3929

A GEOPHYSICAL REPORT ON
A SEISMIC REFRACTION SURVEY
CRANBROOK AREA OF B.C.
- for -
RIO ALTO EXPLORATION LTD.
- by -
T.R.B. Dundas, M.Sc., D.I.C.
J. E. Wyder, Ph.D., P.Eng.

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REPORT ON

A SEISMIC REFRACTION SURVEY

IN THE

CRANBROOK AREA OF B.C.

FOR

RIO ALTO EXPLORATION LTD.

BY

KENTING EXPLORATION SERVICES LIMITED

CALGARY, ALBERTA

OCTOBER 1972

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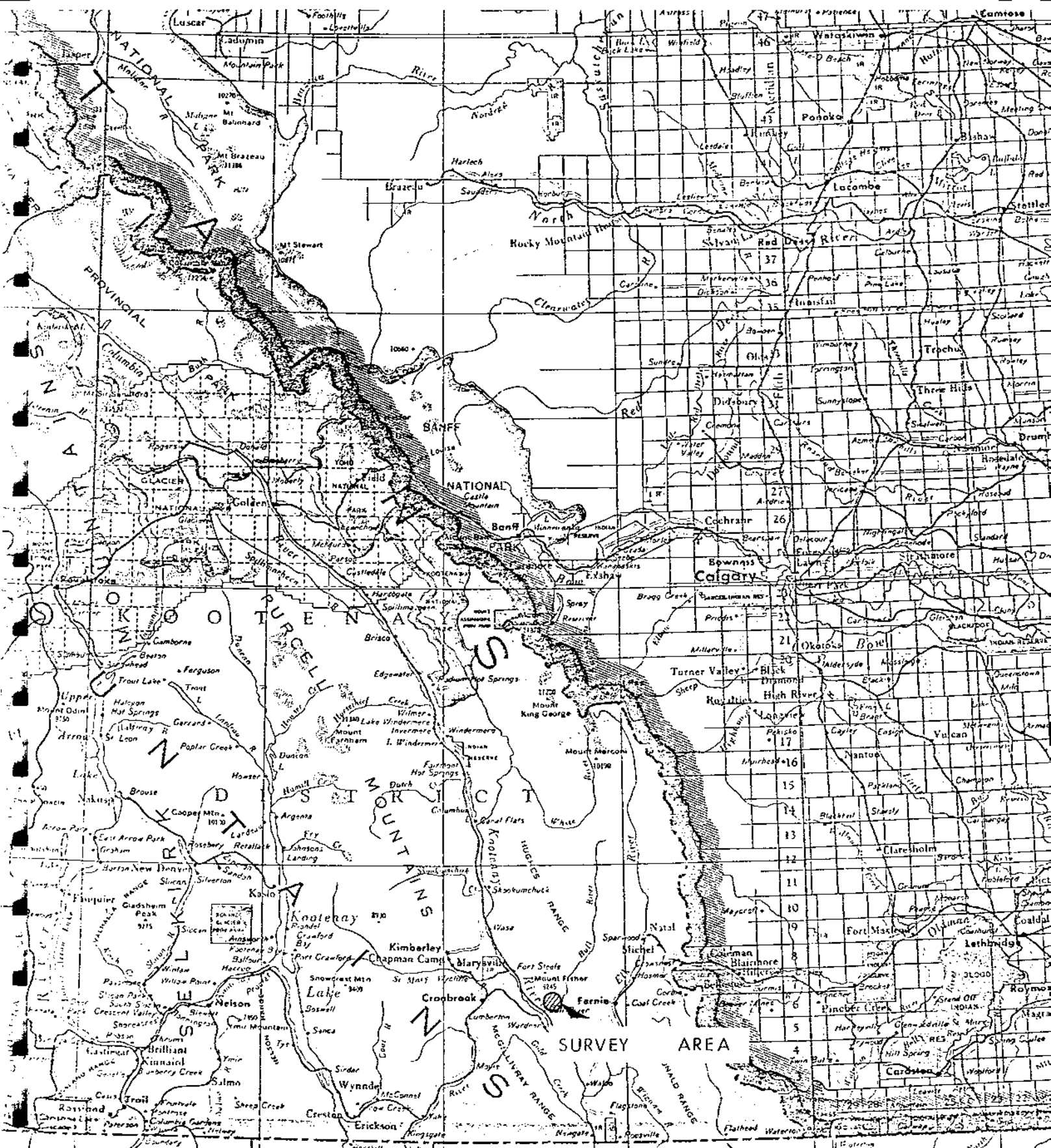

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LOCATION MAP
SCALE 1:2,000,000

INTRODUCTION

General

This report describes the results of a seismic refraction survey carried out in the Bull River Area near Cranbrook, B.C., by Kenting Earth Sciences, a Division of Kenting Exploration Services Limited for Rio Alto Exploration Ltd.

The field work was carried out in the period October 14th to 17th, 1972, by a crew of four (4) men supervised by T.R.B. Dundas, senior geophysicist, using the RS-4, 12 channel seismograph.

A total of ten (10) complete set-ups, each 550 feet long, were surveyed.

Claim Group

The claim group covered by the work consists of:-

Rio Alto No's. 6, 8, 10-19;
No's. 207, 209, 211, 213, 215-224.

Location and Access

The claims are approximately thirty (30) miles east by road from Cranbrook. The property can be reached by road from the Main No. 3 Highway along the east bank of the Kootenay River and then by gravel road along the north side of the Bull River (Fig. 1).

Purpose of the Survey

The purpose of the survey was to define the depth to bedrock, and locate the position of the major fault which separates the Devonian rocks on the south side of the Bull River from the Precambrian (Purcell) rocks on the north side.

OPERATING PRINCIPLES

According to the principles of elasticity, when a semi-infinite elastic medium such as the layered earth is impacted, body and surface waves are generated and propagated within and along the interfaces of layers. At each point of an advancing wave front, new waves originate and emerge into the overlying lower velocity layer and will travel on a straight line through any medium of constant velocity, but will be refracted when passing across a boundary between two media of different velocities (Fig. 2).

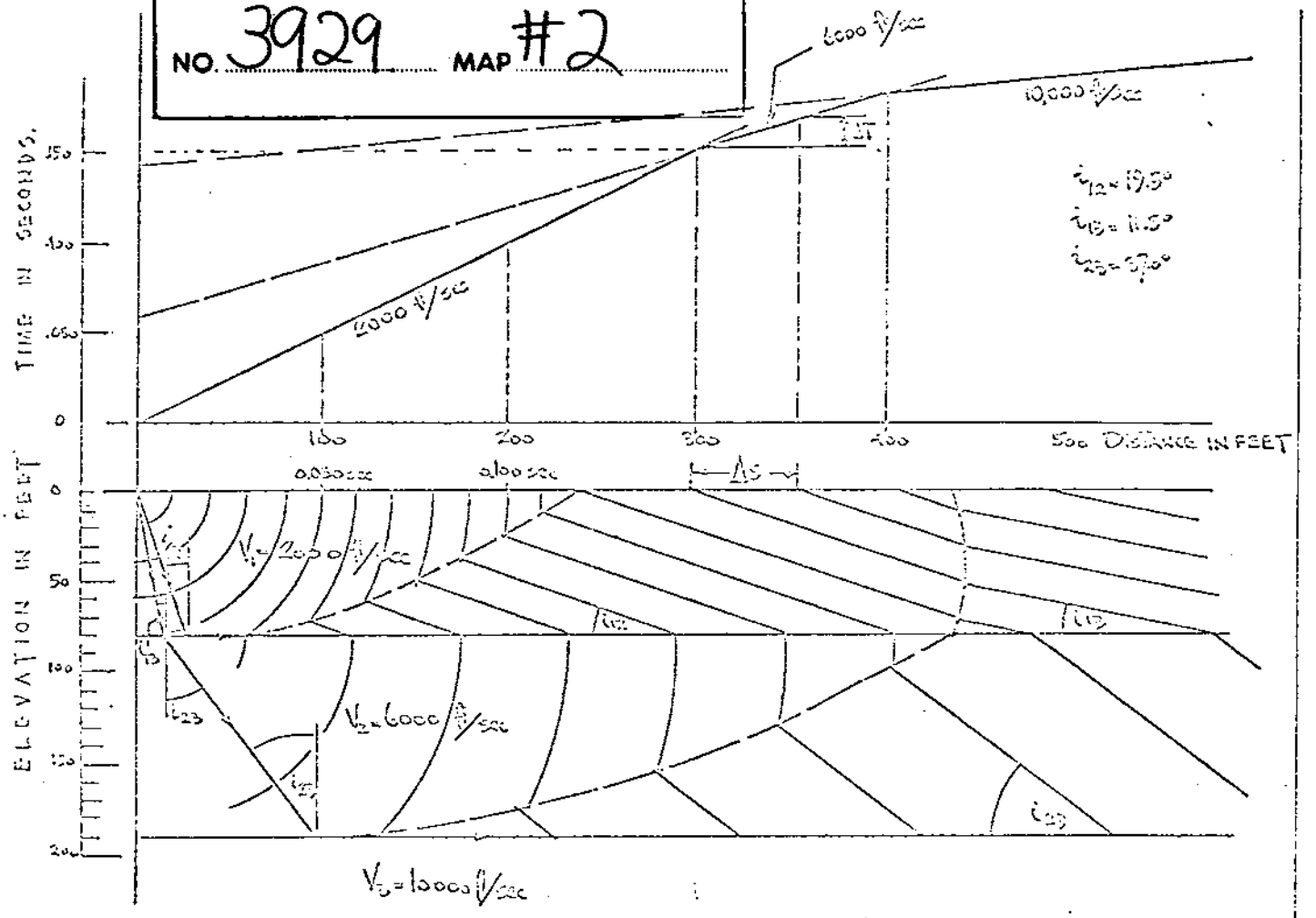


FIG. 2. WAVEFRONTS ACCORDING TO FIRST ARRIVAL DATA.

The generated shock waves are also propagated downward into the greater velocity layer. New waves emerge into the overlying lower velocity medium reaching the detectors placed on the ground surface.

By measuring the distance from energy source to each geophone position and recording the travel-time of elastic waves between the instant of explosion and the wave arrival to each geophone, the characteristic seismic velocities may be determined and the depths of refracting horizons computed.

In the case of horizontal seismic interfaces, the slopes of the time-distance plots are equal to the inverse of the seismic velocities of the respective layers. Thus, from a time-distance curve, a subsurface model may be established.

In order to obtain a refracted headwave, each successive layer must be thicker than the one above it and must have a minimum thickness which is related to the spectrum of the seismic waves observed.

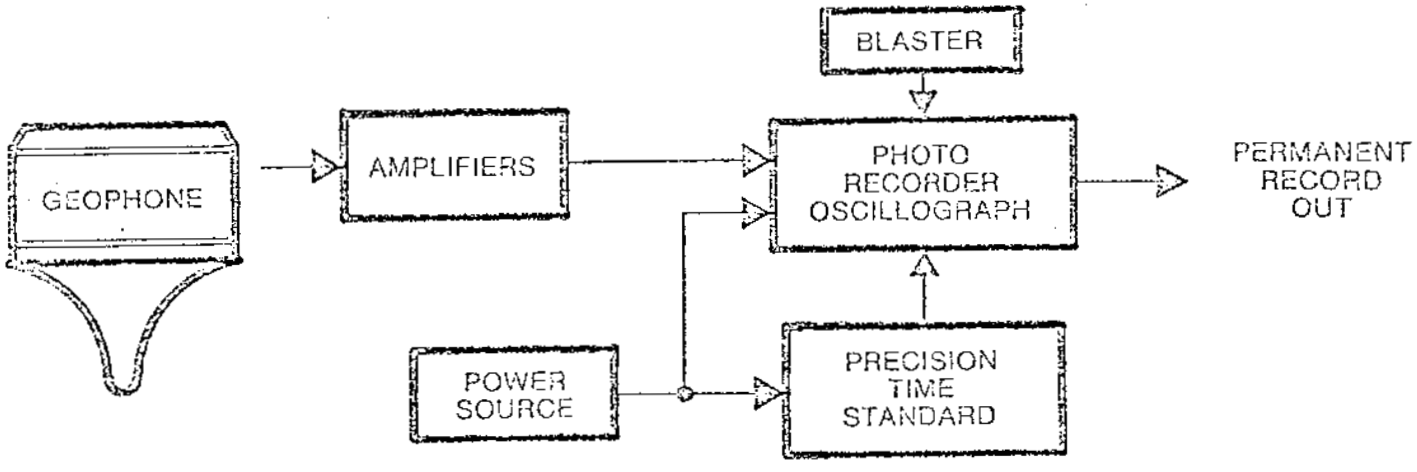
A significant elastic (velocity) contrast must exist between the layers to obtain refractions at all, and each layer must have a successively higher velocity than the one above it.

EQUIPMENT

The RS-4 12 channel system (Dresser, SIE) is a portable seismic recorder unit powered by a 12 volt battery. As a result of the explosion, the geophones generate a small electric current in response to the ground vibration. The complete solid state amplifier units increase the signal from each geophone and through the galvanometers the full signal waveform is recorded on a "dry-write" paper, developed daylight without the use of chemicals. A sample record is shown in Fig. 3.

A precision unit generates vertical timing lines of 10 milliseconds interval on the record so the first arrivals can be measured from the instant of impacting the ground surface.

The system consists of units shown on the block diagram below:



THE RS-4 SYSTEM DIAGRAM AND DESCRIPTION

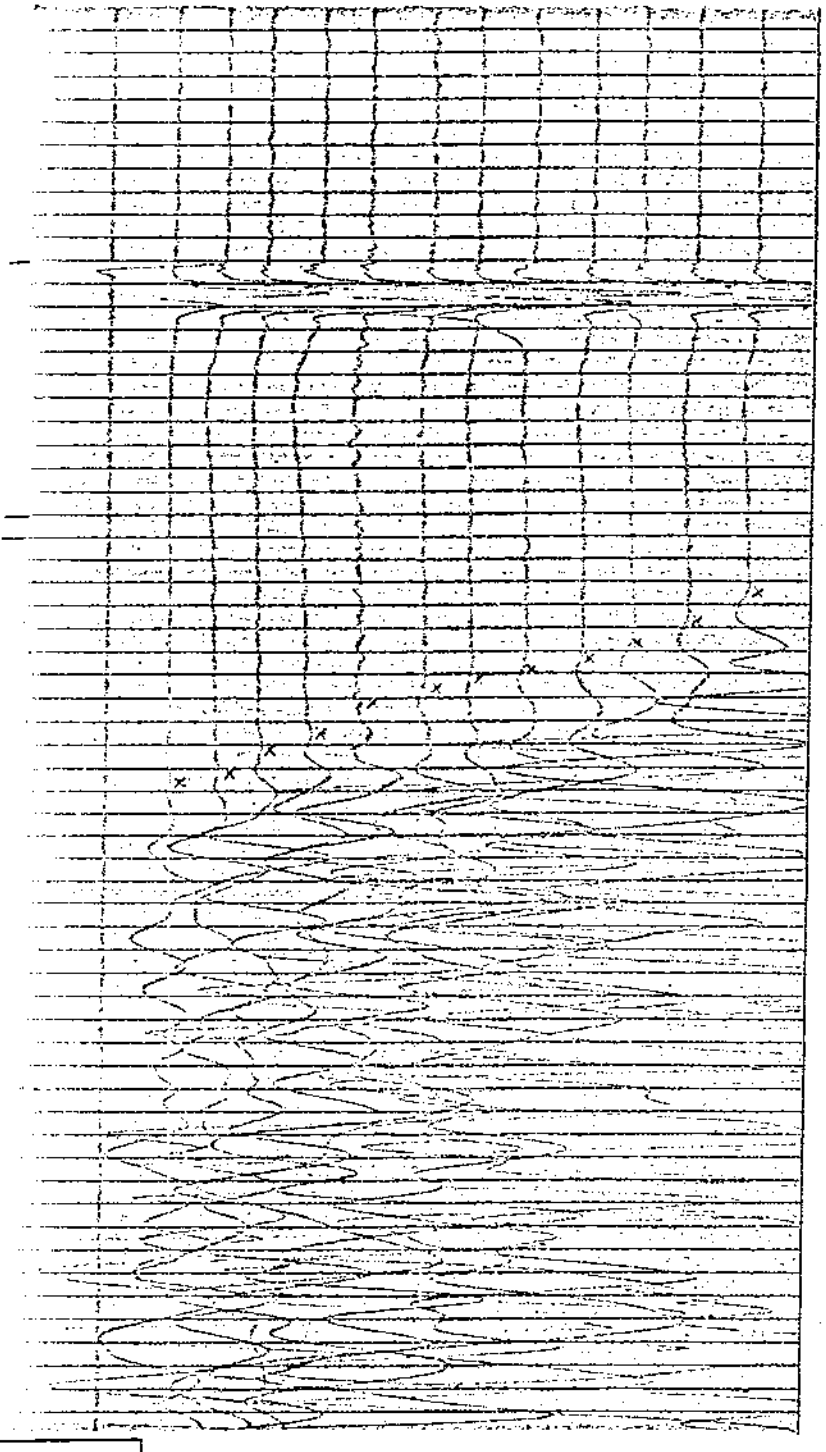


Fig. 3 – Sample Record

FIELD PROCEDURE

The RS-4 was used with a 550 foot long cable - i.e. geophone separation of 50 feet.

The majority of the 10 complete set-ups were shot from four (4) positions:- one (1) shot at either end of the geophone array and shots at a distance of one spread length from either end of the geophone array. In some cases, the distant shots could not be made due to access problems.

Explosive charges were used as the source and varied from 1 to 3 sticks for the near shots and up to 25 sticks for the distant shots. The charges were buried as deep as possible to get the maximum energy into the ground.

The survey lines were chained and picketed every 50 feet. Elevation differences along the profiles were measured with a transit where applicable. The lines locations and directions were mapped using a detailed survey map supplied by Rio Alto Exploration Ltd.

GEOLOGY

The general geology of the area is described in G.S.C. Paper 58-10, Fernie Map Area, West Half, British Columbia, by G. B. Leech, 1958.

A major fault, which is part of the east side of the Rocky Mountain Trench system, crosses the property in a northwest direction and crosses the Bull River. The exact location is not known due to the thick river sediments which fill the Bull River valley. The Devonian rocks on the southwest are downthrown against the Precambrian formation.

Locally the Precambrian consists mainly of argillites with a low dip to the north. These have been cross fractured and copper mineralization which is concentrated in the fracture zones is at present being mined on the property directly north of the claim group.

The Devonian consists of massive limestones with some shaly bands.

INTERPRETATION

The results of the survey show considerable variations in the velocity contrast both laterally and with depth. This is caused by the variety of the river sediments which contribute to the very thick sequence, possibly up to 650 feet thick. Considerable lateral variations have been caused by different levels of the river at various times which have reworked the older sediments. These are expressed topographically as benches on each side of the present river.

The location of the lines surveyed is shown in Fig. 4 and the results are presented as profiles (Fig's. 5-10). The elevation differences of the profiles are given relatively to each other, with the elevation of the north end of Line 2 (where drill hole information indicates overburden depth of 350 feet) established as 0 elevation.

The velocities within the river sediments vary considerably but are generally less than 10,000 feet per second. Bedrock velocity is in the range of 20,000 to 22,000 feet per second. There is no apparent difference in the bedrock velocities expressed by the Precambrian and Devonian rocks which can be recognized.

The results from Lines 1 and 2 show considerable difference in the depth to bedrock on either sides of the river. The bedrock on the north side has an apparent steep dip to the south, and the thickness of the overburden increases to a maximum of approximately 650 feet at the south end of Line 2. The bedrock on the south side of the river in contrast is approximately 200 to 220 feet beneath the surface.

A break occurs in the bedrock between Stations 9 and 10 on Line 2 with

the displacement down to the south. The amount of the displacement could not be estimated and this feature may be caused by a parallel fault to the major displacement in the area which is probably located closer to the river.

Lines 3 and 5 were surveyed at approximately the same elevation of the river. These failed to locate bedrock and indicate that there is a considerable thickness of sediments beneath the river at these locations.

Lines 4 and 6 form an almost continuous profile except that there is an elevation difference of approximately 150 feet between the two levels. The bedrock elevation determined on both of these lines would place the bedrock at approximately the same elevation, 420 feet. The bedrock surface is probably more complicated as there are indications that the bedrock, as determined on Line 6, is dipping to the north.

Line 7 shows bedrock at the south end but the continuation to the north has to be terminated by a break (fault?), but the location could not be determined exactly from the results. The bedrock has an apparent steep dip to the south.

The probable location of the faulting in the area is indicated on the plan map of the survey lines (Fig. 4). The major faulting in the area is located close to the present river course.

CONCLUSIONS AND RECOMMENDATIONS

The results of the survey show considerable differences in the overburden thickness on either side of the Bull River. The bedrock, where located on the north side of the river, shows a dip to the south in contrast to that on the south side which is relatively flat.

The bedrock velocities determined for the Precambrian and Devonian rocks were similar and no separation of the rock types could be made on this basis.

The accuracy of the refraction method has been limited by the topographic relief and lateral changes in the sediment velocity. It may be possible to obtain more accurate results in future work by using the reflection method in combination with the refraction work.

Respectfully submitted,

KENTING EARTH SCIENCES
A Division of Kenting Exploration Services Limited

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Senior Geophysicist

J.E. Wyder, Ph.D., P.Eng.
Chief Geophysicist.

ROAD

MINOR FAULT?

LINE 2

LINE 5

RIVER

BULL

LINE 7

10,000 N

LINE 3

LINE 6

LINE 4

LINE 1

MAIN FAULT?

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3929 MAP #4

LINES LOCATION MAP
1" = 400'

14,000 E

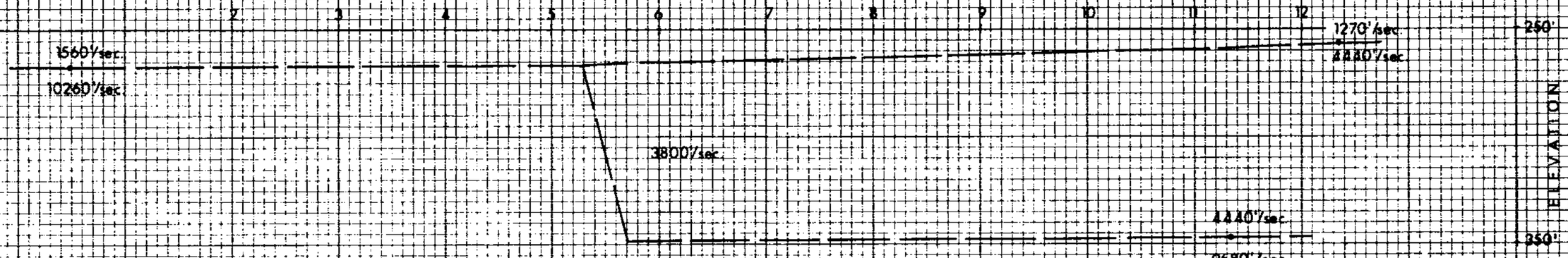
16,000 E

18,000 E

Fig. No 4

N

S



RIO ALTO EXPLORATION LTD.

SEISMIC SURVEY

SEISMIC LINE 3

CRANBROOK, BRITISH COLUMBIA

KENTING EXPLORATION SERVICES LIMITED
Calgary EARTH SCIENCES DIVISION Alberta

To accompany report by: T. R. B. DUNDAS M.Sc. D.I.C.	Scale: 1" = 50'	Date: October 1972
	Job No: 1369	Fig. No: 6

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RIO ALTO EXPLORATION LTD.

SEISMIC SURVEY

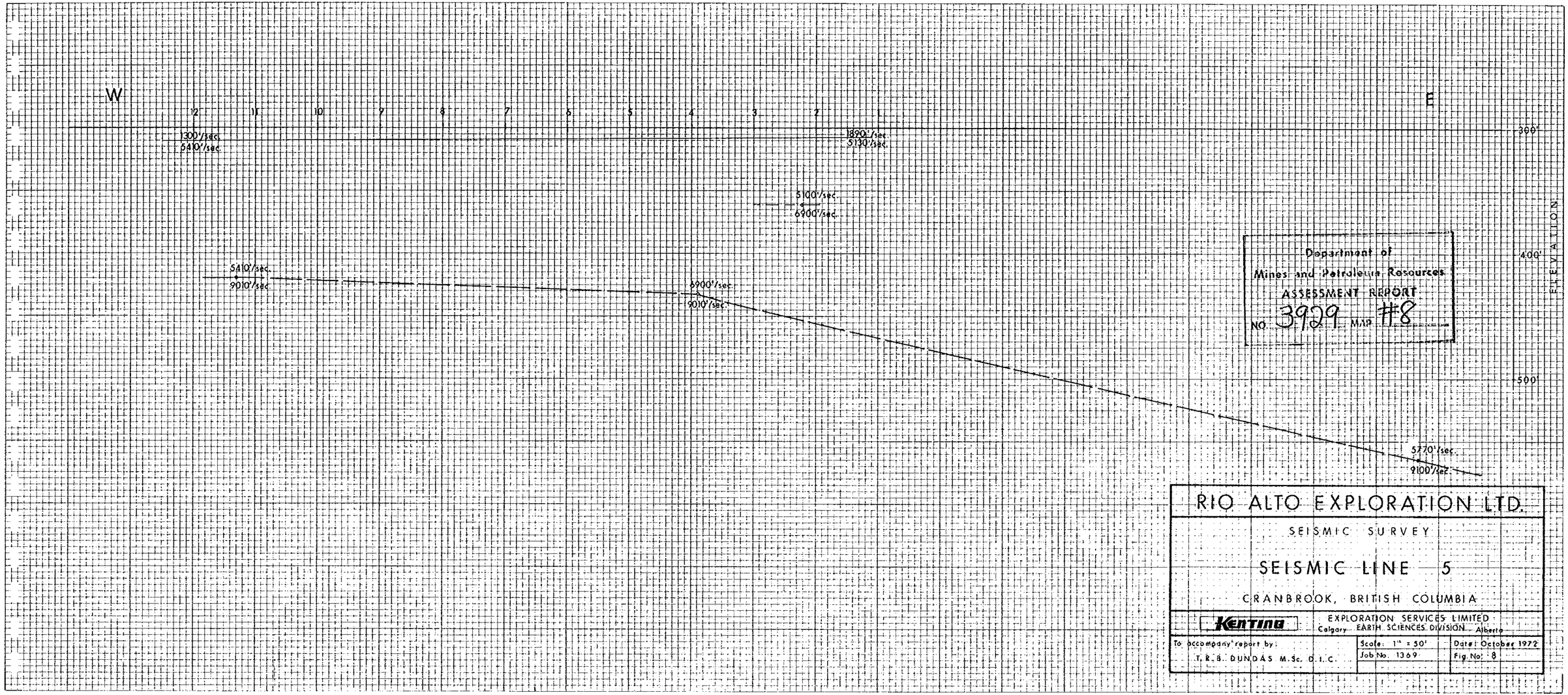
SEISMIC LINE 1,2

CRANBROOK, BRITISH COLUMBIA

KENTING EXPLORATION SERVICES LIMITED
Calgary EARTH SCIENCES DIVISION Alberta

To accompany report by:	Scale: 1" = 50'	Date: October 1972
T.R.B. DUNDAS M.Sc. D.I.C.	Job No: 1369	Fig. No: 5

10 X 10 TO THE INCH



RIO ALTO EXPLORATION LTD.

SEISMIC SURVEY

SEISMIC LINE 5

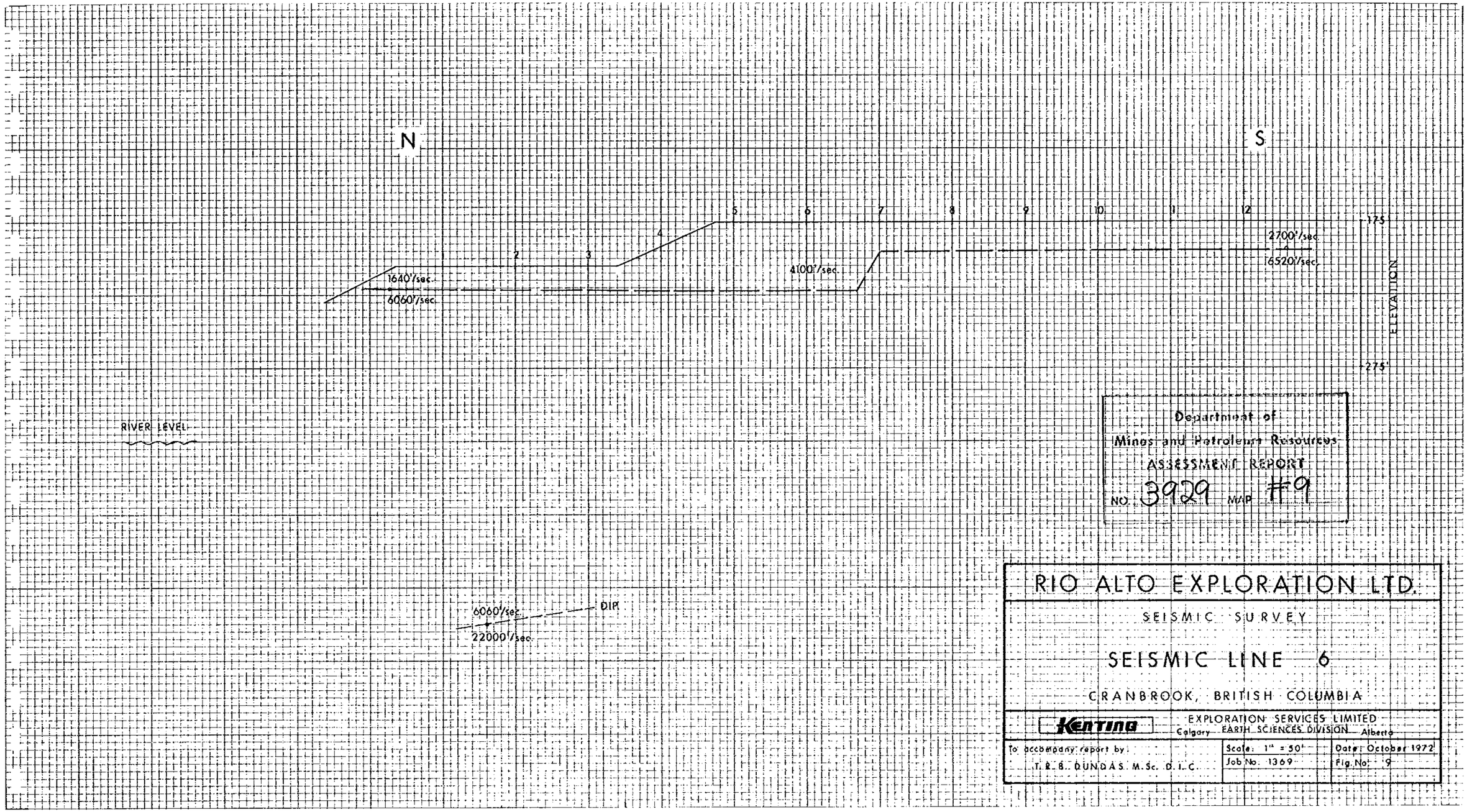
CRANBROOK, BRITISH COLUMBIA

KENTING EXPLORATION SERVICES LIMITED
Calgary EARTH SCIENCES DIVISION Alberta

To accompany report by:
T. R. B. DUNDAS M.Sc. D.I.C.

Scale: 1" = 50'
Job No. 1369

Date: October 1972
Fig. No: 8



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RIO ALTO EXPLORATION LTD.

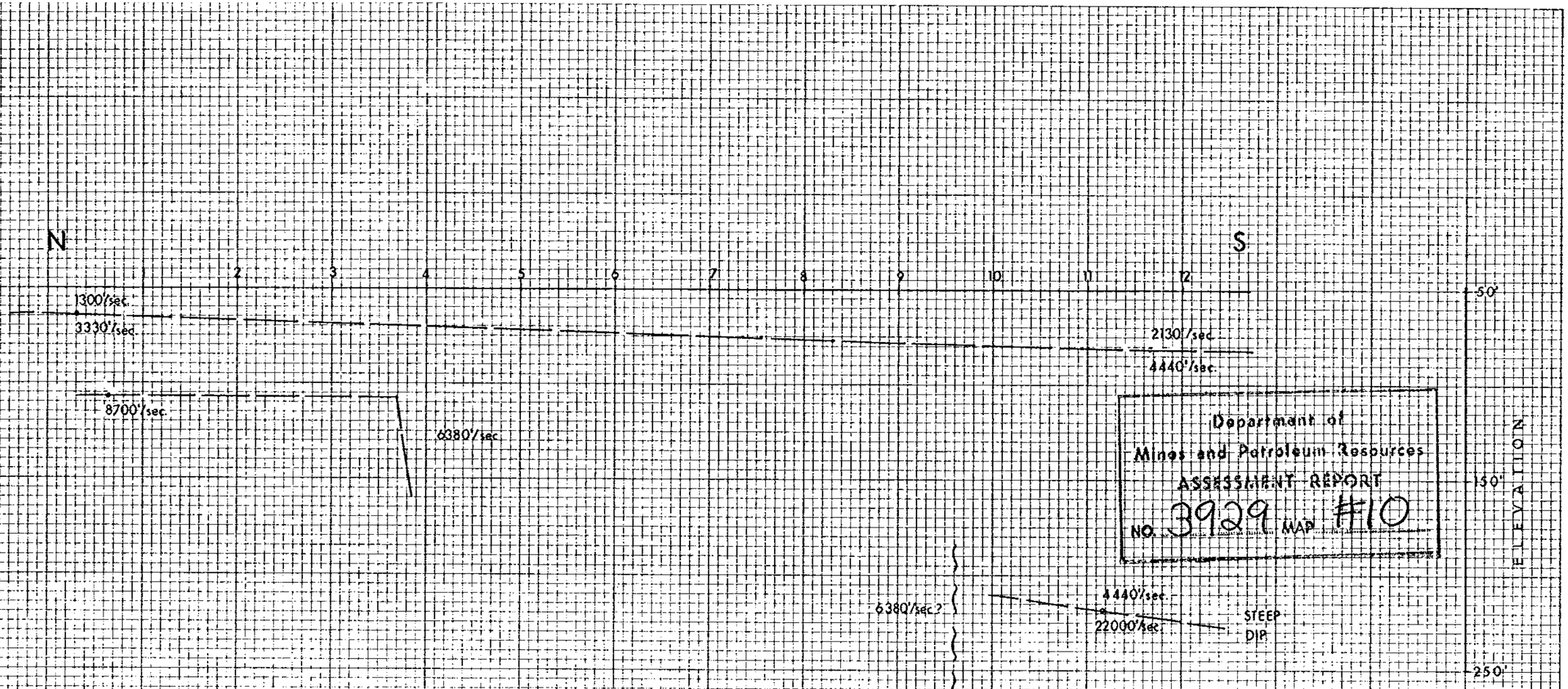
SEISMIC SURVEY

SEISMIC LINE 6

CRANBROOK, BRITISH COLUMBIA

KENTING EXPLORATION SERVICES LIMITED
Calgary EARTH SCIENCES DIVISION Alberta

To accompany report by: T. R. B. DUNDAS M.Sc. D.I.C.	Scale: 1" = 50'	Date: October 1972
	Job No. 1369	Fig. No. 9



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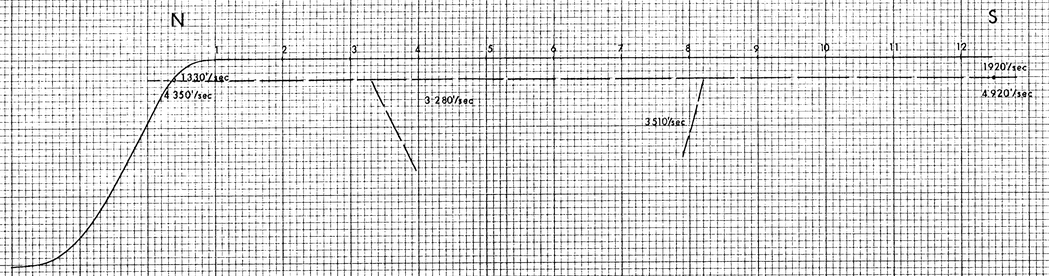
SEISMIC SURVEY

SEISMIC LINE 7

CRANBROOK, BRITISH COLUMBIA

KENTING EXPLORATION SERVICES LIMITED
Calgary EARTH SCIENCES DIVISION Alberta

To accompany report by: T. R. B. DUNDAS M.Sc. D.I.C.	Scale: 1" = 50'	Date: October 1972
	Job No: 1369	Fig. No: 10



ELEVATION

0'

100'

5080'/sec

?

22000'/sec

RIO ALTO EXPLORATION LTD.

SEISMIC SURVEY

SEISMIC LINE 4

CRANBROOK, BRITISH COLUMBIA

KENTING EXPLORATION SERVICES LIMITED
Calgary EARTH SCIENCES DIVISION Alberta

To accompany report by: T. R. B. DUNDAS M.Sc. D.I.C.	Scale: 1" = 50'	Date: October 1972
	Job No: 1369	Fig. No. 7