

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1966/149



017002

SEISMIC REFLECTION
SURVEY OF THE
NORTHERN END OF THE
GINGIN ANTICLINE,
PERTH BASIN, WESTERN AUSTRALIA
1955

by

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RESTRICTED

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1966/149

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SUMMARY

A seismic reflection traverse running across the Perth Basin through the township of Gingin was completed about six weeks before the commencement of the present survey. It revealed the existence of a deep seated anticline, the Gingin Anticline, with its crest about three miles west of the township.

The survey dealt with in this Record was north of the former traverse and indicated that in that area the Anticline plunges to the north.

INTRODUCTION

The seismic work discussed in this report follows directly from the recommendations made after the analysis of the results of a seismic traverse (Traverse A) crossing the Perth Basin and running through Gingin (Vale 1956). Gingin is about 45 miles north of Perth and lies approximately in the centre of the Perth Basin.

Traverse A confirmed the hypotheses based on a gravity survey (Thyer and Everingham, 1956) that the Perth Basin is a deep sedimentary basin. It also revealed the presence of structure, previously unknown, in the form of a deep seated anticline (the Gingin Anticline). Because of the presence of a thick unknown sedimentary section the Gingin Anticline becomes a petroleum prospect until proved otherwise. An essential criterion before embarking on a test boring programme is that the anticline should be shown to be closed and the approximate location of the culmination indicated. To assist to this end the present work was undertaken. As it now stands the anticline is shown plunging to the north. It is understood that the West Australian Petroleum Pty. Ltd. will engage a contract seismic party to continue the investigation to the south.

Note: This text was written in 1955 at the time of the survey and is being bound at this time (1966) for reference and record purposes only.

2. GEOLOGY

For a description of the known geology of the Perth Basin the reader is referred to Fairbridge, 1949 and to summaries contained in the reports by Thyer and Everingham, 1956, and Vale, 1956. Fairbridge's Hill River Fault cuts through the eastern side of the area surveyed (see Plate 2). It is marked at the surface by a low scarp with Cretaceous or Jurassic beds (both marine and fresh water) on the high ground to the east. These beds are dipping gently to the east. Dr. Fairbridge considers (at least in this area) that the scarp has eroded for some distance, perhaps half a mile, back from the true line of the fault (personal communication). Quaternary sand plains occur to the west and tend to mask the true line of the fault.

Although many people doubt the existence of the Hill River Fault, I shall for the purpose of this report assume its existence.

3. GENERAL METHODS

The party and the equipment used were the same as that described for Traverse A (Vale, 1956). Computing methods employed were also the same. The party arrived at Gingin on 2nd April, 1955 and departed on 23rd April.

Three traverses (C, D and E-Plate 1) were shot. These comprised 71 shot holes. A bulldozer was employed on the clearing of traverses D and E.

Only two phantom horizons, "B" and "C" were drawn. These tied into phantom horizons "B" and "C" on traverse A, where they were the only two showing the Gingin Anticline.

Contour plans have been drawn for both phantom horizons and these are shown on Plates 11 and 12.

4. DISCUSSION OF RESULTSTraverse C. (Plates 5 and 6)

Numerous reflections giving good control of phantom horizons, are recorded from SP400 to SP407. There is a break in the continuity of reflections down to 6000 feet on the north side of SP 407 which may be indicative of minor faulting. Shot points 410 and 411 also give good control but from SP412 to SP421 the control is poor. This portion of the traverse is running close to and roughly parallel to the assumed Hill River Fault and the poor control may be related to it. It may also be caused by near surface conditions.

i. Phantom Horizon "B".

This phantom horizon is generally flat except at the northern end where it is rising towards S.P. 401.

ii. Phantom Horizon "C".

This phantom horizon rises about 500 feet from SP400 to SP415. It then undulates to SP421.

Traverse D. (Plates 7 and 8)

Numerous reflections giving good control down to about 20,000 feet are recorded between shot points 441 and 430. Between SP430 and SP421 the control is poor down to 10,000 feet but between 10,000 feet and 20,000 feet it is fair. There may be minor faulting on the north side of SP430.

i. Phantom Horizon "B".

This phantom horizon falls by approximately 200 feet from SP441 to SP421.

ii. Phantom Horizon "C".

This phantom horizon rises by about 100 feet from SP441 to SP421.

Traverse E. (Plates 9 and 10)

The control on this traverse is comparatively poor. On the eastern side between shot points 448 and 445 where the reflections are numerous there are many associated features (particularly reverse curvature of the reflections without any apparent reason to be deduced from the weathering breaks) that reduces the reliability of the control. If my remarks on possible faulting on traverses C and D have any substance then it must also be assumed that the poor control shown on this traverse is related to a zone of minor faulting.

Traverse A. (Plates 3 and 4)

This traverse is shown from SP279 to SP174. Further information on this traverse may be obtained from Vale (1956). Between shot points 212 and 210 the control is poor and may indicate some minor faulting. Between shot points 201 and 196 there is a complete absence of reflections of any significance. The Hill River "Fault" escarpment crosses the traverse within this portion and, while the absence of reflections is purely negative evidence of faulting, it is the strongest geophysical evidence yet recorded by the Bureau in support of the fault hypothesis. Elsewhere along the portion of the traverse shown on Plates 3 and 4 the seismic control obtained is quite good. An anticlinal reversal of dips is most prominent on this section.

3.

i. Phantom Horizon "B".

This phantom horizon falls by about 250 feet from SP226 to SP220. It then rises by over 500 feet to SP213 and then falls by about 1,850 feet with minor undulations to SP196.

ii. Phantom Horizon "C".

This phantom horizon rises by over 1,400 feet from SP226 to SP 212. It then falls with undulations by about 2,150 feet to SP194.

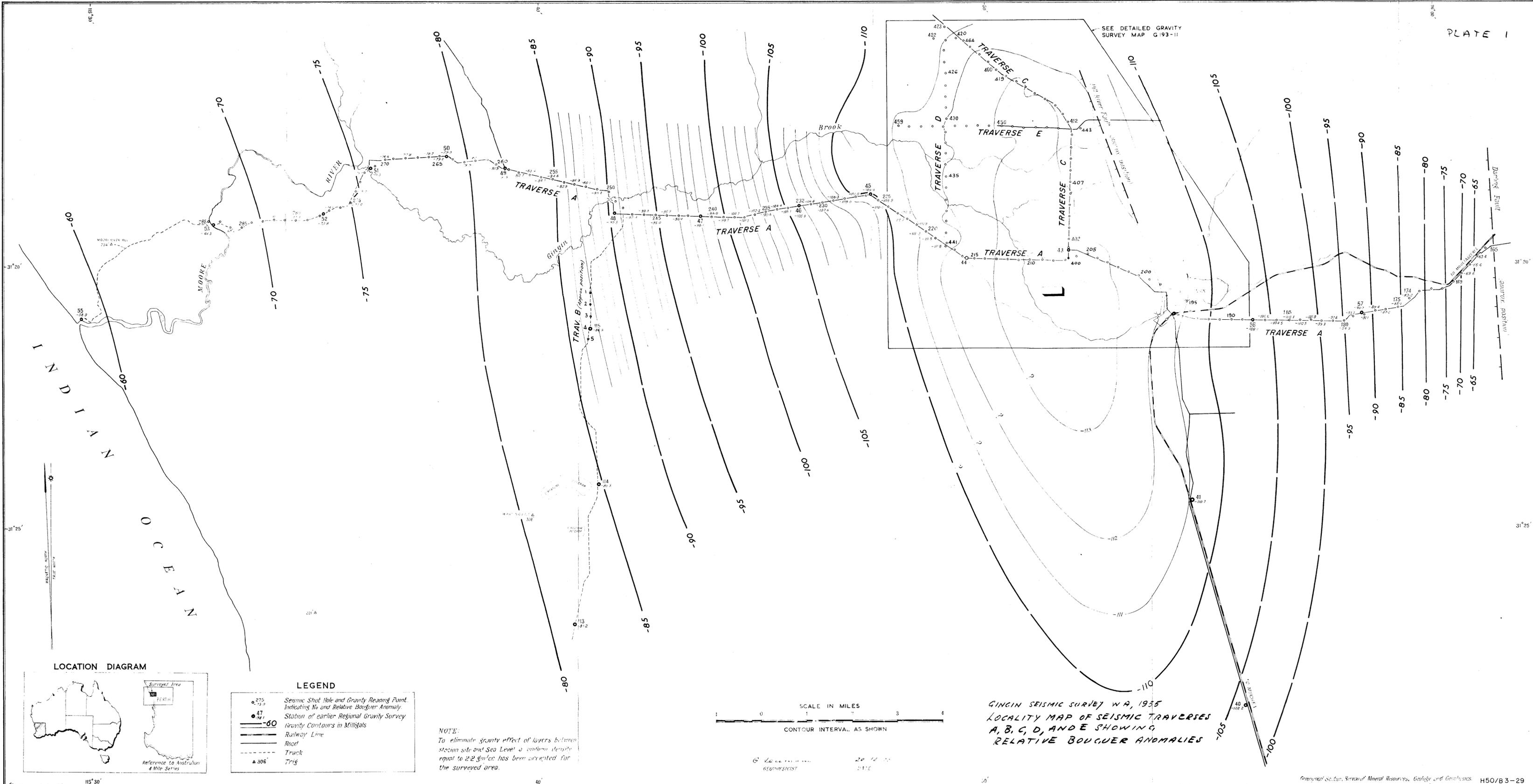
Summary

The results obtained by the above traverses are summarised by the drawing of two contour plans (Plates 11 and 12) representing phantom horizons "B" and "C".

Both phantom horizons show a north-south axis for the Gingin Anticline and indicate a north plunge. Maximum relief is shown on traverse A.

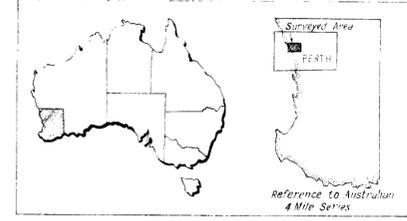
5. REFERENCES

- | | | |
|-------------------------------------|------|--|
| VALE, K.R. | 1956 | Preliminary Report on a Seismic Reflection Traverse across the Perth Basin at Gingin, W.A.
<u>Bur. Min. Res. Geol. Geophys. Record No. 1956/26.</u> |
| THYER, R.F. and
EVERINGHAM, I.B. | 1956 | Gravity Survey of the Perth Basin, W.A. <u>Bur. Min. Resour. Aust. Bull. 33</u> |
| FAIRBRIDGE, R.W. | 1949 | Preliminary Report on the Geology of the Coastal Plain and other Sedimentary Areas between Busselton and Geraldton, W.A. (unpublished report, written for Richfield Oil Corporation, U.S.A.) |
| GABY, P.P. | 1947 | Grading System for Seismic Reflections and Correlations. <u>Geophysics</u> , 12 (4), 590-617. |



SEE DETAILED GRAVITY SURVEY MAP G 193-11

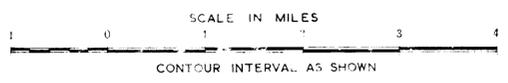
LOCATION DIAGRAM



LEGEND

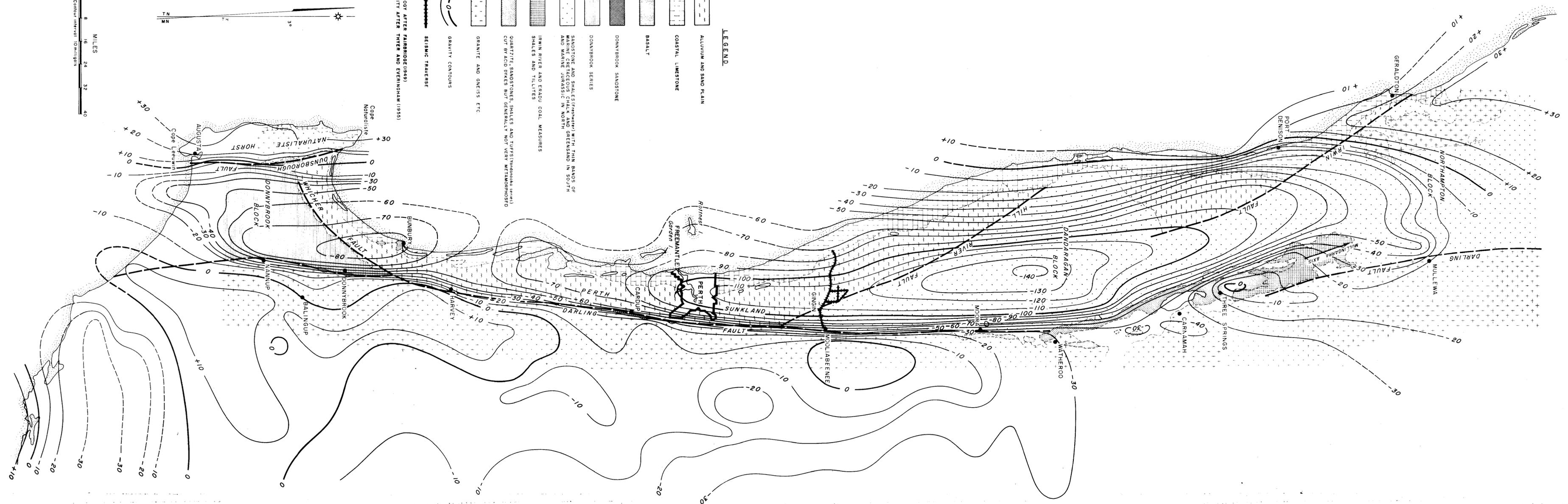
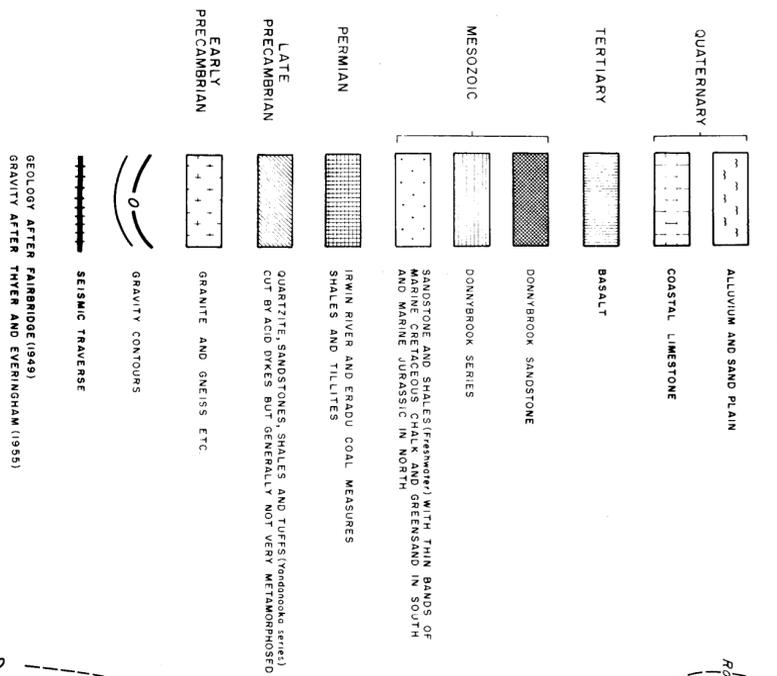
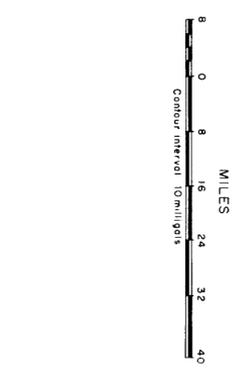
- 375
● 341 Station of earlier Regional Gravity Survey
- 375
○ 341 Seismic Shot Hole and Gravity Reading Point, Indicating No and Relative Bouguer Anomaly
- -60 Gravity Contours in Milligals
- Railway Line
- Road
- - - Track
- ▲ 306 Trig

NOTE:
To eliminate gravity effect of layers between station site and Sea Level a uniform density equal to 2.2 gm/cc has been accepted for the surveyed area.

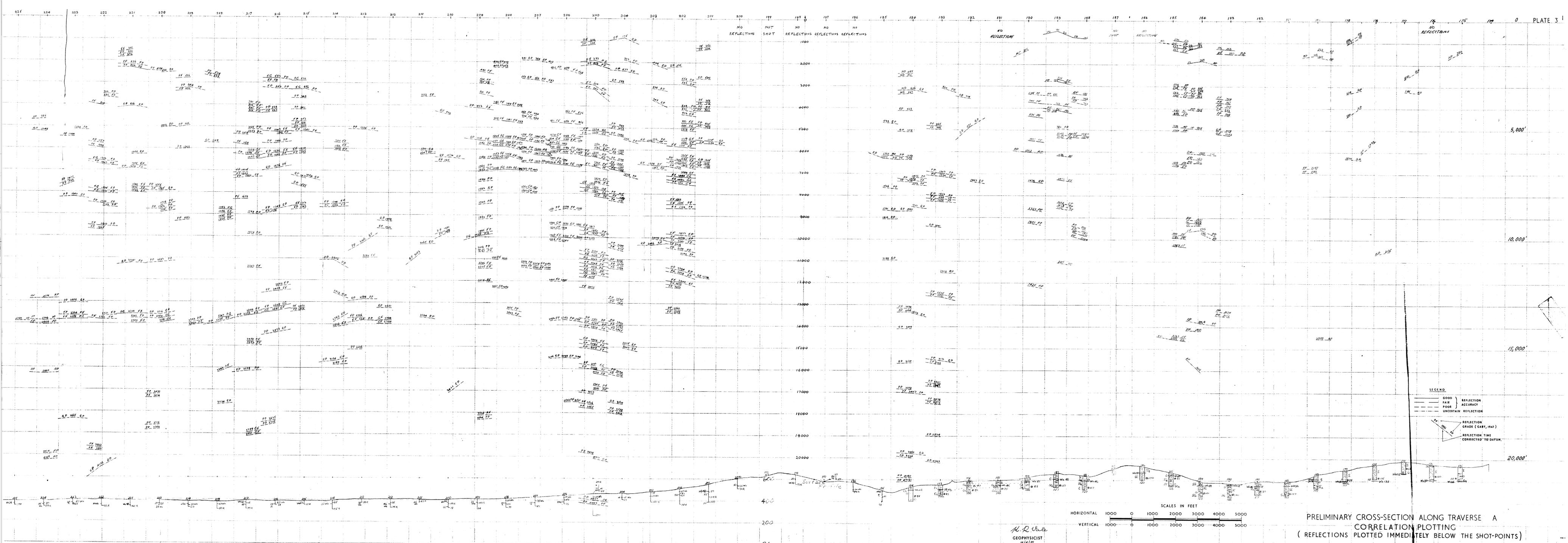


GINGEN SEISMIC SURVEY WA, 1955
LOCALITY MAP OF SEISMIC TRAVERSES
A, B, C, D, AND E SHOWING
RELATIVE BOUGUER ANOMALIES

G. V. KENNEDY
GEOPHYSICIST

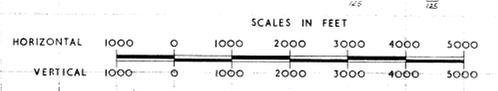


PLAN SHOWING TRAVERSES,
SURFACE GEOLOGY AND GRAVITY CONTOURS
OF PERTH BASIN



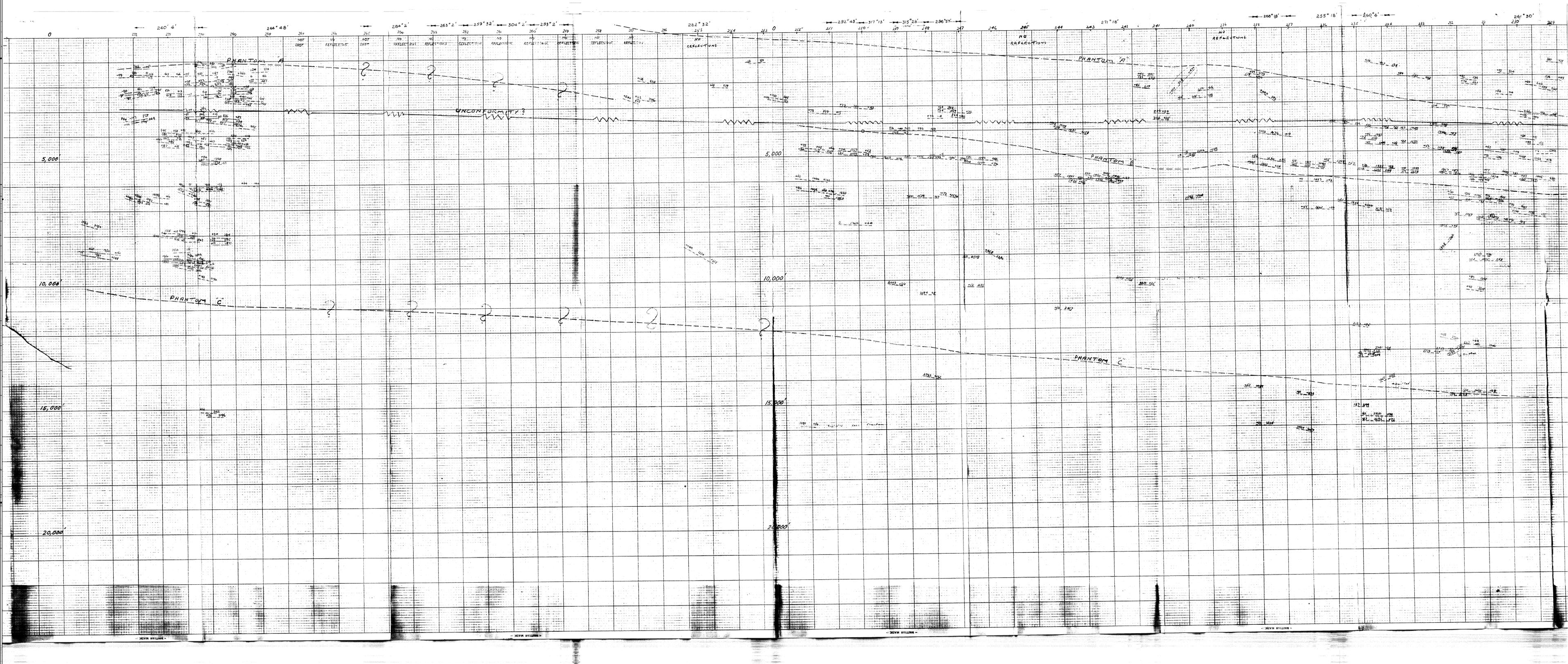
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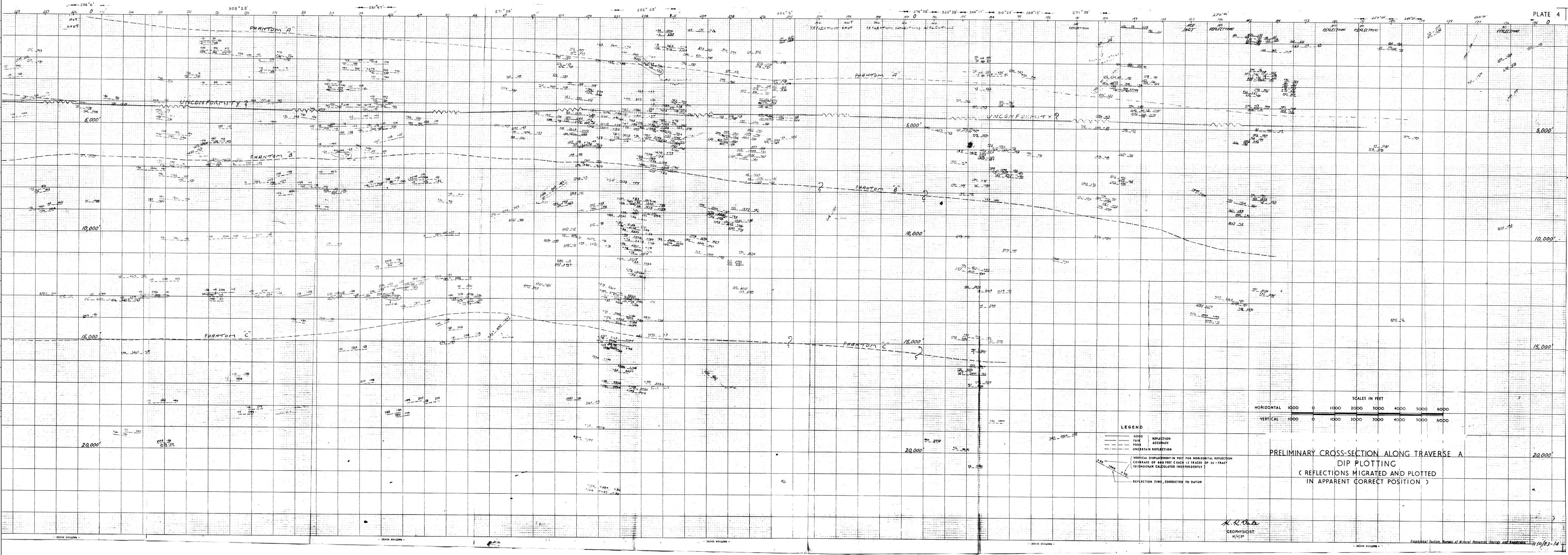
- REFLECTION ACCURACY GOOD
- - - REFLECTION ACCURACY FAIR
- · · REFLECTION ACCURACY POOR
- REFLECTION UNCERTAIN
- △ REFLECTION GRADE (GARY, 1947)
- REFLECTION TIME CORRECTED TO DATUM



PRELIMINARY CROSS-SECTION ALONG TRAVERSE A
CORRELATION PLOTTING
(REFLECTIONS PLOTTED IMMEDIATELY BELOW THE SHOT-POINTS)

H. R. Vail
GEOPHYSICIST
1/14/55



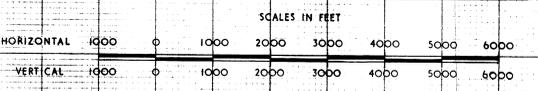


LEGEND

- GOOD REFLECTION ACCURACY
- - - FAIR REFLECTION ACCURACY
- POOR REFLECTION ACCURACY
- UNCERTAIN REFLECTION

VERTICAL DISPLACEMENT IN FEET FOR HORIZONTAL REFLECTION
 COVERAGE OF 400 FEET EACH 12 TRACES OF 24 - TRAC
 (SEISMOGRAM CALCULATED INDEPENDENTLY)

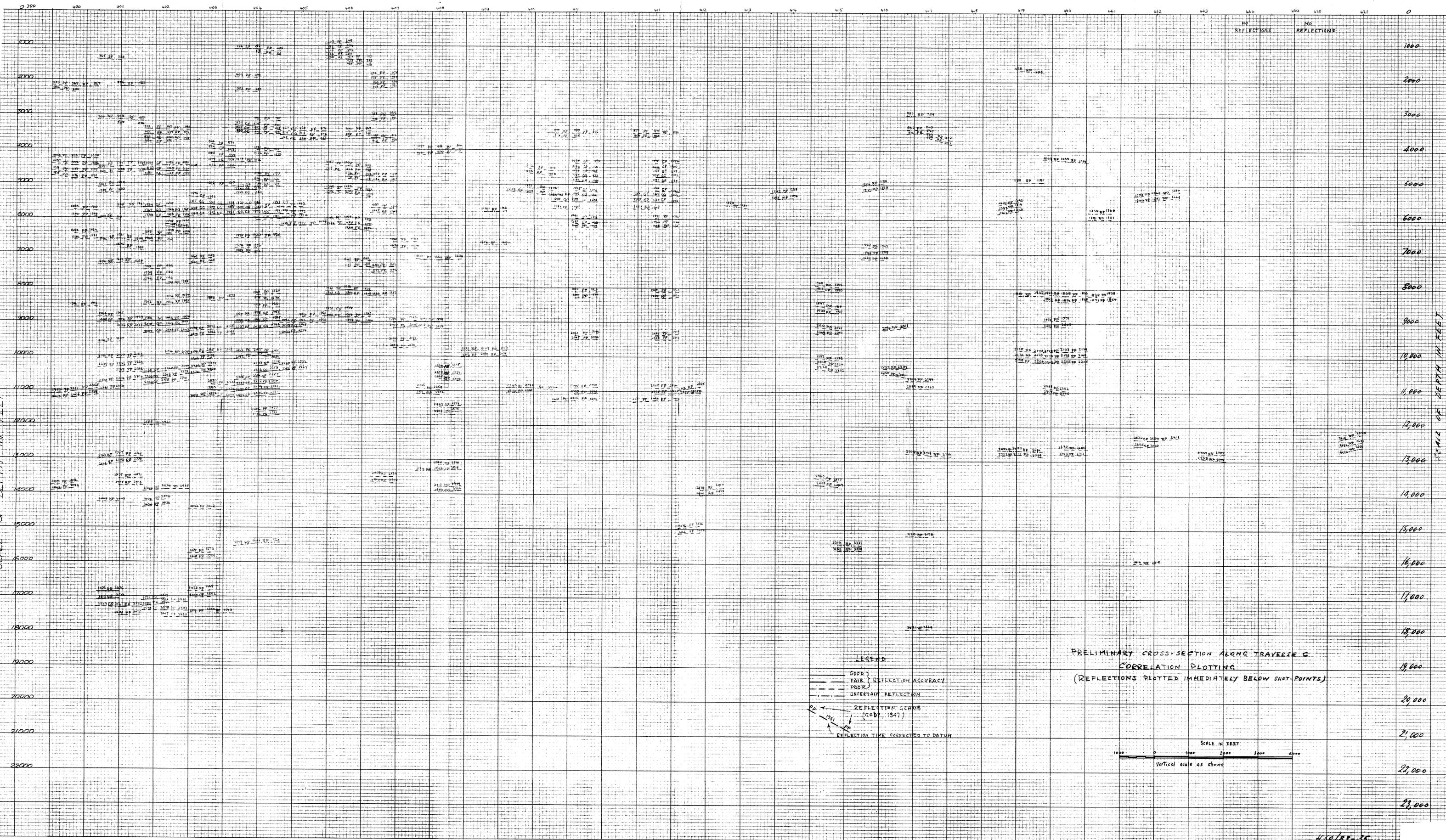
REFLECTION TIME, CORRECTED TO DATUM



PRELIMINARY CROSS-SECTION ALONG TRAVERSE A
 DIP PLOTTING
 (REFLECTIONS MIGRATED AND PLOTTED
 IN APPARENT CORRECT POSITION)

H. R. Vail
 GEOPHYSICIST
 11/1/58

S ← CINGIN TRAVERSE "C" → N



PRELIMINARY CROSS-SECTION ALONG TRAVERSE C
CORRELATION PLOTTING
(REFLECTIONS PLOTTED IMMEDIATELY BELOW SHOT-POINTS)

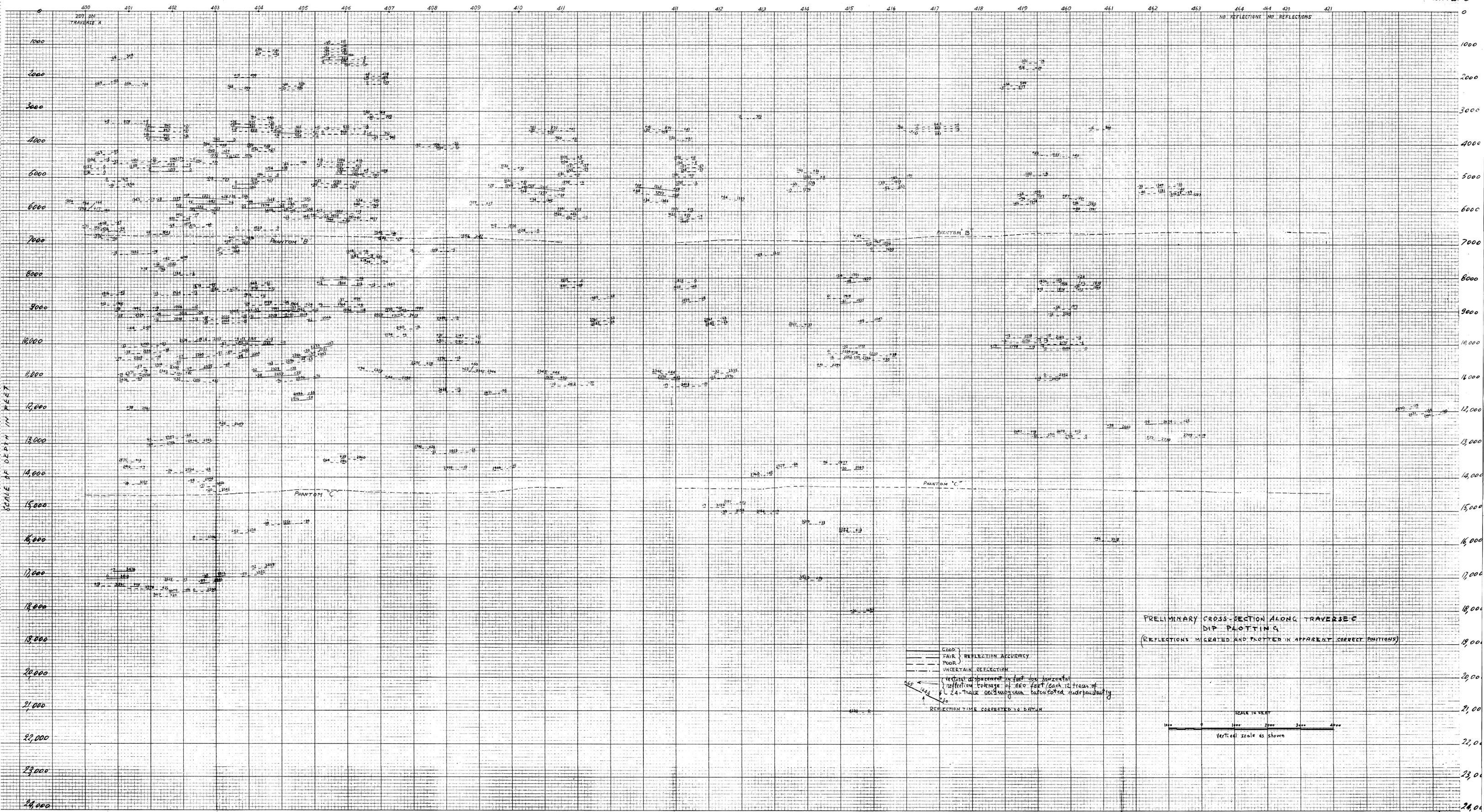
LEGEND

GOOD } REFLECTION ACCURACY
FAIR }
POOR }
UNCERTAIN REFLECTION

REFLECTION GRADE
(GAB, 1947)

REFLECTION TIME CORRECTED TO DATUM

SCALE IN FEET
1000 0 1000 2000 3000 4000
Vertical scale as shown



207 DN
TRANSVERSE A

NO. REFLECTIONS NO. REFLECTIONS

PHANTOM B

PHANTOM B

PHANTOM C

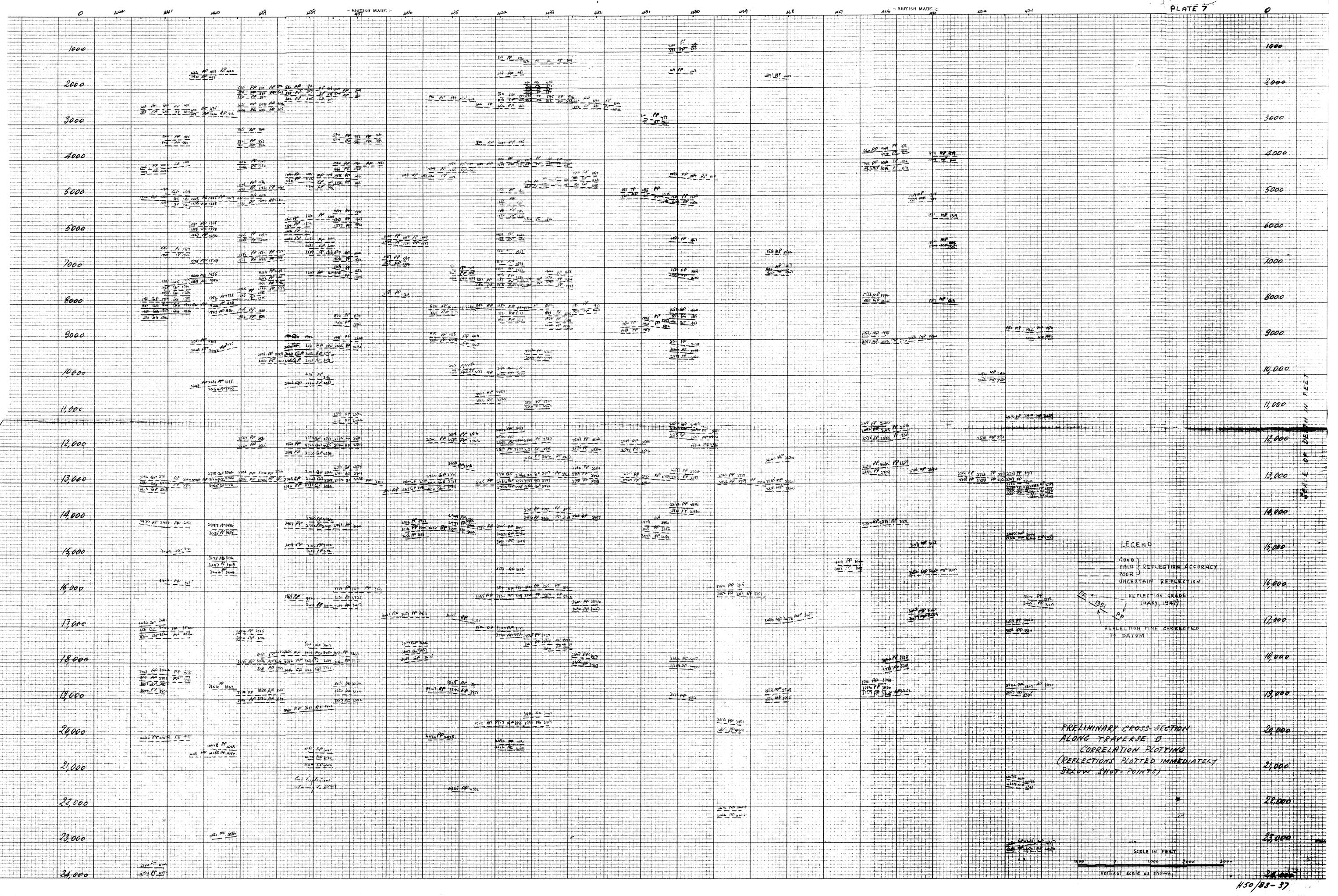
PHANTOM C

PRELIMINARY CROSS-SECTION ALONG TRAVERSE C
DIP PLOTTING
(REFLECTIONS MIGRATED AND PLOTTED IN APPARENT CORRECT POSITIONS)

——— Good REFLECTION ACCURACY
 - - - Fair REFLECTION ACCURACY
 . . . Poor REFLECTION ACCURACY
 - - - UNCERTAIN REFLECTION

Vertical displacement in feet for horizontal
 reflection tolerance of 660 feet each 12 traces of
 24-trace geobloggram tape coded independently
 REFLECTION TIME CORRECTED TO DATUM

SCALE IN FEET
Vertical scale as shown



DEPTH IN FEET

LEGEND

(GOOD) FAIR (REFLECTION ACCURACY)

(POOR) UNCERTAIN REFLECTION

REFLECTION GRADE (GARY, 1947)

REFLECTION TIME CORRECTED TO DATUM

PRELIMINARY CROSS-SECTION
ALONG TRAVERSE B
CORRELATION PLOTTING
(REFLECTIONS PLOTTED IMMEDIATELY
BELOW SHOT-POINTS)

SCALE IN FEET

0 1000 2000 3000

vertical scale as shown



SCALE OF DEPTH IN FEET

SCALE OF DEPTH IN FEET

LEGEND

- GOOD
 - - - FAIR REFLECTION ACCURACY
 - POOR
 - UNCERTAIN REFLECTION
- Vertical displacement in feet for horizontal reflection coverage of 600 ft (each 12 traces of 24 traces seismicogram calculated independently)
- $\frac{1}{2} \times \frac{t^2}{2 \times \Delta t}$
 reflection time corrected to datum

PRELIMINARY CROSS-SECTION
 ALONG TRAVERSE D
 DIP PLOTTING
 (REFLECTIONS MIGRATED AND
 PLOTTED IN APPARENT
 CORRECT POSITIONS)

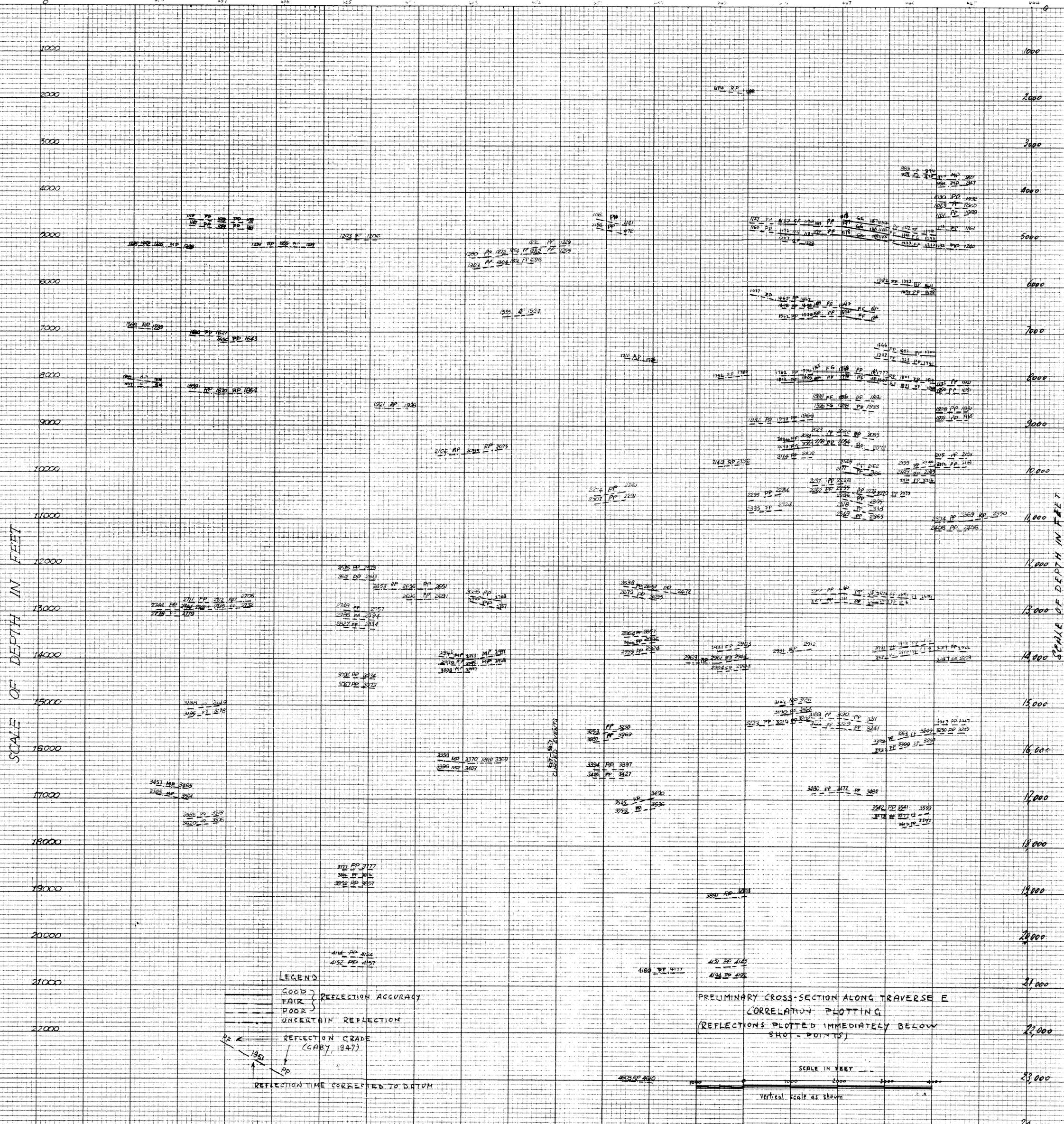
SCALE IN FEET
 1000 0 1000 2000 3000 4000
 Vertical scale as shown

PP Reflections
 4800 + 28
 4808 + 21
 5142 + 7
 5142 + 7
 5142 + 7

W

GINGIN

E



SCALE OF DEPTH IN FEET

SCALE OF DEPTH IN FEET

LEGEND

GOOD } REFLECTION ACCURACY
 FAIR }
 POOR }
 UNCERTAIN REFLECTION

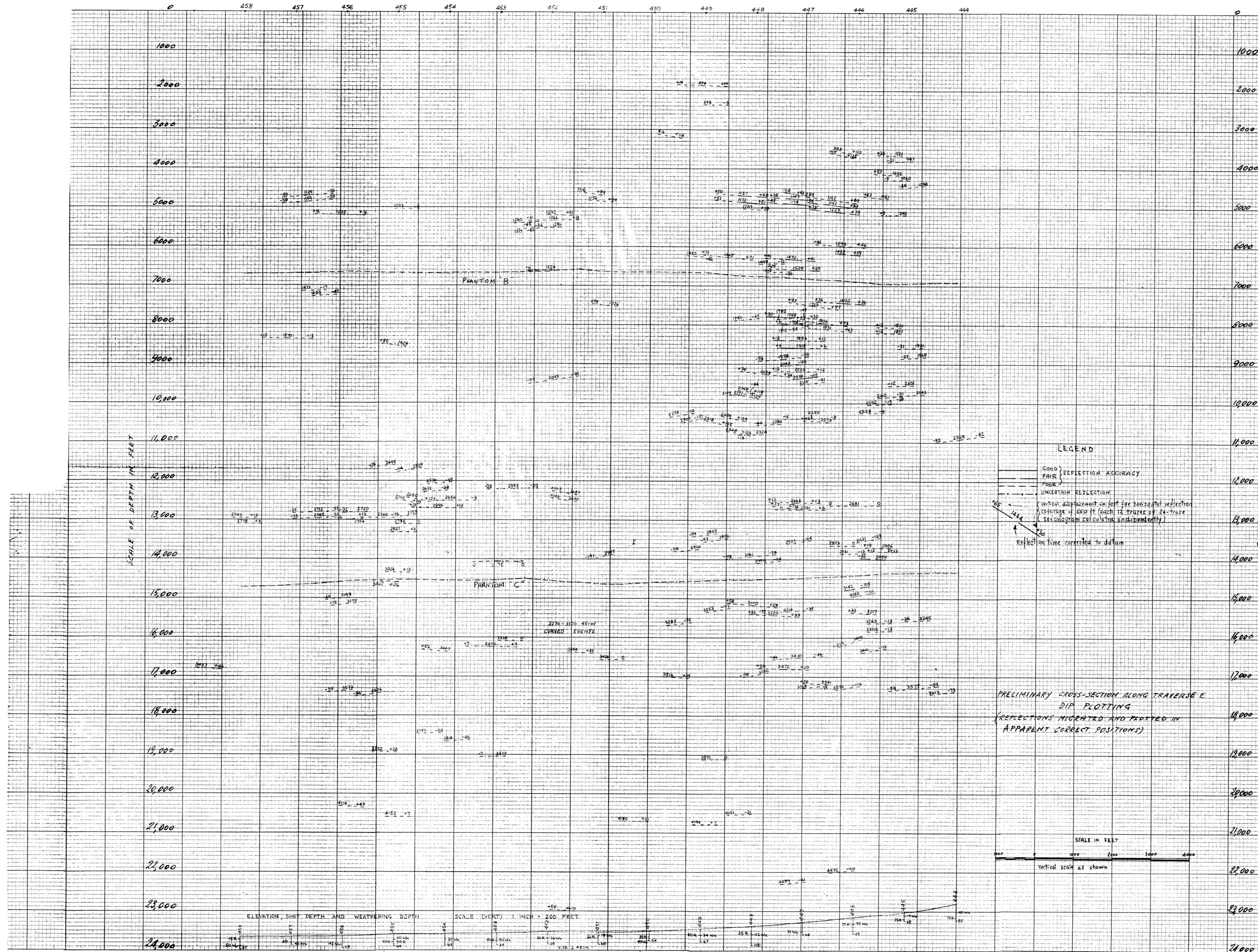
REFLECTION GRADE
 (GABY, 1947)

REFLECTION TIME CORRECTED TO DATUM

PRELIMINARY CROSS-SECTION ALONG TRAVERSE E
 CORRELATION PLOTTING
 (REFLECTIONS PLOTTED IMMEDIATELY BELOW
 SHOT - POINTS)

SCALE IN FEET

Vertical scale as shown



LEGEND

GOOD REFLECTION ACCURACY

FAIR REFLECTION ACCURACY

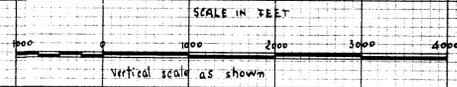
POOR REFLECTION ACCURACY

UNCERTAIN REFLECTION

(Vertical displacement in feet for horizontal reflection coverage of 660 ft (each 12 traces of 24-trace seismicogram calculated independently))

Reflection time corrected to datum

PRELIMINARY CROSS-SECTION ALONG TRAVERSE E
DIP PLOTTING
(REFLECTIONS MIGRATED AND PLOTTED IN APPARENT CORRECT POSITIONS)



ELEVATION SHOT DEPTH AND WEATHERING DEPTH

SCALE (VERT) 1 INCH = 200 FEET

HULLSH RWDE

HULLSH RWDE

H50/83-40

