

GEOPHYSICAL REPORT
on
PROSPECTING LEASE #4405

BASED ON
A SEISMIC SURVEY
CARRIED OUT FROM
March 1, 1980 to March 3, 1980

NTS 115 H/9W & 115 H/10E
Lat. $61^{\circ}32'N$; Long. $136^{\circ}28'W$

on behalf of

John M. Graham

by

DITA RUNKLE, M.Sc.
J.H. MONTGOMERY, P.Eng.

120010
~~090540~~

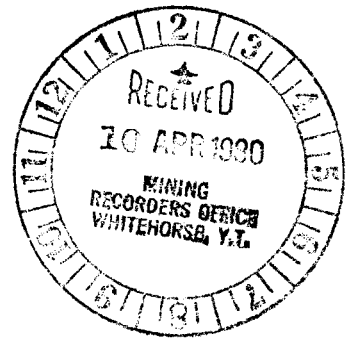
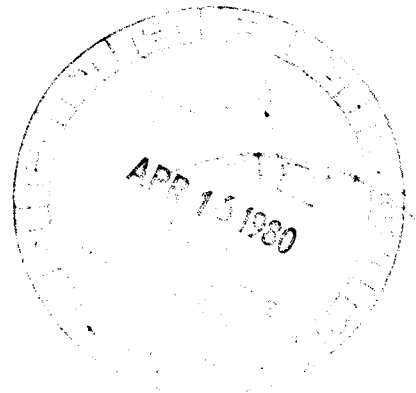


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1.0 SUMMARY AND CONCLUSIONS

John M. Graham of Whitehorse, Yukon Territory, holds title to a 5-mile prospecting lease on an unnamed tributary of Kirkland Creek, about 120 kilometers northwest of Whitehorse.

The creek cuts through basaltic and andesitic flow rocks of the Carmacks Volcanics, but is largely filled with gravel.

Surficial geology was mapped along the creek, and a preliminary seismic refraction survey was carried out to determine the depth of gravel to bedrock. Seismic velocities obtained in this survey were consistent with those obtained for similar materials elsewhere. Depths to bedrock ranged from .91 meters to 5.02 meters. Seismic data was scant, but the seismic refraction method proved to be a viable one for this type of exploration.

2.0 INTRODUCTION

This report is written on behalf of John Graham of Whitehorse, Yukon Territory. The report contains results and interpretation of seismic data and a map of the surficial geology along a 5 mile prospecting lease. The report is based on information supplied by Mr. Graham.

3.0 LOCATION AND ACCESS

The Kirkland Creek prospecting lease is located along an unnamed tributary that feeds Kirkland Creek from the West. The confluence of the two creeks is near co-ordinates $61^{\circ}32'N$; $136^{\circ}28'W$, and the lease continues for 5 miles to the southwest along the tributary creek. Elevation of the creek is about 3100 feet.

There are no roads to the property. Access is by helicopter from Whitehorse, a distance of approximately 120 kilometers.

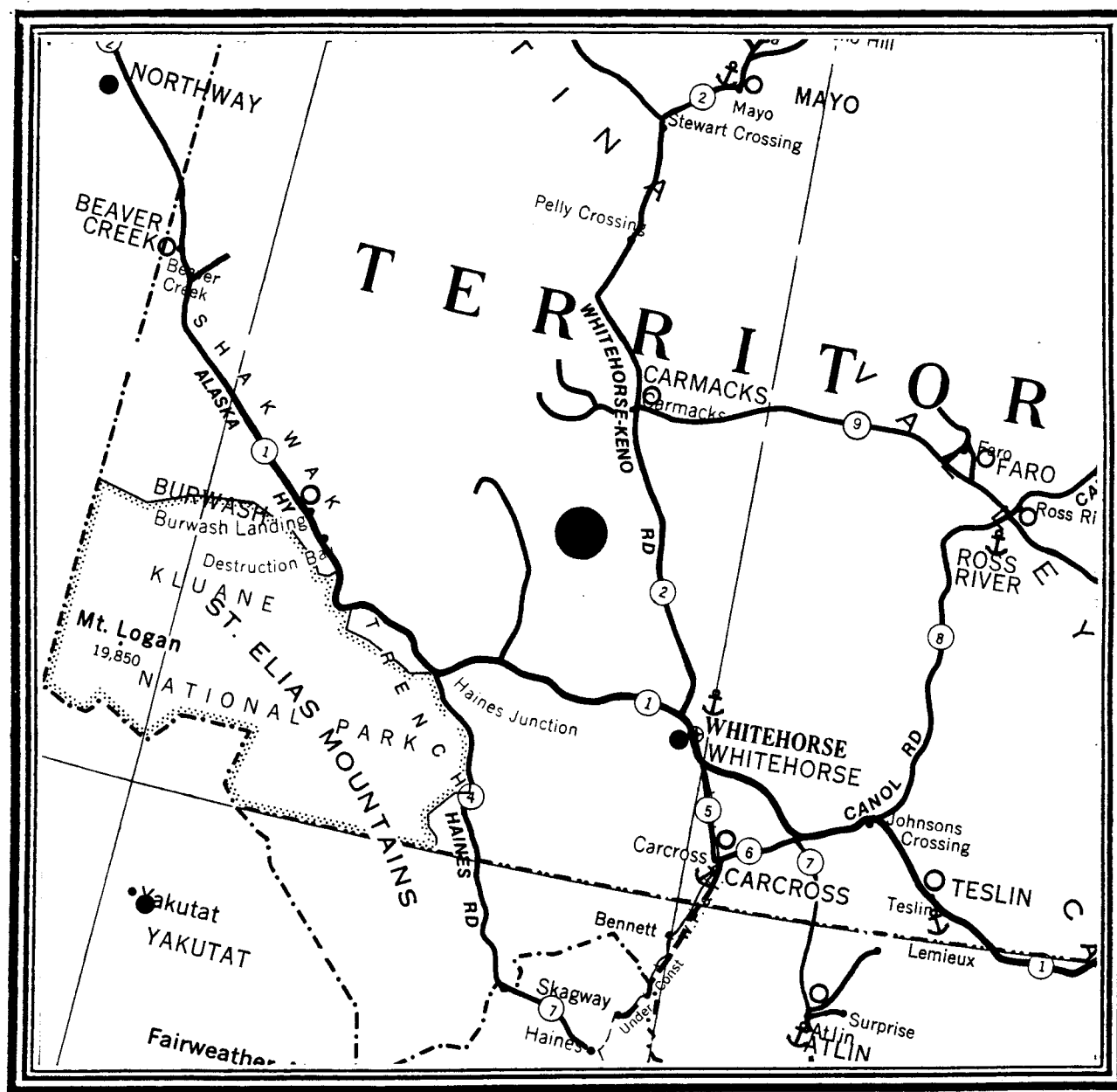


FIGURE 3-1

LOCATION MAP KIRKLAND CREEK PLACER LEASE



4.0 CLAIM INFORMATION

John Graham of Whitehorse, Yukon Territory, holds title to a 5-mile prospecting lease; #4405. The term of the lease is one year commencing April 21, 1979 and ending April 20, 1980. Figure 4-1 shows a map of the lease.

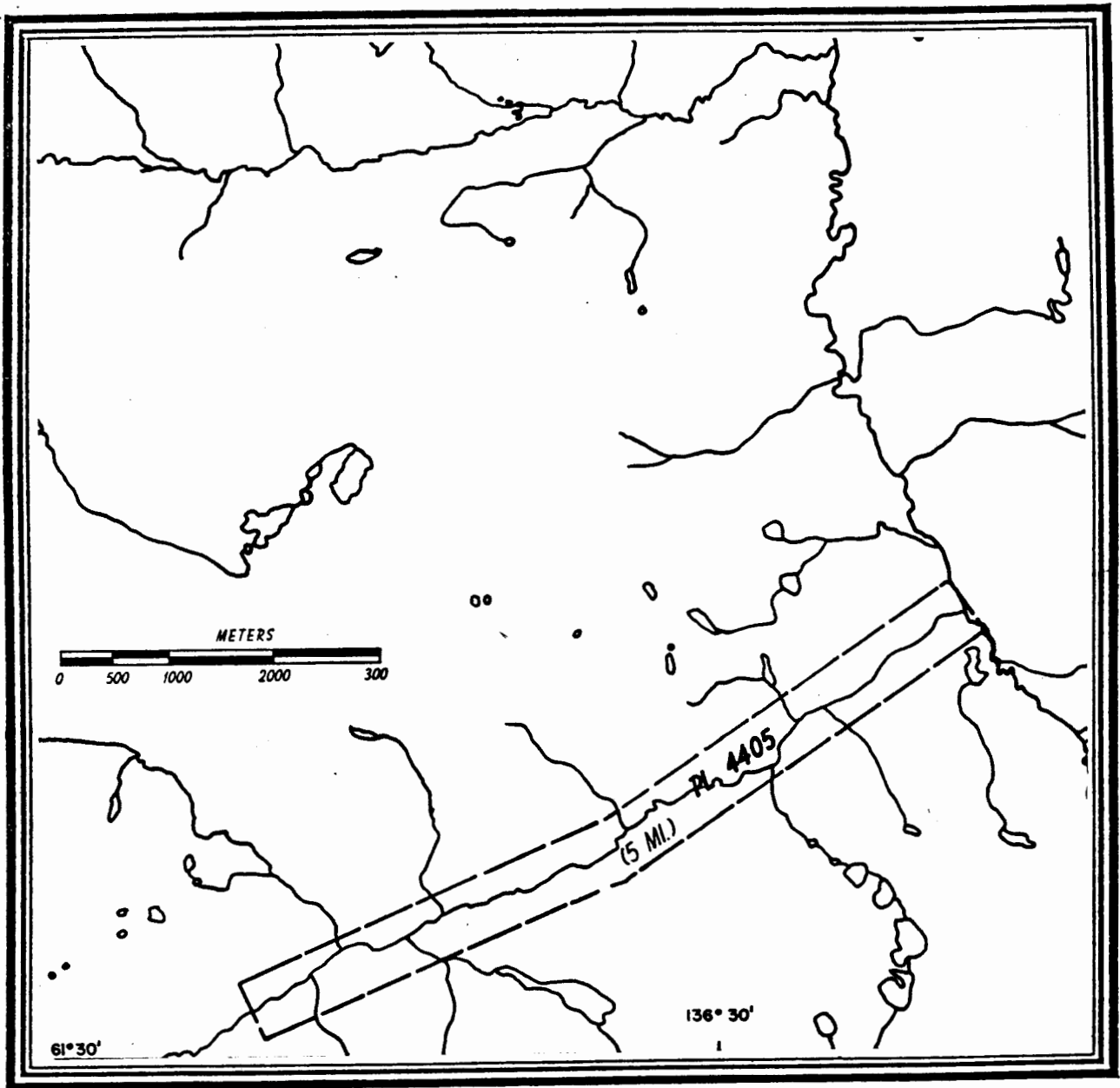


FIGURE 4-1

CLAIM LOCATION MAP

KIRKLAND CREEK PLACER LEASE



5.0 LOCAL GEOLOGY

A sketch map of the placer lease was prepared by D. Reinke, using chain and compass. (Figure 5-1). The creek flows through vesicular and amygdaloidal basaltic and andesitic flow rocks; minor acid volcanic rocks; and local pebble conglomerate, sandstone and shale of the Carmacks Volcanics. (Templeman-Kluit, 1972). The creek is largely filled with gravel. Figure 5-1 shows areas of clay, gravel, bedrock, and timber along the creek.

LEGEND



WORKABLE GRAVEL



VOLCANICS

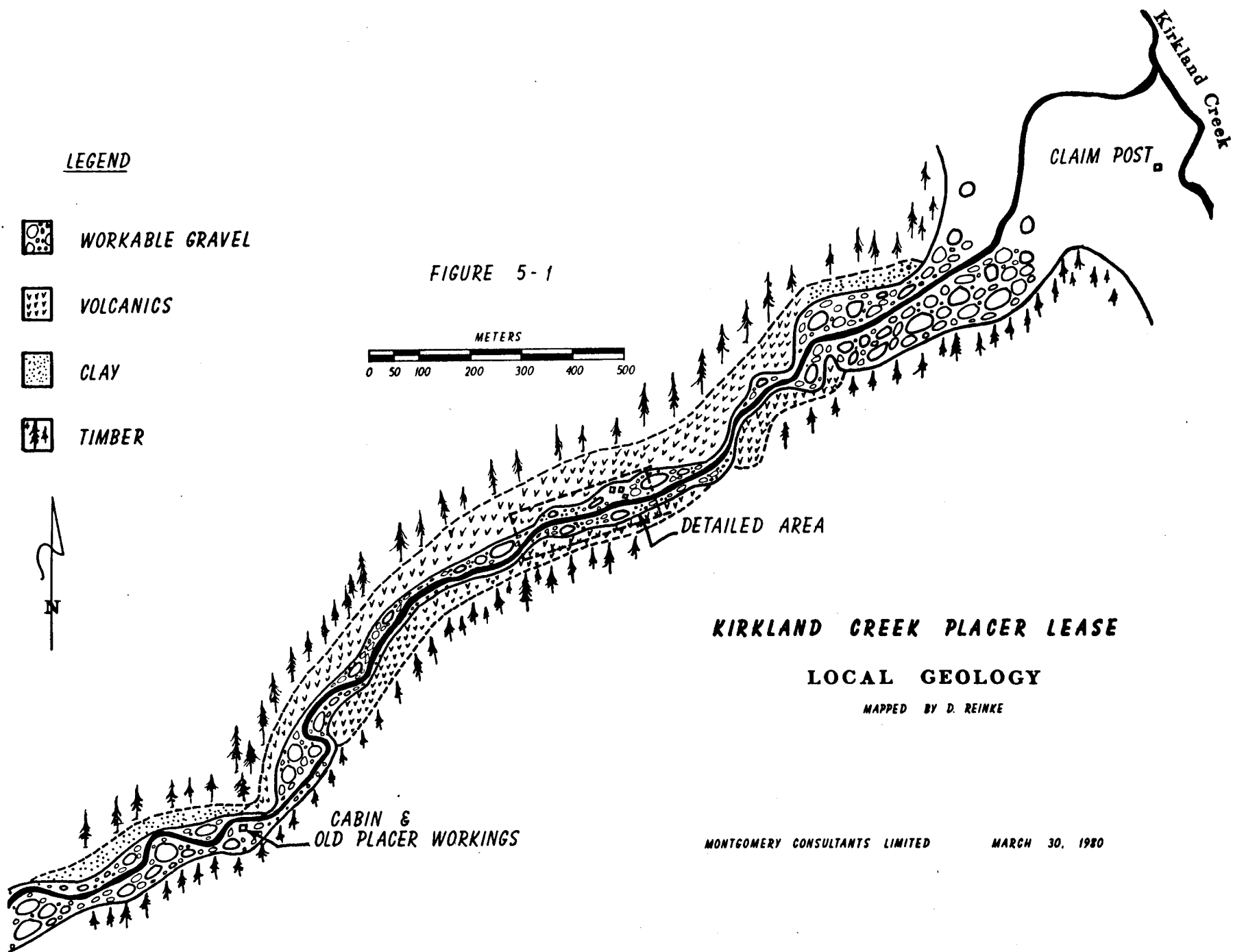


CLAY



TIMBER

FIGURE 5-1



KIRKLAND CREEK PLACER LEASE

LOCAL GEOLOGY

MAPPED BY D. REINKE

MONTGOMERY CONSULTANTS LIMITED

MARCH 30, 1980

6.0 SEISMIC SURVEY

A seismic refraction survey was performed along a 210 meter section of the property, in order to determine the depth of gravel to underlying bedrock. The seismic refraction method has been used extensively by oil companies to determine structure and thickness of subsurface layers, and has also been successful in determining depth of the soil horizon to bedrock.

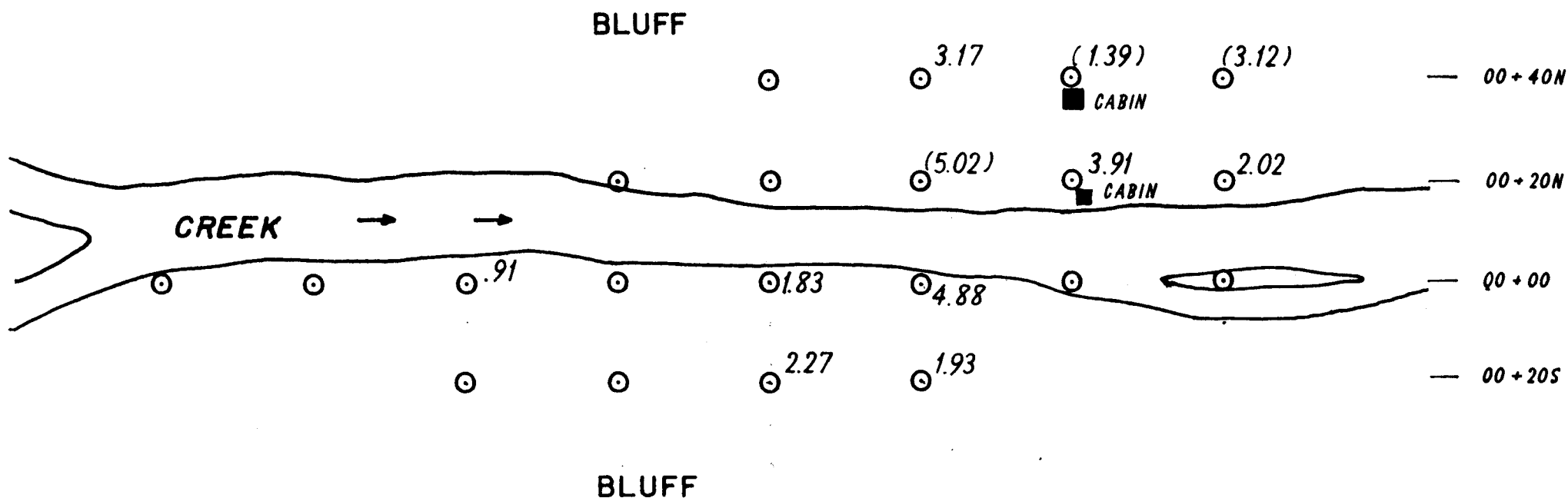
6.1 INSTRUMENTATION

A Nimbus ES-126 signal enhancement seismograph was used in this survey. A steel plate was struck with a 6 lb. sledge hammer at progressively further distances from the instrument. The instrument is equipped with a cathode ray tube, a sweep marker and a digital readout to allow efficient identification of the first sound wave to arrive at the instrument. Instrument specifications are given in Appendix I.

6.2 THEORY & PROCEDURE

An outline of the principles of refraction seismology is given in Appendix II. The essential function of the seismograph is to measure the time necessary for the fastest wave to reach the instrument. By moving the source of the shock wave away from the instrument, velocity differences between underlying layers can be graphed, and their respective depths can be calculated. The procedure used is as follows:

1. From a grid point, a line was laid out in the direction that best avoided irregularities in topography.



KIRKLAND CREEK PLACER LEASE

SEISMIC GRID

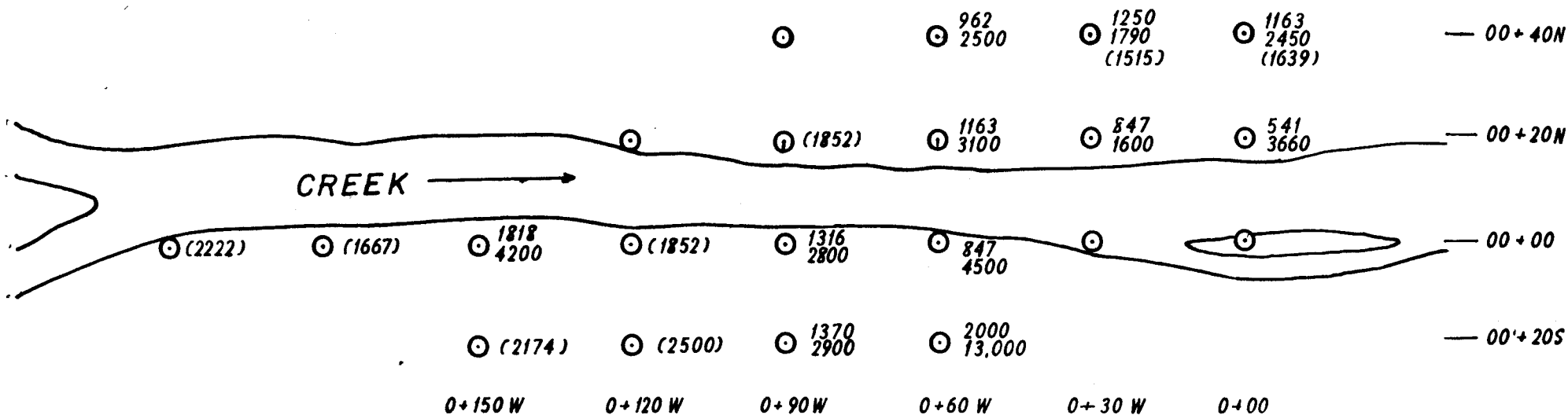
FIGURE 6-1

DEPTHS IN METERS

MONTGOMERY CONSULTANTS LIMITED

MARCH 30, 1980





KIRKLAND CREEK PLACER LEASE

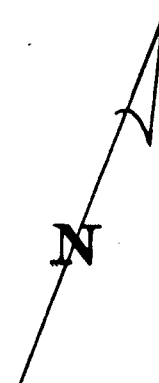
FIGURE 6-2

MONTGOMERY CONSULTANTS LIMITED

SEISMIC GRID

INITIAL VELOCITY
FINAL VELOCITY
(AVERAGE VELOCITY) M / SEC.

MARCH 30, 1980



2. Hammer stations were chosen along this line at 2 meter intervals up to 10 meters and then 5 meter intervals up to 30 meters.

3. The time taken for the first shock wave to return to the instrument at each station was recorded and plotted on a graph against the distance.

4. From this graph, the depth to bedrock was calculated, according to the following equation:

$$\text{Depth} = \frac{x}{2} \sqrt{\frac{V_2 - V_1}{V_2 + V_1}}$$

Where V_1 is the seismic velocity of the surface layer; V_2 is the seismic velocity of the underlying layer, and x is the distance value on the graph where V_1 and V_2 intersect.

6.3 RESULTS AND INTERPRETATION

Results from the seismic survey are presented in Appendix III, and plotted on figures 6-1 and 6-2. Calculated depths ranged from .91 meters to 5.02 meters, and averaged 2.77 meters. Initial velocities ranged from 541 to 2000 meters per second, which is within the known range for gravel (Redpath, 1973) and final velocities of 1600 meters per second to 4500 meters per second are consistent with velocities for volcanic rocks.

Average velocities were calculated for stations where 2 layers were not distinguishable. Average velocities are consistent with the initial velocities, and don't exceed 2000 meters per second.

Problems with the seismograph battery under operating conditions of -20°C makes data from some stations suspect. These are noted on figure 6-1 by parentheses under questionable values.

Success of the seismic refraction method depends on the satisfaction of two assumptions: 1) that each layer is isotropic with respect to propagation velocity and 2) successively deeper layers have a higher velocity than the overlying ones. The presence of frozen water in surface gravels, or an underlying permafrost layer could violate these two assumptions, and put restrictions on the interpretation of seismic data.

Although the seismic survey was a limited one, and there are reservations about the validity of some of the data, the data configurations for the other stations indicate that the seismic refraction method is a viable one for determining depth of stream gravels to bedrock.

7.0 PERSONNEL

JOHN M. GRAHAM - Prospector - 25 years

DARYL REINKE - Prospector - 25 years

BRUCE MARTEL - Line cutter - Staker -
10 years experience

8.0 COST BREAKDOWN

8.1 WAGES

John Graham	9 days @ \$100.00 / day	\$ 900.00
Daryl Reinke	8 days @ \$100.00 / day	\$ 800.00
	Employee benefits	\$ 48.85
Bruce Martel	6 days @ \$100.00 / day	\$ 600.00

8.2 SERVICES

Report writing	\$ 256.50
Drafting	\$ 114.00
Typing	\$ 42.00
Reproduction costs and supplies	\$ 53.88

8.3 SUPPLIES - field supplies and equipment rental	\$ 157.84
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8.4 ACCOMMODATION - Motels, meals, groceries	\$ 151.96
--	-----------

8.5 TRANSPORTATION - Airfare, helicopter, truck rental, cab	\$2,988.28
--	------------

TOTAL	\$6,113.31
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9.0 BIBLIOGRAPHY

- 1) Redpath, Bruce B. (1973) Seismic Refraction
Exploration for Engineering Site Investigations,
National Technical Information Service,
Technical Report AD 768 710.
- 2) Templeman-Kluit, D.J. (1972) Operation Snag-
Yukon, GSC Paper 72-1A, P. 36.

10.0 CERTIFICATE

I, Dita Runkle, of 5665 Toronto Road, Vancouver, British Columbia, do hereby certify that:

1. I am a geologist under contract to Montgomery Consultants Ltd. of #605-850 West Hastings Street, Vancouver, B.C.

2. I am a graduate of Mount Holyoke College, South Hadley, Massachusetts (B.A. 1974) and UBC (M.Sc. 1980) in Geological Sciences.

3. I have practised my profession continuously since graduation.

4. I have no interest, either direct or indirect in the Kirkland Creek prospecting lease, nor do I expect to receive any such interest.

6. I have based this report on information supplied by Mr. Graham.

DATED at Vancouver, B.C. this 30th day of March 1980.

Respectfully submitted,

Dita Runkle

Dita Runkle,
5665 Toronto Road,
Vancouver, B.C.

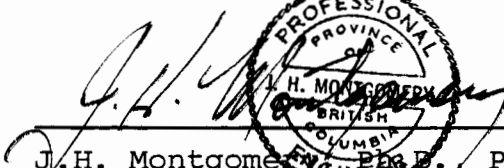
10.0 CERTIFICATE

I, J.H. Montgomery, of Vancouver, British Columbia,
hereby certify that:

1. I am a geological engineer and reside at 4153
West 11th Avenue, Vancouver, B.C.
2. I am a graduate of the University of British
Columbia; B.Sc. in 1959, M.Sc. in 1960, Ph.D. in 1967.
3. I have practiced my profession since 1959.
4. I am a member of the Association of Professional
Engineers of British Columbia.
5. I have no interest, direct or indirect, in the
Kirkland Creek prospecting lease, nor do I expect to
receive any such interest.
6. I have based this report on information
supplied by Mr. Graham.

DATED at Vancouver, B.C. this 30th day of March 1980.

Respectfully submitted


J.H. Montgomery, P.D. P.Eng.
4153 West 11th Avenue,
Vancouver, B.C.



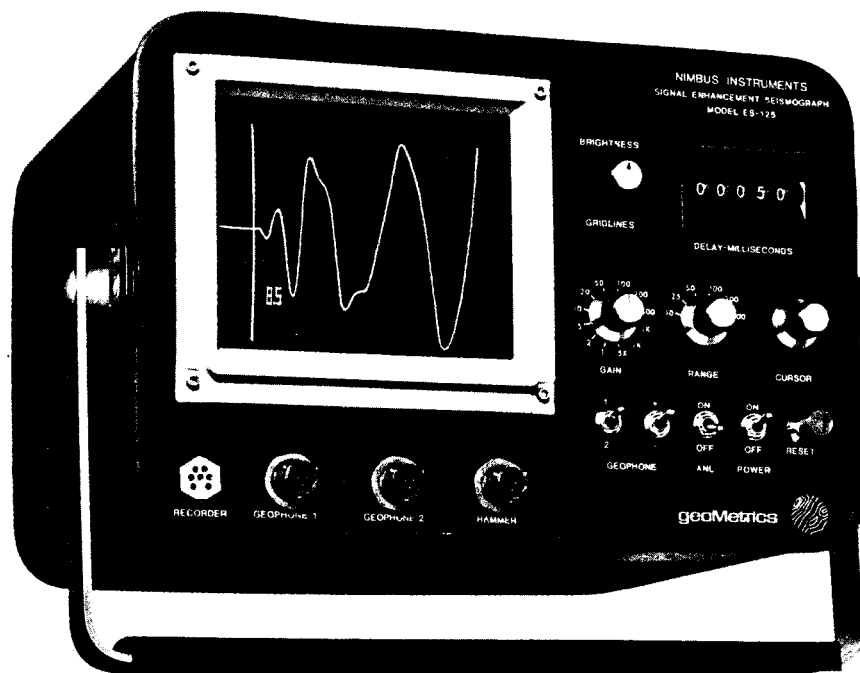
APPENDIX I

Nimbus Instruments
A Division of geoMetrics INC.



SIGNAL ENHANCEMENT EXPLORATION SEISMOGRAPH

Model ES-125



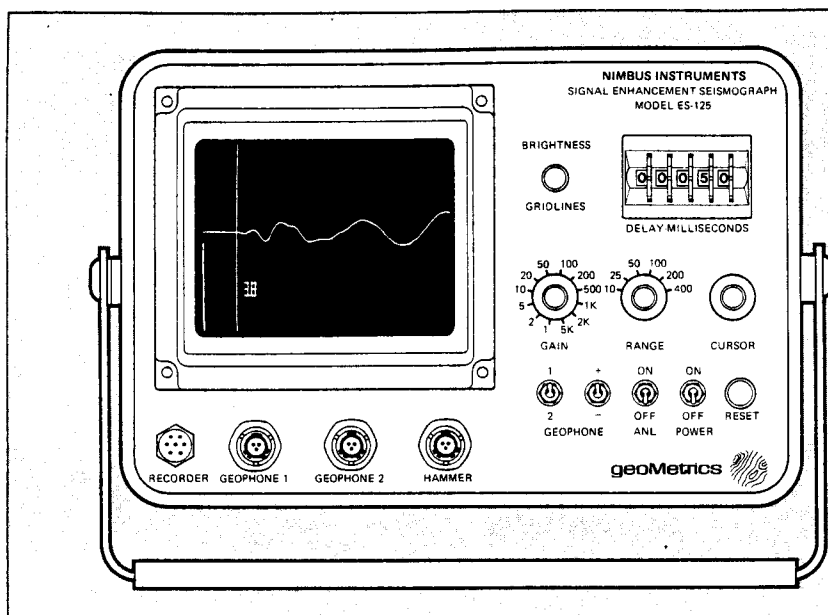
Features

- One-man operation.
- Signal enhancement for greater sensitivity, improved waveform definition and more accurate time measurements. Lets you operate under high natural and man-made background noise conditions.
- *Exclusive* automatic noise limiting and start-inhibit alarm prevents waveform loss because of transient, high-level noise being stacked into memory.
- Continuous waveform display.
- Daylight-visible CRT display—the largest available on a single-channel instrument. Special viewing hood not required. Grid lines aid readout.
- *Exclusive* vertical line cursor on CRT display. Does not distort waveform and is easier to read than conventional marker pips.
- Stepped gain control for fast reset to the same absolute value each operation.
- 100 μ sec resolution.
- Memory size: 8 bits x 256 words (256 x 256 points).
- Solid state hammer switch.
- Hammer delay adjustable from 0 to 9999.9 milliseconds. Automatically added to arrival time.

- Record duration switch from 10 to 400 msec.
- 8-hour performance from internal rechargeable battery. Charger included.
- Strip chart recorder output.
- Shear wave measurement capability.
- Utilizes latest LSI technology—compact, low cost, simple to operate. Rugged, all-aluminum case.

Applications

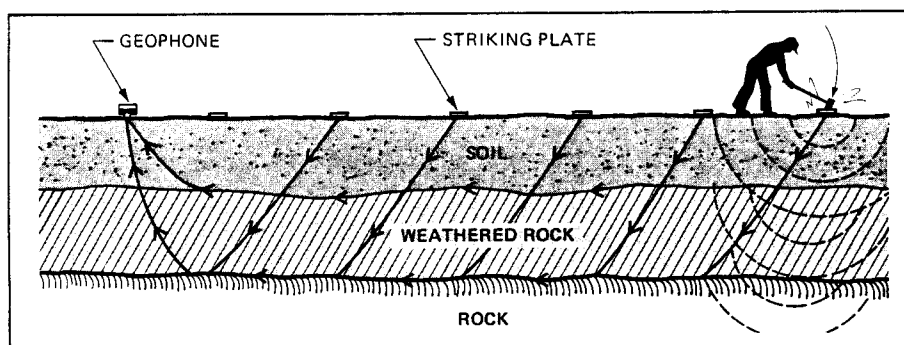
- Preliminary site geology for highways, pipelines, and other structures.
- Detailed foundation investigations including site response.
- Estimating excavation costs (rippability).
- Evaluating gravel deposits.
- Groundwater studies.
- Mineral and geothermal exploration.
- Landslide and slope stability studies.
- Fault location.
- All other applications requiring knowledge of near subsurface characteristics.



SIMPLE FOUR-STEP OPERATION

Despite its sophistication, the ES-125 is simple to operate and requires only a minimum of training for field personnel. After initial set-up, the following four-step procedure is all that is required at each survey point:

1. Select time **RANGE** and **GAIN**.
2. Strike ground as many times as is necessary to bring up a useable signal.
3. Turn **CURSOR** knob until the marker lies over first arrival. The seismic signal is continuously displayed for leisurely examination of the waveform. Arrival time is shown on CRT.
4. Record time on graph pad and erase waveform.



detection by the geophone. As the spacing between the impact and the sensor is increased, the waves which refract through the deeper layers will arrive first, because part of their travel is through higher velocity materials. The arrival times, when plotted against distance, reveal the nature of the underground layering.

The waveform of the shock wave detected by the geophone is displayed on the seismograph CRT, or on an optional strip-chart recorder. When using the GeoMetrics/Nimbus ES-125, the operator merely moves a cursor to the first arrival of the waveform as shown previously. The time is instantaneously displayed in milliseconds.

DATA REDUCTION

A graph is plotted of arrival times vs. distances between the striking plate and the geophone. As shown to right, "best fit" lines are drawn through the points. In practice, the survey is usually run in both directions resulting in two sets of overlapping lines. There will be a straight line segment for each subsurface layer, with the slope of each line segment equaling the apparent velocity in that layer.

The depths of each layer can be calculated as follows:

$$D_1 = \frac{X_{C1}}{2} \sqrt{\frac{V_2 - V_1}{V_2 + V_1}} \quad \text{and}$$

$$D_2 = 0.8 D_1 + \frac{X_{C2}}{2} \sqrt{\frac{V_3 - V_2}{V_3 + V_2}}$$

X_C = critical distances, where straight line segments intercept. V = velocity. D_1 = depth of first layer, D_2 = depth of second layer.

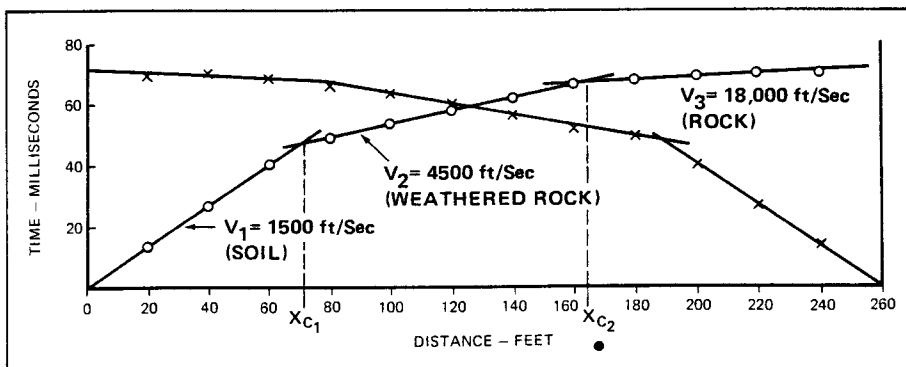
Irregularities, such as faults, dipping layers, large boulders, stream channels,

dikes, lateral changes, etc., will produce corresponding irregularities in the time-distance graph. A number of solutions are available to solve for these various geometries by graphical means, pocket calculators or computer programs.

INTERPRETATION AND APPLICATION

The time-distance plot is used to draw a cross-sectional map of the subsurface below the survey line; delineating layers and structures with differing seismic velocities. When the velocities are coupled with knowledge of the local geology, the types and depths of material can be predicted.

This structural-material cross-section is useful in a wide variety of geological applications. The procedure of gathering and reducing the data is largely mechanical and easily learned. While geological interpretation comes into play, many applications do not require a wide range of expertise. Whatever your particular field, better subsurface knowledge obtained from seismic surveys can add immeasurably to your job. Complete applications information is available from GeoMetrics/Nimbus to assist field surveys.



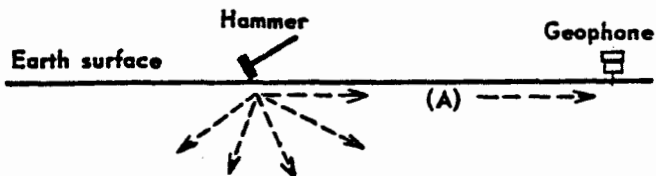
APPENDIX II

Principles of Refraction

Seismology

A very brief discussion is given here. More detailed descriptions will be found in papers and books by Dobrin, 1960; Johnson, 1954; Linehan, 1953; and others.

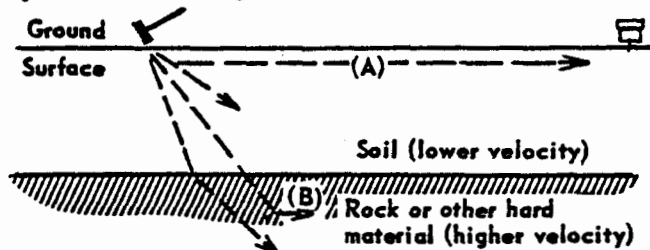
When the hammer strikes the surface of the earth, which for the moment we will assume is of uniform composition, sound waves are sent out in all directions:



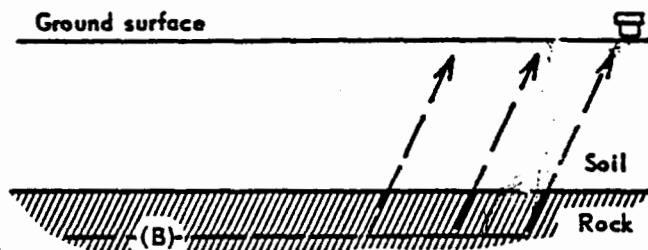
One of these rays in particular, A, travels parallel to the surface and will arrive at the geophone after a time interval which is directly proportional to the distance between hammer and geophone. This is called the "Direct" seismic wave. The essential function of the MD-1 Seismograph is to measure this time interval, to very high precision.

If the hammer is struck at a distance of 10 feet, say, a particular time reading will be observed. If it is struck at 20 feet, a reading of twice that value will be observed, at 30 feet, three times that value, and so on, providing the material does not change. A graph of hammer distance vs. time reading will produce a series of points lying on a straight line which passes through zero. The slope of the straight line gives the velocity of sound waves in the uniform top portion of the earth. This type of graph is shown in figure IV-3.

If the subsurface includes a higher velocity (harder) layer such as bedrock, the sound rays will be bent as they enter, much as light rays are bent when they pass from air into glass:



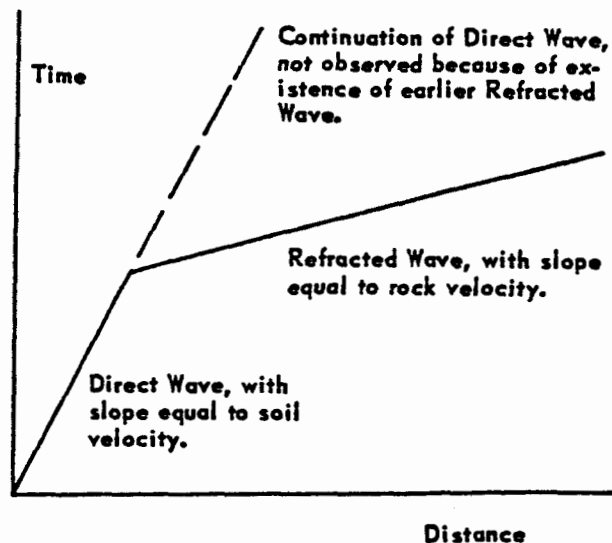
All of the downward rays except B will continue downward and disappear. Ray B will travel along the top of the bedrock and continually leak energy back into the upper layer:



This leakage is called the "Refracted" wave.

At larger hammer-geophone distances, the Refracted Wave will arrive earlier than the Direct Wave, even though the path is longer, because a portion of the path is in the high-velocity rock.

The MD-1 Seismograph measures the travel time for the fastest wave traveling between the hammer and geophone, whatever its path may be. The Seismograph does not identify the path directly, but the identification becomes immediately evident when readings from successive hammer stations are plotted on graph paper as described in Section IV (This plot is called a travel time graph). The pattern for a layer of soil overlying rock appears as follows: (see also figure IV-4):



APPENDIX III

PROJECT: KIRKLAND CK.

CK

TIME
(MILLISECONDS)

DISTANCE (METERS)

RECEIVER STATION

20S + 60W

~~20S + 60W~~

1 IN. = 5 METERS

$$X = 4.5$$

$$V_1 = 2000$$

$$V_2 = 130$$

$$D = 1.93$$

30

25

20

15

10

8

6

4

2

40

30

20

10

PROJECT: KIRKLAND CK.

ck
1000

TIME
(MILLISECONDS)

30 25 20 15 10 8 6 4 2

DISTANCE (METERS)

RECEIVER STATION

205 + 90 W

1 IN. = 5 METERS

X = 7.6
V₁ = 1370
V₂ = 29.0
D = 2.27

PROJECT: KIRKLAND CK.

CK
100

TIME
(MILLISECONDS)

30

25

20

15

10

8

6

4

2

DISTANCE (METERS)

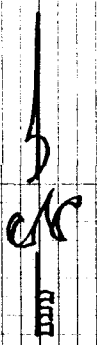
$V = 2500$

RECEIVER STATION

20S + 120 W

12 5705
10 X 10 TO THE INCH

PROJECT: KIRKLAND CK.



TIME
(MILLISECONDS)

30 25 20 15 10 8 6 4 2

DISTANCE (METERS)

RECEIVER STATION

$V = 2174$

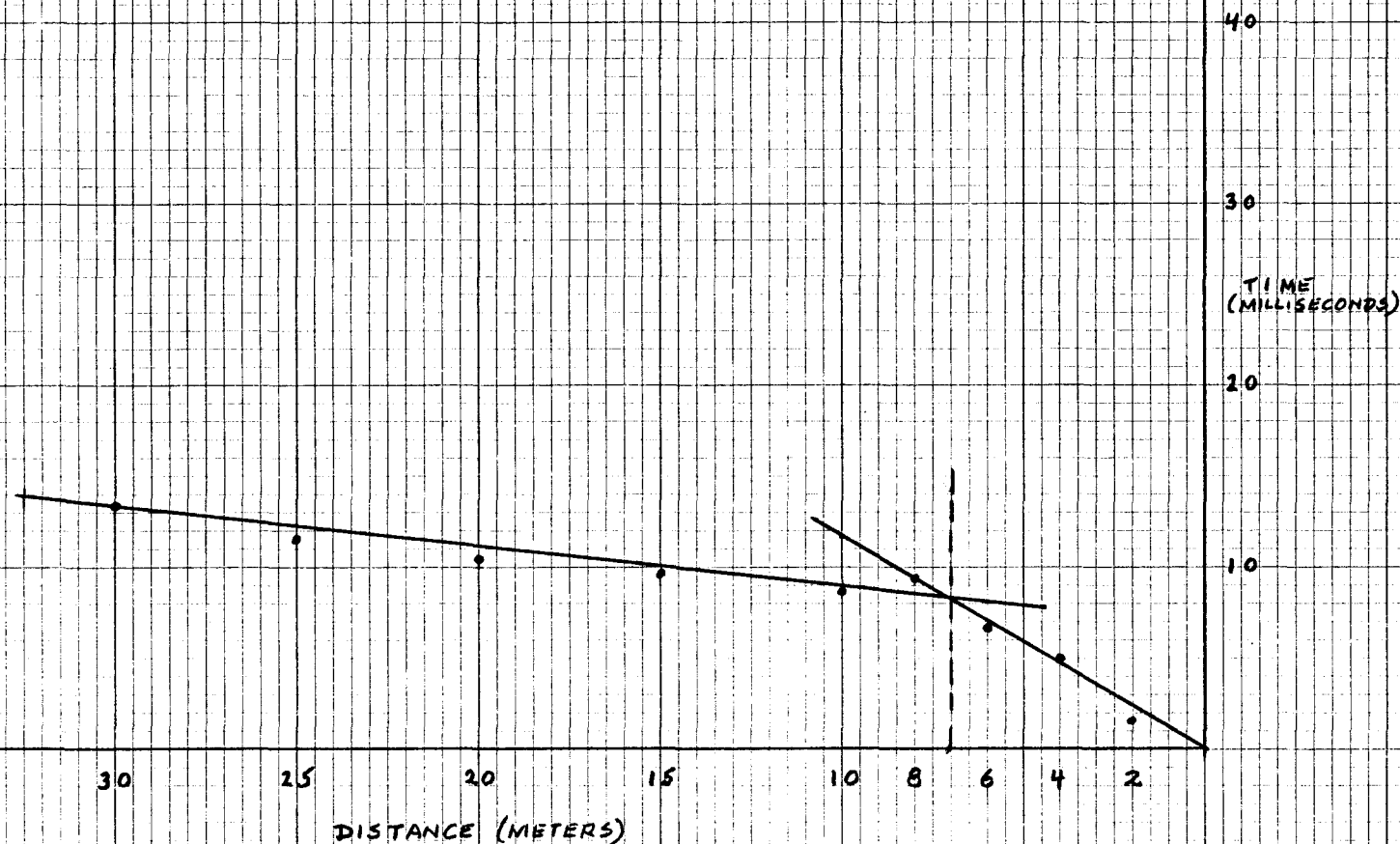
205 + 150W
1 IN. = 5 METERS

KEUFFEL & ESSER CO
MADE IN U.S.A.

PROJECT: KIRKLAND CK.

J. GRAHAM and D. REINKE

FEB 24 - MAR 1st 1980



RECEIVER STATION
00 + 60 W

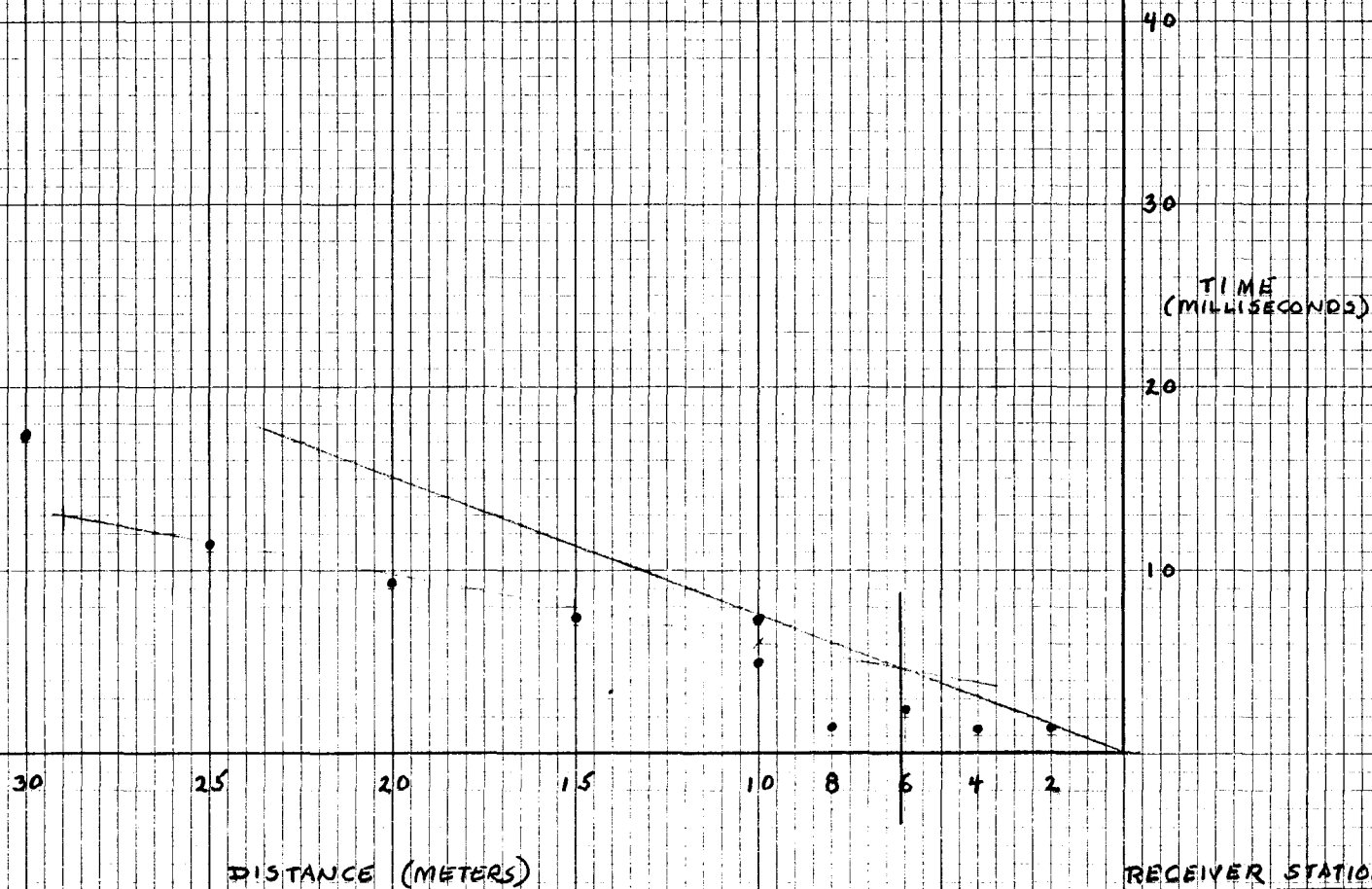
$\lambda_1 = 7$
 $V_1 = 847$
 $V_2 = 45.0$
 $D = 4.88m$

PROJECT: KIRKLAND CK.

J. GRAHAM and D. REINKE

FEB 24 - MAR. 1980

A
chr



RECEIVER STATION

00+90 W

1 IN. = 5 METERS

$$X_1 = 6.1$$

$$V_1 = 13.6$$

$$V_2 = 28.0$$

$$D = 1.83$$

PROJECT: KIRKLAND CK.

CK

40

30

TIME
(MILLISECONDS)

20

10

30

25

20

15

10

8

6

4

2

DISTANCE (METERS)

RECEIVER STATION

00 + 120 W

1 IN. = 5 METERS

V = 1852

PROJECT: KIRKLAND CK.

1
2
3
4
5

40
30
20
10
TIME
(MILLISECONDS)

30 25 20 15 10 8 6 4 2

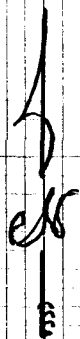
DISTANCE (METERS)

RECEIVER STATION

$X_1 = 2.9$
 $V_1 = 1818$
 $V_2 = 42$
 $D = .91$

00 + 150 W
1 IN = 5 METERS

PROJECT: KIRKLAND CK.



TIME
(MILLISECONDS)

30 25 20 15 10 8 6 4 2

DISTANCE (METERS)

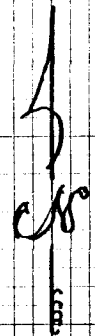
RECEIVER STATION

00 + 180 W

1 IN = 5 METERS

$V = 1667$

PROJECT: KIRKLAND CK.



40

30

TIME
(MILLISECONDS)

20

10

30

25

20

15

10

8

6

4

2

DISTANCE (METERS)

V = 2222

RECEIVER STATION

00 + 210 W
1 IN. = 5 METERS

PROJECT: KIRKLAND CK.

1
ck
mm

40
30
20
10
TIME
(MILLISECONDS)

30 25 20 15 10 8 6 4 2

DISTANCE (METERS)

RECEIVER STATION

00 + 20 N

1 IN = 5 METERS

$X = 4.7$
 $V_1 = 54.1$
 $V_2 = 36.6$
 $D = 2.02$

PROJECT: KIRKLAND CK

eff

555

40

30

TIME
(MILLISECONDS)

20

10

30

25

20

15

10

8

6

4

2

DISTANCE (METERS)

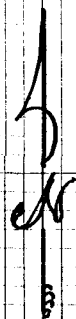
$X = 14.1$
 $V_1 = 84.7$
 $V_2 = 16$
 $D = 3.91$

RECEIVER STATION

20N + 30W

1IN. = 5 METERS

PROJECT: KIRKLAND CK.



TIME
(MILLISECONDS)

30 25 20 15 10 8 6 4 2

DISTANCE (METERS)

RECEIVER STATION

20 N + 60 W

1 IN = 5 METERS

?
X = 14.9
V₁ = 1163
V₂ = 31.0
D = 5.02

PROJECT: KIRKLAND CK

CK

40

30

TIME
(MILLISECONDS)

20

10

30

25

20

15

10

8

6

4

2

DISTANCE (METERS)

V = 1852

RECEIVER STATION

20N + 90W

1 IN. = 5 METERS

PROJECT: KIRKLAND CK

ck

TIME
(MILLISECONDS)

DISTANCE (METERS)

RECEIVER STATION

00 + 40N
1 IN = 5 METERS

$V = 1639$

CV

$X = 10.9$

$V_1 = 1163$

$V_2 = 245$

$D = 3.12$

PROJECT: KIRKLAND CK

dr

40

TIME
(MILLISECONDS)

30

20

10

30

25

20

15

10

8

6

4

2

$V = 1515$

or

DISTANCE (METERS)

$X = 6.6$

$V_1 = 1250$

$V_2 = 17.9$

$D = 1.39$

RECEIVER STATION

40 N + 30 W

1 IN = 5 METERS

PROJECT: KIRKLAND CK.

CK

TIME
(MILLISECONDS)

30 25 20 15 10 8 6 4 2

DISTANCE (METERS)

RECEIVER STATION

40N + 60W

1 IN. = 5 METERS

$X = 9.5$
 $V_1 = 962$
 $V_2 = 250$
 $D = 3.17$