COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1962/64

ROSEDALE VELOCITY SURVEY OF APM No. 1 BORE, VICTORIA 1960

by

S.J. Watson and K.B. Lodwick

RECORD No. 1962/64

ROSEDALE VELOCITY SURVEY OF APM No. 1 BORE, VICTORIA 1960

by

S.J. Watson and K.B. Lodwick

CONTENTS

ILLUSTRATIONS

SUMMARY

A seismic velocity survey of the APM Development Pty Limited No. 1 bore at Rosedale, Victoria, was made by the Geophysical Branch of the Bureau on the 3rd May 1960 using a TIC three-component well geophone. Measurements were taken with the geophone suspended in the well at selected intervals down to 5500 ft.

It was apparent that signals reached the geophone by transmission along the cable by which it was suspended, and these interfered with the signals reaching the geophone along a path directly through the ground. This made interpretation difficult; however, by careful inspection of both the vertical and horizontal components of the signals received by the geophone at each depth, an interpretation has been made that yields a series of velocity/depth determinations.

The average vertical velocity increases from 5000 ft/sec at the surface to 8930 ft/sec at a depth of 5500 ft.

The average velocity in the Tertiary (0-2159 ft below datum) was computed to be 6420 ft/sec; the average velocity in the Mesozoic rocks penetrated (2159-5314 ft below datum) was 12,180 ft/sec.

Two reflection spreads laid out and recorded in the vicinity of the bore showed the presence of reflectors at depths estimated to be in excess of 7700ft.

1. INTRODUCTION

The APM Development Pty Limited No. 1 bore at Rosedale, Victoria, was at a depth of 5500 ft on 3rd May 1960. Woodside (Lakes Entrance) Oil Company N.L. , which was about to put a seismic party in the field in East Gippsland, was at this stage given the use of the bore to make a velocity survey that would provide their field party with seismic velocity data. A Lane-Wells five-conductor logging cable was provided and operated by Oil Drilling and Exploration Limited, under arrangements made by Woodside (Lakes Entrance) Oil Company, while the Bureau of Mineral Resources supplied shot-hole drills, explosives, amplifiers, a well geophone, and the geophysical staff to operate them.

The object of the survey was to measure the average vertical seismic velocities to depths down to the bottom of the bore, and to examine interval velocities over selected depth intervals.

The Bureau staff attending the survey were S.J. Watson, C.S. Robertson, K.B. Lodwick, K.F. Fowler, J. Grace, and J. Halls.

2. METHOD

A TIC three-component geophone, comprising two horizontal detectors and one vertical detector, was attached to the end of a Lane-Wells five-conductor cable. The outside conducting sheath of the cable was used as a return conductor for one of the horizontal components. The conductors at the other end of the cable were connected to a set of TIC 521 portable seismic amplifiers with a TIC camera so that:

(a) the signal from one horizontal component was recorded on traces 1, 2, and 3.

(b) the signal from the other horizontal component (with the outer conducting sheath in its circuit) was recorded on traces 5, 6, and 7.

(c) the signal from the vertical component was recorded on traces 9, 10, and 11.

The geophone was lowered to specified depths in the bore. Recordings were taken of the seismic signal reaching the geophone from charges of Geophex exploded in shot-holes 550 ft away from the bore, the shot instant being recorded on trace No. 24. Recordings were taken when the geophone was at 2345 ft below the kelly bushing, as this represents the surface between the Tertiary and Mesozoic sediments, and at 3030 ft, where the bore log had shown a lithological change. As there appeared to be no other geological or geophysical boundaries of interest, recordings were taken at other suitably spaced intervals, namely 1000, 2000, 3500, 4000, 4500, 5000, and 5500 ft.

The well known method of computation used for deriving the velocity/depth relationship from the time of arrival of the geophone signal is summarized in Plate 2. The measurement of depth recorded by the cable operator gives the distance (E_k + D) between the rotary table kelly bushing and the geophone. As the elevation of the rotary table above sea level is known, the depth D of the geophone below sea level (datum) is known. Further, the elevation(Es - ds) of the shot above datum can be calculated, and therefore the vertical distance between geophone and shot is known (D + Es - ds). The horizontal distance (X) between shot and geophone is known from direct measurement, so the angle α between the vertical and the direct path between the shot and the geophone can be calculated.

The measured time t_o over the direct path is converted to an equivalent time over the vertical path (D + Es - ds) by the relation

$$t \text{ (vertical)} = t_o \cos \alpha$$

This is reduced to a quantity tc representing the time taken to travel the vertical path D, by subtracting the small time required to travel the distance (Es - ds) between shot and datum at the sub-weathering velocity Ve. The average velocity is then

$$Va = D/tc$$

Defining the depth interval ΔD as the difference between successive values of D, and the time interval Δtc as the difference between the associated successive values of tc, then the interval velocity for this depth interval is given by

$$V_i = (\Delta D)/(\Delta tc)$$

The manner in which the average and interval velocities vary with the depth is shown in Plate 3.

There are two possible ray paths by which the first seismic wave may reach the geophone. They are illustrated on Plate 2 as t_o, corresponding to the direct path through the formation and as to_{cab}, corresponding to the refracted path along the cable. The critical angle is constant, and the time at which the signal down the cable reaches the geophone depends therefore on the length of the cable below the point B, traversed at the cable velocity Vcab which may be much higher than that of the surrounding rocks. The cable break may be the first energy arrival recorded and may be picked in error as, or otherwise confused with, a true formation break. Such confusion did occur on the present survey.

Owing to difficulties encountered during the operation, shots were fired at only one distance from the bore, and this increased the difficulty of deciding which seismic arrival on the records represented the formation break as distinct from the cable break. The approximate positions where one would expect a cable break have been marked on the seismograms of Plates 4, 5, and 6 so as to facilitate identification of the true formation breaks.

Where the energy onset on the record coincides, or nearly coincides, with the expected position of a cable break, it has been considered not to be a true break and the formation break has been looked for as a later event.

3. RESULTS

The seismograms showing the energy recorded by the well geophone at specified depths in the bore are shown in Plates 4, 5, and 6. It is evident that the signals from horizontal components of the geophone (Traces 1, 2, 3, and 5, 6, 7) are often very much disturbed by irregular noise of unknown origin and by induced noise with a frequency of 50 c/s presumably associated with the power supply to the nearby town of Rosedale. The signal from the vertical component (Traces 9, 10, 11) does not show a sharp onset, and therefore the picking of the time of arrival of energy at the geophone presents some difficulty.

The following considerations were applied in picking the energy arrival times:

At $(E_k + D)$ = 1000 ft there is no energy arrival near the expected cable break, but on traces 1,2,5,6, there is a definite sudden onset at 0.204 sec. There is no sharp onset shown on the vertical component traces. The time 0.204 derived from the horizontal component is therefore taken to be the true arrival time.

At $(E_k + D)$ = 2000 ft, there is energy that is not cable break energy, arriving on traces 1,2,3. The traces showing the vertical component energy give a different time of arrival, and there is thus some confusion. The time of 0.325 registered on traces 1,2,3 has been accepted, but its reliability must be regarded as very poor.

At $(E_k + D)$ = 1345 ft the energy onset on traces 9,10,11 appears too close to the expected cable break time, and is not considered. The horizontal component on traces 1,2,3 shows an appreciable onset at 0.362 sec. There is no corresponding energy arrival on the vertical component traces, and the value 0.362 although used, must be considered as of poor reliability.

At $(E_k + D)$ = 3030 ft, the cable break position as computed falls on the first arrivals on traces 9,10,11; the energy onset from the vertical component is thus suspect. On traces 4,5,6, there is evidence that a new energy onset begins at 0.426 sec; as a new arrival seems to be beginning in the vertical component at this time, it has been accepted as an arrival time.

At d = 3500 ft, the first energy arrival in the vertical component coincides with the time of the estimated cable break. The horizontal component on trace 1 shows a sharp movement at 0.461 sec. This time coincides with a sharp upward movement of the vertical component and has been accepted as the correct time, but it is of poor reliability.

At d = 4000 ft, the first energy arrival in the vertical component coincides with the estimated cable break. The next sharp energy arrival appears on traces 1,2,3, near 0.502 sec, which seems to correspond to a sharp upward movement of the vertical component at 0.499 sec. In this case the movement of the vertical component has been accepted.

At d = 4500 ft, the first energy arrival on the vertical component traces coincides with the expected position of the cable break, and is rejected. A sharp downward break in the horizontal component registered on traces 1,2,3, at 0.545 sec coincides with an energy arrival on trace 9. This time has been accepted, but it is of poor reliability.

At d = 5000 ft, the energy onset in the vertical component occurs at 0.584 sec, which is so much later than the expected cable break that it is regarded as a true formation break. There is no corresponding arrival on traces 1,2,3, while trace 5,6,7 record only 50-c/s interference.

At d = 5500 ft, the first upward movement of the vertical component traces begins at 0.620 sec. There is no corresponding energy onset recorded in the horizontal components.

The above values of energy arrival times have been introduced into the tabulation of Plate 2, and the computation has been carried through to yield the times over vertical travel paths between datum (sea level) and the geophone.

The velocity/depth relation as computed on Plate 2 has been drawn in the form of a graph in Plate 3. The data point to a relatively low velocity of 6420 ft/sec in the Tertiary sequence and a much higher average velocity of 12,180 ft/sec in the Mesozoic sequence between the base of the Tertiary and the limit of penetration of the geophone (5314 ft below datum).

4. CONCLUSIONS

The results obtained were dependent upon an interpretation that involved distinguishing the geophone energy arriving through the ground from that arriving down the cable from which the geophone was suspended; furthermore, the interpretation involved recognizing energy onsets of very small amplitude. Some of the 'picks' were very doubtful. Nevertheless the velocities derived are compatible with values obtained from a t:Δt Analysis of seismic records from the Latrobe Valley, about 20 miles west of Rosedale, by Lodwick and Moss (1958).

The results are regarded as acceptable, but should be reviewed if further well surveys or seismic reflection surveys are made in the area.

5. REFERENCES

LODWICK, K.B. and MOSS, F.J.	1958	An experimental seismic survey, Latrobe Valley, Victoria, April 1958. Bur. Min. Resour. Aust. Rec. 1959/151.

APPENDIX

Discussion of reflection seismograms from spreads near APM No. 1 bore

A conventional reflection spread of geophones was laid out in a westerly direction from Shot-point SP2 located 550 ft west of the bore. A copy of the record obtained is presented in Plate 7 (a). Recording conditions were not good, owing to rain and strong wind. The record shows several poor alignments, one of which (0.733 sec) could be from a reflector just within the top of the Jurassic. There is a further alignment at 1.270 sec corresponding to an estimated depth of 6000 ft. It is impossible to assign this to any lithological change, because the bit did not penetrate to this depth, but it provides evidence that the sedimentary column continues below the bottom of the bore.

Another seismic spread was placed along the Dennison Road at SP1 a mile north of the bore (Plate 1). Despite adverse weather, two fair-quality reflection records were obtained; they are shown in Plate 7(b) and (c). There are several shallow reflections providing evidence of reflecting surfaces within the column of Tertiary sediments. Below the Tertiary alignments there are reflections at 1.467 sec, 1.579 sec, and 1.733 sec. Accurate velocity data are not available in these strata as they are at depths well below the point reached by the drill bit, but assuming velocities of 6420 ft/sec in the Tertiary and 12,180 ft/sec in pre-Tertiary the reflectors have been assigned depths of roughly 7000 ft, 7700 ft, and 8600 ft. Below this there may be other alignments, although they have not been considered owing to the presence of interfering signals of about 30 to 35 c/s.

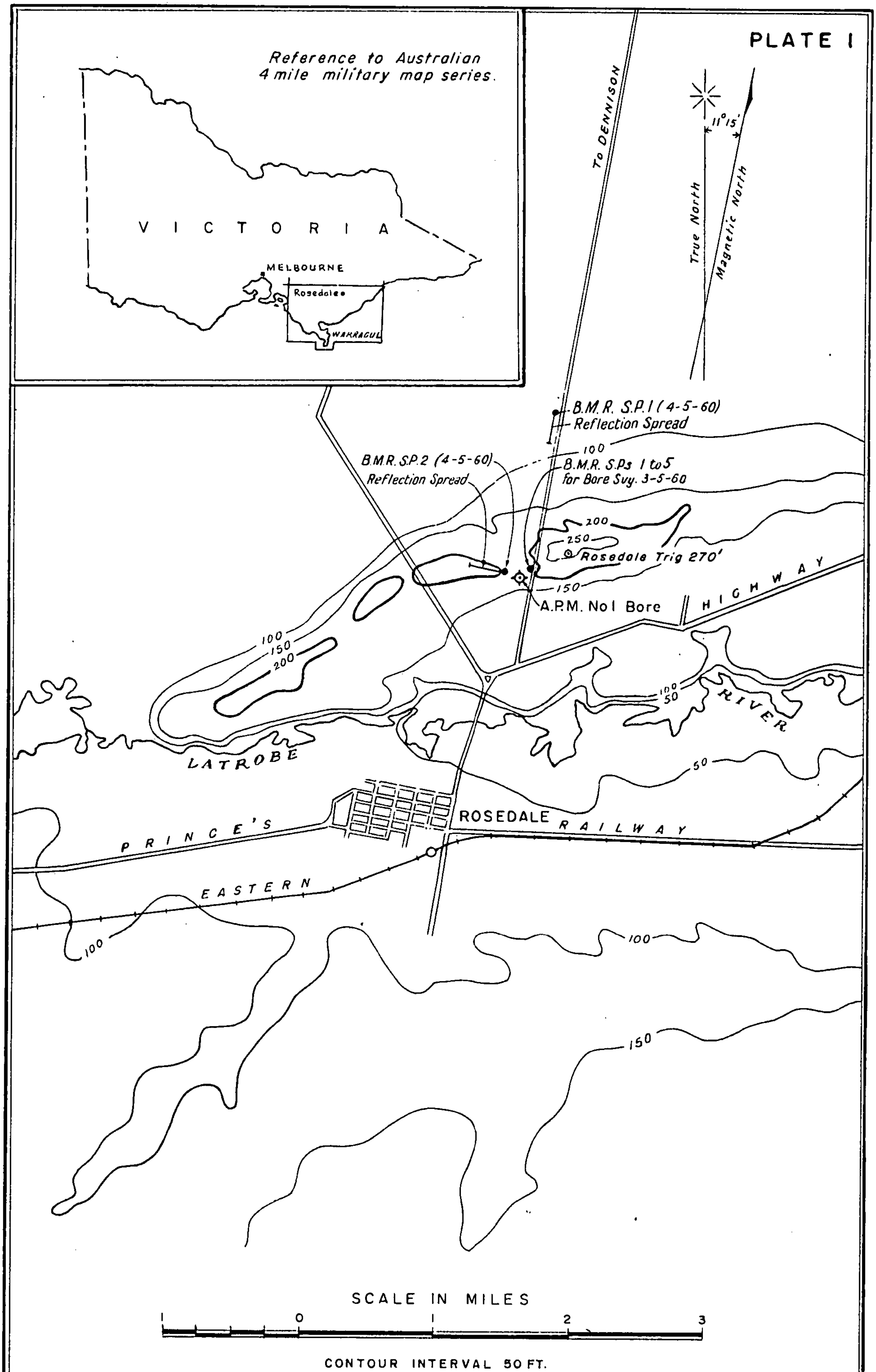
In conclusion the reflection records indicate that:

(a) Reflections are readily obtained in the Rosedale area with charges as low as 5 lb and shot depths less than 100 ft.

(b) Several good reflections are returned from beds within the Tertiary.

(c) The sedimentary column is thicker than 8600 ft in the Rosedale area.

PLATE I



ROSEDALE, VICTORIA
APM No1 BORE VELOCITY SURVEY, 1960
LOCALITY MAP

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G 105—2

To accompany Record No 1962/64

WELL VELOCITY SURVEY DATA SHEET

WELL NAME ROSEDALE No. 1
OWNER Australian Paper Manufacturers (Development) Pty. Ltd.
WELL LOGGING CONTRACTOR Oil Drilling and Exploration Ltd.

LOCALITY ROSEDALE, VICTORIA
ADDRESS Southgate, Melbourne
ADDRESS 82 Elizabeth St, Sydney

COORDINATES 38°8'S, 146°47'E
DRILLING CONTRACTOR Oil Drilling and Exploration Ltd.
TYPE AND NUMBER OF LOGGING UNIT Lane-Wells

DATE OF SURVEY 3rd May 1960
ADDRESS 82 Elizabeth St, Sydney
LOGGING UNIT OPERATOR —

ORGANISATION SUPERVISING VELOCITY SURVEY B.M.R.
ADDRESS
SURVEY SUPERVISOR S.J. Watson

SEISMIC INSTRUMENTS
MAKE T.I.C.
TYPE 521

WELL GEOPHONE
MAKE T.I.C.
TYPE 3-component
No Serial No. 113

B.M.R. REPRESENTATIVE S.J. Watson
DATA CALCULATION Watson and Lodwick

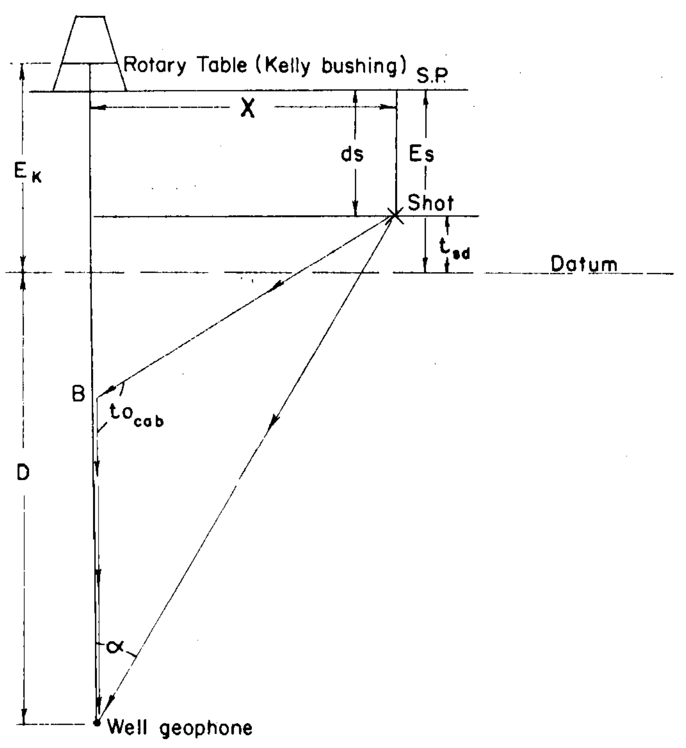
E_K = 186 ft Vo = 2000 ft/sec Ve = 5000 ft/sec Do = S.L. ρm = 1·17 B.H.T. or Tm = Not known Vcab {(Manufacturer) = ; (Test) = 11,300 ft/sec assumed} Cable Depth Accuracy = ± 1 ft

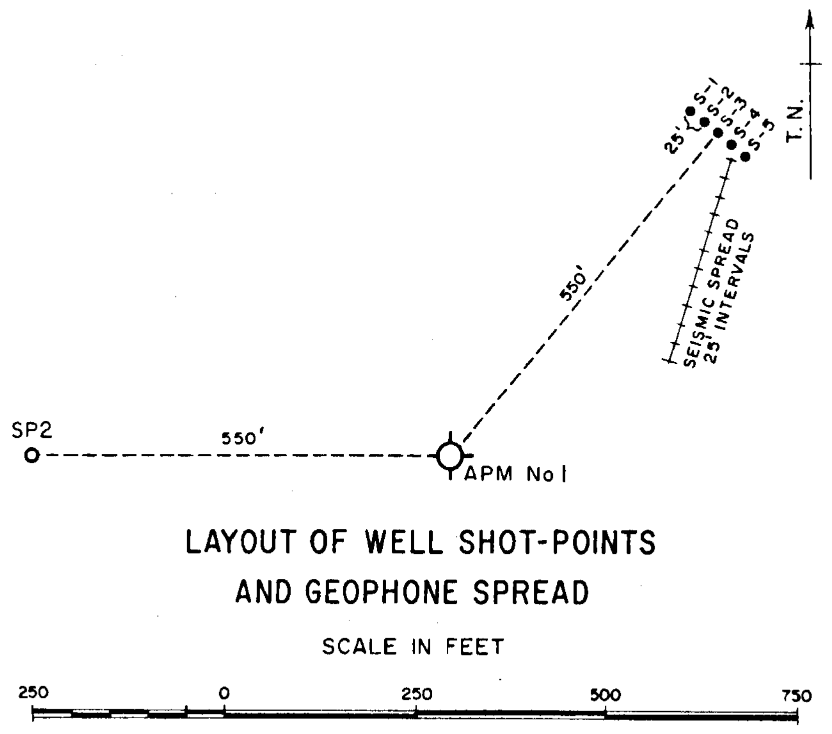
Shot No	E_K+D	D	S.P.	X	chge	Es	ds	t_{sd}	α	tv_1	Gr.	tv_2	Gr.	tha_1	Gr.	tha_2	Gr.	thb_1	Gr.	thb_2	Gr.	t_{RG} or to_R	Gr.	Δt_{RG} or Δto_R	t_{cab}	to_{cab} Gr	t_o or $t_o - \frac{t_{sd}}{\cos\alpha}$	Cos. α	tc	Va
9A	1000	814	S-5	550	20	175	65	022	30°40'	188	?	196	?	204	PG	212	PG	204	PG	212	PG			742	168		204	·8593	153	5320
8B	2000	1814	S-4	550	20	175	65	022	15°57'	290	?	300	?	325	PG	334	PG	356	?	368	?			742	256		325	·9615	290	6250
7A	2345	2159	S-4	550	10	175	98	015	13°49'	284	?	290	?	362	PG	372	PG	373	?	382	?				287		362	·9711	336	6420
6A	3030	2844	S-3	550	20	175	99	015	10°40'	426	PF	431	PF	416	PG	424	PG	426	PG	432	PG				345	346	426	·9827	404	7040
5C	3500	3314	S-2	550	30	175	79	019	9° 10'	461	PG	470	PG	461	PG	466	PF								386	390	461	·9872	436	7600
4B	4000	3814	S-2	550	35	175	79	019	8° 1'	499	PG	509	PG	499	?	502	PG								432	439	499	·9902	475	8030
3A	4500	4314	S-2	550	40	175	85	018	7°7'	545	PG	555	PG	545	PG	553	PG								475	475	545	·9923	523	8250
2B	5000	4814	S-1	550	40	175	65	022	6°22½'	584	PF	597	PF											740	522		584	·9938	558	8630
1A	5500	5314	S-1	550	40	175	65	022	5°47½'	620	PF	634	PF											744	568		620	·9949	595	8930

ΔD	Δtc	Vi
1000	137	7300
345	046	7500
685	068	10070
470	032	14690
500	039	12820
500	048	10420
500	035	14290
500	037	13510

REMARKS:

1. Weather conditions: Rain, strong winds.
2. Assumed formation velocity for cable-break calculations = 5500 ft/sec
3. TD = 5577 ft at 4/5/60; drilled ahead to completion at 5836 ft on 9/5/60 in Jurassic sand and shale
4. Average velocity in Tertiary, computed = 6420 ft/sec
5. Average velocity in Jurassic, computed = 12180 ft/sec
6. Cable breaks and 50 cycle power interfered with most records
7. t_{cab} was calculated using 5500 ft/sec formation velocity from shot to point of refraction along cable
8. 11,300 ft/sec assumed for Ve since this is a common value and it fits presumed to_{cab} times





LAYOUT OF WELL SHOT-POINTS AND GEOPHONE SPREAD

DEFINITIONS OF SYMBOLS AND COLUMN HEADINGS:

- E_K+D — Depth of well geophone below rotary table Kelly bushing
- Do — Elevation of Datum above sea level.
- E_K — Elevation of rotary table Kelly bushing referred to datum plane
- D — Depth of well geophone below datum plane
- ΔD — Difference between depths of well geophone for two shots
- S.P. — Shot-point
- X — Distance of shot-point from centre of well
- chge — Pounds weight of explosive fired
- Es — Elevation of shot-point referred to datum plane
- ds — Depth of shot below surface
- Vo — Weathering velocity
- Ve — Subweathering velocity
- t_{sd} — Vertical time from shot to datum plane. Normally $= \frac{Es-ds}{Ve}$
- α — Vertical angle subtended by straight line from shot to well geophone $= \tan^{-1}\frac{X}{D+Es-ds}$
- tv_1 — Vertical component first break time for well geophone
- tv_2 — Vertical component first trough time for well geophone
- tha_1 — Horizontal component A first break time for well geophone
- tha_2 — Horizontal component A first trough time for well geophone
- thb_1 — Horizontal component B first break time for well geophone
- thb_2 — Horizontal component B first trough time for well geophone
- RG — Reference geophone
- t_{RG} — Reference geophone time
- Δt_{RG} — Reference geophone correction time. In general practice $tv_1 - \Delta t_{RG}$ is best estimate of t_o
- to_R — Reference reflection time
- Δto_R — Reference reflection correction time. In general practice $tv_1 - \Delta to_R$ is best estimate of $t_o - \frac{t_{sd}}{\cos\alpha}$
- t_{cab} — Calculated cable break time
- to_{cab} — Observed vertical component cable break time
- Δto_{cab} — Difference between to_{cab} corresponding to well geophone depth difference ΔD
- t_o — Accepted time for straight line ray from shot to well geophone. In idealized case t_o would equal tv_1, tha_1 and thb_1
- tc — Vertical time from datum plane to well geophone $= t_o \cos\alpha - t_{sd}$
- Va — Average vertical velocity between datum plane and well geophone $= \frac{D}{tc}$
- Δtc — Difference between tc corresponding to well geophone depth difference ΔD
- Vi — Interval velocity over depth difference ΔD $\left(= \frac{\Delta D}{\Delta tc}\right)$
- Vcab — Logging cable velocity $= \frac{\Delta D}{\Delta to_{cab}}$
- T.D. — Total depth of well referred to rotary table Kelly bushing
- ρm — Density of mud in well
- Tm — Temperature of mud returns when circulating in hole
- B.H.T. — Bottom hole temperature i.e. temperature at T.D.
- Gr. — Grading of certainty and accuracy of time:
  - 1st grade G means: Certain that true formation break selected
  - P " : Some doubt " " " "
  - 2nd grade G " : Accuracy less than ± ·001 seconds
  - F " : " " " ± ·003 "
  - P " : " " " ± ·005 "
  - ? grade means very doubtful certainty or time

FIELD INSTRUCTIONS:

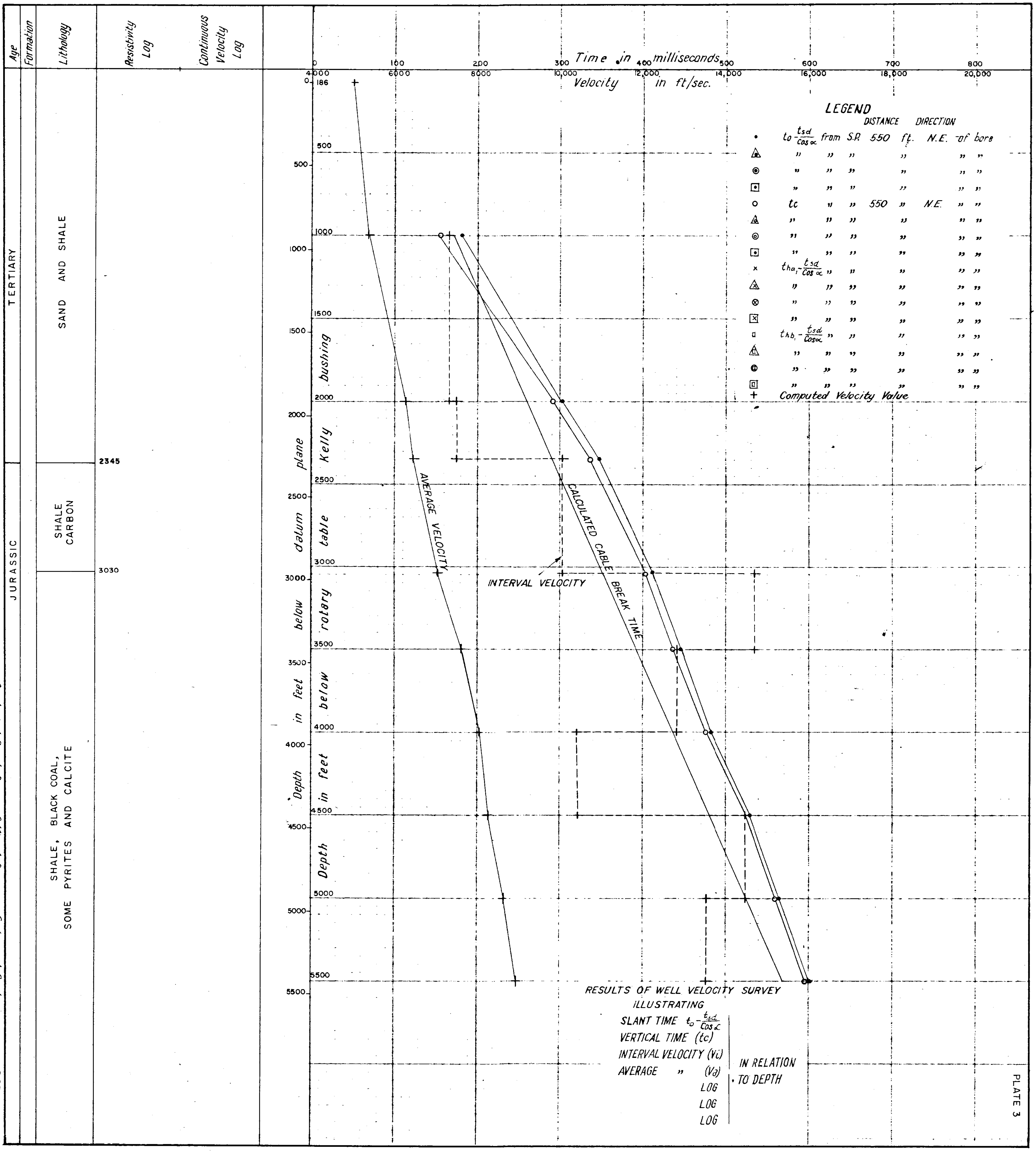
1. Do not use outer sheath of cable or other neutral lead as geophone lead.
2. Before running geophone in well, shoot buried detonator under well geophone or do tap test to check all connexions and polarity.
3. While running geophone into well fasten small geophone and a clamp to cable and strike a vertical blow on the clamp to check manufacturer's figure for cable velocity.
4. As soon as cable and shallow formation velocities are sufficiently well known, and before survey proceeds, construct calculated cable break curves for all shot-point offsets.
5. Do complete calculation as survey progresses and watch for cable breaks.
6. Where possible obtain copies of C.V.L.? electric and lithologic logs and fill in all information required on this sheet.

After G.85-113

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G 93-83
To accompany Record No 1962/64

PLATE 2

ROSEDALE, 1960

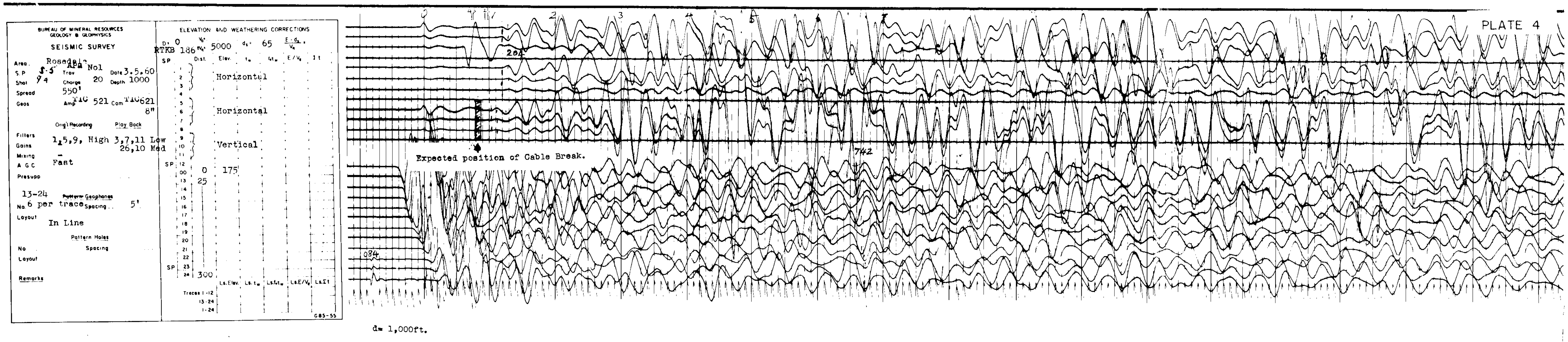


AFTER G 85-114

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.
To accompany Record No 1962/64

G 93-84

PLATE 3



4a

4b

4c

G105-10

BUREAU OF MINERAL RESOURCES GEOLOGY & GEOPHYSICS
SEISMIC SURVEY

Area Rosedale APM No 1
S.P. 53 Date 3.5.60
Shot 6A Charge 20 Depth 3030
Spread 550'
Geos. Amp TIC 521 Cam TIC 621 8"
Filters
Gains 1,5,9, High 2,6,10 Med 3,7,11 Low
Mixing –
A.G.C. Fast
Presupp
13-24 Pattern Geophones
No 6 per trace Spacing 5'
Layout In line
Pattern Holes
No. Spacing
Layout
Remarks

ELEVATION AND WEATHERING CORRECTIONS
D= 0 RTKP 186 Vw= 5000 ds= 99

Traces 1-4: Horizontal; 5-8: Horizontal; 9-12: Vertical; SP 0, 175; 25; 300

5a

BUREAU OF MINERAL RESOURCES GEOLOGY & GEOPHYSICS
SEISMIC SURVEY

Area Rosedale APM No.1
S.P. 53 Date 3.5.60
Shot 5C Charge 30 Depth 3500
Spread 550'
Geos. Amp TIC 521 Cam TIC 621 8"
Filters
Gains 1,5,9, High 2,6,10 Med 3,7,11 Low
Mixing –
A.G.C. Fast
Presupp
13-24 Pattern Geophones
No 6 per trace Spacing 5'
Layout In line.
Pattern Holes
No. Spacing
Layout
Remarks

ELEVATION AND WEATHERING CORRECTIONS
D= 0 RTKB 186 Vw= 5000 ds= 79

Traces 1-4: Horizontal; 5-8: Horizontal; 9-12: Vertical; SP 0, 175; 25; 300

5b

BUREAU OF MINERAL RESOURCES GEOLOGY & GEOPHYSICS
SEISMIC SURVEY

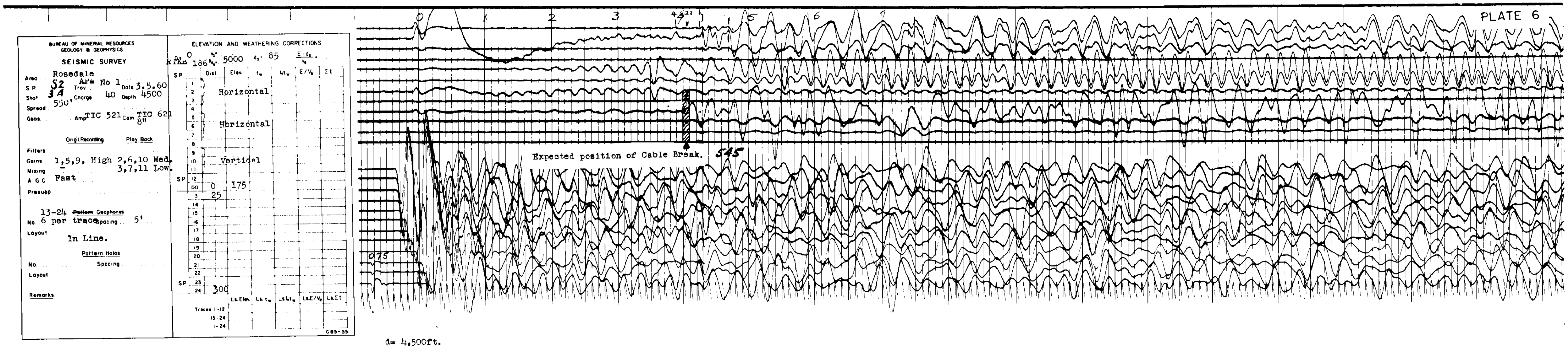
Area Rosedale APM No.1
S.P. 53 Date 3.5.60
Shot 4B Charge 35 Depth 4000
Spread 550'
Geos. Amp TIC 521 Cam TIC 621 8"
Filters
Gains 1,5,9, High 2,6,10 Med. 3,7,11 Low.
Mixing –
A.G.C. Fast
Presupp
13-24 Pattern Geophones
No 6 per trace Spacing 5'
Layout In line
Pattern Holes
No. Spacing
Layout
Remarks

ELEVATION AND WEATHERING CORRECTIONS
D= 0 RTKB 186 Vw= 5000 ds= 79

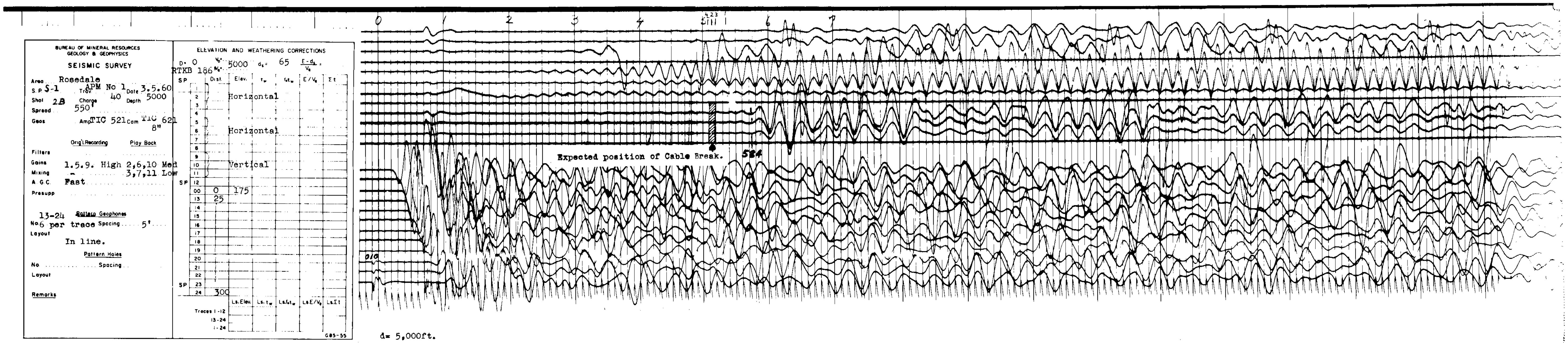
Traces 1-4: Horizontal; 5-8: Horizontal; 9-12: Vertical; SP 0, 175; 25; 300

5c

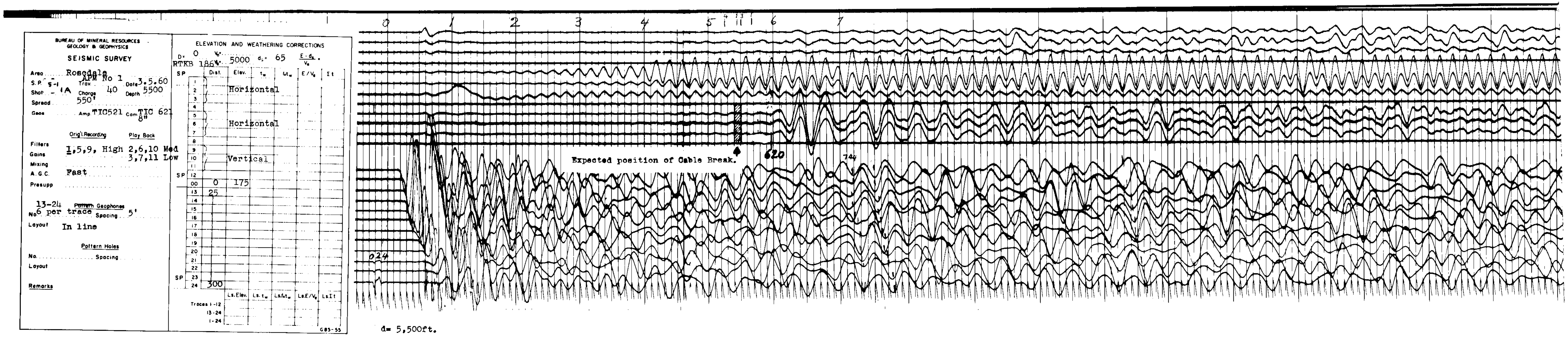
PLATE 6



6a



6b



6c

G105-12

PLATE 7

BUREAU OF MINERAL RESOURCES
GEOLOGY & GEOPHYSICS
SEISMIC SURVEY

Area 550 ft West of APM No.1
S.P. 2 Trav. - Date 4.5.60
Shot - Charge 30 lbs Depth 90 ft
Spread 1320 ft
Geos TIC 20 Amp. 521 Com.

	Orig'l Recording	Play Back
Filters	L2-H3	
Gains	Max	
Mixing		
A.G.C.		
Presupp	50%	

Pattern Geophones
No. 6 Spacing 22ft
Layout In line

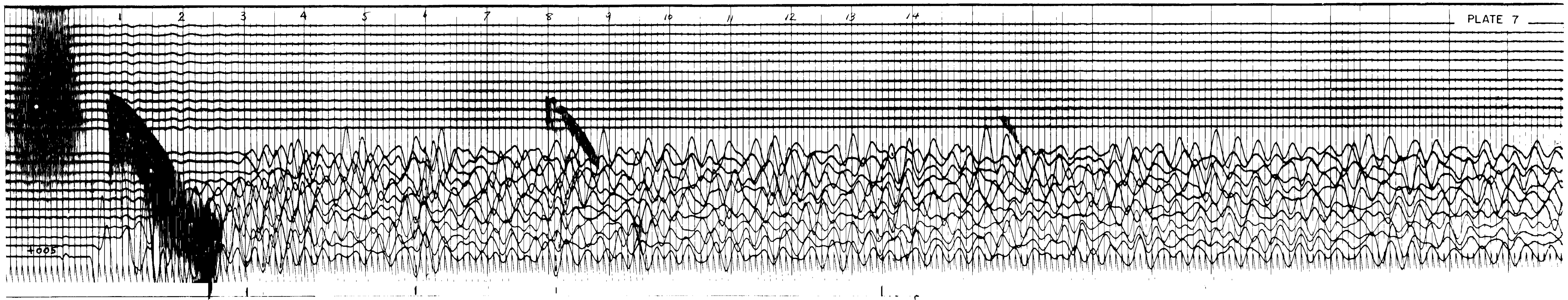
Pattern Holes
No. Spacing
Layout

Remarks
Record from region 550 ft west of APM No.1

ELEVATION AND WEATHERING CORRECTIONS

SP	Dist.	Elev.	t_w	Δt_w	E/V_e	Σt
00		191ft			(Est)	084

G83-55



REFLECTION TIME CORRECTED TO DATUM :-	0·223	0·504	0·733	1·270
ESTIMATED DEPTH BELOW ROTARY TABLE :-	750	1750	2650	6000

(a)

7a

BUREAU OF MINERAL RESOURCES
GEOLOGY & GEOPHYSICS
SEISMIC SURVEY

Area 1 Mile North of APM No.1
S.P. 1 Trav. - Date 4.5.60
Shot - Charge 20 lbs Depth 67+75 ft
Spread 1320 ft
Geos. TIC 20 Amp. 521 Com.

	Orig'l Recording	Play Back
Filters	L3-H3	
Gains	Max	
Mixing		
A.G.C.		
Presupp	20%	

Pattern Geophones
No. 6 Spacing 22ft
Layout In line

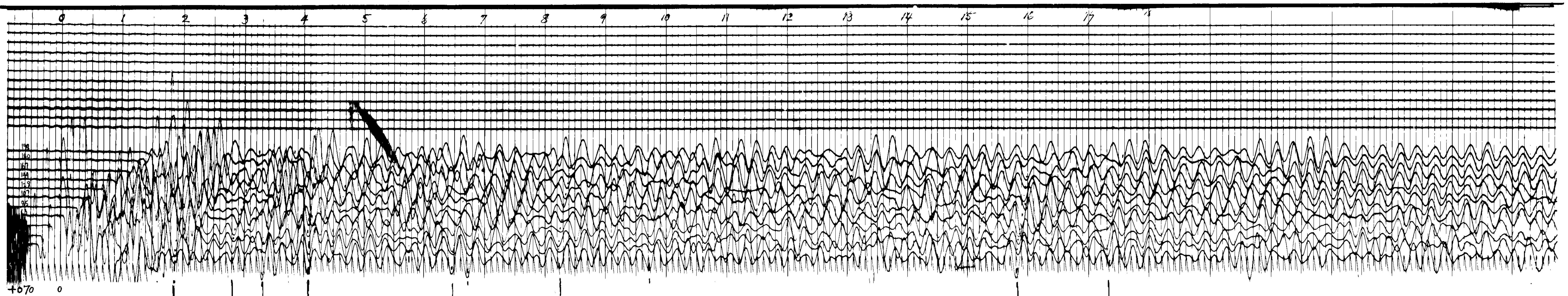
Pattern Holes
No. Spacing
Layout

Remarks
Record from region 1 mile north of APM No.1

ELEVATION AND WEATHERING CORRECTIONS

SP	Dist.	Elev.	t_w	Δt_w	E/V_e	Σt
00		150 ft			(Est)	072

G83-55



REFLECTION TIME CORRECTED TO DATUM :-	0·184	0·278	0·328	0·466	0·644	0·822	1·579	1·732
ESTIMATED DEPTH BELOW DATUM :-	500	740	890	1180	2050	2950	7690	8620

(b)

7b

BUREAU OF MINERAL RESOURCES
GEOLOGY & GEOPHYSICS
SEISMIC SURVEY

Area 1 Mile North of APM No.1
S.P. 1 Trav. - Date 4.5.60
Shot Charge 5 lbs Depth 34'
Spread 1320 ft
Geos TIC20 Amp. 521 Com.

	Orig'l Recording	Play Back
Filters	L3-H4	
Gains	Max	
Mixing		
A.G.C.		
Presupp	20%	

Pattern Geophones
No. 6 Spacing 22 ft
Layout In line.

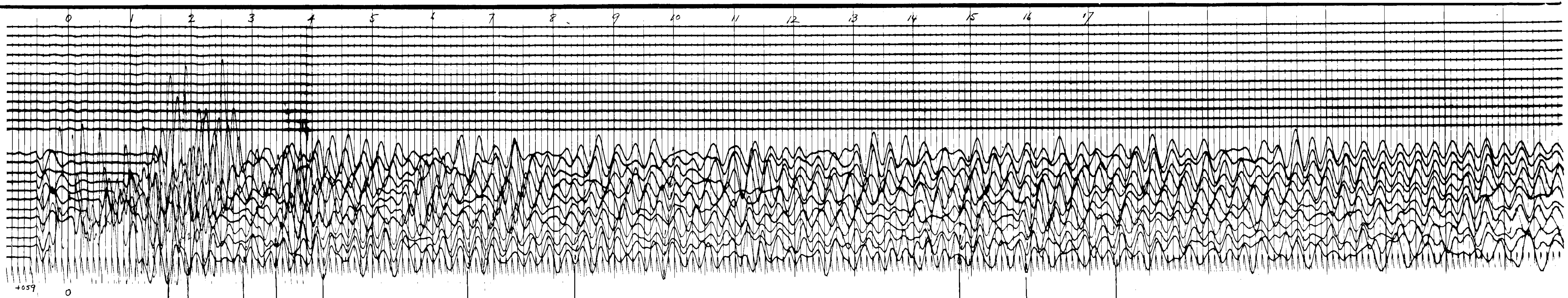
Pattern Holes
No. Spacing
Layout

Remarks
Record from region 1 mile north of APM No.1

ELEVATION AND WEATHERING CORRECTIONS

SP	Dist.	Elev.	t_w	Δt_w	E/V_e	Σt
00		150'			(Est)	072

G83-55



REFLECTION TIME CORRECTED TO DATUM :-	0·149	0·183	0·274	0·326	0·407	0·645	0·822	1·467	1·579	1·733
ESTIMATED DEPTH BELOW DATUM :-	400	500	730	890	1180	2060	2950	7010	7690	8630

(c)

7c

G 105-13