COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1972/51

OAKS ESTATE RIVER GRAVEL SEISMIC REFRACTION SURVEY, ACT, 1972

by

P.J. Hill

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SUMMARY

A seismic refraction survey was made by the Bureau of Mineral Resources, Geology & Geophysics to determine the quantity and distribution of sand and gravel on a site by the Molonglo River near Queanbeyan. The deposits on the area consist of ancient alluvial fills and fossil aeolian sand dunes together with recent alluvium deposition along the river. Reserves of commercial material amounting to about 400,000 cubic metres and extending to depths of up to 16 metres are indicated by the survey results.

1. INTRODUCTION

The granting of a lease to a private company for the extraction of sand and gravel from a river deposit on the Molonglo River near Queanbeyan is being considered by the Department of the Interior. The area on Block 105, Gungahlin is shown in Plate 1. It is proposed after completion of gravel extraction that the site be developed into a recreational area. In order to plan the working of the deposit and for assessing the operator's rental, the depths over the site and the total amount of commercial material on the site are required. A request was made by the Commonwealth Department of Works for the Bureau of Mineral Resources, Geology & Geophysics (BMR) to conduct a survey on the site and map the deposit.

The work was done in January 1972, using the seismic refraction method, by a party from the Engineering Geophysics Group of the Bureau consisting of P.J. Hill (Geophysicist), S. Hall (Field Assistant), and P. Furlonger (Student).

2. DESCRIPTION OF DEPOSIT

The area investigated lies at the end of a low spur inside a sharp bend of the Molonglo River about 700 metres downstream from the Queanbeyan River junction. From the river, which forms much of the site's boundary, a low lying river flat extends about 50 metres; there is then a steep rise in elevation to the remaining part of the site about 15 metres above river level.

Most of the site except for the east section has been worked to some degree, and in the elevated central area removal of surface material has exposed fresh sand and gravel. This alluvium is fairly clean and slightly cemented and is thought to originate from ancient fluviatile deposits (van Dijk, 1959). As one proceeds northwards the material becomes less coarse and the percentage of clay appears to increase. From mapping done in 1964 (Gardner, 1966) it is believed that here transition into fossil aeolian sand dune deposits occurs. Deposits of this kind are common on the Queanbeyan-Canberra plain and are thought to have been laid down in cycles during the late Pleistocene and early Recent times from sand blown from river flats by strong west or north-west winds during periods of frigid climatic conditions.

On the river flat the material consists of loose gravel, sand, and silt - recently brought down from upstream or derived from erosion of the old in situ fluviatile deposits. Where the spur drops down sharply to the narrow river flat on the far east side of the site rock outcrop can be seen on the steep slope and also at its base. The rock is a bedded fine-grained argillaceous sandstone striking approximately north and with a dip of about 70° to the east, and would belong to the Pittman Formation - sediments of Ordovician age which run through the Queanbeyan area (Henderson & Strusz, 1971).

3. METHOD AND EQUIPMENT

The seismic refraction method (Dobrin, 1952) was used to obtain depth information on the survey area; the equipment employed was standard equipment used by BMR for surveys of this type, and consisted of a 24-channel SIE seismograph and 20-Hz TIC geophones.

Seismic recording was done on Traverses 1 to 7 (shown in Plate 1). Traverses were located on representative parts of the site; in addition the sites selected for the geophones were as flat as possible to allow easier and more accurate interpretation of results.

Spreads were laid with either a 2 or 3-metre geophone spacing, thus giving spread (or traverse, in this case) lengths of 46 and 69 metres respectively. For the energy source, small charges of gelignite were exploded with instantaneous electric detonators on the surface or buried within about 60 cm of the surface. For each spread shots were fired at the centre and at, 1 metre and about 50 metres beyond each end.

Depths of the refracting layers were calculated using intercept times from the time-distance plots and a modified 'reciprocal method' (Hawkins, 1961).

4. SEISMIC RESULTS

The seismic cross-sections of Traverses 1 and 2, Traverses 3 and 4, and Traverses 5, 6, and 7 are shown in Plate 1, Plate 2, and Plate 3 respectively.

The nature of the surface material along each traverse is tabled below and serves as an aid in the interpretation of the seismic layers.

Traverse No.

1	slightly cemented river sand and gravel (coarse), silty at west end
2	weakly cemented silt, sand, and gravel
3	slightly cemented river sand and gravel (coarse)
4	weakly cemented silt, sand, and gravel
5	silt
6	loose river gravel (up to cobble size) at east end, to medium-grained dry sand at west end
7	soil, fine sand, silt.

From the surface geology in the area and the results of a sand investigation (Gardner, 1966) the seismic interpretation is as follows:

Seismic velocity (m/s)	Material
310	Soil, loose sand, or gravel (dry)
440	Weakly bonded silty gravel
760 - 1210	Cemented sand and gravel, ancient dune sand (fine)
1500	Water saturated sand or gravel
1750 - 2100	Moderately to highly weathered sandstone
3000 - 3600	Slightly weathered sandstone.
3600 - 4300	Fresh sandstone.

The results indicate a large thickness (up to 16 metres) of deposit on the elevated central and central north area of the site.

The seismic velocity of the weathered bedrock layer on Traverses 1, 3, 5, and 6 could not be accurately determined from the time-distance plots owing to the presence of the 1500-m/s water-saturated alluvium, which has a velocity lower than but close to that of the weathered bedrock. A value of 2000 m/s was adopted, which is also the velocity expected from consideration of velocities recorded on Traverse 7, the west end of Traverse 2, and the southwest end of Traverse 4. The small uncertainty in the velocity has the effect of introducing some error into determination of the bottom of the water-saturated alluvium.

For sand and gravel material above the water-table the quantity estimated to be present on the site is 260,000 cubic metres; considering material below the water-table as well, the estimate becomes less precise and a value of 400,000 cubic metres is obtained.

5. CONCLUSION

On the basis of the seismic refraction results the quantity of commercial sand and gravel on the survey area is estimated to be 400,000 cubic metres, most of the material being concentrated in the central and central north part of the area.

6. REFERENCES

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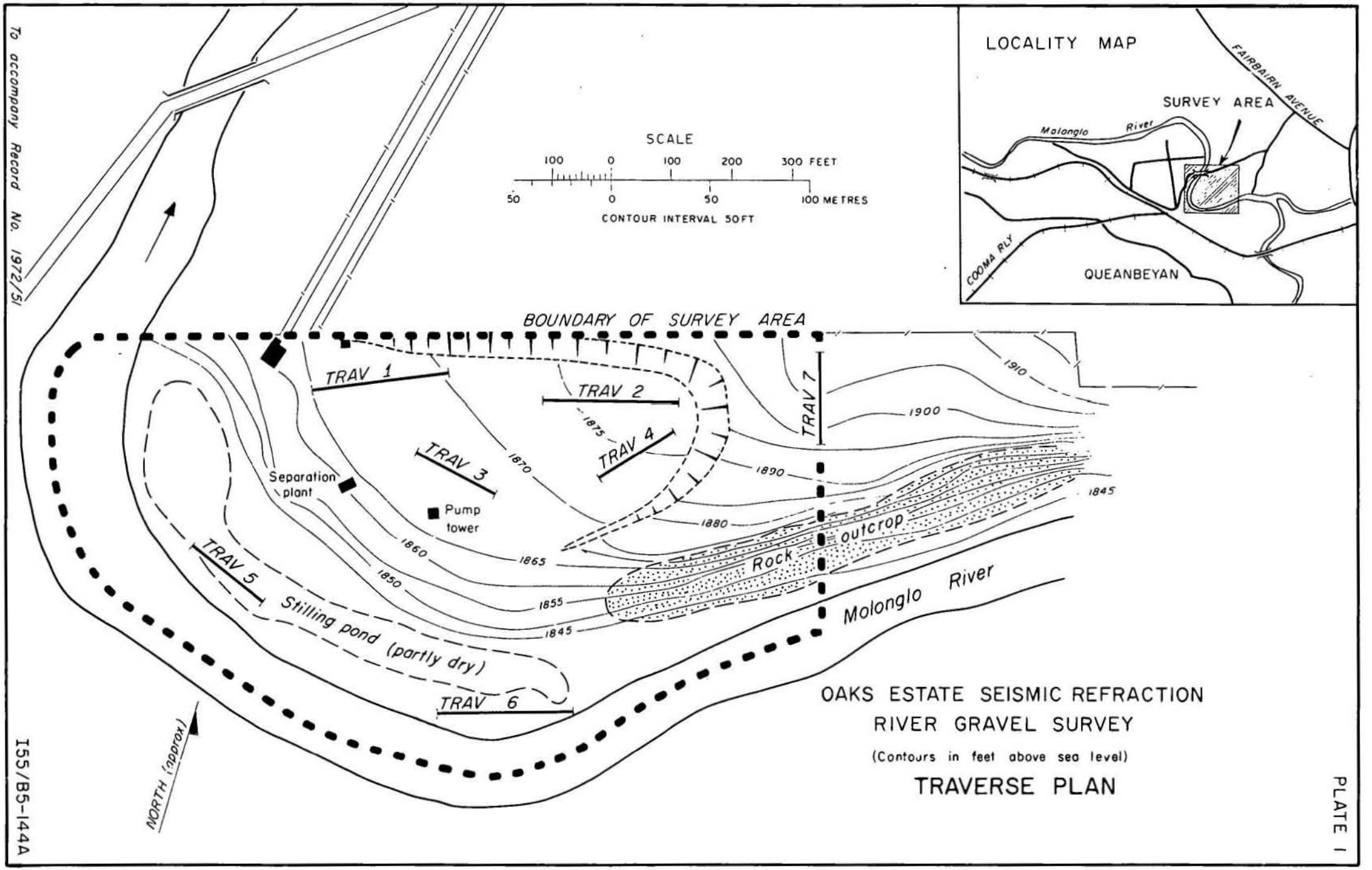
To accompany Record No. 1972/51



OAKS ESTATE SEISMIC REFRACTION RIVER GRAVEL SURVEY

(Contours in feet above sea level)

TRAVERSE PLAN

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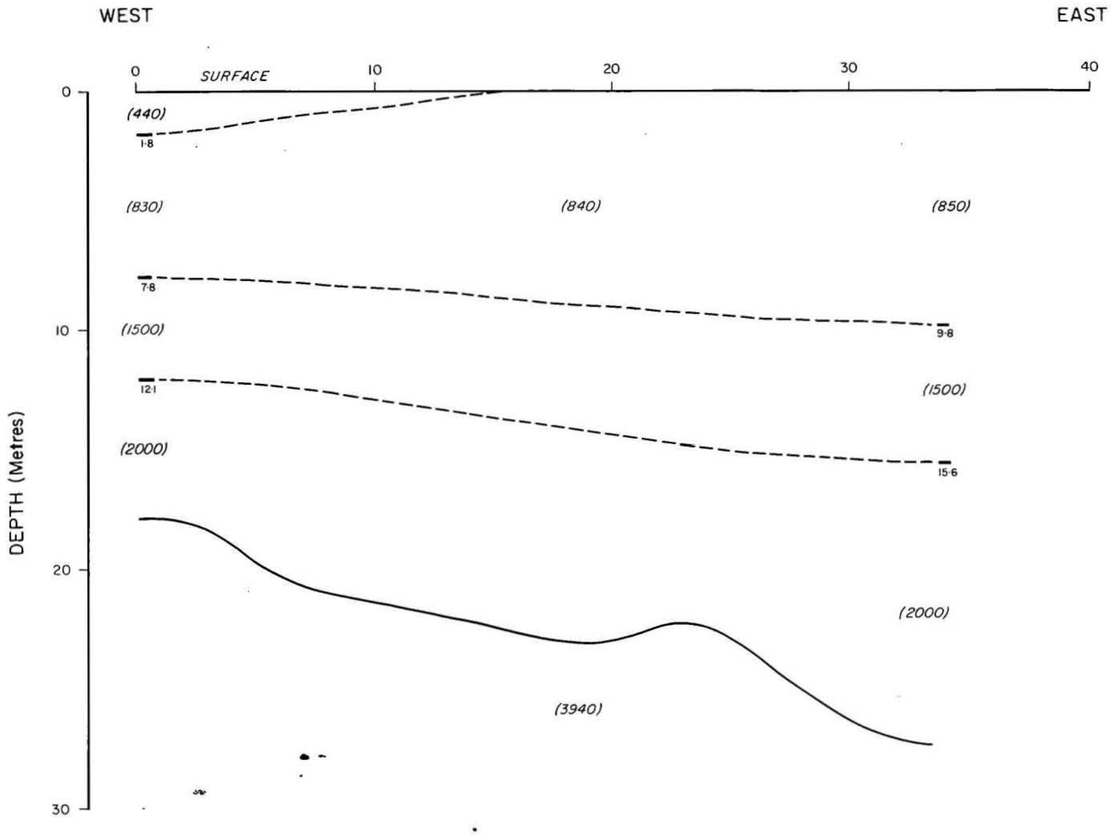
PLATE 1

TRAVERSE 1



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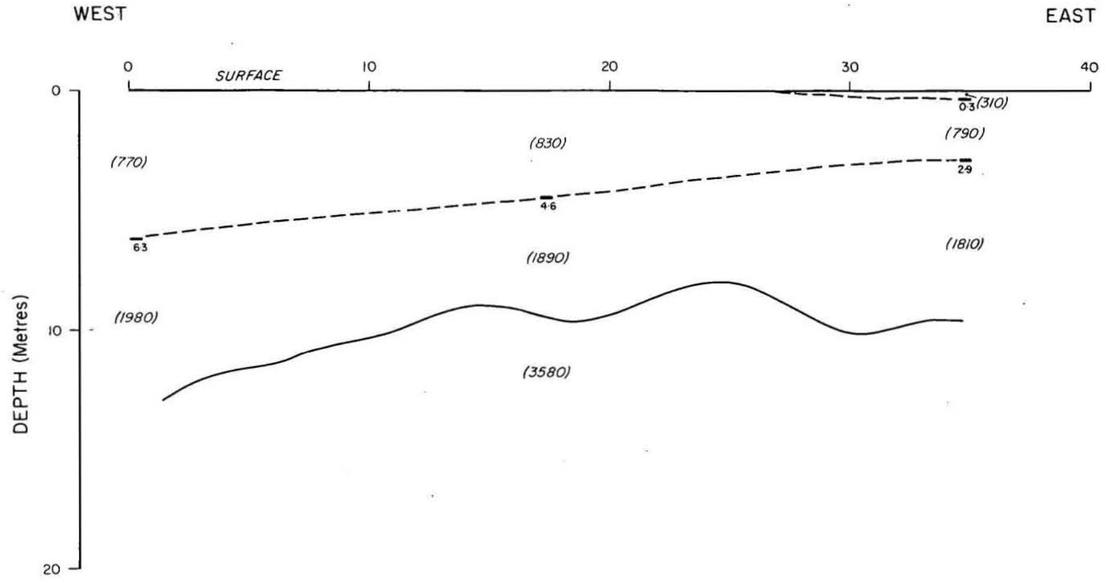

LEGEND

- Interpolated boundary
- 10·6 Depth to refractor (metres)
- (3000) Seismic velocity in formation (metres/second)

TRAVERSE 1 AND 2

SEISMIC PROFILES

To accompany Record No. 1972/51

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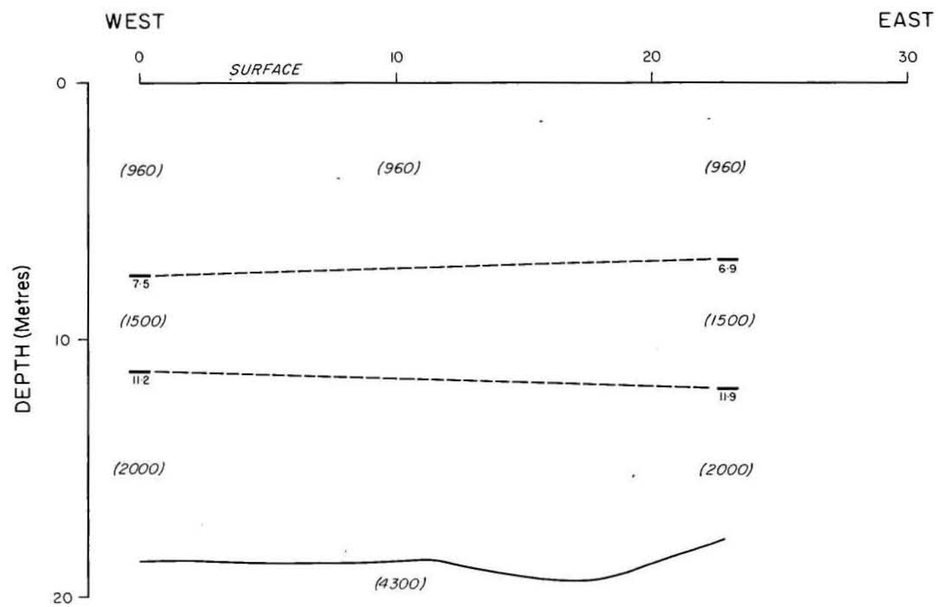
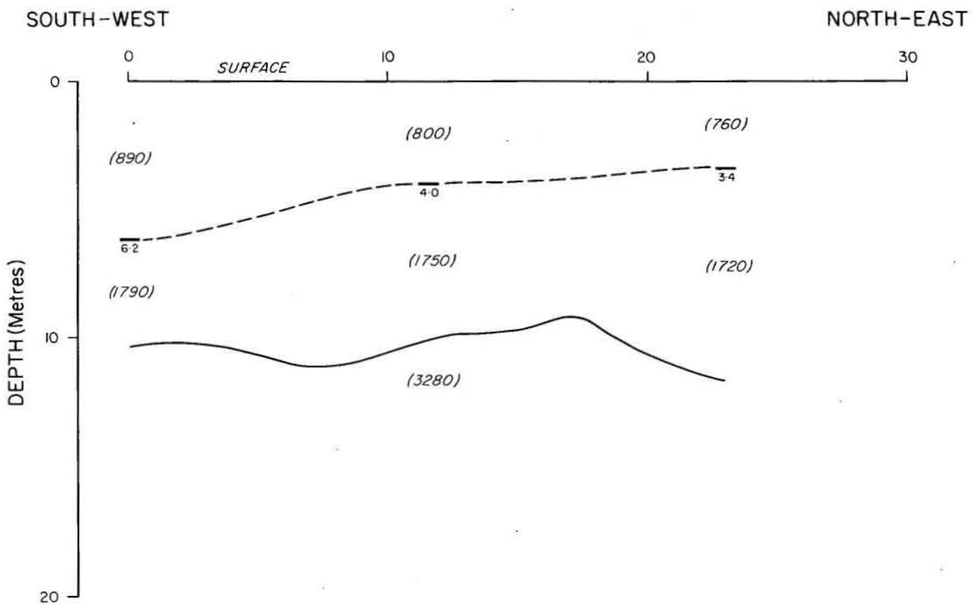
TRAVERSE 3



TRAVERSE 4



LEGEND

10·6	Depth to refractor (metres)
–––––	Interpolated boundary
(3000)	Seismic velocity in formation (metres/second)

TRAVERSE 3 AND 4

SEISMIC PROFILES

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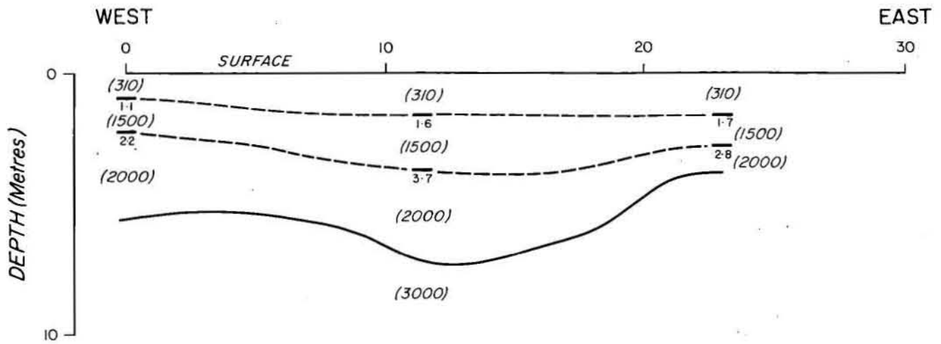
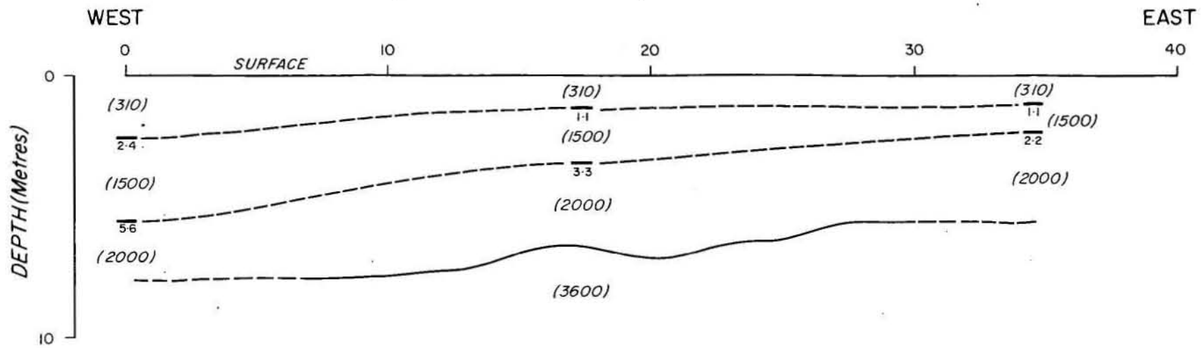
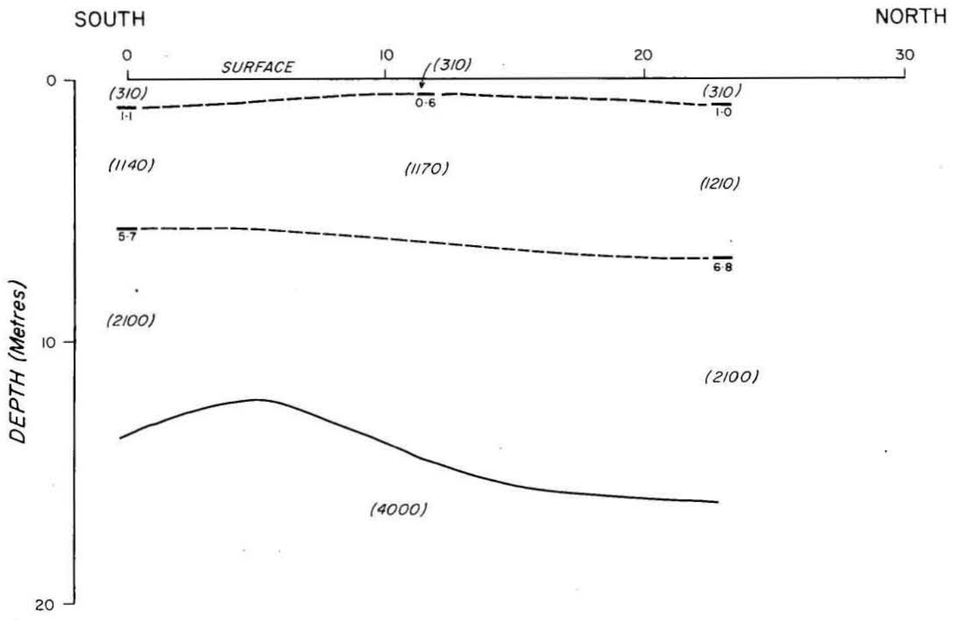
TRAVERSE 5



TRAVERSE 6



TRAVERSE 7



LEGEND

10·6	Depth to refractor (metres)
– – – –	Interpolated boundary
(3000)	Seismic velocity in formation (metres/second)

TRAVERSE 5, 6, AND 7

SEISMIC PROFILES

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