Homestead. Elevations obtained from Peebles Bore were used for the initiation of the survey and lines were tied back to Northern Territory Bench Mark 69/51 with a mistie of -1.8 feet.

In the Anacoora Bore area, the elevations used originated from permanent markers established by a former gravity survey, the elevations could be compared with gravity stations permanently marked every five miles. The largest mistie was found to be +1.2 feet.

Both areas were connected by a 50 mile tie line through East Bore,

The mistie between the old shooting (1962) at sp. 187 and the new (Z-68) was found to be -1.7 feet.

The weather during the period of the survey was of an extreme nature. Summer temperatures prevailed, falling in the 100-120°F range for most of December to March. Dust storms were prevalent with every change of weather pattern causing a slowdown or, in extreme cases, a complete shutdown.

Experimentation in the area included the normal uphole velocity shots, establishment of the best shooting depths, a noise analysis and check on the best playback filter setting.

The uphole time velocity test was made on shot point B226 A-57 Andado area, at D140 Anacoora area and again on the J line. A graph (Plate I) of the uphole vs depth indicates a near surface velocity in the range, corresponding to the sand layer and a higher velocity of 5500 to 6500 feet per second below the sand.

A noise analysis was conducted at shot point D140 in the Anacoora Bore area. A graph of the results is presented on Plate 2 as a frequency vs. wave number plot.

The frequencies, velocities and wave numbers of the four coherent noise plotted patterns are as follows:-

Frequency	wave length	K - wave number
33 cycles	141 feet	.0071
25 cycles	88 feet	.0114
20 cycles	78 feet	.0122
17 cycles	64 feet	.0154

Examination of the resulting plot shows the low cut electrical filter position on the amplifiers was sufficient to eliminate most of the ground roll. The electrical filtering was combined with the three hole inline pattern spaced at 15 feet to further eliminate this ground roll. The

remaining two dominant noise frequencies were then attenuated by length of the geophone string (44 feet). The higher frequency noise following the refraction breaks normally appeared to fall in the wipeout area of the record causing little interference to the reflection records. The use of multiple holes and geophones also helped to reduce the random background noise present on the records.

Shooting depths varied in both areas. In the Andado area from 50 to 150 feet and in the Anacoora Bore area depths varied from 30 to 90 feet. In the East Bore to North Bore area, extremely poor records were obtained. Five hole patterns and several deep holes were tried with no appreciable change in results.

The best filter setting found for the area was 30-64, however a narrower 20-42 was tried occasionally for comparison and to check filter lags. The 20-42 filter, although used throughout the 1962 Andado survey, appeared to give a poorer resolution of the reflections than the 30-64 filter.

III GEOLOGY AND GEOPHYSICS.

GEOLOGY.

The Hale River Prospect, including the Andado and Anacoora survey areas, is located within the central-western area of the Simpson Desert. This desert occupies a topographically depressed alluvial area that overlaps the projected junctioning of several intracratonic Palaeozoic basins emerging from the West Australian Precambrian shield. It also envelops the most north-westerly development of the Mesozoic Great Artesian Basin.

Basement rocks in the perimeter areas are Archaean metasediments and acid to basic igneous intrusives. They are overlain and/or separated by thick sedimentary developments of Upper Proterozoic, Cambrian, Ordovician, (?)Devonian, (?)Carboniferous, Permian, (?)Triassic and Cretaceous ages. In the desert areas a very complete Palaeozoic

succession underlying extensive Mesozoic section is blanketed by thin Cainozoic deposits, principally Early Tertiary duricrust, Quaternary alluvium and sand dunes.

Upper Proterozoic, Cambrian, Ordovician and Cretaceous sediments were extensively marine. Upper Palaeozoic sediments as they outcrop marginally about the desert are considered to be dominantly continental. It is reasonable to suspect that these may become more marine in structurally "negative" areas beneath the Simpson Desert.

Water bores put down in geological provinces beyond the desert margin to the southwest are recognised (Ludbrook, 1961) to have penetrated marine intercalations in the Permian sections. Malcolms Bore, near the northwestern extremity of the present prospect, entered non-marine Permian shales below about 1,300 feet, but was abandoned about the predicted level of the Lower Sakmarian marine horizon encountered elsewhere in the extreme southwestern portions of the Great Artesian Basin.

The basement complexes in outcrop marginally about the desert are intensively folded, faulted and igneous-intruded. These were deeply peneplaned and isolated by an enormous time break from Upper Proterozoic sedimentation.

Several distinct cycles of Post-Archaean sedimentary deposition were accompanied and/or separated by orogenic and epeirogenic episodes of movement.

Structural deformation within the Upper Proterozoic - Lower Palaeozoic strata in the extreme northern desert areas has been accompanied by sliding and decollement formation and possibly salt (anticlinal) diapirism (Sprigg, 1962). In this (Camel Gap) region, Jura-type anticlines with near-vertical limbs and separated by flat-lying strata have been developed. The age or ages of this structural deformation has not been accurately defined. It appears not to pre-date Middle Palaeozoic

and may be epi-Devonian.

Permian strata appear not to be notably deformed, but then exposures are few. The Cretaceous Artesian Basin sediments overlap all earlier formations flatly, although N-S axes of gentle upwarping (2 to 3 degree limb-dips) are present in the Dalhousie Springs area, extending away south from the extreme southwest corner of the project area. This younger warp direction which probably related to basement faulting, trends across that of decollement (anticlinal) formation to the north end of the desert.

The principal older Palaeozoic fold directions visible immediately north of the desert approximate east-west direction. Major fault structures at the north end of the desert are believed to be extensively transcurrent and principally they strike NW-SE. These are part of a complimentary (intersecting) diagonal fault-fracture system. In the northern desert areas, "normal" faults throw down to the southwest,

GEOPHYSICS.

Much of the Simpson Desert area in Northern Territory has been covered by gravity surveys of one type or another, With the exception of the Andado reconnaissance gravity survey adjoining the present survey (Denton and Sprigg, 1962), these surveys have been by helicopter on a one station per 15 square miles network.

More detailed reconnaissance gravity geophysical surveys were, however, carried out in the immediate western limits of Beach Petroleum N.L.'s concession, namely about Andado Station.

They indicated a general regional gradient to the south and east, upon which several localised positive Bouguer anomalies are superimposed. In the north towards Malcolms Bore, a positive anomaly appears to be closed off structurally. To the south-west a more complicated pattern is believed to correlate with shallowing bedrock in this direction.

Reconnaissance reflection seismic surveys (Denton et alia, 1962) in the Andado region indicate a broadly conformable section extending to possibly 10,000 feet or more. A gentle unconformity at about 2,000-3,000 feet below surface is also indicated. All the sections deepen to the southeast, viz. desertwards.

Also, during the current exploration operations, aeromagnetic surveys have been carried out in the Simpson Desert in the Northern Territory, under contract to the Bureau of Mineral Resources. Reports on these operations are not yet available but advanced copies of aeromagnetic contour maps have been made available for the immediate area of interest.

The aeromagnetometer has also been flown extensively over the Simpson Desert immediately south of the concession, across the State border in South Australia by Delhi Australian Petroleum Ltd, and Santos Ltd. The relevant reports have not been published.

The 1962 Hale River Regional Gravity Survey carried out by the present company, successfully outlined the major gravity features of much of the Central Simpson Desert in the Northern Territory and enabled a better understanding of the major regional geological structures in this area.

The area of the survey was shown to be one of a broad, relative minimum Bouguer anomaly, presumably related to deep sedimentation, flanked by the Andado "high" on the west, the Geosurveys Hill "high" on the east and a "high" south of Mt. Etingambra. These latter areas are almost certainly related to shallowing basement in these situations. A deepened gravity trough on the west coincides with synclinal development suggested by the structure of Tertiary duricrust and relates to the Mt. Dare syncline south of the area. The broad Dalhousie anticline coming in from the south, pitches northwards into this zone about Mt. Etingambra. A zone of maximum gradient occurring along the northeasterly extension of the

west limb of this anticline appears to reflect deep structural development of the nature of a strong fault.

A number of strong asymmetrical anomalies, indicated by zones of maximum gradient, extend NNW-SSE and are presumed to be related to deep-seated block faults. In the Geosurveys Hill vicinity, E-W anomalies of asymmetrical form suggest faulting with southerly downthrow.

Other more symmetrical linear gravity anomalies were considered to be indicative of folding. Of these the line of gravity maxima extending north-east from a point 15 miles north of Mt. Etingambra and lying in a zone of potentially deeper sedimentation, was considered to be particularly attractive in the search for drillable anticlinal targets.

A striking sub-circular gravity minimum approximately 10 miles across was delineated in the central northern portion of the area.

Sedimentary thicknesses within the survey area were considered to range between 10,000 and 20,000 feet or more. However, in addition to the uncertainties arising from station spacing, the problems of such interpretation are presumed to be complicated by the presence of varying thicknesses of underlying unmetamorphosed Upper Proterozoic bedrock, some of which may, however, also constitute prospective sediment (e.g. Bitter Springs Limestone).

IV RESULTS

The record quality in the Simpson Desert area can be considered fair. The better records falling in the down dip areas where deeper section is expected.

The horizons picked are based on first cycles of the persistent energy bands. A sample record is included to show these legs.

In the Andado area a strong shallow reflection is present in the .300

to ·600 second range. Below this reflector, intermittent energy is present, much of which is possibly extraneous; i.e. multiples.

In the Anacoora Bore area the record quality was better with two strong bands of energy present. The shallower energy falling in the ·297 to ·700 second range, termed shallow reflector 'C' Horizon, and intermediate reflector, termed Intermediate reflector 'P' Horizon, falling in the ·450 to 1·400 second time range. Other reflections are present, but mostly off the anticlinal structure which forms the principal objective.

Comparison of the reflectors below the Intermediate Horizon against idealized multiple reflection paths for the shallower prominent reflections suggests the majority of the deeper reflections are probably multiples. A check of the Andado corrected sections suggests this same condition exists here.

Although multiples are present several reflectors do not appear to fit this pattern and these probably are legitimate reflections. On the D line at shot points D122 to D124 steep dip falls at a corrected time of 2 secs.

Resolved time migration sections have been plotted of the Anacoora Bore area, where steep dip in the order of ·100 to ·150 seconds magnitude is noted in this area off the northern edge of the structure. A horizontal velocity of 6000 feet per second was used in the resolved time migration method, as this corresponds to the sub weathering refractor velocities. For the Andado area, point plotted sections of the centre-corrected times falling vertically below each shot point have been submitted.

In addition, record sections were produced of each line; they varied in the type of presentation. In the Andado area, variable area and wiggly trace combined sections were made, but in the Anacoora Bore area V.D.F. sections, with a horizontal scale one-half the vertical, were produced.

The V.D.F. sections of the Anacoora Bore area show exaggerated dip. With this reduced horizontal scale it was hoped to bring any

correlatable reflectors present in the lower beds into perspective for easier comparison. On the V.D.F. sections, lines D, G and F, which cross the McDills anticlinal structure nearly at right angles, diffraction patterns were noticeable. These diffractions appear to be travelling along the line of profile. The diffraction pattern is not noticeable on the line of profiles running southeast from the crest of the structure in the reverse direction.

Corrected wiggly trace record sections using the regular 1 x 1 scale are also included in the Anacoora Bore area.

A t Delta t analysis was computed statistically, the average moveout values being taken from shot points J130 to J200. A graph showing the scattering of the moveout values with average curve plotted is included (Plate 3).

A velocity function was completed by t Delta t analysis from the moveout graph of the J line (Plate 3) and an expression for the velocity with respect to time calculated which satisfies the equation
$Va = 6000 + 1910\ t$ where t is two way time in seconds.

The mapping horizons which were carried throughout the Anacoora area were defined as the Shallow and Intermediate horizons, both being the first legs on the two continuous bands of energy present in this area. It was found on the tie line that the intermediate reflector of the Anacoora Bore area tied into the good shallow reflector in the Andado area and that both are one and the same. A final decision as to the actual geological formations being mapped could not be made until approximate ties were made to the water bores in the area.

These ties were made at Malcolms Bore at the extreme north of the map area, for the Intermediate horizon and at East Bore, located at shot point J158, for the Shallow reflector.

On mapping the area under survey, a set of four base maps were

necessary. Depth markers were placed opposite selected contours.

V. INTERPRETATION.

The maps presented are identified as Shallow Horizon - Tentative Blythesdale and Intermediate Horizon 'P' Reflector. A Time Interval Map showing the times between shallow and 'P' reflector is also presented.

The identification of the shallow reflector was made to East Bore. Here a time of 0.193 seconds was tied to the aquifer at 1300 feet below the surface. The intermediate horizon was tied into Malcolms Bore via a jump correlation of five miles to shot points 85 to 88 located at the bore. Here the first leg of the 'P' was tied to a depth of 1128 feet in the bore. This reflection was found to be equivalent to Lower Permian.

These maps were conformable where both horizons were present, but beyond J158 the shallow horizon was entirely missing. The maps exhibited two subsurface "high" areas, one at Andado, referred to as the Andado "high", another to the south termed the McDills Anticline. Between the two "highs" a broad trough 35 miles wide and exceeding 7000 feet in depth is exhibited.

Following the 'P' reflector down-dip from the structure, the time interval between the shallow and 'P' reflector increases. On the flanks of the McDills Anticline this change of interval is marked. The zone of maximum thinning on the time interval map appears to coincide with the axis of the structure as found on the 'P' map.

The Intermediate horizon ('P') as carried in the Anacoora area time ties to a strong shallow reflector in the Andado area which has previously been referred to as Cretaceous in the 1962 surveys.

The shallow reflection (Blythesdale) appears to be conformable to the deeper 'P' reflector. This moves into the wipeout area of the records at shot points Z120 to Z123 on the Andado "high". From this point on

throughout the Andado area, this reflector did not appear to be present.

Over the McDills Anticline the shallow reflector character does not change, the crest of the structure on this reflector appears to fall immediately above that noted on the deeper 'F'.

Between the two horizons mapped another reflector of lesser quality is present and appears to be continuous throughout the southern Anacoora area. This reflector exhibits shallower dip than the 'F' as beds are added or subtracted between it and the 'P' reflector. From the general thickening and thinning of the section above the 'F', this intermediate section, in this interpreter's opinion, would be Middle Permian and suggests Permian onlap onto an older geological structure.

The reflector midway between the Shallow and Intermediate would then be considered top of the Permian. The velocity to this reflector is found by Delta 't' to be 6800 feet per second close to that average velocity found for the lower 'F',

The lower reflectors are conformable to that of the 'F' reflector, suggesting most of the true dips are masked by multiple energy. Onlap onto a basement high of the Lower Palaeozoic beds as exhibited by other structures in the artesian basin suggests an unconformity exists at the base of the Permian. Some reflectors are present which may be legitimate, not fitting any multiple pattern. These reflectors are found in the 2.0 second range on the D line. On the J line, reflectors visible at 1.8 seconds also appear to be legitimate,

The reflections noted below the 'P' reflector is conformable both on the flanks and off structure in the trough area,

On structure a strong diffraction pattern emanating off the top of the McDills Anticline obscures all legitimate energy returns so that all signs of discordance beneath the 'P' and lower beds on this important area is obscured.

Plotting back the diffractions, the point sources appear to fall in the area of extreme thinning between the Blythesdale and Permian. The diffractions could be explained as emanating either from one or more small faults in this zone or from the lensing effects of the Middle Permian on structure.

Structural "closure" on the McDills Anticline is difficult to define beyond question because of the lack of closed loops, particularly at either extremity. However, examination of the contours shows that minor closure of twenty milliseconds is found at shot point D120 and forty milliseconds at AB235.

A feature of considerable importance is the obvious thinning within the presumed Permian limits. Thickness of this section north of, on top of, and south of the anticline is shown on the time interval map to be 1000 feet, 400 feet and 500 feet respectively.

VI CONCLUSIONS.

The seismic survey has demonstrated that the gravity and seismic results are, to a large extent, confirmatory. Of the two large structures observed, the relatively smaller McDills Anticline appears to be more promising as a potential petroleum reservoir. Two reflectors have been carried throughout the area with some certainty. These show section to the Lower Permian. Below this bottom Permian reflector little can be differentiated because of the poor reflection returns and the masking effect of multiple energy.

Deeper section is believed to be present in the McDills area, and may be confirmed by legitimate reflections found around 2.0 seconds. The outcrop of rock sequences on the desert margins appears to indicate the probability of lower section being present in the survey area.

The Andado "high" appears to be structurally "baldheaded", below

the level of the Permian. Deeper Palaeozoic section may be completely absent in this zone.

The seismic survey has revealed generally steeper east-northeast plunge of the principally anticlinal structure than would have been interpreted from the simple gravity anomaly presented for the McDills area. A regional gravity gradient appears to be present, and may relate to thickening Palaeozoic and/or Upper Proterozoic section increasing to eastwards.

VII RECOMMENDATIONS

Agreement between gravity and seismic data is generally good. However, notable regional gravity gradients appear to be present and which require to be extracted in undertaking closer correlation. The survey that would be of interest would be one N-S line along the Hale River. This line would also delineate the structure found here at depth.

The McDills Anticline in the Anacoora Bore vicinity appears to be structurally "closed", thereby presenting an immediate target for drilling. An additional line located in the extreme south west would more effectively demonstrate, and possibly extend, this "closure". With the general dipping of the McDills Anticline to the east, more shooting would be warranted down-plunge along the anticline, and also across it to establish the thickening of Permian section over its crest.

The survey in the Andado area has drawn attention to stratigraphic trap possibilities in deeper lying Palaeozoic section about the southern flank of this presumed bed rock "high".

A. Yakunin

AY:be
28/1/65

Approved by R. C. Sprigg

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STACKLER, W.F., and SPRIGG, R.C., 1963. Gravity Survey, Simpson Desert O.P. 57 N.T. For Beach Petroleum N.L. by Geoseismic (Australia) Ltd.

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APPENDIX I

PERSONNEL AND EQUIPMENT

DETAILS OF MAKE, TYPE AND SPECIFICATIONS OF EQUIPMENT

TECHNICAL

Type of Seismograph	S.I.E.
Number of Channels	24
Type of Camera	PRO-11
Type of Amplifier	F-11
Type of Geophones	EVS-2
Frequency	20 cycles
Geophones per trace	8
Connection	Series parallel
Spacing in group	5 feet
Spread length	1320 feet
Geophone interval	110 feet
Shot point to near Geophones	110 feet
End trace Geophones	At interlocking shot points

MAGNETIC RECORDER.

Make	Electro-Tech
Type	DS-7 Direct Recorder
Number of traces	27

Equipped with moveable heads and velocity cams if required.

DRILLING.

1 - Mayhew 1000' drilling rig equipped with 10 foot Kelly, air and water drilling (Gardner Denver 4½" x 6" pump and WCG 427 cubic foot air compressor) mounted on a 1961 Bedford 4 x 4 truck and complete with 250 feet of drill stem plus drilling accessories.

1 - Mayhew 1000 drill rig equipped with 15 foot Kelly, air and water combination (Gardner Denver 5" x 6" pump and WCG 480 cubic foot air compressor) mounted on 1961 International 4 x 6 with size 1700 tyres in addition 300 feet 2⅞" OD drill stem and all drilling accessories.

2 - 1000 gallon tankers with built in gear pumps mounted on four wheel drive Bedfords.

SHOOTING

1 - 4 x 4 Bedford mounted with 600 gallon Griffin tank and related shooting accessories.

1 - 4000 lb. licenced dynamite storage, equipped as per explosive regulations.

SURVEYING

1 - Toyota (4 x 4) Landcruiser

1 - Gurley alidade and plane table

1 - Wild T1 Theodolite

1 - Stadia Rod

UTILITY.

1 - Landrover (4 x 4) Personnel carrier

1 - Toyota (4 x 4) Landcruiser; office and scouting vehicle

1 - Ford F600 Supply truck

RECORDING

1 - International 120 (4 x 4) fitted with recording cab

1 - Toyota (4 x 4) Landcruiser, fitted as cable and geophone laying unit.

ADDITIONAL EQUIPMENT

1 - 20 foot Carapark caravan modified as Mobile Office

ONE CAMP COMPLETE WITH

a. Tents with stretchers, blankets, sheets, for crew sleeping accomodation.

b. 1 - Kitchen caravan fitted with gas stoves, electric freezer, one dining marquee,

c. 1 - Shower caravan fitted with pressure pumps, lockers and washing facilities,

d. 1 - Lighting plant - 6KVA Dunlite and accessory cables,

e. 1 - Mobile workshop with welder, mounted on (4 x 4) Ford Blitz.

f. 1 -TD-14 Tractor, equipped with wide tracks and drag for clearing line.

MAJOR PERSONNEL ON CREW

A. Yakunin	Party Chief
P. Taylor	Geophysicist
J. Hastie	Party Manager
F. Braham	Observer
P. Harding	Junior Observer
T. Campion	Surveyor
J. Owens	Shooter
C. Grigor	Driller
T. Quarry	Driller
P. Lademan	Driller
R. Mather	Computer
M. Finche	Computer
M. Gibbon	Mechanic
R. Clark	Mechanic
J. Makinson	Cook
D. Rose	Bulldozer operator.

APPENDIX II

TABLE OF OPERATIONS

Date of Commencement	October 2nd, 1963
Date of Completion	April 29th, 1964
Miles Traversed	156.7 miles

RECORDER

Drive Time	213.5 hours
Field Hours	682.0 hours
Total Hours	895.5 hours
Down Time	11 days - for instrument repairs and dust storms
Number of Holes Shot	647 holes 9 reshoots
Average size of shot	10 lbs. in Andado 5 lbs. on 5 hole patterns 20 lbs. on J line
Average depth of best shot	60 feet in Anacoora 86 feet in Andado 80 feet on Tieline 40 feet on Patterns
Amount of Explosives Used	9083 lbs. Geophex 1055 lbs. Ammonium Nitrate
Number of Detonators	1274 detonators

DRILLING

	Bedford - Drill 1	International - Drill 2
Drive Hours	305 hours	122 hours
Field Hours	617.5 hours	331 hours
Total Hours	922.0 hours	453 hours
Down Hours	52 hours	62 hours

Holes Drilled	952 including all pattern holes
Footage Drilled	50,122 feet
Average rate of penetration	43.3 feet per hour
Types of Bits and	Skidmore Crooks 4¼" Williams, Hawthorne inserts
Number used	44 bits
Casing used	Nil

DO NOT REMOVE FROM SEPIA TUBE

PR NUMBER	PR1964-0019
SURVEY NAME	Report on a Reflection Seismic Survey of the Ardaddo + Anacoora Area

LINE NUMBER	SP / VP INTERVAL	BARCODE	TUBE NUMBER	RACK NUMBER	VERSION
Time Interval Map to Intermediate Horizon		S05286			
Time Interval Map to Intermediate Horizon		S05287			
Intermediate Horizon (Tentative Permian)		S05288			
Intermediate Horizon (Tentative Permian)		S05289			
Time interval Map to ?					
Intermediate Horizon ?		S05290			
Shallow Horizon (Tentative Blythesdale)		S05291			
Shallow Horizon (Tentative Blythesdale)		S05292			
Intermediate Horizon (Tentative Permian)		S05293			
Intermediate Horizon (Tentative Permian)		S05294			

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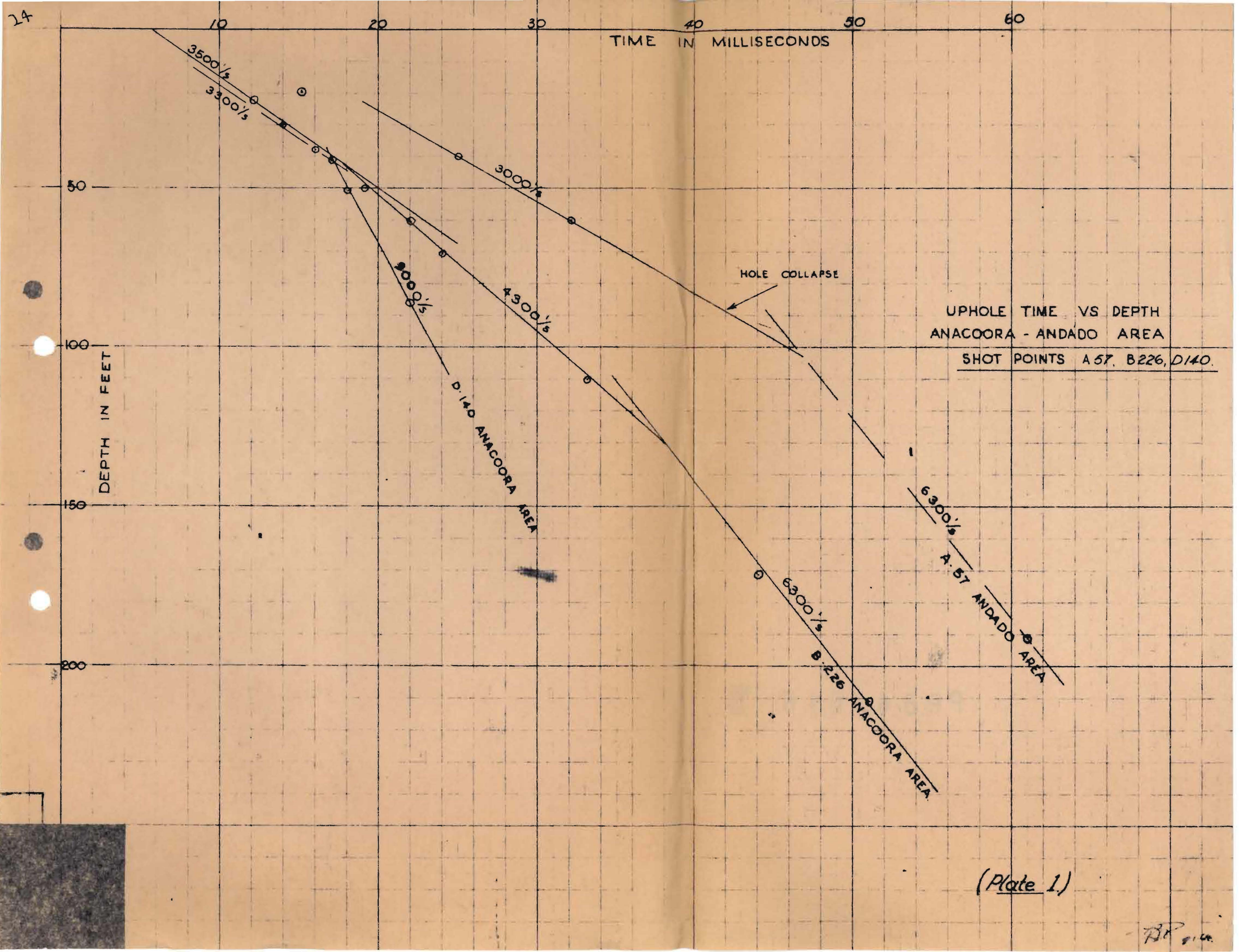
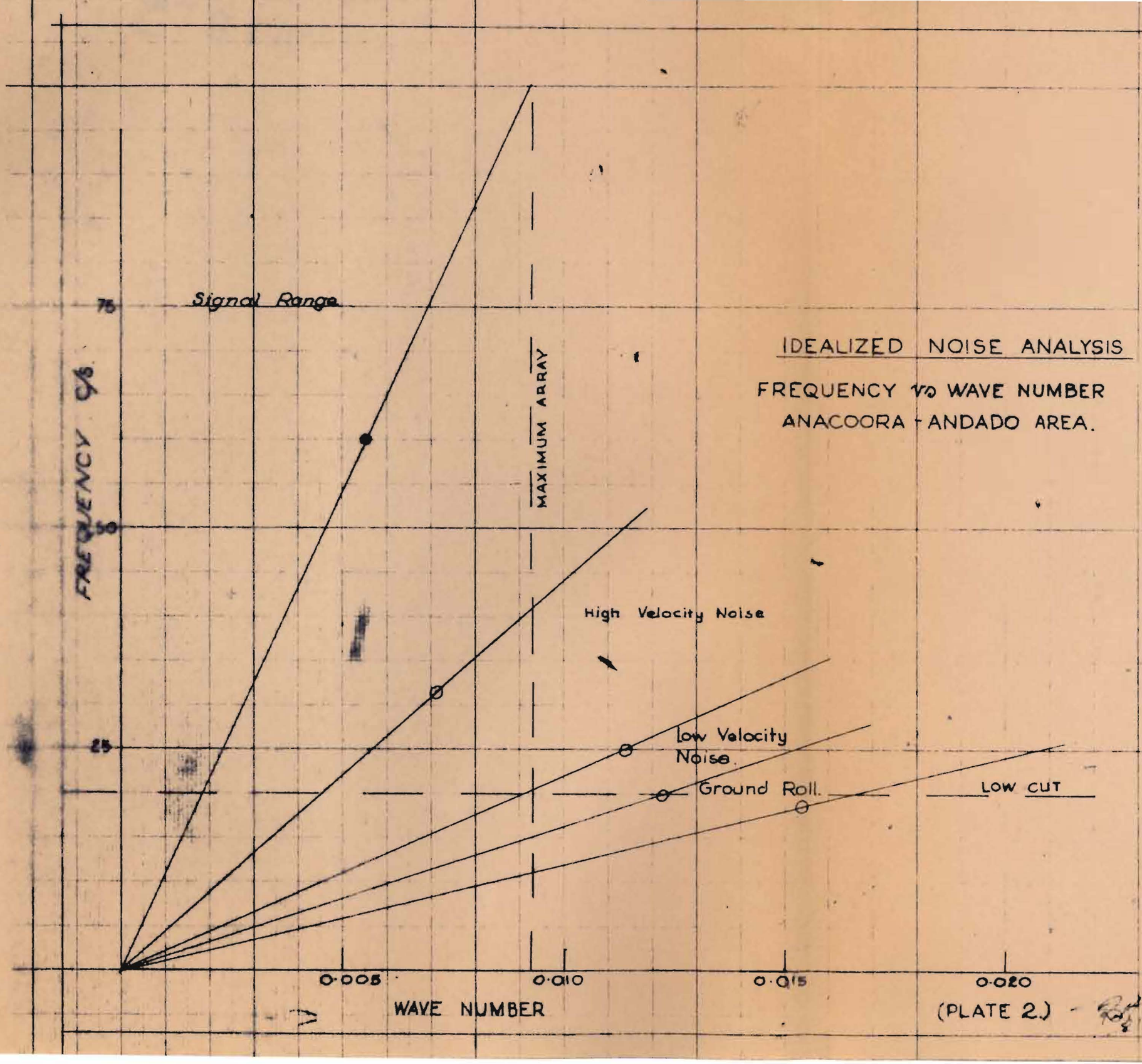


UPHOLE TIME VS DEPTH
ANACOORA - ANDADO AREA
SHOT POINTS A 57, B 226, D 140.

(Plate 1.)

25

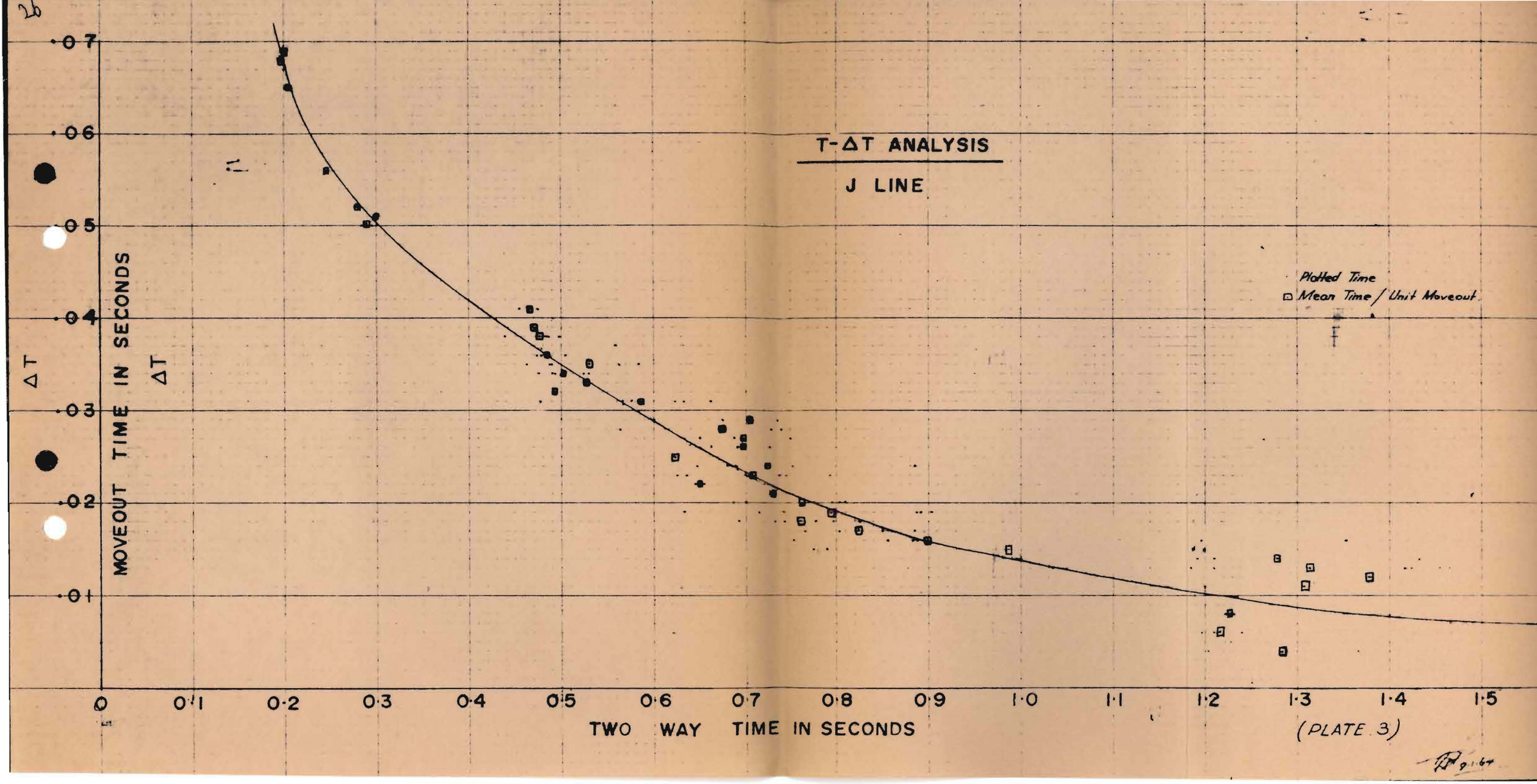


IDEALIZED NOISE ANALYSIS

FREQUENCY Vs WAVE NUMBER

ANACOORA - ANDADO AREA.

(PLATE 2.)


T-ΔT ANALYSIS
J LINE
Plotted Time
Mean Time / Unit Moveout
MOVEOUT TIME IN SECONDS
ΔT
ΔT
·07
·06
·05
·04
·03
·02
·01
0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8
0·9
1·0
1·1
1·2
1·3
1·4
1·5
TWO WAY TIME IN SECONDS

(PLATE 3)

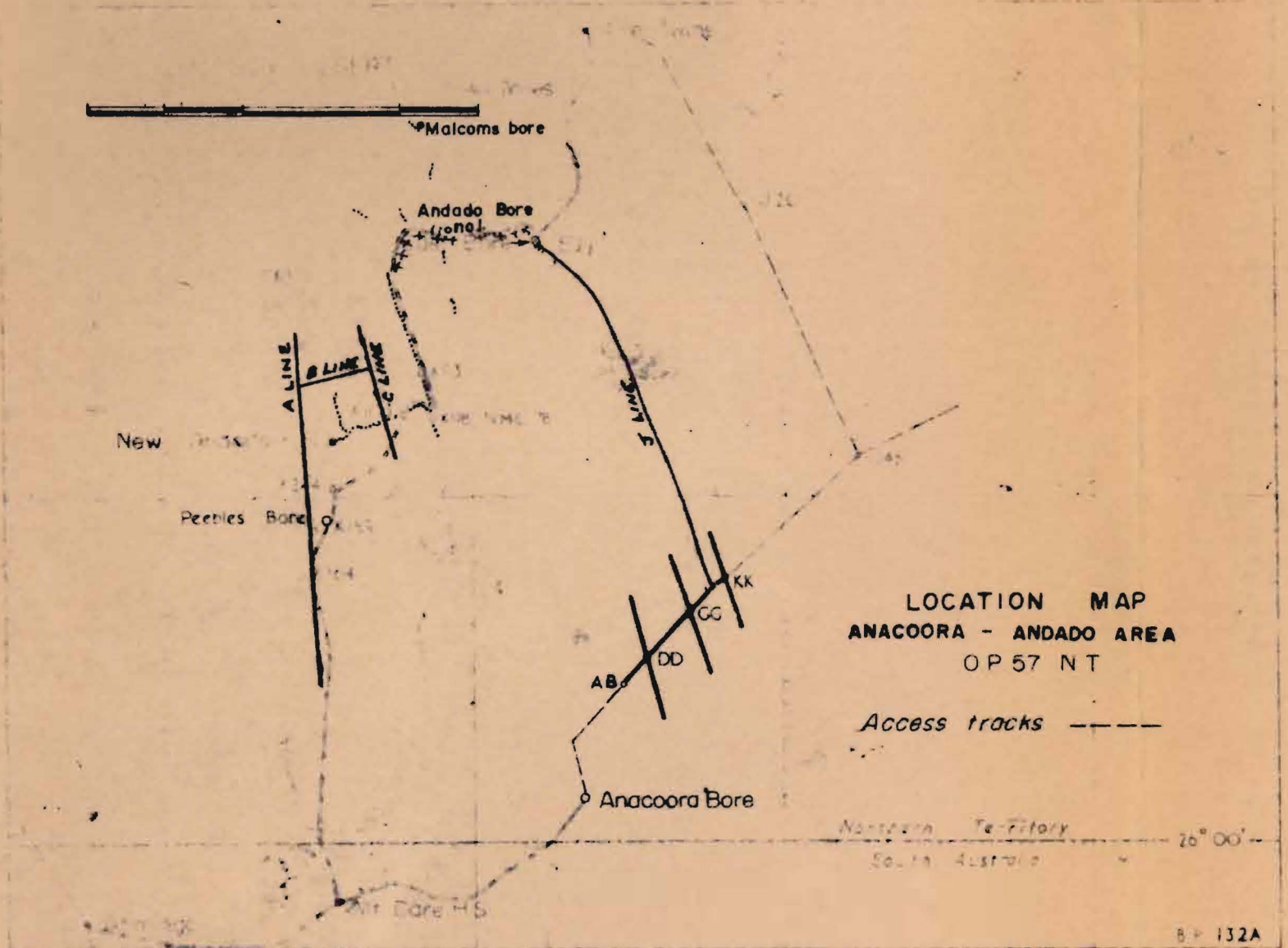
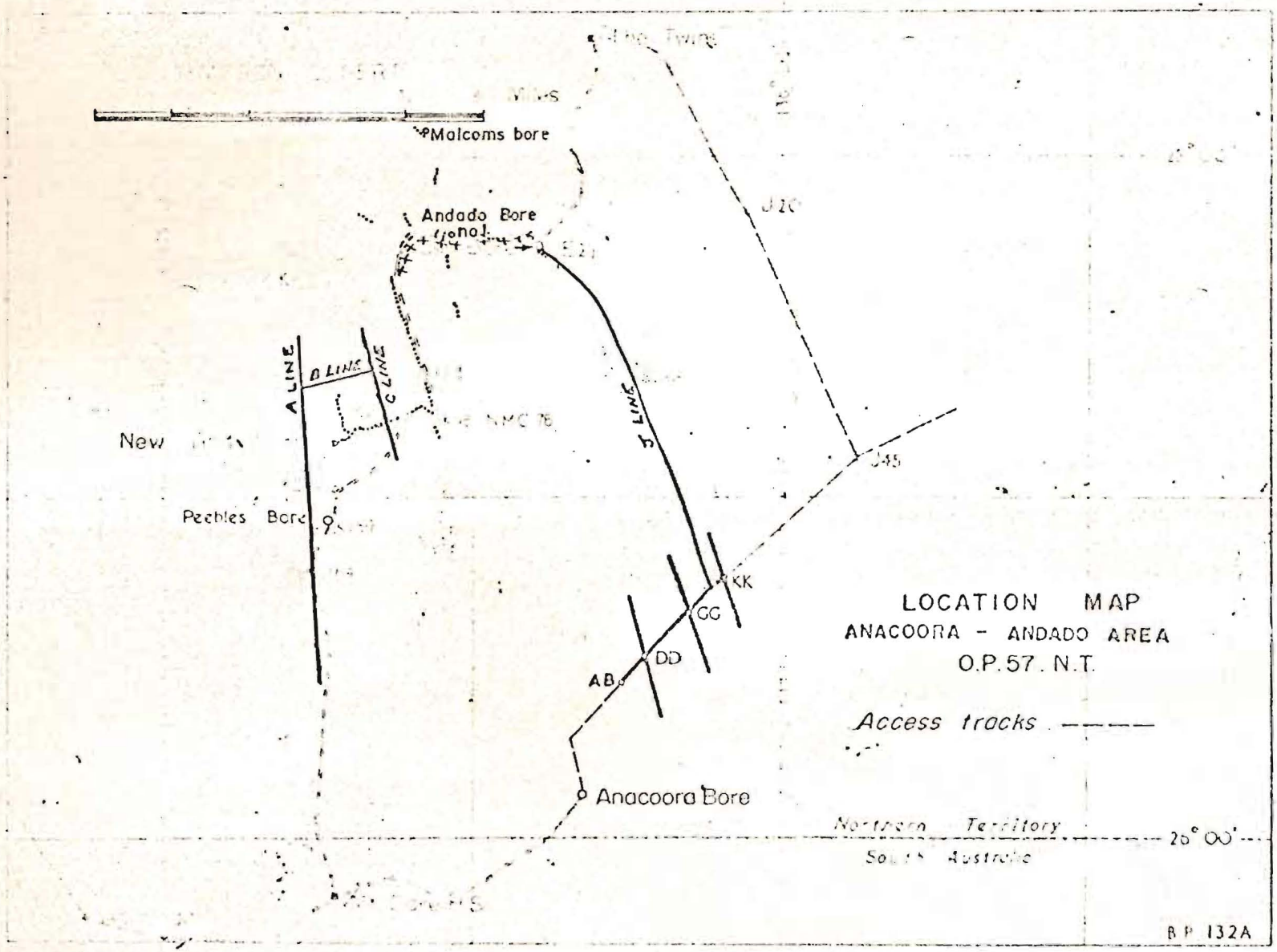

Malcoms bore
Andado Bore
A LINE
B LINE
C LINE
J LINE
New
Peebles Bore
KK
GG
DD
AB
Anacoora Bore
Northern Territory
South Australia
26° 00'
Air Bore HS
LOCATION MAP
ANACOORA - ANDADO AREA
OP 57 NT
Access tracks

Plate 4


Malcoms bore
Andado Bore
A LINE
B LINE
C LINE
J LINE
Peebles Bore
KK
GG
DD
AB
Anacoora Bore
LOCATION MAP
ANACOORA - ANDADO AREA
O.P.57. N.T.
Access tracks
Northern Territory
20° 00'
BP 132A

Plat