COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES.

GEOLOGY AND GEOPHYSICS

RECORD No. 1961-165

ROSEDALE SEISMIC SURVEY,

VICTORIA 1961

by

K. F. FOWLER

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ABSTRACT

Between February and April 1961 the Bureau of Mineral Resources, Geology and Geophysics made a seismic survey in the Rosedale area of the Latrobe Valley, partly at the request of the State Electricity Commission of Victoria to provide more information about the brown coal measures in this area, and partly in order to test the Bureau's latest seismic recording equipment. One traverse, combining both reflection and refraction profiling techniques, was run south from the A.P.M. No.1 bore at Rosedale as far as Merrimans Creek, and a second traverse was run west from the bore as far as Toongabbie.

Results show that the maximum thickness of the Tertiary sequence is about 3000 ft and that it thins gradually to 1000 ft at Toongabbie and rapidly to about 750 ft on the Baragwanath Anticline. It is shown that early Tertiary deposits were laid over the whole area but have been uplifted and partly eroded in late Tertiary or post-Tertiary times in the Toongabbie and Baragwanath areas, but the main syncline sank and accumulated thick Tertiary sediments. Results show also that on the northern flank of the Baragwanath Anticline where crossed by the seismic lines the Tertiary and Jurassic sediments are steeply folded but not necessarily faulted.

No positive information was obtained below 4500 ft but long refraction shots suggest that a high-velocity basement does not exist at a depth less than 12,000 ft.

1. INTRODUCTION

Between 22nd February and 13th April 1961, the Bureau of Mineral Resources, Geology and Geophysics made a seismic survey in the Rosedale area of the Latrobe Valley, Victoria. The survey consisted of two traverses as shown on Plate 3, involving both reflection and refraction techniques. Both traverses were linked to the A.P.M. No.1 bore at Rosedale.

The survey had been planned to serve two purposes; firstly, the State Electricity Commission of Victoria had requested that some seismic work be done in this area to improve knowledge of the brown coal deposits, and secondly, the Bureau had acquired a new set of seismic recording equipment and it was necessary to test it thoroughly under field conditions close to headquarters before committing it for major survey work in the Northern Territory.

The objectives of the survey were

(a) to test under working conditions a set of H.T.L. 7000 B recording amplifiers and control units;

an Electro-Tech. DS7/700 Magnetic Recorder; and

an Electro-Tech. ER 66 Recording Camera.

(b) to provide a cross-section of the structures of the coal measures along traverses from Toongabbie to Rosedale and from Rosedale across the Rosedale fault and Baragwanath Anticline to Merrimans Creek; and to determine the depth to, and the configuration of, the Jurassic deposits underlying the coal measures.

(c) to try to clarify the apparent inconsistency between the large south-westerly dips (25°), shown from A.P.M. No.1 bore results, and the gentle dips suggested from gravity results in the Snake Ridge locality.

(d) to check the results of the velocity survey of the Rosedale A.P.M. No.1 bore.

2. GEOLOGY

The geology of the district has been described by Thomas (1953). The main structural feature of the Latrobe Valley is the Latrobe Syncline (See Plate 1), which in the Yallourn-Rosedale area is flanked to the north by the Yallourn Fault and Monocline and to the south by the Rosedale Fault.

Jurassic sediments crop out north of the Yallourn Monocline in the foothills of the Dividing Range and also to the south in the Strzelecki Ranges. Silurian sediments crop out north of the Yallourn Monocline and have been identified at Balook Dome 8 miles south-west of Carrajung. It is thus likely that they underlie the Jurassic sediments in the Rosedale area.

The Rosedale Fault forms the steep northern flank of the Baragwanath Anticline. Thick coal seams have been found at shallow depths on the southern limb of the Baragwanath Anticline at Coolungoolun (Gloe, 1960) and also north of the Rosedale Fault at Rosedale (A.P.M. No.1. bore). From the Baragwanath Anticline these seams dip gently to the south and fairly steeply to the east, where they are overlain by Tertiary marine sediments to a depth of from 2000 to 3000 ft. These marine sediments have been found in bores near Sale but were not found at Rosedale.

Evidence from the A.P.M. No.1 bore at Rosedale (Smith, 1960) (Plate 4) shows that the Tertiary sediments are overlain by 170 ft of post-Kalimnan sand, clay, and gravel; the thickness of the Tertiary deposits is 2175 ft including five major seams of brown coal. Owing to the large number of minor coal seams and clay and sand bands within these major divisions any correlation with the brown coal seams in the Yallourn area can only be tentative. South-westerly dips (up to 25°) were found on these coal seams and also on the Jurassic sediments, the base of which had not been reached at a total depth of 5836 ft.

3. PREVIOUS GEOPHYSICAL WORK

Detailed gravity work has been done by the Bureau of Mineral Resources over the whole of the Latrobe Syncline (Neumann, 1960). Interpretations of this work agree closely with the geological structures as indicated by bores drilled in this area. In the Baragwanath Anticline area average density values of 2.5 and 1.9 g/c.c. are suggested for the Jurassic sediments and the overlying Tertiary sediments respectively.

A seismic survey of the Morwell-Traralgon area (Plate 1) was made by the Bureau of Mineral Resources in 1958-1959 (Lodwick and Moss, 1959; Lodwick, 1960). Information on the main structures of the Latrobe Syncline was obtained and also on several minor structures superimposed on it, but the work did not show for certain what type of basement rock underlies the coal measures. The depth of the sediments was placed at between 10,500 and 15,000 ft.

A velocity survey was made of the Rosedale A.P.M. No.1 bore (Watson, in preparation) and velocities were recorded down to 5500 ft. The results are shown on Plates 4 and 5. Also during this survey short reflection spreads were shot and reflection records of fair quality were obtained.

4. FIELD WORK

The surveying of the traverses and pegging of the shot-points and geophone stations were undertaken by the surveyors of the Brown Coal Investigation Division of the State Electricity Commission at Traralgon. Surveying conditions were good except between Shot-points 166 and 191 where there are thickly timbered hills, often with dense undergrowth; this slowed down the surveying work considerably, and the traverse was made to follow tracks as closely as possible in order to reduce vehicle access difficulties to a minimum.

Experiments were made to determine the best method of drilling. Air drilling was first tried but was effective only down to 45 ft. Water drilling also proved unsatisfactory as circulation was lost at about 60 ft. Drilling by auger was found to be the best method and was very satisfactory over the whole survey, except at Shot-point 190 where unconsolidated water-sand was encountered at 40 ft. A Failing 750 drill was brought from Melbourne to drill three holes at this shot-point to depths of 150 ft, using bentonite to seal off the water sand.

Most of the drilling was through sand and clay with occasional encounters with water-sand at Shot-points 132, 133, 141, 142, 143, and 155. The water sand, however, was not troublesome as recording conditions were not affected by the limitation of shooting depth that its presence imposed. Brown coal was drilled into at Shot-points 166, 168, and 174 at shallow depths (40 to 120 ft).

After some experiments it was found that the best recording conditions for reflection shooting were with slow A.G.C., filter settings 18-75 c/s, and filter cut-off slopes of 18 db per octave. Playback records were made with the same A.G.C. and filter cut-off settings, but with filter settings of 24-57 c/s. Record quality was fair, but reflections suffered from lack of character.

Refraction shots were also recorded on tape, using slow A.G.C., filter settings of 0-47 c/s, and filter cut-off slopes of 18 db per octave. The playback records were made with the same A.G.C. and filter cut-off settings, but with filter settings dependent on the frequency of the refracted wave under consideration. They were particularly useful in the study of second events.

The Electro-Tech. ER66 camera is equipped with a system for variable-area presentation of records and it is this system that has been used for the final presentation of the corrected play-back reflection cross-sections shown in Plates 8, 9, and 10. Owing to the physical limitations of the cam representing the velocity function during playback the portion from 0 to 0.3 sec cannot be adequately corrected for spread correction.

Reflection shooting commenced at Shot-point 150, the site of the A.P.M. No.1 bore, using $\frac{1}{8}$-mile spreads and with geophone groups (each group comprising 6 geophones placed at 11-ft intervals along the line of spread) spaced at 55-ft intervals, and proceeded thus as far as Shot-point 157 when it was appreciated that quite satisfactory results could be achieved with $\frac{1}{4}$-mile spreads. The rest of the reflection programme was shot using $\frac{1}{4}$-mile spreads and the portion from Shot-point 150 to Shot-point 157 was re-shot using this spread-length. On Traverse D reflections were fair until at Shot-point 168 they cut out altogether, owing to an exceptionally large increase in weathering depths (from 85 ft at Shot-point 168 to 430 ft at Shot-point 175½). A nine-hole diamond pattern shot was tried at Shot-point 174 with the holes 10 ft apart, and 5-lb charges were placed at a depth of 50 ft in each hole. The results were no improvement on those from a one-hole shot. The portion of this traverse from Shot-point 163½ to Shot-point 183½ was consequently studied by means of a continuous five-mile refraction profile, using one-mile spreads and shooting at each end for weathering information and at one mile from each end of the spread to pick up the strong refracting layer believed to be the top of the Jurassic sediments.

Reflection and refraction work on Traverse E was straightforward. Reflections were fair between Shot-points 128 and 138; reflections between Shot-points 94 and 98 were very poor.

5. RESULTS

The weathering velocity was determined, from up-hole times and special weathering spreads, to be 2000 ft/sec; and the sub-weathering velocity, derived from the first-break times from the reflection records, was 6000 ft/sec.

From the reflection records, a $t:\Delta t$ Analysis was made and from it was derived a distribution of vertical average velocities down to a depth of 5500 ft (Plate 4). Below this depth, reflections were not sufficiently good to yield reliable data. The time-depth relation is shown on Plate 5 and it can be seen to agree very closely with the results of the velocity survey on the A.P.M. No.1 bore at Rosedale and also with the results of the seismic survey in the Morwell area.

The results of the velocity profile (Plates 6 and 7), although they agree fairly closely with the $t:\Delta t$ Analysis, are not very reliable. The genuine reflections are not easy to pick owing to the presence of very strong multiple reflections such as M1, M2, and M3 on Plates 6 and 7.

This effect of strong multiple reflections interfering with the true reflections is apparent on the reflection cross-sections (Plates 8, 9, and 10). An alignment of troughs is sometimes split into two, or sometimes pinched-out by two converging alignments of peaks. The effect makes the correlation of reflections difficult.

Another detrimental feature of the reflection records is the lack of character in any of the reflections. This could be due to lack of "character" in the earth structures, i.e. to lack of suitable acoustic impedance in the geological sequence penetrated. Much time was spent in the field on this problem but the best recording conditions obtained failed to yield reflections with correlatable character.

A third detrimental feature of the reflection records is the presence of low-frequency (20 c/s) noise which persists at high amplitudes down to four seconds. The noise has the appearance of reflections on the records in that the troughs align very well from trace to trace and sometimes even from record to record (for example records S.P.141 and S.P.142). The origin of these signals was not determined.

The presence of these three effects, viz. multiple reflections, lack of character, and noise, made the correlation of reflections from record to record rather difficult, but it was possible to correlate without too much doubt down to about 1 sec to give five reflecting horizons. Below about 1 sec the interfering energy swamps the reflected energy and no reliable information could be derived.

The results of the refraction work on Traverse D are shown on Plate 11. The average weathering velocity was found to increase from 2000 ft/sec to 2700 ft/sec as weathering thickness increased between Shot-points 170½ and 171½. The initial work was done between Shot-points 175½ and 181½ to determine how useful the refraction profiling technique would be over the Baragwanath Anticline. Two good refractors were found, one with a true velocity of 14,200 ft/sec at a depth of 1000 ft and the other with a true velocity of 16,900 ft/sec at a depth of 1800 ft. The velocity of 14,200 ft/sec was taken as being representative of the top of the Jurassic sediments and it was decided to follow this refractor for a total distance of five miles over the Baragwanath Anticline from Shot-point 163½ to Shot-point 183½. This gave one mile of overlap with the reflection work and thus provided good correlation. The refractor velocity was independently confirmed at three different locations along the traverse.

Because the upper part of the Tertiary was thin along most of the refraction profile a value of 6500 ft/sec (a higher value than Plate 4 indicates) was chosen to represent all the Tertiary above the refractor. This value of average velocity gave very good agreement of depth calculations when calculated from intercept times, offset distances, and critical distances. The resulting depth profile (Plate 11) shows the Baragwanath Anticline but does not indicate any major fault corresponding to the Rosedale Fault. The depth of the 14,200-ft/sec refractor correlates very well with reflection horizon D.

The results of the refraction work on Traverse E are shown on Plate 12. The only definite refractor is one of 16,500-ft/sec velocity at a depth of about 4000 ft at Shot-point 135 and about 1500 ft at Shot-point 96. A velocity of 14,000 ft/sec was recorded when shooting in one direction only; viz. from Shot-point 189 and over only eight consecutive geophone stations. This is most probably the same refractor as the 14,200-ft/sec one of Traverse D. The fact that it was not recorded when shooting from the west would suggest that it is thinning out towards the west and that the shortest travel-time path is down to and along the 16,500-ft/sec refractor. If its true velocity is 14,200 ft/sec then the bed it represents is practically horizontal and at a depth of about 2750 ft which agrees very closely with the correlated depth of horizon D at that point.

Long refraction shots were made from Shot-point 106 (7 miles from the spread) from Shot-point 94 (10 miles from the spread) and from Shot-point 190 (11 miles from the spread) in an attempt to detect a higher velocity (for example a "basement") below the Jurassic sediments. However, although the records were good, no higher velocity was recorded. The velocities from Shot-points 94 and 106 were both about 15,900 ft/sec and their reciprocal times agreed very well (within 20 msec) with the reciprocal time from Shot-point 188. Also the velocity of the corresponding section (Shot-points 134 to 138) shot from Shot-point 126 was found to be 15,500 ft/sec. These facts suggest that the velocities obtained from the three shot-points (94, 106, and 126) are from the same refractor. The very high velocities recorded from Shot-points 188 and 190 do not tie in with any of the velocities recorded by shooting from the west. It is probable that the 22,700-ft/sec velocity recorded from Shot-point 189 represents an up-dip velocity of the 16,500-ft/sec refractor but it could possibly come from a deeper refractor. The 25,200-ft/sec velocity recorded from Shot-point 190 has a similar profile to the 22,700-ft/sec velocity. Thus although it must come from a deeper refractor, the similarity in profiles suggest that it would not be much deeper. With the limited information obtained it is impossible to attribute either velocity to a definite refractor.

6. CONCLUSIONS

On Plates 13 and 14, the reflection and refraction cross-sections are combined on a reduced scale to show five horizons, and gravity profiles are also shown. Identification of the horizons is based on the information from the A.P.M. No.1 bore and is as follows:-

Horizon A represents the top of Morwell No.1B seam.

" B " " " " Morwell No.2 seam.

" C " " " " Traralgon seam.

" D " " " " Jurassic sediments.

" E " layer of shale within the Jurassic.

The two younger coal seams (Morwell No.1A and Yallourn) were too shallow to follow on the reflection cross-sections, but it is probable that they run parallel to the other seams and most likely they crop out between Shot-points 166 and 168 on Traverse D. On Traverse E, the base of the Tertiary is gradually becoming shallower towards the west.

There is no evidence of major faulting on the northern flank of the Baragwanath Anticline and it is probable that the Rosedale Monocline does not develop into a fault until a few miles farther east where the synclinal cross-section is thickening.

In the Snake Ridge locality between Shot-points 147 and 151 there is a definite small anticline, which explains the large south-westerly dips found on the dip-log survey of the A.P.M. No.1 bore.

Although a velocity of 14,200 ft/sec seems high for the top of the Jurassic sediments it is almost certain from the results of this survey that this velocity is in fact associated with the top of the Jurassic. The same velocity was found in the Morwell-Traralgon area (Lodwick, 1960) and attributed to either the Jurassic sediments or a basalt layer. Basalt, however, is not known to occur on the Baragwanath Anticline and was not found in the bore at Rosedale. Correlation between the reflections at the bore and refraction results over the Baragwanath Anticline supports the assumption that the velocity is associated with the Jurassic sediments.

The 16,500-ft/sec velocity was found by refraction on two parts of Traverse E and also on Traverse D and arises from a strong refractor. If the 14,200-ft/sec refractor is the top of the Jurassic sediments, as appears likely, then the 16,500-ft/sec refractor is placed about 1500 ft into the Jurassic. This also is a higher velocity than would have been expected from any of the Jurassic sediments found in the A.P.M. No.1 bore. Its occurrence on all three refraction probes suggests it is a characteristic of the Jurassic sequence in this area. It may be associated with a band of shale.

The gravity profile is found to follow the general structure of the Jurassic sediments, but superimposed in this general structure are the following minor structures suggested by the seismic profiles:-

(1) A small syncline with its axis beneath Shot-point 141.

(2) An anticline with its axis beneath Shot-points 148 and 149.

(3) A gentle syncline with its axis beneath Shot-point 159.

(4) A small anticline with its axis beneath Shot-point 162.

(5) A small syncline with its axis beneath Shot-point 164.

(6) Possibly a small fault beneath Shot-point 169.

The only information obtained regarding the base of the sedimentary sequence is of a negative nature, arising from the results of the long refraction shots on Traverse E. If it is assumed that the basin sediments rest on a basement material with a high velocity (say 20,000 ft/sec), then the minimum depth to it would be 12,000 ft to account for it not being recorded from Shot-point 94. This estimated depth is an absolute minimum, always assuming that the rock underlying the Jurassic has a regular surface and is in a condition favourable to the transmission of refracted seismic energy.

In any further work in this locality it would be necessary to consider how to eliminate noise and multiple reflections in order to improve the reflection quality. Standard reflection techniques would then be adequate except over the Baragwanath Anticline, and generally over the hilly areas, where the weathering depth is great. In these areas it is recommended that experiments be made using pattern shots and pattern geophone groups to record reflections. If, however, information is required on only one horizon such as the base of the Tertiary, then the refraction profiling technique as used on this survey is a very reliable and economical method.

7. REFERENCES

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THOMAS, D.E. 1953 Geology of the brown coal of Victoria Fifth Empire min. metall. Congr. Vol.6 - Coal in Australia. A.I.M.M., Melbourne.

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APPENDIX "A"

STAFF AND EQUIPMENT

STAFF:

Party Leader :- K.F. Fowler
Geophysicist :- J. Davies

Surveyors :- Members of S.E.C. Surveying staff.

Clerk :- E.J. Quinn. (part-time only)
Observer :- G.L. Abbs.
Shooter :- R. Cherry.
Toolpusher :- L. Sprynskyj.
Drillers :- J. Chandler.

Mechanics :- None

EQUIPMENT:

Seismic Amplifiers :- H.T.L. 7000B
Seismic Oscillograph :- Electro-Tech. ER66
Magnetic Recorder :- Electro-Tech. DS7/700
Geophones :- T.I.C. 6-cycle and 20-cycle.

Drills :- Carey
Failing 750 (2 days only)

Water Tanker :- Bedford 5-ton
Shooting Truck :- Bedford 5-ton

APPENDIX "B"

TABLE OF OPERATIONS

Sedimentary Basin :-	Latrobe Valley
Area :-	Rosedale
Headquarters :-	S.E.C. Traralgon
Established Headquarters :-	21st February 1961
Surveying Commenced :-	20th January 1961
Drilling Commenced :-	22nd February 1961
Shooting Commenced :-	23rd February 1961
Miles Surveyed :-	38½
Total Footage :-	11,991 ft
Explosives Used :-	4000 lb Geophex
Datum Level for Corrections :-	300 ft A.S.L.
Weathering Velocities :-	2000 ft/sec
	2700 ft/sec (between S.P. 171½ and S.P.182)
Sub-weathering Velocities :-	6000 ft/sec
	6500 ft/sec (between S.P. 166 and S.P. 191)
Source of Velocity Distribution :-	t:Δt Analysis

REFLECTION SHOOTING DATA:

Shot-Point Interval :-	1320 ft
Geophone Group :-	6 x 20-c/s phones in line at 22-ft intervals
Geophone Group Interval :-	110 ft
Holes Shot:-	64
Miles Traversed :-	10¼
Common Shooting Depths :-	30-90 ft
Usual Recording Filter :-	18-75 c/s
Usual Playback Filter :-	24-57 c/s
Common Charge Sizes :-	10 lb

REFRACTION SHOOTING DATA:

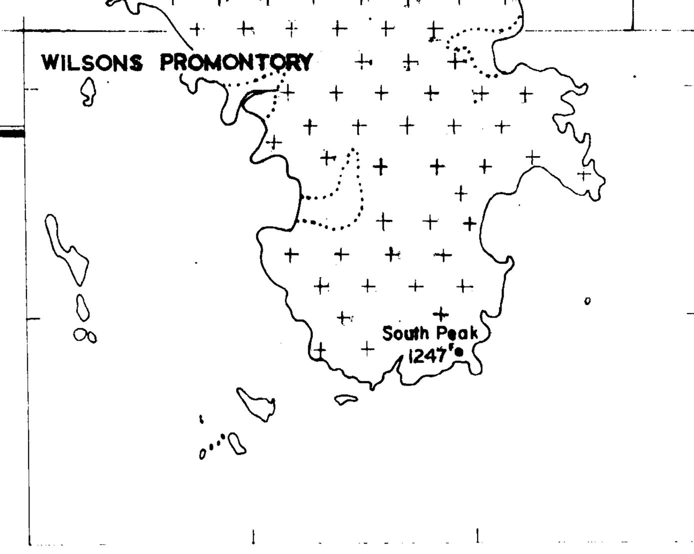
Geophone Group :-	2 x 6-c/s phones in parallel
Geophone Group Interval :-	220 ft
Holes Shot :-	28
Usual Recording Filter :-	0-30 c/s
Number of Refraction Traverses :-	3
Charge Sizes :-	10 lb-600 lb
Maximum Shot Geophone Distance :-	10 miles 4560 ft
Miles Traversed	8½

APPENDIX "C"

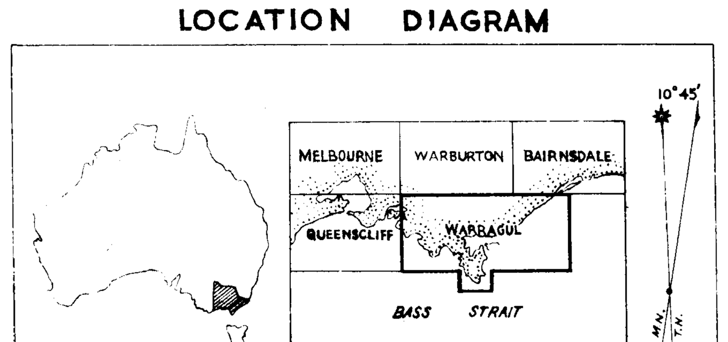
DRILLING STATISTICS

Total footage drilled	11,991 ft
" number of holes drilled	149
Average depth of holes drilled	80 ft
Deepest hole drilled	170 ft
Travelling time	64 hr
Rigging up time	30½ hr
Time lost, waiting on water	2½ hr
" " repairs to drill	34¼ hr
" " rain	11½ hr
" " repairs to rig engine	nil
" " waiting on surveyors	nil
Drilling time	142 hr
No. of shifts worked	33
Maintenance to drill	11½ hr
Bentonite used	6 bags
Fishing jobs	nil
Standby recorder	3 hr
Tanker broken down	1¼ hr
Loading shot-holes	4¼ hr
Waiting on instructions from Party Leader	3 hr
Rate of penetration	85 ft/hr

PLATE I
LEGEND
ROAD
RAILWAY
OIL-BEARING AREA
GRAVITY CONTOUR
MONOCLINE, FAULT Geologically known
Geophysically indicated
ANTICLINE Geologically known
Geophysically indicated
TECTONIC AND TREND Geol known
Geoph indicated
B.M.R. SEISMIC SURVEY 1958-1959
B.M.R. REFLECTION SPREADS 1960
B.M.R. SEISMIC TRAVERSES 1961
EXPLANATION
Contours show Bouguer values relative to an arbitrary datum. An average density of 1.887 has been assumed for rocks between station site and sea level in reduction of gravity values.
To convert to Bouguer Anomalies relative to theoretical values on International Ellipsoid (density σ 2.67), subtract from values shown:
(9.13 + 0.01 · h) milligal,
where 'h' is the station altitude in feet above Sea Level.
SCALE
MILES 4 0 4 8 12 16 20 MILES
CONTOUR INTERVAL 5 MILLIGALS
LOCATION DIAGRAM
MELBOURNE
BASS STRAIT
LAKE WELLINGTON
LAKE KING
LAKE VICTORIA
NINETY MILE BEACH
CORNER INLET
Bairnsdale
Lakes Entrance
Stratford
Sale
Longford
Rosedale
Traralgon
Morwell
Yallourn
Moe
Trafalgar
Yarragon
Toongabbie
Heyfield
Maffra
Briagolong
Stradbroke
Seaspray
Gormandale
Carrajung
Woodside
Yarram
Alberton
Welshpool
Toora
Foster
Meeniyan
Boolarra
Mirboo North
A.P.M. No.1 BORE
PRINCES HIGHWAY
SOUTH GIPPSLAND HIGHWAY
37° 45'
38° 00'
38° 15'
38° 30'
38° 45'
146° 00'
146° 30'
147° 00'
147° 30'
147° 45'
148° 30'
EAST CENTRAL GIPPSLAND, VICTORIA
MAJOR STRUCTURAL FEATURES GRAVITY CONTOURS AND SEISMIC TRAVERSES
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
G93-43-1
TO ACCOMPANY RECORD No. 1961-165



LOCATION DIAGRAM



REFERENCE TO AUSTRALIAN 4-MILE MILITARY MAP SERIES

LEGEND

- Tertiary, Reef of siliceous Limestone
- " Terrestrial Sediments
- " Basalt
- Jurassic
- Lower Devonian / Silurian
- Ordovician
- Granite

GEOLOGICAL MAP OF SOUTH GIPPSLAND

INCLUDING MAJOR TECTONICS

SCALE IN MILES

4 0 4 8 12 16 20

LEGEND

- • 351 Altitude In Feet
- First Class Road
- Second " "
- Third " "
- Railway
- Exploration Bore
- Definite Fault or Monocline
- Indefinite " " "
- Anticline
- Local Gravity Anomaly

MAP DATA

PROJECTION: Transverse Mercator, Australian Series

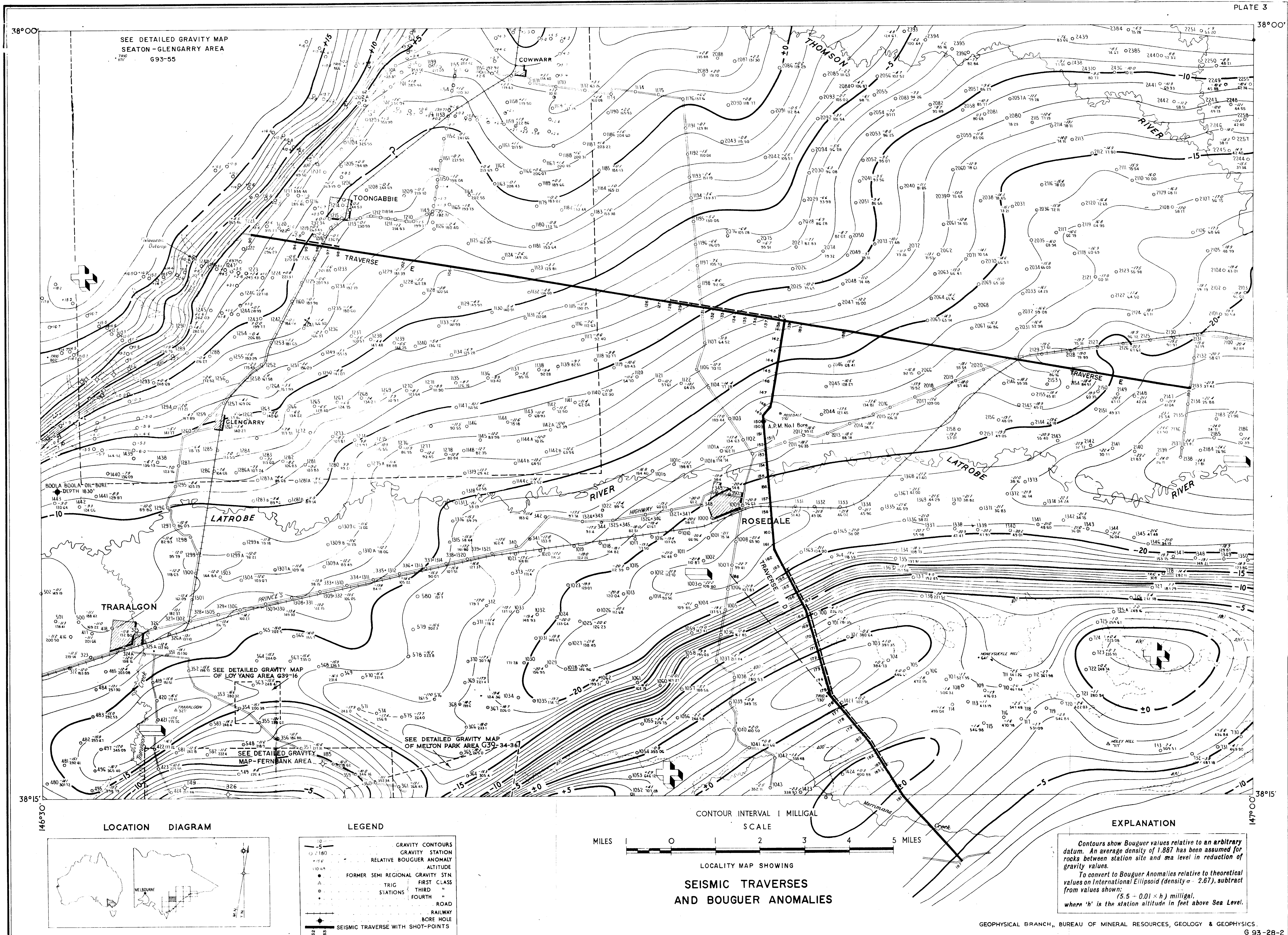
DETAIL: Planimetry from Royal Australian Survey Corps Warragul 4 miles to 1 inch map

Geology from geological map of Victoria by Department of Mines, Victoria, 1955 and geological and topographical plan of part of South Gippsland by H. HERMAN, 1952.

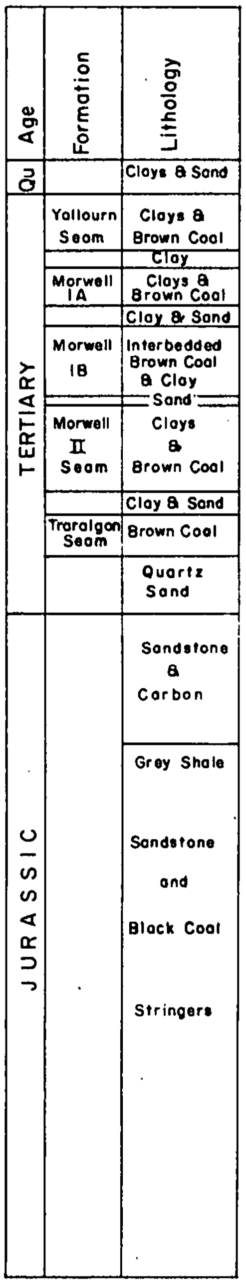
Geophysical (gravity and seismic) information on structural features by B.M.R. surveys 1948-1956.

DROUIN	Royal Australian Survey Cps. 1 mile to 1 inch map.	G93-46 FOSTER	Previously published B.M.R. Bouguer anomaly 1 mile to 1 inch map

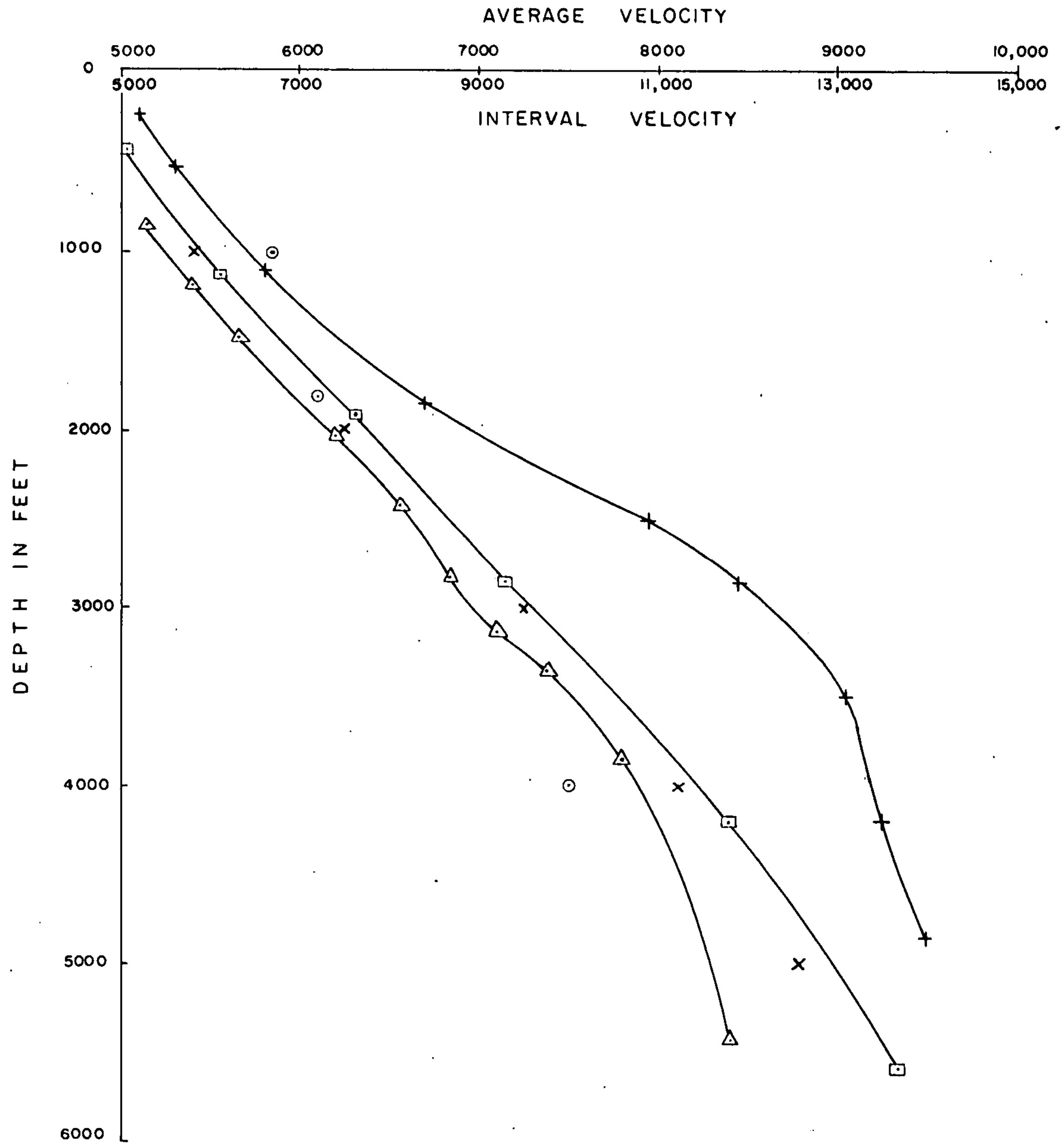
VICTORIA
ROSEDALE



TO ACCOMPANY RECORD No. 1961-165



A.P.M. No.1 Bore
ROSEDALE



× Average Velocity from Velocity Log. of A.P.M. No.1 Bore Rosedale.

⊡ " " " t , Δt analysis, 1961 Seismic Survey.

Δ " " " Velocity Profile, 1961 Seismic Survey.

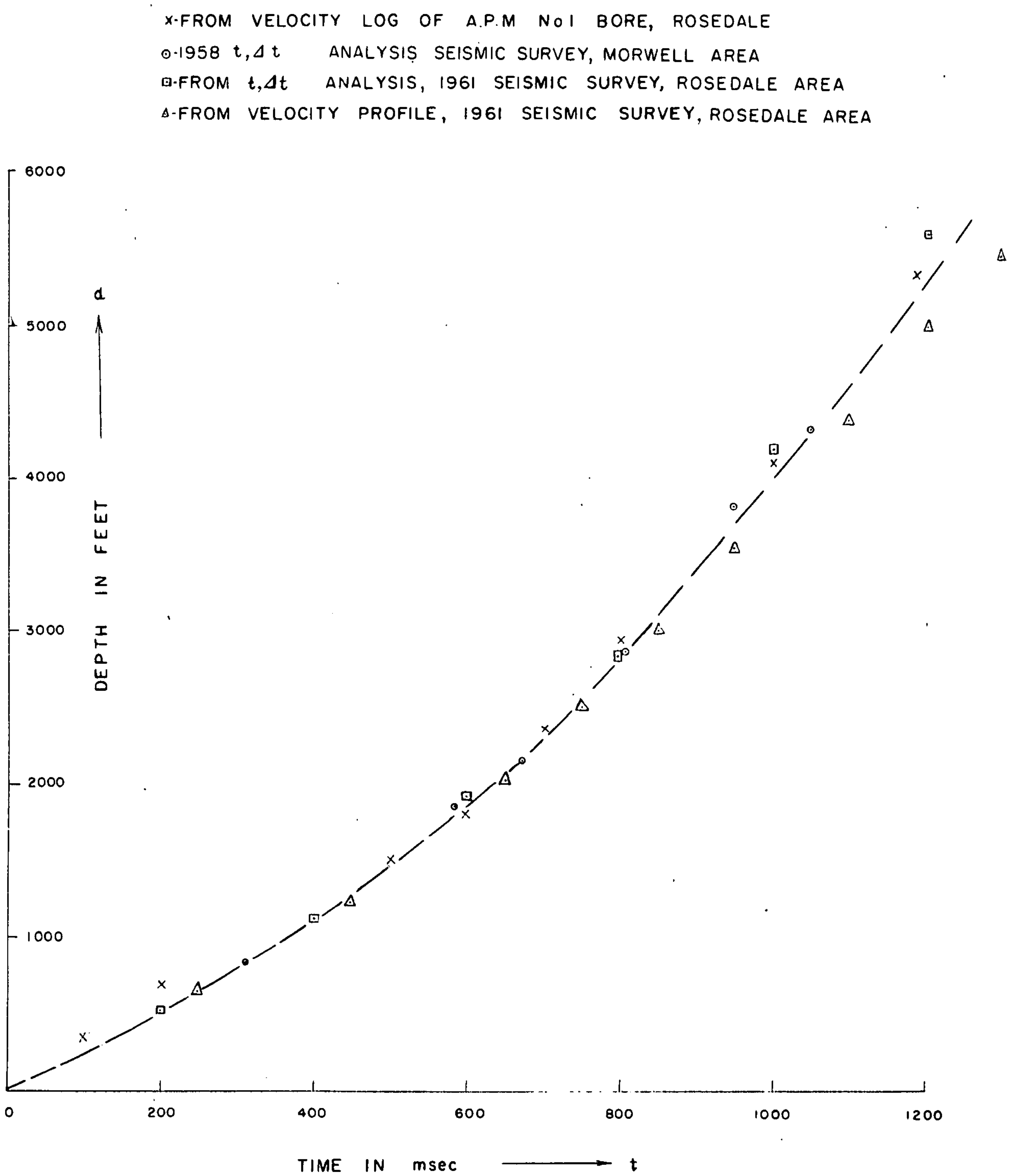
⊙ " " " t, Δt analysis 1958 Morwell Seismic Survey.

+ Interval Velocity from t, Δt analysis 1961 Seismic Survey.

VELOCITY Vs. DEPTH CURVES

Rosedale Vic., 1961

PLATE 5



TIME-DEPTH CURVE

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS G. 93—87

TO ACCOMPANY RECORD No. 1961-165

ROSEDALE VIC., 1961

PLATE 6

Area ROSEDALE
S.P 157½
S.P Elevation 54'
ds 26'
Datum 30'
Vo 2000'/sec.
Ve 6000'/sec.

S.P.	Dist.	Elev.	Σt
161½	5280	104	-1
	5170	104	0
	5060	102	0
	4950	101	+1
	4840	100	0
	4730	98	+1
	4620	95	+1
	4510	91	+1
	44[illegible]	87	0
	4290	85	+1
	4180	86	+1
	4070	83	+2
160½			
	3850	68	0
	3740	60	-1
	3630	55	-1
	3520	53	-1
	3410	53	0
	3300	53	0
	3190	53	0
	3080	53	0
	2970	54	0
	2860	54	-1
	2750	54	-1
159½	2640	54	-1

Area ROSEDALE
S.P 158½
S.P Elevation 53'
ds 48'
Datum 30'
Vo 2000'/sec.
Ve 6000'/sec.

S.P.	Dist.	Elev.	Σt
160½	2640	76	-3
	2530	68	-4
	2420	60	-5
	2310	55	-5
	2200	53	-5
	2090	53	-5
	1980	53	-4
	1870	53	-4
	1760	53	-4
	1650	54	-4
	1540	54	-4
	1430	54	-5
159½			
	1210	54	-5
	1100	54	-5
	990	54	-5
	880	54	-5
	770	54	-5
	660	54	-5
	550	53	-5
	440	53	-5
	330	53	-5
	220	53	-4
	110	53	-4
158½	0	53	-4

Area ROSEDALE
S.P 159½
S.P Elevation 76'
ds 38'
Datum 30'
Vo 2000'/sec.
Ve 6000'/sec.

S.P.	Dist.	Elev.	Σt
159½	0	54	0
	110	54	0
	220	54	0
	330	54	0
	440	54	0
	550	54	0
	660	54	0
	770	53	0
	880	53	0
	990	53	0
	1100	53	+1
	1210	53	+1
158½			
	1430	53	+1
	1540	53	+1
	1650	53	+1
	1760	53	+1
	1870	53	+1
	1980	53	+1
	2090	53	+1
	2200	53	+1
	2310	53	+1
	2420	53	0
	2530	53	0
157½	2640	54	0

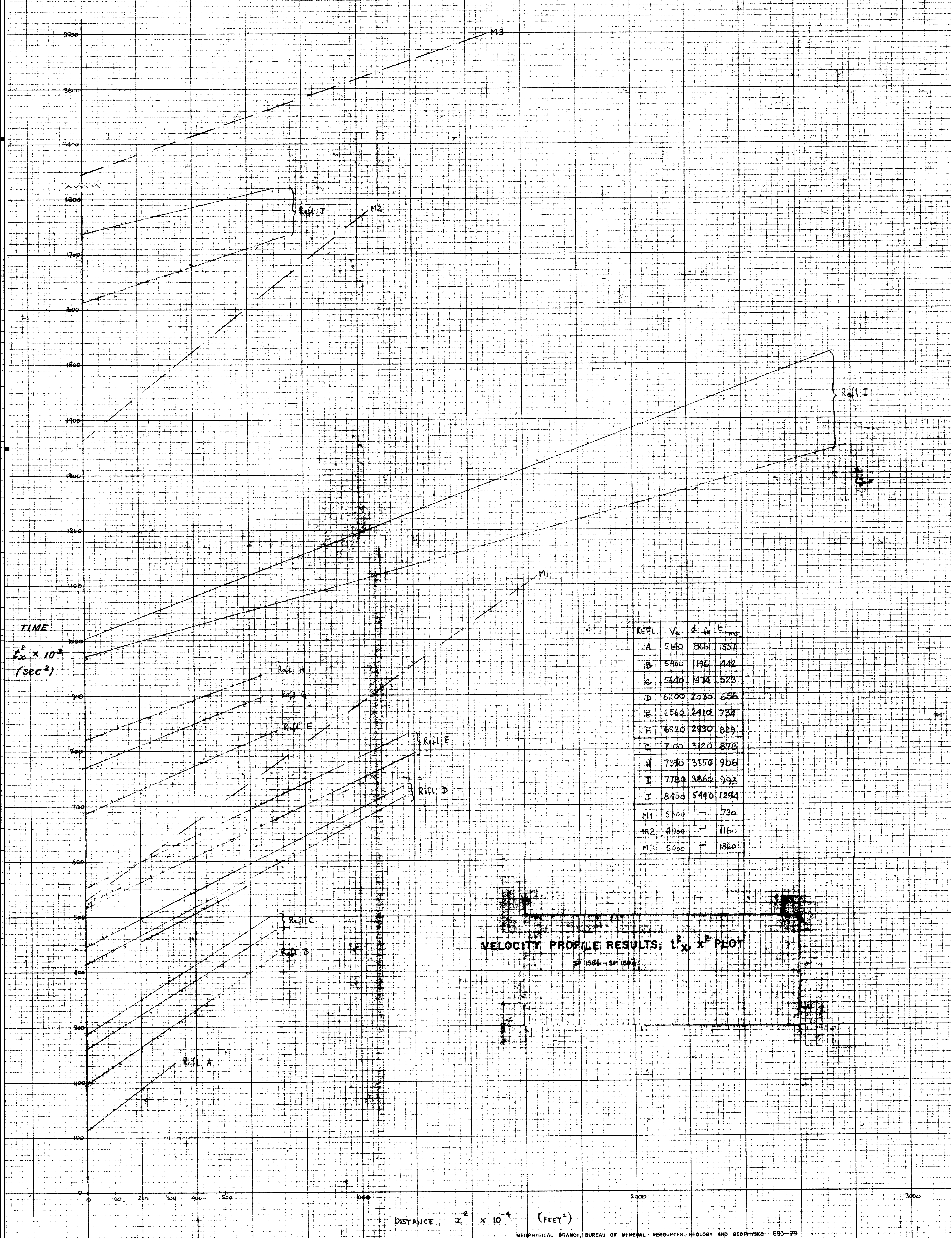
Area ROSEDALE
S.P 160½
S.P Elevation 54'
ds 36'
Datum 30'
Vo 2000'/sec.
Ve 6000'/sec.

S.P.	Dist.	Elev.	Σt
158½	2640	53	-2
	2750	53	-2
	2860	53	-2
	2970	53	-2
	3080	53	-2
	3190	53	-2
	3300	53	-2
	3410	53	-2
	3520	53	-2
	3630	53	-3
	3740	53	-3
	3850	53	-3
157½			
	4070	54	-4
	4180	54	-4
	4290	54	-4
	4400	54	-4
	4510	54	-5
	4620	54	-5
	4730	52	-5
	4840	43	-5
	4950	40	-5
	5060	39	-5
	5170	39	-5
156½	5280	39	-5

VELOCITY PROFILE, ROSEDALE, 1961

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G93-80

TO ACCOMPANY RECORD No. 1961-165



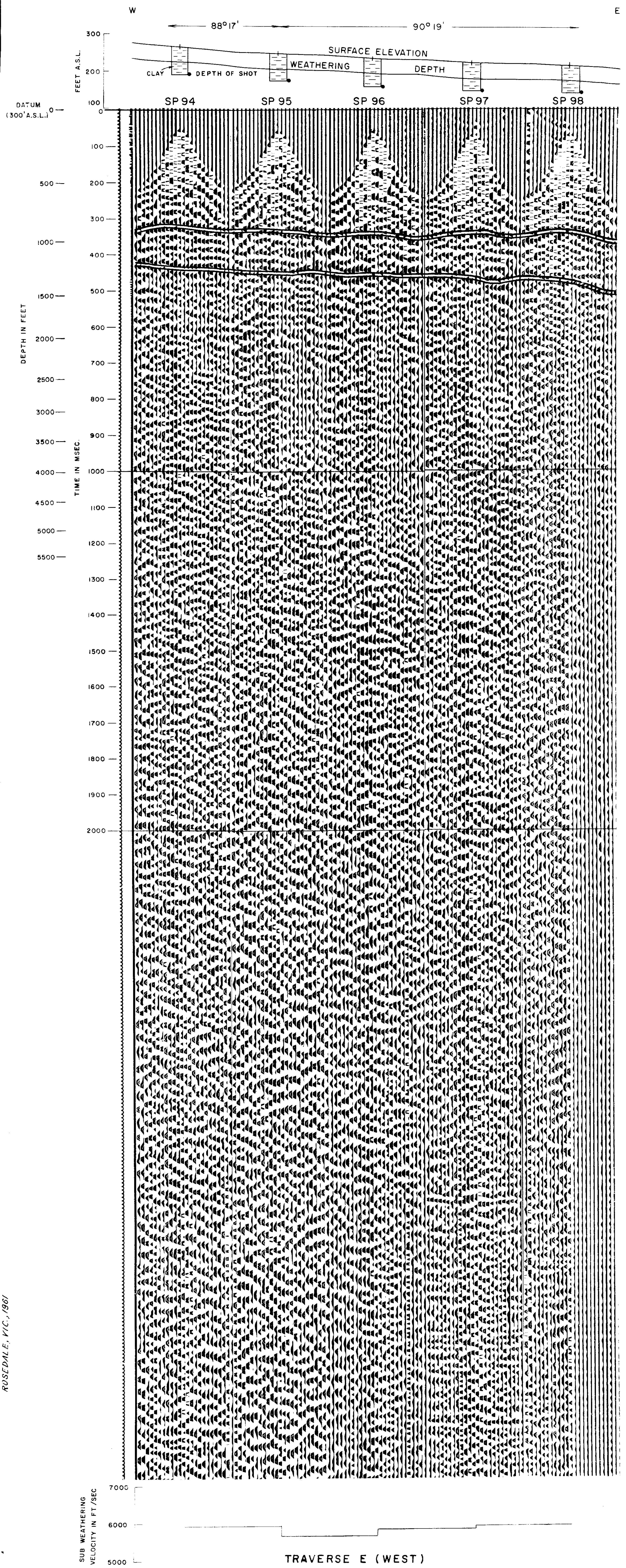
REFL.	V_a	d ft	t ms
A	5140	866	337
B	5900	1196	442
C	5610	1474	523
D	6200	2030	656
E	6560	2410	734
F	6820	2830	829
G	7100	3120	878
H	7390	3350	906
I	7780	3860	993
J	8400	5440	1294
M1	5800	—	780
M2	4900	—	1160
M3	5400	—	1820

VELOCITY PROFILE RESULTS; t_x^2, x^2 PLOT

SP 1586 – SP 1593

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS 693–79

TO ACCOMPANY RECORD No. 1961–165.



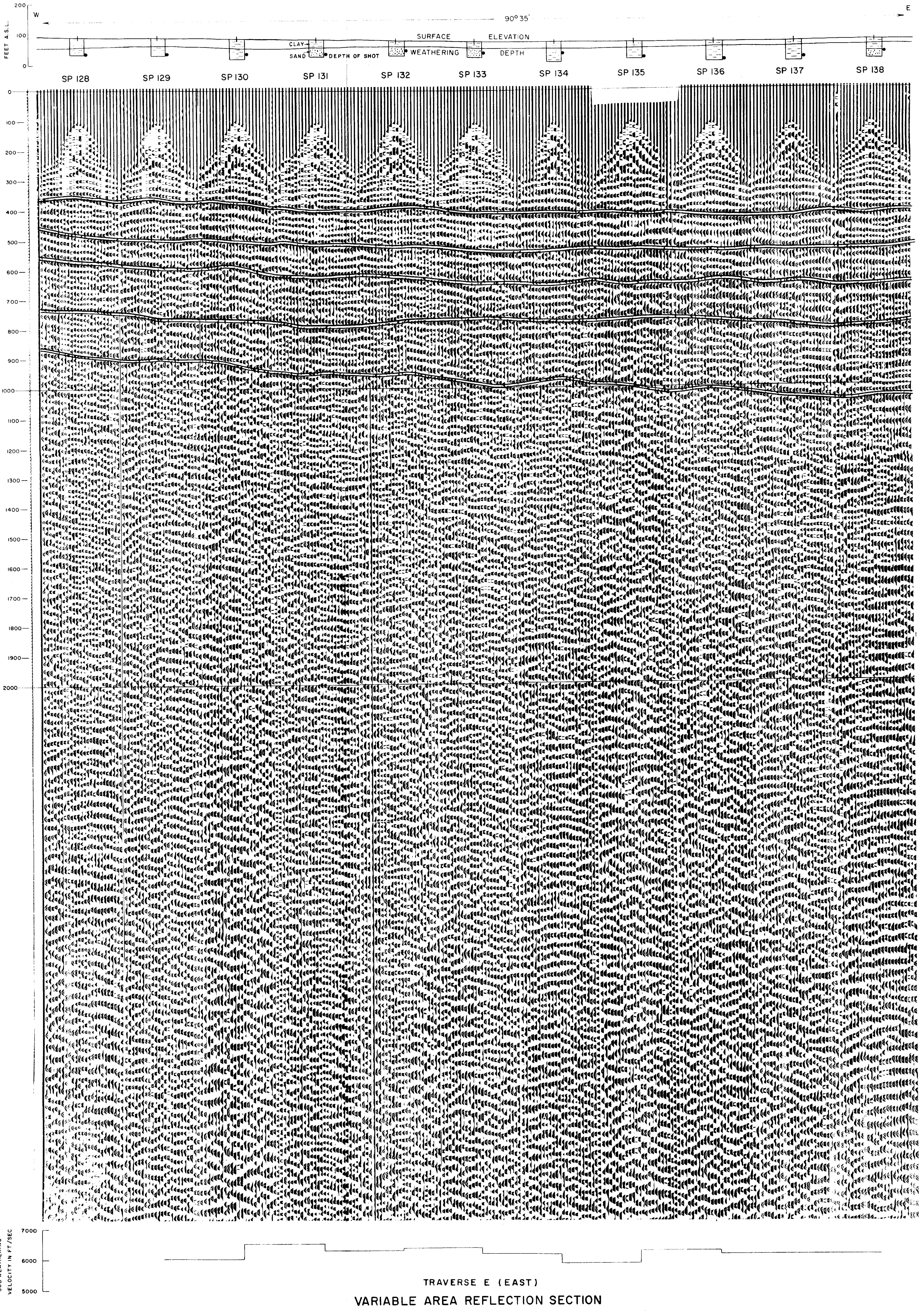
TRAVERSE E (WEST)

VARIABLE AREA REFLECTION SECTION

ROSEDALE, VIC., 1961

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G93-89

TO ACCOMPANY RECORD No. 1961-138



TRAVERSE E (EAST)

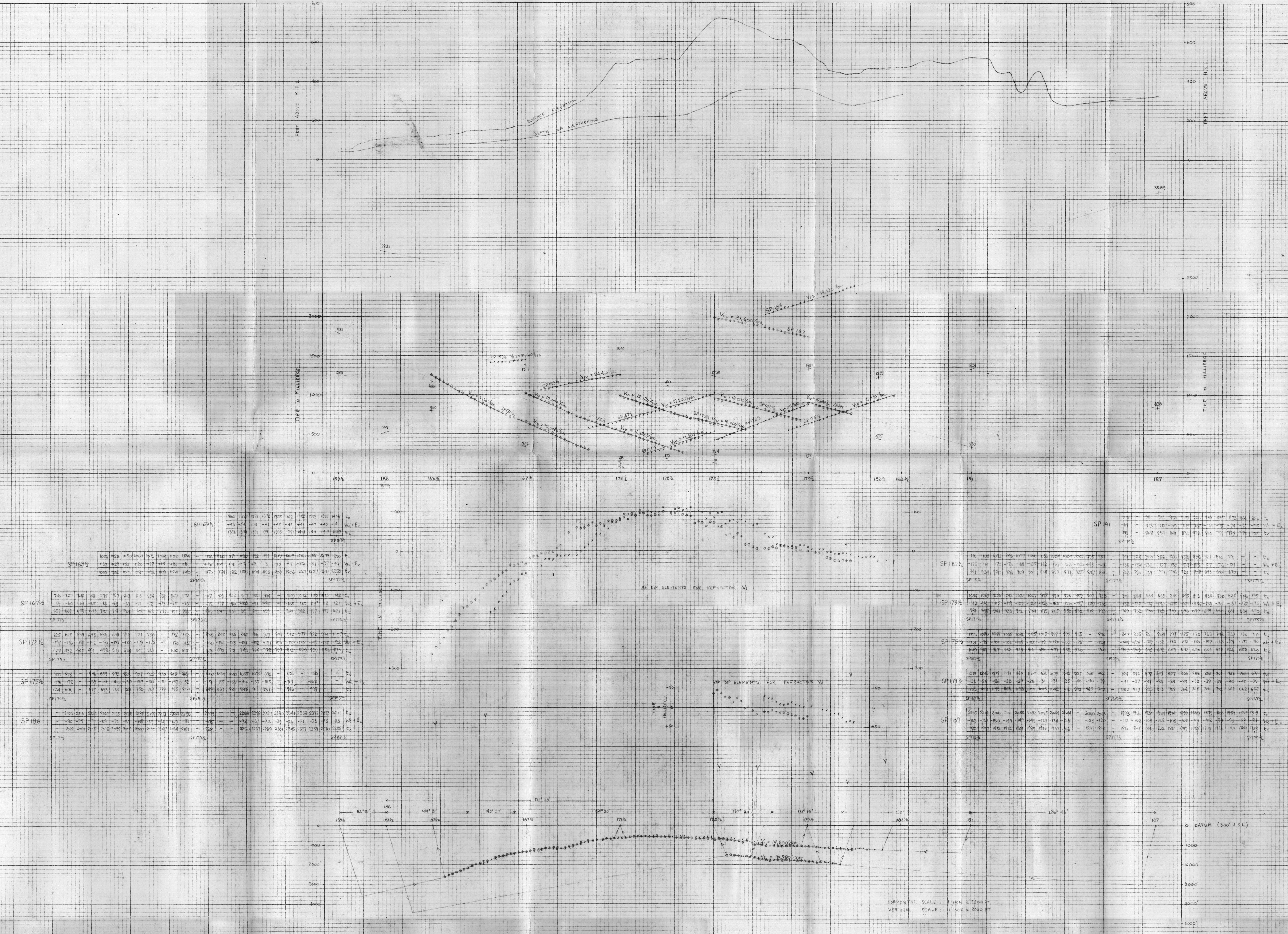
VARIABLE AREA REFLECTION SECTION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G93-90
TO ACCOMPANY RECORD No. 1961-165

TRAVERSE D

VARIABLE AREA REFLECTION SECTION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.
TO ACCOMPANY RECORD No. 1961-165
G93-91



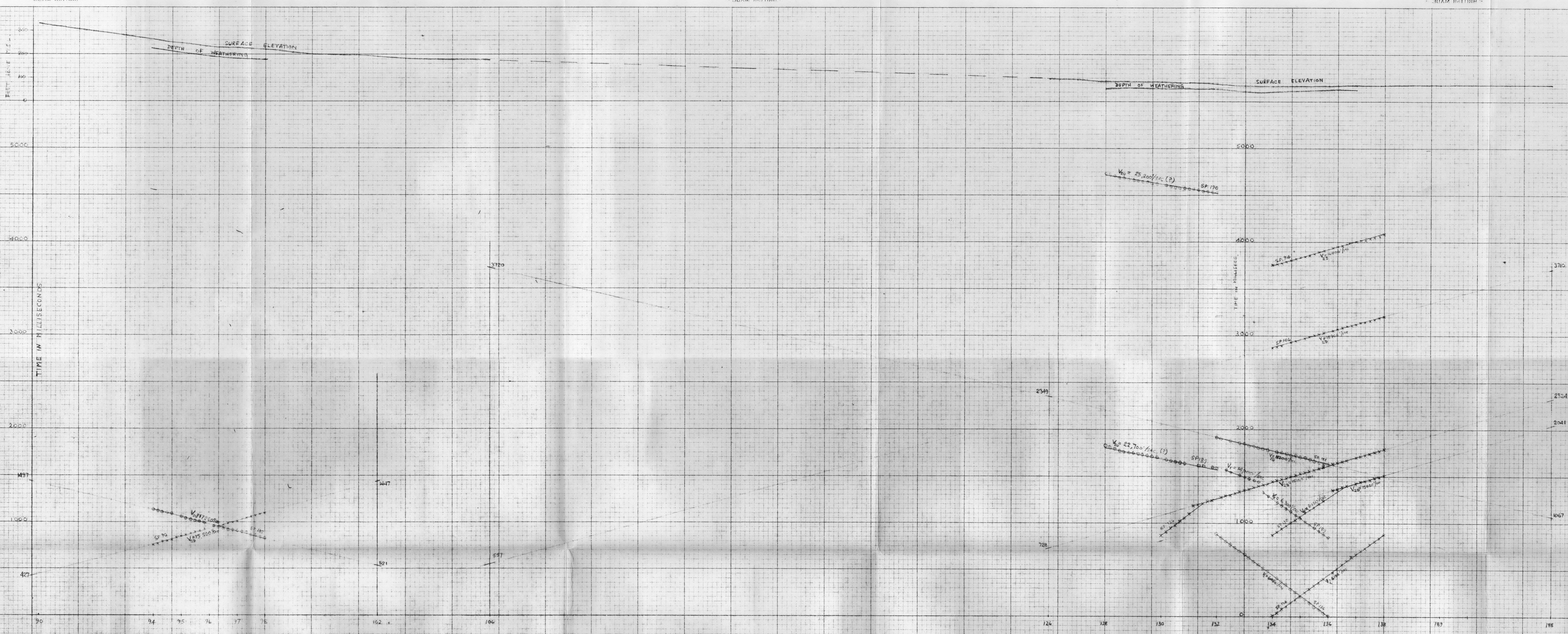
TRAVERSE D

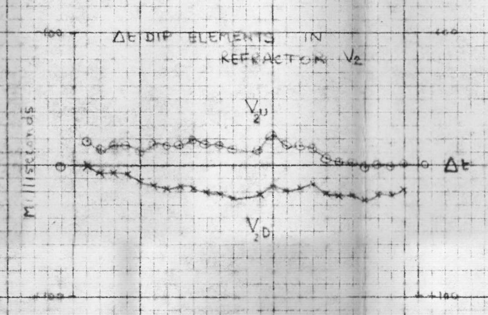
REFRACTION RESULTS

TIME-DEPTH CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G. 93-81

TO ACCOMPANY RECORD NO. 1961-165





to	748	766	780	794	811	829	842	898	875	830	902	920	-	544	951	969	978	989	1008	-	1038	1054	1066	1079	1087
Wc + Ec	+3	+4	+5	+4	+6	+4	+3	+3	+2	+3	+5	+6	-	+4	+4	+5	+4	+6	+6	+7	+5	+5	+6	+5	+6
tc	751	770	783	798	817	833	850	861	877	893	907	924	-	948	956	973	984	995	1016	-	1043	1059	1070	1084	1093
	94												96												98

SP 90

to	1111	1103	1088	1024	1062		1033	1019	1004	991	978	964	-	935	917	910	890	884	877	869	857	842	828	816	802
Wc + Ec	+24	+25	+24	+25	+27	+26	+25	+25	+23	+24	+26	+28	-	+26	+25	+26	+26	+27	+27	+30	+27	+27	+28	+27	+27
tc	1135	1128	1112	1099	1089	1070	1058	1044	1027	1015	1004	992		966	942	936	922	911	904	899	884	869	856	843	829
	94												96												98

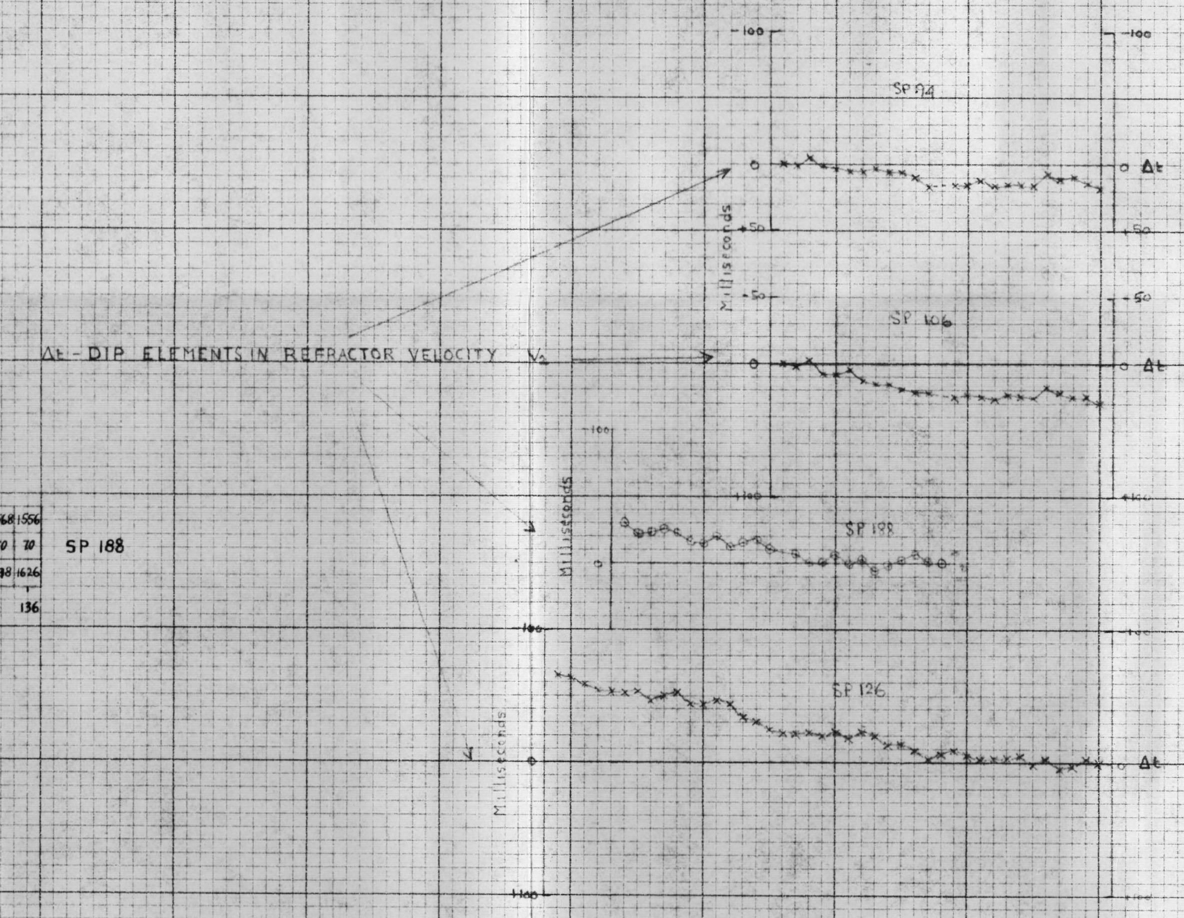
SP 102

to	1846	1841	-	1811	-	1796	1785	1764	1755	1741	1726	1721	-	1696	1689	1676	1658	1657	1636	1631	1611	1594	1576	1568	1556
Wc + Ec	70	70	69	69	67	67	67	65	69	70	69	68	-	70	70	70	68	69	68	67	69	70	70	70	70
to	1916	1911	-	1880	-	1863	1852	1832	1828	1811	1795	1789		1766	1759	1746	1726	1720	1704	1698	1650	1664	1646	1638	1626
	132												134												136

SP 188

to	1380	1396	1406	1431	1446	-	1481	1499
Wc + Ec	+68	+66	+66	+66	+67	-	+69	+68
tc	1448	1456	1472	1497	1513	-	1550	1567
				SP133				

SP 189



to	3706	3718	3724	3744	3762	3775	3789	3860	3814	3827	3844	3864	-	3889	3904	3914	3928	-	3955	3970	3972	3989	4000	4016	4034
Wc + Ec	+48	+50	+50	+50	+47	+49	+48	+47	+49	+50	+50	+50	-	+49	+48	+47	+50	+50	+48	+47	+49	+49	+50	+50	+50
tc	3754	3768	3774	3794	3809	3824	3837	3847	3863	3877	3894	3914	-	3928	3952	3961	3978	-	4003	4017	4021	4038	4050	4066	4084
	134												136												138

SP 94

to	2813	2825	2833	-	2873	2880	-	2918	2930	2945	2960	2973	-	3002	3014	3022	3041	-	3016	3082	3084	3100	3115	3122	3145
Wc + Ec	+58	+60	+60	+60	+58	+59	+58	+52	+59	+60	+60	+60	-	+59	+58	+58	+60	+60	+58	+57	+59	+59	+60	+60	+60
tc	2871	2985	2893	-	2931	2939	-	2975	2989	3006	3020	3033	-	3061	3072	3085	3101	3110	3123	3139	3143	3159	3175	3187	3205
	134												136												138

SP 106

to	879	911	950	986	1024	1060	1097	1119	1133	1148	1165	1178	-	1205	1225	1236	1248	1269	1283	1293	1308	1330	1348	1368	1383
Wc + Ec								64	64	67	68	68	-	69	68	68	66	66	66	67	68	69	68	67	18
tc								1183	1197	1215	1233	1246	-	1274	1293	1304	1314	1335	1349	1360	1376	1399	1416	1435	1451
	130												132												134

to	1396	1406	1423	1438	1453	1463	1460	1498	1510	1528	1547	-	1568	1587	1604	1613	-	1641	1660	1669	1688	1698	1708	1723
Wc + Ec	70	70	70	67	69	68	67	69	70	70	70	-	69	68	67	70	70	68	67	69	69	70	70	70
tc	1466	1478	1493	1505	1522	1531	1547	1567	1580	1598	1617	-	1637	1655	1671	1683	-	1709	1727	1738	1757	1768	1778	1793
																								138

SP 126

TRAVERSE E
REFRACTION RESULTS
TIME DEPTH CURVES AND INTERPRETATION

HORIZONTAL SCALE 1 INCH : 2200 FEET
VERTICAL SCALE 1 INCH : 2000 FEET

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.
TO ACCOMPANY RECORD No 1962/155

G 93-82

ROSEDALE VIC., 1961

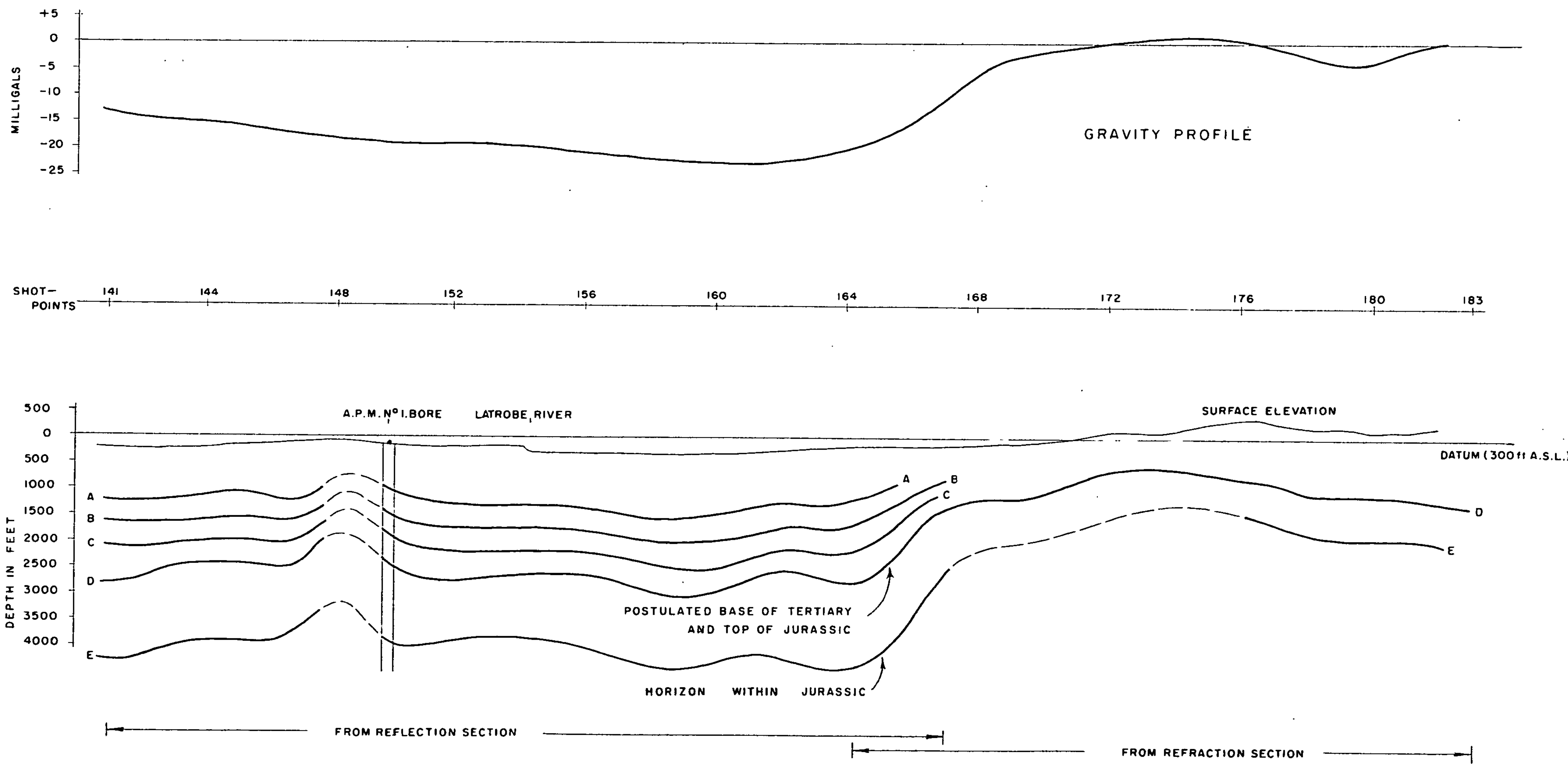


PLATE 13

HORIZONTAL SCALE: 1 INCH = 1 MILE

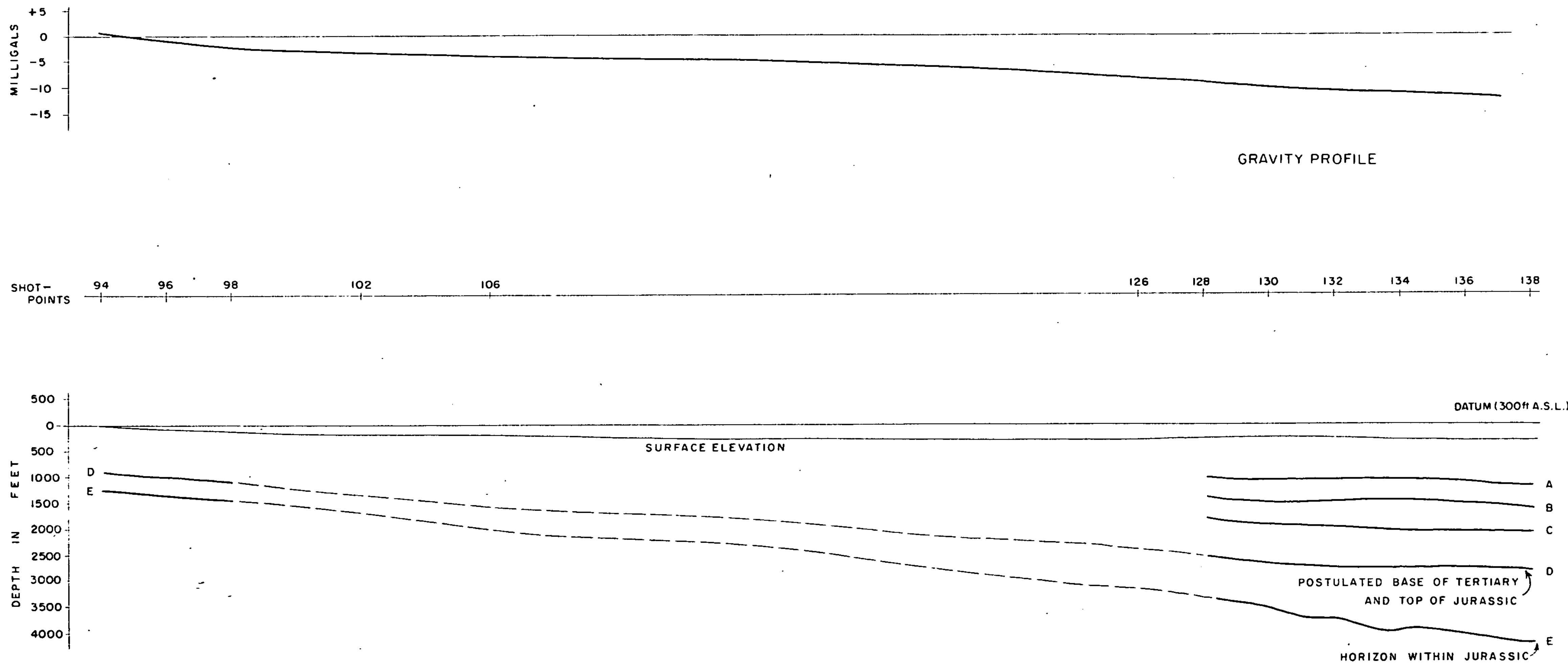
TRAVERSE D

COMPOSITE CROSS-SECTION AND GRAVITY PROFILE

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G 93-85

TO ACCOMPANY RECORD No. 1961-165

ROSEDALE VIC., 1961



TRAVERSE E

COMPOSITE CROSS-SECTION AND GRAVITY PROFILE

PLATE 14

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G 93-86

TO ACCOMPANY RECORD No. 1961-165