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PEL 8

OTWAY BASIN

1973 TARTWAUP SEISMIC SURVEY

FINAL REPORT

Submitted by

Alliance Oil Development Australia NL

1975

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PRIMARY INDUSTRIES AND RESOURCES SA

ENVELOPE 2331

TENEMENT: PEL 8; Otway Basin

TENEMENT HOLDER: Alliance Oil Development Australia NL (operator), General Exploration Company of Australia Pty Ltd, Beach Petroleum NL and Santos Ltd

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Seismic section full-scale transparencies are stored at the Document Storage Centre (DSC) in the multi-plan hanging racks by Geophysics Branch (both the original line sections and a set reprocessed sections done in 1984 by Seismograph Service Ltd for Beach Petroleum NL, the operator of PEL 28).

~~CONFIDENTIAL~~ 00116

~~(To be Passed by Hand)~~

ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.

MELBOURNE VICTORIA

FINAL REPORT

TARTWAUP SEISMIC SURVEY

P.E.L.8

OTWAY BASIN S.A.

M.L.P. CADART
Alliance Oil Management Pty. Ltd.

M.W. COVIL
Seismograph Service Limited.

S.J. WATSON
Geophysicist Consultant.

May 1974

00117

TARTWAUP SEISMIC SURVEY - VIBROSEIS

OTWAY BASIN - SOUTH AUSTRALIA.

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00118

PART I

GEOPHYSICAL REPORT

ON THE

TARTWAUP SEISMIC SURVEY - VIBROSEIS

P E L 8, SOUTH AUSTRALIA

OTWAY BASIN

S.J. Watson.

22 April 1974

00119

1. Introduction.

Previous seismic effort in the Gambier Trough portion of the Otway Basin has consisted mainly of short experimental traverses, and a "thumper" regional survey.

Results obtained were scarcely usable owing to a combination of adverse surface and subsurface factors.

After some consideration of previous work, it was decided that a digital Vibroseis programme, played back with Phoenix, would be mounted on a regional basis, with the option of detailing areas of interest if required.

The heavy effort of the Vibroseis proved to be rewarding, with the added advantage that there was no damage to forests, roads, or private property.

2. Abstract.

Noise spreads, filter analyses, and trial seismic spreads were carried out at four typical problem areas, and suitable production techniques were established. Twelve fold stacking was adopted on a routine basis.

Traverses were designed so as to include the four wells drilled in the area , and this allowed structural contours to drawn on the two most prospective targets in the area, namely the base of the Tertiary and the base of the Upper Cretaceous.

The survey disclosed an east-west anticlinal axis lying a few miles northwest of Mt. Gambier, and two good closures on both horizons exist on this axis.

Between Mt. Gambier and the coast there are a number of faults trending northwest, and although structural traps may be associated with these faults, they are as yet poorly defined.

3. Previous Geophysical Information.

3.1 Aeromagnetic Surveys.

1.1 S.A. Mines Department 1962.

'Results of Airborne Magnetic Surveys in South Australia' (unpublished).

1-2 Haematite Exploration Pty Ltd 1961.
'Bass Strait and Encounter Bay Aeromagnetic Survey 1960 -1961'. P.S.S.A. Publication No.60, Department of National Development.

These aeromagnetic surveys have been reviewed, compiled and published in a Special Bulletin by the Geological Surveys of South Australia and Victoria, 'The Otway Basin of Southeastern Australia'. It is shown that west and southwest of Mt Gambier the magnetic basement may lie as deep as 18,000 feet, while north of Kalangadoo it may be about 14,000 feet.

3-2. Ground Magnetic Surveys.

2-1 Industrial Geophysical Surveys Pty Ltd 1966.
'Magnetic Survey of Caroline Area, O.E.L.22, South Australia'. Private Report to Alliance Oil Development Australia NL'.

3-3. Gravity Surveys.

3.1 Stackler W.F. 1966 'Caroline - Killanoola Gravity Survey O.E.L. 22, South Australia', Geosurveys of Australia Pty Ltd, for Alliance Oil Development Australia NL.

3.2 Stackler and Radus 1967 'Kongorong Gravity Survey O.E.L.22 South Australia', Geosurveys of Australia Pty Ltd for Alliance Oil Development Australia NL.

3.3 'Otway EV 68 Land Gravity Survey, O.E.L. 22, South Australia', Geophysical Associates Pty Ltd for Esso Standard Oil (Australia) Limited 1969.

3.4 Kendall G.W. 1966, 'A Gravity Interpretation of the Western Otway Basin between Cape Jaffa S.A. and Warrnambool Victoria,' Department of Mines, South Australia, Report No. 728, G.S. 3507.

These Gravity surveys can be interpreted so that the 'highs' represent areas of elevated basement (e.g. pre-Mesozoic metamorphics)while the 'lows' are produced by thick sedimentary deposits. Structures in the Otway Basin have expression in the gravity anomalies. Thus the Penola Trough, the Kalangadoo 'High', and the Gambier Trough are well defined. However some of the smaller anomalies in the Gambier Trough have not been clarified, and may be complicated by the gravity effect of near-surface limestone.

3-4. Seismic Surveys.

4.1 Namco International Inc. 'Penola Seismic Survey 1964' for Alliance Oil Development NL.

4.2 Namco International Inc. 'Kalangadoo - Lucindale Seismic Survey 1965' for Alliance Oil Development Australia NL.

4.3 Namco Geophysical Co. 'Caroline - Killanoola Seismic Survey 1966' for Alliance Oil Development Australia NL.

4.4 Namco Geophysical Co. 'Mount Schank Seismic Survey 1964' for Alliance Oil Development Australia NL.

4.5 'Otway and Sydney Basin Experimental Vibroseis Survey 1964' Bureau of Mineral Resources Record No. 1965/198.

4.6 'Otway Basin (Gambier Limestone and Sand Dune Prospects). Experimental Seismic Survey for comparison with a Vibroseis Survey 1965', B.M.R. Record No. 1966/176.

4.7 Ray Geophysics 'Gambier Trough Seismic Survey 1970', a 'Thumper' Survey for Alliance Oil Development Australia NL.

4.8 'Caroline Experimental Seismic Survey 1971' by S.A. Geophysical Survey, Petroleum Exploration Division.

These Seismic Surveys show that normal seismic reflection techniques give a fair to poor picture of the Tertiary of the Otway Basin whereas high effort techniques are needed to delineate the pre-Tertiary, and in particular the Waarre formation, which is considered to be suitable target.

3-5 Depth versus Reflection Time.

Sonic logs are available for Lake Bonney No. 1 and Caroline No.1. From these the depth data of Enclosure 7-4 were produced. For comparison, the R.M.S. data for Line TB-220 as derived at the Phoenix playback centre are included.

Sonic logs were not taken at Mt Salt No.1 .

4. Objectives of the Present Survey.

After consideration of the usually accepted reasons why readable seismic records were difficult, or impossible, to obtain in the Gambier Trough, the first objective was to carry out experimental recordings in four widely spaced problem areas with a view to developing a suitable routine technique.

- The first location on Line TA was selected in an area where near-surface volcanic material produced noise interference.
- The second location on Line TD is in an elevated sandy area where previous seismic work shows that reflections below the Tertiary are difficult to obtain.
- The third location on Line TE is in an area of surface, or near-surface limestone.
- The fourth location on Line TL is in an area where caves are thought to scatter the seismic energy.

The second objective of the survey was to carry out a broad regional survey connecting the wells drilled on the prospect, with subsequent detailing in areas of interest in order to locate drillable targets at the base of the Tertiary and in the Upper Cretaceous.

5. Results.

The results of the noise tests and experimental programme are reported in a 'report on the Experimental Programme carried out at the Beginning of the Tartwaup Survey' by Seismograph Service Ltd October 1973, a copy of which is included in this final report. The reasons for selecting appropriate recording parameters are also presented.

The quality of the cross-sections produced at the Phoenix playback centre in Adelaide were generally good to fair, but Line TD through Caroline No. 1 was disappointingly poor.

Line TA, of which a reproduction is included in this report, was recorded end-on. It shows the general structure of the basin from near the coast in the south to the Tartwaup Fault in the north.

The unconformity between the Lower Tertiary and Upper Cretaceous can be seen, but the Lower Cretaceous is not aparent. The end-on recording was abandoned after Line TA, and split-spreads were adopted.

A reproduction of Line TC is included to show the appearance of a north-west trending fault that may have produced closure in both Tertiary and pre-Tertiary targets.

A reproduction of Line TD is included to demonstrate an area of very poor data near Caroline No.1. This area was the subject of an increased hogh effort, namely 20 sweeps per Vibrator station, and 24-fold stacking. However no improvement was obtained and the contours at Line TD rely heavily on phantom data and weak information.

The contour map depicting the base of the Tertiary shows a system of faults, roughly parallel to the coastline. Movement is down to the south. Closures could exist against these faults, especially as shown at Line TC, but to clarify this, more detailing would be needed than was possible in this survey.

To the northwest of Mt Gambier, near Burungule, the Tertiary horizon shows a very pronounced anticlinal axis, with two separate closures, and bounded on the north by the Tartwaup Fault. Line TU, although not tied to the survey, shows some indication that the axis may persist to the east of Mt Gambier.

Much deeper in the section,contours based on a horizon at,or near, the base of the Sherbrook Group have been constructed. This horizon includes some phantom data, but is tied in to the Lake Bonney, Caroline, and Mt Salt wells, although the tie to Lake Bonney is only fair. This map shows essentially the same structural elements as exist at the base of the Tertiary, namely closures northwest of Mt Gambier and faulting towards the coast. The Tartwaup Fault is clearly marked, but data north of this is lacking.

There is no indication that the recent volcanic intrusions (e.g. Mt Gambier, Mt Schank, Mt Burr) have had any appreciable effect on the sedimentary section.

On the coast, immediately west of Douglas Point No. 1 well, both contoured horizons indicate that a structural high might exist, but the problems of further delineating this seem insurmountable owing to the nature of the coastline and the presence of inshore reefs, rocks, and surf.

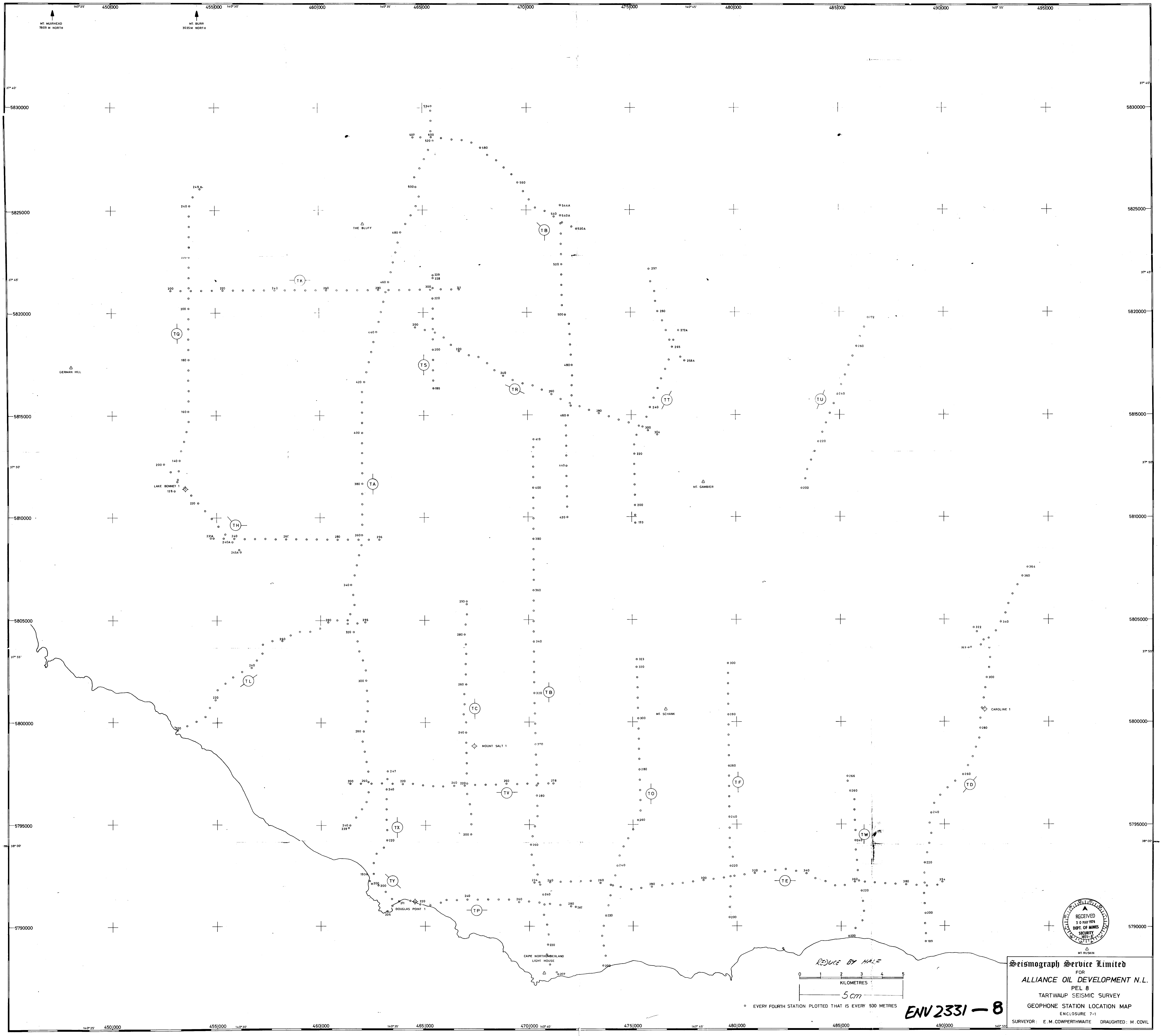
The choice of a second wellsite near Caroline No. 1 has not been developed beyond the point that a closure might exist at the fault about a mile and a half south of Caroline, but this is conjectural at present.

6. Recommendations.

By convention, no seismic report is complete without recommendations. In this case, a decision to drill the Burungule anticlines is recommended. Each of the culminations is attractive, but the westernmost one has slightly shallower targets.

A less well-defined target lies near Line TC - 255, or Line TB - 304 where there is some closure against a fault.

The possibility of a structural high existing immediately west of Douglas Point No.1 is attractive, but it is not recommended that further seismic effort be expended either here or at Caroline No.1 until the obvious sites have been investigated.



Seismograph Service Limited

FOR

ALLIANCE OIL DEVELOPMENT N.L.

PEL 8

TARTWAUP SEISMIC SURVEY

GEOPHONE STATION LOCATION MAP

ENCLOSURE 7-1

SURVEYOR: E.M.COWPERTHWAITE DRAUGHTED: M.COVIL

MT. MUIRHEAD 7809 M NORTH
MT. BURR 3035M NORTH
THE BLUFF
GERMAN HILL
MT. GAMBIER
LAKE BONNEY 1
BASED ON DOUBTFUL DATA
NO TIE
MOUNT SALT 1
CAROLINE 1
DOUGLAS POINT 1
CAPE NORTHUMBERLAND LIGHT HOUSE
S.A. OIL WELL BORES
MT. RUSKIN
RECEIVED 30 MAY 1974
SECURITY 2331-π
Duplicate
KILOMETRES
EVERY FOURTH STATION PLOTTED THAT IS EVERY 500 METRES
2331-9
Seismograph Service Limited
FOR
ALLIANCE OIL DEVELOPMENT N.L.
PEL 8
TARTWAUP SEISMIC SURVEY
BASE OF TERTIARY IN FEET BELOW SEA LEVEL
TIED TO LAKE BONNEY No1, CAROLINE No1, DOUGLAS POINT No1
CONTOUR INTERVAL 50'
DATA BY VIBROSEIS. SCALE 1:50,000 PROCESSED BY PHOENIX
S.J. WATSON ENCLOSURE 7-2 4th MARCH, 1974

tc	Z
1250	5600
1275	5760
1300	5920
1325	6070
1350	6230
1375	6385
1400	6550
1425	6710
1450	6865
1475	7020
1500	7175
1525	7335
1550	7490
1575	7650
1600	7805
1625	7959
1650	8120
1675	8270
1700	8430
1725	8585
1750	8740
1775	8900
1800	9055
1825	9210
1850	9370
1875	9525
1900	9680
1925	9835
1950	9995
1975	10,150
2000	10,305

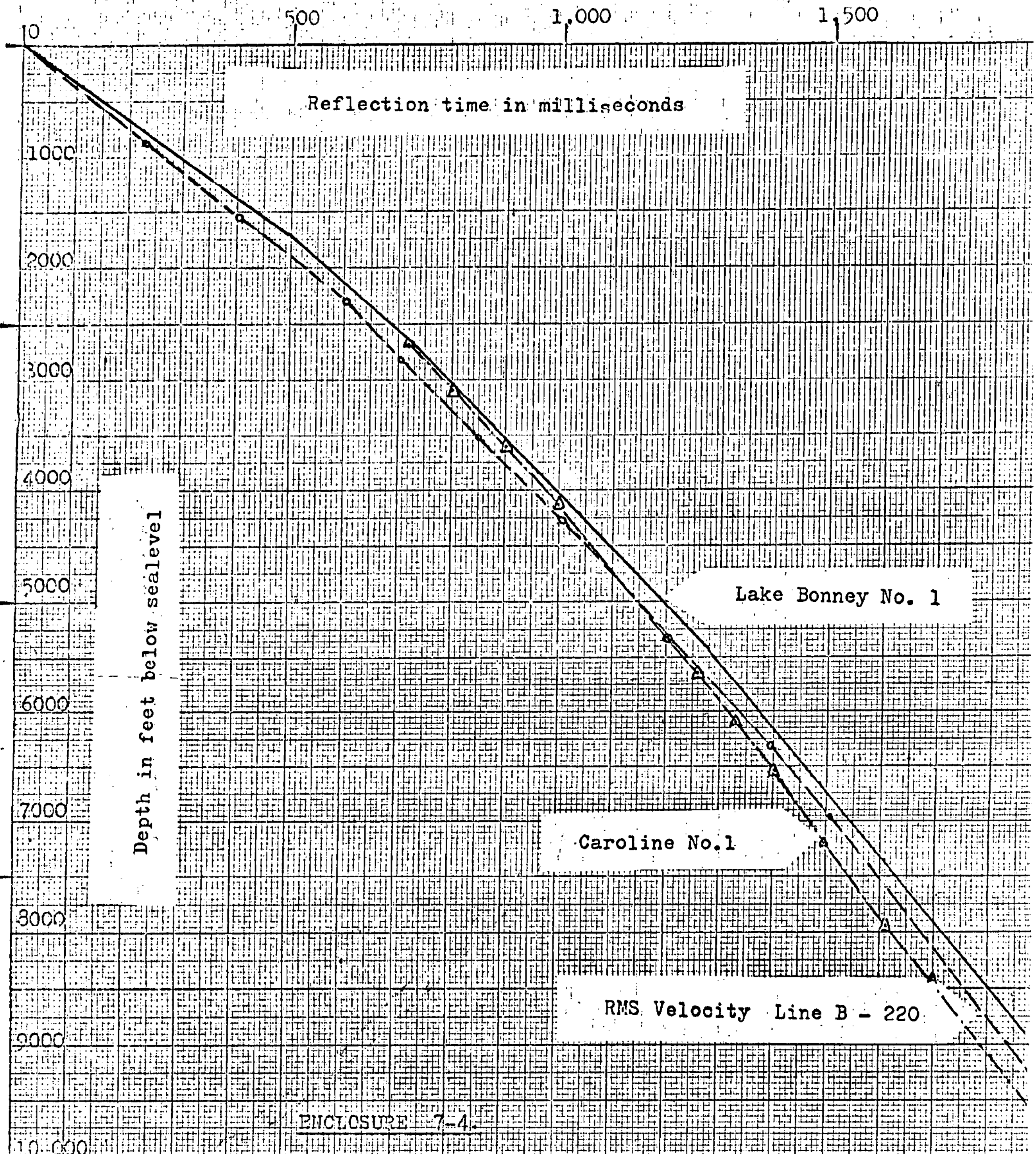
TIME-DEPTH SCALE
APPROXIMATE ONLY.
WEAKEST AT LAKE BONNEY Nº1.

RECEIVED
30 MAY 1974
SECURITY
2331-11
Duplicate

2331-10

Seismograph Service Limited
FOR
ALLIANCE OIL DEVELOPMENT N.L.
PEL 8
TARTWAUP SEISMIC SURVEY
CONTOURS ON WAARRE FORMATION
INTERVAL=25 M/SECS (170' APPROX)
SCALE 1:50,000

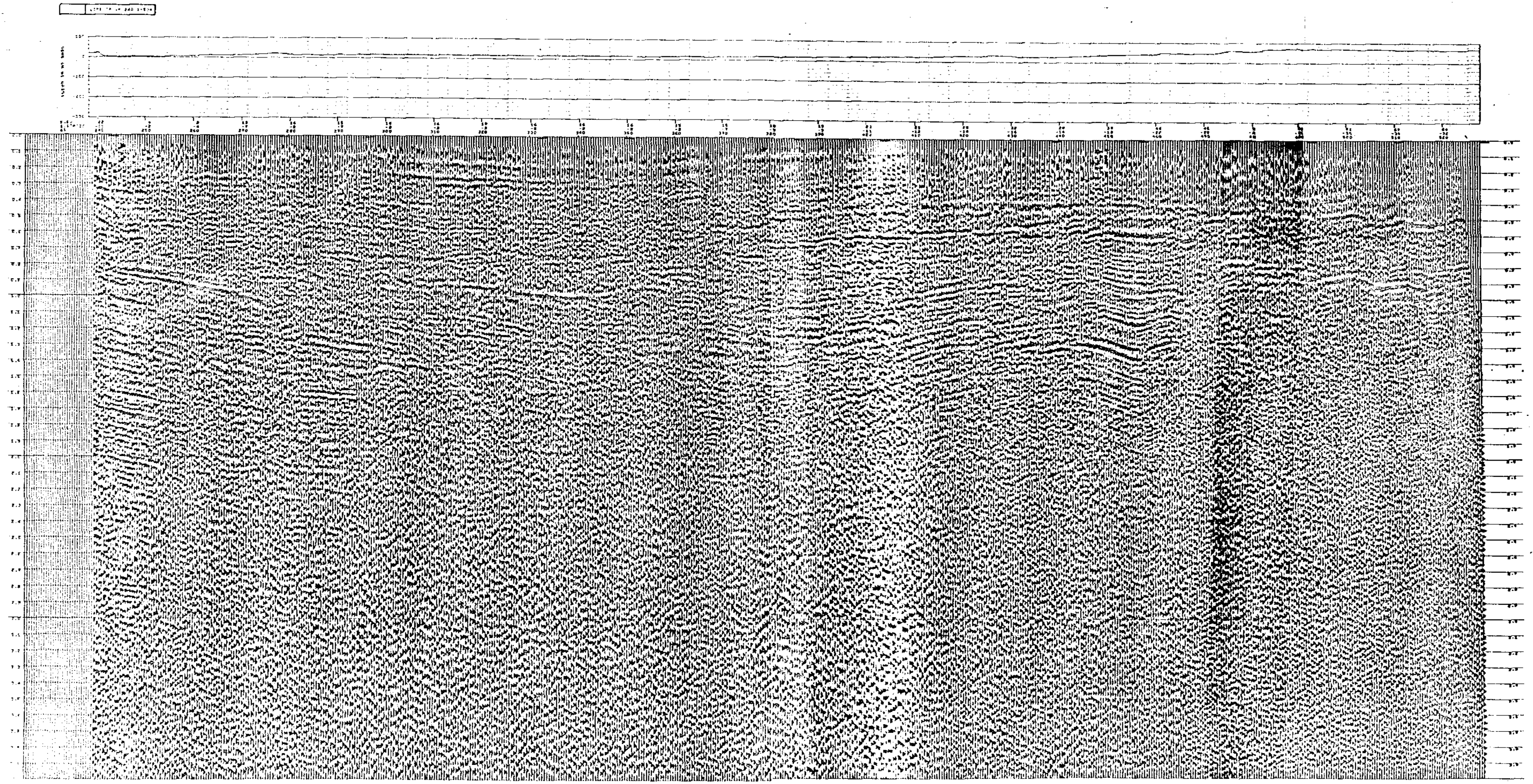
DATA BY VIBROSEIS.
S.J. WATSON
DATUM: SEA LEVEL
ENCLOSURE 7-3
PROCESSED BY PHOENIX
12th MARCH, 1974

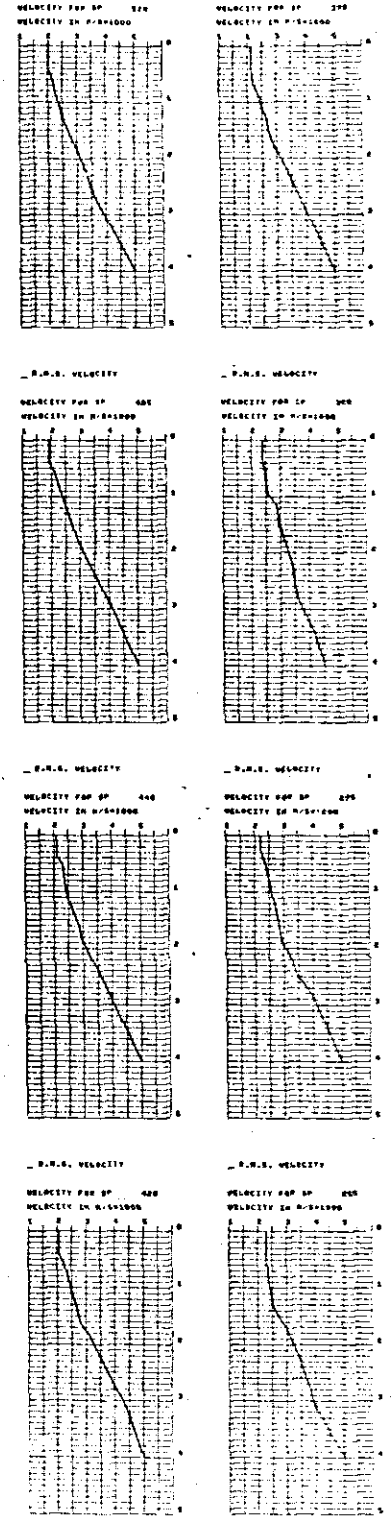


ENCLOSURE 7-4.

Depth versus Reflection Time

Encl 7-5





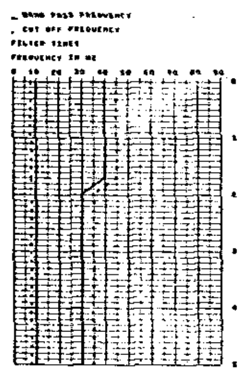
ALLIANCE	LINE TR YP 535/V-2V1/0

RECORDED BY — SEISMOGRAPH SERVICE LTD.
PROCESSED BY — SEISMOGRAPH SERVICE LTD. - ADELAIDE
PROSPECT — SOUTH AUSTRALIA
SPECIAL REMARKS

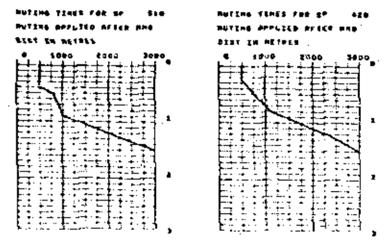
PROCESSED THROUGH PHOENIX

RECORDING PARAMETERS	RECORDING GEOMETRY

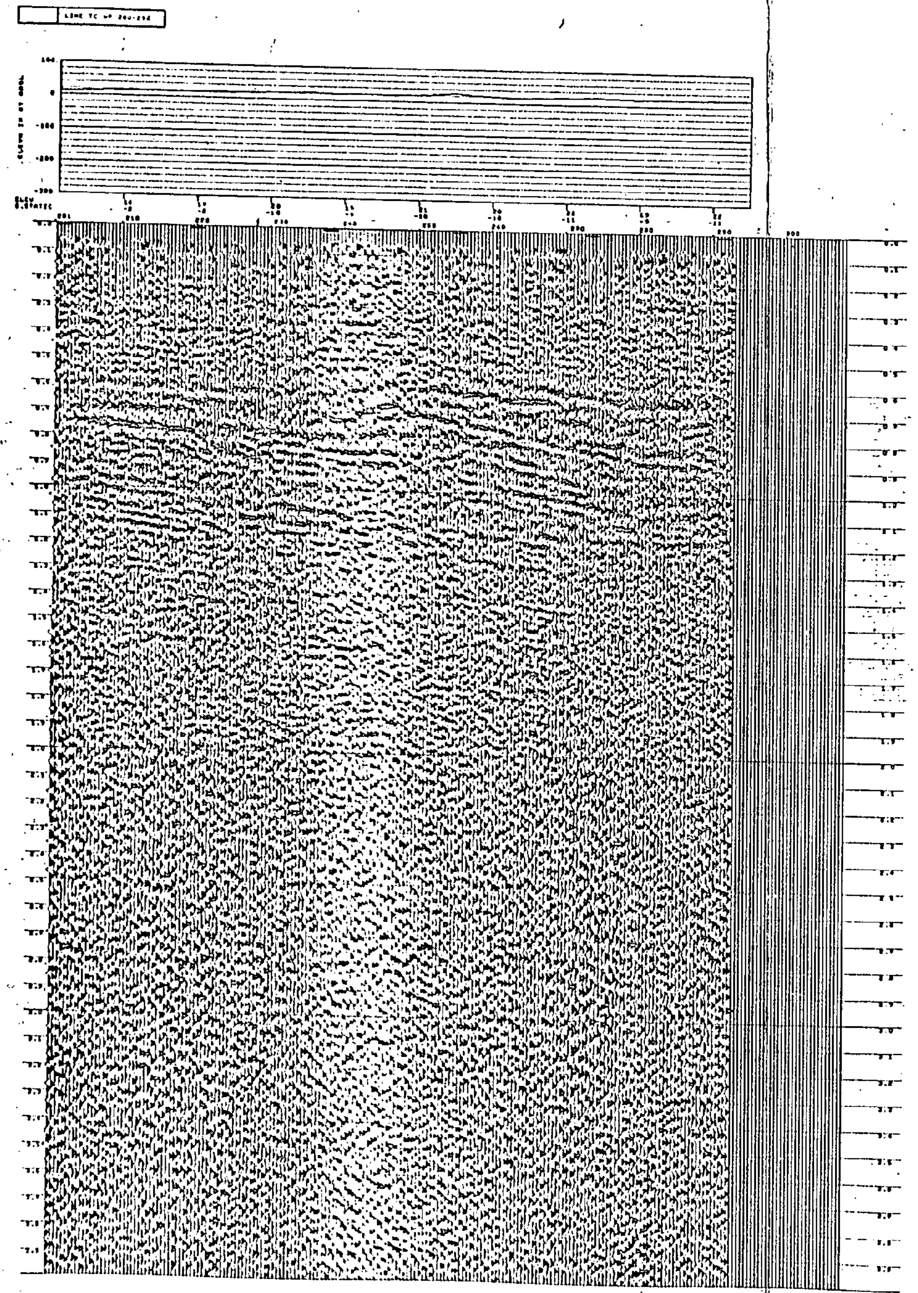
SEQUENCE	PROCESSING PARAMETERS
1 DEMULTIPLEX	BINARY GAIN RECOVERY
2 FDXCOR	FREQUENCY DOMAIN CROSSCORRELATION
3 EDIT	
4 CDP SORT	
5 TVTRIM	
6 SEISPAK	NMO CORRECTIONS
7 CSTAT	AUTOMATIC CDP STATICS AND STACK
8 DECONVOLUTION	
9 TVFILTER	
10	TRACE EQUALISATION
DISPLAY	



2331-11



Encl 7-6



ALLIANCE	LINE TC VP 200/1-292/3

RECORDED BY — SEISMOGRAPH SERVICE LTD.

PROCESSED BY — SEISMOGRAPH SERVICE LTD. - ADELAIDE

PROSPECT — [illegible] - SOUTH AUSTRALIA

SPECIAL REMARKS

FOR ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.

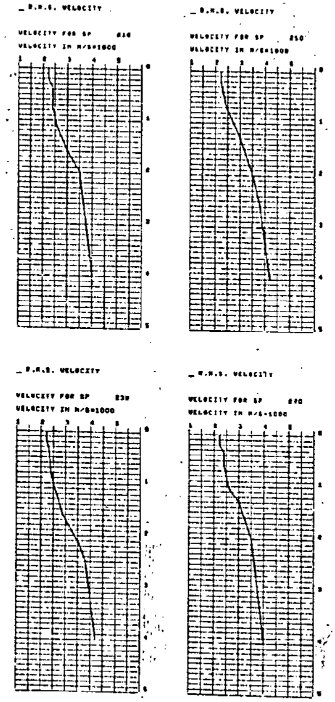
[illegible] CONTINENTAL OIL CO.

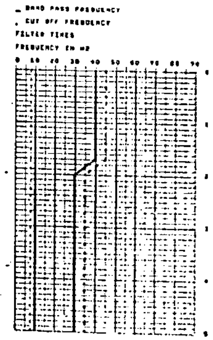
ELEVATIONS BASED ON AN ASSUMED DATUM

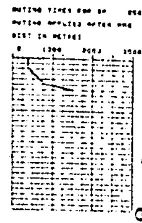
PROCESSED THROUGH PHOENIX

RECORDING PARAMETERS	RECORDING GEOMETRY
PARTY [illegible] INSTRUMENTS [illegible] 24 CHANNEL TOTAL RECORD TIME 10 SECS SAMPLING RATE 4 MS 14 SEC 45-10HZ DOWNSWEEP RECORDING FILTER 10-50HZ BINARY GAIN SOURCE: VIBRATORS GEOPHONES: [illegible] NUMBER OF TRACES: [illegible] FIELD TAPE NOS: [illegible]	SPREAD [illegible] STATION INTERVAL [illegible] SPLIT SPREAD VIBRATED FROM SOUTH TO NORTH 3 VIBRATORS IN LINE [illegible] SPACING [illegible] MOVEUP 10 SWEEPS-UP [illegible] [illegible] [illegible] IN PARALLEL [illegible] INTERVAL

SEQUENCE	PROCESSING PARAMETERS		
1 DEMULTIPLEX	BINARY GAIN RECOVERY		
2 FDXCOR	FREQUENCY DOMAIN CROSSCORRELATION		
3 EDIT			
4 CDP SORT	12-FOLD [illegible]		
5 TVTRIM	WINDOW [illegible]		
6 SEISPAK	NMO CORRECTIONS [illegible]		
7 CSTAT	AUTOMATIC CDP STATICS AND STACK [illegible]		
8 DECONVOLUTION	TIME VARIANT [illegible] WINDOW 200-1500MS [illegible]		
9 TVFILTER	[illegible]		
10BASELEV	TRACE EQUALIZATION		
DISPLAY	[illegible]	PROCESSED ADELAIDE OCTOBER 1973	PREPARED BY [illegible]



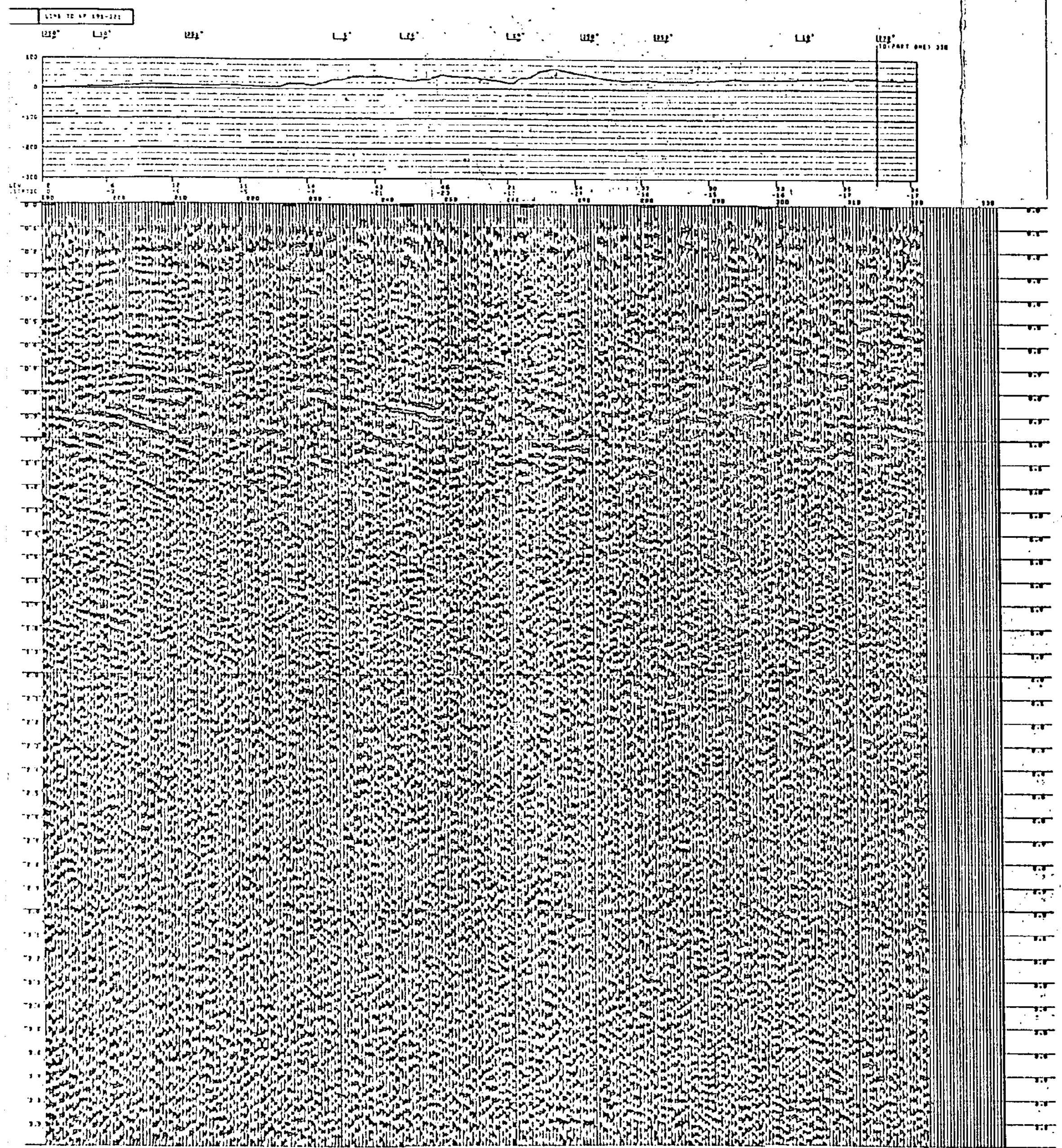


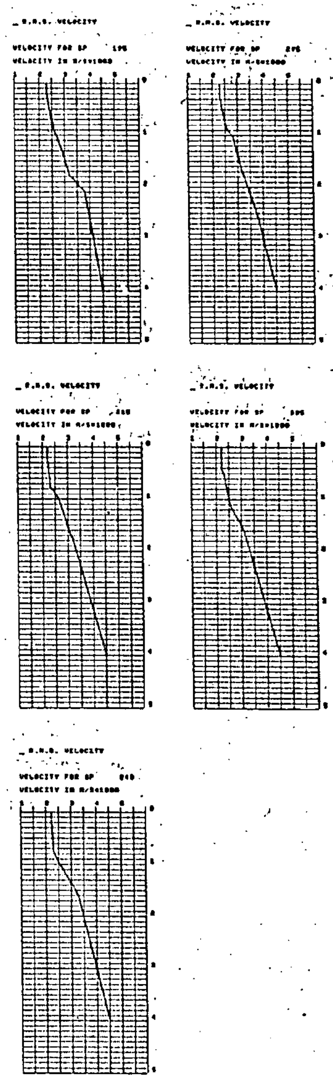


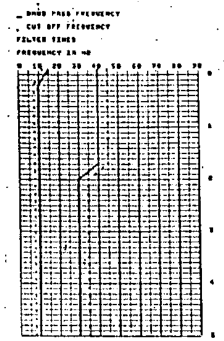
00192

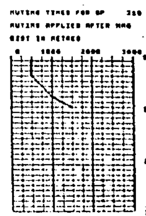
Encl 7-7(a)

D.O.D. Copy









ALLIANCE	LINE TO VP 191/2-321/2

RECORDED BY - SEISMOGRAPH SERVICE LTD VIBROSEIS

PROCESSED BY - SEISMOGRAPH SERVICE LTD. - ADELAIDE

PROSPECT - TARTUNUP - SOUTH AUSTRALIA

SPECIAL REMARKS

FOR ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.

VIBROSEIS TRADEMARK CONTINENTAL OIL CO.

ELEVATIONS BASED ON AN ASSUMED DATUM

PROCESSED WITH ... OVERCOME GEOMETRY OF LINE

PROCESSED THROUGH PHOENIX

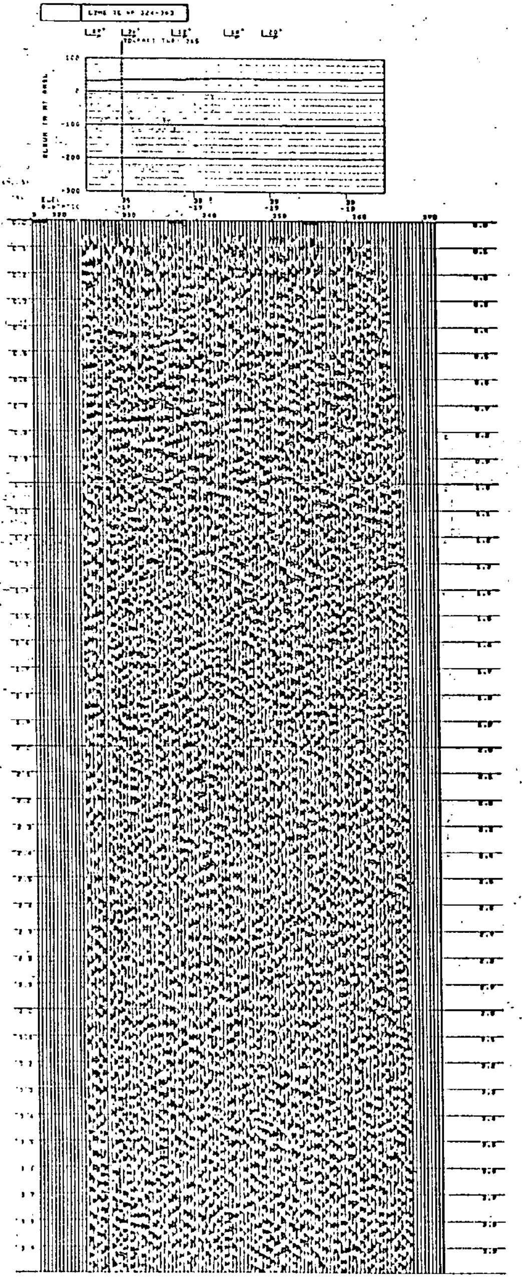
RECORDING PARAMETERS	RECORDING GEOMETRY
PARTY 660 ... INSTRUMENTS GLOBE/LEACH 10 24 CHANNEL TOTAL RECORD TIME 18 SECS SAMPLING RATE 4MS 14 SEC. 40-15HZ DOWNSWEEP RECORDING FILTER ... BINARY GAIN SOURCE: 3 VIBRATORS GEOPHONES: ... NUMBER OF TRACKS: ... FIELD TAPE NOS: ...	SPREAD ... STATION INTERVAL ... SPLIT-STRADDLE VIBRATED FROM NORTH TO SOUTH 3 VIBRATORS IN LINE ... SPACING 10M MOVEUP 10 SWEEPS/VP GEOPHONE PATTERN WEIGHTED ... 2 STRINGS OF 6 CONNECTED IN PARALLEL ... INTERVAL

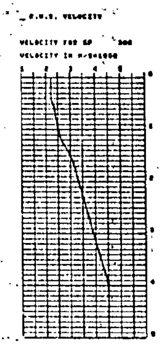
SEQUENCE	PROCESSING PARAMETERS		
1 DEMULTIPLEX	BINARY GAIN RECOVERY		
2 FDXCOR	FREQUENCY DOMAIN CROSSCORRELATION		
3 EDIT			
4 CDP SORT	12-FOLD, ELEV. VEL. 2000M/S, DATUM ...		
5 TVTRIM	WINDOW 1000MS		
6 SEISPAK	NMO CORRECTIONS FAR TRACE BLANKED ...		
7 CSTAT	AUTOMATIC CDP STATICS AND STACK 5 TRACE PILOT		
8 DECONVOLUTION	TIME DOMAIN DERIVATION WINDOW 200-1200MS OPERATOR 100MS, GAP 30MS		
9 TVFILTER	12-18-40-45HZ(...), 8-10-40-45HZ(...), 8-10-30-35HZ(2000MS).		
10 BASELEV	TRACE EQUALISATION		
DISPLAY	HORIZ: 1:25000 VERT: ...	PROCESSED ADELAIDE NOVEMBER 197?	PREPARED BY C.P.-R.D.

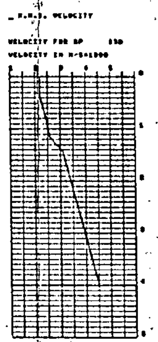
0019

A.O.D ...

Encl 7-7(b)







ALLIANCE	LINE TD VP 324/5-363/4

RECORDED BY SEISMOGRAPH SERVICE LTD [illegible]

PROCESSED BY SEISMOGRAPH SERVICE LTD. - ADELAIDE

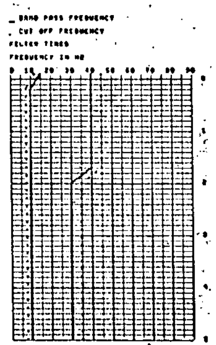
PROSPECT [illegible] - SOUTH AUSTRALIA

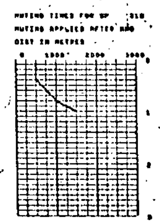
SPECIAL REMARKS
FOR ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.
[illegible] CONTINENTAL OIL CO.
ELEVATIONS BASED ON AN ASSUMED DATUM
PROCESSED WITH [illegible] TO OVERCOME GEOMETRY OF LINE

PROCESSED THROUGH PHOENIX

RECORDING PARAMETERS	RECORDING GEOMETRY
PARTY [illegible] INSTRUMENTS [illegible] 24 CHANNEL TOTAL RECORD TIME 14 SECS SAMPLING RATE 4 MS [illegible] SWEEP RECORDING FILTER [illegible] BINARY GAIN SOURCE: VIBRATORS GEOPHONES: [illegible] NUMBER OF TRACES: [illegible] FIELD TAPE NOS: [illegible]	SPREAD [illegible] STATION INTERVAL [illegible] SPLIT-STRADDLE VIBRATED FROM [illegible] [illegible] VIBRATORS IN LINE [illegible] SPACING [illegible] MOVEUP 10 SWEEPS/VP GEOPHONE PATTERN WEIGHTED [illegible] 2 STRINGS OF 6 CONNECTED IN PARALLEL [illegible] INTERVAL

SEQUENCE	PROCESSING PARAMETERS		
1 DEMULTIPLEX	BINARY GAIN RECOVERY		
2 FDXCOR	FREQUENCY DOMAIN CROSSCORRELATION		
3 EDIT			
4 CDP SORT	12-FOLD. ELEV. VEL. [illegible] DATUM [illegible]		
5 TVTRIM	WINDOW 1000MS		
6 SEISPAK	NMO CORRECTIONS FAR TRACE BLANKED TO 900MS		
7 CSTAT	AUTOMATIC CDP STATICS AND STACK 5 TRACE PILOT		
8 DECONVOLUTION	TIME DOMAIN: DERIVATION WINDOW 200-1200MS. OPERATOR 100MS. GAP 30MS		
9 TVFILTER	[illegible]		
10DASELEV	TRACE EQUALIZATION		
DISPLAY	[illegible]	PROCESSED ADELAIDE NOVEMBER 1973	PREPARED BY C.R.-R.D.





00194

APPENDIX 8-I

00125

A REPORT ON THE EXPERIMENTAL PROGRAMME CARRIED OUT AT THE BEGINNING OF THE TARTWAUP SEISMIC SURVEY

FOR

ALLIANCE OIL DEVELOPMENT N.L.

BY

SEISMOGRAPH SERVICE LIMITED

OCTOBER 1973

INTRODUCTION.

The Tartwaup Seismic Survey is programmed to cover the area of the Western Otway Basin roughly South of the line Mount Gambier to Millicent.

This is an area well know to be difficult for recording good quality seismic records.

Perhaps the main difficulties are due to the geology peculiar to this area.

Four short lines were chosen throughout the prospect being representative of the various geological conditions expected.

The positions of these are shown on enclosure number 1.

- TA - An area in which near surface volcanic material could make recording difficult.
- TD - An elevated sandy area where previous seismic shows reflections below the tertiary are difficult to obtain.
- TE - An area of surface or near surface limestone.
- TL - An area where underground caves could be expected to make recording difficult.

The approach to the experimental programme was to evaluate the systems of "noise" associated with each area and to record a trial spread using a basic field technique and a representative suite of sweep frequencies.

The same set of experiments was carried out at each of the four positions and the data flown to the Adelaide processing centre and played out over night.

The experiments were completed in three days.

TECHNICAL DETAILS.

A noise spread consisting of 12 bunched geophones in 24 groups spaced 25 metres apart were laid to the side of the road or track. One vibrator was used to make 10 sweeps using a 45-5Hz 14 second long sweep at each of 6 positions off the end of the geophone spread to give a maximum offset of 3600 metres.

These noise spreads were played out with different filters to show the frequency spectrum of the noise systems.

These noise spreads are shown in enclosure number 2.

Enclosure number 4 show the relative positions of the noise spread geophone and vibrator points and the relative geophone spacing was computed for each vibrator position to enable the true velocity to be picked across each set of 24 traces of the noise spreads.

The variations in positions from a straight line were due to the meanders of the roads used.

The velocities and frequencies were picked and it can be seen that the main interfering event is a low frequency ground roll with a velocity about 760 m/s and a frequency about 16 Hz.

A trial spread was also laid out with the following parameters:-

Geophone interval 125 metres.

Geophone pattern 11222211 spaced 10 metres apart.

Vibrator pattern 3 spaced 22 metres apart.

Number of sweeps 10.

Move up between sweeps 9 metres.

Vibrator offset from Geophone spread 500 metres.

Sweep frequencies 35-5Hz, 40-10Hz, 45-15Hz. 14 seconds long.

These records are shown in enclosure number 3.

The 45-15Hz sweep record was repeated with the vibrator drive reduced to half. This was done as it was felt that a lower level energy input would generate less interference.

The reduced vibrator drive did not show any significant improvement in signal to noise, however as both the full drive and the reduced drive records are comparable this suggests that energy input is sufficient with the normal full drive production technique.

The three sweep comparisons confirm the noise spread results that the lower frequencies generate high interference.

The problem then is to generate only usefull reflection energy and to stack as many variable ray paths as economically possible to allow the reflected energy the best chance of recovery from the varied coherent noise systems.

It is for this reason a fairly long geophone interval of 125 metres was chosen and a 12 fold stacking technique.

It was decided to use an end on technique on the first line to allow a practical measurement of the best offset for the best depth of section.

This was changed to split straddle for the remainder of the programme on two main considerations, firstly the excessive MNO stretch which necessitated the editting out of most of the longer offset data and secondly an indication on the raw field records that the outer traces bore less reflected energy than the inner traces.

It was intended to produce two sections for comparison from the end on line of the outer 12 against the inner 12 traces but the excessive NMO stretch made this a worthless exercise.

The geophone and vibrator patterns were designed for production recording to attenuate the ground roll which is centred about a wavelength of 54 metres, the response curves are shown in enclosure number 5.

The initial production sweep was chosen as 45-10Hz but was later changed to 40-15Hz to reduce the amount of low frequency interference generated and because filter tests indicated that no useful energy was reflected above 40Hz.

Initial results on line TA show a reasonable section down to 2 seconds with very broken geology.

Signed For SEISMOGRAPH SERVICE LTD.

M. Covil

M. COVIL.
Supervisor Australia.

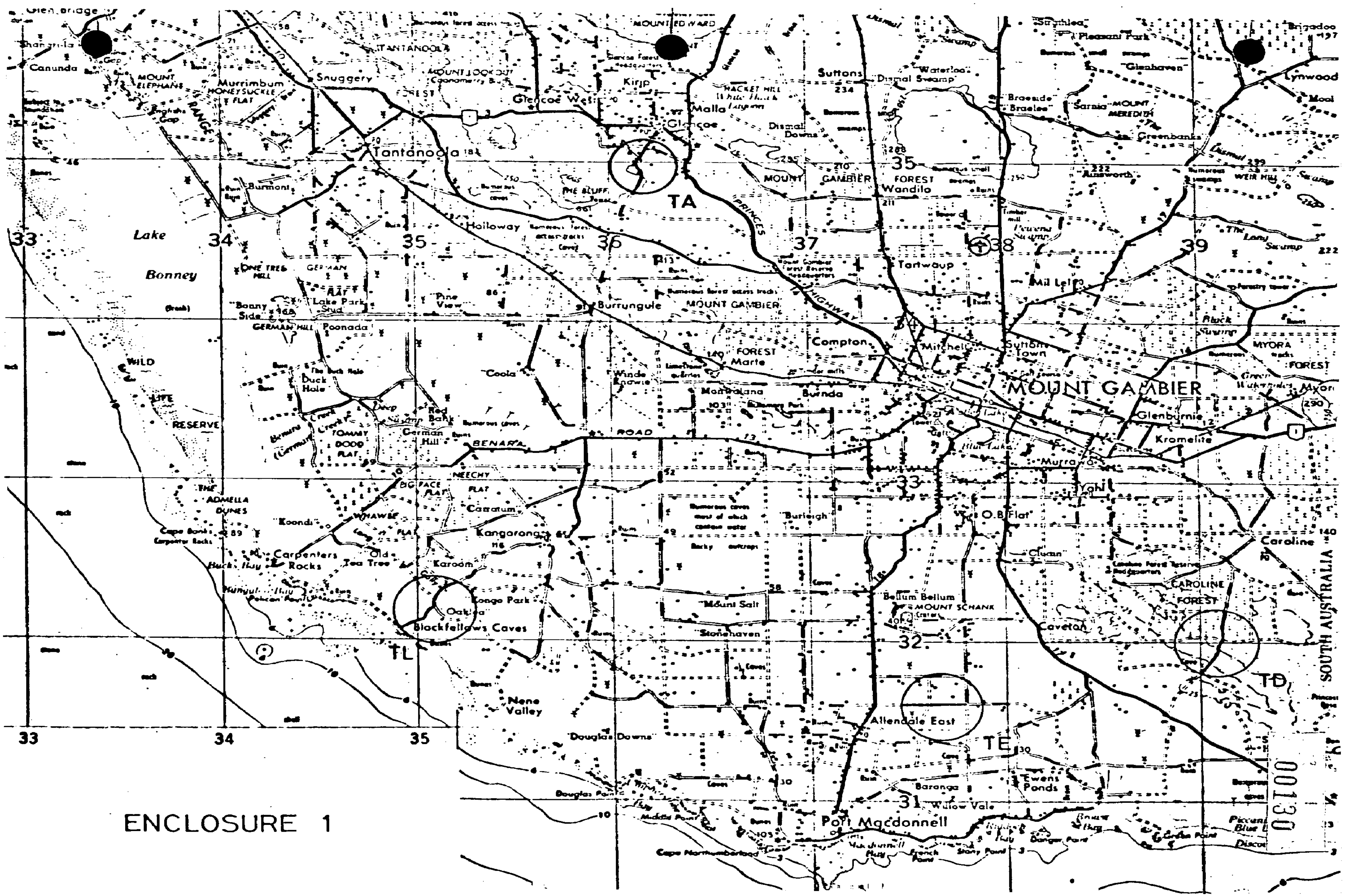
ENCLOSURE 1. MAP SHOWING 4 EXPERIMENTAL AREAS.

2. NOISE SPREAD SECTIONS.

3. SWEEP COMPARISONS.

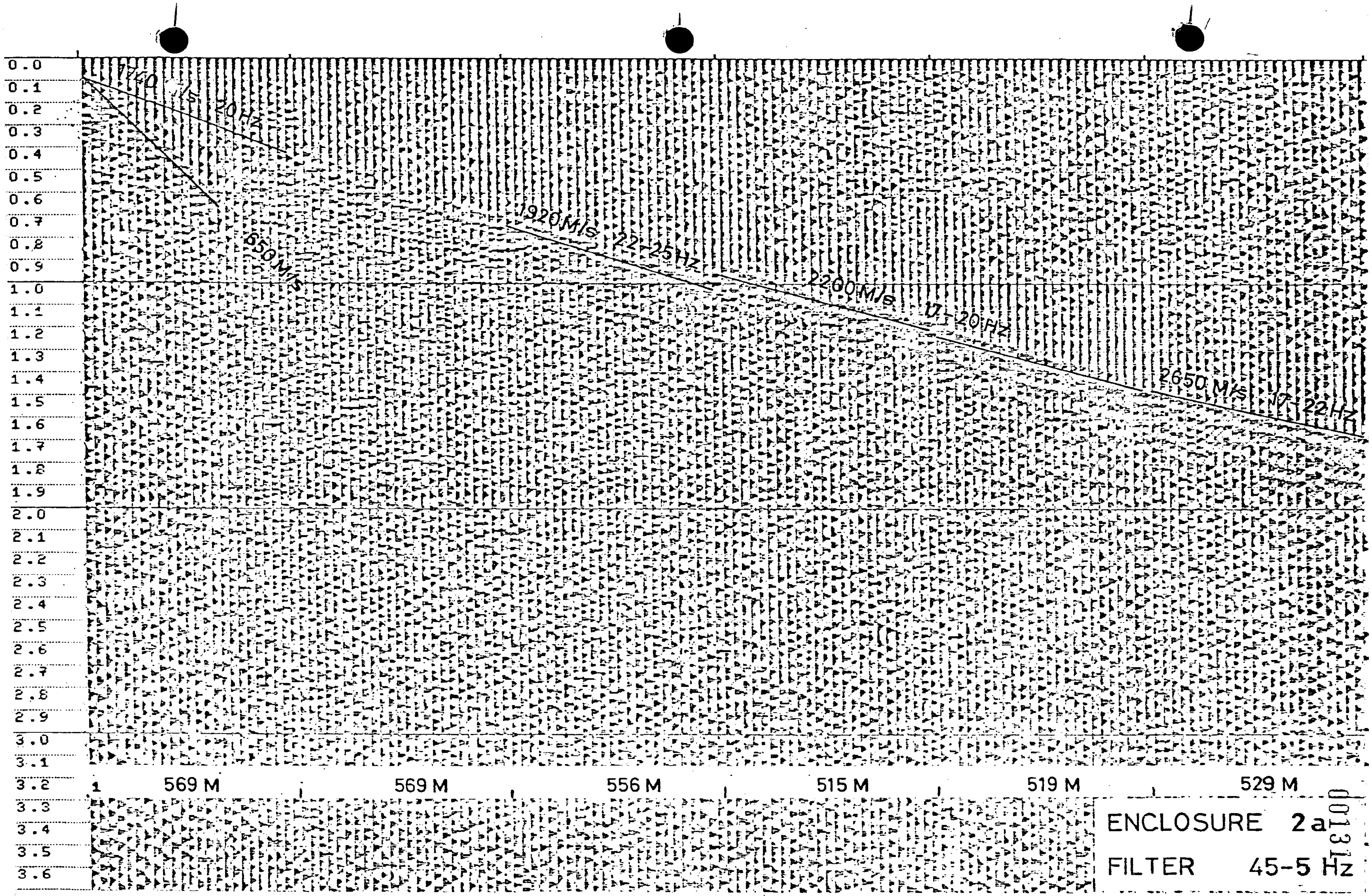
4. NOISE SPREAD LAY OUT.

5. GEOPHONE & VIBRATOR PATTERN RESPONSE CURVES.



ENCLOSURE 1

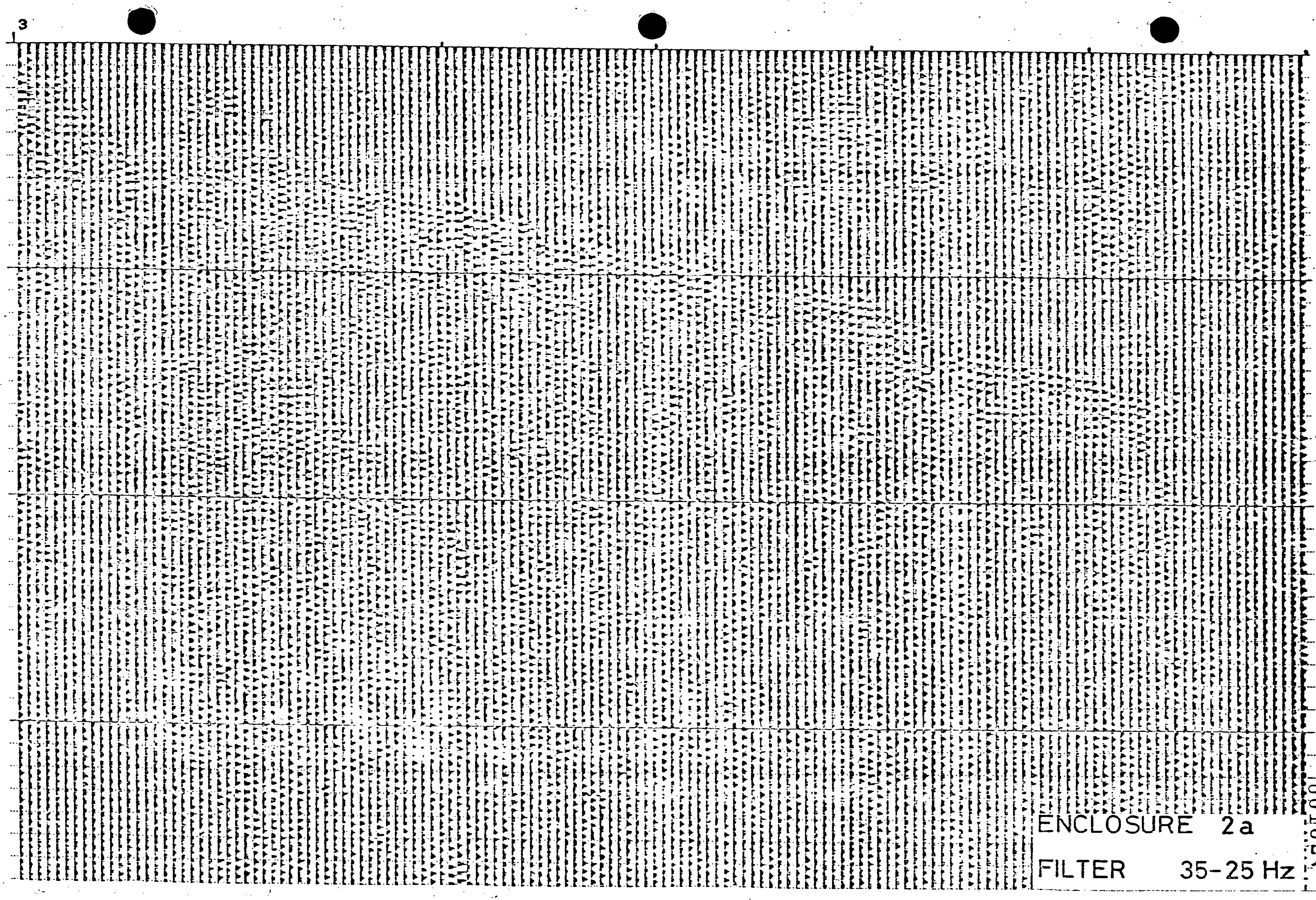
001130



ENCLOSURE 2a

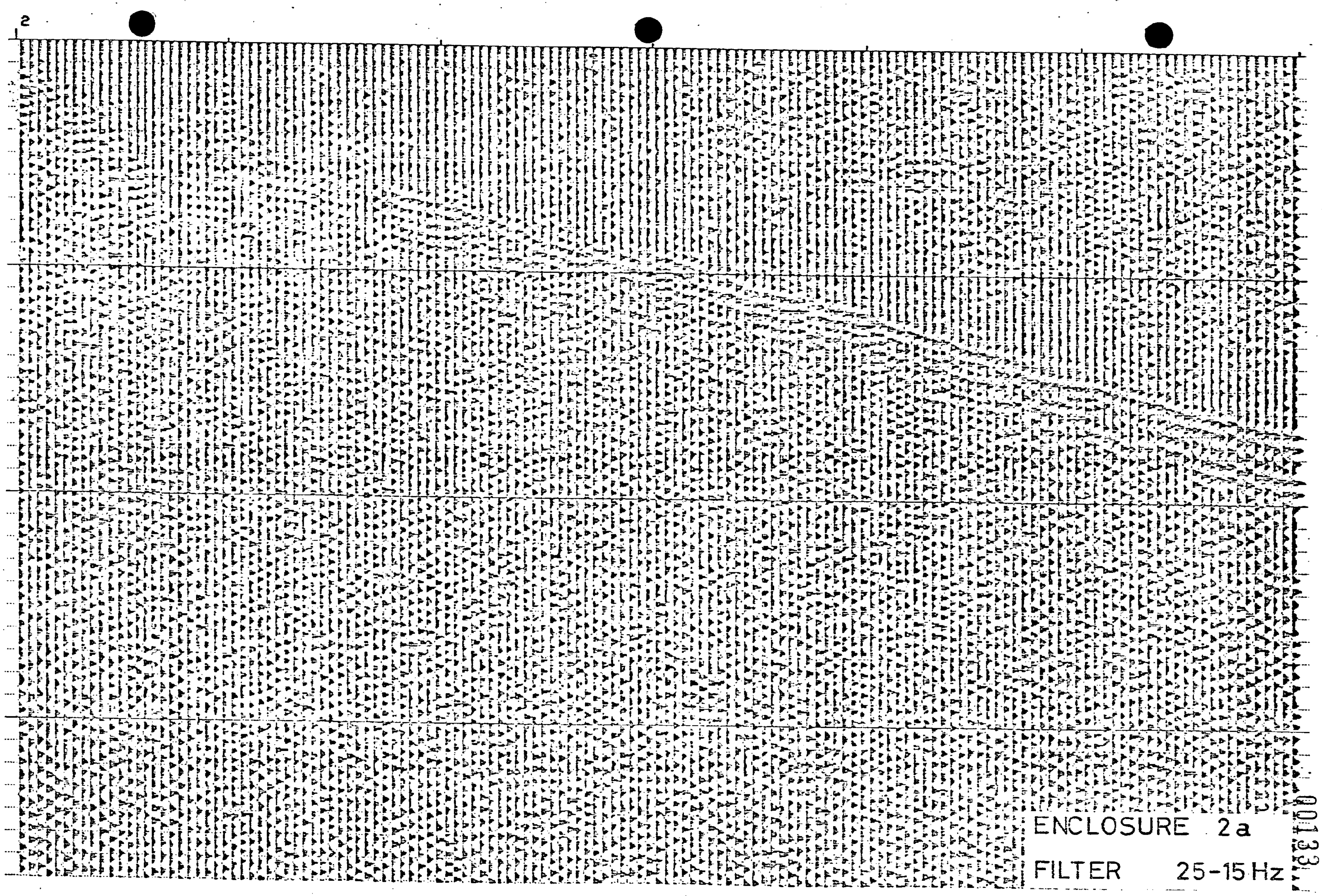
FILTER 45-5 Hz

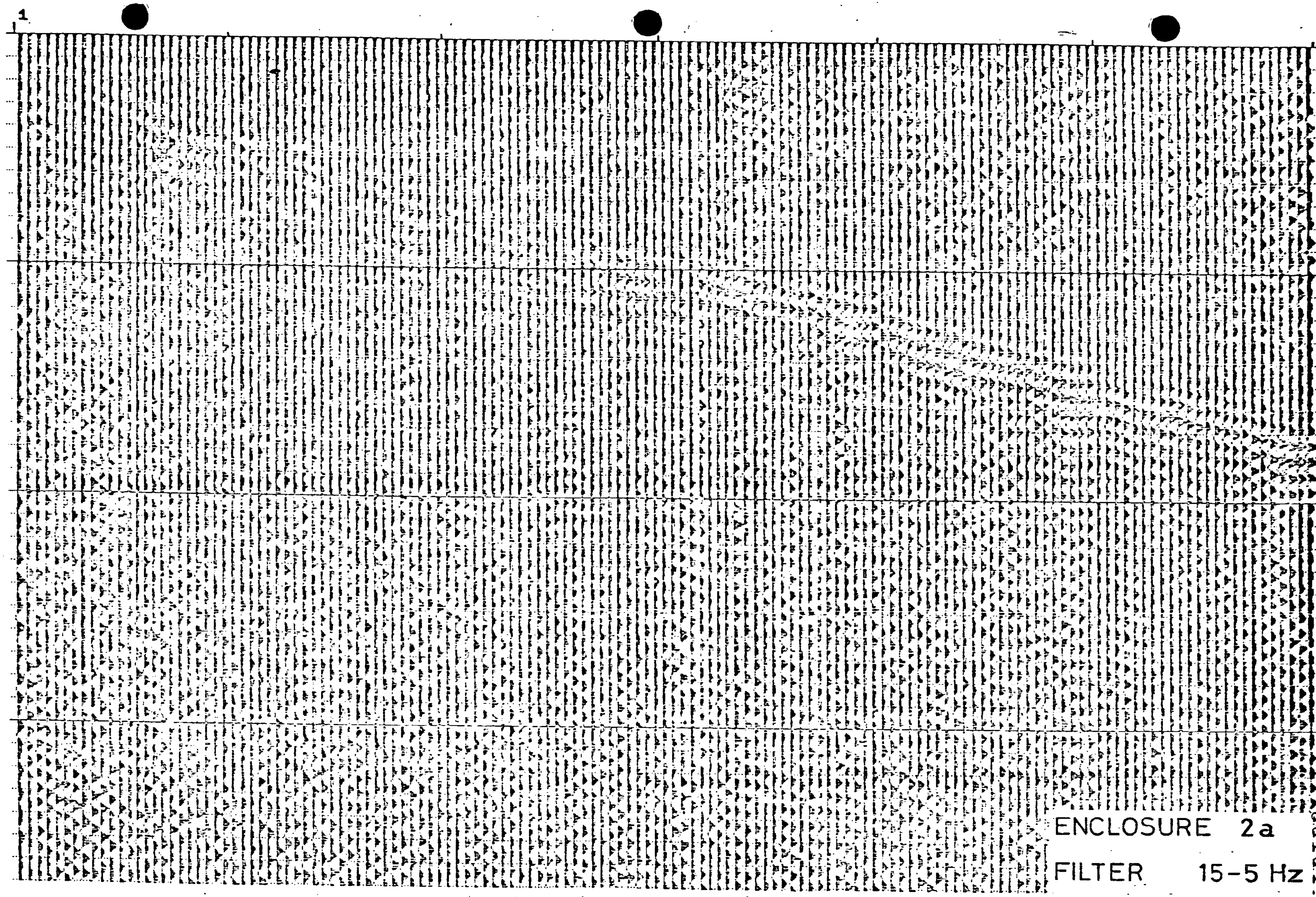
00131



ENCLOSURE 2a

FILTER 35-25 Hz

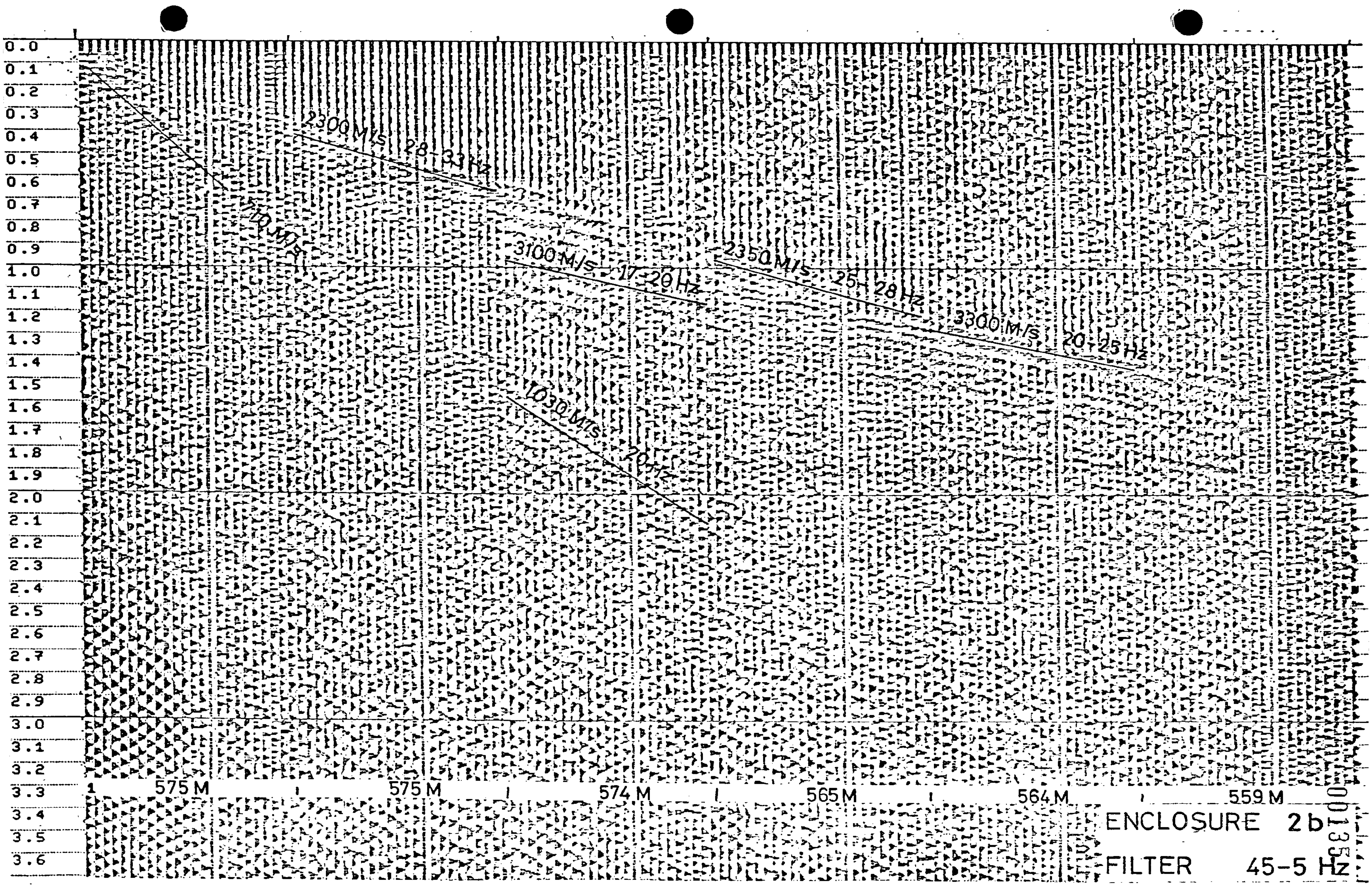

2
ENCLOSURE 2a
FILTER 25-15 Hz

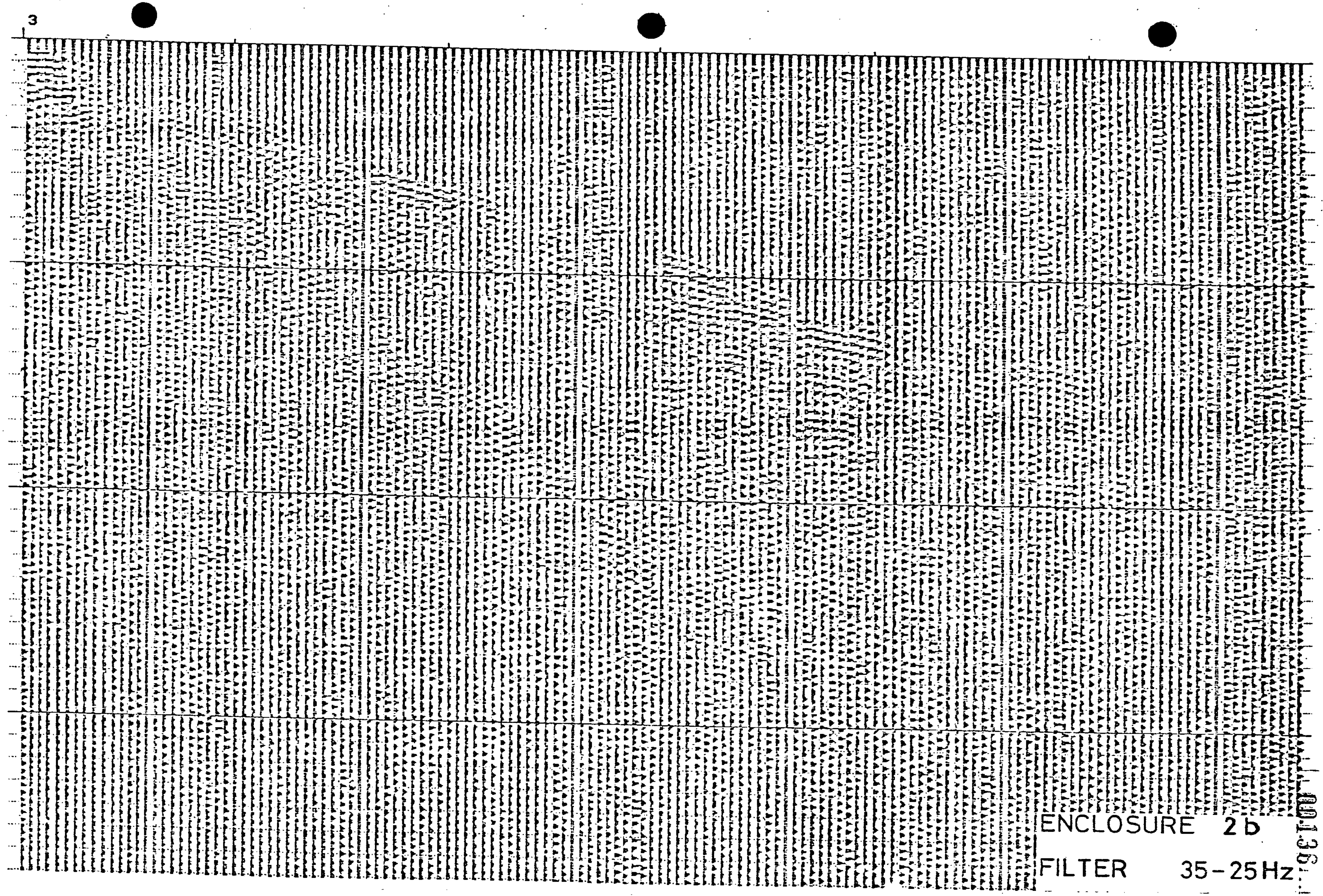


ENCLOSURE 2a

FILTER 15-5 Hz

00134

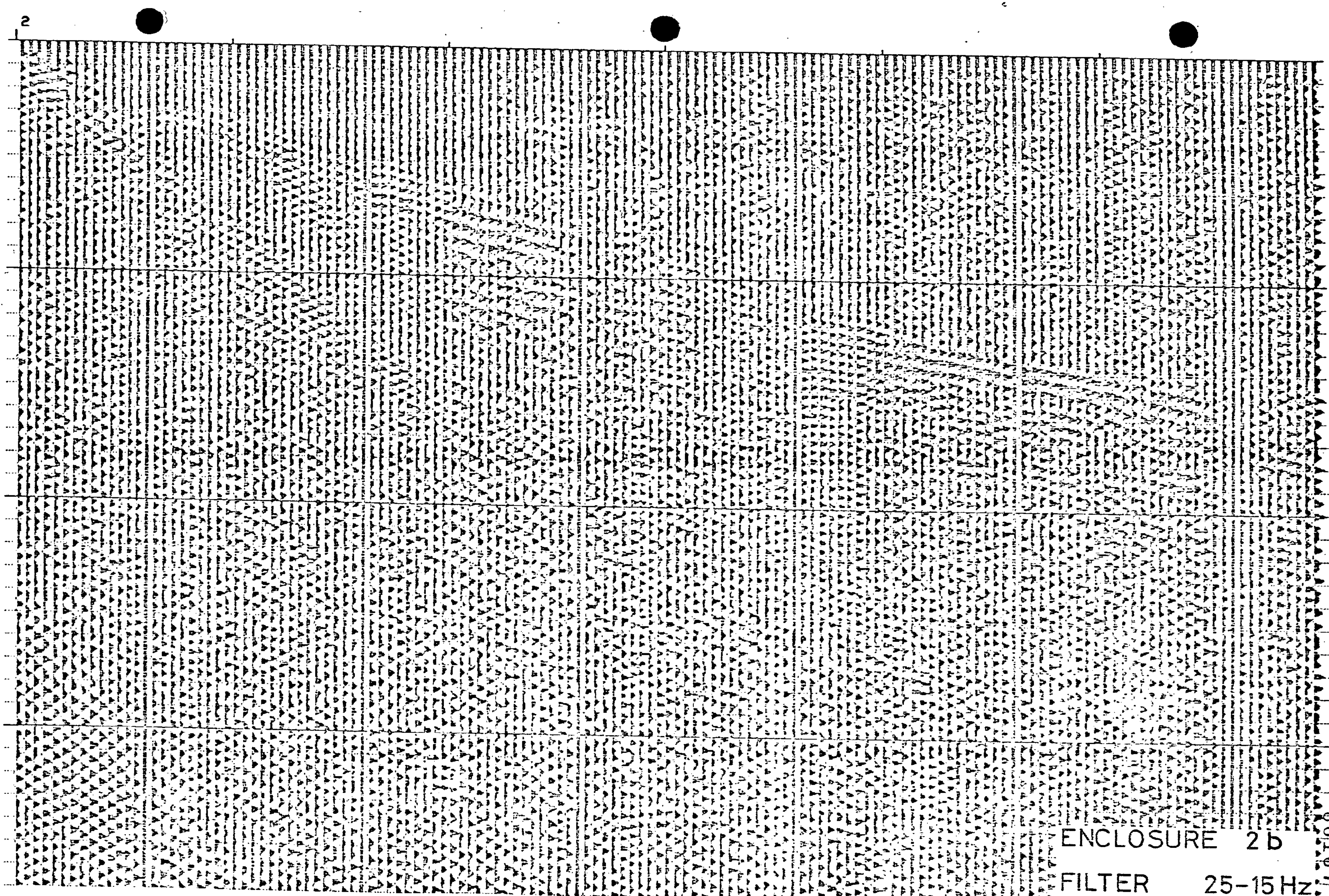

2300 M/s 28-33 Hz
3100 M/s 17-20 Hz
2350 M/s 25-28 Hz
3300 M/s 20-25 Hz
1030 M/s 20 Hz
575 M
575 M
574 M
565 M
564 M
559 M
ENCLOSURE 2b
FILTER 45-5 Hz



ENCLOSURE 2b

FILTER 35-25Hz

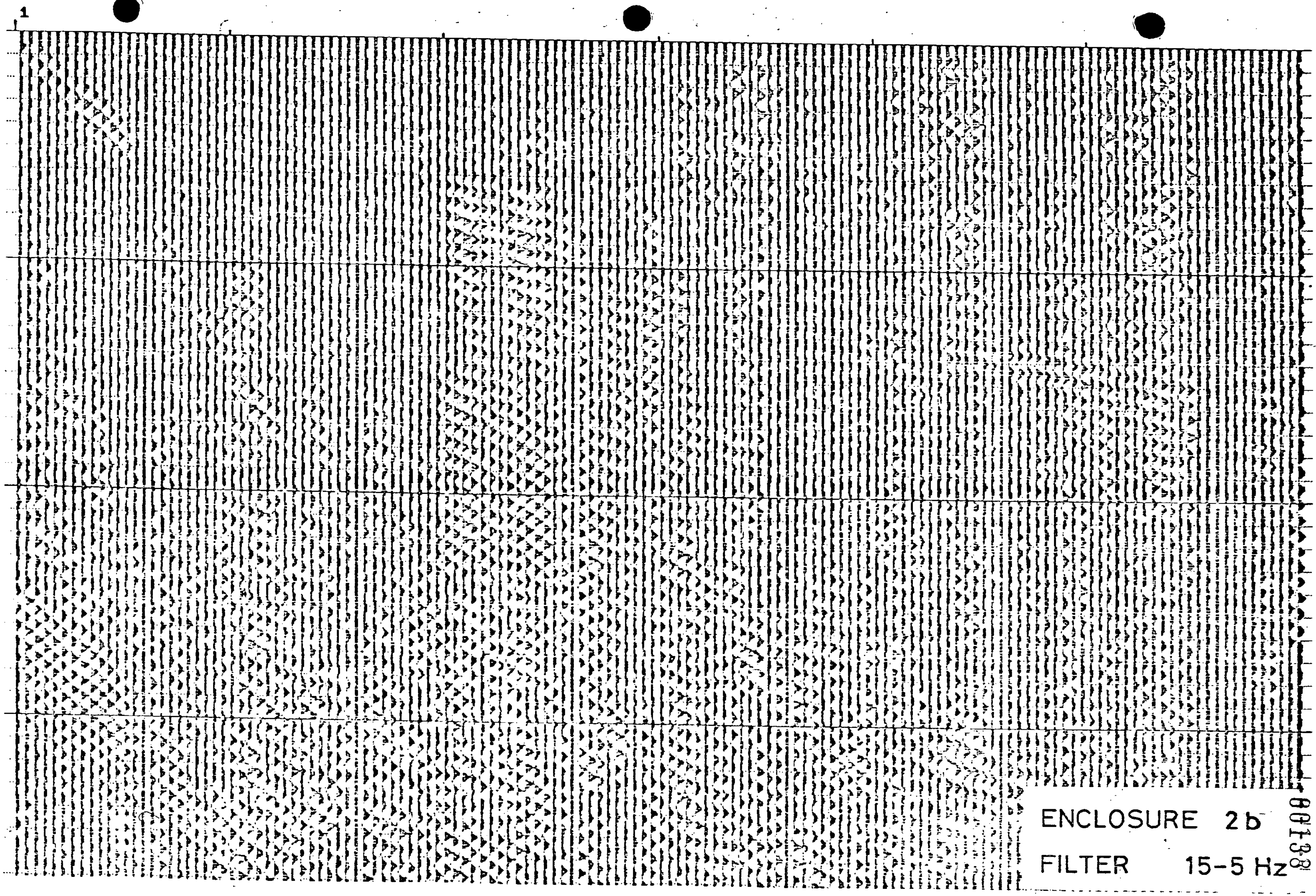
00136



ENCLOSURE 2b

FILTER 25-15 Hz

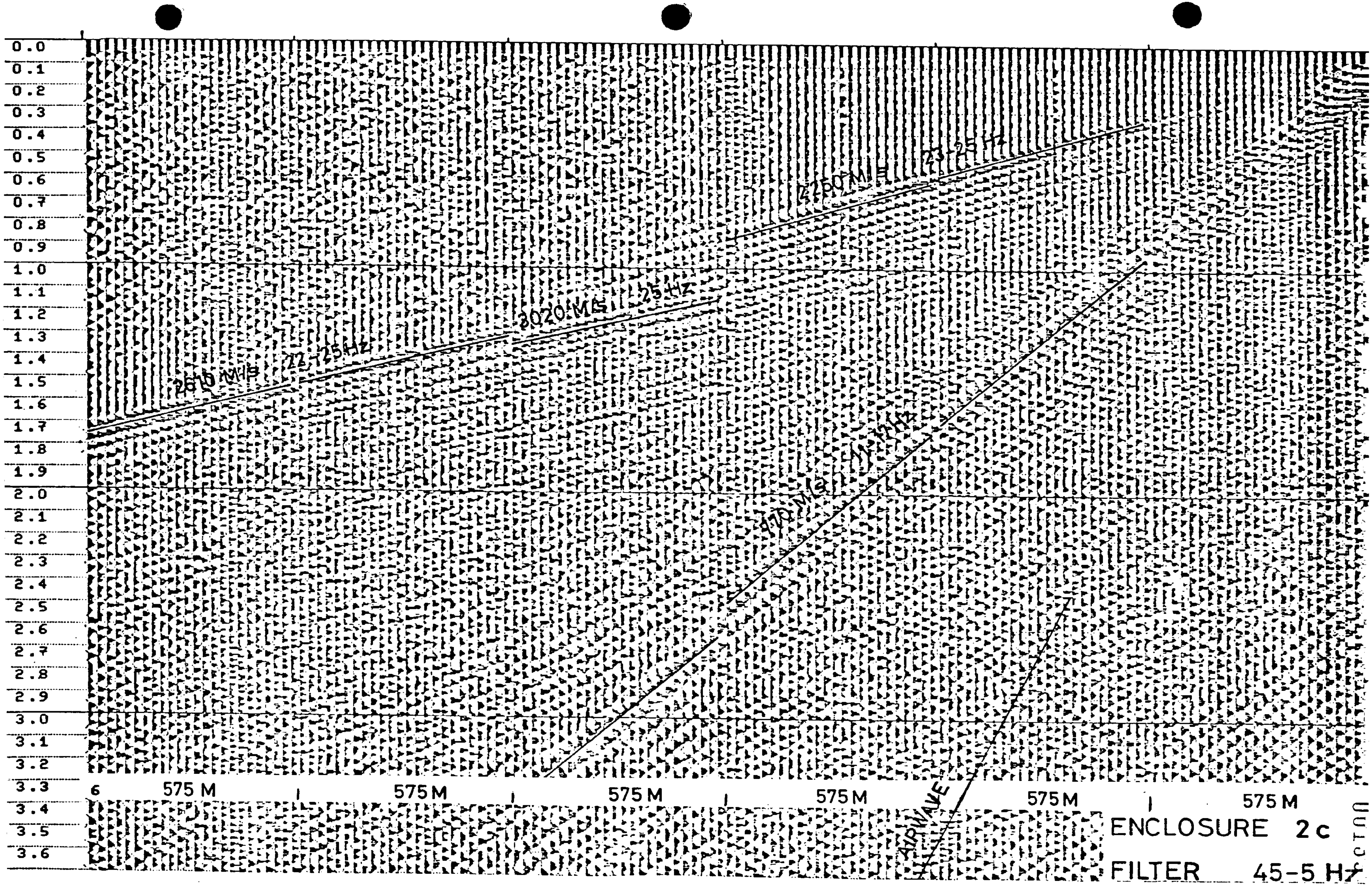
00137



ENCLOSURE 2b

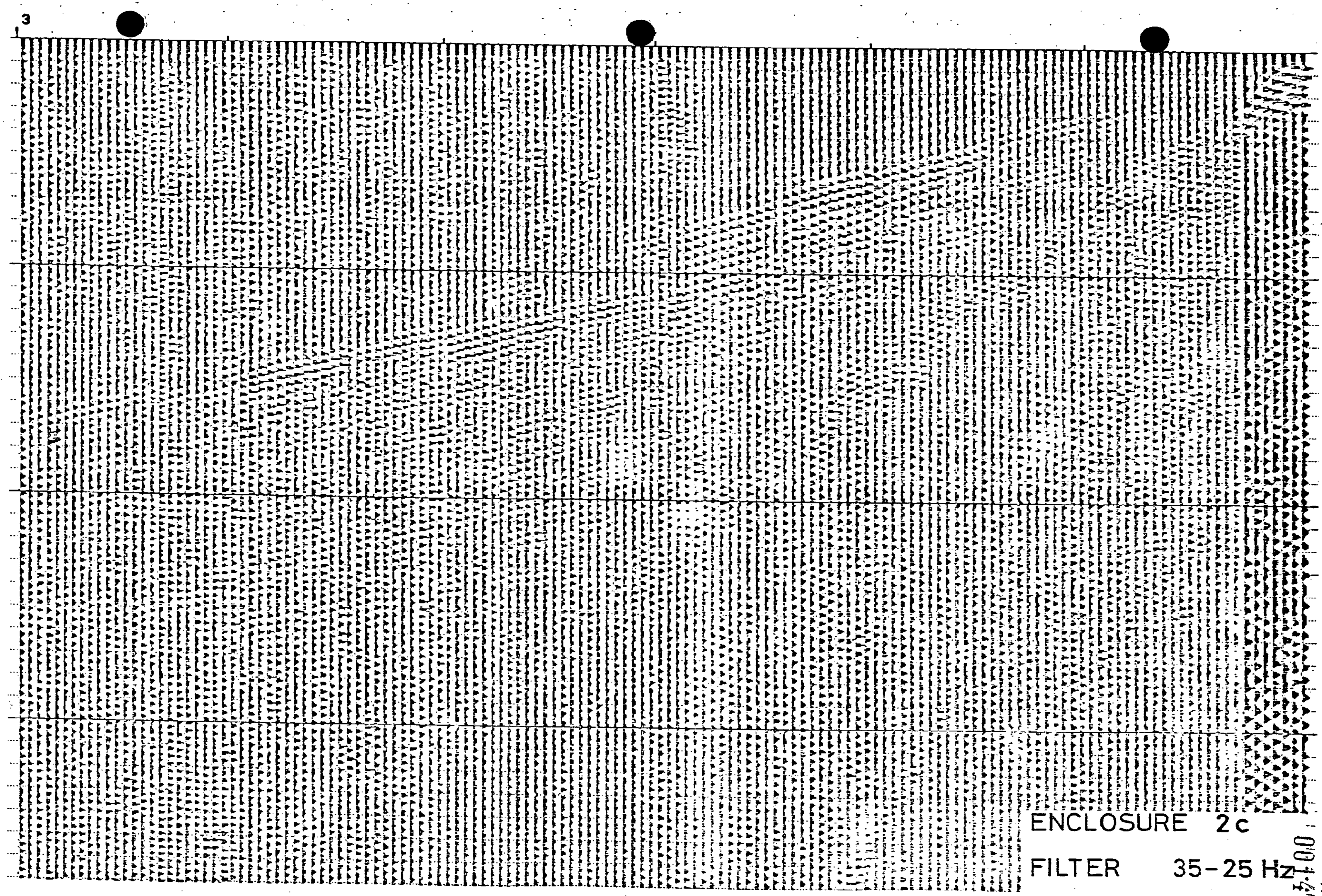
FILTER 15-5 Hz

00138



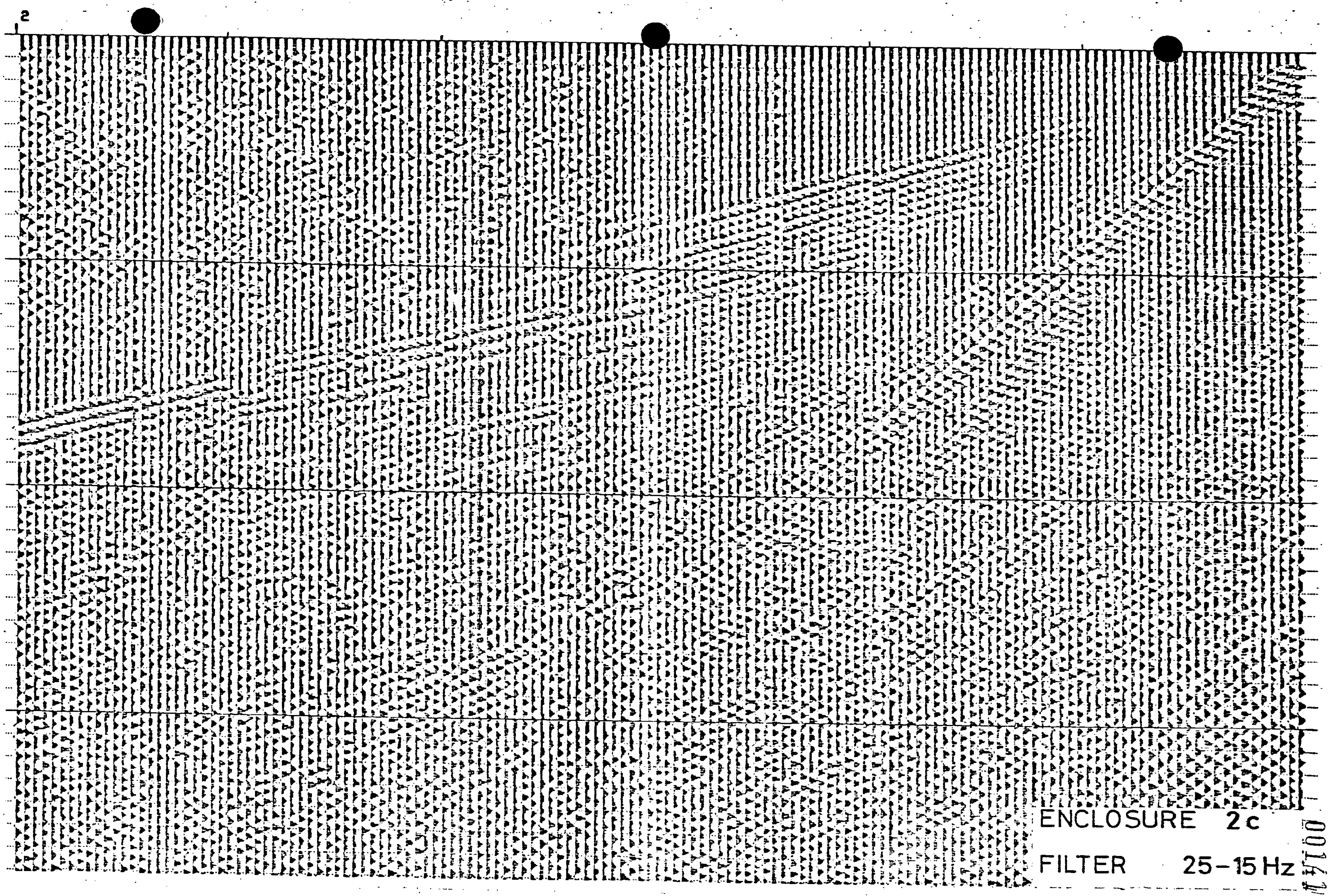
ENCLOSURE 2c

FILTER 45-5 Hz



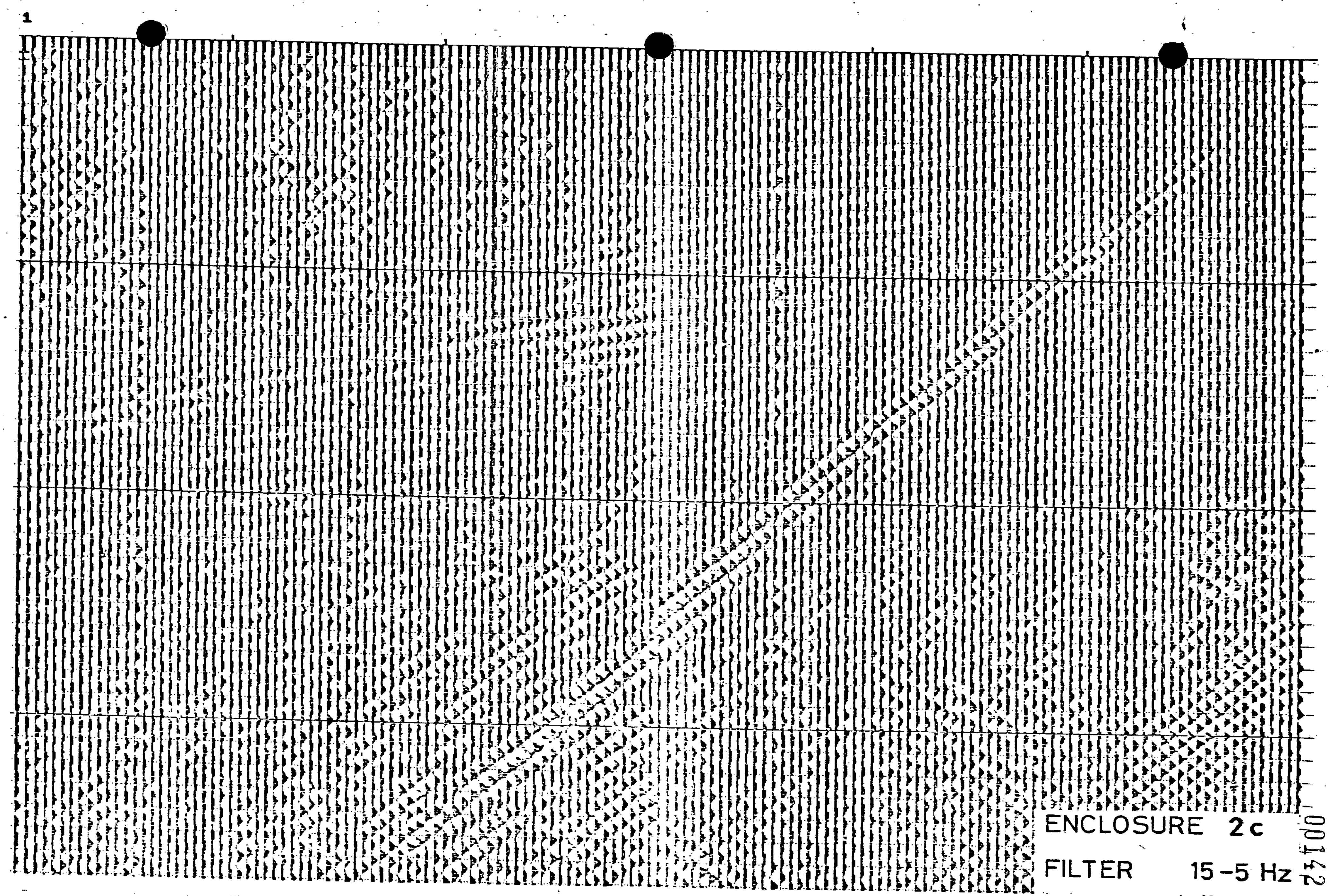
ENCLOSURE 2c

FILTER 35-25 Hz



ENCLOSURE 2c

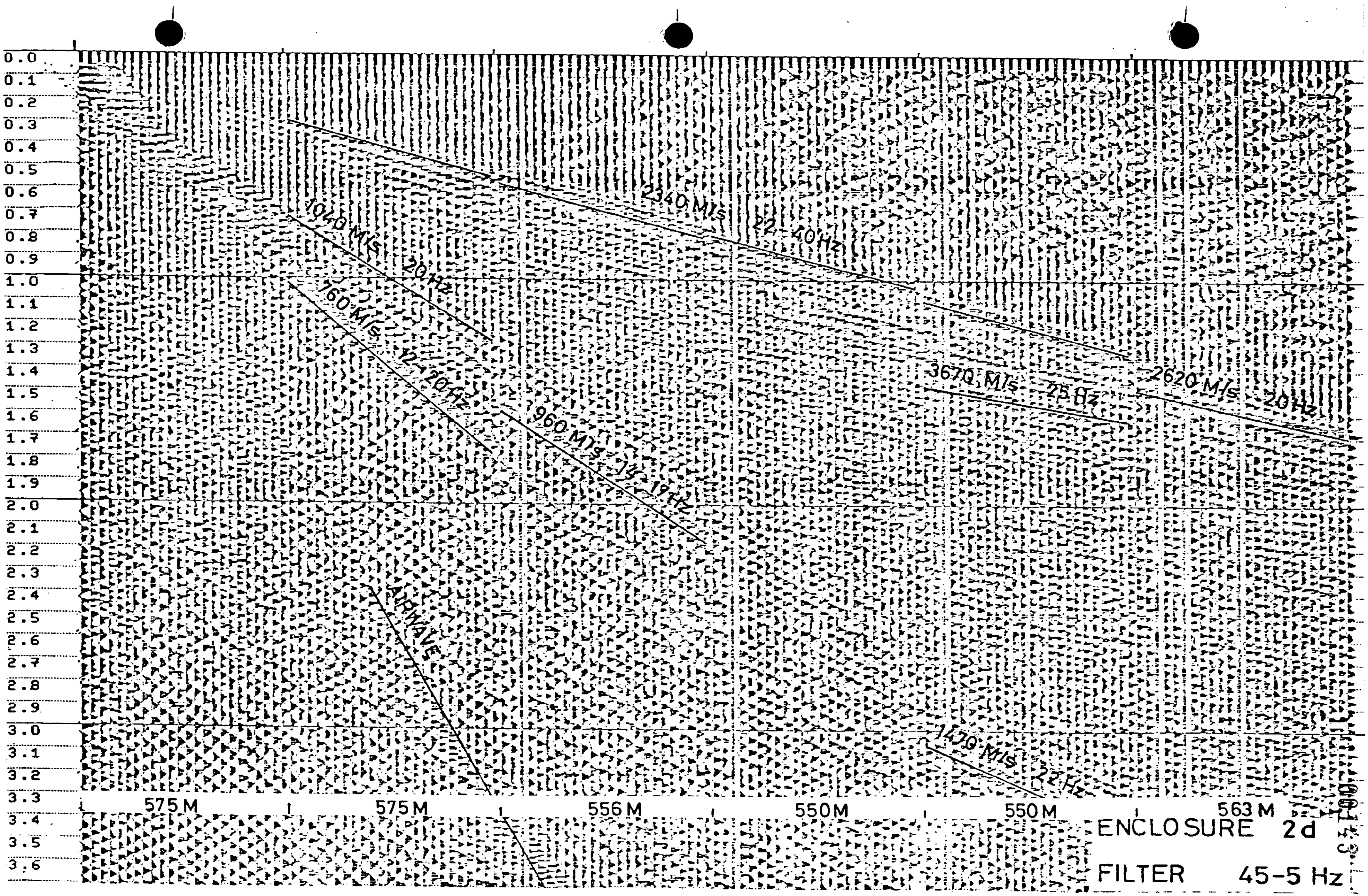
FILTER 25–15 Hz

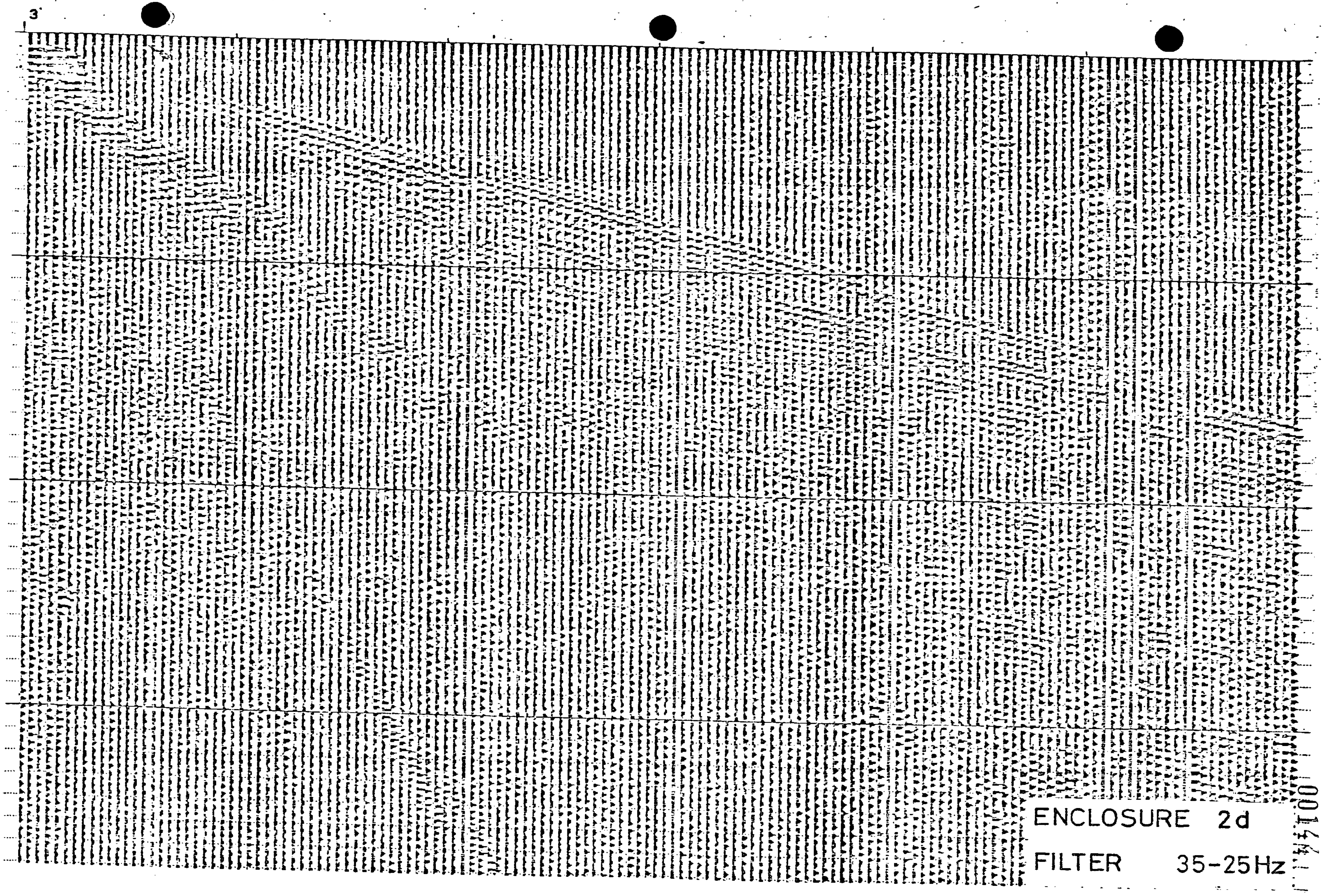


ENCLOSURE 2c

FILTER 15-5 Hz

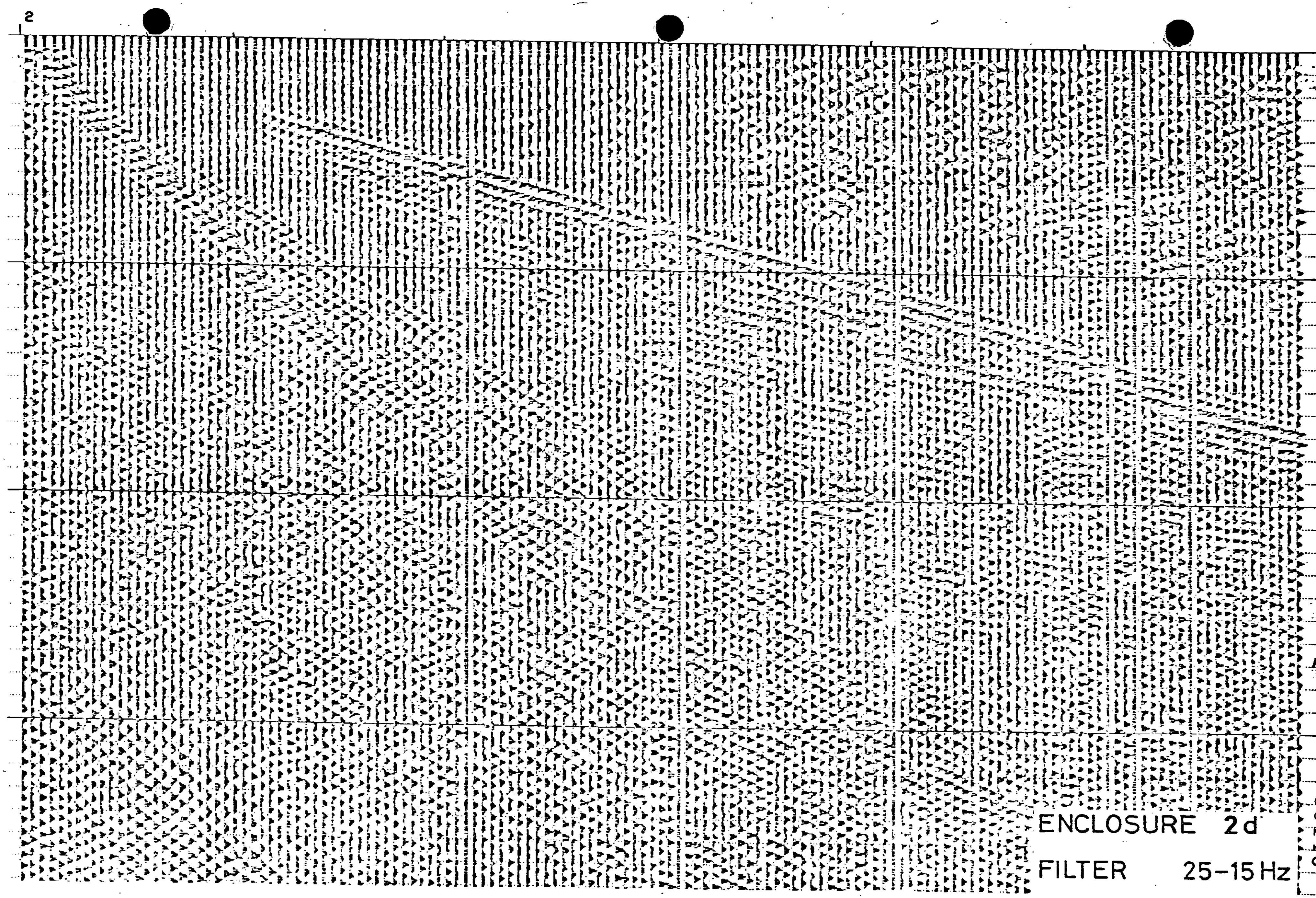
00142


0.0
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
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3.0
3.1
3.2
3.3
3.4
3.5
3.6
2340 M/s 22-40 Hz
1040 M/s 20 Hz
760 M/s 12-20 Hz
960 M/s 14-19 Hz
3670 M/s 25 Hz
2620 M/s 20 Hz
AIRWAVE
1470 M/s 22 Hz
575 M
575 M
556 M
550 M
550 M
563 M
ENCLOSURE 2d
FILTER 45-5 Hz



ENCLOSURE 2d

FILTER 35-25Hz

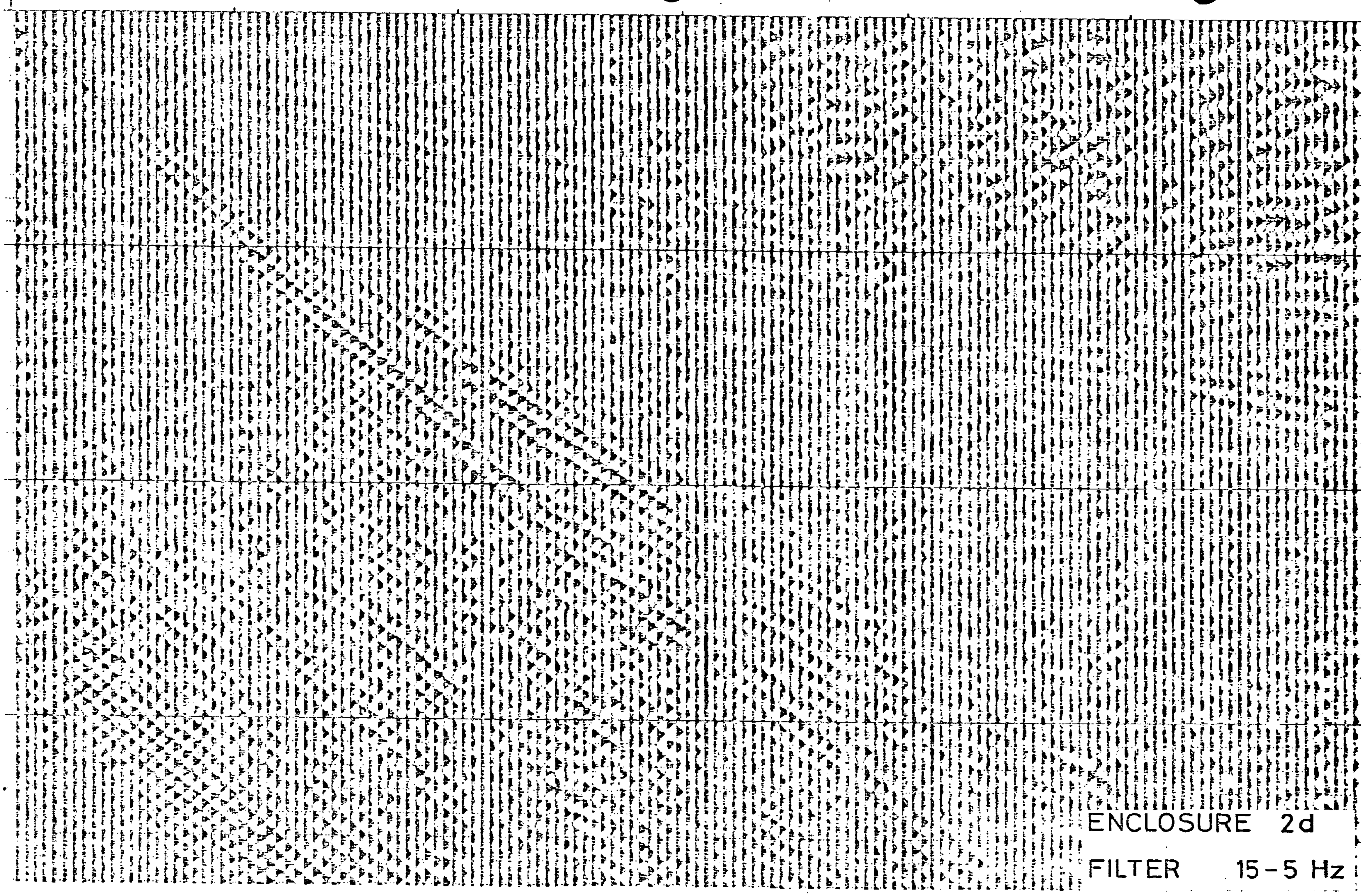


ENCLOSURE 2d

FILTER 25–15 Hz

00145

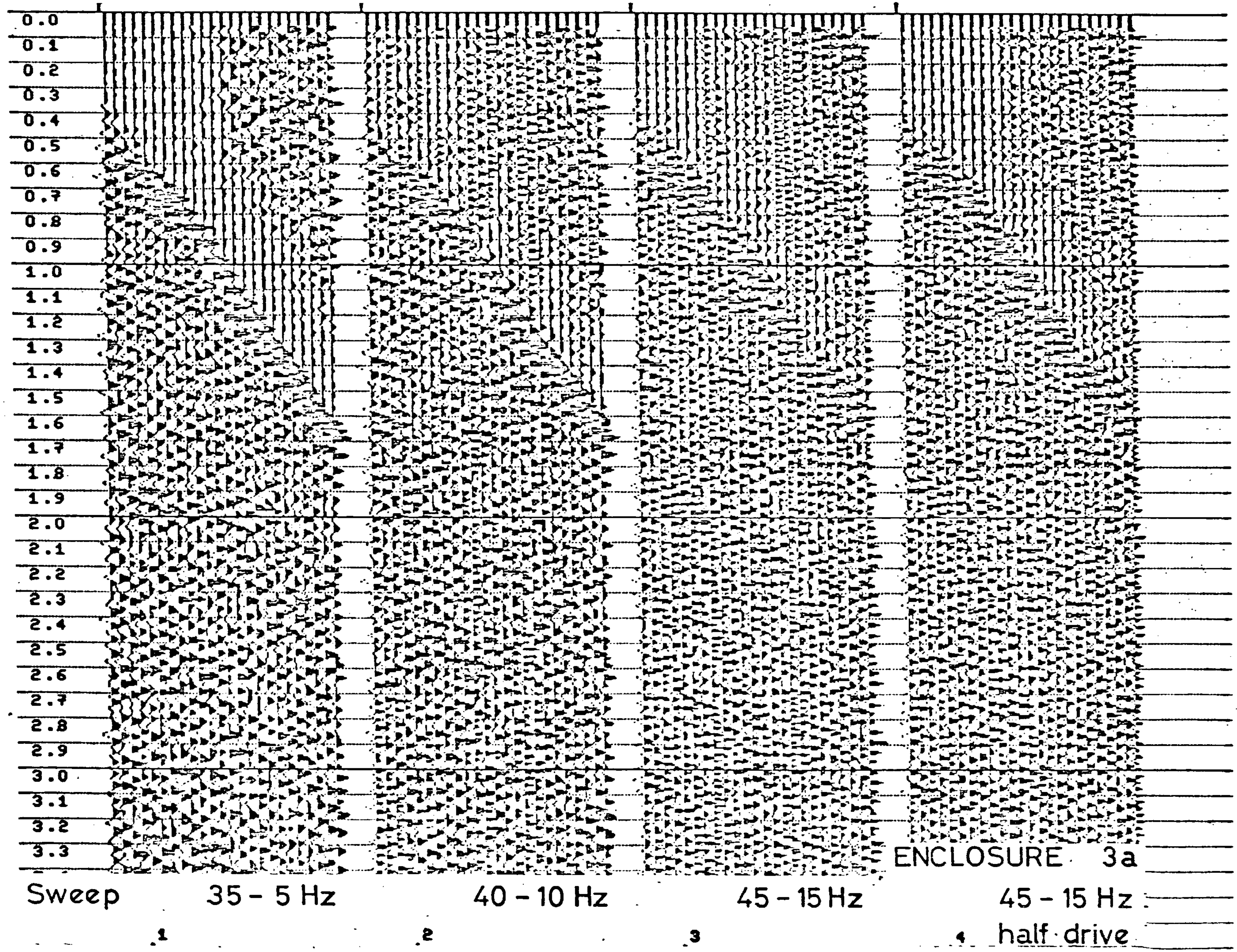
1



ENCLOSURE 2d

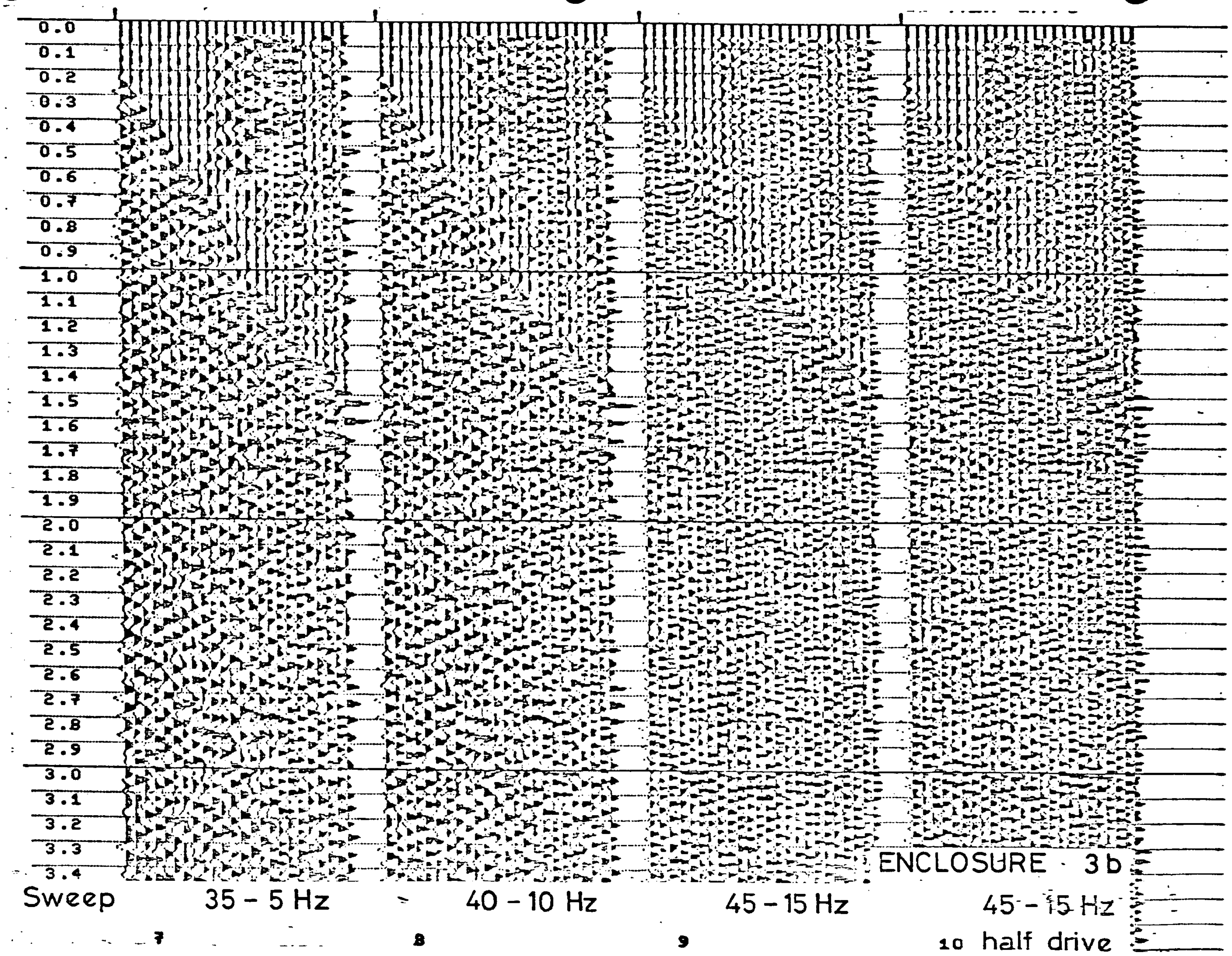
FILTER 15 - 5 Hz

00146



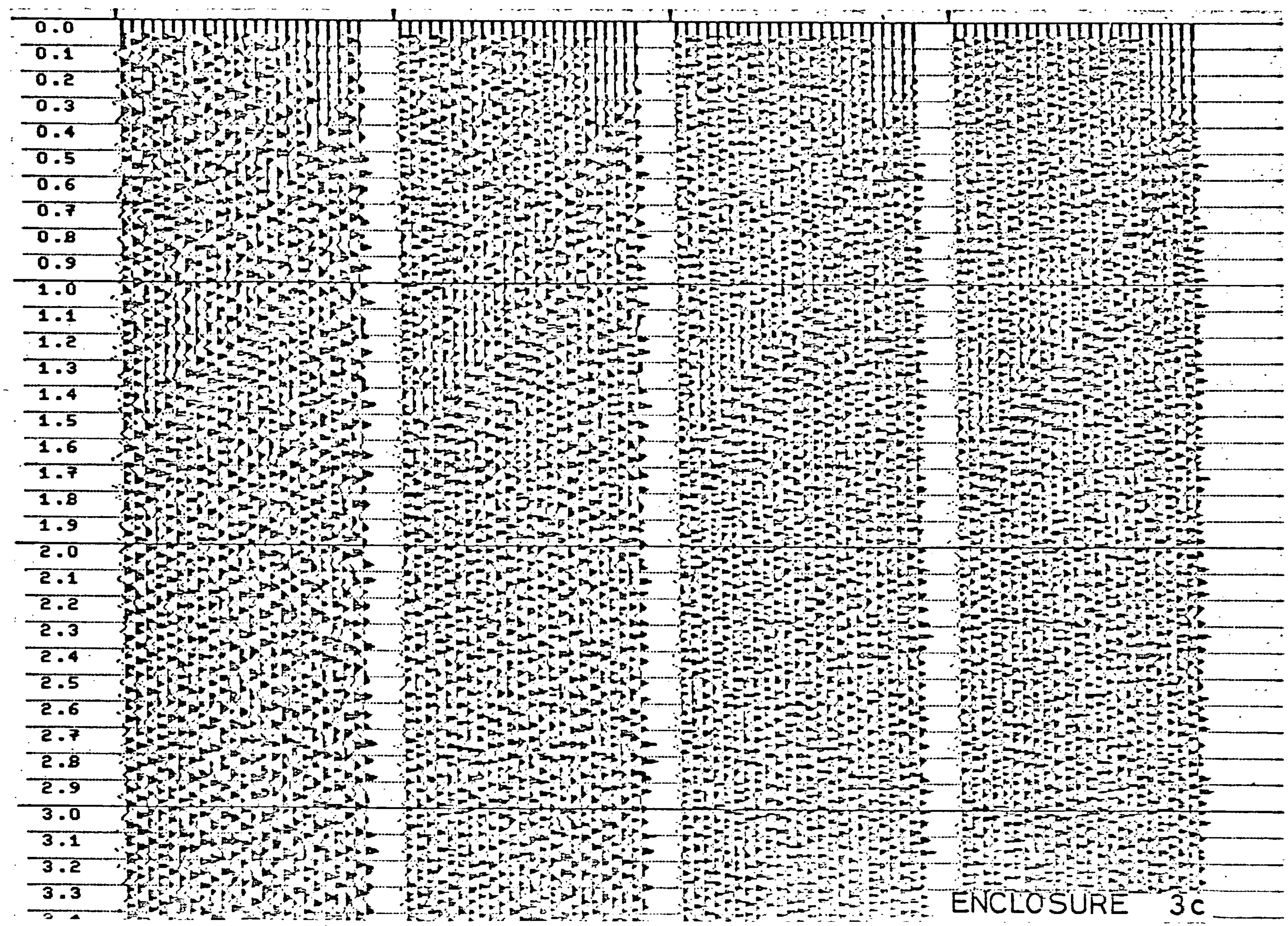
ENCLOSURE 3a

00147



ENCLOSURE 3b

00148

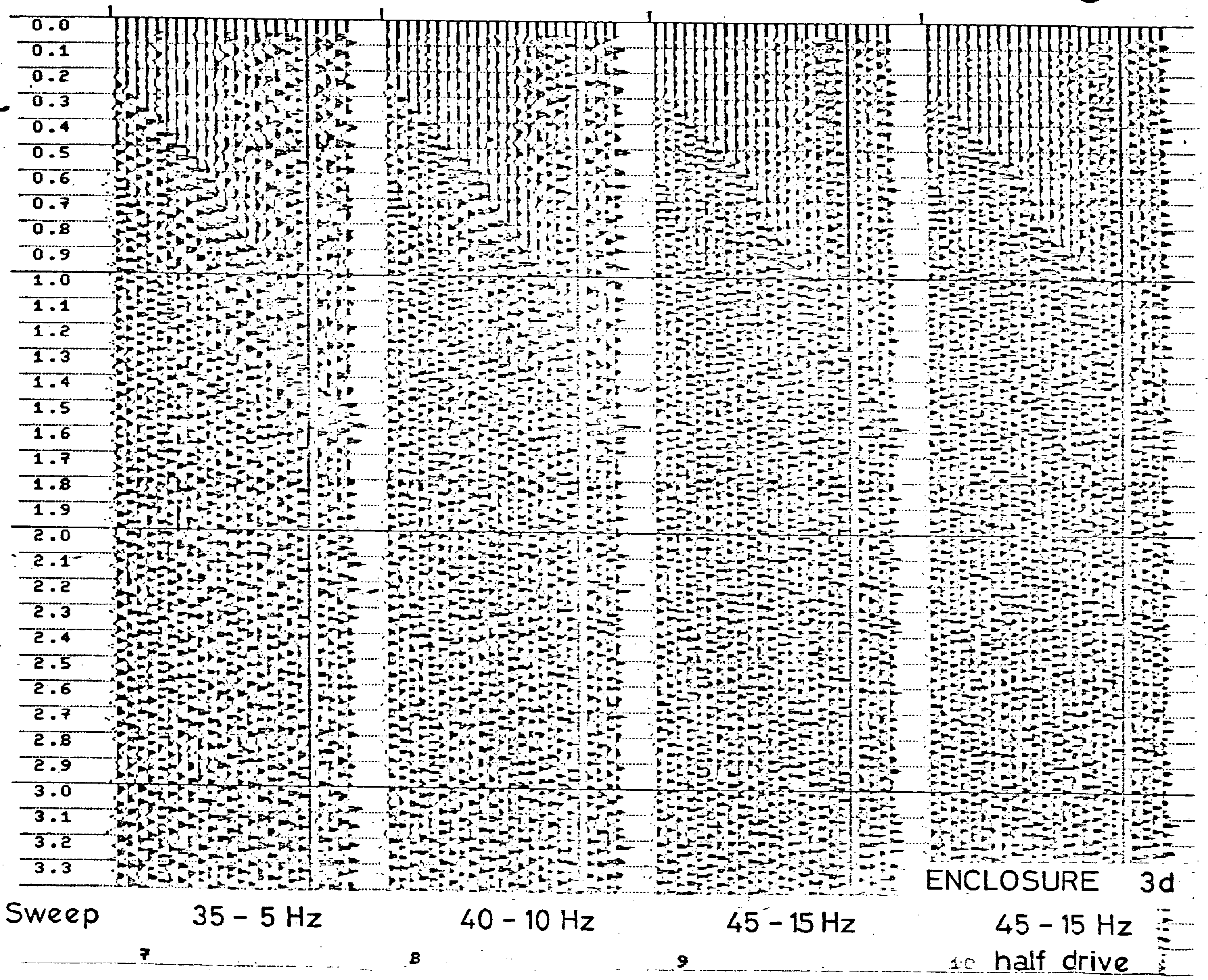


ENCLOSURE 3c

Sweep 35 - 5 Hz 40 - 10 Hz 45 - 15 Hz 45 - 15 Hz

half drive

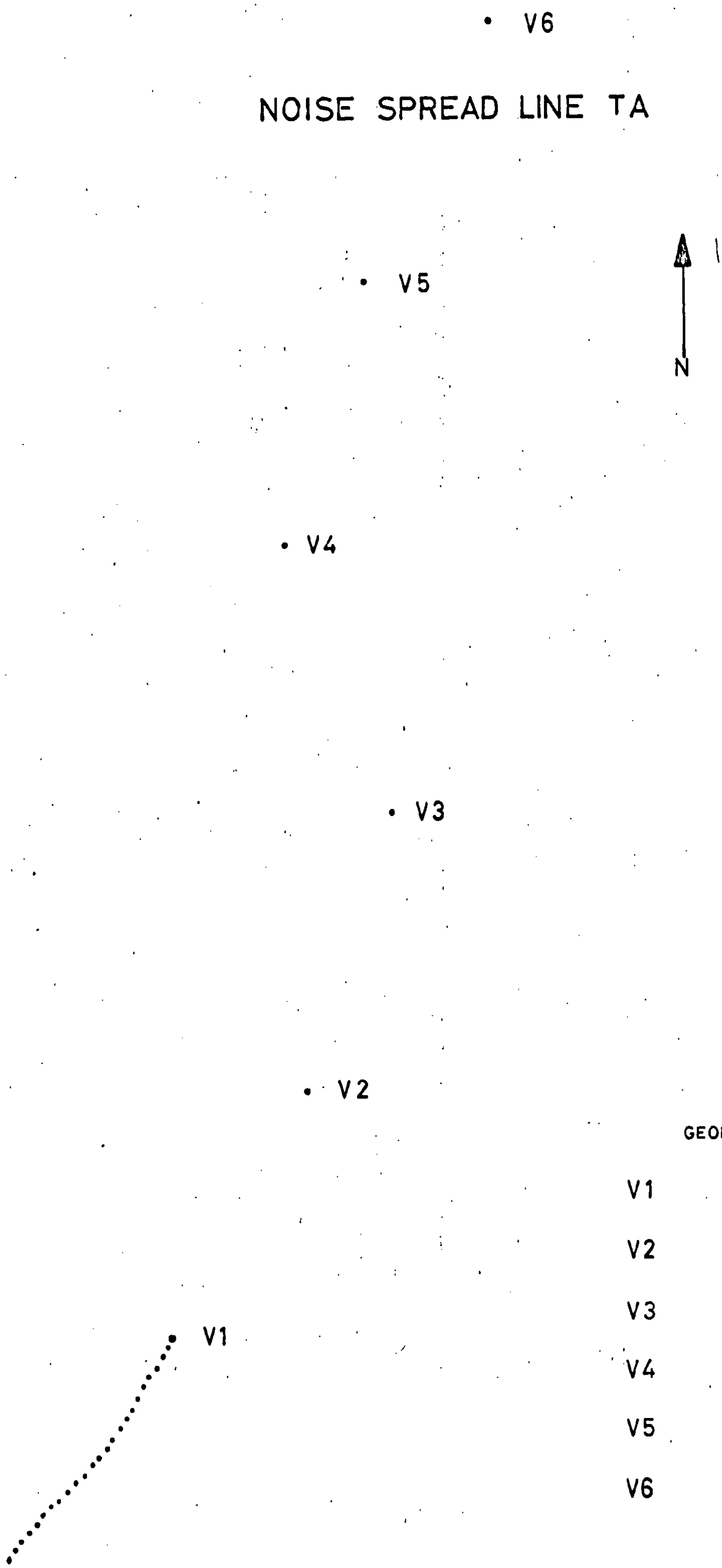
00149



ENCLOSURE 3d

00150

NOISE SPREAD LINE TA



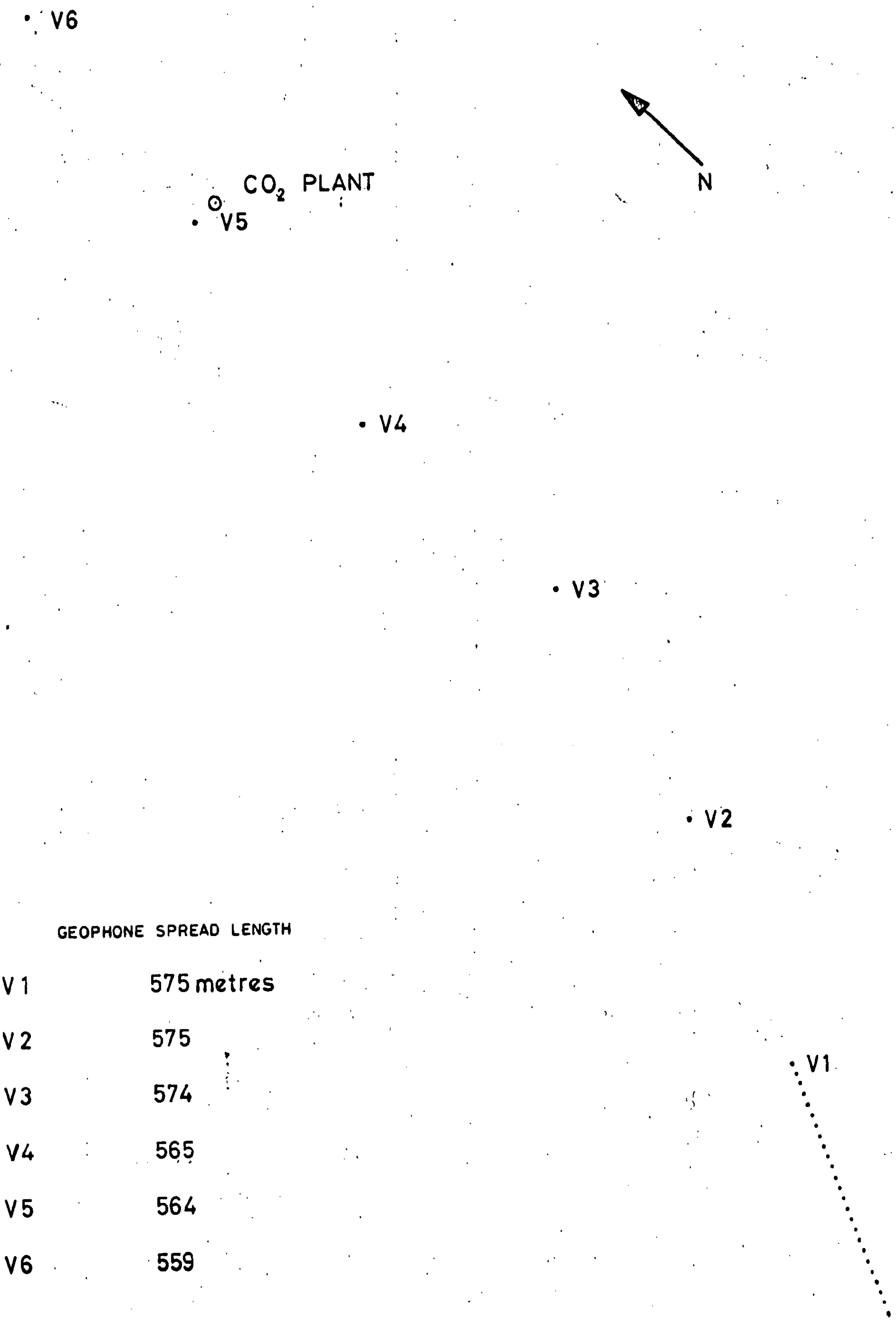
GEOPHONE SPREAD LENGTH

V1	569 metres
V2	569
V3	556
V4	515
V5	519
V6	529

SCALE 1:12500

ENCLOSURE 4a

NOISE SPREAD LINE TD



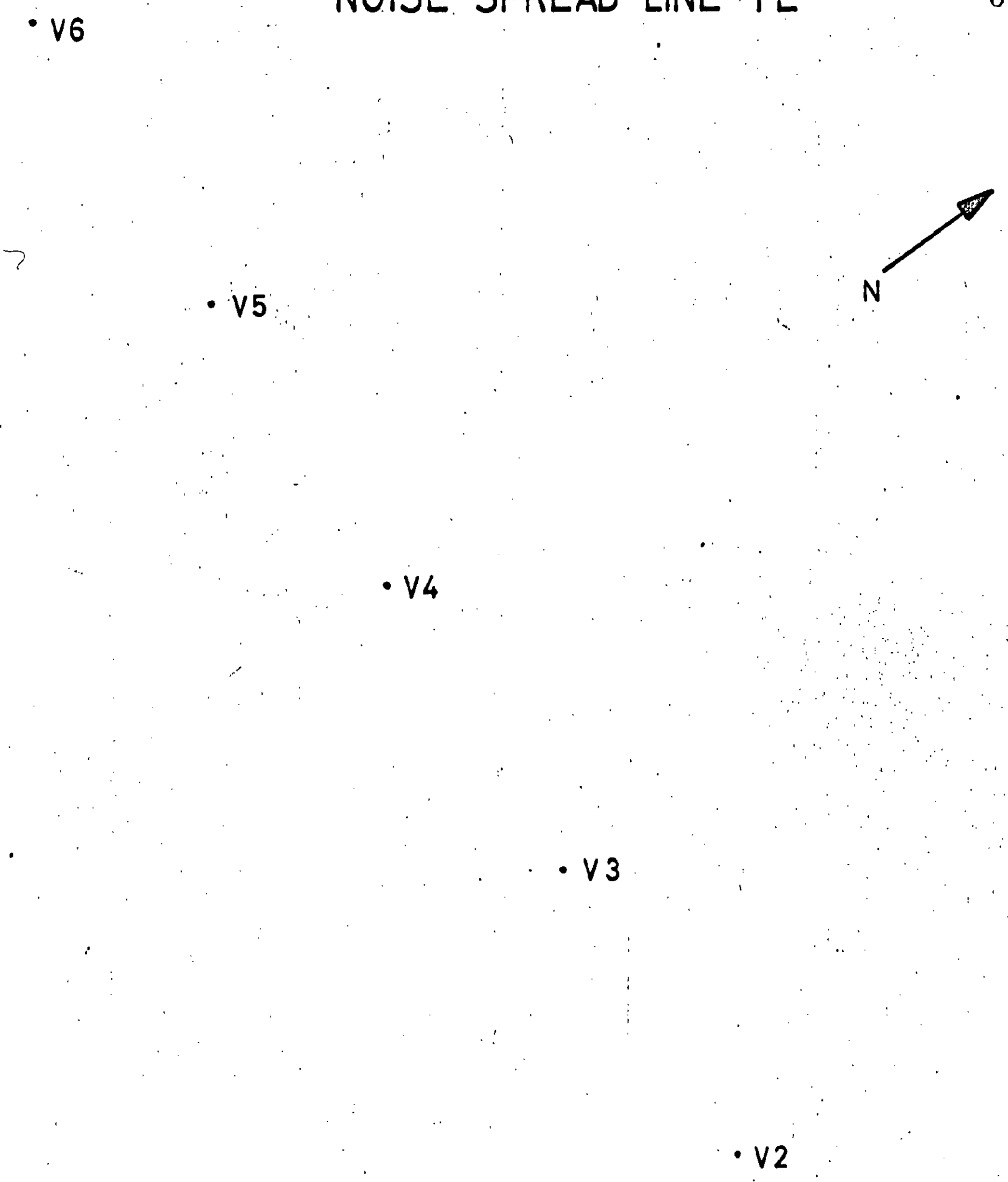
GEOPHONE SPREAD LENGTH

V1	575 metres
V2	575
V3	574
V4	565
V5	564
V6	559

SCALE 1:12500

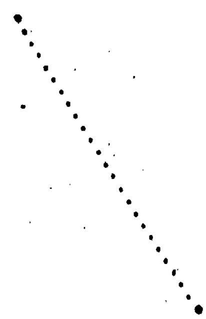
ENCLOSURE 4b

NOISE SPREAD LINE TE



GEOPHONE SPREAD LENGTH

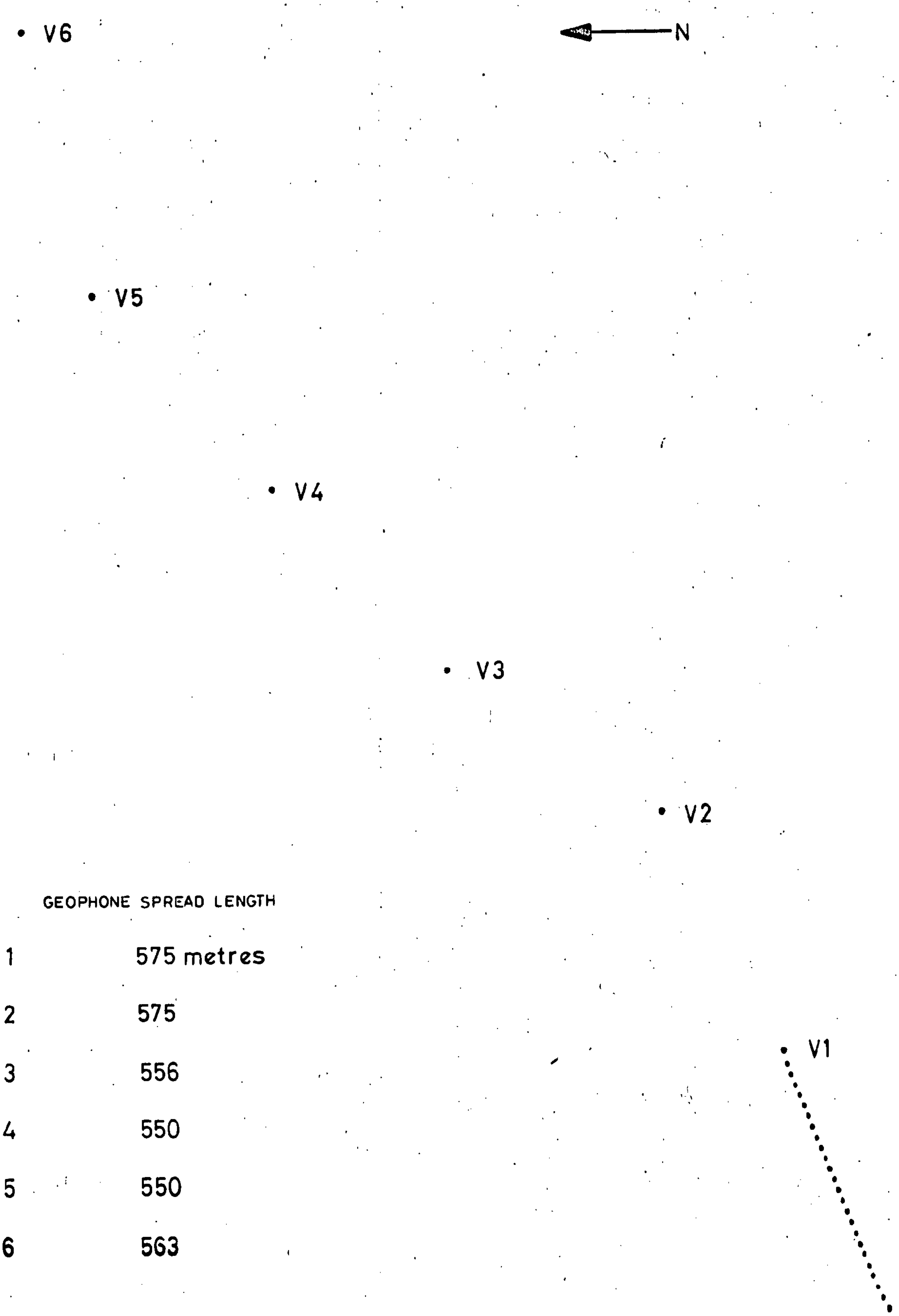
V1	575 metres
V2	575
V3	575
V4	575
V5	575
V6	575



SCALE 1:12500

ENCLOSURE 4c

NOISE SPREAD LINE TL



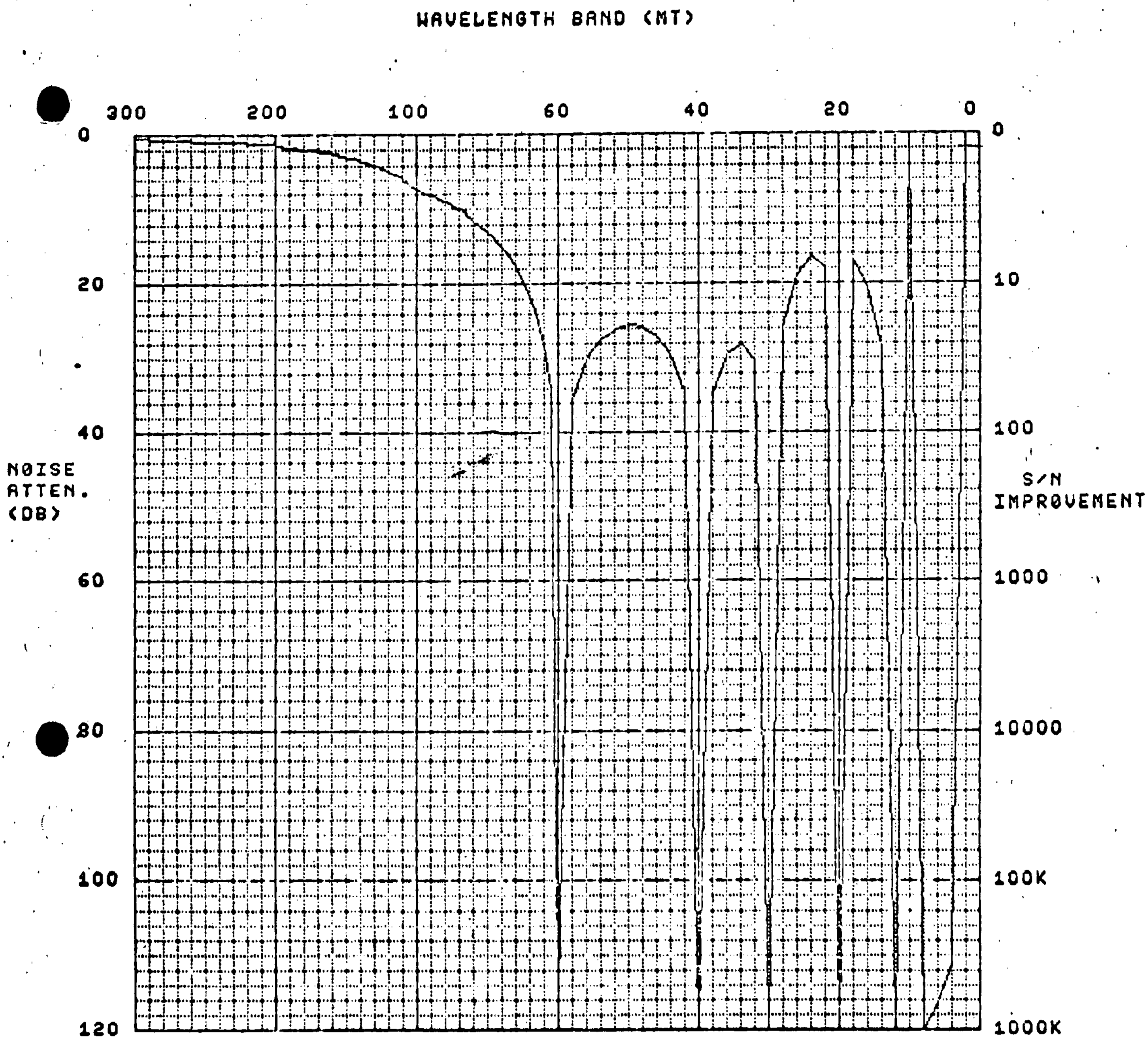
GEOPHONE SPREAD LENGTH

V1	575 metres
V2	575
V3	556
V4	550
V5	550
V6	563

SCALE 1:12500

ENCLOSURE 4d

00155

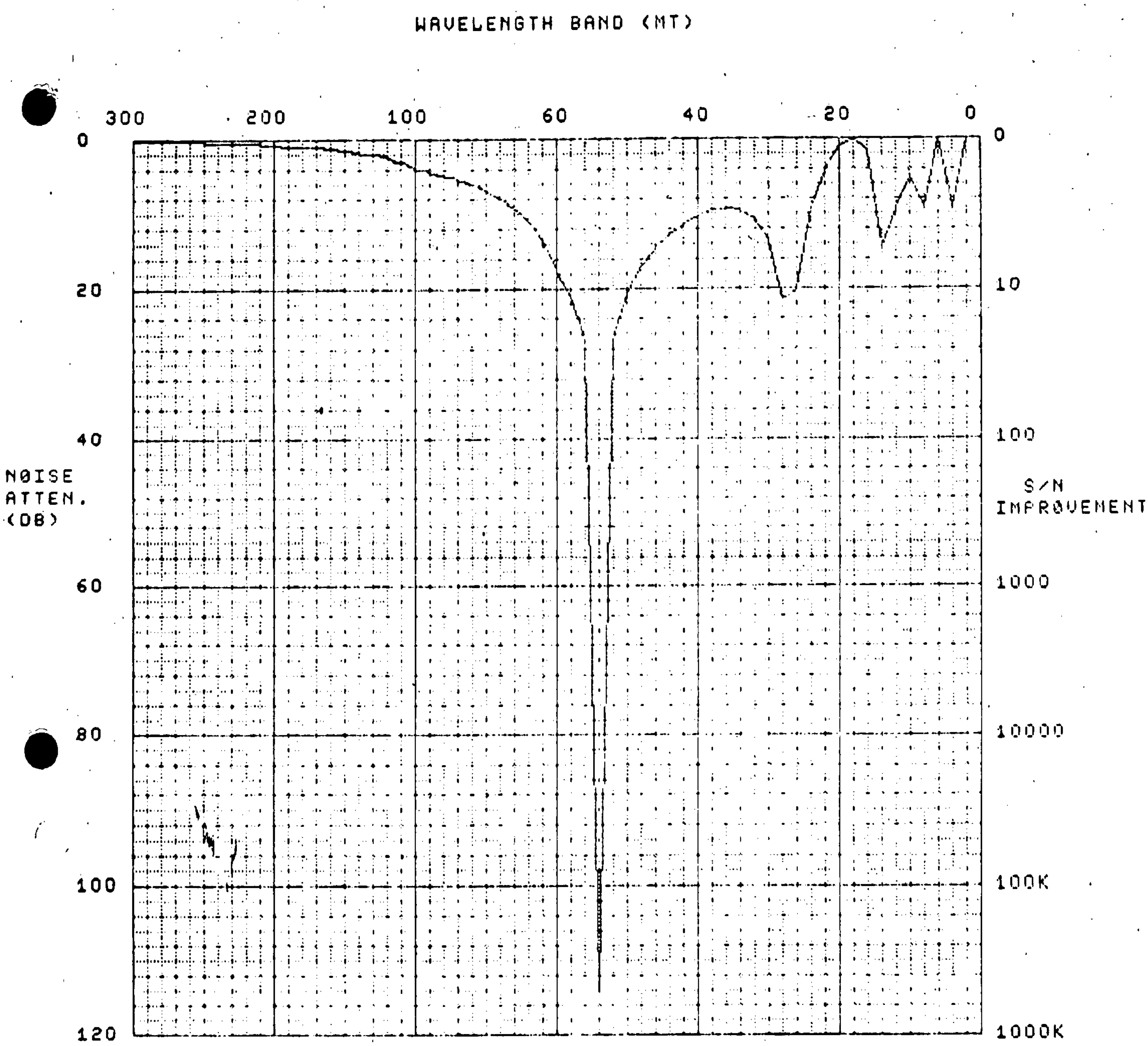


GEOPHONE ARRAY

POINTS: 8 SPACING: 10 LENGTH: 70 NO. ELEMENTS 12

1 1 2 2 2 2 1 1

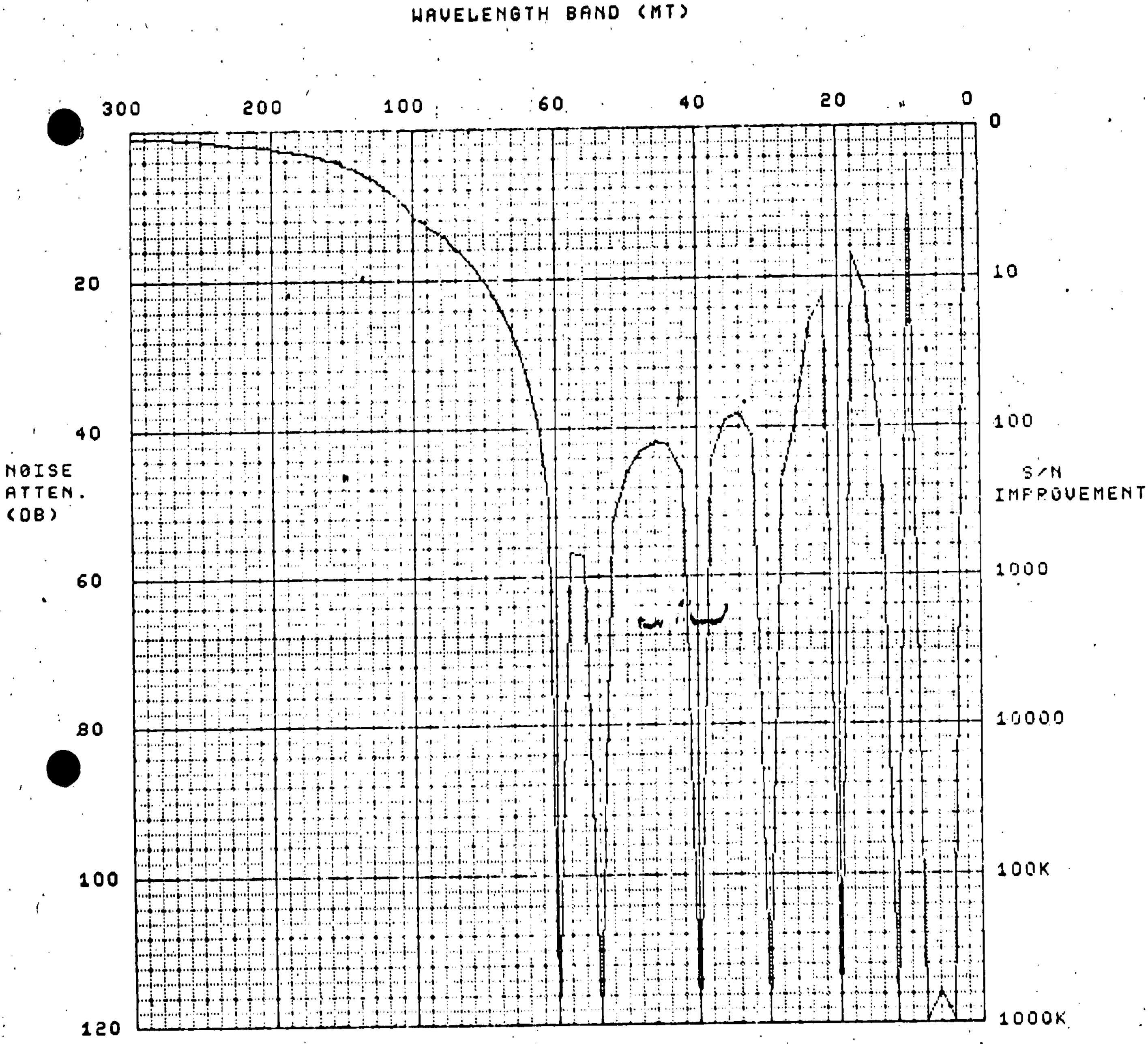
ENCLOSURE 5a



VIBRATOR ARRAY
PØINTS: 3 SPACING: 18 LENGTH: 36 NØ. ELEMENTS 3

1 1 1

ENCLOSURE 5b



GEOPHONE ARRAY
POINTS: 8 SPACING: 10 LENGTH: 70 NO. ELEMENTS 12

1 1 2 2 2 2 1 1

SOURCE PATTERN
POINTS: 3 SPACING: 18 LENGTH: 36 NO. ELEMENTS 3

1 1 1

ENCLOSURE 5c

Appendix 8-2.

TARTWAUP SEISMIC SURVEY - FIELD OPERATION.

The Tartwaup Seismic Survey was conducted by Seismograph Service Limited on behalf of Alliance Oil Development Australia N.L. The concession area was covered by Petroleum Exploration licence No.8. in South Australia (PLATE 1) and the survey took place during the period 13th October 1973 to 22nd January 1974.

The energy source used was +Vibrosies with recording parameters determined from an experimental programme recorded at the beginning of the survey.

This experimental programme was reported seperately.

In the initial programme issued there was 230 Kilometres of reconnaissance line and 50 Kilometres of detailing. This programme was ammended as the survey progressed to investigate two areas of interest - one at Douglas Point and the other near Burrungule. Extra programme was issued in Mid December including one short line 80 miles North West of Mount Gambier which passed through the Lake Eliza No.1. well.

Staff accommodation was rented at the Baldorney and Avalon Motels in Gray Street Mount Gambier. The field office was set up in the Baldorney motel and workshop was rented in Lumeah Street about one mile from the office.

Labour was recruited locally by advertising in the local press and through the Commonwealth Employment Exchange in Mount Gambier.

Two breaks were taken during the survey. One from November 25th to December 2nd when the crew moved to Victoria to record a short programme for Shell and the second from December 24th to January 2nd to cover the Christmas and New Year holidays.

The weather was good for most of the survey although heat, rain and high winds all caused delays.

+Trademark of Continental Oil.

PERMITTING.

Two permits were required for the vibrators before the survey started. The first was obtained by Seismograph Service Limited from the Road Traffic Board of South Australia to allow the left hand drive trucks to be driven on South Australian roads. The second was obtained by the client from the various councils in the prospect area to allow the vibrators to work on the roads in the prospect.

Although most lines followed roads some of the detail lines crossed private land where permission was required from the land owners before the lines could be laid. As many land owners did not live in the vicinity of their property they were contacted by plotting the lines on the "hundreds" maps of the area, extracting the section numbers of the land crossed and obtaining the section owners name and address from the appropriate council.

In all cases the property owners contacted were willing to allow the crew to work on their land especially after they were assured that this was a Vibroseis crew and that there would be no drilling, no explosives and no damage to their land from the Vibroseis operation.

SURVEY.

The survey was made with Wild T1A theodolites fitted with tubular compasses. Distances were chained and checked by tacheometric traverse.

Stations were marked by flagging tied to fence posts on the road side and by paint on the road surface. In fields with cattle, wooden pegs were used although their use was avoided as much as possible as the pegs had to be removed after the line was recorded.

Initially elevations were computed by assuming an elevation for one station on the line. These values were later adjusted when vertical control data was obtained, from Government Bench Marks.

Horizontal control was obtained by resection from nine trig stations in the area and by traverse to the Cape Northumberland trig.

A Geophone station location map was plotted on a scale of 1:50,000 and forwarded to the client at intervals throughout the contract. The final plot of this is Enclosure 1.

It was not possible to place permanent marks in the prospect as these would have constituted road hazards. The system was adopted of drawing sketch maps showing the positions of Key Geophone stations relative to Topographical features. These are submitted with the survey notes.

Some of the well co-ordinates did not plot in physical agreement with the seismic lines - Lake Bonney particularly. This may be due to the scale conversion from geographical to grid co-ordinates. It has been plotted in physical agreement with line TH.

SURVEY CONTROL DATA Supplied by Lands Department Adelaide.

STATION	EASTING.	NORTHING.
Mount Gambier	478419.272	5811697.850
Mount Schank	476597.266	5800640.130
Cape Northumberland	470713.827	5787746.861
Cape Northumberland Light'house	470709.807	5787705.860
Bluff	462101.208	5824324.234
Mount Burr	454174.833	5838035.481
Mount Muirhead	447246.745	5842808.969
Mount Ruskin	496821.298	5788789.841
German Hill	448051.809	5817368.548

Well co-ordinates supplied by Alliance Oil Development N.L.

Lake Bonney No.1	140° 28' 21" E	37° 50' 31" S
Caroline No.1	140° 54' 30" E	37° 56' 30" S
Douglas Point No.1	140° 35' 44" E	38° 01' 33" S
Mount Salt No.1	140° 37' 43" E	37° 57' 25" S

RECORDING.

Recording commenced on the 13th October. The first three days being spent working on an experimental programme to obtain data in four areas of the prospect expected to give different results. These areas were indicated by the client. The four areas were:-

1. An area of Cavernous limestone.
2. An area of Gambier limestone.
3. An area of Volcanics.
4. An area known to give deep reflections.

In each area a noise spread was recorded to a maximum offset of 3600 metres using one vibrator sweeping 10 times per V.P. with a 14 second 45-5 Hertz sweep. A trial spread was also recorded at each location with the following parameters:-

Geophone interval	125 metres.
Geophone pattern	weighted 11222211 spacing 10 metres.
Vibrators	3 spaced 22 metres.
Sweep	10 per V.P.
Vibrator move up	9 metres between sweeps.
Vibrator offset	500 metres from nearest geophone.
Sweep frequencies	35-5 Hertz 14 seconds.
	40-10Hertz 14 seconds.
	45-15Hertz 14 seconds.

From the results of these experiments the production parameters for the first line were decided. The geophone interval and pattern were unchanged from the trial spread. Other parameters were:-

Vibrators	3 spacing 18 metres.
Sweep	10 per V.P.
Vibrator move up	9 metres.
Sweep frequency	45-10 Herts 14 seconds.
Coverage	1200%.
Spread	End-on $1\frac{1}{2}$ peg offset from vibrators.

Plates 3 and 4 show the production field lay-out.

After completing the first line -TA- the spread configuration was changed to split straddle with a $1\frac{1}{2}$ peg offset from V.P. to inner traces as the inner traces on the end-on records showed better quality data and the NMO stretch on the outer traces was excessive.

After recording a sweep comparison on the Northern end of line TC the sweep frequency was changed to 40-15 Hertz as the higher frequencies did not appear to be contributing to the reflected energy and the lower frequencies were generating most of the interference in this area. Subsequently the sweep frequencies were altered again using a 35-8 Hertz sweep for the Northern part of the prospect and a 40-10 Hertz sweep for the Southern area.

Line TD produced the most disappointing results and towards the end of the programme was rerecorded near the Caroline well in an attempt to improve record quality. A 40-8 Hertz 14 second sweep was used with bi-directional end-on recording to give a 24 fold stack. Twenty sweeps were recorded for each V.P. The geophone interval and pattern were unchanged.

The weather, although generally good, caused some loss of production through high winds and rain causing the background noise to rise to unacceptable levels and high temperatures which stopped production one day when the vibrators began to damage a road after the tar had melted. On some occasions the humidity caused hi-line pick up to become excessive and consequently slowed down production as the time taken to balance the hi-line bridge was increased.

Other delays were caused by the intensive farming in the Mount Gambier area. Where lines crossed farm land often large detours had to be made to gain entry and cables had to be man-handled across fences. More time was lost when fields had cattle in them as then all cables and geophones had to be guarded during the day and picked up at night to avoid damage.

Travel time to the lines averaged 30-45 minutes each way although for the final line TZ the travel time was over 3 hours per day. However as the line was completed in two days there was no need to set up a field camp in the area.

On the 13th December a small fire started on line TH in the vicinity of the vibrators and the local councils refused permission to continue the line unless a water tanker was in attendance. The S.S.L. water tanker was brought from Adelaide with the clients permission and was kept on the line until the end of the contract.

Recording was completed on the 22nd January 1974.

COMPUTING.

No computing was done on the field crew.

DAMAGES.

Damage was caused on two occasions during the survey.

The first time when the road surface on the Glencoe to Wandilo road started lifting on the Vibrator wheels and the second when a Vibrator sank into a waterlogged field.

The road damage was reported to the police on the day of occurrence. The field damage was repaired to the farmers satisfaction after the land had dried out.

No damage claims were received during the survey.

DATA DESPATCH.

The two initial consignments of data were sent by courier to Adelaide to ensure the swift return of the results.

All subsequent data was consigned to the Phoenix Seismologist by air express via Ansett Air Lines from Mount Gambier and collected at Adelaide Airport.

PROCESSING.

Processing was carried out by SSL's PHOENIX system in Adelaide.

The Hardware consists of :-

(i) A Raytheon 706 central processing unit.

(ii) Random Access Device (2 x 8K Discs).

(iii) 3 Magnetic Tape units.

(iv) Array Transform Processor.

(v) Card Reader.

(vi) Teletype.

(vii) Electrostatic plotter.

The supporting Phoenix software is divided into five Phases plus a set of utility programmes arranged as follows (see PLATE 5):-

PHASE 1.

(i) Demultiplex and Gain Recovery.

(ii) Frequency Domain Cross-correlation.

PHASE 2.

(i) Edit - removal of dead and noisy traces.

(ii) Static correction (Ve=2000 m/sec. Datum=M.S.L.) applied during sorting of data into common depth point gathers. The mean X and Y co-ordinates of all traces in the CDP are computed from the geometry of the line. With sharp angles some locations are trapped out leaving holes in the CDP stack.

(iii) Trace equalisation.

PHASE 3.

Analysis programme to determine processing velocities, optimum muting times, and frequency characteristics of the data.

PHASE 4.

Stacking the data after correction for normal moveout and statics. Also includes Automatic residual statics.

PHASE 5.

(i) Time - domain deconvolution.

(ii) Time - variant filtering.

(iii) Trace equalisation.

(iv) Final Display. - Variable area/wiggle trace with horizontal scale of 12 traces/inch and vertical scale of 5 inches/second.

DETERMINATION OF PROCESSING PARAMETERS:-

(i) VELOCITY ANALYSES:-

On each line several multi-velocity stack analyses were carried out, the number of analysis locations being dependent on the geology of the line. The programme takes groups of common depth point traces and stacks them repeatedly using a wide range of different velocities. From the resultant display the velocity that gives the best stack for each event on the section is picked. These velocities are reproduced on the Final Display. PLATE 6 shows a composite velocity curve for the whole area.

(ii) TRACE MUTING (BLANKING):-

Blanking parameters were checked on each line. A group of 144 CDP traces were taken from the analysis point and sorted into ascending trace number order to form a "trace gather". NMO corrections were applied and from the display each trace was examined to determine the amount of blanking to avoid NMO stretch. The amount of blanking required was dependent upon the geometry of the line. PLATE 7 indicates the blanking applied after NMO.

(iii) DECONVOLUTION:-

Time and frequency domain deconvolution trials were carried out before and after stack to assess the optimum parameters for the equalisation of the spectrum of the Signal and removal of reverberant energy following primary signals. From visual inspection of the results in association with sectional autocorrelograms before and after deconvolution, the following parameters were chosen:-

Time domain after stack.
Operator Length 100ms.
Predictive Gap 30ms.
Derivation window - Time variant according to structure.

(iv) FILTER:-

A final filter suite was carried out on a 24 trace segment of the deconvolved data from each line. Parameters chosen varied on lines according to the original sweep frequency. These filters are reproduced on the Final displays.

Optimum parameters for a 40-10 HZ downsweep were:-

0-200 ms	12-15-30-35 HZ
200-2000ms	10-12-30-35 HZ
2000-4000ms	14-16-30-35 HZ

TARTWAUP SEISMIC SURVEY REPORT.

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3. PERSONNEL.
4. STATISTICS.
5. PERMANENT MARKS.

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2. PROGRAMME MAP.
3. SPREAD GEOMETRY.
4. VIBRATOR & GEOPHONE PATTERNS.
5. PROCESSING FLOW DIAGRAM.
6. COMPOSITE VELOCITY FUNCTION.
7a. END ON TRACE BLANKING.
7b. SPLIT STRADDLE TRACE BLANKING.

CONTRACT VEHICLES

1 BEDFORD 4x4 AIRCONDITIONED RECORDING TRUCK

4 INTERNATIONAL 6x4 VIBRATOR TRUCKS

1 BEDFORD 4x4 MOBILE WORKSHOP

2 BEDFORD 4x4 LOADCARRIERS

3 LANDROVER 4x4 GEOPHONE AND CABLE PICK-UPS

4 LANDROVER 4x4 PICK-UPS

1 BEDFORD 4x4 1000 GALLON WATER TANKER
(from 16 December)

TECHNICAL EQUIPMENT

1	24 CHANNEL LEACH GLOBE BINARY GAIN AMPLIFIER SYSTEM
1	LEACH LOOP SUMMER
1	9 TRACK LEACH RECORDER MTR 3200
1	DIGITAL SWEEP GENERATOR SSG 200
1	24 TRACE MONITOR CAMERA SDW 300
900	GSC 20D GEOPHONES 10 Hz - 6 PER STRING IN SERIES
16	CDP GEOPHONE CABLES EACH 3x125M STATION INTERVAL
4	HYDRAULIC VIBRATOR UNITS WABCO 600BD SPECIFICATION
4	VIBRATOR CONTROL ELECTRONICS VIBK 1000
5	PHILIPS MOBILPHONE VIBRATOR CONTROL RADIOS 172·5 MHz
5	PHILIPS MOBILPHONE LINE CONTROL RADIOS 154·0 MHz
1	COMPLETE SET ELECTRONIC TEST EQUIPMENT
1	COMPLETE SET SURVEY EQUIPMENT WITH T1A THEODOLITE
1	PHOENIX PROCESSING SYSTEM COMPRISING:

RAYTHEON 706 CENTRAL PROCESSING UNIT,

RANDOM ACCESS DEVICE - 2x8K DISCS,

3 TAPE DECKS, ARRAY TRANSFORM PROCESSOR,

CARD READER, TELETYPE, CARD PUNCH,

ELECTROSTATIC GOULD PLOTTER.

APPENDIX 2

STAFF PERSONNEL

SUPERVISOR	M.W.COVIL
PARTY CHIEF	K.A.POTTS
DEPUTY PARTY CHIEF	P.S.HEATHCOTE
SENIOR OBSERVER	D.R.HUTCHINSON
SENIOR OBSERVER	R.WHITESIDE
ASSISTANT OBSERVER	A.J.CLARK
ASSISTANT OBSERVER	L.HARWOOD
ASSISTANT OBSERVER	G.J.HILTON
SENIOR SURVEYOR	E.M.COWPERTHWAITE
SURVEYOR	P.YOUNG
MECHANIC	A.J.ROUGHTON
VIBRATOR MECHANIC	S.CARSON
ADMINISTRATOR	H.G.DUNN

PROCESSING

SEISMOLOGIST	C.ROWSON
ASSISTANT SEISMOLOGIST	R.BRANSON
ENGINEER	G.HIGGINBOTTOM

STATISTICS

TARTWAUP 14 OCT - 24 NOV: 3 DEC-26 DEC: 2 JAN-21 JAN.

DAYS EXPERIMENTAL	3
DAYS PRODUCTION	69
PUBLIC HOLIDAYS	3
DAYS MAINTENANCE	8
TOTAL DAYS	83
12 FOLD COVERAGE	297·8 KM
24 FOLD COVERAGE	5·8 KM
COVERAGE/RECORDING DAY	4·4 KM
NUMBER OF LINES	20

LAKE ELIZA 22 JAN.

DAYS PRODUCTION	1
12 FOLD COVERAGE	4·5 KM
NUMBER OF LINES	1

APPENDIX 5.

PERMANENT MARKS.

TA 261
TA 325
TA 359
TA 457
TA 521

TB 237
TB 245
TB 285
TB 392
TB 420
TB 465
TB 600

TC 220
TC 287

TD 212
TD 315
TD 330

TE 236
TE 264
TE 311

TE 361
TE 387

TF 216

TH 208
TH 289

TK 207
TK 283
TK 301

TL 288

TO 232

TP 211
TP 270

TQ 133
TQ 207

TR 207
TR 269

TR 297

TS 207
TS 223

TT 232

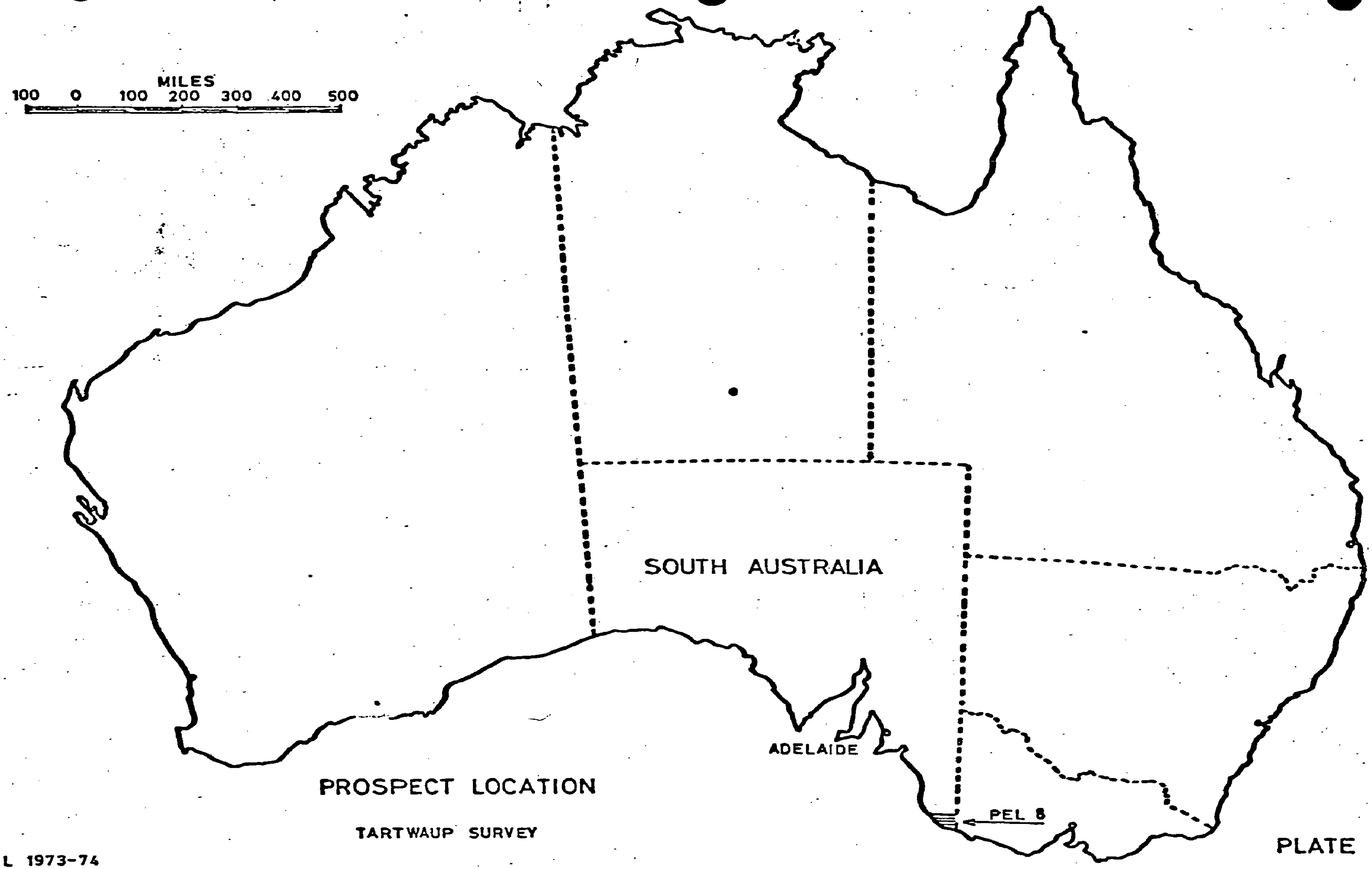
TU 205
TU 272

TV 207
TV 214
TV 245
TV 271

TW 224

TX 201
TX 204
TX 242

TY 197
TY 211



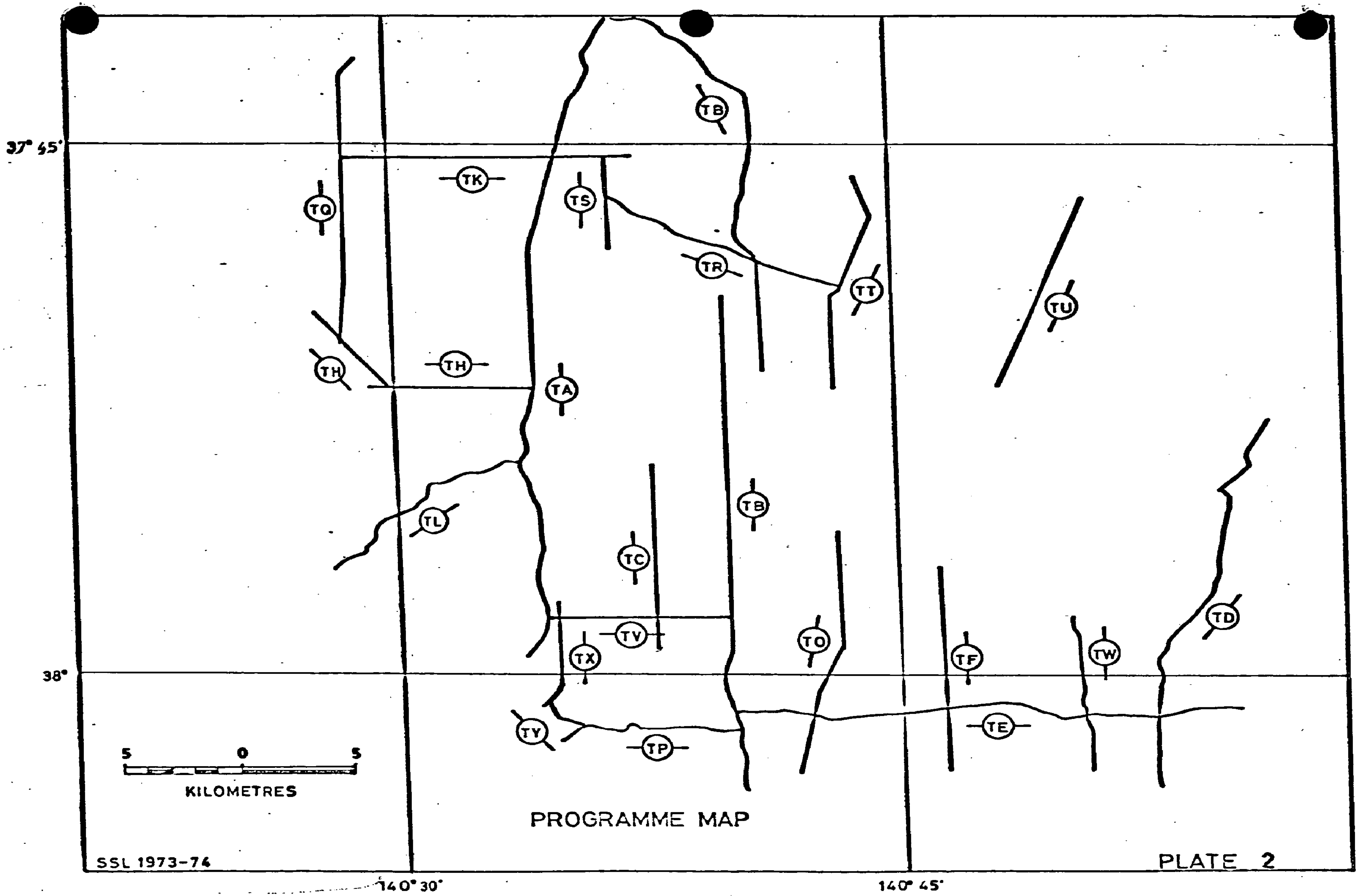
PROSPECT LOCATION

TARTWAUP SURVEY

SSL 1973-74

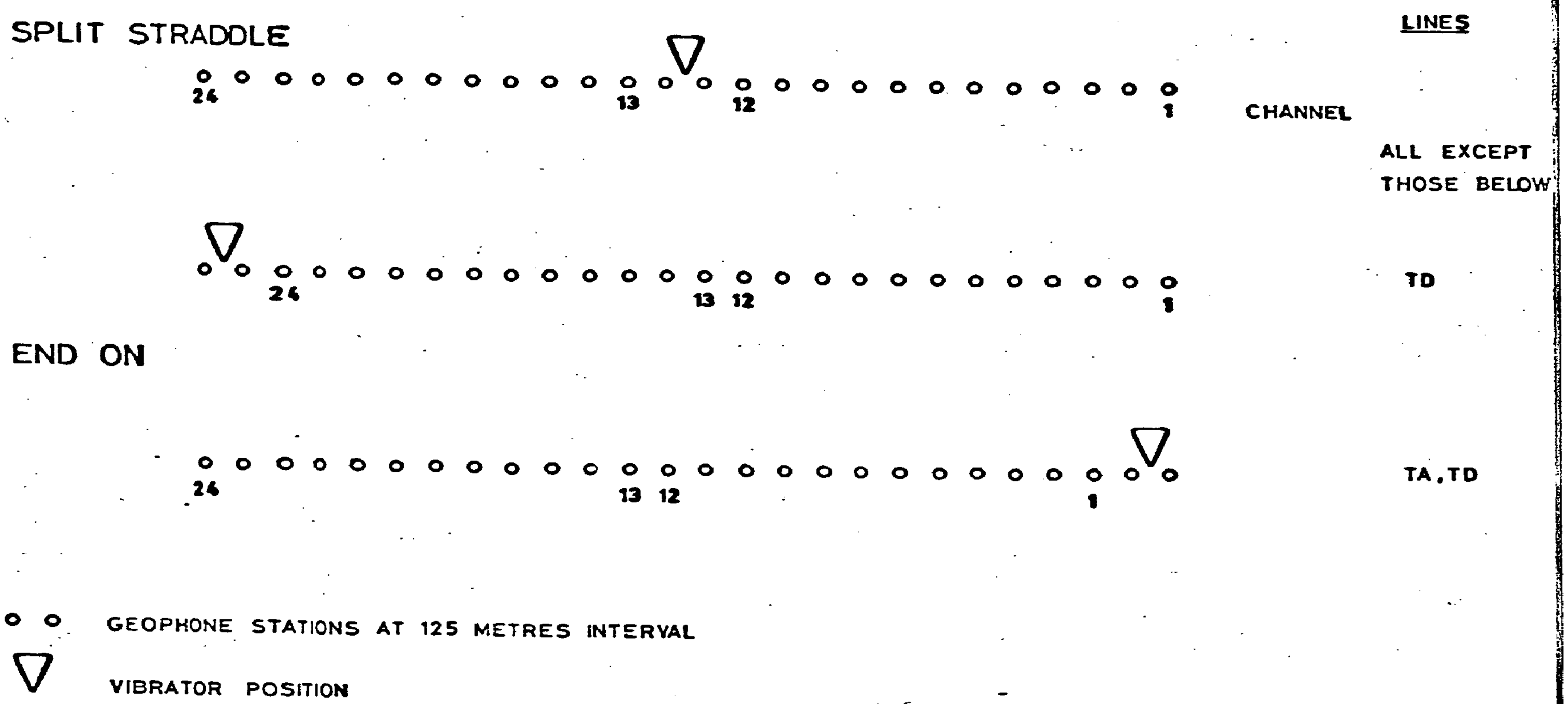
PLATE 1

00177



37° 45'
38°
140° 30'
140° 45'
TB
TK
TQ
TS
TR
TT
TU
TH
TH
TA
TL
TB
TC
TV
TX
TO
TF
TW
TD
TY
TP
TE
5
0
5
KILOMETRES
PROGRAMME MAP
SSL 1973-74
PLATE 2

00178



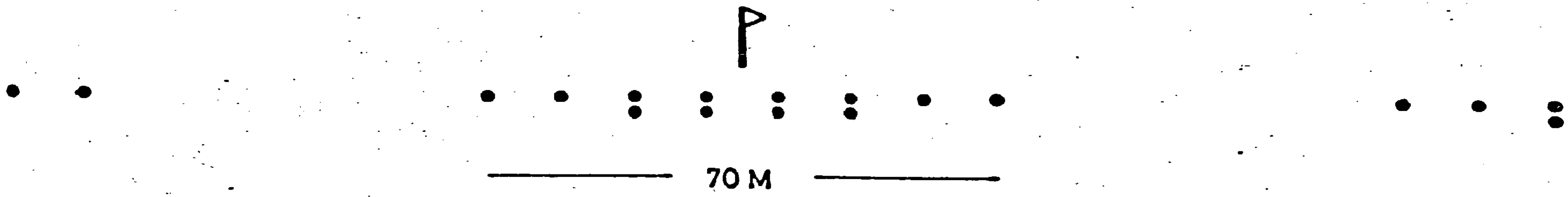
SPREAD GEOMETRY

SSL 1973-74

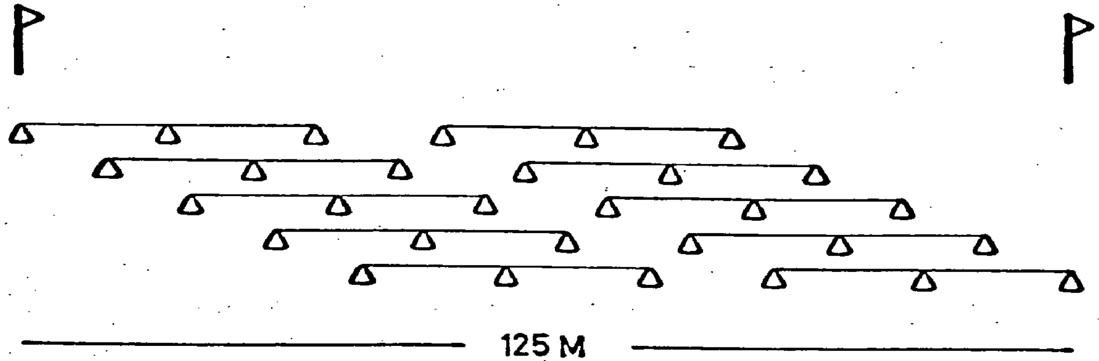
PLATE 3

00179

VIBRATOR AND GEOPHONE PATTERNS



GEOPHONES 12 PER TRACE 10 M SPACING



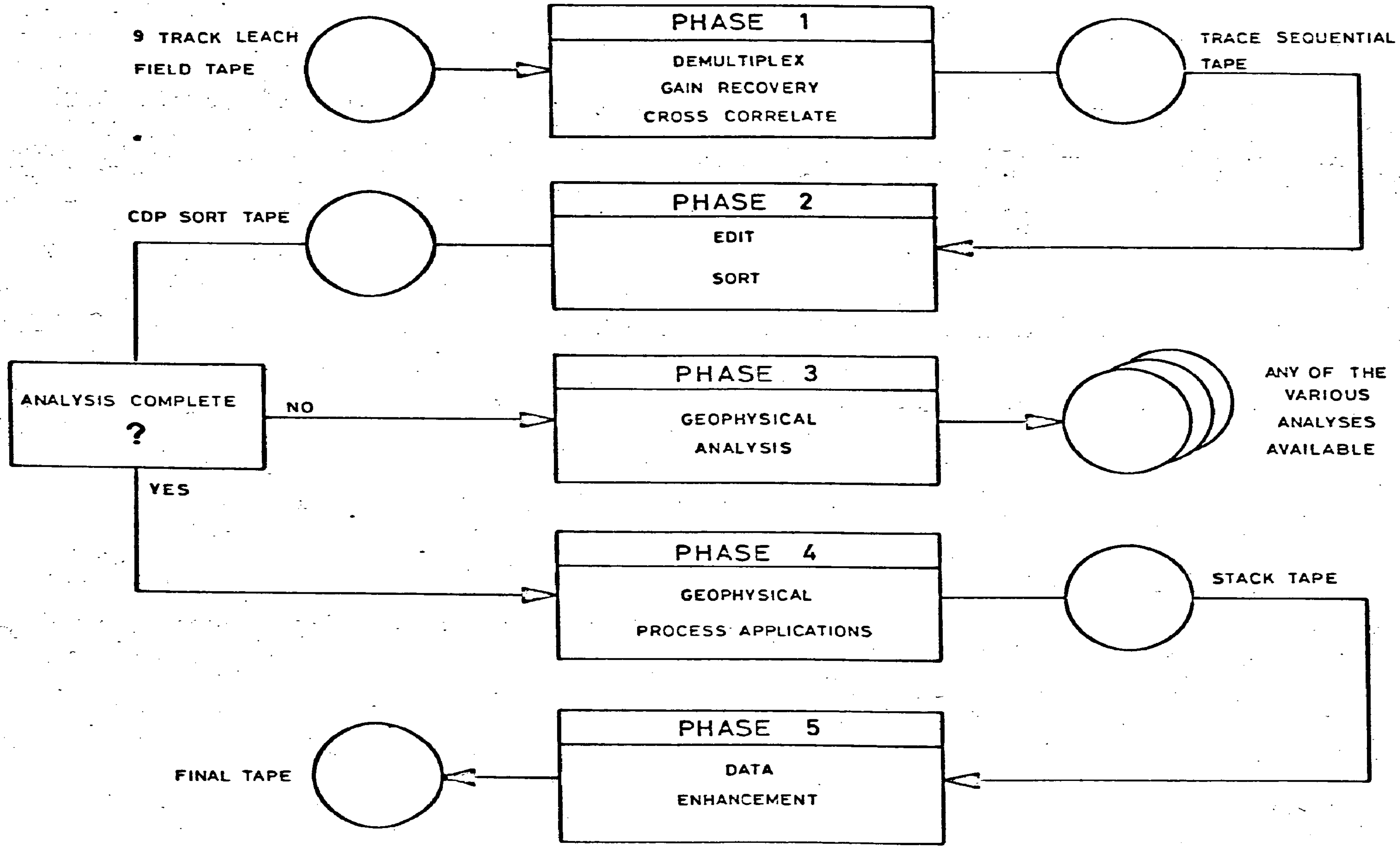
VIBRATORS 3 IN LINE 17·5 M SPACING   MOVE UP 10 M PER SWEEP

SSL 1973-74

PLATE 4

00180

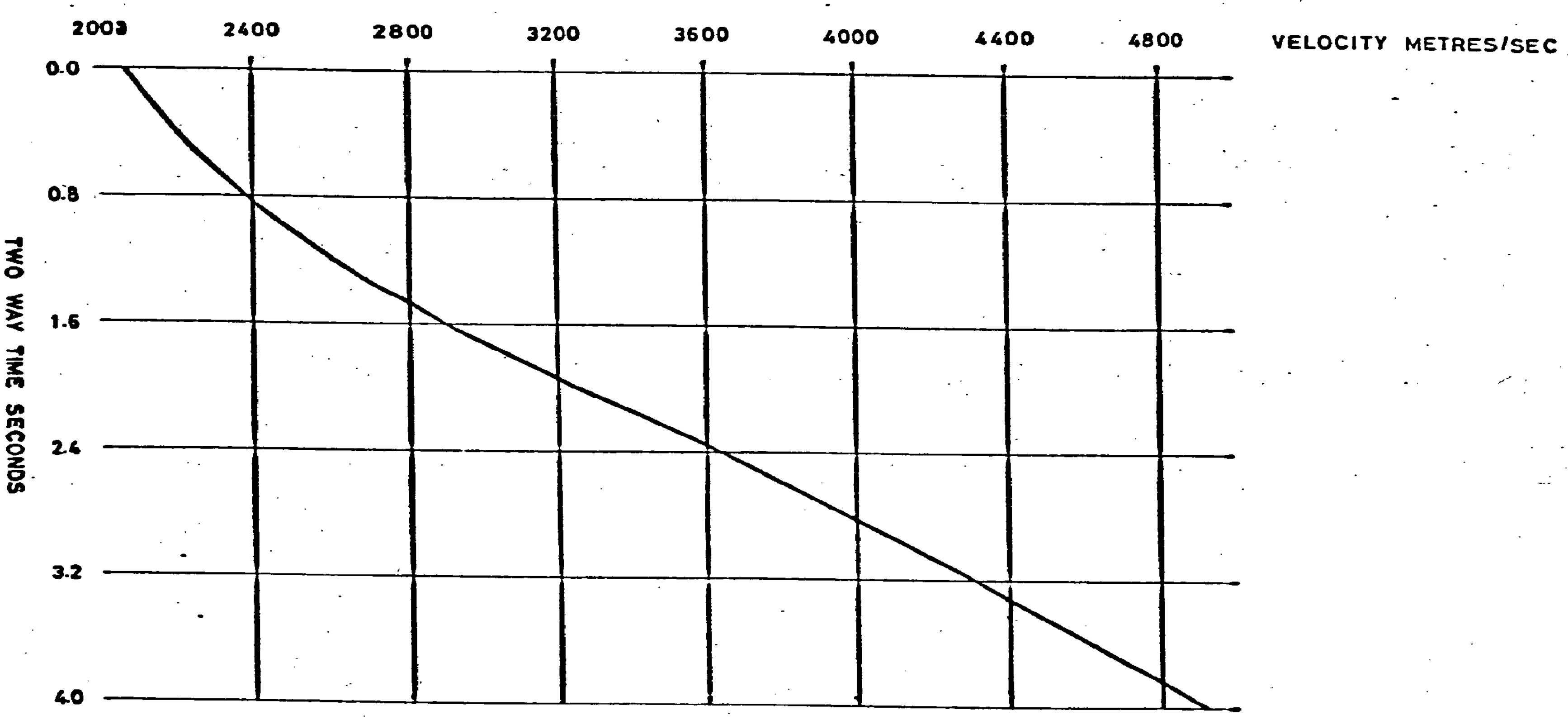
PROCESSING FLOW DIAGRAM



00181

SEISMOGRAPH SERVICE LTD

PLATE 5

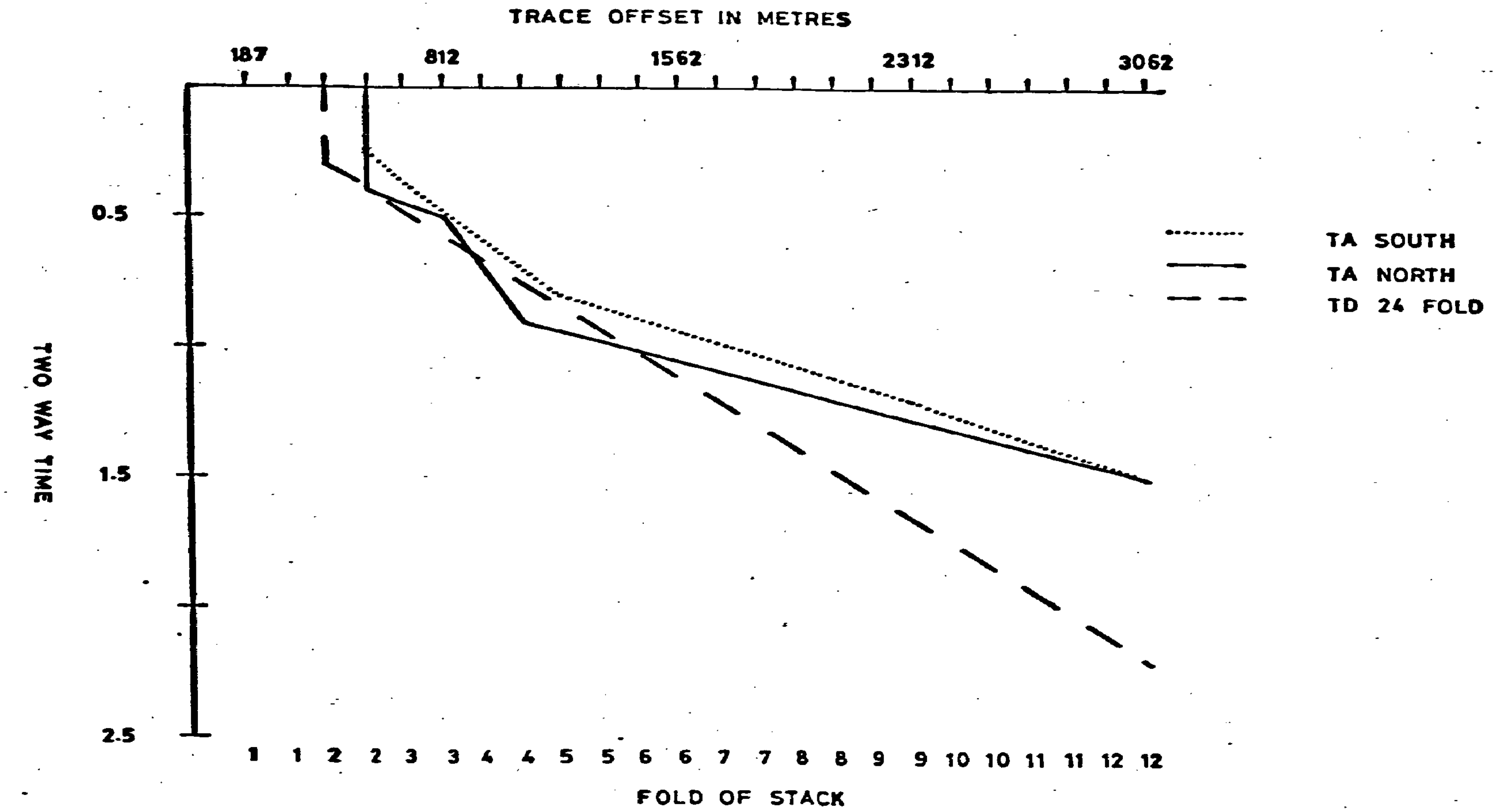


COMPOSITE AVERAGE VELOCITY CURVE

SSL 1973-74

PLATE 6

001182



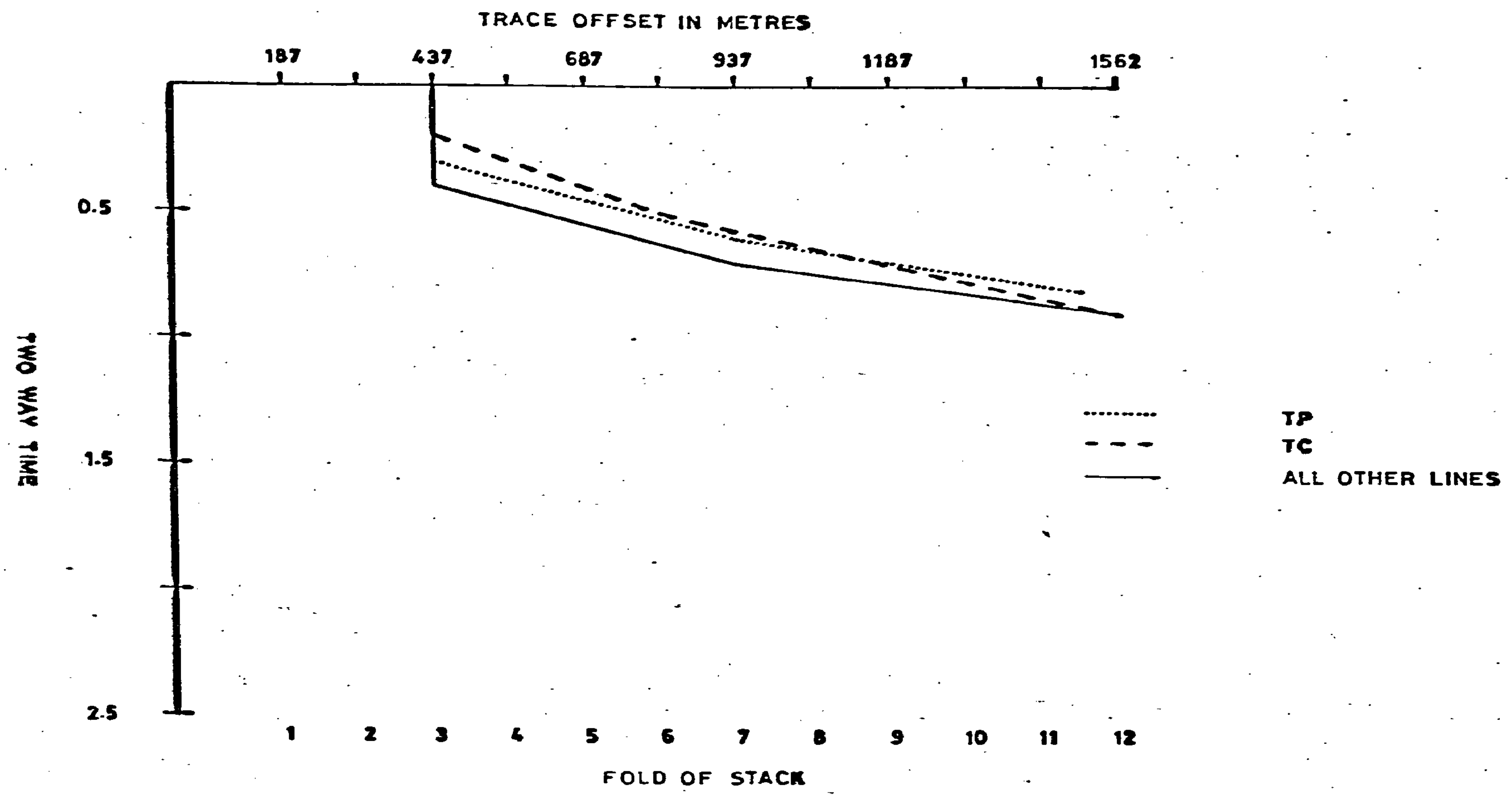
TRACE BLANKING

END ON

SSL 1973-74

PLATE 7a

00183



TRACE BLANKING

SPLIT STRADDLE

SSL 1973-74

PLATE 7b

00184

PART II

REGIONAL GEOLOGY

The Otway Basin, of Mesozic to Late Tertiary age, is an east-west trough extending over 300 miles between Cape Jaffa on the South Australia coast and Melbourne on Port Phillip Bay in Victoria. Its axis is almost at right angle to the north-westerly trend of the underlying basement rocks which consist of Paleozoic Metasediments of the Tasman Geosyncline.

The Otway Basin covers 21,000 square miles both onshore and offshore and is thought to extend into the Southern (Indian) Ocean to at least the 1,000 fathom line. The maximum thickness of sediments exceeds 20,000 feet.

The Otway Basin was initiated probably along tension lines in the early part of the Mesozoic. The oldest sediments recognised to date consist of the fluviatile Pretty Hill Sandstone at the base, overlain by non-marine, greywackes, shales and coal of the Lower Cretaceous Otway Group. The faulted horst structure of the slightly metamorphosed Paleozoic basement controlled the sedimentation, and thickness vary from a few thousand feet above basement highs to an excess of 12,000 feet in deep basinal positions.

Several breaks during the deposition of the Otway Group are represented by local or regional unconformities. One of those, identified at the top of the Pretty Hill Sandstone in Crayfish No. 1 is of great significance to oil exploration. But the most important of the unconformities occurred at the end of the Lower Cretaceous, when parts of the basin was uplifted, and the Otway Group partly eroded.

At the beginning of the Upper Cretaceous embayments of the old basin continued to subside and received marine mudstones. Later the deposition became fairly general and graded into paralic and deltaic environment. Large quantities of materials were carried into the basin. The sources of these materials were dominantly the same as during the previous cycle, but the newly uplifted Otway regions also contributed. The sinking of the basin was rapid, but the supply was abundant and great thicknesses of sediments were accumulated. In the Mount Sale No. 1 Well the Upper Cretaceous Sherbrook Group thickness is greater than 6,800 feet.

Many structural movements took place in the Otway Basin during Upper Cretaceous times. There are indications of faulting contemporaneous with sedimentation in the Port Campbell - Argonaut area. Onshore, similar evidences are found associated with the Tartwaup Fault, north-west of Mount Gambier. The latest Mesozoic movements took place at the close of the Upper Cretaceous, and are indicated by an erosional unconformity on top of the Sherbrook Group. Seismic cross sections show this unconformity over most of the basin.

During Paleocene to Upper Eocene a widespread paralic neritic environment was established. At least 4,000 feet of well sorted clastic sediments represented by the Wangerrip Group were deposited. They thin gradually to the south onto the Upper Cretaceous strata.

In Upper Eocene to Lower Pliocene a transgressive sea deposited limestone and marl until at least Late Miocene. Epeirogenic uplift occurred during Pliocene times. This was accompanied by some gentle faulting and folding. At the same time widespread volcanism occurred in Tasmania and West Central Victoria.

In late Pliocene and Pleistocene times the sea assumed its present position.

The Otway Basin configuration and major structural features are shown on Figure II.1. The Gambier Embayment of the Otway Basin is an arcuate depression limited to the north by the Pathaway Ridge and to the east by the Merino Uplift and the Dartmoor Ridge. The Gambier Embayment may be further subdivided structually into the Beachport - Penola Shelf and the Gambier Trough.

On the Beachport Penola Shelf, which was structurally high during much of Upper Cretaceous times, poorly consolidated sands of the Wangerrip Group rest directly on the well lithified clastic sediments of the Otway Group, or in places are underlain by a thin wedge of Upper Cretaceous sediments.

Within the Gambier Trough, there are at least 20,000 feet of Cretaceous sediments. The thickness of Upper Cretaceous rocks increases rapidly south of the Tartwaup Fault to more than 10,000 feet in the deepest part of the Trough. The remaining of the Cretaceous section belong to the Otway Group of Lower Cretaceous age.

Stratigraphy: The stratigraphic column penetrated at Alliance Lake Bonney No.1, within the area of the seismic survey, is as follows :

LAKE BONNEY NO. 1 STRATIGRAPHIC TABLE KB 86' ASL TD 9,550'

Age	Fm Name	Top KB	Top Subsea		Thickness
TERTIARY	Gambier Lst.	16	+	70	894
	Nelson Sdst.	780	-	694	130
	Dilwyn Fm.	910	-	824	1,542
	Pebble Pt. Fm.	2452	-	2,366	183
****************** Unconformity **********************					
UPPER CRETACEOUS	Curdies Fm.	2,635	-	2,649	1,646
	Paaratte Fm.	4,281	-	4,195	3,361
	Belfast Muds.	7,642	-	7,556	672
	Flaxman's Bed	8,314	-	8,228	158
	Waarre Fm.	8,472	-	8,386	454
****************** Unconformity **********************					
LOWER CRETACEOUS	Otway Gp	8,926	-	8,840	524 +
	Total Depth	9,550	-	9,464	

Note : Formation tops taken from Lake Bonney No. 1 Well Completion Report. (Laing - Leblanc - Stephens 1968).

A summary of lithological description of the stratigraphic section penetrated at Lake Bonney No. 1 is as follows :

Miocene - Oligocene. Gambier Limestone: 16 - 780 feet. The Gambier Limestone consists of bryozoal and bioclastic limestone with minor calcareous siltstone and mudstone.

Upper Eocene - Nelson Sandstone: 780 - 910 feet. Medium to coarse grained subrounded quartz sandstone with trace of glauconite and sideritic cement.

Eocene-Paleocene Dilwyn Formation: 910 - 2,452 feet. Unconsolidated, clear to brownish medium to very coarse quartz sand with some brown silt matrix and interbedded brown siltstone.

Paleocene Pebble - Point Formation: 2,452 - 2,635 feet. Medium to very coarse quartz sandstone, with common sideritic and limonitic matrix. The Pebble-Point

Formation marks the unconformity separating Upper Cretaceous from Tertiary sediments.

Upper Cretaceous Curdies Formation: 2,635 - 4,281 feet. Poorly consolidated, white - clear fine to coarse grained quartz sandstone subangular to subrounded, interbedded with some light to medium brown silty mudstone, coal bands and brown sideritic siltstone at the base. Good porosity throughout.

Upper Cretaceous Paaratle Formation: 4,281 - 7,642 feet. The upper unit down to 6,237 is composed mainly of light grey sandstone, coarse to pebbly, interbedded with light grey to pale brown very fine to fine grained sideritic and dolomitic sandstone, and minor grey brown siltstone and fissile shale.

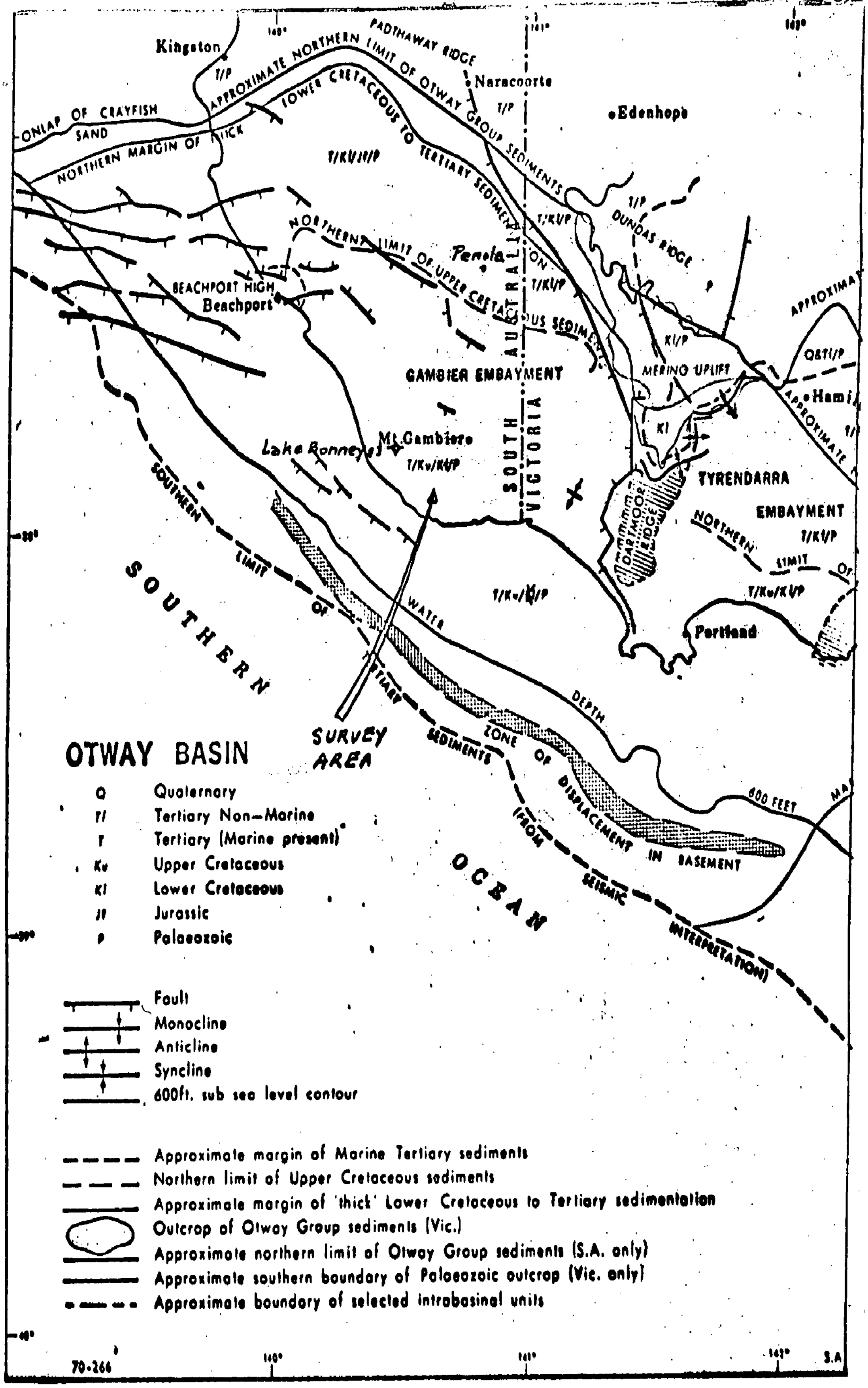
The lower unit, from 6,237 to 7,642 feet, consists of medium grey and brown argillaceous and micaceous siltstone and dark grey brown shale interbedded with sandstone, light grey unconsolidated, quartz and lithic grains in a kaolin and green clay matrix. Grain size range from very fine to very coarse.

Upper Cretaceous Belfast Mudstone: 7,642 - 8,314 feet. It is composed of dark grey and medium grey glauconitic marine mudstone and light greenish grey siltstone, lithic and glauconitic with rare interbeds of fine to medium grained argillaceous sandstone.

Upper Cretaceous Flaxman's Bed: 8,314 - 8,472 feet. Sandstone very fine to medium coarse, with slight calcareous matrix, glauconitic interbedded with dark grey abundantly glauconitic silty shale.

Upper Cretaceous Waarre Formation: 8,472 - 8,926 feet. It is composed of porous sandstone interbedded with thin shale and siltstone beds. Sandstone is light grey to green, fine to medium grained, subangular subrounded quartz, felspar and lithics, with a cement argillaceous, dolomitic or calcareous. Siltstone and shale are medium to dark grey, micaceous, carbonaceous.

Lower Cretaceous Otway Group: 8,926 - 9,550 feet. At Lake Bonney No. 1, the Otway Group penetrated consists of grey green felspatic sandstone and pale green lithic siltstone and medium to dark grey micaceous shale.



Basin Configuration and Major Structural Features

Fig. II 1

Extract From Figure 1. 1
"The Otway Basin of South Eastern Australia"
Edited by H. Wopfner & J.G. Douglas

MILES 10 0 10 20 30 40 50 60 70 80 90 100 MILES

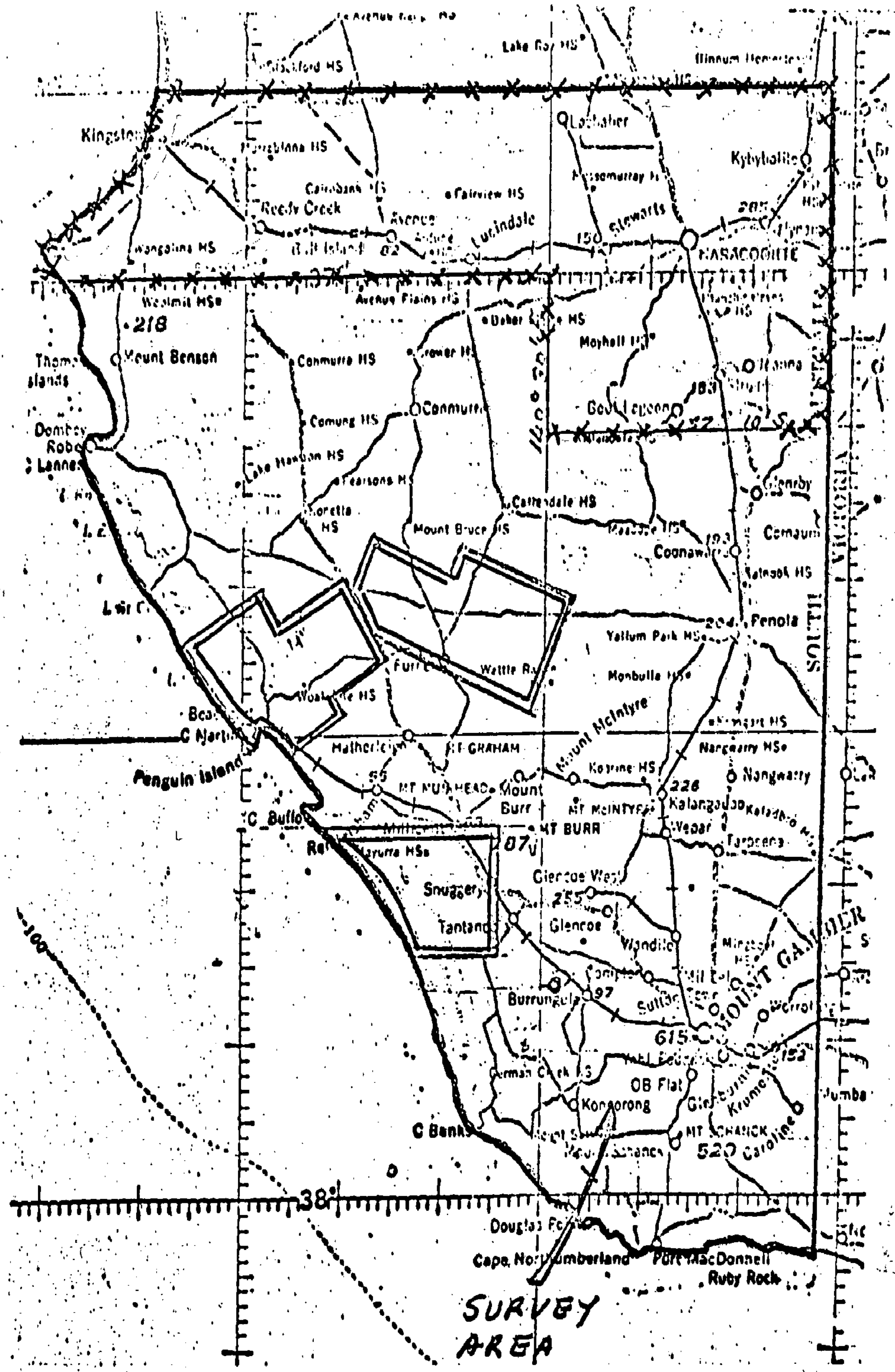


fig II.2.

ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.

P.E.L. 8 S.A.

SCALE 1:1,000,000

PRESENT AREA

AREA FOR SURRENDER 30/4/74

FARMOUT AREAS.

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

CNR CONSTITUTION AVENUE AND ANZAC PARADE, CANBERRA
Postal address: P.O.Box 378, Canberra City, A.C.T. 2601
Please address all communications to the Director

AUSTRALIA
Department of Minerals & Energy

Telephone: 499111
Telegrams: BUROMIN
Telex: 62109

REC'D 24 DEC 1974

00195

In reply please quote: 73/245

S. Watson is preparing a report suitable to BMR requirements
RLC

The General Manager,
Alliance Oil Development Australia N.L.,
100 Collins Street,
MELBOURNE. VIC. 3000

20 December 1974

Dear Sir,

Petroleum Search Subsidy Act 1959-1973
Tartwaup Seismic Survey

It has been brought to my attention that there is no discussion in the Tartwaup final report on the seismic line traversed northwestwards from Lake Eliza No. 1 well. It is noted in the Operations Report that recording on this line (4.5 km) was carried out on 22 January 1974. The seismic section along line TZ is included with other full-scale record sections accompanying the report, but there is no interpretation given, nor is there a shotpoint location map for this particular traverse.

It would be appreciated if you would please forward at your earliest convenience three copies of a suitable shotpoint location map, including line TZ, together with an evaluation of this part of the survey.

Yours faithfully,

E. R. Smith

for (L.C. NOAKES)
Acting Director

00196

ADDENDUM TO TARTWAUP SEISMIC SURVEY.

LAKE ELIZA TRAVERSE TZ.

Lake Eliza Traverse TZ was intended to give more detail to the contour map of the top of the Pretty Hills Sand member (or Crayfish Sand) at the Lake Eliza structure.

The main structure has been outlined by Esso Exploration and Production Australia Inc. in their 0-69-A Seismic Survey (subsidised). The structure lies mainly below Lake Hawdon South, a body of shallow water, some of which is permanent, and the remainder swampy and unpredictable. Access is uncertain.

Traverse TZ was planned on paper to be a straight line. In the field it was necessary to bend the line twice at the northwest end in order to get suitable access into the swamp. The traverse was tied to Esso Lake Eliza No. 1 Well at VP 232 on Traverse TZ.

Enclosed is a contour map drawn on the top of the Pretty Hills Sand, incorporating data from TZ and from the previous 0-69-A survey, and tied to Lake Eliza No.1.

It is noted that the structural culmination lies more than 1 kilometre north west of the well. Thus, the unconformity surface dips to the southeast, whereas dipmeter measurements at the well indicate that the actual dips below the unconformity are to the southwest.

Note 1: Lake Eliza No.1 has been relocated at Lat 37 13 43 Long 139 58 56 to conform with surveyed data supplied by Messrs Ballantyne and Henningsen.

Note 2:

SP No.	200	202	204	206	208	209
Elevation (Metres)	8.96	8.9	9.0	9.1	11.2	10.9
SP No.	210	212	213	214	215	216
Elevation	9.3	9.0	9.2	9.2	9.3	9.4
SP No.	217	219	220	222	224	225
Elevation	9.3	9.5	9.7	9.8	10.2	10.2

Note 2 (continued):

SP No.	226	230	231	232	234	236
Elevation (metres)	10.2	10.6	10.7	8.5	9.0	9.4

SP No.	238	239
Elevation	9.7	9.3

S.J.Watson.

January 1975