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DEPARTMENT OF MINES
SOUTH AUSTRALIA

REPORT ON RECONNAISSANCE REFLECTION CORRELATION SEISMIC SURVEY

for

DELHI AUSTRALIAN PETROLEUM LTD.

at

DURHAM STRUCTURE
SOUTH-WESTERN QUEENSLAND
AUSTRALIA

SR 11/5/39.

by

S.A. Department of Mines

FOR OFFICE USE O.

22nd July, 1959.

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TENEMENT HOLDER: Delhi Australian Petroleum Ltd.

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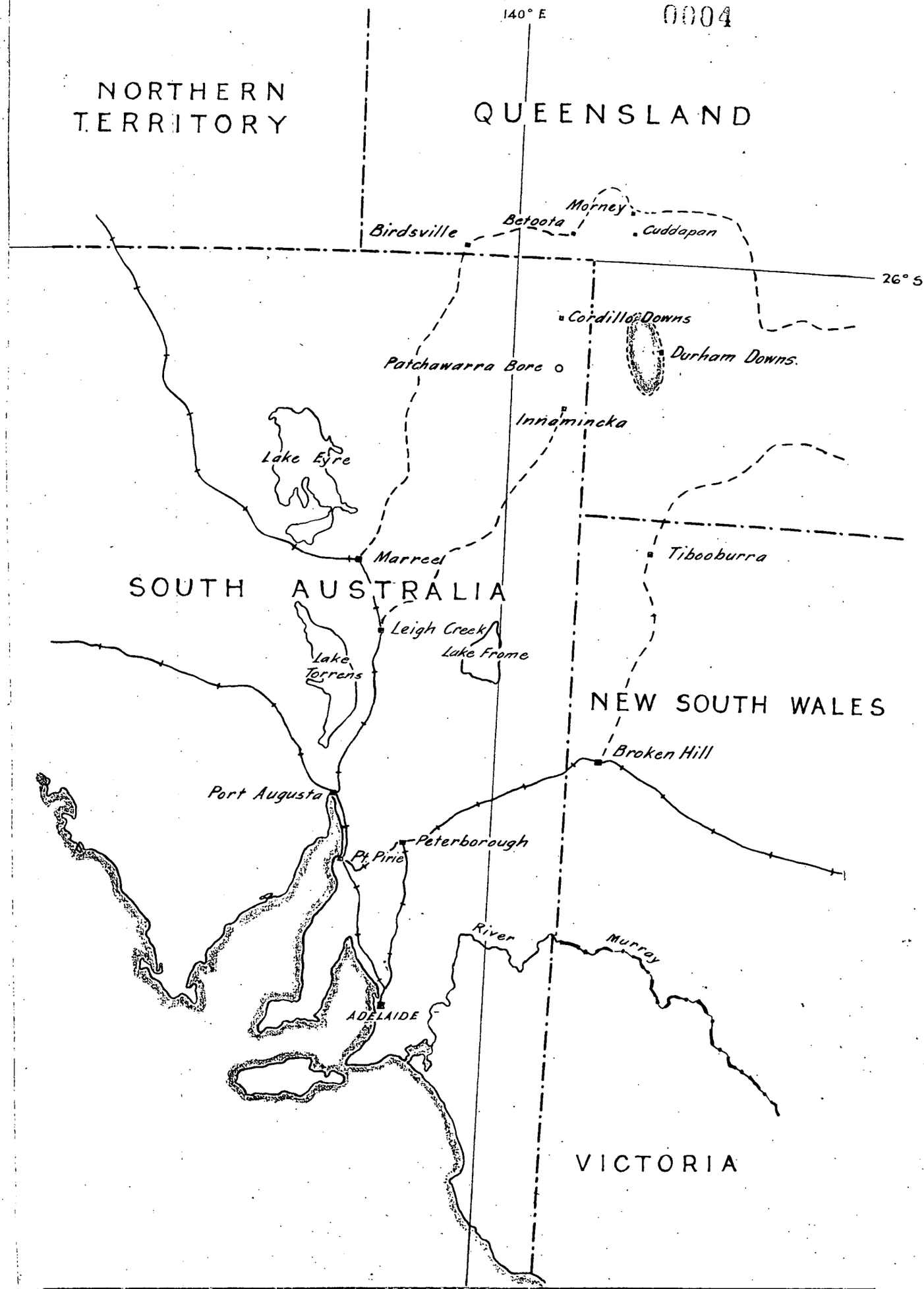

S.A. DEPARTMENT OF MINES					
Approved	Passed	Drn.	LOCALITY MAP	D.M.	Scale: 84·70 Miles to 1in.
		Tcd. R.R.	DURHAM STRUCTURE AREA	Req.	S 2052
		Ckd.	QUEENSLAND		994·2/3
Director		Exd.			Date 21·4·59

REPORT ON SEISMIC REFLECTION SURVEY
YAMMA YAMMA, DURHAM, AND KARMONA DOME AREAS AND CURALLE - YAMMA YAMMA CONNECTION LINE SOUTH-WESTERN QUEENSLAND - AUSTRALIA

TEXT OF REPORT - PART I

RESULTS OF SURVEY

A. INTRODUCTION

1. Purpose of Assignment

In an area west of Cooper Creek in south-western Queensland on Durham Downs and Karmona station properties, geological reconnaissance suggests that upper Cretaceous and Tertiary rocks are folded, possibly into three domal structures which have been named the Yamma Yamma, Durham and Karmona Domes. This reconnaissance seismic reflection survey was carried out to determine the thickness of sediments in the area, the degree and nature of folding in the subsurface rocks and to relate this information to that obtained at the Curalle Dome and thence to the other areas surveyed in the Great Artesian Basin - the Innamincka, Nappamilkie, Betoota and Morney Domes.

2. Location of Area

The area covered by the survey is in south-western Queensland and is bordered on the east by Cooper Creek. The South Australia - Queensland border lies about 40 miles to the west of the survey area while the eastern end of the Innamincka Dome is about the same distance to the west of the Karmona structure.

A field camp and office were set up about 6 miles west of Durham Downs homestead. Access by road from Adelaide includes approximately 450 miles of unsealed roads and unimproved station tracks.

B. MAPS SUBMITTED

1. "C" Horizon, 4000 - 6000 feet below sea level.

   Reflections from this horizon vary considerably in quality but it can be traced over the whole area and correlated with the horizon labelled "C" at Curalle. The work disclosed no evidence of faulting of this horizon.

2. "P" Horizon, 8000 - 10000 feet below sea level.

   Reflections from this horizon are generally good and its character

and relationship to the "C" suggest that it is correlatable with the reflection labelled "P" in the Innamincka area. Again, there is no direct evidence of faulting.

C. DISCUSSION AND CONCLUSIONS

Generally, 50 lb. charges at approximately 100 feet gave ample return energy and several reflections can be traced over most of the distance of the traverses shot.

Line 1 shows northerly dip of the order of 1000' north of SP 168 and southerly dip of the order of 2000' south of SP 120. Between SPS 120 and 168 several minor culminations are indicated. Cross lines were shot at three of these, at SP 163 (Line 2), 146 (Line 3) and 120 (Line 4). A westerly dip of approximately 1000 feet west of SP 146 is shown on line 3 and easterly and westerly dips of several hundred feet from SP 120 are assumed from line 4. No extensive dip is shown on line 2 or on the eastern end of line 3.

The contour maps of the "C" and "P" horizons show that there may be up to six separate domal culminations in the area and that the pattern of folding is much more complex than in the other areas surveyed in this part of the Great Artesian Basin, viz. Innamincka, Betoota, Curalle and Morney. The shot point coverage in the Durham area has not been sufficiently dense to resolve the complex folding and indicate correctly the location of domal culminations.

The shallowest recording of the "C" horizon is at SP 422 on the assumed Karmona dome where it is 4330 feet below sea level. At SP 348 (Durham) it is at 4390 feet and at SP 268 (Yamma Yamma) it is at 4430 feet. These depths are considerably greater than the corresponding depths at the other domes investigated e.g. Innamincka 3600 feet, Betoota 2400 feet, Curalle 2100 feet.

K.R. Seedsman
GEOPHYSICIST

22/7/59

TEXT OF REPORT - PART II

SURVEY METHODS AND PROCEDURE

A. GENERAL

1. Disposition of Original Data

All original records and surveyors' field books have been forwarded to Mr. J.C. Ryan, Exploration Supervisor, Delhi Australian Petroleum Ltd.

2. Area

a. Curalle - Yamma Yamma Connection Line.

This traverse follows a station track and is approximately 58 miles long. Shot point interval was about 5 miles.

b. Yamma Yamma, Durham, Karmona Domes.

A line trending NNW was set out to follow the major axes of the assumed structures. It was approximately 62 miles long with shot points at intervals of about two miles. Three cross-lines were placed across suggested subsurface culminations on the major line.

Contour maps drawn from the results obtained from these lines cover about 600 square miles.

3. Transportation

The road distance from Adelaide to the field is approximately 750 miles of which about half is along unimproved station tracks. Trans Australia Airlines' DC 3 Channel Service calling fortnightly at the Durham Downs airstrip was used extensively for transport of supplies and personnel, with occasional use of chartered light aircraft for personnel travelling between Adelaide and the camp. A number of station tracks were useful for travelling within the area of the survey. Off these, however, travel was extremely difficult and slow because of the numerous deep creeks and rocky scarps.

B. DRILLING

The rate of drilling on the Durham structure and the Curalle - Durham connecting line was less than in most previous areas surveyed due to the long distances travelled over very difficult country and the variable surface conditions existing within the dome area. Patches of

duricrust occur away from the scarps, particularly on the assumed Karmona dome, and this resulted in difficult drilling conditions at some shot points. In parts of the area it was necessary to grade a track through country broken by deep creeks before obtaining access to the shot points.

About 50% of the total footage was drilled using compressed air. In areas where the water table was penetrated, the holes were completed drilling with water.

The average shot hole depth was 116 feet and an average of 2.3 holes per day was drilled over the lines surveyed.

C. SURVEYING

1. Method

Shot and geophone points were surveyed by officers of GeoSurveys of Australia Ltd. by stadia traverses on compass bearings. Elevations were related to sea level via the connecting line to the Curalle survey and thence to a bench mark at Birdsville, Queensland.

2. Topography

Duricrust-capped mesas outline the structures on the north, west and south and surround low rolling gibber covered hills and occasional isolated mesas. The broad complex of channels of Cooper Creek terminates the surface expression of the structures on the east and sand dunes and clay pans surround the whole. Several dry steep-banked creeks dissect the surface inside the structure and under the prevailing drought conditions the stunted trees and scrub along the creeks were the only significant plant growth in the area.

D. RECORDING

1. Instruments

Seismic equipment used was H.T.L. 7000B. A 24 trace, 50% unilateral mixed record was shot with filter settings low cut 27 c/s, high cut 40 c/s.

2. Spreads

A split spread of 2500 feet was laid down. The geophone point interval was 100 feet with 150 feet between the shot point and

traces 12 and 13. Generally 10 geophones at intervals of 10 feet along the line were used on each trace, although some records were shot with 20 geophones per trace in two parallel lines of 10 geophones, the lines being 50 feet apart. In the latter case, 12 traces were recorded, 6 either side of the shot point with the nearest trace 750 feet from the shot point.

3. Record Quality

Inside the structure where shot holes were drilled in shale the record quality was fair to good. Where sandstones are at or near the surface record quality was poor with little improvement gained by varying charges up to 100 lb. Slightly better definition of reflections was obtained by shooting a 12 trace record with 20 geophones per trace. Sufficient information was obtained to correlate across these areas.

E. COMPUTING

Two methods of computing corrections to the Datum Plane at Mean Sea Level were adopted, the method used depending on the nature of the weathered (low-velocity) layers disclosed by an analysis of a plot of first break times (Figs. 1 & 2).

Where the low velocity layers are thin, the first break plot reveals a single velocity, generally of the order of 6500 - 7000 feet per second. For such seismic records, the form of computation demonstrated in Fig. 3 was used.

Where the low velocity layers are thicker than the depth of charge, two or more velocities appear from the first break plot. In such cases, the thickness of the low velocity layer(s) has been calculated assuming horizontal beds and using the appropriate refraction formulae. The horizontal velocity (V) is obtained as a mean of the velocities on either side of the shot point belonging to the same layer; the vertical velocity (U) in that layer is estimated as $U \doteq 0.9\ V$; and an average of the intercept times from either side of the shot point is used for interpolation in the formula. The correction to datum in this case is then assumed to be twice (uphole time + Time to travel length of the charge + (Distance from base of charge to top of refracting layer)/(U in the layer)

+ (Thickness of next layer)/(U in the layer) + etc.) (see Fig. 2). It should be noted that all records have been shot "mixed", i.e. there are only 22 independent traces, with traces 12 and 13 "straight", 11 composed of 50% 12 and 50% 11, 10 of 50% 11 and 50% 10, and etc. As a result, the first break times of 11 and 12 are the same, and the break at trace 10 is the consequence of energy arriving at geophone 11, at 9 from 10, and etc. The first break plots of refraction arrival times against distance from the shot point of the nearest geophone of the multiple group will then show traces 11 and 14 nearest the shot point at a distance of 100 feet; 10 and 15 at 200 feet; and etc.

F. SOURCE OF VELOCITY DATA

As definite information of average vertical velocities is lacking, an average velocity of 8000 feet per second has been assumed for the computation of depth points to the "C" horizon and 10,000 feet per second to the "P" horizon.

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STATISTICS

REFLECTION SEISMIC SURVEY

CURALLE - YAMMA YAMMA CONNECTING LINE

YAMMA YAMMA, DURHAM, KARMONA - QUEENSLAND - AUSTRALIA

Date of report: 22nd July, 1959.
Inclusive dates of shooting: 29/3/59 to 30/4/59
Location: Between 26° and 27°40' S latitude
141°20' and 142° E longitude
Road distance from Adelaide: 750 miles
Air distance from Adelaide: 550 miles

Field Data

Type of survey: Reconnaissance
Method of survey: Reflection correlation
Number of traverses: Five
Distance between Shot Points: Curalle - Yamma Yamma: 25,000 feet
Others: 10,000 feet
Elevation range: 281 feet to 545 feet m.s.l.
Character of reflections: Fair to good
Average shot depth: 111 feet
Average weight of charge: 57 lb.

Results

See text

Operations Report

Shooting and Recording

Number of days worked: 29
Good profiles shot: 61
Repeat and test profiles: 3
Average profiles/day: 2.3
Total traverse length:
Curalle - Yamma Yamma: 58 miles
Main axis - Yamma, Durham, Karmona: 66 miles
Cross line - Yamma: 12 miles
Durham: 20 miles
Karmona: 6 miles
Dynamite used: 3665 lb.
Caps used: 124

Drilling

Number, type drills used:
Mayhew 1000 (R78) 29/3 to 29/4/59
" " (R82) 29/3 to 28/4/59
Failing 1500 12/4, 13/4, 22/4 to 28/4/59
Total drill days worked: 54
Total holes drilled: 68
Total feet drilled: 7884
Footage/drill/day: 146 feet
Average hole depth: 116 feet

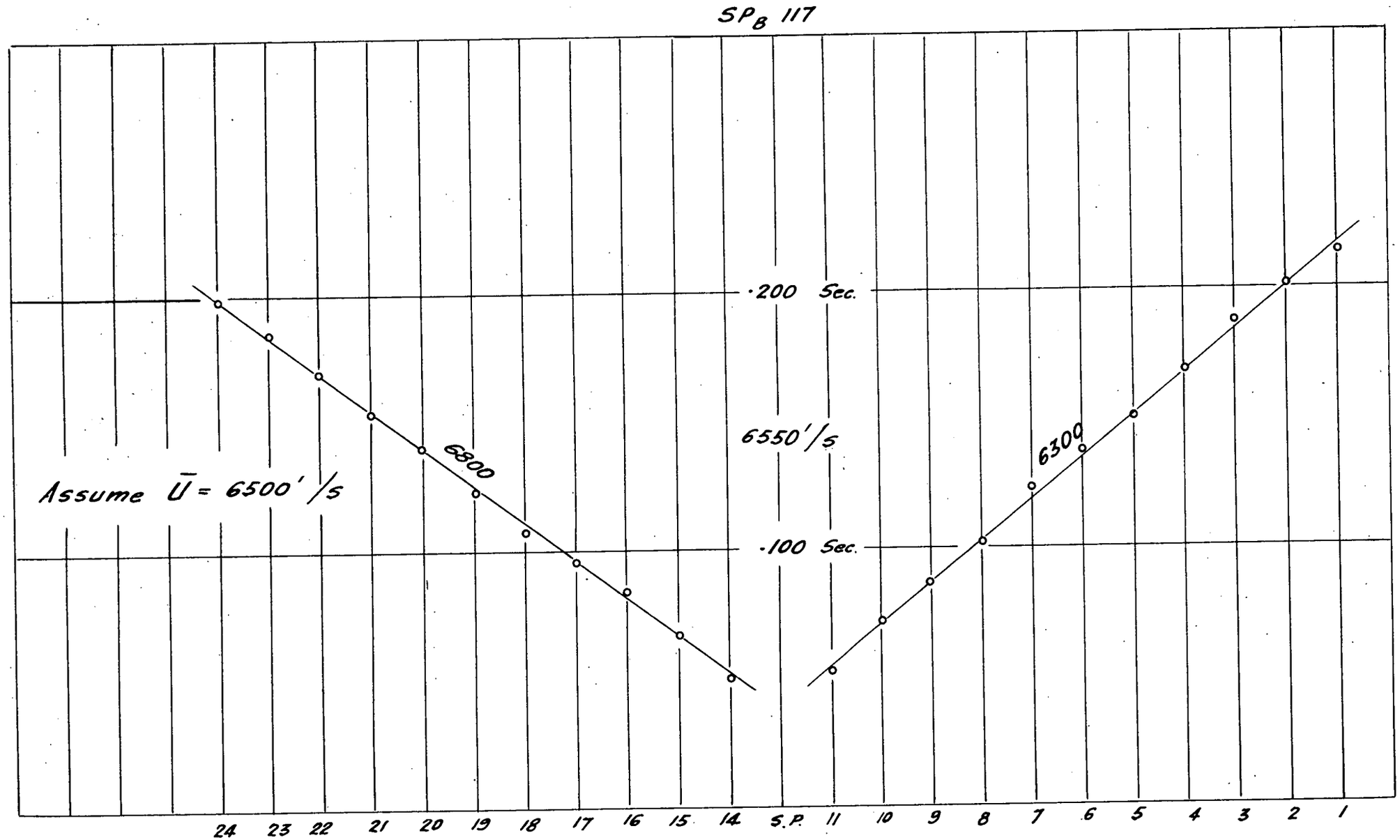
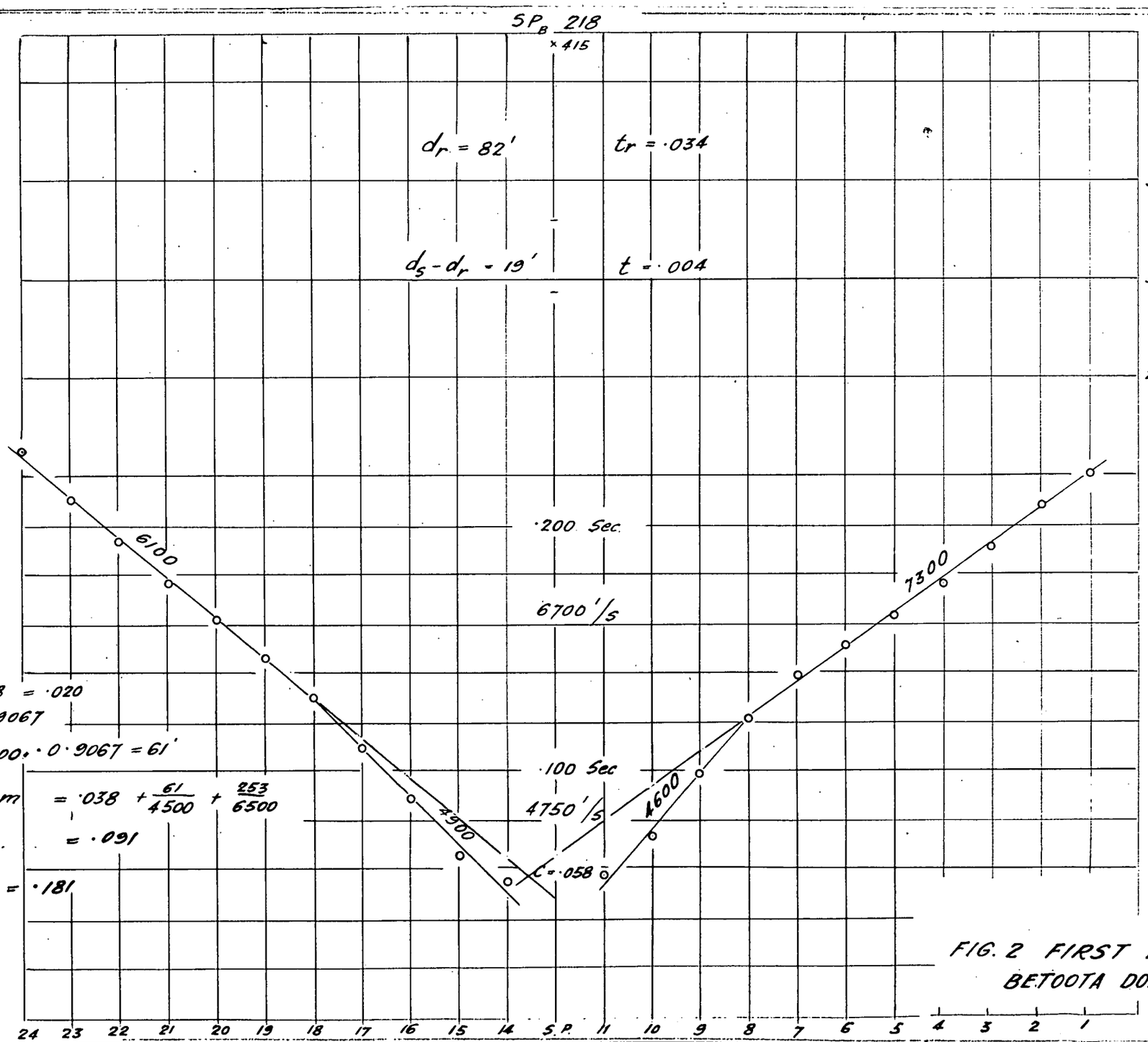


FIG. 1 FIRST BREAK PLOT
BETOOTA DOME AREA



$U = 4500'/s$

$V = 6700'/s$

$C' = ·058 - ·038 = ·020$

$\tan \alpha_{12} = 0.9067$

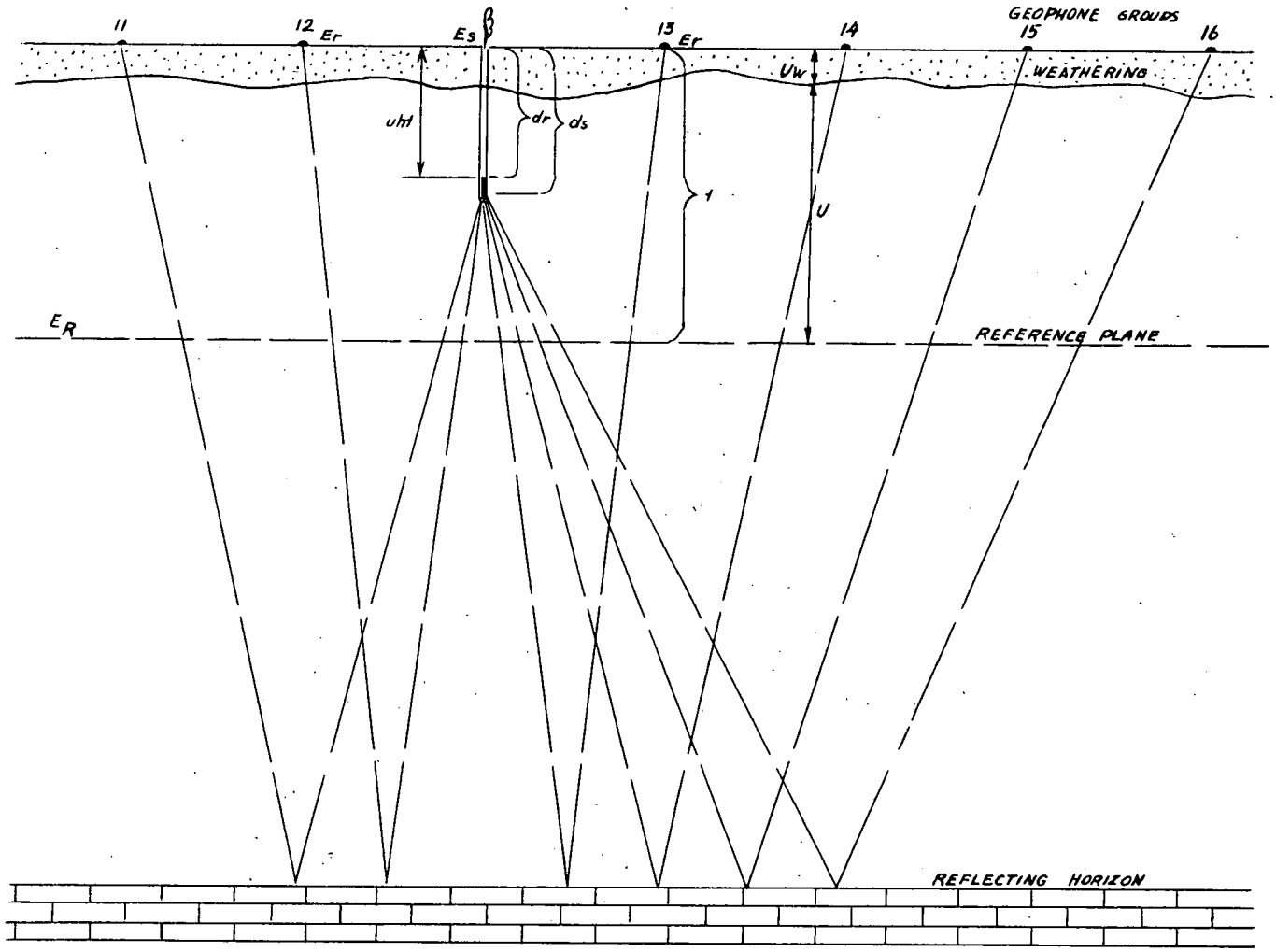
$Z = \frac{·020}{2} \cdot 6700 \cdot 0.9067 = 61'$

Time to datum $= ·038 + \frac{61}{4500} + \frac{253}{6500}$

$= ·091$

Correction $= ·181$

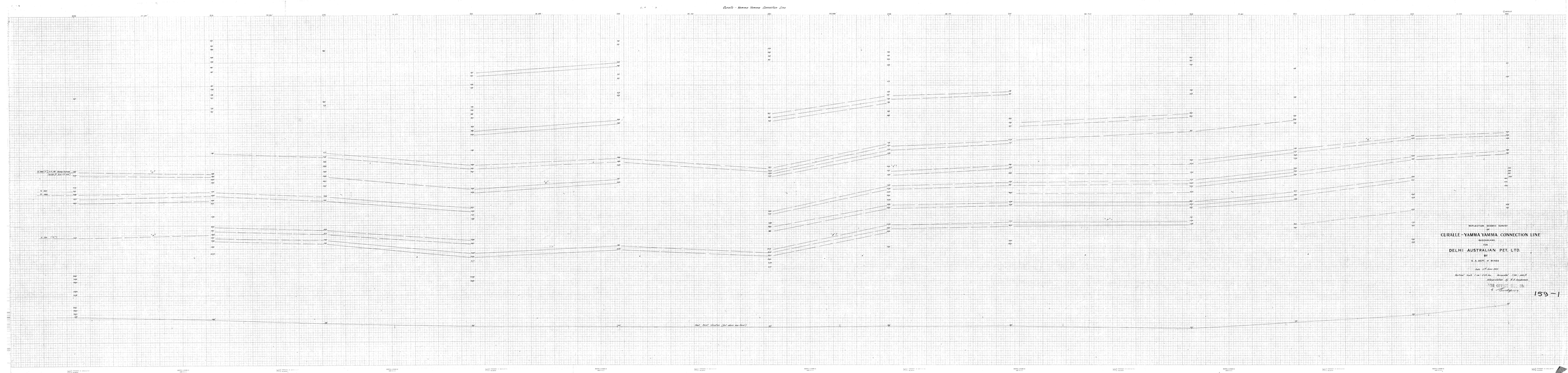
FIG. 2 FIRST BREAK PLOT
BETOOTA DOME AREA



Es Elevation of Shot Point, or Uphole geophone.
Er Mean elevation of the two center traces.
ds Depth of base of charge.
dr Depth of top of charge.
E_R Reference plane.
2uht Two times the Uphole time.
td Time of detonation of charge.
U Assumed velocity to reference plane.
t Total time correction.

COMPUTATION DIAGRAM

Es 260	Er 257	-2 uht = -.064
-ds 150	-dr 140	-td = -
110	117	-227 / v7000'/s = -.032
-ER S.L.	-ER S.L.	
-[+110	+117]	t = -.096


Curalle - Yamma Yamma Connection Line
REFLECTION SEISMIC SURVEY
OF
CURALLE-YAMMA YAMMA CONNECTION LINE
QUEENSLAND
FOR
DELHI AUSTRALIAN PET. LTD.
BY
G. A. GEOPHYSICAL SURVEYS
Date 27th June 1961
Recorded Each Line Field Re-recorded Line South
Interpretation by R.A. Anderson
Chief Geophysicist
159-1

300 000 E

400 000 E

500 000 E

600 000 N

500 000 N

400 000 N

SP 266 (Curalle Survey)

20370'
162° 27' 35"

SP 258

25280'
152° 58' 50"

SP 253

22350'
146° 27' 15"

SP 248 -7700

38920'
126° 55' 30"

SP 241 -7700

26170'
150° 50' 05"

SP 236 -7800

25590'
208° 51' 35"

SP 231 -8700

32460'
218° 10' 10"

SP 226 -8600

3430'
168° 14' 40"

SP 221 -8700

2095.0'
198° 58' 05"

3650'
173° 21' 40"

Tanbar Bore

SP 215 -8400

2220'
205° 13' 20"

SP 210 -8300

29660'
115° 47' 25"

SP 205 -8300

24320'
109° 18' 45"

SP 178

LAKE

YAMMA YAMMA

CREEK

COOPER

Surveyed by officers of Geosurveys (Aust.) Ltd.

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SURVEY PLAN

OF

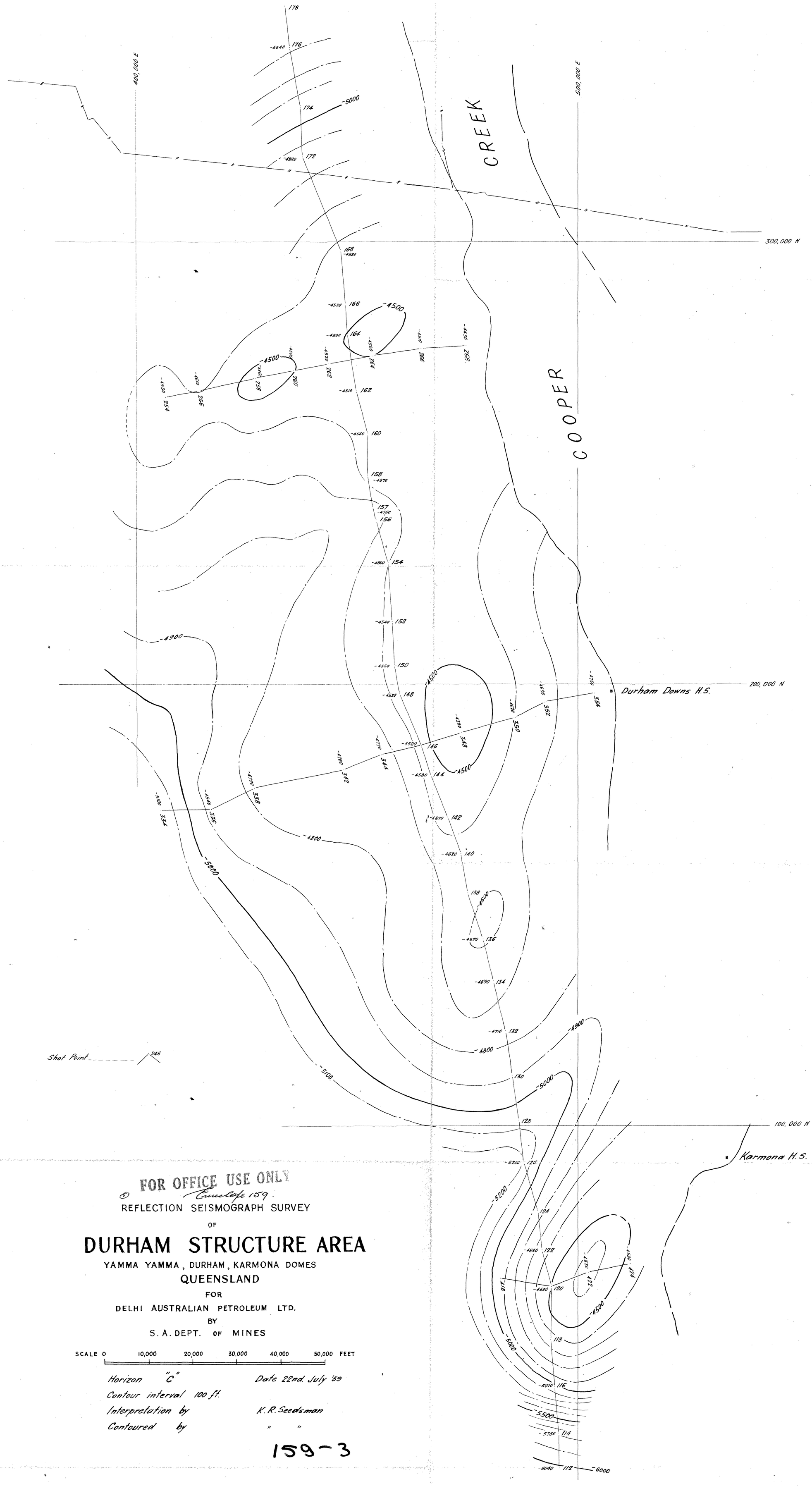
CURALLE – YAMMA YAMMA CONNECTING LINE

QUEENSLAND

FOR

DELHI AUSTRALIA PET. LTD.

159-2



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Enclosure 159.

REFLECTION SEISMOGRAPH SURVEY

OF

DURHAM STRUCTURE AREA

YAMMA YAMMA, DURHAM, KARMONA DOMES

QUEENSLAND

FOR

DELHI AUSTRALIAN PETROLEUM LTD.

BY

S. A. DEPT. OF MINES

SCALE 0 10,000 20,000 30,000 40,000 50,000 FEET

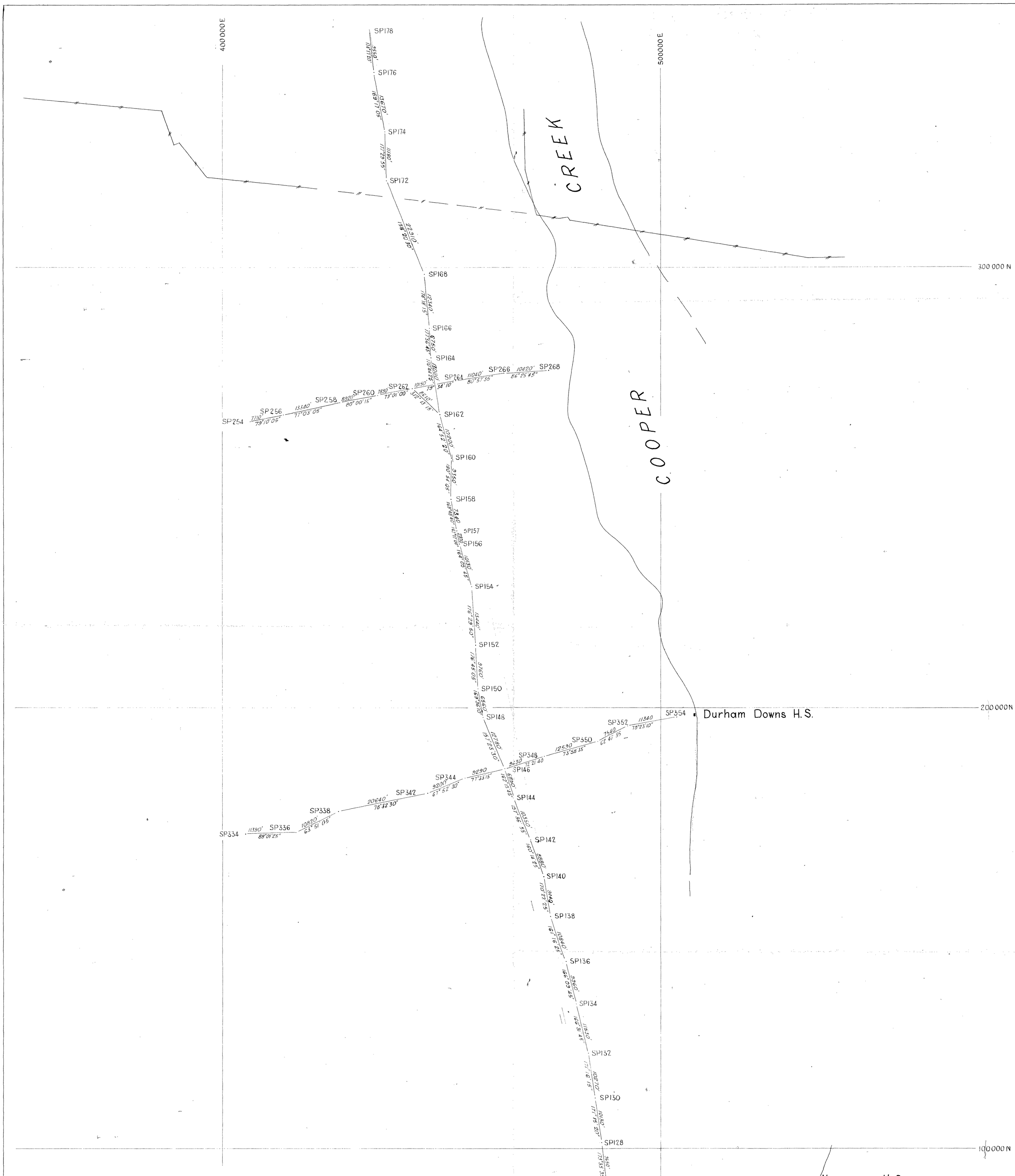
Horizon "C" Date 22nd. July '59

Contour interval 100 ft.

Interpretation by K. R. Seedsman

Contoured by " "

159-3



Surveyed by officers of Geosurveys (Aust) Ltd.

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SURVEY PLAN

OF

DURHAM STRUCTURE

YAMMA YAMMA, DURHAM, KARMONA DOMES

QUEENSLAND

FOR

DELHI AUSTRALIA PET. LTD.

159-4

400,000 E

500,000 E

300,000 N

200,000 N

100,000 N

CREEK

COOPER

Durham Downs H.S.

Karmona H.S.

Shot Point _____ 246

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4" Timeclose 159.

REFLECTION SEISMOGRAPH SURVEY

OF

DURHAM STRUCTURE AREA

YAMMA YAMMA, DURHAM, KARMONA DOMES

QUEENSLAND

FOR

DELHI AUSTRALIAN PETROLEUM LTD.

BY

S.A. DEPT. OF MINES

SCALE 0 10,000 20,000 30,000 40,000 50,000 FEET

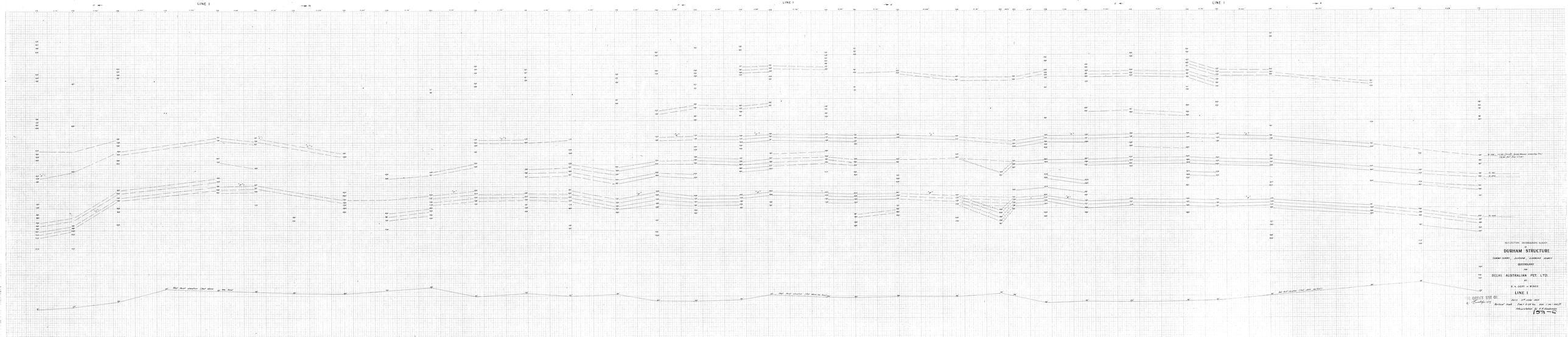
Horizon "P" Date 22nd. July '59

Contour interval 100 ft.

Interpretation by K. R. Seedsman

Contoured by " "

159-5


LINE 1
LINE 1
LINE 1
LINE 1
N
SEISMIC REFRACTION SURVEY
OF
DURHAM STRUCTURE
SURAT BASIN, QUEENSLAND
QUEENSLAND
FOR
DELHI AUSTRALIAN PET. LTD.
BY
R. A. DEPT. OF MINES
LINE 1
DATE OF SURVEY
Recorded Book
OFFICE USE ONE
Date
Initials
Refraction Plot of Observations
1596

LINE 2

Yamma Yamma Cross-line

W ← → E

254 — 7,710 — 256 — 13,340 — 258 — 8,920 — 260 — 7,890 — 262 — 163 — 264 — 11,040' — 266 — 10,420' — 268

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REFLECTION SEISMOGRAPH SURVEY
OF
YAMMA YAMMA CROSS-LINE
QUEENSLAND
FOR
DELHI AUSTRALIAN PET. LTD.
BY
S. A. DEPT. OF MINES
LINE 2

Date 17th June '59

Vertical scale 1 cm = 0.04 sec. Hor. Scale 1cm = 1000 ft.

Interpretation by K. R. Seedsman

159-7

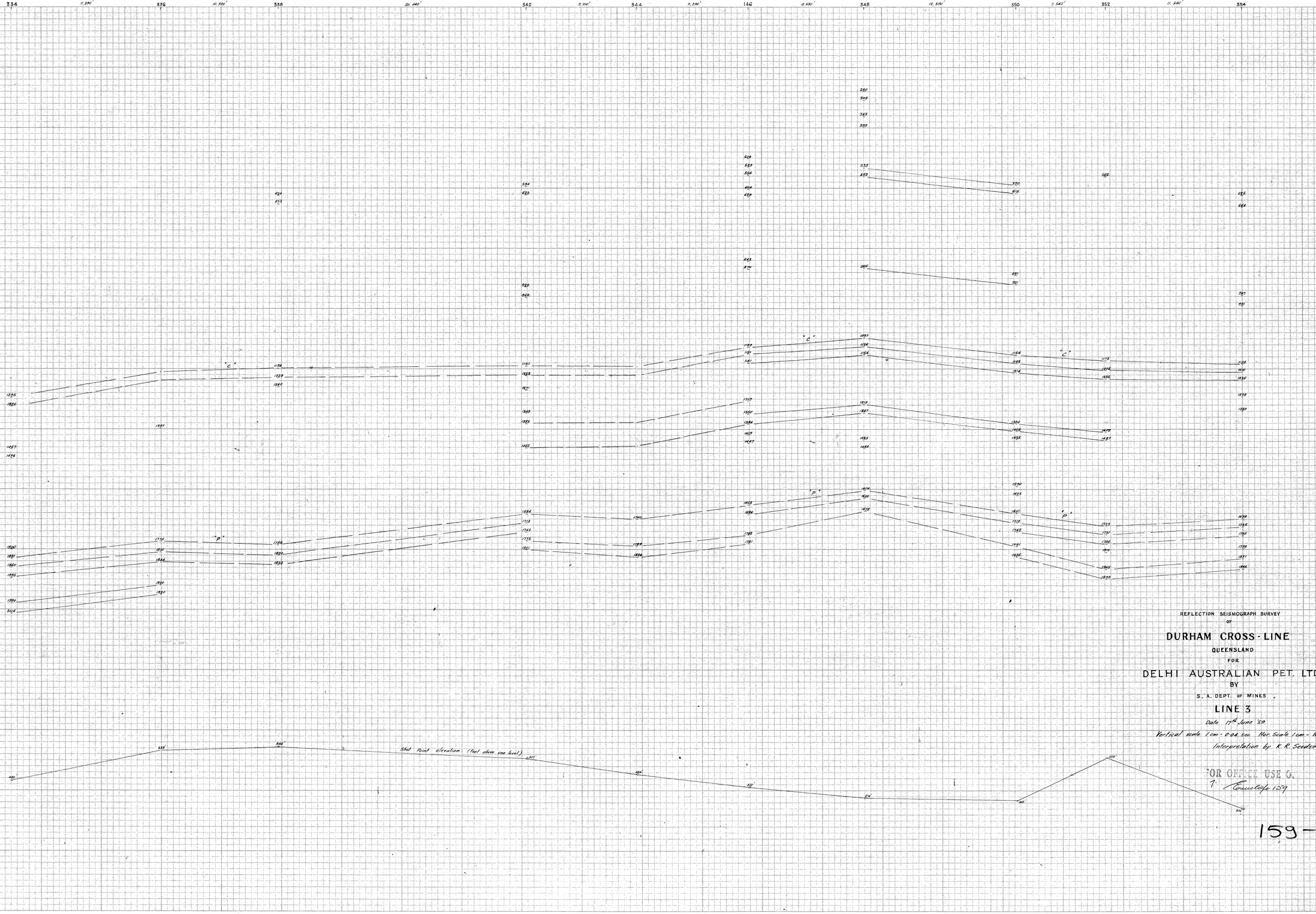
Shot Point Elevation (Feet above sea level)

LINE 3

(Durham cross line)

W ← → E

334 — 11,320' — 336 — 10,920' — 338 — 21,640' — 342 — 5,720' — 344 — 11,280' — 346 — 8,520' — 348 — 12,520' — 350 — 7,540' — 352 — 11,640' — 354



REFLECTION SEISMOGRAPH SURVEY
OF
DURHAM CROSS-LINE
QUEENSLAND
FOR
DELHI AUSTRALIAN PET. LTD
BY
S. A. DEPT. OF MINES.

LINE 3

Date 17th June 59.

Vertical scale 1 cm - 0.04 sec. Hor. Scale 1 cm - 1000 ft.

Interpretation by K. R. Seedsman.

159-8

W ← LINE 4 → E

(Karmona Cross-line)

418 — 11,550' — 120 — 8,870' — 422 — 9,830' — 424

554
584
609

749

1082 "C"
1115
1145
1153
1180
1144
1170
1197
1242
1271
1304
1347
1379
1371
1400
1424
1452
1476

1494
1516
1525
1546
1559
1580 "P"
1600
1614
1632
1647
1660
1572
1598
1634
1667
1711
1610
1639

1916
1947
1984

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REFLECTION SEISMOGRAPH SURVEY

OF

KARMONA CROSS-LINE

LINE 4

QUEENSLAND

FOR

DELHI AUSTRALIAN PET. LTD.

BY

S. A. DEPT. OF MINES

Date 17th June 59

Vertical Scale 1 cm = 0.04 sec. Hor. Scale 1 cm = 1000'

Interpretation by K. R. Seedsman.

416' Shot Point elevation 429' (Feet above Sea level) 451' 311'

159-9