COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1963/7

GILES - CARNEGIE SEISMIC TRAVERSE, WA AND SA 1961

by

S. J. WATSON

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CONTENTS

ILLUSTRATIONS

SUMMARY

Seismic refraction velocities were measured in the Archaean or crystalline basement rocks at Mount Davies (SA) and Giles (WA) where the rocks are near the surface.

Refraction velocities were measured in the Proterozoic outcrops of the Rawlinson Range and Lake Hopkins.

Refraction velocities were measured in the Palaeozoic and Mesozoic rocks at Lake Christopher, and in the Mesozoic rocks at Iragana Turnoff.

These velocities were used as a basis for a suggested correlation between refractors recorded at traverses between Signpost and Mount Beadell. Reflection techniques, as tried, yielded fair reflections at Mount Beadell, and doubtful reflection alignments at trig. point NMF 19.

It is likely that the sedimentary basin shows an increasing thickness of sediments from Signpost to Mount Beadell. At Mount Beadell there is at least 6000 ft of apparently post-Proterozoic sediments. The thickness and degree of metamorphism of Proterozoic ratio below this have not been determined.

Present evidence suggests an area of uplift under Lake Breaden.

1. INTRODUCTION

A seismic reconnaissance across the Gibson Desert between Giles and Carnegie, as requested by the Geological Branch of the Bureau of Mineral Resources, was begun in 1961 and will be completed in 1962. This Record describes the reconnaissance survey between Giles and Mount Beadell; the duration of the survey was from 6th September to 23rd October 1961. Eleven refraction and four reflection traverses were made, and six drill cores were taken for geological examination.

The area between Giles and Mount Beadell consists of flat or slightly undulating plains, with many sand ridges, and some large areas of harder material generally free of sand dunes and probably indicating areas of Mesozoic outcrop. The low outcrops that are found west of Signpost are conspicuous because they are the only landmarks in an otherwise featureless and monotonous area, and the title of 'Mount' is somewhat misleading. Near the outcrops there are usually a few short steep-sided dry creeks or drainage channels that apparently carry the water, collected from the rare periods of rainfall, outwards into alluvial fans where it is lost.

In all areas visited the soil is loose and sandy and contains no visible humus. The vegetation is typical of desert areas, e.g. much spinifex, sporadic grass, stunted gums, grevillea, and mulga. Vegetation destroyed by fire or drought does not appear to be readily replaced.

The area gives the impression that the weather is usually warm to very hot, and very dry, with long periods of drought. During the survey many violent thunderstorms occurred at night, but recorded showers were few and very localised. It seems likely that the rare 'good' seasons occur only if the monsoonal 'wet season' happens to move south as far as this.

All supplies used in the area were brought by road or track from Leonora, Wiluna, or Giles Weather Station. Supplies collected at Giles were delivered to Giles by air or road from Alice Springs. A track known as Gunbarrel Highway connects Giles with Carnegie.

Owing to the inhospitable nature of the area, geological reconnaissance has been limited to the examination of rock material at the edges of a few selected spots than can be reached fairly readily from Gunbarrel Highway. The basin here appears to be an area of weak sedimentation composed of a thin layer of post-Proterozoic sediments over a thick Proterozoic (10,000 - 15,000 ft) sequence. In the seismic reconnaissance survey described in this Record it was intended, in general, to make a number of seismic probes in the portion of the basin between Giles and Carnegie to test the thickness of sediments and to identify them by velocity correlation.

2. GEOLOGY

The history of the geological investigations in the area covered by the reconnaissance survey and in the related neighbouring areas may be studied from the references given by Wells, Forman, and Ranford (1961). Many of these references are now of historic interest only. The most recent investigations probably present the best founded conclusions, and it is only necessary to consider those listed at the end of this Record.

Veevers and Wells (1961) traced the Canning Basin from its contact with the sea near Derby and Port Hedland, WA, down southwards as far as the northern boundaries of the Madley, Warri, Cobb, and Rawlinson 4-mile areas. The eastern and western edges of the Basin are shown, in this region, as Precambrian sediments and metamorphics but the sediments in the main part of the Basin (extending across an east-west front of about 250-mile width at latitude 25°S and comprising Permian and undifferentiated Mesozoic rocks) extends southward.

Near longitude 124°30'E, latitude 24°S, the Woolnough Hills diapir (or cluster of diapirs) occurs (Plate 1). The intrusive core material is said to be salt of pre-Permian or Permian age, and the age of intrusion is late Tertiary, but Leslie (1961) considers that the salt is of Upper Proterozoic (or older) age and that movement did not occur beyond the Jurassic period.

Wells, Forman, and Ranford (1961) entered the present area along the Giles/Carnegie road, and reported Permian and Mesozoic sedimentary outcrops. Permian glacial sediments crop out on the road near Lake Christopher. Between Mount Charles and Young Range, siltstone and sandstone occur, and these are said to be undoubtedly the continuation of Cretaceous sediments of the Canning Basin. Well-preserved marine Cretaceous macrofossils occur at Mount Samuel.

There is no geological evidence so far to suggest that there is more than about 1000 ft of post-Proterozoic ssdiments overlying an unknown thickness of Proterozoic rocks.

3. PREVIOUS GEOPHYSICAL SURVEYS

Gravity traverses

There was no gravity information available along the seismic traverses when the 1961 seismic traverses were planned. The nearest gravity information available applies to the part of the Canning Basin north of latitude 24°S, (Flavelle and Goodspeed, 1962) and it cannot be extrapolated as far south as the Giles/Carnegie road with any reasonable accuracy. However, it is almost certain that the Anketell Gravity Ridge extends south-west to Signpost and Mount Charles (Plate 2).

Magnetic traverses

An aeromagnetic reconnaissance survey made by the Bureau of Mineral Resources (Goodeve, 1961) showed that the magnetic basement is shallow at Giles. East of Giles the magnetic anomalies suggest a deeper basement, possibly greater than 5000 ft in depth.

Shallow magnetic basement was estimated to lie east of a point between Signpost and Mount Charles. A marked, narrow anomaly begins near Signpost and extends out into the basin in a north-westerly direction. This anomaly has been interpreted as arising from a structure, possibly a contact, that is shallow near Signpost and deepens, (possibly to 10,000 ft) as it extends under the sedimentary basin (Plate 2). It is likely that the above magnetic basement anomaly is related to the Anketell Gravity Ridge.

Two flight-lines were of some relevance to the present seismic survey, and they indicate that between Mount Charles and Mount Beadell there could be a thickness of more than 5000 ft of non-magnetic material.

4. OBJECTS OF THE SURVEY

The main object of the survey was to conduct a two-month seismic survey into the region between Giles and Mount Beadell, using refraction and reflection techniques to achieve the following:

(a) to distinguish between the main sequence of rocks by criteria involving velocity and structural indications such as unconformities; more particularly to identify Archaean, Proterozoic (mainly Upper), Palaeozoic, and Mesozoic rocks,

(b) to delineate regional structure if moderately deformed sediments are detected; more particularly to help determine directional trends of axes, faults, and regional dips,

(c) to trace the tectonic history of any anticlinal feature discovered; more particularly to trace periods of deposition, quiescence, movement, and erosion,

(d) to indicate from seismic evidence where stratigraphic drilling might produce significant information, and to drill some holes where the targets are within the capabilities of the equipment held on the seismic crew,

(e) to make reflection and refraction traverses (with gaps) as far west as Mount Beadell, following the main rock sequences by seismic techniques.

5. PROGRAMME

To achieve the above objectives, a programme was proposed as follows (see Plate 1):

(1) while travelling between Alice Springs and Giles, to record a refraction traverse on the Archaean (Musgrave Complex) rocks at Mount Davies, SA ,

(2) at Giles, to record a refraction traverse on Archaean rocks,

(3) at Giles, to record a refraction traverse on the north side of the Rawlinson Range to determine velocities associated with the Lower Proterozoic Dean Metamorphics (quartzite),

(4) in the Giles area, if access could be gained to the Carnegie Range about 60 miles north of Giles, to record a refraction traverse on the Upper Proterozoic (Bonython) Dolomite and the neighbouring Upper Proterozoic rocks,

(5) at Lake Christopher, about 60 miles west of Giles, where Permian glacial rocks crop out, to record a refraction traverse and so find the seismic velocity in this material, and in the underlying material. A geological sample to be cored from a shot-hole,

(6) about 60 miles west of Lake Christopher, and near the Iragana Turnoff, to record a refraction depth probe which should penetrate the Mesozoic and Permian rocks and reach the underlying high-velocity material. A geological sample to be cored from a shot-hole,

(7) at Sunday Hill, to record a refraction depth probe to reach Archaean basement beneath the Permian and Mesozoic rocks,

(8) at a suitable location just west of Signpost, to determine a refraction technique that will allow the Archaean refractor, and if possible the Permian refractor, to be followed westward towards Mount Charles, in such a way that the thickening of sediments above the basement can be estimated,

(9) if Upper Proterozoic rocks can be located just south of Mount Charles, to make a refraction depth probe. A geological sample to be cored near Mount Charles,

(10) at about eight miles west of Mount Samuel, to record a reflection and a refraction traverse on the Permian rocks. A geological sample to be cored,

(11) near trig. point NMF 19, to record reflection and refraction probes on top of the Mesozoic rocks. A geological sample to be cored at NMF 19, which is near the contact of Permian rocks with Mesozoic rocks,

(12) at Mount Beadell (NMF 20), to record reflection and refraction probes. According to known geology (Leslie, 1961) this might reveal Jurassic, Permian, Upper Proterozoic, and Archaean rocks. A geological sample to be cored,

(13) if the general seismic picture warrants it, and if time permits, to make further probes in the Mount Charles/Mount Beadell area to obtain information about regional trends.

6. RESULTS

The programme proposals outlined above were carried through with various degrees of completeness. Items (1) to (3) were completed as planned. Item (4) was modified because reasonably easy access to Carnegie Range could not be found. This traverse was therefore laid near Lake Hopkins where Upper Proterozoic rocks occur at shallow depth, but it seems likely that the material investigated was Carnegie Formation rather than the Bonython Dolomite as planned. Item (5) was completed as planned. Item (6) was completed as planned, although the crystalline basement was not recorded. Item (7) was abandoned because no suitable track to Sunday Hill could be found.

Item (8) was done with limited success, and the crystalline basement was recorded only at Signpost. Farther west it is presumably present below an unknown thickness of Proterozoic rocks, but owing to the limited nature of the reconnaissance survey it was deemed advisable at the time not to expend a great amount of time and explosives in an attempt to record the crystalline basement.

Item (9) was modified in the field. The Upper Proterozoic rocks were not identified with certainty just south of Mount Charles, so the traverse was placed on the track at Mount Charles itself, where it is believed the Proterozoic rocks were recorded at depth. In addition to the refraction traverse, a short reflection traverse was recorded using simple geophone arrangements, but no reflections were recorded.

Item (10) was done with limited success. The Permian rocks were apparently deeper in the cross-section than expected. The refraction investigation was not carried far enough to reveal either the Proterozoic rocks or the crystalline basement. Simple techniques were used on the reflection traverse; no reflections were recorded.

Item (11) was done with limited success. The refraction investigation was not carried far enough to reveal either Proterozoic or crystalline basement. However, some very-poor reflection alignments, possibly from Proterozoic sediments, were obtained.

Item (12) was done with limited success. The refraction investigation was not carried far enough to record the crystalline basement. Simple reflection techniques yielded a number of reflection alignments down to 1.5 sec. At times greater than this there are many regularly spaced alignments whose significance is not known. Item (13) was not attempted because both time and supplies were limited.

The locations of all traverses are shown roughly on Plate 1 and with greater accuracy on Plate 2. Precise location of shot-points can be obtained, if required, from the sheets MISC. 137 referred to in Plate 2, but not included in this Record.

Refraction time/distance curves for all traverse are shown in Plates 4 to 14. Variable-area presentations of the reflection data from Mount Charles, Mount Samuel, NMF 19, and Mount Beadell are shown in Plates 15, 16, 17, and 18 respectively.

Methods of computation as used during the survey are listed in Appendix B.

7. DISCUSSION OF RESULTS

The refraction results can be grouped as follows:

(a) refraction data from Mount Davies, Giles, Rawlinson, Lake Hopkins, and Lake Christopher, which give characteristic velocities to be later used in velocity correlation as a means for identifying main rock sequences.

TABLE 1

Traverse	Refractor velocity (ft/sec)	Material
Mount Davies	9000	Regolith, probably derived from nearby weathered Musgrave Complex material.
	19,850	Crystalline basement. Musgrave Complex.
Giles	13,750	Regolith, probably weathered derivative of underlying crystalline basement.
	18,900	Crystalline basement (either Archaean or Lower Proterozoic)
Rawlinson	7500	Weathered material and sand.
	16,100	Dean quartzite (Lower Proterozoic)
Lake Hopkins	6300	Weathered material
	14,000	Upper Proterozoic (possibly Carnegie Formation)
Lake Christopher	9500	Weathered material or Mesozoic material
	11,070	Permian
	16,010	Prcterozoic (? Upper, ? Lower)

(b) refraction data from Signpost, Mount Charles, Mount Samuel, NMF 19, Mount Beadell, and Iragana Turnoff, in which the above velocities are used to identify the basin sediments occurring at depth.

In Table 2, the probable nature of the refractor recorded has been indicated. Most of the velocities are close to the velocity values listed in Table 1, but the weathered material, (or immediate subweathering material) shows a range of values that is by no means diagnostic.

TABLE 2

Traverse	Refractor velocity	Material or age of formation*
Signpost	6000	Weathered material
	20,800	Crystalline basement (? Musgrave Complex)
Mount Charles	6000	Weathered material
	9300	Mesozoic
	17,800	? Proterozoic sediments
Mount Samuel	7600	Weathered material
	8900	Mesozoic
	11,140	Permian sediments
NMF 19	7300	Weathered material
	10,100	Permian sediments
Mount Beadell	9000	Mesozoic
	10,450	Permian
	17,300	? Proterozoic sediments
Iragana Turnoff	6000	Weathered material
	9000	Mesozoic
	14,350	Proterozoic, possibly Carnegie Formation.

* Age of formation interpreted by velocity correlation and geological probability.

Although in field tests velocities higher than 16,100 ft/sec were not recorded on Proterozoics, velocities of 17,300 and 17,800 ft/sec have been taken to indicate buried Proterozoic sediments. This interpretation is favoured by the presence of Proterozoic outcrops south of Mount Charles (Plate 1), which were associated with the appearance of a 17,800-ft/sec refractor at the Mount Charles traverse.

A generalised cross-section of the basin between Signpost and Mount Beadell is shown in Plate 3, based upon the above interpretations. The classification of rock sequences is very broad, so that for example, the group shown as of Permian age, might include other Palaeozoic rocks. Post-Proterozoic sedimentation is presented as having reached a thickness of 5000 to 6000 ft near Mount Beadell, mainly consisting of Permian(or Palaeozoic) sedimentation. Leslie (1961) showed from geological evidence at outcrops, that Permian sediments reach at least 750 ft in thickness, but so far no evidence other than seismic has shown that there could be much more than this. This point should be further investigated, preferably be means of a suitably placed exploratory bore.

The attitude of the 10,000 to 11,000-ft/sec refractor at Mount Samuel and NMF 19 indicates the possible development of a high area at Lake Breaden, and this has been drawn in Plate 3 with the added suggestion that the underlying Proterozoic rocks have also been brought closer to the surface. The dip shown on the 8900-ft/sec refractor is much less than on the Permian refractor, and this must indicate either differential compaction in the sediments or a vertical movement of the axis that continued through the period of post-Permian deposition. Either way, there is an indication of an anticlinal development, and since it implies the presence of an anticlinal axis, or some similar tectonic feature, in the Proterozoic rocks, it is important that the depth and attitude of the Proterozoic rocks in this region should be determined.

Beneath Mount Beadell, the Proterozoic rocks show an east dip component, but the Permian refractor is flat, indicating that Proterozoic rocks may be coming up towards the surface to form a ridge or platform (possibly an ancient erosional surface) in which there has been little tectonic movement since Proterozoic times.

Assuming that the ultimate floor of the basin is a crystalline material with a refraction velocity of 20,000 ft/sec (in conformity with measurements at Mount Davies and Signpost), it is readily computed that the refraction traverses at Mount Beadell would have recorded the floor if it were shallower than 11,000 ft. This establishes a low estimate of the total amount of sediments present, but would imply that only about 5000 ft of Precambrian sediments is present, whereas Leslie (1961) estimates that as much as 15,000 ft may be present in outcrop at Iragana Hills. It is certain that the recording of the basement by refraction methods near Mount Beadell will be a difficult task and will only be achieved by using large shot-to-geophone distances and large explosive charges.

At the Iragana Turnoff, the refraction results show at least 1800 ft of sediments with a small component of north-west dip. The deeper refractor could be of Upper Proterozoic age, in accordance with measurements previously made at Lake Hopkins. The crystalline basement and the 17,000 to 18,000-ft/sec Proterozoic refractor were not recorded.

The reflection techniques used were simple ones (see Appendix B). Only at Mount Beadell were undisputed reflections obtained, and although alignments down to at least 1.5 seconds were obtained, the dips recorded were in conflict with the computed dip of the Proterozoic refractor at 5000 to 6000 ft. This might indicate a depositional unconformity between the Proterozoic rocks and the sediments (? Palaeozoic) above them but there is not enough evidence available yet to form a firm conclusion.

8. CONCLUSIONS AND RECOMMENDATIONS

The main sequences of rocks have been distinguished by velocity criteria, and more particularly, the velocities in Archaean, Proterozoic, Palaeozoic, and Mesozoic rocks have been measured. Distinction between Upper and Lower Proterozoic rocks on the basis of velocity has not been possible so far. The use of structural unconformities has not yet been applicable in distinguishing the main sequences.

Some deformation of sediments was noted, and it is believed that there is evidence of depositional unconformity between the Proterozoic and Palaeozoic rocks at Mount Beadell. It is also believed that an uplift at Lake Breaden has led to local thinning of sediments during Mesozoic deposition. The trend of the uplift was not determined but may coincide with the north-easterly trend of Lake Breaden. The direction of regional dip cannot be deduced from the data supplied by the single traverses as recorded.

Any attempt to deduce the history of the uplift at Lake Breaden must necessarily be based on scanty evidence, especially since the Proterozoic rocks and the basement were not recorded. It can be inferred that the Proterozoic sequence was warped upwards after, if not during, Palaeozoic deposition, and continued moving during the Mesozoic sedimentation.

The only part of the survey where stratigraphic drilling should be profitable is near Lake Breaden, and this would only be useful if carried down to the Proterozoic rocks to determine (a) the thickness and type of post-Proterozoic ssdimentation, and (b) the nature of the 17,000 to 18,000-ft/sec material considered here to be of Proterozoic age. A more suitable location for a stratigraphic test bore could probably be found after more geophysical investigations are made in the basin.

Using reflection and refraction methods, the main rock sequences have been followed from Signpost to Mount Beadell with various degrees of completeness. A generalised cross-section of the part of the basin so far covered (Plate 3) shows that there are some gaps in the information, but these could be filled in by some further refraction traverses, e.g. at Mount Beadell, Mount Samuel, and NMF 19.

The remainder of the original traverses, namely those lying between Mount Beadell westward to Carnegie, were not completed in 1961.

9. REFERENCES

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APPENDIX A

STAFF AND EQUIPMENT

STAFF

Party leader	:	S.J. Watson
Geophysicists	:	K.F. Fowler A. Turpie (4th to 23rd October)
Surveyors	:	R. Leetham) M. Francki) Department of the Interior
Clerk	:	E.J. Quinn
Observer	:	G.L. Abbs
Shooter	:	R.J.E. Cherry
Mechanics	:	I.D. Pirie H. McPherson
Drilling supervisor	:	E.G. Beever (6th September to 1st October)
Toolpusher	:	J.G. Halls
Drillers	:	J. Chandler R.O. Larter
Drill helpers	:	2
Cooks	:	2
Field assistants	:	8

EQUIPMENT

Seismic amplifiers	:	HTL 7000B
Seismic oscillograph	:	Electro-Tech ER 66
Magnetic recorder	:	Electro-Tech DS7/700
Geophones	:	Electro-Tech 20-c/s. TIC 6-c/s
Drills	:	Failing 750 (Commer) 2 Careys (Bedfords)
Water tankers	:	4 x 700-gal (Bedfords)
Shooting truck	:	700-gal (Bedford)
International 4 x 4, A120	:	2
Land Rover	:	4
Bedford, 4 x 4	:	2
Chamberlain tractor	:	1
4-wheel trailers	:	4
2-wheel trailer	:	1
Office caravan	:	1

APPENDIX B

TABLE OF OPERATIONS

Sedimentary basin	:	? Canning - ? Officer
Area	:	Mount Davies to Mount Beadell
Camp sites	:	1. Giles 9th to 22nd September 2. Signpost 23rd September to 23rd October
Period of survey	:	6th September to 23rd October 1961
Miles surveyed	:	$13\frac{1}{4}$
Topographic survey control	:	MSL Port Augusta
Total footage drilled	:	5463
Explosives used	:	3016 lb
No. of detonators used	:	206
Datum levels for corrections (feet above sea level)	:	Mount Davies 2000 Giles 1900 Rawlinson 1800 Lake Hopkins 1600 Lake Christopher 1300 Signpost 1600 Mount Charles 1500 Mount Samuel 1450 NMF 19 1400 Mount Beadell 1450 Iragana Turnoff 1650
Source of reflection velocity distribution	:	Cross-section at Mount Beadell (Plate 2)
Method used in refraction computation	:	Vale and Smith (1961)
Method used in weathering computation	:	Vale (1960), reciprocal time method

REFLECTION SHOOTING DATA

Shot-point intervals	:	1320 ft
Geophone groups	:	6 x 20-c/s geophones in line at 22-ft intervals
Geophone group interval	:	110 ft
Number of holes shot	:	21
Miles traversed	:	$6\frac{1}{2}$ miles
Usual recording filters	:	K18 K75
Usual playback filters	:	K30 K57
Common charge sizes	:	5 to 10 lb
Common shooting depth	:	50 to 100 ft

REFRACTION SHOOTING DATA

Geophone groups	:	2 x 6-c/s geophones in parallel
Geophone group interval	:	220 ft
Number of holes shot	:	49
Usual recording filter	:	K0 K57
Number of refraction traverses	:	11
Charge sizes	:	10 to 200 lb
Miles traversed	:	$12\frac{1}{4}$
Maximum shot-to-geophone distance	:	$2\frac{3}{4}$ miles

APPENDIX C

DRILLING STATISTICS

Seismic shot-point drilling

Drilling rigs	:	2 Careys
Total footage drilled	:	5739
No. of holes drilled	:	156
Average depth of hole	:	37 ft
Deepest hole drilled	:	150 ft
Drilling time	:	169½ hr
Travelling and rigging-up time	:	143½ hr
Time lost standing by recorder	:	26
" " waiting for water	:	6½ hr
" " because of stuck pipe	:	2 hr
No. of shifts worked	:	53
Maintenance to drills	:	81 hr
Bentonite used	:	6½ bags
Drilling rate	:	33.8 ft/hr

Water-bore drilling

Total footage drilled	:	665
No. of holes drilled	:	7
Drilling time	:	20½ hr
Travelling time	:	16½ hr
Time taken bailing and casing the holes and setting-up the pump head	:	41½ hr
No. of shifts worked	:	9

CANNING BASIN

SALT DOME WOOLNOUGH HILLS

IRAGANA HILLS INLIER OF PRECAMBRIAN ROCKS

ALFRED & MARIE RA

YOUNG RA

NMF 22 NMF 23 NMF 25 NMF 27 NMF 29 NMF/19

MT EVERARD MT BEADELL MT SAMUEL MT CHARLES

FAME RANGE MT ARCHIE CARNEGIE

SUNDAY HILL SIGN POST

RAWLINSON RA

WARBURTON MISSION

WILUNA

AMADEUS TROUGH

ALICE SPRINGS GOSSES BLUFF ANGAS DOWNS ERLOUNDA

WESTERN AUSTRALIA NORTHERN TERRITORY SOUTH AUSTRALIA

MT DAVIES

OFFICER BASIN

LEGEND

CAINOZOIC	UNDIFFERENTIATED	Cz	Sand, alluvium, and limestone
	TERTIARY	T	Limestone and sandstone
MESOZOIC	UNDIFFERENTIATED	M	Sandstone, siltstone, shale, and minor limestone
PALAEOZOIC	PERMIAN TO UPPER CARBONIFEROUS	Pzu	Sandstone, shale, and limestone
	UPPER CARBONIFEROUS TO MIDDLE DEVONIAN	Pzm	Sandstone and limestone
	MIDDLE DEVONIAN TO CAMBRIAN	Pzl	Dolomite, limestone, sandstone, shale, chert, red beds, greensand, plateau basalt
PROTEROZOIC	UNDIFFERENTIATED	P	Sandstone, shale, conglomerate, and volcanics
	??	Pp	Porphyry
	UPPER	Pμ	Shallow-water marine, sandstone, shale, dolomite, conglomerate, and volcanics
	LOWER	Pl	Geosynclinal sediments, regionally metamorphosed, basic and granite intrusions
ARCHAEAN	UNDIFFERENTIATED	A	Granite, gneiss, metamorphic rocks, and some meta sediments
LOWER PALAEOZOIC TO ARCHAEAN		g	Granite

LEGEND

- Aerodrome or landing ground
- Geological boundary
- Geological boundary indefinite
- State boundary
- Aeromagnetic traverse
- Fault
- ? Fault indefinite
- Traverse
- Road or track
- △ NMF29 Trig. point

GEOLOGY DERIVED FROM TECTONIC MAP OF AUSTRALIA WITH MODIFICATIONS SUGGESTED BY BMR GEOLOGICAL BRANCH

SCALE

miles 100 80 60 40 20 10 0 100 miles

GEOLOGICAL SKETCH MAP, SHOWING RAWLINSON RANGE — YOUNG RANGE AEROMAGNETIC RECONNAISSANCE AND SEISMIC TRAVERSES

Geophysical Branch, Bureau of Mineral Resources Geology & Geophysics G 52/B3-1

TO ACCOMPANY RECORD No. 1963/7

PLATE 2

EDB > 5000 ft

EDB > 5000 ft

ALFRED AND MARIE RANGE

MAGNETIC ANOMALY (AFTER GOODEVE 1961)

ASSUMED EXTENSION OF ANKETELL GRAVITY RIDGE

EDB 2000–5000 ft

EDB 0–2000 ft

MT BEADELL TRAVERSE (See Misc 137 Sh 11)

MT BEADELL

NMF 19 TRAVERSE (See Misc. 137 sh. 10)

MT SAMUEL TRAVERSE (See Misc 137 Sh 9)

MT SAMUEL

MT CHARLES

SIGN POST TRAVERSE (See Misc 137 Sh 7)

MT CHARLES TRAVERSE (See Misc 137 Sh. 8)

Lake Breaden

MT COLLIN

MT COX

YOUNG RA

MT GORDON

MT EVERARD

BROWNE RA

IRAGANA TURN-OFF TRAVERSE (See Misc 137 Sh 6)

WEST HILL

BEDFORD RA

QUARTZ SOAK HILL

SUNDAY HILL

LAKE CHRISTOPHER TRAVERSE (See Misc 137 sh.5)

Lake Christopher

MT FORREST

THREE HILLS

RAWLINSON RANGES

RAWLINSON TRAVERSE (See Misc 137 Sh 3)

GILES

GILES TRAVERSE (See Misc 137 Sh 1)

SIR FREDERICK R.A.

LAKE HOPKINS TRAVERSE (See Misc 137 sh 2)

Lake Hopkins

CARNEGIE R.A.

WALTER JAMES R.A.

SCHWERIN MURAL CRESCENT

Lake Neale

BLOODS RANGE

PETERMANN RANGES

WESTERN AUSTRALIA

NORTHERN TERRITORY

SOUTH AUSTRALIA

BARROW RANGE

WARBURTON MISSION

WARBURTON RA

BROWN RA

HOCKING R.A.

BLACKSTONE MINING CAMP

BELL ROCK R.A.

MT DAVIES TRAVERSE (See Misc 137 sh 4)

MT DAVIES MINING CAMP

TOMKINSON RANGES

MT DAVIES

Lake Kadgo

(BASED ON D OF I MAP No. MISC. 137A)

LOCALITY MAP,

SEISMIC TRAVERSES (1961), ASSUMED EXTENSION OF ANKETELL GRAVITY RIDGE, AND MAGNETIC ANOMALY (AFTER GOODEVE 1961)

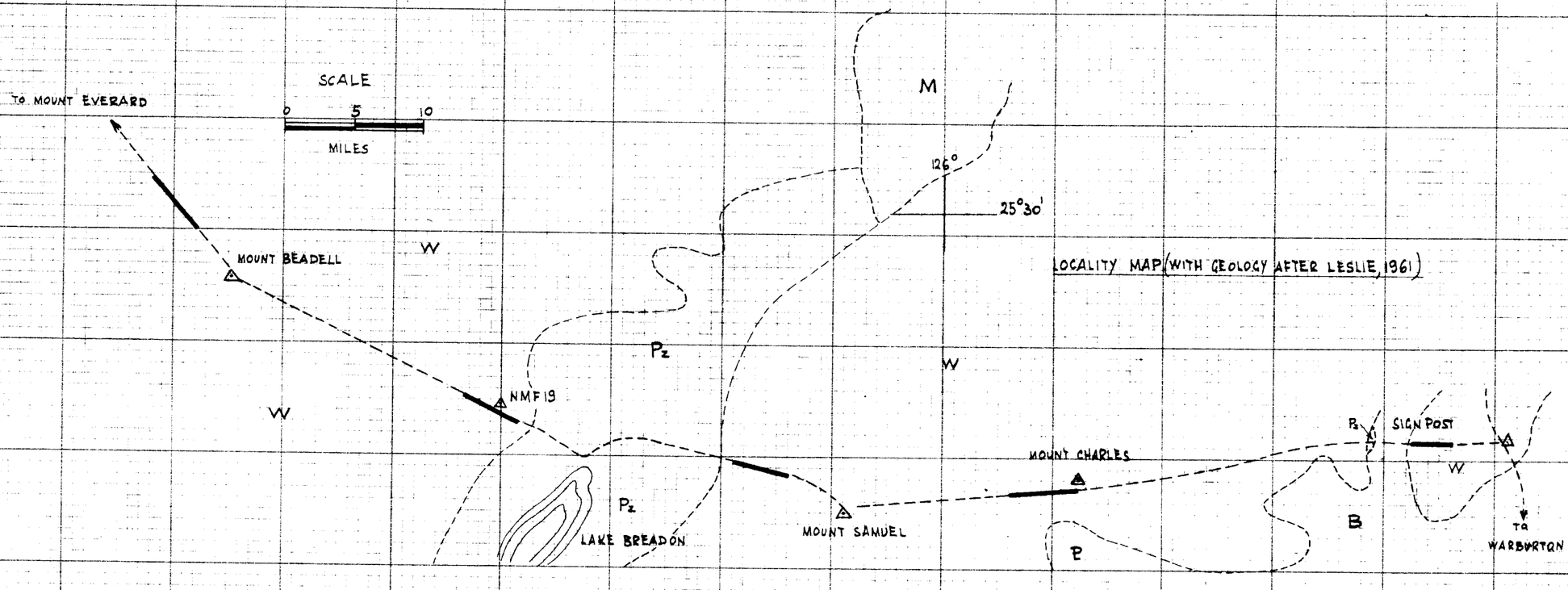
MILES

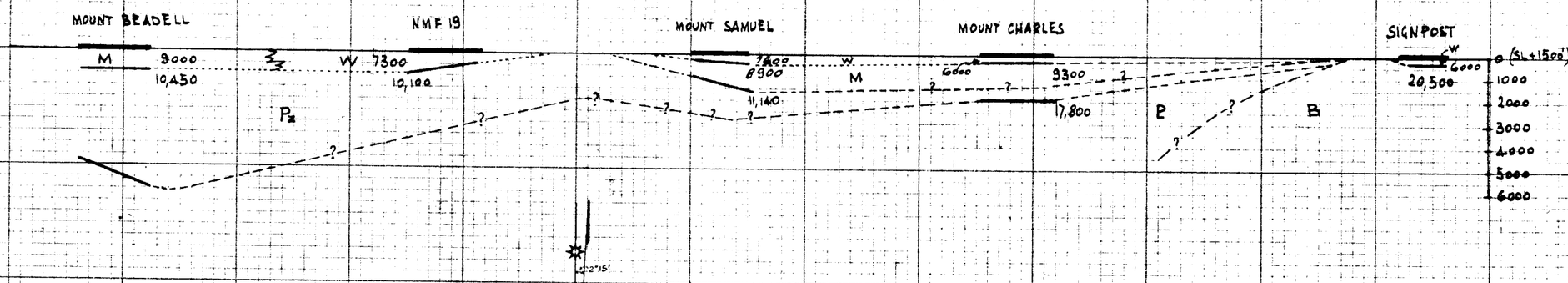
10 5 0 10 20 30

G52/B 3-2

TO ACCOMPANY RECORD No 1963/7

PLATE 3





LEGEND

W	SAND WEATHERED MESOZOIC
M	OTHER MESOZOIC
P_z	PERMIAN, ? OTHER PALAEOZOIC
P	PROTEROZOIC
B	BASEMENT
10,150	SEISMIC VELOCITY (FT/SEC)
△	TRIG. POINT

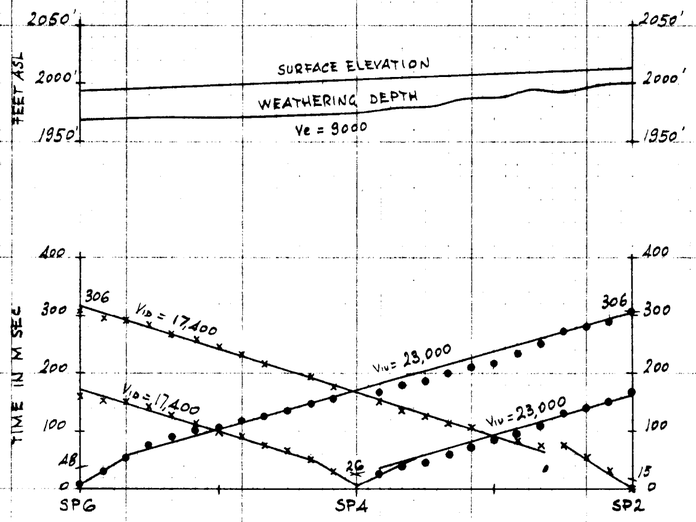
GENERALISED CROSS-SECTION BETWEEN SIGNPOST AND MOUNT BEADELL WA 1961
THE AGE OF FORMATIONS FOLLOWS AN INTERPRETATION BASED ON VELOCITY CORRELATION AND GEOLOGICAL PROBABILITY

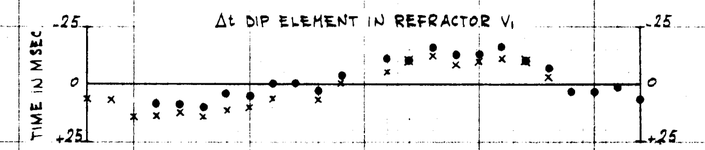
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G52/B3-3

TO ACCOMPANY RECORD No 1963/7

PLATE 4





SP 6

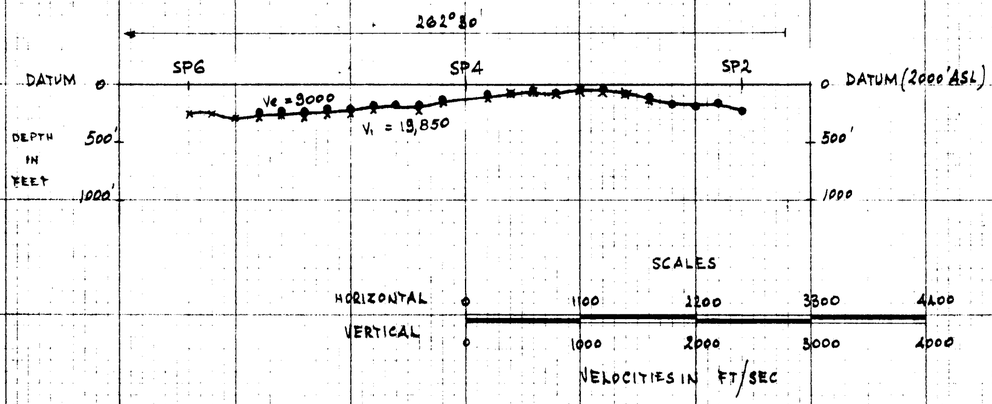
to	—	—	—	72	95	107	112	124	131	142	155	161	—	173	185	191	205	215	223	239	252	273	284	292	308
Wc+Ec	—	—	—	-5	-6	-6	-6	-6	-7	-7	-7	-7	—	-6	-5	-6	-6	-5	-5	-4	-3	-3	-3	-2	-2
tc	—	—	—	77	89	101	106	118	124	135	148	154	—	167	180	185	199	210	218	235	249	270	281	290	306

SP6 SP4 SP2

SP 2

to	313	302	299	289	277	268	254	242	228	—	206	189	—	161	144	132	124	111	99	88	83	—	—	—	—
Wc+Ec	-7	-7	-7	-8	-9	-9	-9	-9	-10	—	-10	-10	—	-9	-8	-9	-9	-8	-8	-7	-6	—	—	—	—
tc	306	295	292	281	268	259	245	233	218	—	196	179	—	152	136	123	115	103	91	81	77	—	—	—	—

SP6 SP4 SP2



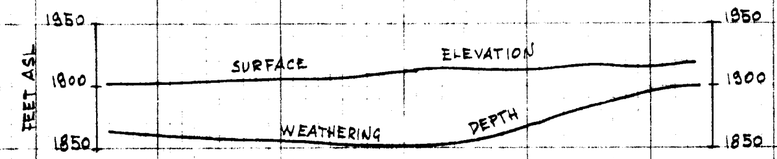
MOUNT DAVIES REFRACTION TRAVERSE TIME/DISTANCE CURVES AND INTERPRETATION

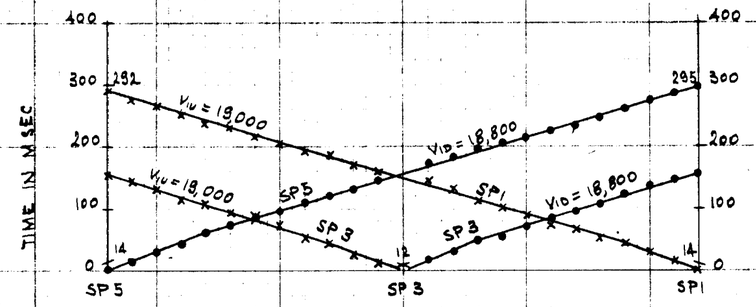
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

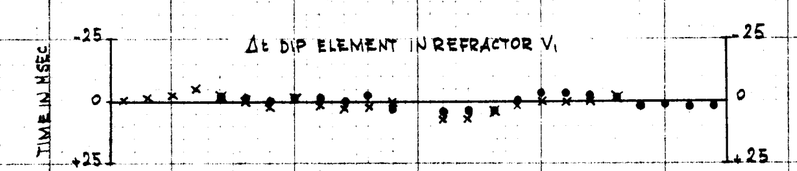
G52/B3-4

TO ACCOMPANY RECORD 1963/7

PLATE 5







SP 5

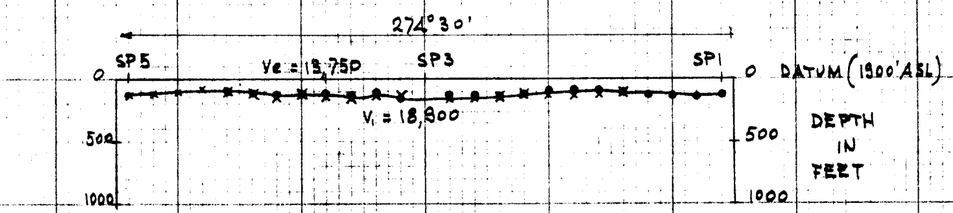
to	16	32	48	63	75	88	100	110	124	138	149	165	—	190	200	213	219	225	235	244	255	268	280	292	301
Wc+Ec	-16	-16	-17	-18	-14	-15	-15	-16	-17	-18	-19	-20	—	-20	-19	-18	-17	-15	-13	-10	-9	-8	-7	-6	-5
tc	0	16	31	45	61	73	85	94	107	120	130	145	—	170	181	195	202	210	222	234	246	260	273	286	296

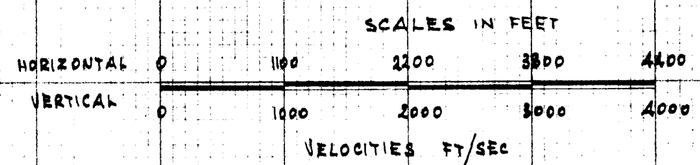
SP 5 — SP 3 — SP1

SP 1

to	7	25	40	52	64	78	92	105	120	136	153	165	—	182	192	205	214	223	236	247	255	266	278	290	302
Wc+Ec	-7	-8	-9	-10	-11	-12	-15	-17	-19	-20	-21	-22	—	-23	-22	-21	-20	-19	-18	-18	-17	-17	-16	-15	-15
tc	0	17	31	42	53	66	77	88	101	116	132	143	—	159	170	184	194	204	218	229	238	249	262	275	287

SP5 — SP3 — SP1



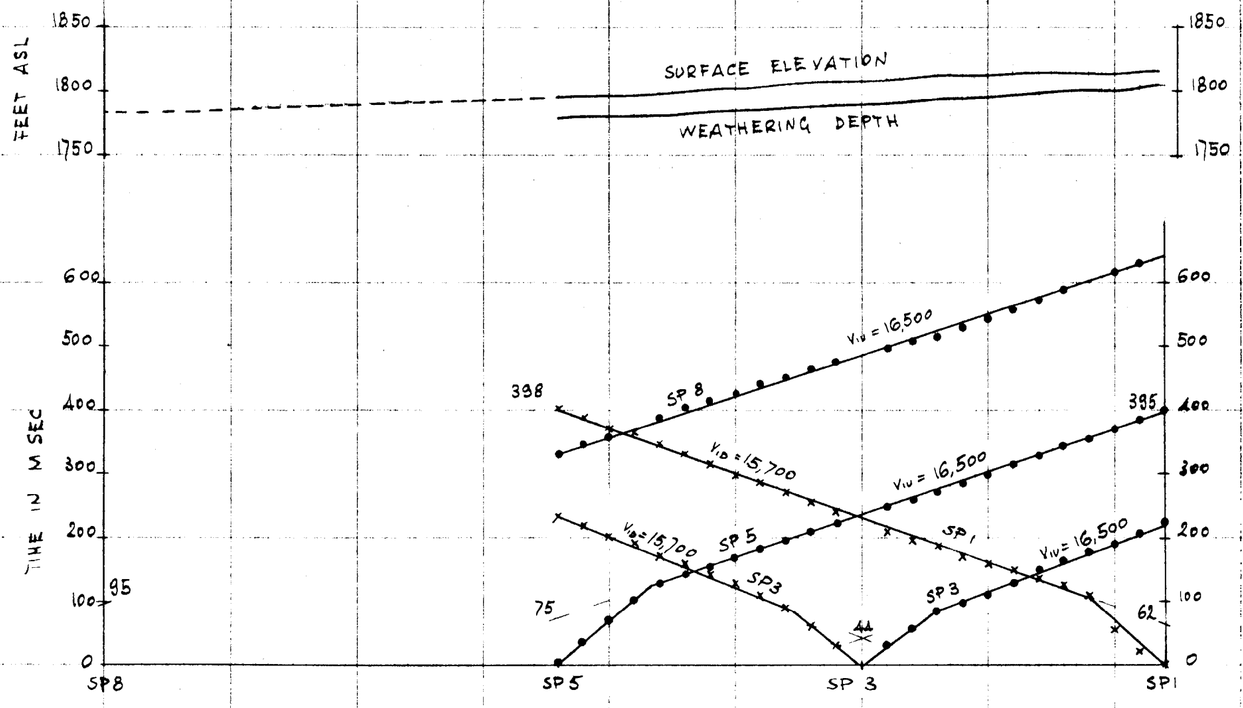


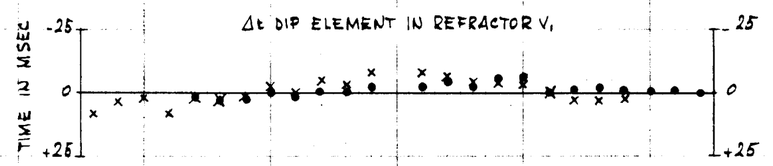
GILES REFRACTION TRAVERSE
TIME/DISTANCE CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. G52/BB-5

TO ACCOMPANY RECORD 1963/7

PLATE 6





SP5

to	17	51	83	107	131	147	160	173	187	201	215	230	–	255	266	279	290	304	321	335	346	361	374	387	402
Wc+Ec	-14	-14	-14	-5	-5	-5	-6	-6	-6	-6	-7	-7	–	-7	-7	-6	-6	-6	-5	-5	-4	-4	-3	-3	-2
tc	3	37	69	102	126	142	154	167	181	195	208	223	–	248	259	273	284	298	316	330	342	357	371	384	400

SP5 SP3 SP1

SP1

to	413	399	383	375	356	343	328	312	298	283	269	253	–	223	212	199	184	172	161	150	135	121	66	30	11
Wc+Ec	-11	-12	-12	-12	-12	-12	-13	-13	-13	-14	-14	-14	–	-14	-14	-13	-13	-13	-12	-12	-11	-11	-10	-10	-10
tc	402	387	371	363	344	331	315	299	285	269	255	239	–	209	198	186	171	159	149	138	124	110	56	20	1

SP5 SP3 SP1

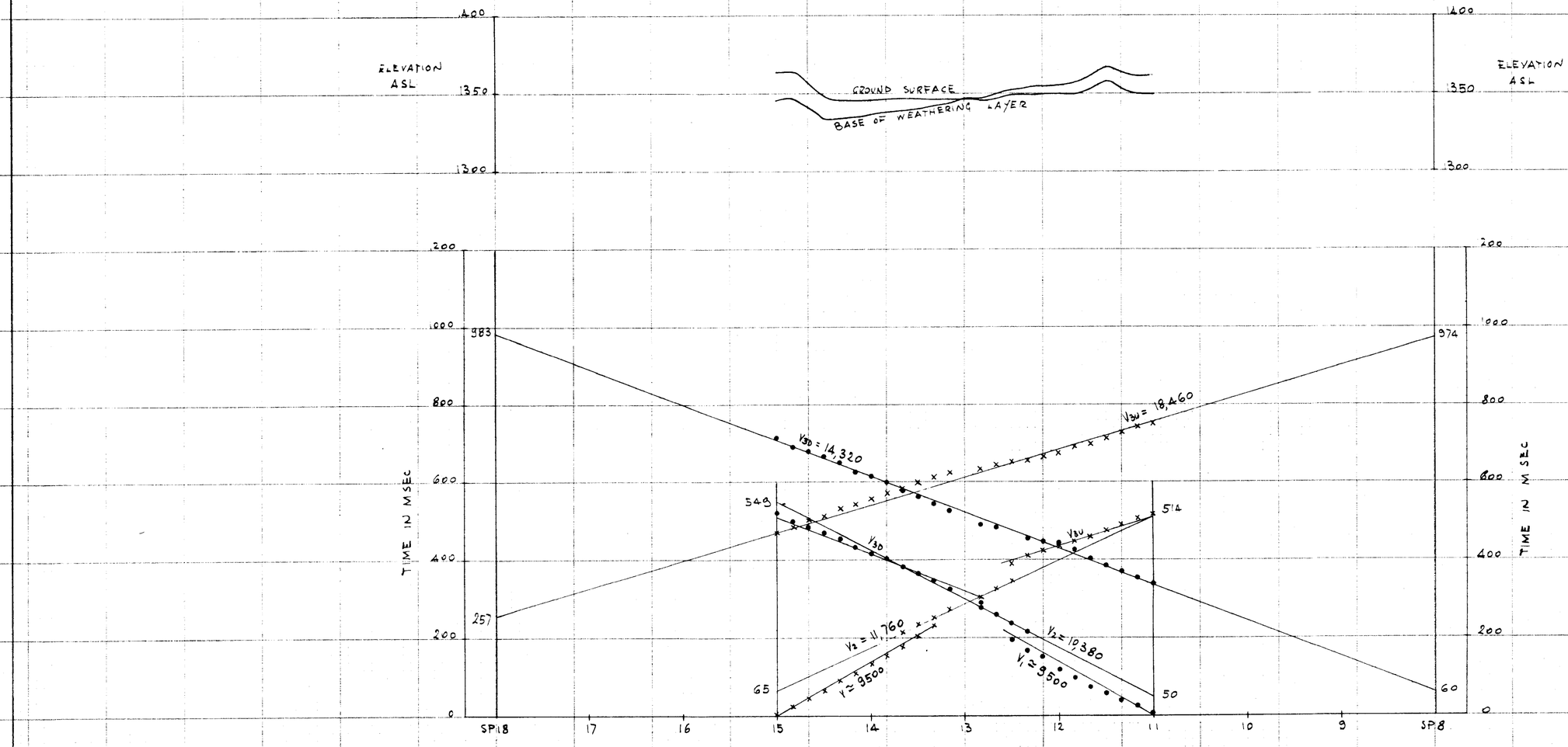
RAWLINSON REFRACTION TRAVERSE
TIME/DISTANCE CURVES AND INTERPRETATION

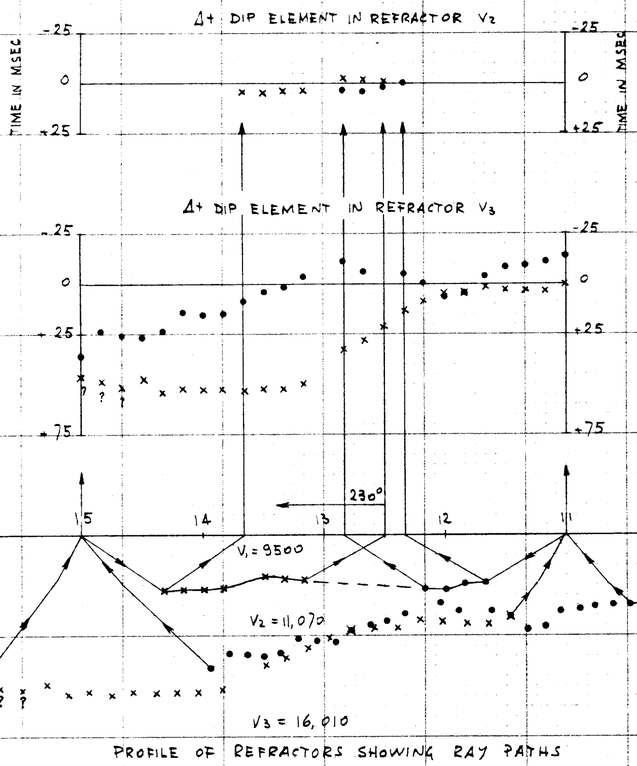
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G 52/B3-6

TO ACCOMPANY RECORD No. 1963/7

PLATE 7





	15	?	?	?		13																		11
To	480	496	512	522	540	552	567	579	593	604	618	628		639	648	656	663	672	684	699	708	724	740	755	765
We+Ec	10	10	9	10	8	8	8	7	7	5	5	4		5	5	6	7	7	8	9	9	10	11	12	13
Tc	470	486	503	512	532	544	559	572	586	599	613	624		634	643	650	656	665	676	690	699	714	729	743	752

SP18 d_s = 63'/75'

	15												13												11
To	3	29	49	67	95	112	136	156	181	208	233	273		308	329	355	413	427	439	454	462	481	499	518	529
We+Ec	6	5	5	4	4	3	3	2	2	2	2	1		2	2	3	5	5	6	7	7	8	9	10	11
Tc	7	24	44	63	91	109	133	154	179	206	231	272		306	327	350	408	422	433	447	457	473	490	508	518

SP 15 d_s = 75/80'

	5												13												11
To	721	696	683	671	653	630	617	602	582	562	526	526		491	483	–	459	450	445	430	407	391	376	362	347
We+Ec	6	6	5	6	4	4	4	3	3	1	1	0		1	1	–	3	3	4	5	5	6	7	8	9
Tc	715	690	678	665	649	626	613	599	579	561	545	526		491	482	–	456	447	441	425	402	385	369	354	338

SP 8 d_s = 85'/97'

	5												13												11
To	528	506	491	471	459	437	423	407	386	367	350	328		262	240	220	142	122	103	80	63	45	32	15	
We+Ec	9	8	7	7	6	6	6	5	5	3	3	2		2	3	4	4	4	5	6	7	7	8	9	
Tc	519	498	484	470	453	431	417	402	381	364	347	326		260	237	216	138	118	98	74	56	38	24	6	

SP 11 d_s = 76'/81'

ELEVATION OF DATUM 1300 FT ASL

SCALES

HORIZONTAL and VERTICAL 0 1100 2200 3300 FEET

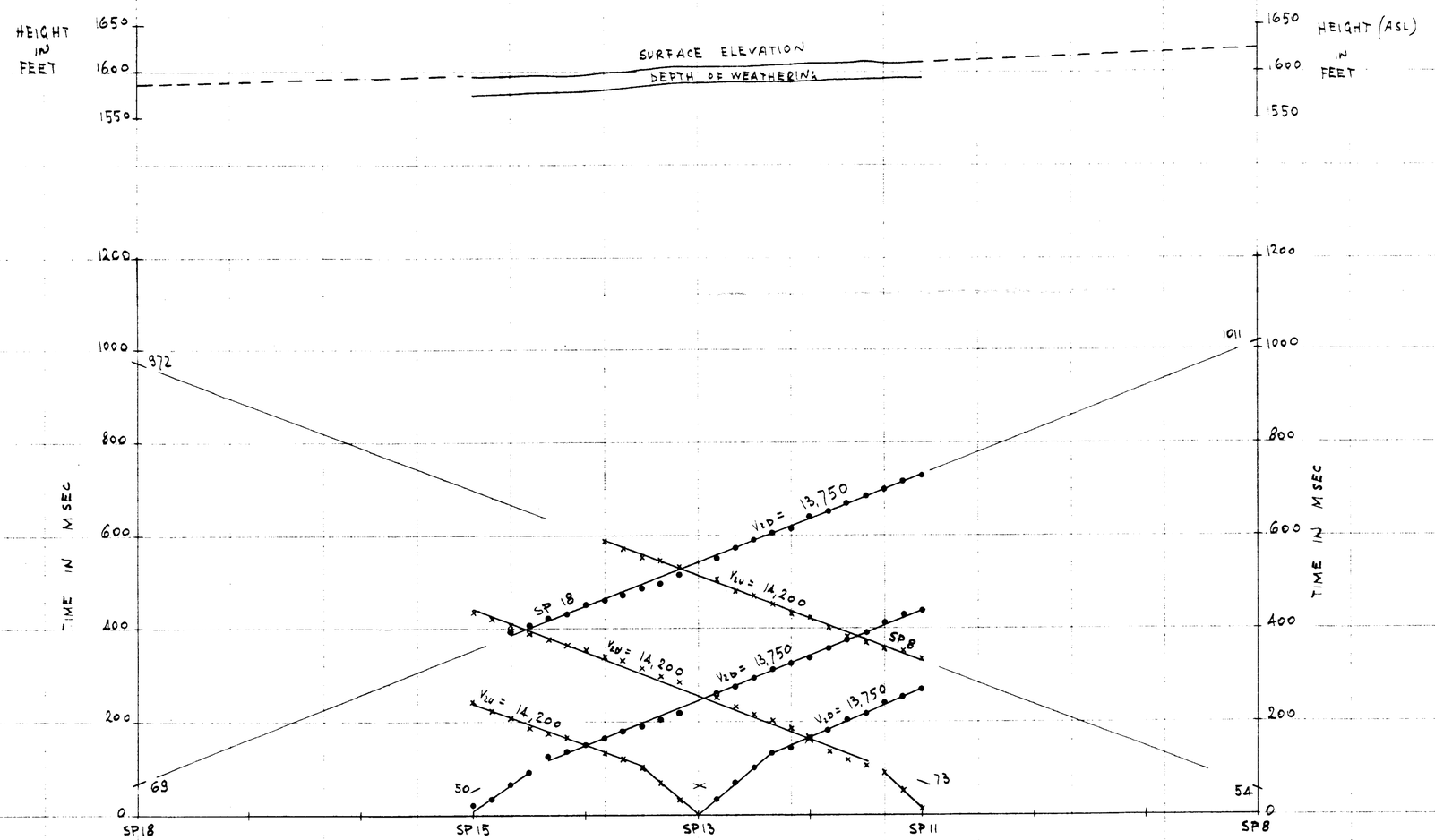
PROFILE OF REFRACTORS SHOWING RAY PATHS

LAKE CHRISTOPHER
REFRACTION TRAVERSE
TIME/DISTANCE CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics G52/B3-7

TO ACCOMPANY RECORD NO 1963/1

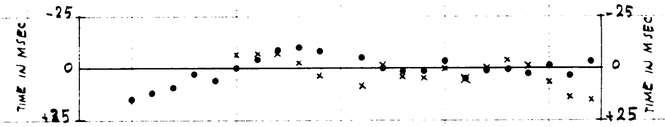
PLATE 8



SP 18

–	–	397	410	422	432	452	462	474	485	500	519	–	554	575	592	608	620	644	656	671	690	702	723	733	t_o
–	–	-2	-2	-1	-1	-2	-2	-2	-2	-2	-3	–	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-4	W_c+E_c
–	–	395	408	421	431	450	460	472	483	498	516	–	551	572	589	605	617	641	653	668	687	699	720	729	t_c

SP 5 — SP 13 — SP 11



SP 8

593	577	560	549	540	–	512	487	476	461	440	429	408	388	375	366	358	344							t_o
-6	-6	-6	-6	-7	–	-7	-7	-7	-7	-7	-7	-7	-7	-7	-7	-7	-8							W_c+E_c
587	571	554	543	533	–	505	482	469	454	433	422	401	381	368	359	351	336							t_c

SP 15

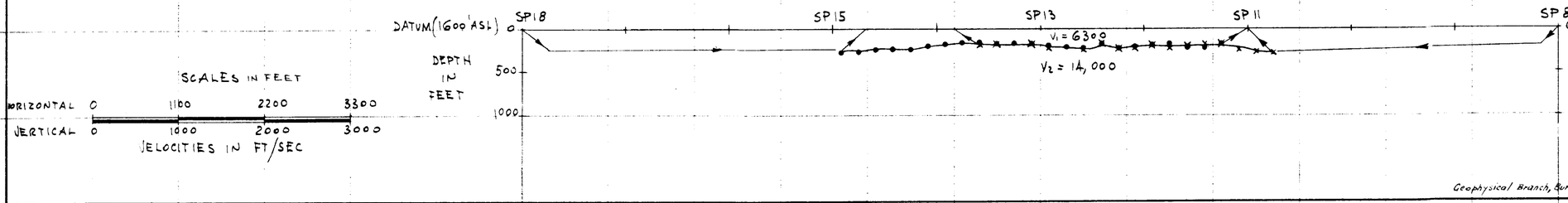
113	125	36	53	7	8	35	211	–	250	271	285	302	312	330	349	367	384	403	419	431				t_o
+11	+11	+10	+10	+10	+10	+10	+9	–	+9	+9	+9	+9	+9	+9	+9	+9	+9	+9	+9	+8				W_c+E_c
124	136	148	163	181	191	205	220	–	259	280	294	311	321	339	358	376	393	412	428	439				t_c

SP 13 — SP 11

SP 11

442	431	411	392	382	368	361	342	334	318	303	289	–	260	236	221	206	190	170	143	124	109			t_o
-4	-4	-4	-4	-3	-3	-4	-4	-4	-4	-4	-5	–	-5	-5	-5	-5	-5	-5	-5	-5	-5			W_c+E_c
438	427	407	388	379	365	357	340	330	314	299	284	–	255	231	216	201	185	165	138	119	104			t_c

SP 15 — SP 13



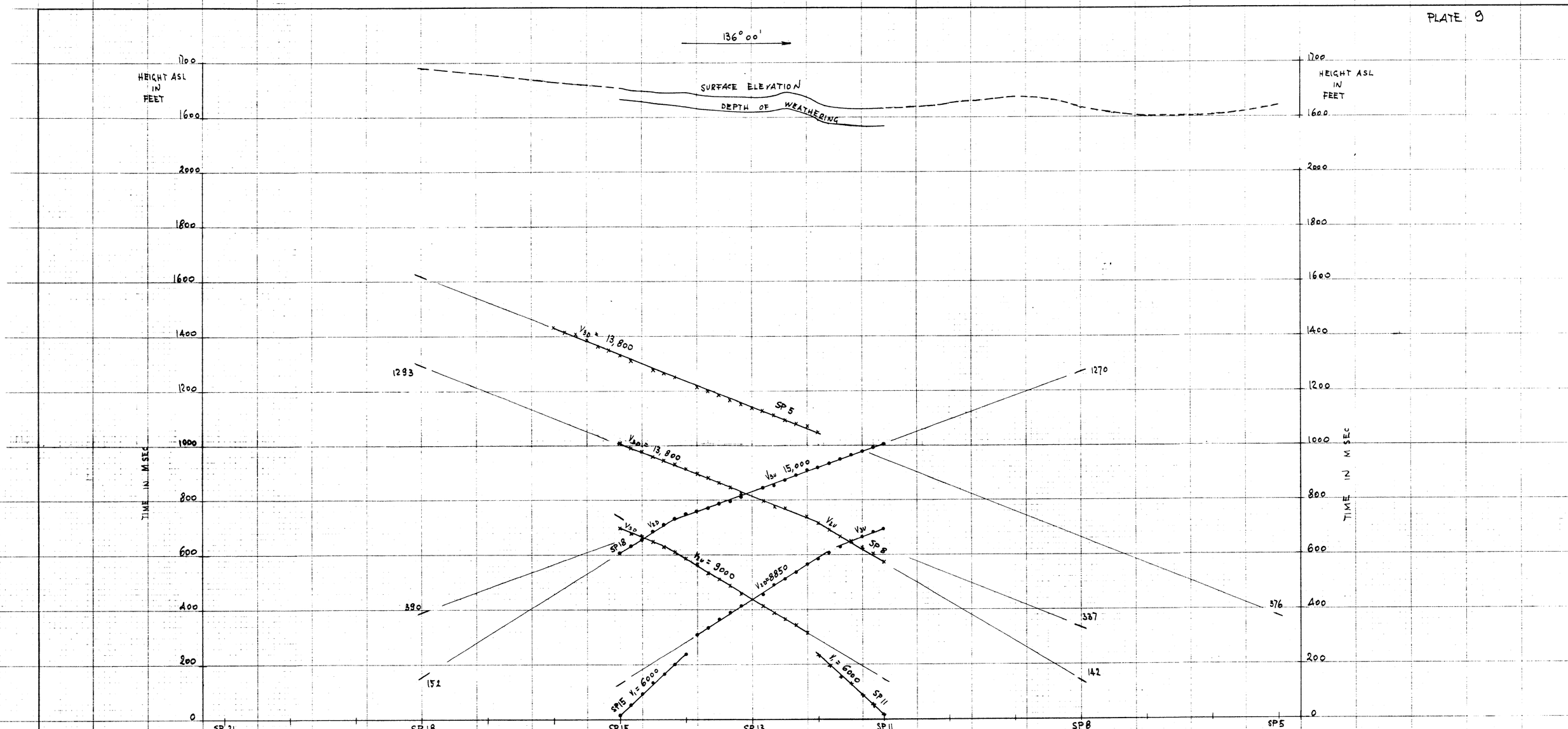
LAKE HOPKINS REFRACTION TRAVERSE TIME/DISTANCE CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G52/B3-8

TO ACCOMPANY ZECORD No. 1963/7

PLATE 9



SP 15

T_D	311	337	364	390	417	–	458	490	515	538	568	585	604	627	645	664	681	691
W_C+E_C	-1	-1	-1	-1	0	–	-2	-2	-3	-3	-2	-2	+2	+2	+1	+1	+1	+1
t_C	310	336	363	389	417	–	456	488	512	535	566	583	606	629	646	665	682	692

SP 13

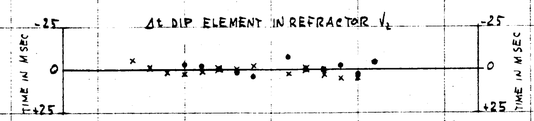
SP 11

SP 18

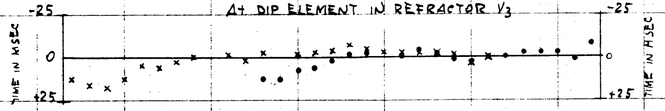
T_D	609	640	663	693	718	739	754	764	777	789	804	816	–	849	861	880	897	914	925	939	952	968	984	1002	1009
W_C+E_C	-6	-6	-6	-7	-7	-6	-6	-6	-5	-6	-6	-6	–	-7	-7	-8	-8	-7	-6	-5	-5	-6	-6	-6	-6
t_C	603	634	657	686	711	733	748	758	772	783	798	810	–	842	854	872	889	907	919	934	947	962	978	996	1003

SP 15 SP 13 SP 11

Δt DIP ELEMENT IN REFRACTOR V_2



Δt DIP ELEMENT IN REFRACTOR V_3



SP 11

T_D	697	676	661	649	629	608	586	562	536	510	485	457	–	413	386	365	342	316
W_C+E_C	+2	+2	+2	+1	+1	+2	+1	+1	+1	+1	+1	+2	–	0	0	-1	-1	0
t_C	699	678	663	650	630	610	587	563	537	511	486	459	–	413	386	364	341	316

SP 15 SP 13

SP 8

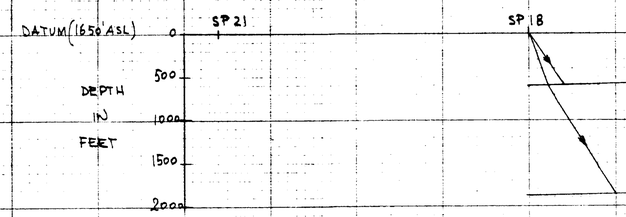
T_D	1008	989	978	959	942	928	912	896	878	860	842	822	–	799	778	769	–	739	717	692	667	649	624	603	578
W_C+E_C	+1	+1	+1	0	+1	+1	+1	+1	+2	+1	+1	+1	–	0	0	-1	–	0	-2	-1	-1	-1	-1	-1	-1
t_C	1009	990	979	959	943	929	913	897	880	861	843	823	–	799	778	768	–	739	715	691	666	648	623	602	577

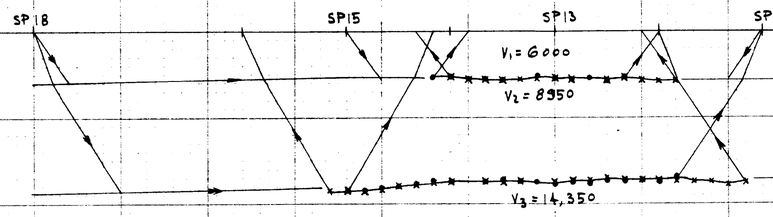
SP 15 SP 13 SP 11

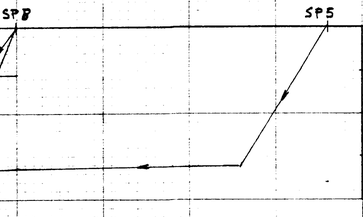
SP 5

T_D	1429	1417	1403	1382	1358	1345	1325	1301	–	1277	1262	1246	–	1214	1196	1181	1163	1149	1137	1121	1106	1085	1068	1059	1047
W_C+E_C	+1	+1	+1	+2	+2	+2	+3	+3	–	+2	+3	+3	–	+3	+4	+3	+3	+3	+2	+2	+2	-1	-1	0	+3
t_C	1430	1418	1404	1384	1361	1347	1328	1304	–	1279	1265	1251	–	1217	1200	1184	1166	1152	1139	1123	1108	1084	1060	1059	1050

SP 16 SP 14 SP 12







IRACANA TURNOFF
REFRACTION TRAVERSE TIME/DISTANCE CURVES AND INTERPRETATION

SCALES

HORIZONTAL 0 1100 2200 3300

VERTICAL 0 1000 2000 3000

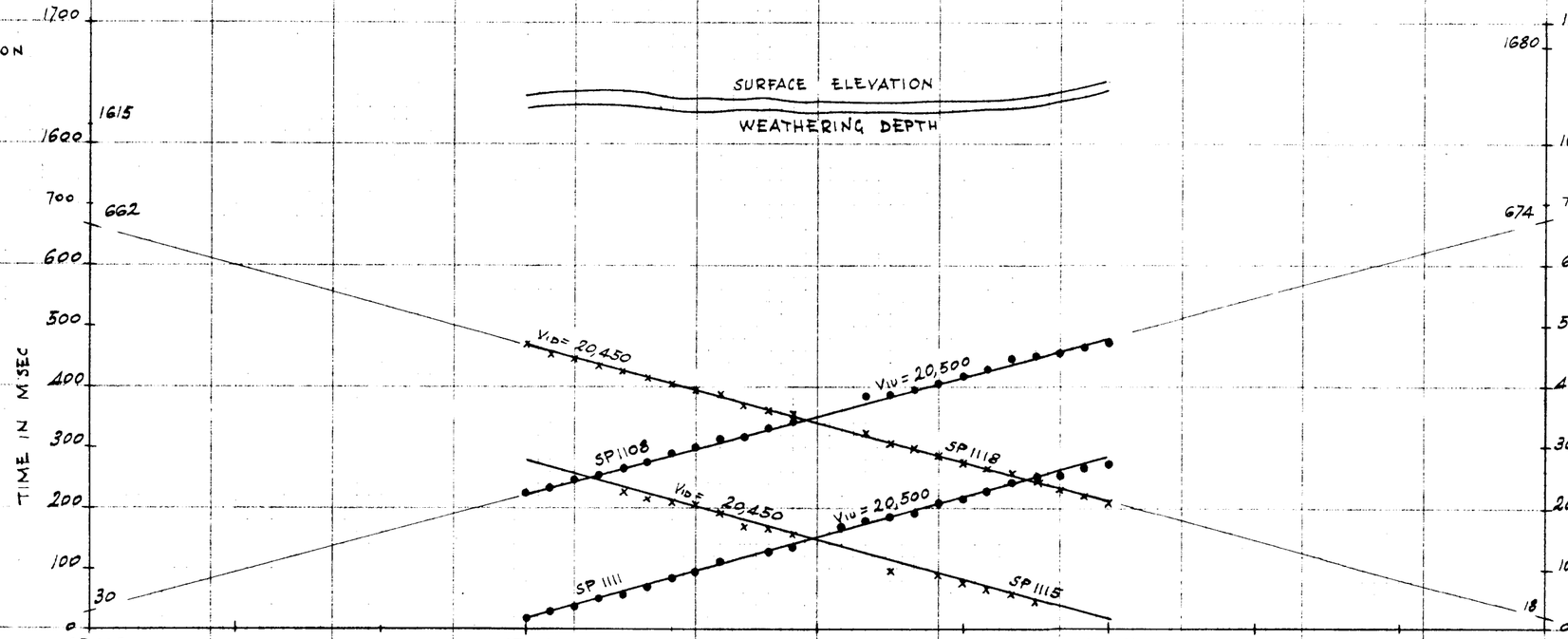
VELOCITIES IN FT/SEC

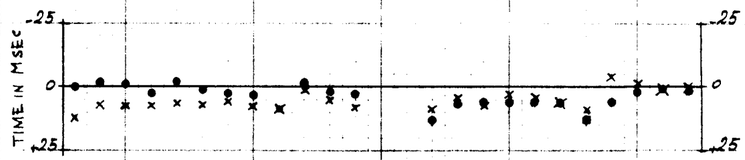
Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G 52/B3-9

TO ACCOMPANY RECORD NO. 1963/7

PLATE 10





SP 1108

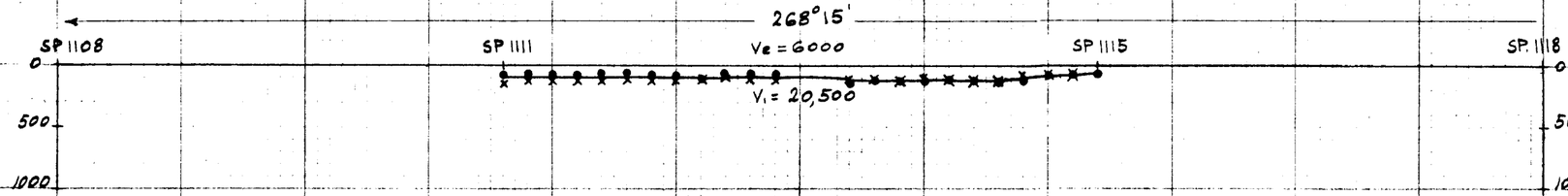
to	232	247	258	267	273	286	298	309	324	324	337	349	—	—	389	393	403	413	424	435	451	455	462	472	484
Wc + Ec	-9	-10	-10	-10	-10	-10	-9	-9	-8	-8	-8	-8	—	—	-6	-6	-6	-6	-6	-6	-6	-5	-6	-7	-7
tc	223	237	248	257	263	276	289	300	316	316	329	341	—	—	383	387	397	407	418	429	446	449	456	465	477

SP 1111 SP 1113 SP 1115

SP 1118

to	492	477	467	457	445	435	422	414	404	385	379	372	—	—	339	324	316	302	292	283	276	260	245	237	226
Wc - Ec	-20	-21	-21	-21	-21	-21	-20	-20	-19	-19	-19	-19	—	—	-17	-17	-17	-17	-17	-17	-17	-16	-17	-18	-18
tc	472	456	446	436	424	414	402	394	385	366	360	353	—	—	322	307	299	285	275	266	259	244	228	219	208

SP 1111 SP 1113 SP 1115



SCALES

HORIZONTAL 0 1100 2200 3300 4400

VERTICAL 0 1000 2000 3000 4000

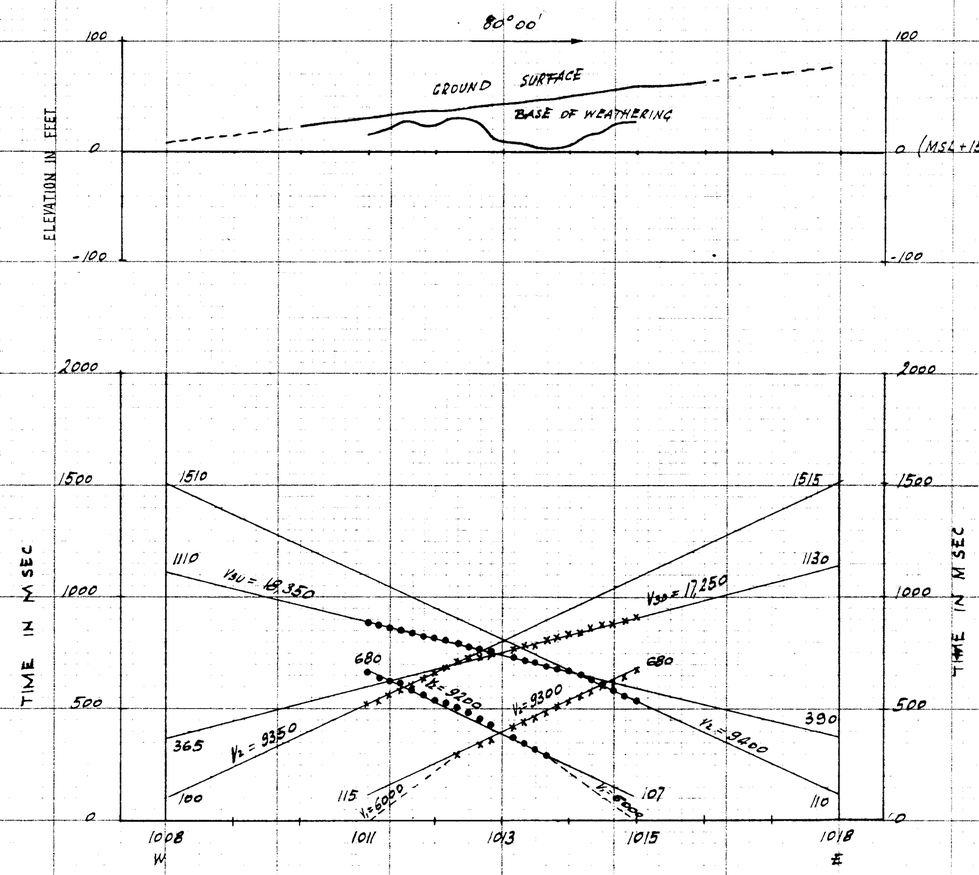
VELOCITIES IN Ft/SEC

SIGNPOST REFRACTION TRAVERSE. TIME/DISTANCE CURVES AND INTERPRETATION

G52/B3-10

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics
TO ACCOMPANY RECORD 1963/7

PLATE II



Δt DIP ELEMENT IN REFRACTOR V_2 (9300)

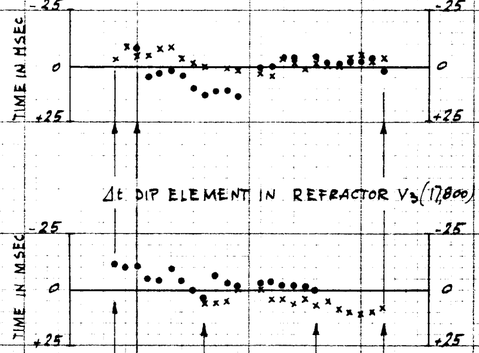
	SP1011													SP1013													SP1015
t_o	514	532	559	581	602	626	656	678	705	718	730	741	—	766	783	796	811	823	838	847	862	877	889	901	911
W_c+E_c	+3	+3	+3	+5	+4	+3	+2	+5	+4	+4	+3	-1	—	-1	-2	-2	-3	-4	-4	-3	-2	-3	-2	-3	-2
t_c	517	535	562	586	606	629	658	683	709	722	733	740	—	765	781	794	808	819	834	844	860	874	887	898	909

SP1008 : d_s = 71'/84'

	SP1011													SP1013													SP1015
t_o	13	33	56	79	108	136	197	261	300	—	352	378	—	428	455	471	497	522	543	568	592	612	632	660	682
W_c+E_c	-4	-4	-3	-2	-3	-4	-4	-3	-3	3	-7	-8	—	-10	-11	-12	-12	-12	-12	-11	-12	-12	-10	-11	-10
t_c	9	29	53	77	105	132	193	258	297	—	345	370	—	418	444	459	485	510	531	557	580	600	622	649	672

SP1011 : d_s = 42'/48'

Δt DIP ELEMENT IN REFRACTOR V_3 (17,800)



	SP1011													SP1013													SP1015
t_o	665	648	628	616	591	568	547	528	508	483	461	440	—	383	359	333	310	223	199	173	147	118	88	—	22
W_c+E_c	-5	-5	-5	-3	-4	-5	-6	-5	-5	-6	-7	-8	—	-10	-11	-12	-13	-13	-13	-11	-10	-10	-9	-10	-9
t_c	660	643	623	613	587	563	541	523	503	477	454	432	—	373	348	321	297	210	186	162	137	108	79	—	13

SP1015 : d_s = 67'/76'

	SP1011													SP1013													SP1015
t_o	888	876	863	855	845	830	822	813	804	781	774	765	—	741	729	718	707	695	685	661	639	615	589	566	546
W_c+E_c	-5	-5	-4	-3	-4	-6	-6	-5	-5	-5	-6	-9	—	-10	-11	-11	-12	-13	-13	-10	-11	-11	-9	-10	-9
t_c	883	871	859	852	841	824	816	808	799	776	768	756	—	731	718	707	695	682	672	651	628	604	580	556	537

SP1018 : d_s = 87'/100'

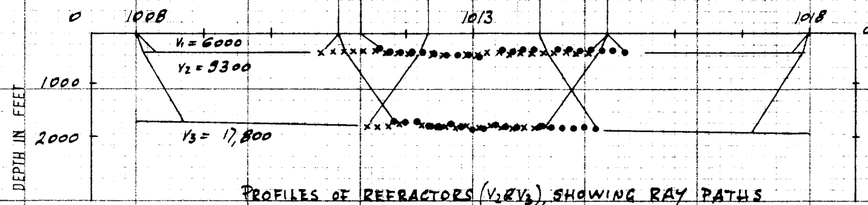
ELEVATION DATUM 1500 Ft ASL

SCALES

HORIZONTAL 0 2200 4400 FEET

VERTICAL

VELOCITIES IN FT/SEC



PROFILES OF REFRACTORS (V_2 & V_3), SHOWING RAY PATHS

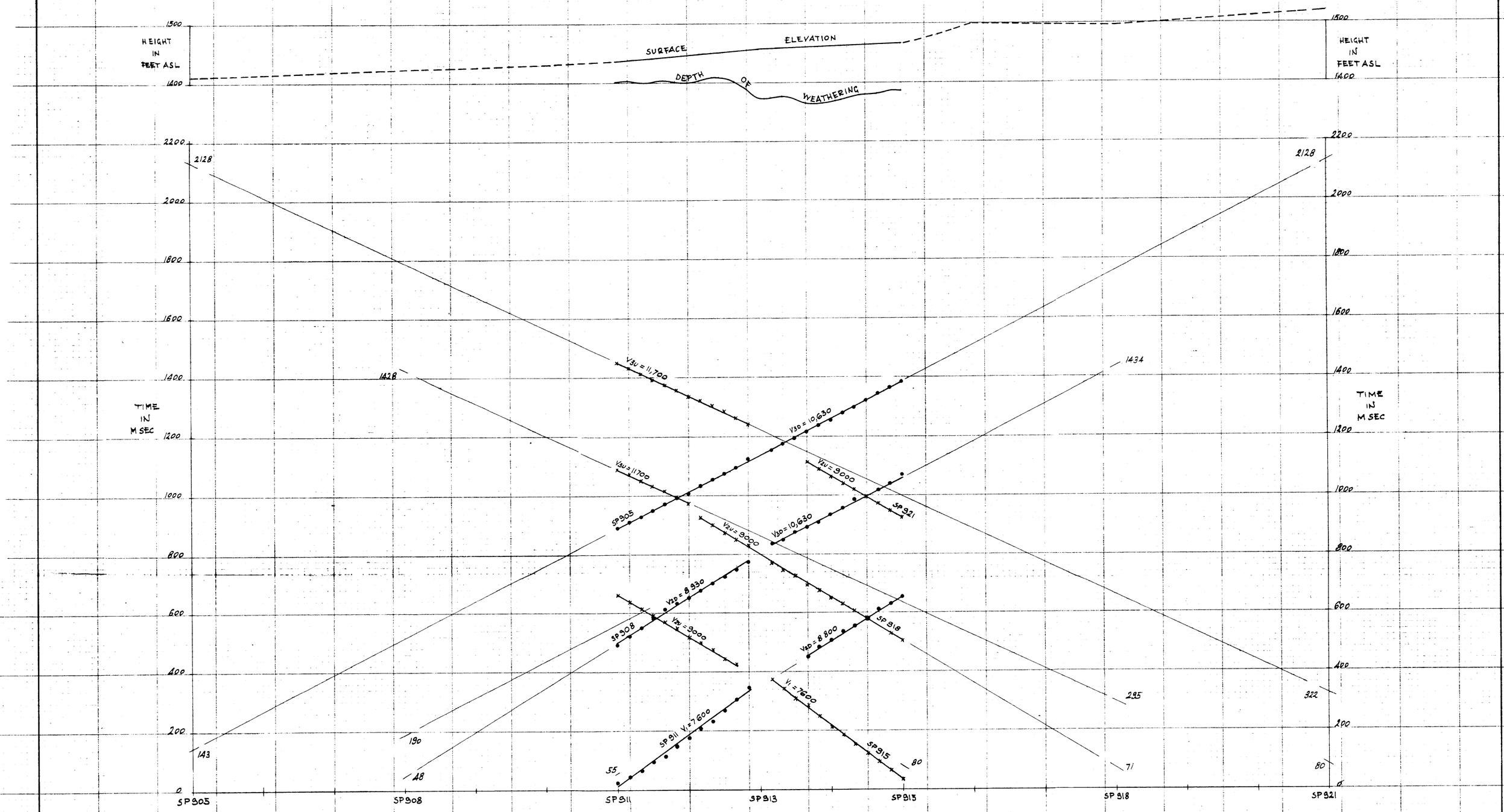
MOUNT CHARLES REFRACTION TRAVERSE
TIME/DISTANCE CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G 52/B3-11

TO ACCOMPANY RECORD NO 1963/7

PLATE 12



SP 905

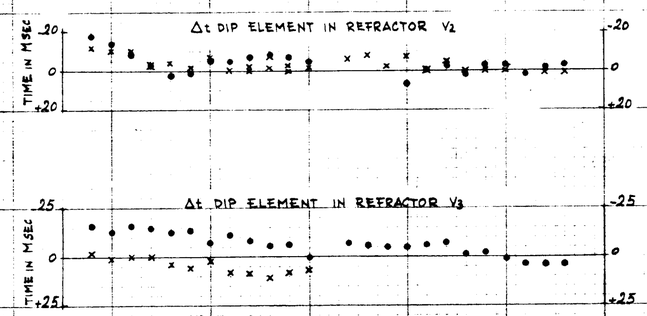
896	918	937	959	980	1000	1019	1044	1065	1088	1110	1141	–	1181	1201	1225	1247	1266	1285	1310	1328	1348	1371	1390	1410	t_o
-6	-6	-8	-9	-8	-10	-12	-11	-9	-10	-13	-18	–	-26	-25	-28	-30	-31	-31	-30	-29	-27	-27	-26	-26	W_c+E_c
890	912	929	950	972	990	1007	1033	1056	1078	1097	1123	–	1155	1176	1197	1217	1235	1254	1280	1299	1321	1344	1364	1384	t_c

SP911 SP913 SP915

SP 908

497	526	556	588	617	642	663	688	709	732	761	754	–	861	874	903	919	937	963	988	1016	–	1044	1072	1196	t_o
-6	-6	-7	-8	-6	-8	-11	-11	-9	-10	-13	-18	–	-26	-25	-28	-30	-31	-31	-30	-29	-27	-27	-26	-26	W_c+E_c
491	520	549	580	611	634	652	677	700	722	748	776	–	835	849	875	889	906	932	958	987	–	1017	1042	1170	t_c

SP911 SP913 SP915



SP 921

1460	1442	1423	1404	1386	1370	1350	1335	1314	1297	1277	1261	–	–	–	–	1148	1122	1098	1078	1054	1030	1004	979	957	t_o
-10	-10	-11	-12	-10	-12	-15	-14	-12	-13	-16	-21	–	–	–	–	-35	-36	-36	-35	-34	-32	-32	-31	-31	W_c+E_c
1450	1432	1412	1392	1376	1358	1335	1321	1302	1284	1261	1240	–	–	–	–	1113	1086	1062	1040	1020	998	972	948	926	t_c

SP911 SP913 SP915

SP 918

1101	1082	1061	1043	1025	1007	987	938	911	886	864	849	–	799	771	755	727	711	681	660	635	608	–	559	534	t_o
-9	-9	-10	-11	-9	-11	-14	-14	-12	-13	-16	-21	–	-29	-28	-31	-33	-34	-34	-33	-32	-30	–	-29	-29	W_c+E_c
1092	1073	1051	1032	1016	996	973	924	899	873	848	828	–	770	743	724	694	677	647	627	603	578	–	530	505	t_c

SP911 SP913 SP915

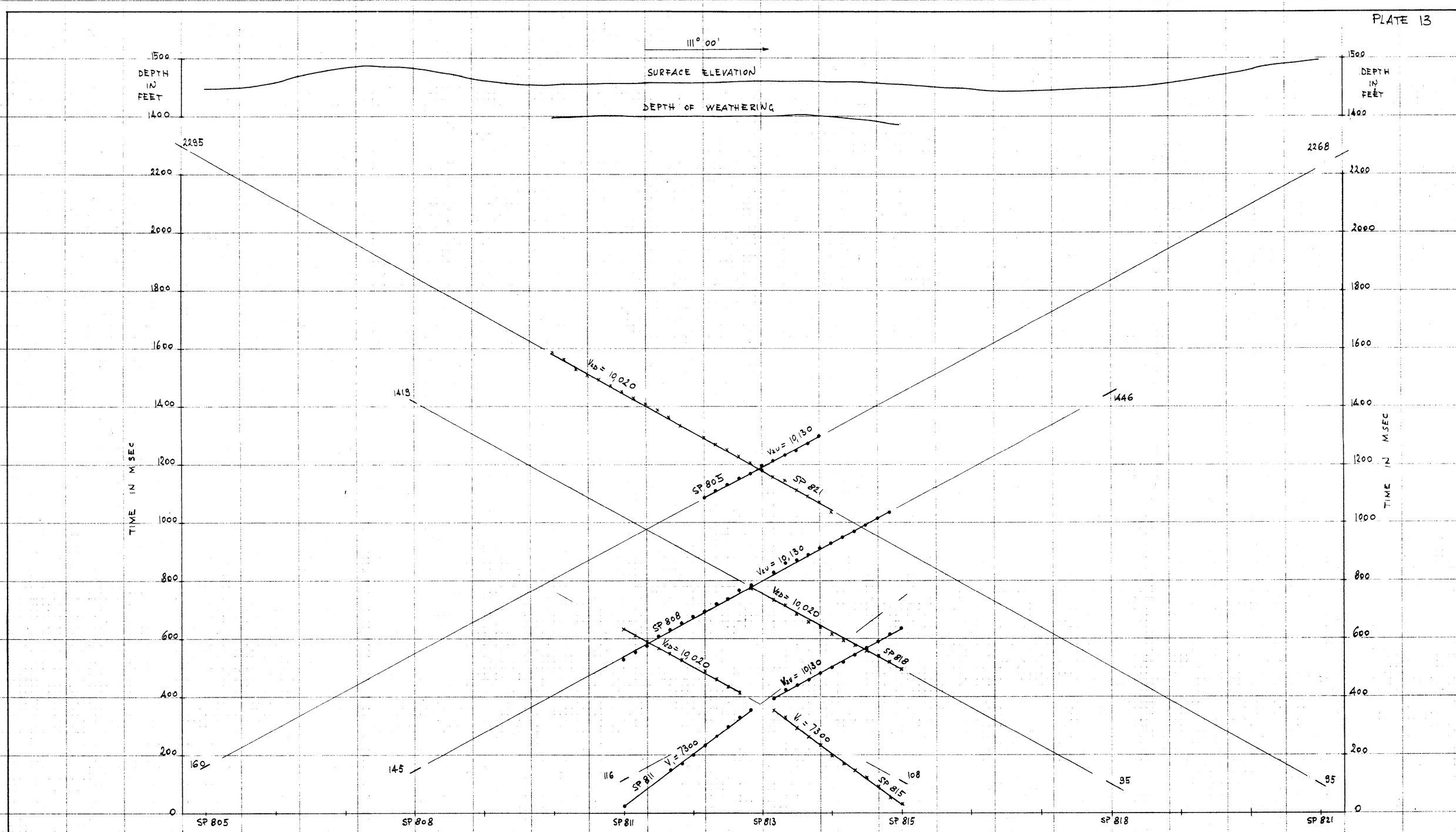
MOUNT SAMUEL REFRACTION TRAVERSE
TIME/DISTANCE CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G52/B3-12

To accompany Record No. 1963/7

PLATE 13



SP 808

to	550	574	598	619	653	676	701	714	743	759	789	805	–	851	877	892	913	938	950	967	993	1016	1042	1062	–
Wc+Ec	-22	-22	-22	-23	-23	-23	-23	-22	-24	-22	-22	-24	–	-24	-21	-22	-24	-24	-24	-23	-24	-25	-26	-25	–
tc	528	552	576	606	630	653	678	692	719	737	767	781	–	827	856	870	889	914	926	944	969	991	1016	1037	–

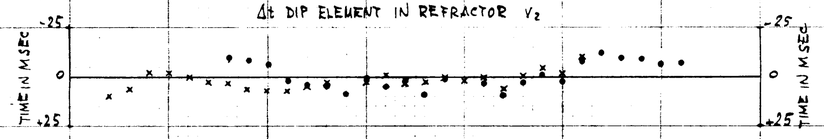
SP 811 SP 813 SP 815

SP 805

To	–	1105	1127	1149	1170	1190	1215	1238	1252	1264	1295	1321	–
Wc+Ec	–	-19	-21	-19	-19	-21	-20	-21	-18	-19	-21	-21	–
Tc	–	1086	1106	1130	1151	1169	1195	1217	1234	1245	1274	1300	–

SP 812 SP 814

Δt DIP ELEMENT IN REFRACTOR V_2



SP 821

1615	1589	1559	1537	1517	1497	1476	1457	1436	1415	1391	1366	–	1321	1296	1278	1255	1233	1211	1189	1170	1142	1118	1089	1069	to
-28	-28	-28	-28	-28	-28	-28	-28	-29	-29	-29	–	-28	-30	-28	-28	-30	-29	-30	-27	-28	-30	-30	-30	Wc+Ec
1587	1561	1531	1509	1489	1469	1448	1429	1408	1386	1362	1337	–	1293	1268	1250	1227	1203	1182	1159	1143	1114	1088	1069	1039	Tc

SP 810 SP 812 SP 814

SP 818

803	–	760	735	708	685	667	643	620	602	586	568	542	522	to
-26	–	-26	-23	-24	-26	-26	-26	-25	-26	-27	-28	-27	-27	Wc+Ec
777	–	734	712	684	659	641	617	595	578	559	540	515	495	Tc

SP 813 SP 815

SCALES

HORIZONTAL	0	1100	2200	3300	4400
VERTICAL	0	1000	2000	3000	4000

VELOCITIES IN FT/SEC

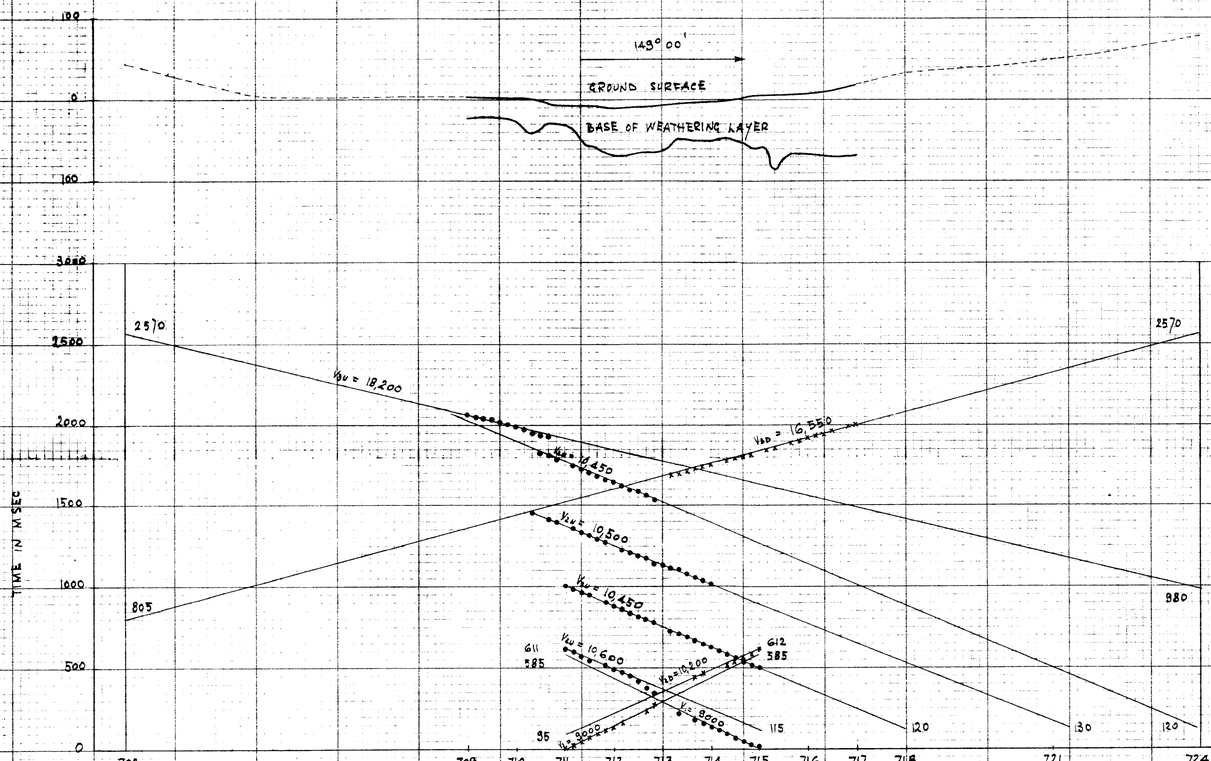
NMF 19 REFRACTION TRAVERSE
TIME/DISTANCE CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics.

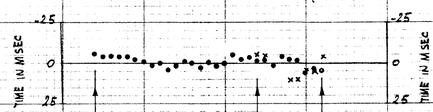
G 52/B3-13

TO ACCOMPANY RECORD No. 1963/7

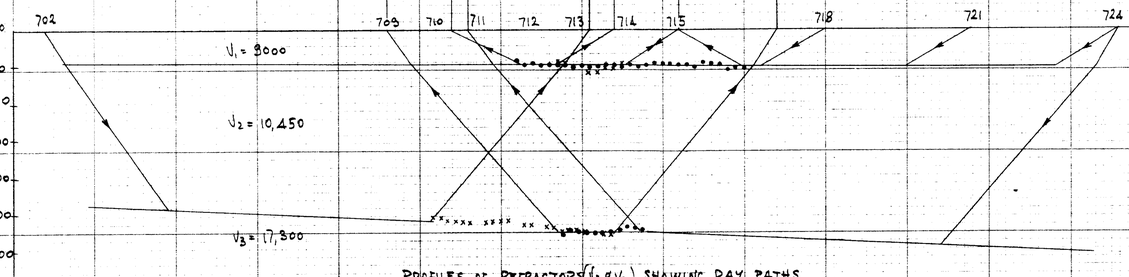
PLATE 14



Δt DIP ELEMENT IN REFRACTOR V_2 (10,450)



Δt DIP ELEMENT IN REFRACTOR V_3 (17,300)



PROFILES OF REFRACTORS (V_2 & V_3) SHOWING RAY PATHS

ELEVATION OF DATUM 1450 FT ASL

SCALES

HORIZONTAL 0 2200 4400

VERTICAL

VELOCITIES IN FT/SEC

SP 713

(Peaks) t_o	—	1789	1800	1818	1833	1848	1863	—
(Est 1st breaks) t_o	—	1685	1700	1718	1733	1748	1763	—
W_o+ E_c	9	6	7	8	8	9	9	8
t_c	—	1619	1693	1710	1725	1739	1754	—

SP 715

	—	1886	1898	1910	1925	—	1858	1878	—	2008	2018	2040	2050	2067	2088	—	2109	2122
	—	1786	1798	1810	1825	—	1858	1878	—	1908	1918	1940	1950	1967	1988	—	2009	2022
	8	9	10	12	11	12	20	18	16	16	16	17	18	18	19	19	21	
	—	1778	1789	1800	1813	—	1846	1858	—	1892	1902	1924	1933	1949	1970	—	1990	2001

SP 702 : d_s = 58/100'

SP 711

T_o	13	31	56	81	106	130	151	180	—	—	259	284	—	—	—	—	455	475	—	—
W_o+ E_c	8	8	12	15	15	17	18	18	18	17	17	17	—	11	9	10	10	10	11	11
t_c	5	23	42	66	91	113	133	162	—	—	241	274	—	—	—	—	445	464	—	—

SP 713

	524	547	573	597	625	—	1789	1800	1818	1833	1848	1863	—	1886	1898	1910	1925	—	1858	1878
	1786	1800	1818	1833	1848	1863	—	1886	1898	1910	1925	—	1858	1878	—	2008	2018	2040	2050	2067
	9	9	10	12	12	13	13	13	12	10	11	11	12	13	13	14	15	15	14	14
	1777	1791	1808	1821	1836	1850	—	1873	1886	1900	1914	—	1846	1865	—	1994	2003	2026	2036	2053

SP 715

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 717 : d_s = 56/100'

SP 711

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 713

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 715

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 718 : d_s = 88/100'

SP 709

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 711

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
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SP 713

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
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SP 715

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 721 : d_s = 68/94'

SP 709

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 711

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 713

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
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SP 715

	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088	2088
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076	2076

SP 724 : d_s = 70/120'

MOUNT BEADELL REFRACTION TRAVERSE
TIME/DISTANCE CURVES AND INTERPRETATION

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

G52/B3-14

TO ACCOMPANY RECORD No. 1963/7

MOUNT CHARLES REFLECTION TRAVERSE
VARIABLE–AREA CROSS–SECTION

PLATE 15

REFLECTION TIME IN SECONDS

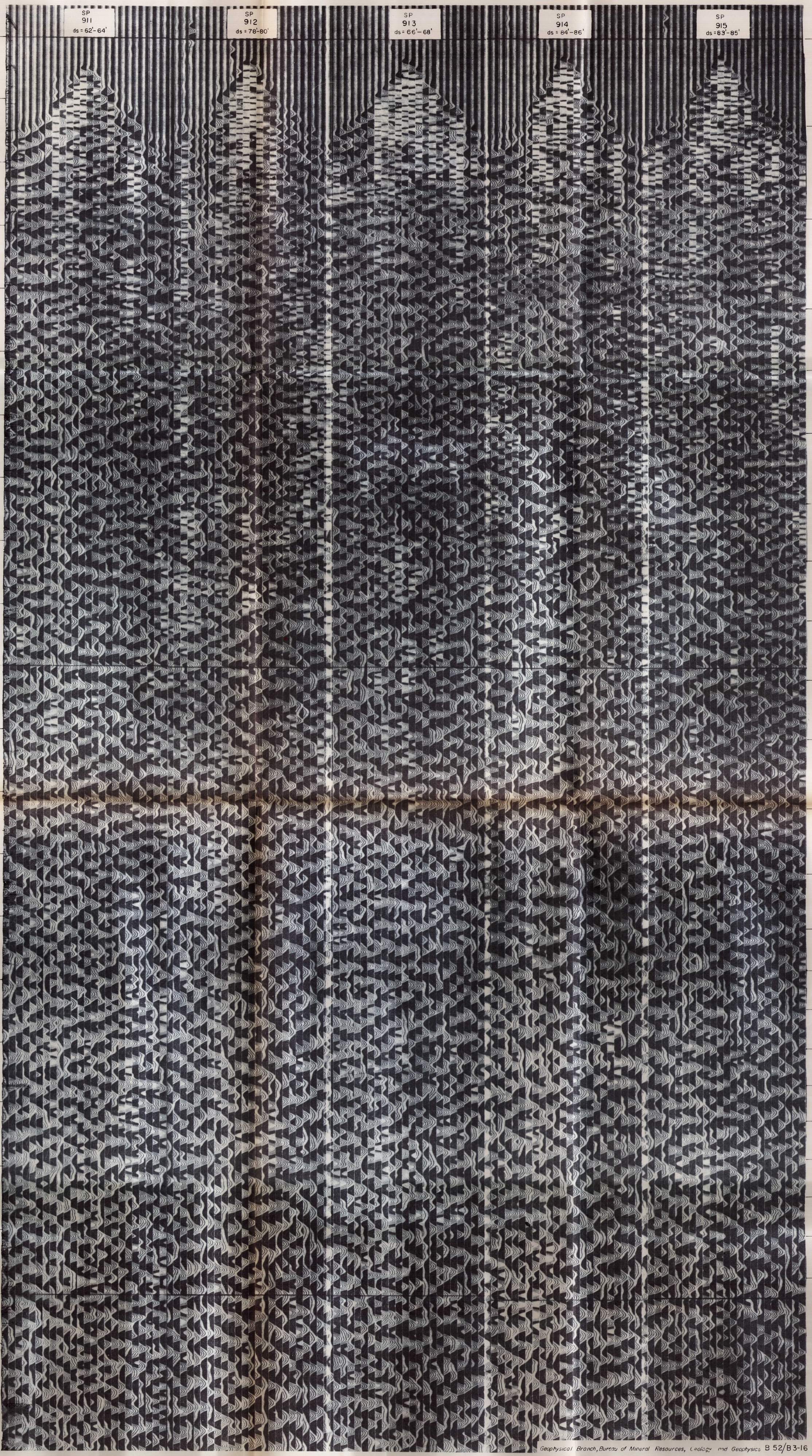
DEPTH IN FEET

TO ACCOMPANY RECORD No 1963/7

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics B 52/B 3–15

MOUNT SAMUEL REFLECTION TRAVERSE
VARIABLE-AREA CROSS-SECTION

PLATE 16



REFLECTION TIME IN SECONDS

DEPTH IN FEET

TO ACCOMPANY RECORD No. 1963/7

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics B 52/B3-16

NMF 19 REFLECTION TRAVERSE
VARIABLE-AREA CROSS SECTION

PLATE 17

REFLECTION TIME IN SECONDS

DEPTH IN FEET

TO ACCOMPANY RECORD No. 1963/-

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MOUNT BEADELL REFLECTION TRAVERSE
VARIABLE–AREA CROSS-SECTION

PLATE 18

TO ACCOMPANY RECORD No. 1963/7

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REFLECTION TIME tc (secs.)	DEPTH d (feet)
0	0
0.1	370
0.2	700
0.3	1050
0.4	1400
0.5	1860
0.6	2370
0.7	2880
0.8	3370
0.9	3880
1.0	4370
1.1	4880
1.2	5370
1.3	5860
1.4	6350
1.5	7100
1.6	7930
1.7	8800
1.8	9630
1.9	10,470
2.0	11,260

GIBSON DESERT VELOCITY DISTRIBUTION

TIME/DEPTH DATA

DERIVED FROM REFRACTION CROSS-SECTION AT MOUNT BEADELL