COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1964/143

EXPERIMENTAL "VIBROSEIS" SURVEY, SOUTH-WEST VICTORIA, 1964.

by

Seismograph Service Limited.

FINAL PROGRESS REPORT

ON AN

EXPERIMENTAL "VIBROSEIS" * SEISMIC SURVEY

conducted in

THE PORTLAND AREA OF THE OTWAY BASIN

SOUTH-WEST VICTORIA

for

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

by

SEISMOGRAPH SERVICE LIMITED

during

MAY - JUNE 1964

* A Trademark of Continental Oil Company

RESTRICTED

SYNOPSIS

An Experimental Vibroseis Seismic Survey was conducted in the Portland Area of the Otway Basin in South-West Victoria by Seismograph Service Limited, Party 243 on behalf of the Bureau of Mineral Resources, Geology and Geophysics. The survey occupied 33 working days during the period from 11th. May to 24th. June, 1964.

The broad objective of the survey was to assess the Vibroseis method on the basalt cover of the Portland Sunklands where conventional shot hole methods had previously produced poor results.

The survey consisted of three projects, Volcanics 1, 2 and 3. The areas of these projects were selected on the basis of availability of previous seismic data, well control, accessibility and pertinance to future oil prospecting proposals.

The Volcanics 1 Project was designed as an initial test of the Vibroseis method in an area of no basalt cover where good conventional seismic data had been obtained. The location selected was in the immediate vicinity of Pretty Hills No. 1 bore; a continuous velocity log and a synthetic seismogram from this bore were available.

The Vibroseis results in this area were good and compare favourably with the conventional results.

The Volcanics 2 Project comprised the major part of the survey and was located in an area of thick basalt cover where previous conventional seismic work had given extremely poor results. All the detailed experimentation was carried out in this area with the objective of establishing the optimum field technique.

The Vibroseis technique which was developed produced good results and is considered to be a satisfactory solution to the seismic problem in this area.

The Volcanics 3 Project was conducted with the objective of testing the identical technique developed on the Volcanics 2 Project in another area of basalt cover within the Portland Sunklands. The site selected for this project was near Heywood approximately 20 miles to the west of the Volcanics 2 location.

The Vibroseis results were generally fair but the reflection continuity was intermittent. This deterioration in the continuity may be partly attributed to the high ambient noise level caused by the heavy traffic and the densely wooded road verges.

SYNOPSIS Contd.

This Final Progress Report is based on a preliminary study of the results obtained. A final interpretative report will be submitted upon the completion of the entire experimental survey of which this Volcanics Project forms a part.

GEOLOGY AND PREVIOUS GEOPHYSICAL WORK

GEOLOGY. The Volcanics Projects were undertaken in the Portland Sunklands area of the Otway Basin around the eastern and northern boundaries of the Tyrendarra Embayment.

The area surveyed is covered by basalts with Tertiary sediments exposed to the south and west and pre-Mesozoic sediments to the north. The thickness of the underlying pre-Tertiary strata increases to the south and is controlled by a series of faults running parallel to the coast and down-throwing towards it. The faults are not seen in the Tertiary which dips to the south and is affected mainly by movements which began at the end of the Lower Cretaceous and whose final stages probably precipitated the Tertiary volcanic activity.

Basalt layers cover the surface together with extensive beds of tuff and scoria and are underlain by alluvial deposits and Tertiary sediments. The latter consist of limestones and marls above quartzose and conglomeratic sandstones; further basalt layers probably occur within the sequence.

The Upper Cretaceous is represented by glauconitic sands and carbonaceous shales below which a mudstone occurs which grades into the Lower Cretaceous sandstones and greywackes. Beneath the latter lies the important Otway Group of course sandstones which have a thickness of 3040 feet in the Pretty Hills No. 1 bore and over 7200 feet in the Eumeralla No. 1 bore. The Otway Formation has the lithology of a good reservoir rock and fluorescence has been detected in it on several occasions. Further sands occur below the Otway Group before the base of the Mesozoic section is found resting upon Cambrian diabase.

GEOPHYSICS

Several isolated magnetic traverses have been made by the Bureau of Mineral Resources aircraft but the results proved difficult to interpret and this method is not considered an effective exploration tool in the Otway Basin.

Gravity surveys have been carried out by the Bureau of Mineral Resources and Frome-Broken Hill Co. Pty. Ltd.; gravity work has generally been unsuccessful in outlining specific Mesozoic and Tertiary structures within the areas covered by volcanics in south-west Victoria. However the gravity results do suggest that a thick sedimentary section probably exists almost as far as Hamilton in the north and Hawkesdale in the east, the margins being indicated by fairly steep gradients.

The Bureau of Mineral Resources carried out the first seismic tests mainly on the areas of basalt cover near Heywood in 1956. Since 1956, Frome-Broken Hill Co. Pty. Ltd. have conducted extensive conventional seismic surveys largely over the coastal non-basalt areas of the Portland Sunklands. The seismic results were good in many areas, however, there are large areas with Volcanic cover where only poor reflection data has been obtained to date.

The area for the experimental Vibroseis seismic survey was chosen in view of the interest in the extension of the sub-basin under the volcanic cover to the north of the Pretty Hills No.1 bore.

PROGRAMME

The locations of the three Volcanics Projects are shown on the Locality Map (Enclosure No.1).

Volcanics 1. This traverse was situated two miles to the south of Orford on the Port Fairy - Macarthur road in the Shire of Belfast. Approximately 2 miles of line was vibrated equidistantly about the Pretty Hills No. 1 bore.

The line was firstly traversed using a transposed method and this part of the programme occupied two days; two days were then worked retraversing the line using a 10-fold common depth point technique.

Volcanics 2. This project was conducted approximately 12 miles south of the township of Hamilton on the Mount Napier road in the Shire of Dundas. The major part of the experimental work was performed at the northern end of this traverse where the basalt cover was considered to be the thickest. A total of 18½ days were occupied on the detailed experimentation, 5½ days on transposed production recording and 2 days on retraversing a part of the line using a 10-fold common depth point technique.

Volcanics 3. This traverse was located about 6 miles to the north-east of Heywood on the road between Heywood and Hamilton in the Shire of Portland. The only experimental work carried out on this second area of basalt cover was a noise spread and this was followed by 2½ days of transposed production recording and 1½ days of 10-fold common depth point recording using the methods previously developed as a result of the experimental programme of the Volcanics 2 Project.

RESULTS.

The Results obtained are presented in Variable Area Section form as enclosures to this report. Appendix "A" is a complete list of enclosures to the Progress Reports submitted during the course of the Survey, to which reference may be made for the details of the various experimental techniques employed. These Progress Reports together with the enclosures which accompany them are available at the office of the Bureau of Mineral Resources.

Volcanics 1. These results are shown in cross section form as enclosures 3 and 4 respectively for the transposed and common depth point methods. The transposed section does not possess the definition and continuity of the reflections that are shown on the common depth point section.

The basement reflector is well defined and appears at a time of 1.7 seconds at V.P. 97. This location is chosen for reference as it is the closest to the Pretty Hills No. 1 bore. By comparison with the synthetic seismogram of this bore the reflector at 0.76 seconds may be identified as originating within the Otway Merino Formation and above this at 0.58 seconds a horizon may be similarly identified as originating within the Lower Wangerrip Group. An unconformity is evident between these two horizons. The Pretty Hills Sands reflector indicated on the synthetic seismogram is evident on the Variable Area Section at a time of 1.36 seconds. The Sonic Log of the Pretty Hills bore indicates good reflecting conditions at the top of the Upper Wangerrip Group, however, reflections from this region are not apparent on the section as the Vibroseis technique employed was designed to enhance the deeper events and, as a consequence, the low average velocity combined with the spread geometry resulted in an attenuation of the shallow events due to normal move out cancellation.

Volcanics 2. The cross sections for this part of the Survey are included as enclosure No. 2 for the transposed and in line work and No. 3 for the part of the line retraversed by the 10 fold common depth point method.

The section of the transposed and in line work is a composite of parts of the various sections submitted with the Progress Report and the numbers of the field tapes on which each profile was recorded are shown at the bottom of the section as a reference to the particular field technique employed. Complete details of these techniques are in the Progress Reports.

At the northern end of the section between V.P.s 199 and 196 the poorer results are probably due to disturbed geological conditions and the section suggests faulting in this region.

From V.P. 196 to 192 in-line technique was used and the results are compatible with the transposed method used from V.P. 192 to the south. The ringing appearance of the records produced with the in-line technique is due to the use of a sweep frequency bandwidth of only one octave (28-57 cps) over this part of the line.

Between V.P.s 196 and 188 a small syncline is revealed whose axis lies at V.P. 193. From V.P. 188 to 183, the quality is poor although a low amplitude event provides continuity at a time of approximately 0.8 secs. Between V.P.s 183 and 184 there is evidence of faulting and from here to the south the record character changes and a high amplitude reflection can be followed which shows good continuity to the southermost end of the section at V.P. 164. This event shows a marked anticlinal reversal centred at V.P. 167. A good character correlation can be made between this strong reflection and the basement reflection recorded on the Volcanics 1 Project, however, there is some evidence, particularly between V.P.s 169 and 165, of deeper alignments. It should be noted that the interface at which this reflector originates lies at a depth of approximately 1500 ft. under V.P. 167. Hence the lithology in this region could be confirmed by drilling.

The section showing the results of the common depth point method has a greater horizontal scale than the transposed being increased by the ratio of the trace interval, i.e. 132 ft. to 88 ft. or $1\frac{1}{2}$ times.

The Common Depth Point method has produced an improvement in continuity between V.P.s 188 to 185. On the transposed section, between V.P.s 185 and 184 a possible fault zone is indicated and disturbed geological conditions to the south from V.P. 184 to 183. The Common Depth Point method does not define this zone as clearly as the transposed.

A weathering survey using a shot hole method was carried out concurrently with the Vibroseis programme and was conducted by the Bureau of Mineral Resourses. The results obtained show that no radical changes occur in the weathering that may seriously affect the stacking of Common Depth Point results or the compositing of individual signals from large source or geophone arrays.

The optimum transposed technique developed from the experimental work was:-

Geophone pattern - 400 x 200 ft.
No. of Geophones - 400
Vibrator pattern - 400 ft. in line
No.of sweeps per trace - 10
Spread length - 880 ft.
Offset - 880 - 1760 ft.
Sweep frequency - 20 - 57 cycles per second.

The common depth point technique used was:-

Geophone pattern - 264 ft. - in line
No.of Geophones - 40 per trace
Vibrator pattern - 264 ft. in line
No. of sweeps per trace - 10
Spread length - 1320 ft.
Offset - 660 - 3300 ft.
Sweep frequency - 20 - 57 cycles per second
Sub-surface sampling - 10 fold.

Volcanics 3

The same techniques were used on this project as for the transposed and common depth point traverses of the Volcanics 2 Project. The overall record quality is poorer although at each end of the transposed section (enclosure No.7) the quality is good. An event at 1.3 secs. can be picked with reasonable continuity from V.P. 199 at the northern end to V.P. 192. Continuity is then poor to V.P. 187 where the horizon re-appears and shows strong south dip. Several shallower horizons exist but the results are less reliable than the deeper information.

The common depth point method has improved the continuity of the event at 0.6 secs. at V.P. 94 to a point midway between V.P.s 92 and 93, at this point the continuity is broken. A continuous event showing south dip exists from V.P. 92 to the southern end of the section emerging at a time of 0.7 secs.

A good correlation can be made between the interval time of the seismic reflections at 0.9 and 0.5 seconds at the northern end of the transposed section and the time interval between the primary reflections shown on the synthetic seismogram of Dumeralla No.1 bore at times of 0.4 and 0.8 seconds. This bore is situated about 20 miles south east of the traverse. The Vibroseis record section shows a deeper reflection at 1.3 seconds which should correspond to a bed within the Otway Group. However the sythetic seismogram at Dumeralla No.1 also indicates the probability of first order surface multiples at this reflection time.

CONCLUSIONS

The major objective of the survey was to assess the merits of the Vibroseis method over the northern part of the Portland Sunklands where difficult seismic reflection conditions are encountered due to the presence of extensive near surface basalt layers.

The extreme velocity contrasts existing at the upper and lower interfaces of these high velocity basalt layers form a screen through which it is difficult to transmit seismic energy into the deeper geological section.

It is considered that the results of the survey demonstrate that the Vibroseis method is capable of penetrating the near surface basalt and can provide reliable structural information on the deeper formations.

On the Volcanics 2 section, the strong reflector recorded at times ranging from 0.5 to 1.0 seconds shows good correlation with the basement reflector recorded at Pretty Hills No.1 bore and this probably accounts for the fact that few deeper alingments are shown on this section.

Using the transposed method adopted as the optimum technique for this survey area, the production rate was 20 profiles per day giving a sub-surface coverage of 1.7 miles. The comparatively short spread length of 880ft. was used in order to minimise the cancellation of reflected energy due to the effects of steep dip and normal move out. These effects were emphasised by the low average velocities that are associated with the region.

The results from the short part of the Volcanics 2 line vibrated with an in-line technique indicate that the production rate could be further improved without any appreciable reduction in the quality of the data by using either an in-line method or a transposed method of lower effort.

With the 10-fold common depth point method employed on the Volcanics 2 and 3 Projects, sub-surface coverage was produced at the rate of 1 mile per day. The results show that it is possible to successfully effect the stacking of the widely dispersed surface samples obtained with this method. It is therefore considered that variations in the weathered layer and lateral changes of average velocity probably do not constitute a major problem in this area as was presupposed.

ACKNOWLEDGEMENTS

The information in the section of Geology and Previous Geophysical Work has been abstracted from the Geophysical Preview Report on the Experimental "Vibroseis" Survey in the Otway and Sydney Basins by F.J. Moss. This Preview Report is an internal, unpublished document of the Bureau of Mineral Resources, Geology and Geophysics.

29th July 1964.

T.L. Kendall,
Party Chief,

Seismograph Service Limited

DISTRIBUTION

Bureau of Mineral Resources - Melbourne -	6 copies
Seismograph Service Limited - London -	1 copy
Seismograph Service Limited - Melbourne -	1 copy
Party 243 -	1 copy

LIST OF ENCLOSURES

1. Locality Map
2. Location Map
3. Variable area section Volcanics 1 VP 96 - 99
4. Variable area section Volcanics 1 VP 96 - 99
   (10-fold common depth point)
5. Variable area section Volcanics 2 VP 164 - 199
6. Variable area section Volcanics 2 VP 88 - 91
   (10-fold common depth point)
7. Variable area section Volcanics 3 VP 186 - 199
8. Variable area section Volcanics 3 VP 91 - 94
   (10-fold common depth point).

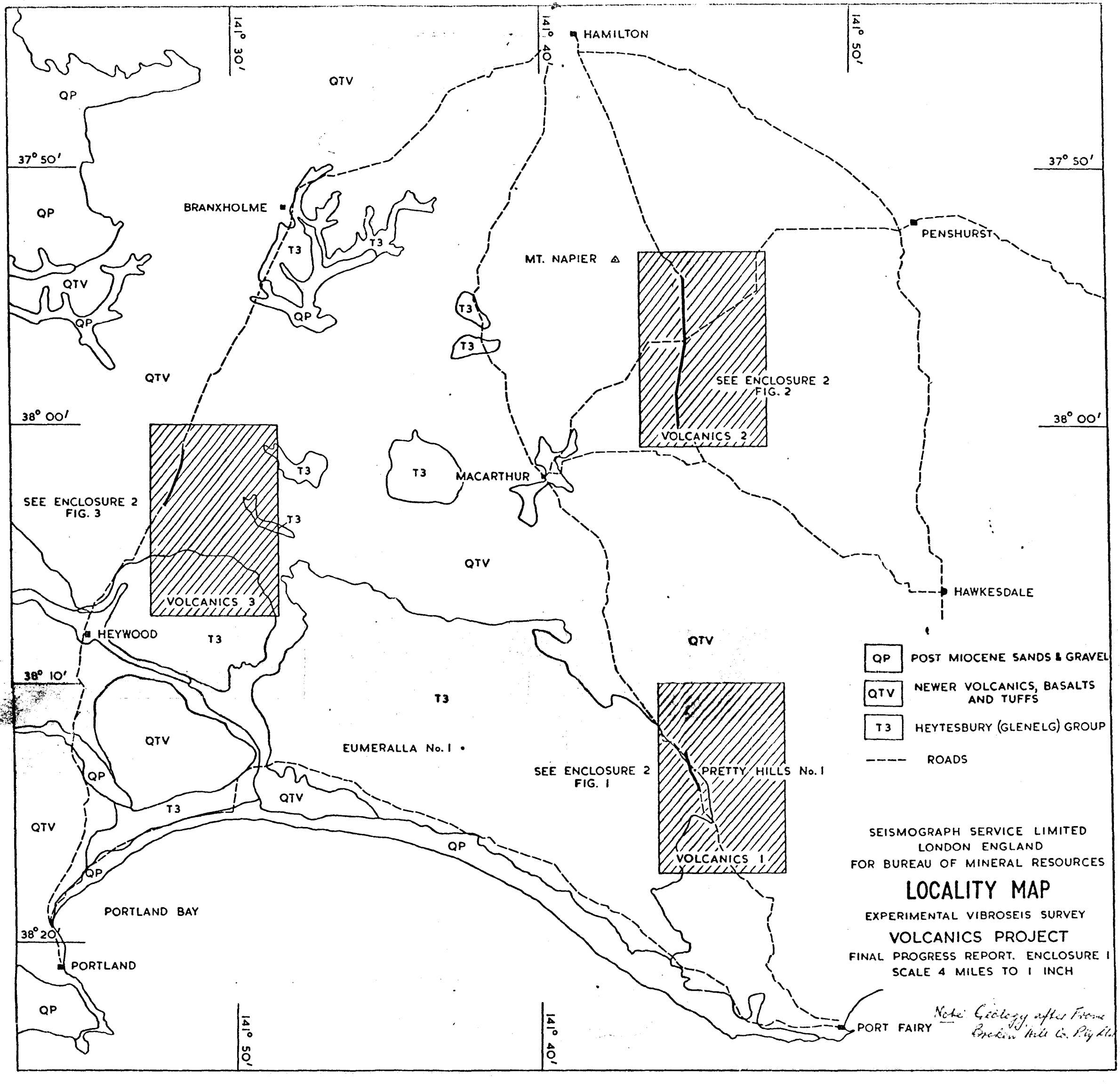
APPENDIX 'A' - LIST OF ENCLOSURES TO PROGRESS REPORTS.

APPENDIX A.

LIST OF PROGRESS REPORT ENCLOSURES AVAILABLE AT THE BUREAU OF MINERAL RESOURCES :-

1. Variable Area Section Volcanics 2 Noise Spread No. 1
2. Combined Pattern Response Curves.
3. Time -depth plot - Volcanics 2 Noise Spread No. 1.
4. Response - Wave Number Plot - Volcanics 2 Noise Spread No. 1.
5. " - Frequency " " 2 " " " "
6. Frequency - Wave Number " " 2 " " " "
7. Variable Area Section Volcanics 2. VP 196-199
8. " " " " 2. VP 88- 91
9. " " " " 2. VP 163-173
10. " " " " 2. VP 173-183
11. " " " " 2. VP 183-188
12. Plot of Pretty Hill Velocity Function.
13. Time-depth Plot - Volcanics 2 Noise Spread No. 2.
14. Response - wave number Plot - Volcanics 2. Noise Spread No. 2.
15. Response - frequency " " 2. " " " "
16. Frequency - Wave Number " - " 2. " " " "
17. Variable Area Section Volcanics 2 VP 185-199
18. " " " " 2 VP 190-193
19. " " " " 2 VP 193-199
20. " " " " 2 VP 195-199
21. " " " " 2 Velocity Profile
22. " " " " 2 8-Fold C.D.P.(Profile 180N.)
23. " " " " 2 Noise Spread No. 3 (Transposed)
24. " " " Volcanics 3 Transposed
25. " " " " 3 Noise Spread
26. Time-depth Plot - Volcanics 3 Noise Spread
27. Response - wave number Plot-Volcanics 3 Noise Spread
28. " frequency " - " 3 " "
29. Frequency - wave number " - " 3 " "
30. SP Location MAP (Weathering) - Volcanics 2.
31. Weathering Profile - Volcanics 2.
32. Diagram of Field Layout For 10-fold C.D.P. ($\frac{1}{2}$ spread offset)
33. Tables of experimental field techniques.

PLATE 1



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FOR BUREAU OF MINERAL RESOURCES

LOCALITY MAP

EXPERIMENTAL VIBROSEIS SURVEY

VOLCANICS PROJECT

FINAL PROGRESS REPORT. ENCLOSURE 1
SCALE 4 MILES TO 1 INCH

Note: Geology after Frome Broken Hill Co. Pty Ltd.

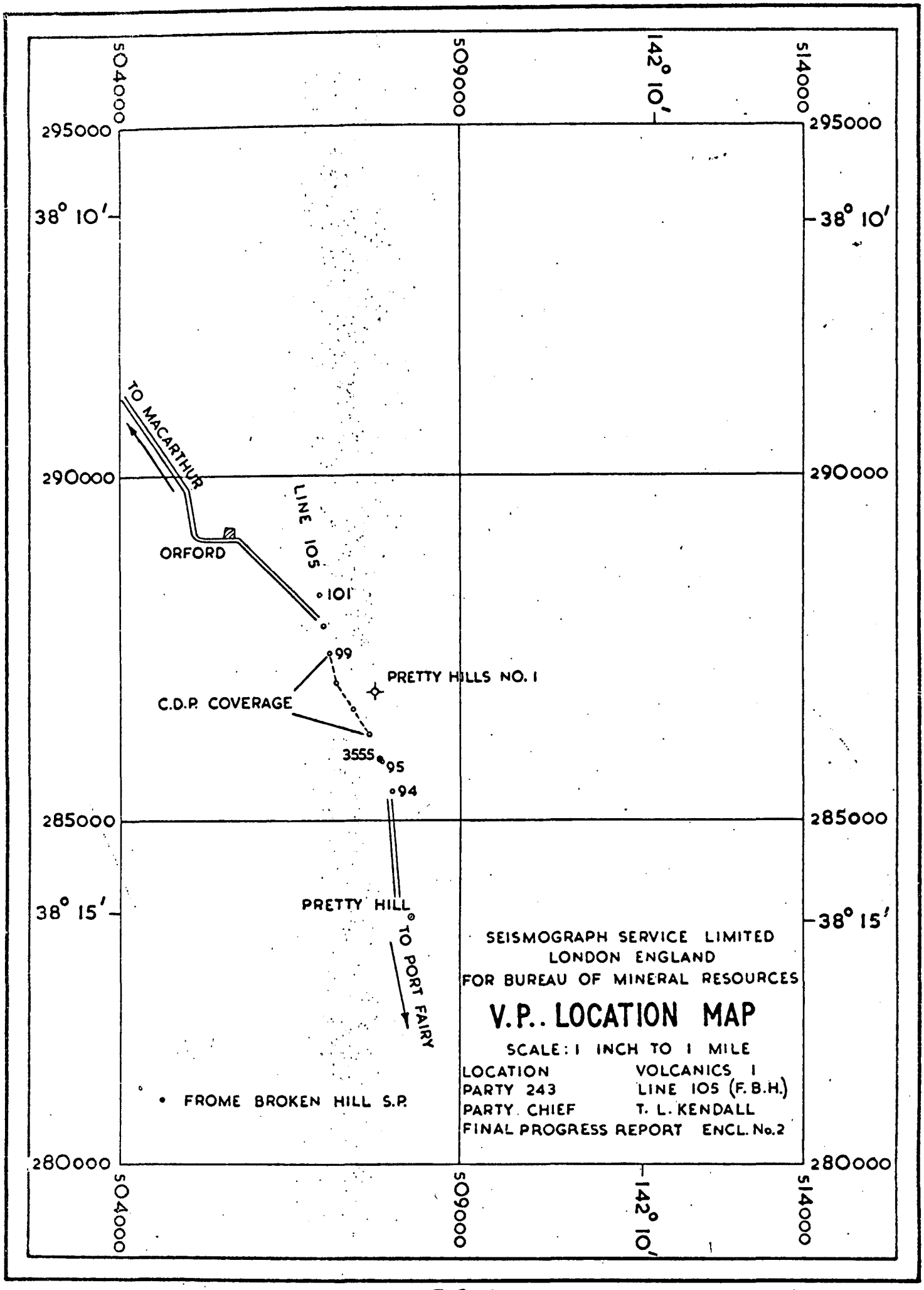
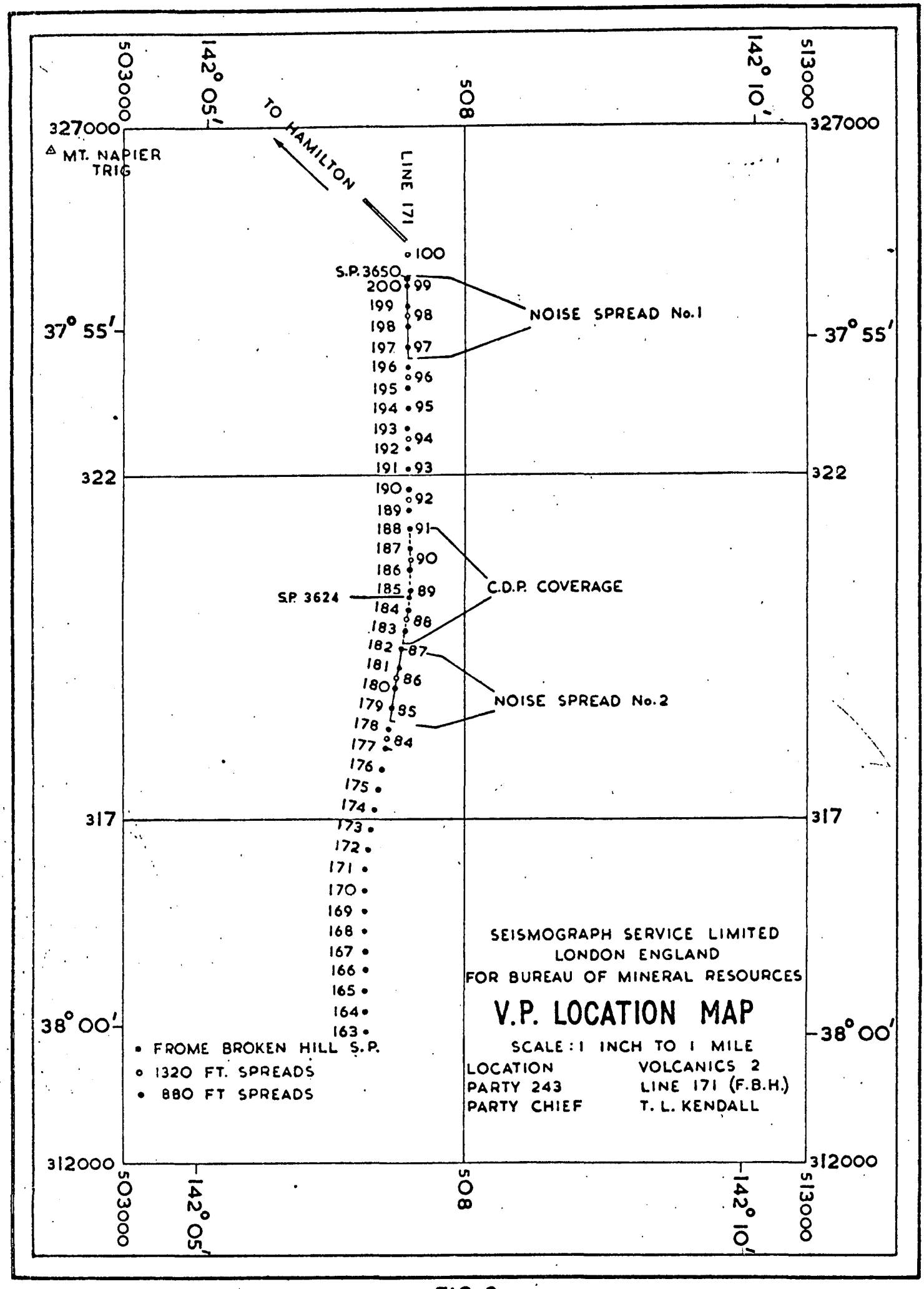

504000
509000
142° 10'
514000
295000
38° 10'
290000
285000
38° 15'
280000
TO MACARTHUR
ORFORD
LINE 105
101
99
PRETTY HILLS NO. 1
C.D.P. COVERAGE
3555
95
94
PRETTY HILL
TO PORT FAIRY
FROME BROKEN HILL S.P.
SEISMOGRAPH SERVICE LIMITED
LONDON ENGLAND
FOR BUREAU OF MINERAL RESOURCES
V.P.. LOCATION MAP
SCALE: 1 INCH TO 1 MILE
LOCATION VOLCANICS 1
PARTY 243 LINE 105 (F.B.H.)
PARTY CHIEF T. L. KENDALL
FINAL PROGRESS REPORT ENCL. No.2

FIG. 1

Plate 2


503000
142° 05'
508
142° 10'
513000
327000
MT. NAPIER TRIG
TO HAMILTON
LINE 171
100
S.P. 3650
200
99
199
98
198
197
97
196
96
195
194
95
193
94
192
191
93
NOISE SPREAD No. 1
37° 55'
322
190
92
189
188
91
187
90
186
185
89
S.P. 3624
184
88
183
182
87
181
86
180
179
85
178
177
84
176
175
174
C.D.P. COVERAGE
NOISE SPREAD No. 2
317
173
172
171
170
169
168
167
166
165
164
163
38° 00'
312000
• FROME BROKEN HILL S.P.
o 1320 FT. SPREADS
• 880 FT SPREADS
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LONDON ENGLAND
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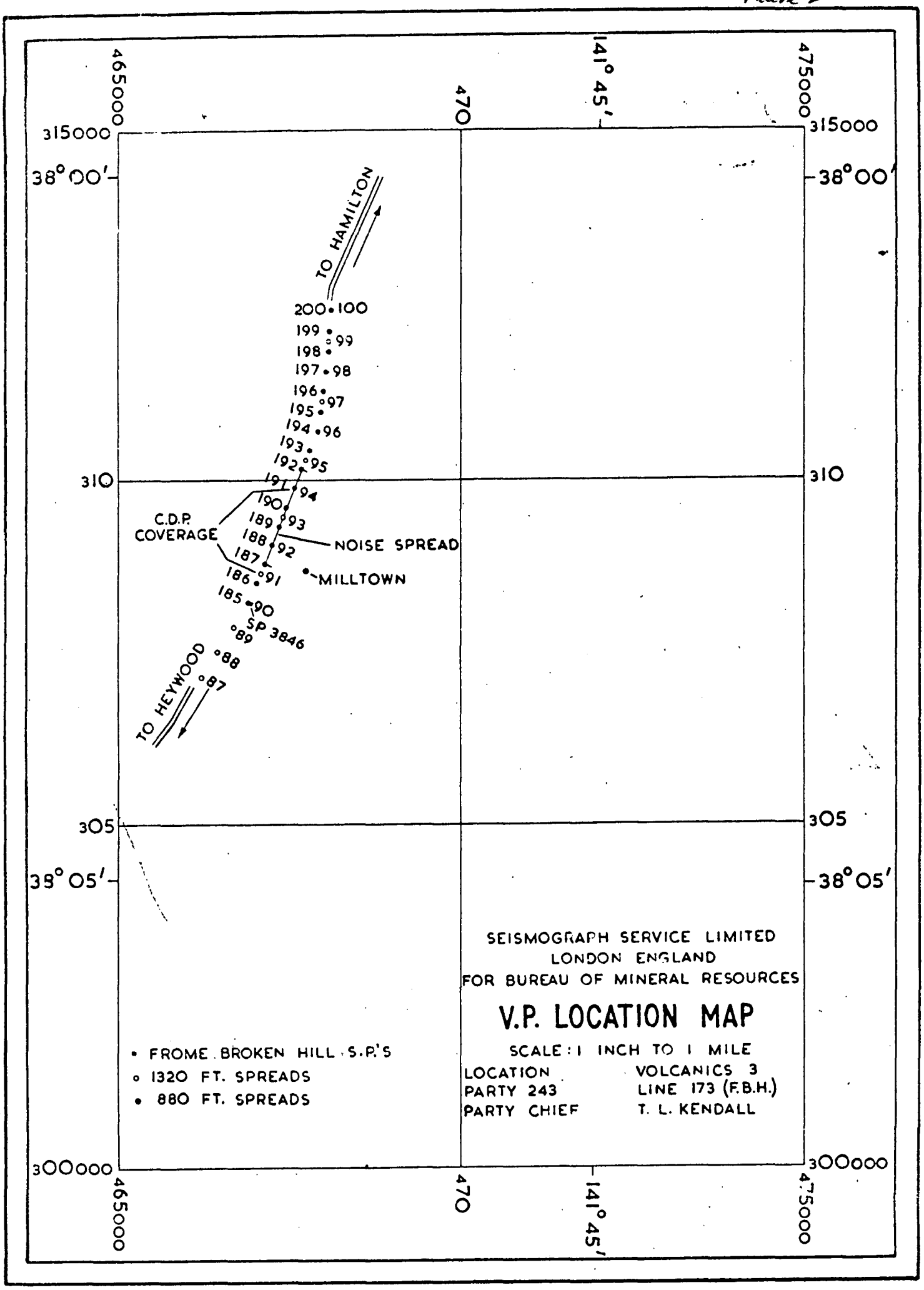
V.P. LOCATION MAP
SCALE: 1 INCH TO 1 MILE
LOCATION VOLCANICS 2
PARTY 243 LINE 171 (F.B.H.)
PARTY CHIEF T. L. KENDALL

FIG. 2

Plate 2


465000
470
141° 45'
475000
315000
38° 00'
310
305
38° 05'
300000
TO HAMILTON
200 • 100
199 ° 99
198 •
197 • 98
196 •
195 ° 97
194 • 96
193 •
192 ° 95
191
94
190
189 ° 93
188 • 92
187
186 ° 91
185 • 90
C.D.P. COVERAGE
NOISE SPREAD
MILLTOWN
SP 3846
°89
°88
°87
TO HEYWOOD
• FROME BROKEN HILL S.P.'S
° 1320 FT. SPREADS
• 880 FT. SPREADS
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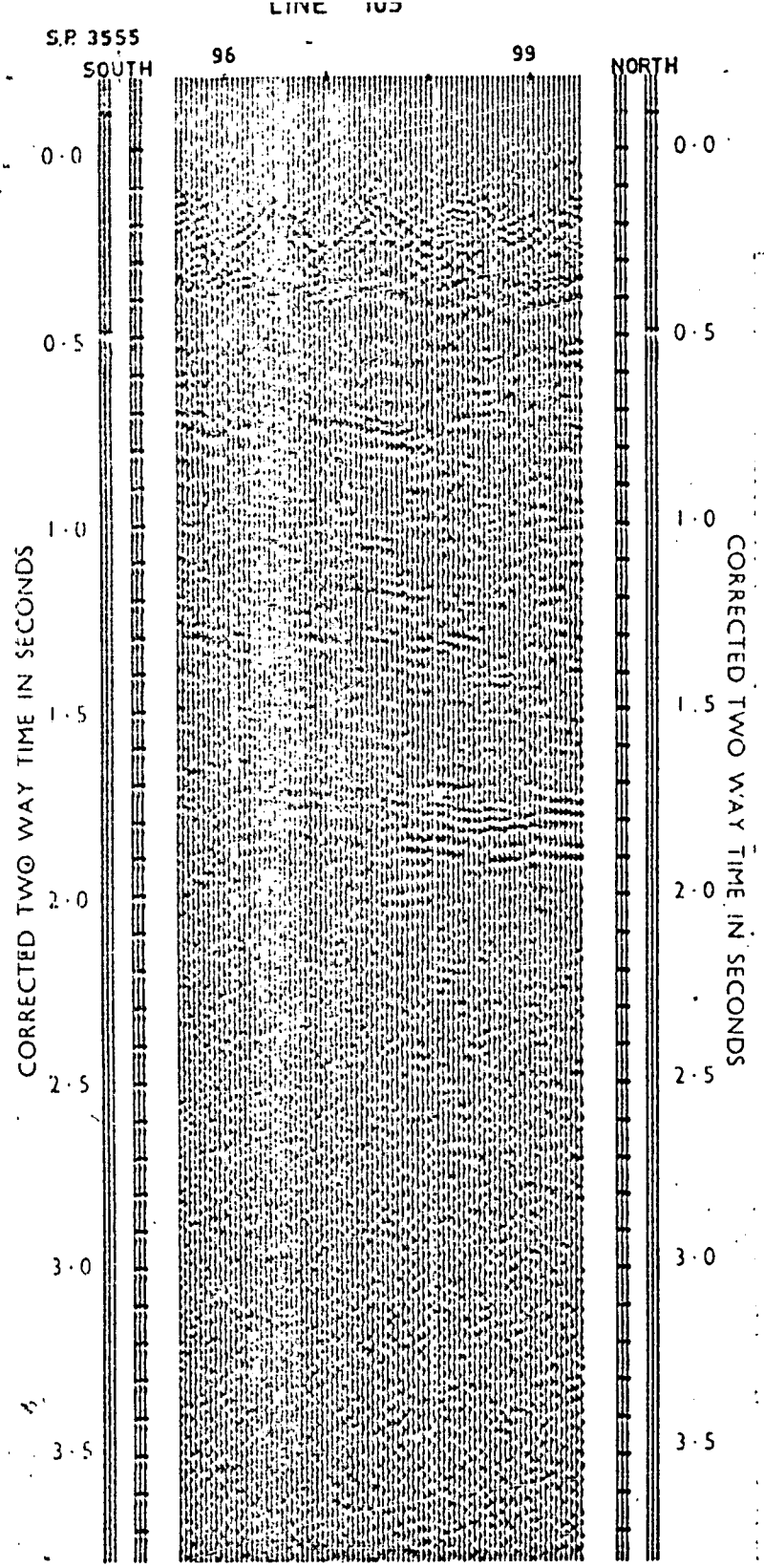
FOR BUREAU OF MINERAL RESOURCES
V.P. LOCATION MAP
SCALE : 1 INCH TO 1 MILE
LOCATION VOLCANICS 3
PARTY 243 LINE 173 (F.B.H.)
PARTY CHIEF T. L. KENDALL

FIG. 3



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VARIABLE AREA CROSS-SECTION
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VOLCANICS 1

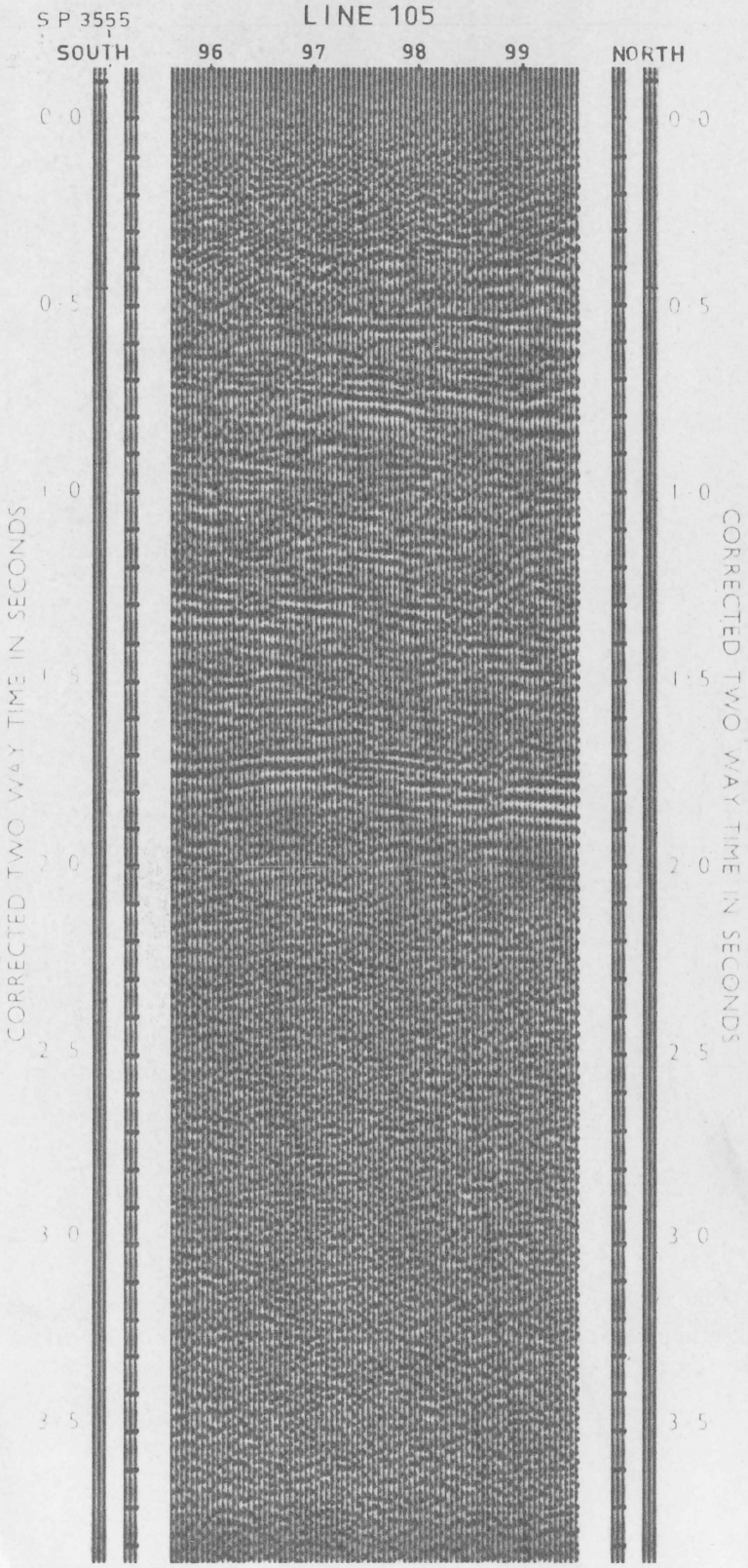
LINE 105 S.P'S. 96 - 99

VELOCITY DISTRIBUTION	PRETTY HILLS No1
WEATHERING VELOCITY (Vw)	2000 FT. SEC.
HORIZONTAL VELOCITY (Vh)	—
ELEVATION VELOCITY (Ve)	6000 FT. SEC.
WEATHERING METHOD	—
DATUM M.S.L.	GEOPHONE INT. 132'
HORIZONTAL SCALE	1": 2400'
OFFSET DISTANCE	1386': 2574'
PLAYBACK FILTER	14 - 60
MIXING UNMIXED	No. OF SWEEPS. 10
No. OF VIBRATORS.	3.
SWEEP FREQUENCY	14 - 57
TYPE OF PROFILING	TRANSPOSED

VIBRATOR PATTERN:
396' IN LINE

GEOPHONE PATTERN:
400' x 198' RECTANGLE OF
400 GEOPHONES

PARTY 243	DATE JULY 1964
ENCLOSURE No 3	FINAL PROGRESS REPORT.



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VARIABLE AREA CROSS-SECTION
VIBROSEIS®
FOR BUREAU OF MINERAL RESOURCES

VOLCANICS 1

LINE 105 S.P.'S. 96 – 99

VELOCITY DISTRIBUTION	PRETTY HILLS No 1
WEATHERING VELOCITY (V_w)	2000 F/SEC
HORIZONTAL VELOCITY (V_h)	—
ELEVATION VELOCITY (V_e)	6000 F/SEC
WEATHERING METHOD	—
HORIZONTAL SCALE 1" : 2400'	DATUM M.S.L.
TYPE OF PROFILING	10 FOLD C.D.P.
GEOPHONE INTERVAL	132
OFFSET DISTANCE	1386 – 3894
No. AND TYPE OF VIBRATORS	3 – 2
SWEEP FREQUENCY 14 – 57	No. OF SWEEPS 10
PLAYBACK FILTER	14 – 60
MIXING	NIL

VIBRATOR PATTERN:

264 X 100

GEOPHONE PATTERN:

264 ALONG LINE WITH 40 GEOPHONES PER TRACE

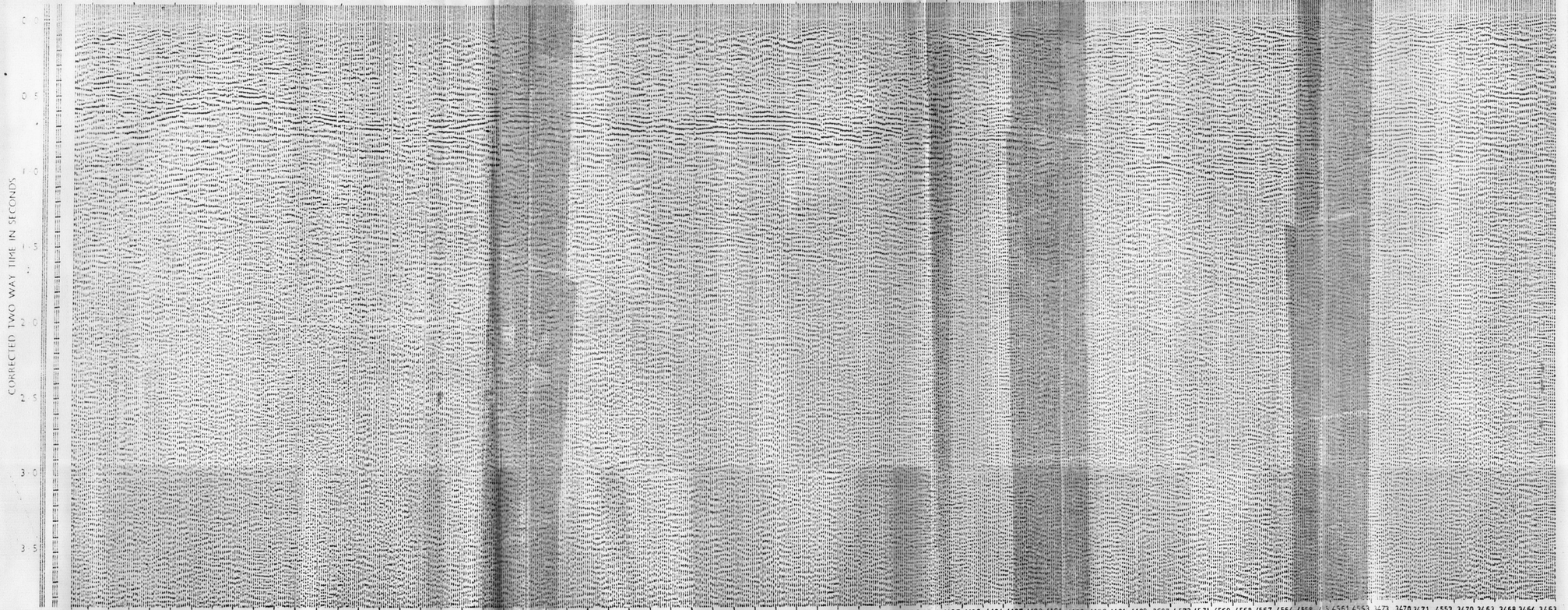
PARTY 243	DATE JULY 1964
ENCLOSURE 4	FINAL PROGRESS REPORT

SSL 94A. ®A TRADE MARK CONTINENTAL OIL CO.

LINE 171

C.D.P. COVERAGE

SOUTH 164 170 175 180 185 190 195 199 NORTH



FIELD TAPE No. 3929 3930 3928 3929 3927 3928 3926 3927 3925 3926 3624 3625 3623 3624 3622 3623 3621 3622 3618 3621 3617 3618 3616 3617 3615 3616 3614 3615 3613 3614 3612 3613 3610 3612 3609 3610 3376 3609 4139 4200 4198 4199 4187 4188 4184 4187 4183 4184 4182 4183 4181 4182 3607 4573 4571 4569 4568 4567 4564 4558 4561 4553 3473 3470 3471 4553 3470 3463 3468 3464 3463 3608

CORRECTED TWO WAY TIME IN SECONDS

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VARIABLE AREA CROSS-SECTION
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VOLCANICS 2

LINE 171 S.P'S. 164 — 199

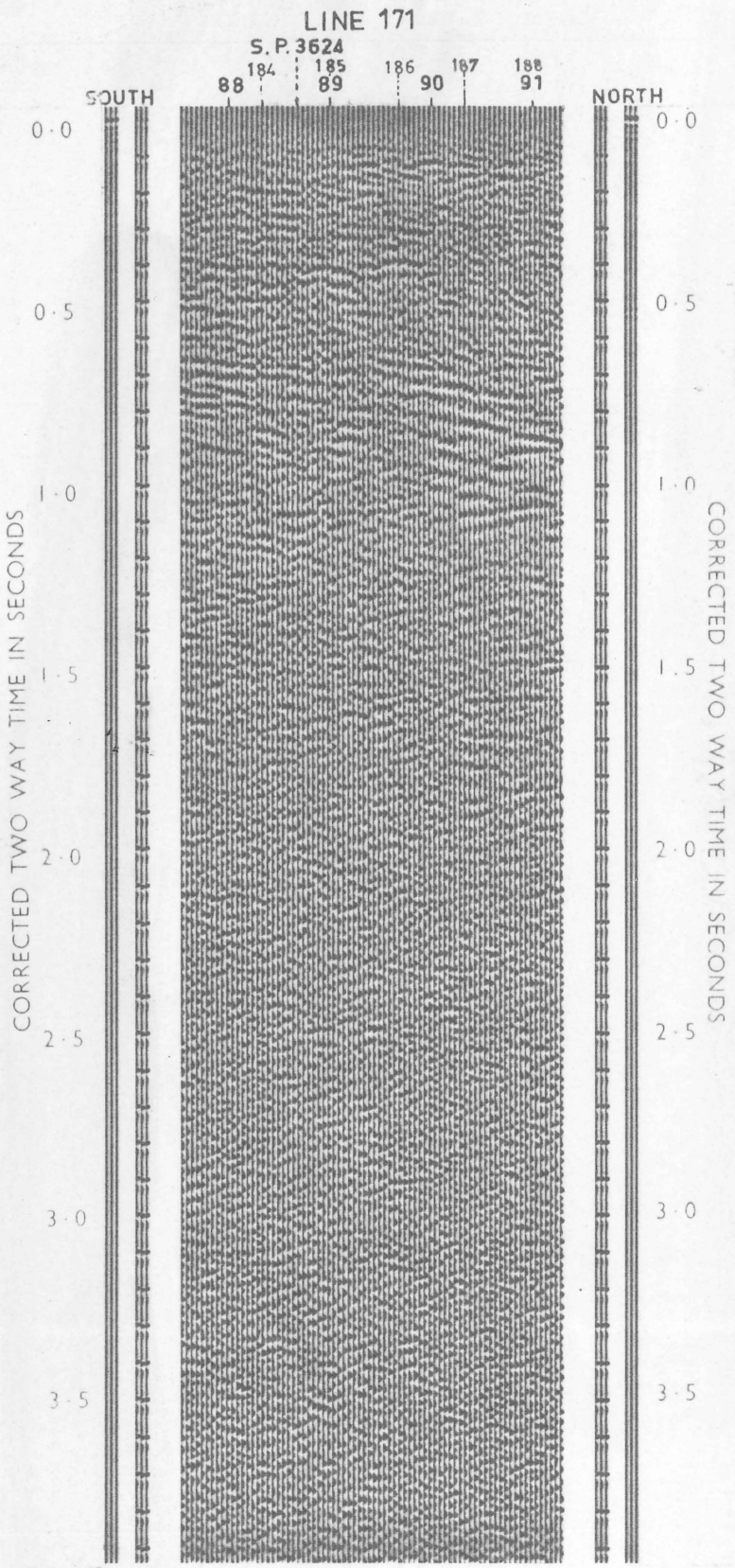
VELOCITY DISTRIBUTION	PRETTY HILLS No.1
WEATHERING VELOCITY (Vw)	2000 F/SEC
HORIZONTAL VELOCITY (V_h)	——
ELEVATION VELOCITY (V_e)	6000 F/SEC
WEATHERING METHOD	——
HORIZONTAL SCALE 1" = 1600'	DATUM MSL +500'
TYPE OF PROFILING	TRANSPOSED
GEOPHONE INTERVAL	88'
OFFSET DISTANCE	
No. AND TYPE OF VIBRATORS	3 OR 2
SWEEP FREQUENCY	No. OF SWEEPS 10-20
PLAYBACK FILTER	20 — 60
MIXING	3/2 COMPOSITED

VIBRATOR PATTERN:
SEE TABLE OF EXPERIMENTAL TECHNIQUES

GEOPHONE PATTERN:
SEE TABLE OF EXPERIMENTAL TECHNIQUES

PARTY 243	DATE JULY 1964
ENCLOSURE No. 5	FINAL PROGRESS REPORT.

SSL 94A. ®A TRADE MARK CONTINENTAL OIL CO.



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VARIABLE AREA CROSS-SECTION
FOR BUREAU OF MINERAL RESOURCES

VOLCANICS 2

LINE 171 S.P'S. 88 - 91

VELOCITY DISTRIBUTION			PRETTY HILLS No1
WEATHERING VELOCITY (Vw)			2000 FT. SEC.
HORIZONTAL VELOCITY (Vh)			—
ELEVATION VELOCITY (Ve)			6000 FT. SEC.
WEATHERING METHOD			—
DATUM	M.S.L. + 500'	GEOPHONE	INT. 132'
HORIZONTAL SCALE		1" : 2400'	
OFFSET DISTANCE		726' — 3234'	
PLAYBACK FILTER		20 - 60	
MIXING	UNMIXED	No. OF SWEEPS.	10
No. OF VIBRATORS.		2.	
SWEEP FREQUENCY		20 - 57	
TYPE OF PROFILING		10-FOLD C.D.P.	

VIBRATOR PATTERN :

264' IN LINE WITH 132' SPACING

GEOPHONE PATTERN :

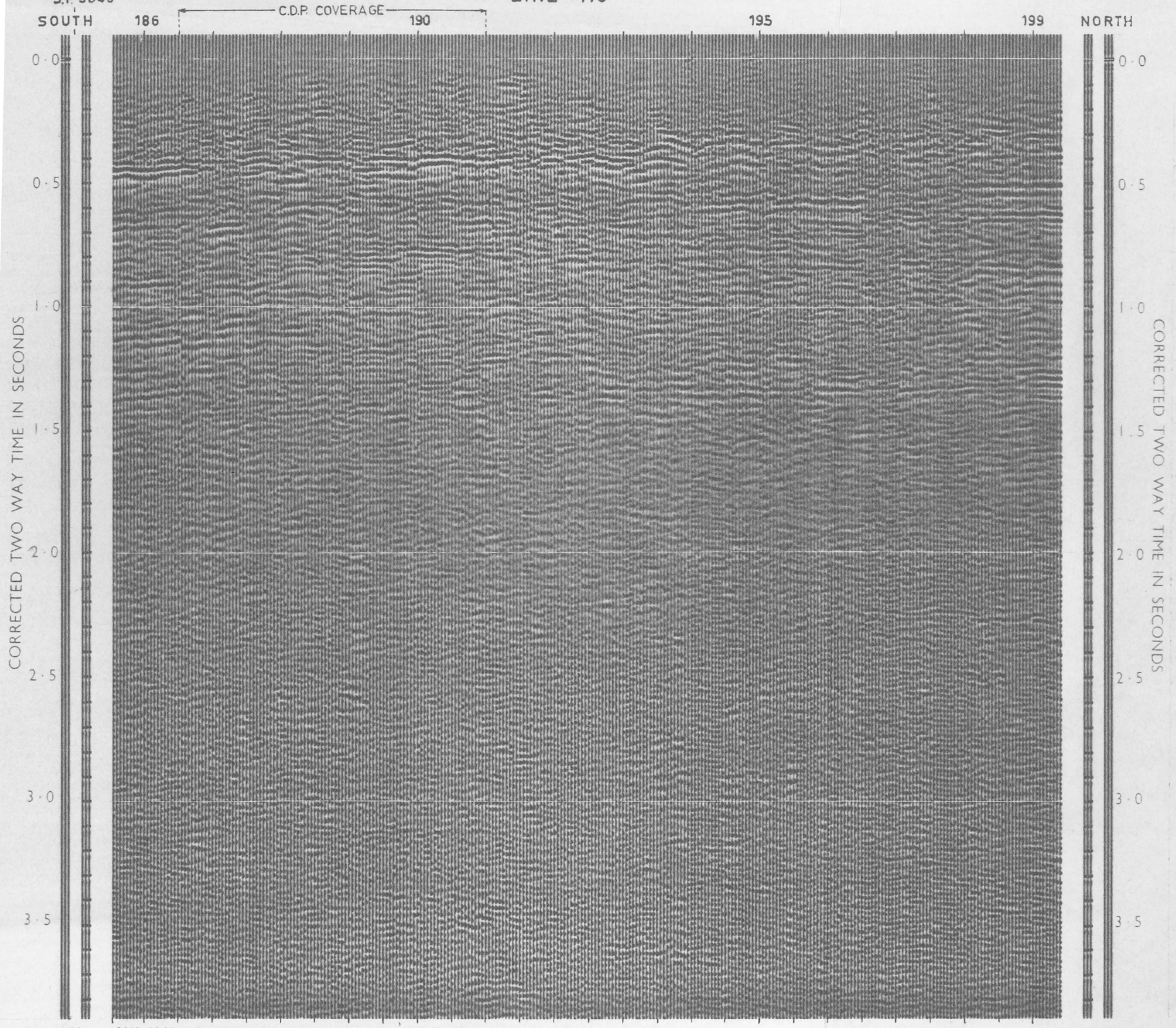
264' ALONG LINE WITH

40 GEOPHONES PER TRACE

PARTY	243	DATE	JULY 1964
ENCLOSURE No.6		FINAL PROGRESS REPORT.	

S.P 3846

LINE 173



SEISMOGRAPH SERVICE LIMITED
LONDON ENGLAND

VARIABLE AREA CROSS-SECTION ,
VIBROSEIS®
FOR BUREAU OF MINERAL RESOURCES

VOLCANICS 3

LINE 173 S.P'S. 186 — 199

VELOCITY DISTRIBUTION	PRETTY HILLS No.1
WEATHERING VELOCITY(Vw)	2000 FT. SEC.
HORIZONTAL VELOCITY(V_h)	—
ELEVATION VELOCITY(V_e)	6000 FT. SEC.
WEATHERING METHOD	—
HORIZONTAL SCALE 1" : 1600'	DATUM MSL + 300
TYPE OF PROFILING	TRANSPOSED
GEOPHONE INTERVAL	88'
OFFSET DISTANCE	924'—1714'
No.AND TYPE OF VIBRATORS	3 OR 2
SWEEP FREQUENCY 20-57	No.OF SWEEPS 10:20
PLAYBACK FILTER	20 — 60
MIXING	3/2 COMPOSITED

VIBRATOR PATTERN:

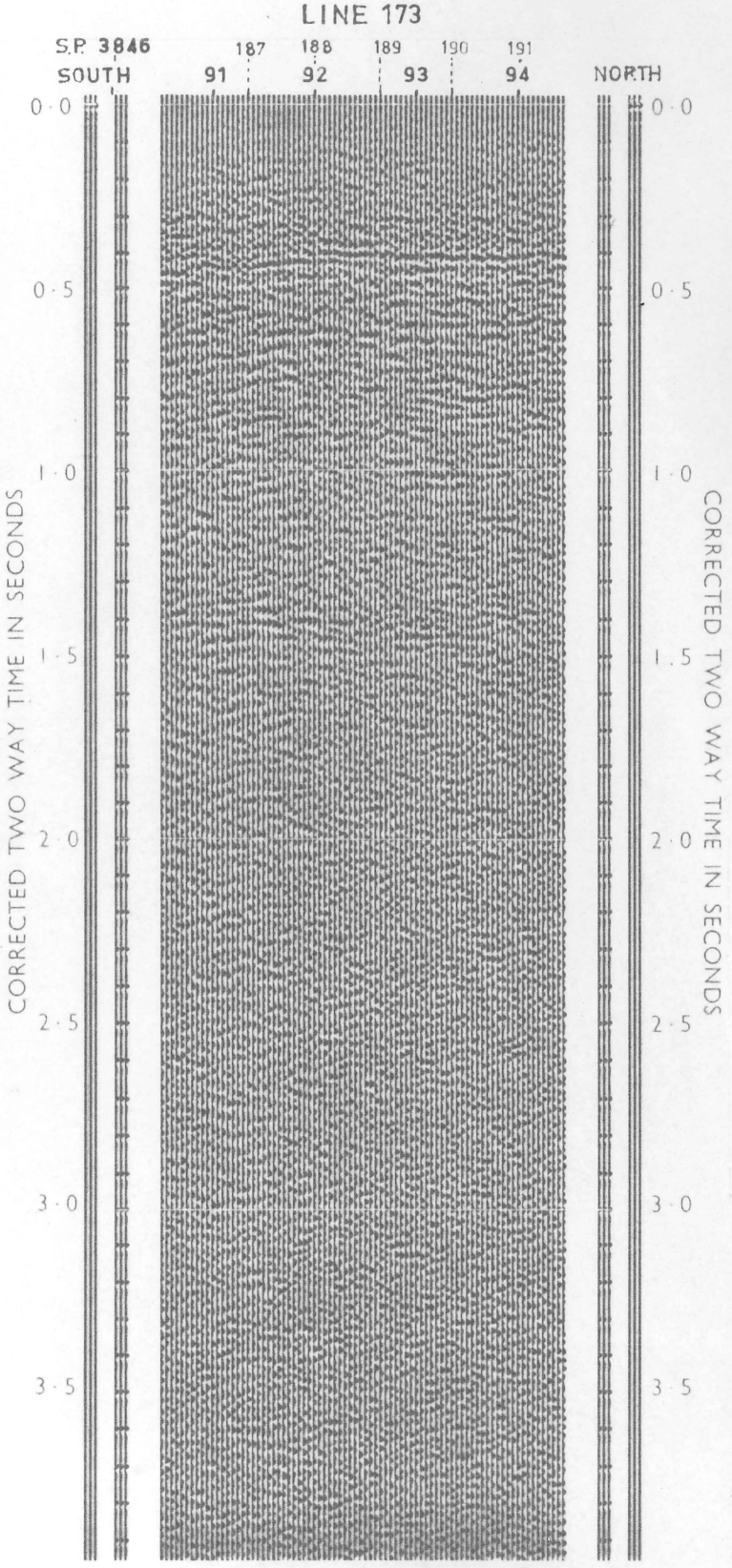
400' IN LINE

GEOPHONE PATTERN:

400'X200' RECTANGLE OF 350 GEOPHONES

PARTY 243	DATE JULY 1964
ENCLOSURE No.7	FINAL PROGRESS REPORT

SSL 94A. ®A TRADE MARK CONTINENTAL OIL CO.



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VARIABLE AREA CROSS-SECTION
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VOLCANICS 3

LINE 173 S.P.'S. 91–94	
VELOCITY DISTRIBUTION	PRETTY HILLS No.1
WEATHERING VELOCITY (V_w)	2000 FT. SEC.
HORIZONTAL VELOCITY (V_h)	—
ELEVATION VELOCITY (V_e)	6000 FT. SEC.
WEATHERING METHOD	—
HORIZONTAL SCALE 1": 2400'	DATUM M.S.L. + 300
TYPE OF PROFILING	10-FOLD C.D.P.
GEOPHONE INTERVAL	132'
OFFSET DISTANCE	726' — 3234'
No. AND TYPE OF VIBRATORS	3
SWEEP FREQUENCY 20 – 57	No. OF SWEEPS 10
PLAYBACK FILTER	20 – 60
MIXING	—

VIBRATOR PATTERN:
264' IN LINE

GEOPHONE PATTERN:
40 GEOPHONES SPACED OVER
264' ALONG THE LINE

PARTY 243	DATE JULY 1964
ENCLOSURE No. 8	FINAL PROGRESS REPORT

SSL 94A. ®A TRADE MARK CONTINENTAL OIL CO.