RECONNAISSANCE SEISMIC REFRACTION SURVEY RESULTS

TROND GULCH PROPERTY

ATLIN, B. C.

- ON -

Placer Leases 1373, 1383, 1371, 1372, 1376, 3044, 3045, and 2957
ATLIN MINING DISTRICT, BRITISH COLUMBIA

- FOR -

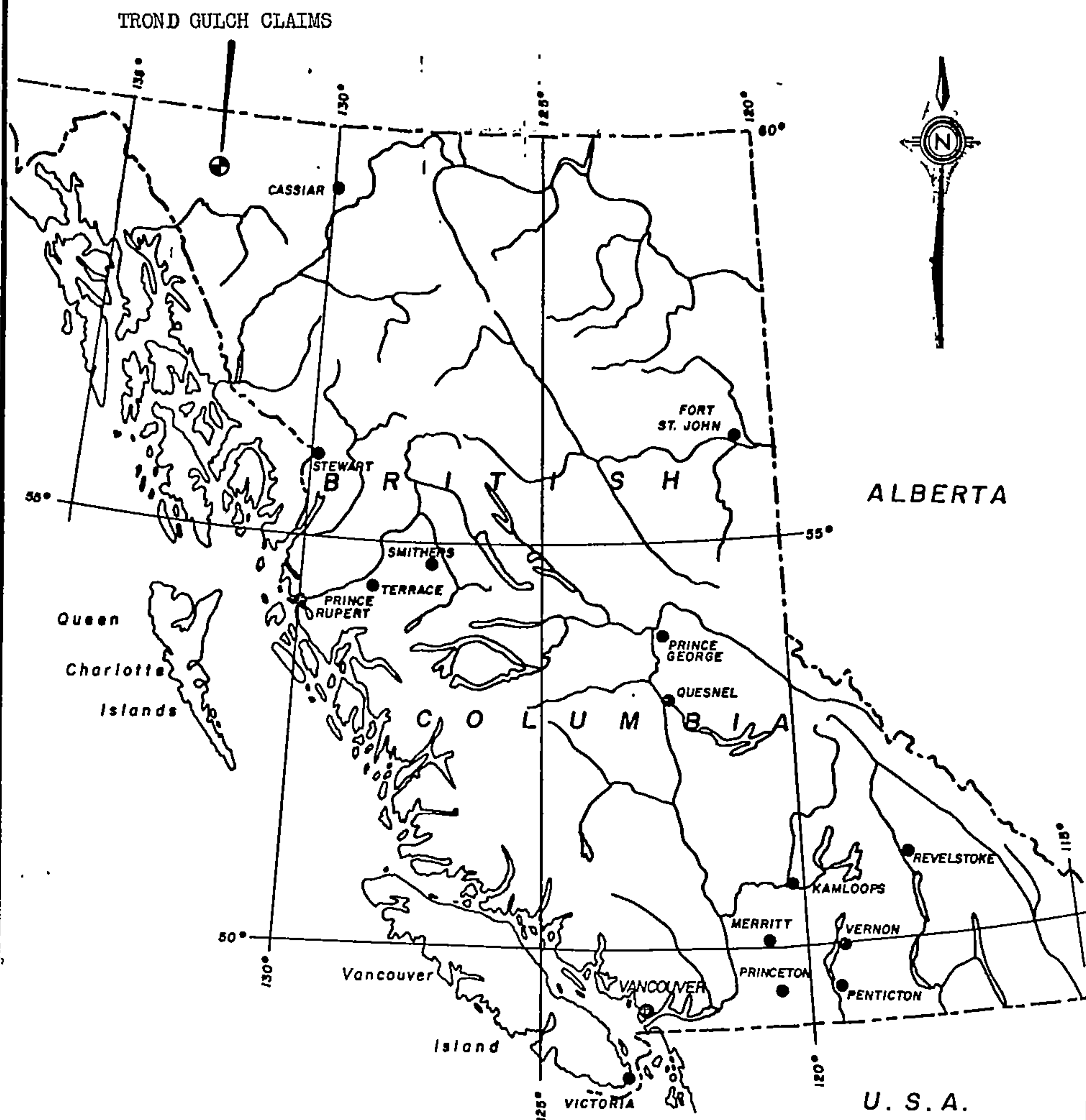
John McFarland
9360 Forest Court Southwest
Seattle, Washington 98136
U.S.A.

Location: 8 km Northeast of Atlin, B.C.
133°38'W; 59°36'N
N.T.S. 104N/12W

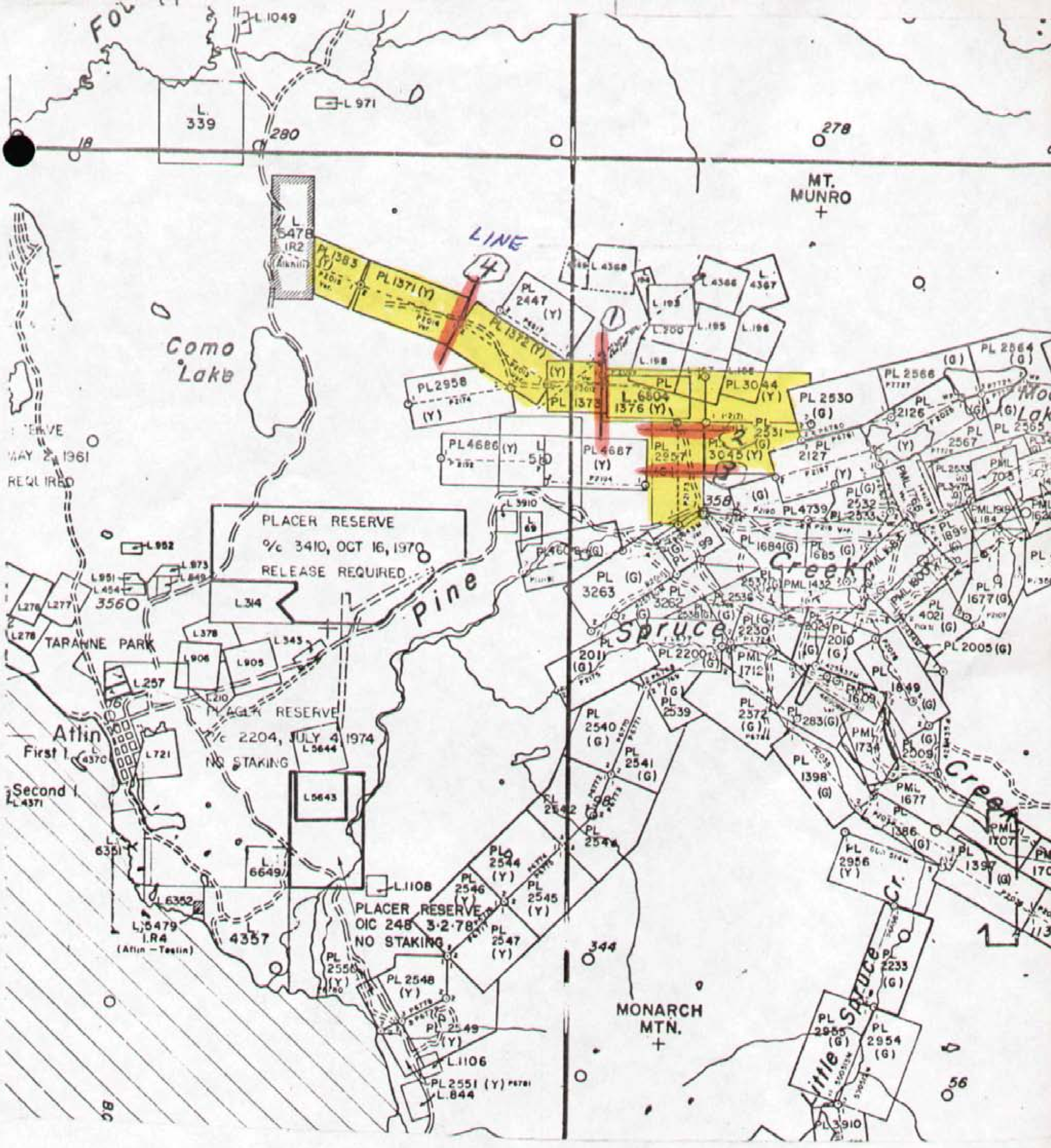
J.E. WALLIS, P. ENG.
P.O. BOX 59
ATLIN, B.C.
VOW 1AO

MARCH 4, 1982

TABLE OF CONTENTS:



For : JOHN M. McFARLAND	
LOCATION MAP	
TROND GULCH CLAIMS	
ATLIN MINING DIVISION, B. C.	
	Date : Mar. 1982.
Scale : 1cm. = 87 km.	



Location of Trond Gulch claims, PLs 1373, 1383, 1371, 1372, 1376, 3044, 3045 and 2957 all marked in yellow. Atlin Mining District, 5 miles NE of Atlin.

Locations of seismograph lines 1, 2, 3, and 4 are marked with red lines and numbers circled.

Introduction

The Trond Gulch property consists of 8 grouped Placer Leases located between Pine Creek and the western flank of Mount Monro. The leases cover an area which may contain an ancient buried stream channel, the original channel of Pine Creek. Several shafts were sunk in this area near the turn of the century. Conflicting reports indicate that these shafts met with minor success. Reportedly, the shafts were in excess of 100 feet deep.

1981 Program

During the summer of 1981 it was decided to undertake a test program to map the bedrock topography of the area. It was elected to conduct a small seismic refraction survey over a portion of the property to test this method as a practical means of defining the bedrock topography. The program was contracted out to Geo-Compu-Graph, Incorporated of Spokane, Washington, a firm with which the author has had considerable success with in other locations.

The program was under the supervision of Robert W. Lankston, Ph. D. with field direction by the author and John McFarland, owner of the leases. Dr. Lankston's report is appended.

Conclusions & Recommendations

The bedrock appears to increase in depth from the South-eastern part of the study area to the Northwestern part. Although no clearcut bedrock channels were evident, the seismic refraction survey method appears to work well in the area.

It is recommended that the next phase of the program be a detailed refraction survey with line spacings of approximately 500 feet.

Ten holes or approximately 1000 feet of drilling should be sufficient to test for the presence of placer gold. Results would have to be reveiwed at that time to determine if further test work is justified.

CERTIFICATE

4 March, 1982

I, James E. Wallis with residence in Atlin, British Columbia, do hereby certify that:

1. I am a Mining Engineer and have practiced this profession for the past 22 years.

2. I am a member of the Professional Engineers Association of British Columbia.

3. I am a graduate of the Haileybury School of Mines, 1958, and hold a B. Sc. from the University of Alaska and a M. Sc. (Eng.) from Queens University 1967 in Mining Engineering.

4. Since 1958 I have held responsible positions in both large and small mining operations in Quebec, Manitoba, Saskatchewan, British Columbia and the Northwest Territories.

5. I have personally examined the Trond Gulch property.

6. I do not beneficially own, directly or indirectly any securities of the Trond Gulch Property.

Respectfully Submitted,

J.E. Wallis, P. Eng.
Atlin, B.C.

COST STATEMENT

Invoice #7941 (copy attached) $7,094.82

Geo-Compu-Graph, Incorporated
East 509 Parkhill Drive
Spokane, Washington 99208

(509)/466-4542

7941

SOLD TO John McFarland
STREET & NO. 8081 Occidental Street
CITY Seattle, Washington 98108

SHIPPED TO
STREET & NO.
CITY

CUSTOMER'S ORDER	SALESMAN	TERMS	VIA	F.O.B.	DATE
Project #1-024		Net Cash			February 10, 1982

Past due (for Field Operations, from Invoice 7904, dated				
Sept. 4, 1981)	$4466	94		
Total received on account	(1000	00)		
Balance Past Due			$3466	94
Interpretation of Seismic Refraction Data from Trond Gulch.				
Professional Services				
Professional hours:				
Interpretation and Report Writing 58 hours @ $40 per hour	$2320	00		
Technician hours:				
Geophysical Data Processing 6 hours @ $20 per hour	120	00		
Cartography 8.5 hours @ $20 per hour	170	00		
Subtotal	$2610	00		
Expenses				
Travel 40 miles @ .20 per mile	$ 8	00		
Printing	9	88		
Subtotal	$17	88		
Total Professional Services			$2627	88
TOTAL NOW DUE			$6094	82
A finance charge of 1½% per month will be applied to overdue accounts.				

Rediform
7H 736

INVOICE

Marion air refund $101.20

INVOICE NO. 7904

Geo-Compu-Graph, Incorporated
East 509 Parkhill Drive
Spokane, Washington 99208

(509)-466-4542

SOLD TO	John McFarland	SHIPPED TO	
STREET & NO.	8081 Occidental Street	STREET & NO.	
CITY	Seattle, WA 98108	CITY	

~~CUSTOMER'S ORDER~~	SALESMAN	TERMS	VIA	F.O.B.	DATE
Project #1-024		Net 30 Days			Sept. 4, 1981

FIELD OPERATIONS:				
General Project Costs (includes shipping, air fare Spokane to Whitehorse, professional time, and related expenses. Costs are divided among three clients.)				
Professional Fees (including travel and standby)	$ 366	.67		
Expenses	468	.34		
Instrument Rental	816	.67		
General Project Costs Subtotal			$1651	68
Specific Project Costs (includes professional time and expenses related to one client)				
Professional and Technician Fees				
Professional Rates 33 hours @ $40 per hour	$1320	.00		
Technician Rates 37.5 hours @ $20 per hour	750	.00		
Professional Travel & Standby	320	.00		
Technician Travel and Standby	240	.00		
Expenses	353	.95		
Instrument Rental	875	.00		
Specific Project Costs Subtotal			$3858	95
TOTAL			$5510	63
RECEIVED ON ACCOUNT (August 20, 1981)			($1000	00)
TOTAL DUE			$4510	63

A finance charge may be applied to overdue accounts.

Rediform
7H 736

INVOICE

... to be billed later

82-#132

Reconnaissance Seismic Refraction Surveying at Trond Gulch, Atlin, British Columbia

Final Report

Submitted to

John McFarland

Seattle, Washington

by

Geo-Compu-Graph, Inc.

Spokane, Washington

Principal in Charge of Project

Robert W. Lankston, Ph. D., P. G.

February 1, 1982

Statement of Professional Qualifications

The geophysical field operations and data processing and interpretation described in this report were conducted under my direct supervision. The techniques employed include commonly accepted and state-of-the-art procedures. The following list of credentials will support my competence as a geophysicist.

Education

1969 B. S. in Geology, Indiana University

1971 M. A. in Geology (geophysics specialization), Indiana University

1975 Ph. D. in Geology (geophysics specialization), University of Montana

Employment

Employment continuously since 1974 as a professional geophysicist by industrial companies and academic institutions.

Registration

Certificate # 406, State of Idaho. Washington has no state registration requirements for geoscientists. Idaho registers geologists and geophysicists with one license.

Publications

Numerous publications in professional journals and reports to clients on gravity, magnetic, radiometric, and seismic surveying.

This report is respectfully submitted to Mr. John McFarland, February 5, 1982.

Robert W. Lankston
Vice President
and Manager of the Geophysical
Systems Development Department
Geo-Compu-Graph, Incorporated

Table of Contents

List of Illustrations

Reconnaissance Seismic Refraction Surveying at Trond Gulch, Atlin, British Columbia
Final Report

Introduction

Seismic refraction surveying with portable seismographs has been used for more than 25 years to determine the depth to bedrock under unconsolidated alluvium or colluvium. The use of the refraction method for mapping placer deposits dates back at least fifteen years (Greene, 1970). Seismic refraction surveying has among its stengths relatively low cost for the precision of the subsurface data that are obtained. Depth precisions of less than +/- one meter can often be expected in a properly executed survey.

Seismic refraction surveying was undertaken in Trond Gulch near Atlin, British Columbia. The refraction survey was conducted in an effort to map the configuration of the bedrock in the valley. Field operations were conducted August 29 through September 2, 1981 under the direction of Robert W. Lankston, Vice President of Geo-Compu-Graph, Inc., Spokane, Washington. Survey sites were selected by John McFarland.

The present report outlines the general considerations of the design of the Trond Gulch survey, field operations, and the results of the interpretation of the data collected.

Geologic Problem

Gold is believed to exist in the placer deposits in Trond Gulch which is situated approximately 5 kilometers northeast of Atlin, British Columbia. In this particular valley, the gold is believed to reside in alluvium that was not eroded by glacial action. Such deposits are believed to be late Tertiary or early Pleistocene in age and to lie on the surface of the crystaline bedrock.

Seismic refraction surveying was undertaken at Trond Gulch in an effort to map the surface of the bedrock. Of specific interest in the survey was whether or not any narrow channels incised into the bedrock could be identified. These would be more likely to have been sheltered from glacial action and thus contain gold.

Field Methods

The seismic refraction surveying that was conducted at Trond Gulch incorporated an EG&G geoMetrics ES-1210F seismograph. This is a twelve channel, signal enhancement instrument. A twelve channel system allows the earth vibrations at twelve discrete locations to be recorded simultaneously. The signal enhancement feature of the system was extensively employed because a lightweight sledgehammer was used as an energy source. Figure 1 presents two typical seismograms recorded during the Trond Gulch Project. The first break refraction arrivals are of usable, but not particularly high quality. This is a function of the weak signal source and spongey soil conditions.

The objective of the refraction survey was to map bedrock which was believed to be at depths as great as 30 meters below the surface. The design of seismic refraction surveys is discussed in detail in many geophysics textbooks (e. g., Telford, et al., 1976). The survey at Trond Gulch incorporated a minimum of five and a maximum of nine "shots" per set-up of the twelve channel seismic system (Fig. 2). The term "shot" is loosely used in shallow seismic work to indicate the energy source for the survey. The twelve channel seismograph cable was extended such that the distance between the successive geophones was 20 feet. This gave a total spread of 220 feet. The total distance between a shot placed 10 feet off of the end of the geophone cable and the twelfth geophone was 225 feet. The expected depth of penetration of the signals that could be recorded with this shooting geometry would be approximately 75 feet. In order to map to greater depths, shots were placed at greater distances off-the-ends of the geophone cable. Such offsets as 90, 210, and 290 feet were used. Also, a shot was placed midway along each geophone spread. For shots with an offset of 210 feet, the total distance from the source to the twelfth geophone was 430 feet giving an expected depth of investigation of 140 feet. The multiplicity of data obtained by recording five or more shots per geophone spread reduces ambiguity in defining the number of refracting horizons during the interpretation phase of the project, allows

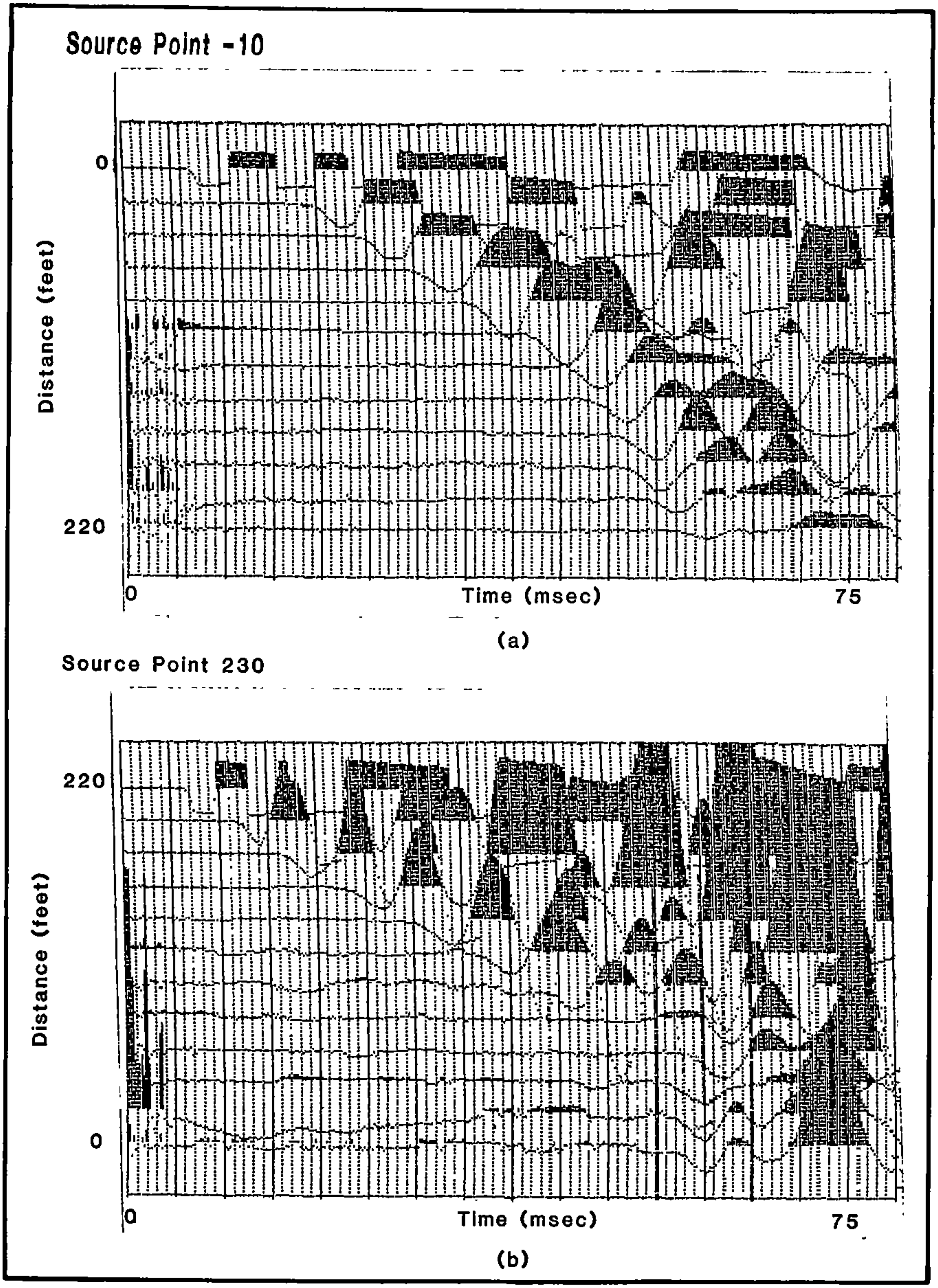


Figure 1. Typical field records. (a) Forward record. (b) Reverse record.

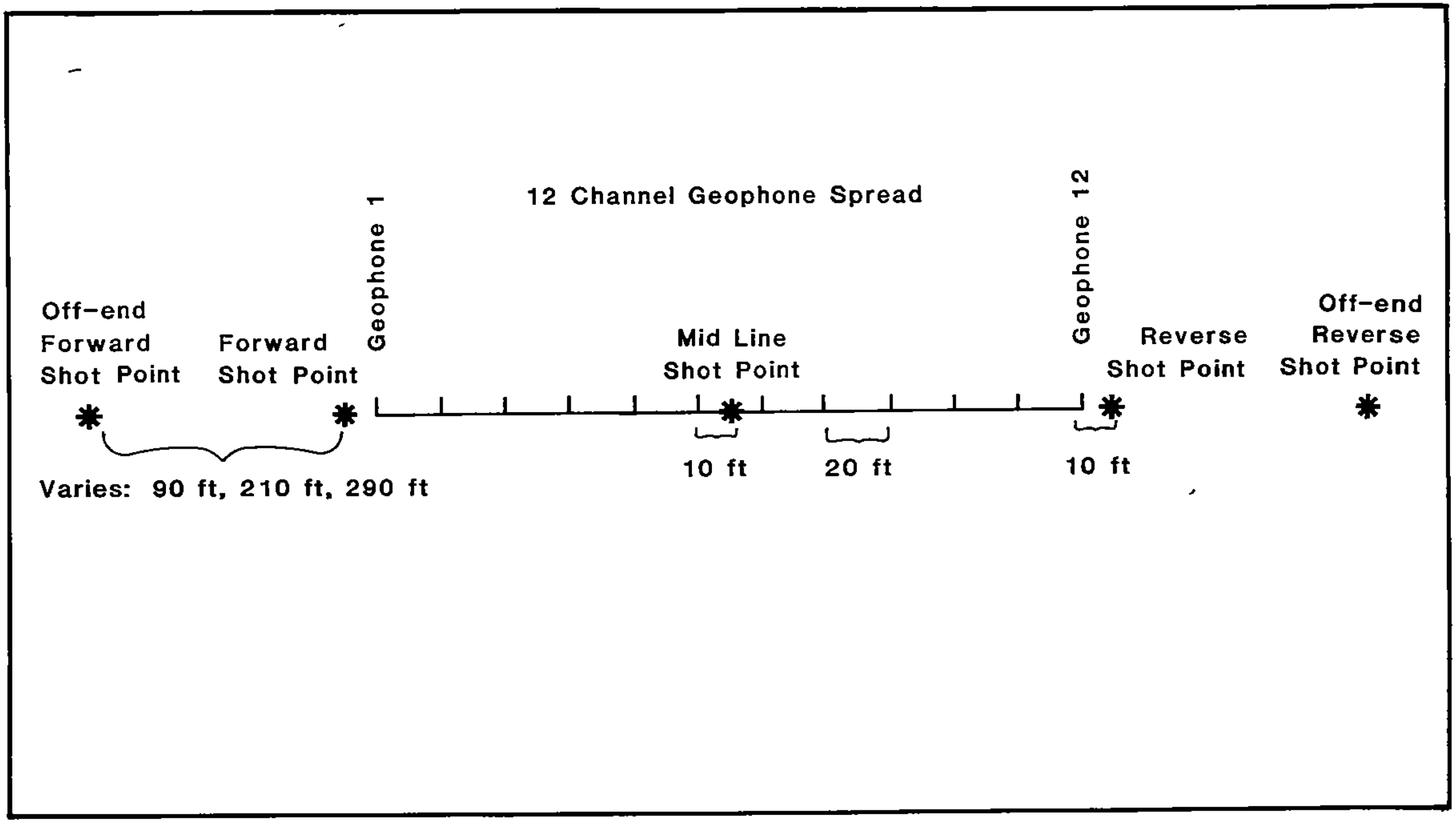


Figure 2. Shooting geometry indicating relative geophone and shot point positions.

refractors at greater depths to be identified, and helps to identify lateral velocity changes in each refracting horizon.

The relative elevations of each geophone and each source point were determined by surveying with a Brunton compass and a Jacob's staff. The precision of such surveying is not expected to be greater and +/- one foot. However, for the purposes of the present survey, such precision is adequate. The irregular surface topography along each line required determining the relative elevations in order to separate geologic and topographic effects on the refracted signals.

The multiplicity of data, the irregularity of the ground surface, and the expected irregularity of the bedrock and other refracting horizons requires that a computer assist in the interpretation of the data. Therefore, only minimal consideration was given to the data in the field. In the field, each record (e. g., Fig. 1) was inspected to determine that first breaks were obvious. Identifying first breaks varied in difficulty from site to site. This was a function of the depth to the refracting horizon, the shot offset distance, the surface soil conditions, and on one day, falling rain. Time versus distance graphs were made for selected field records. However, this was primarily a quality control effort and was not intended to yield geologic results. Manual plotting of the refraction data is time consuming and unless the data from all of the shots for each geophone spread are plotted, erroneous thoughts can be generated with respect to the velocity of refracting horizons and the apparent dip and depth of the horizons.

Refraction data were collected along four lines in Trond Gulch. Along each line, the geophones for each location were arranged such that the last two geophone positions of one location were coincident with the first two geophone positions of the next location. Figure 3 is a sketch map showing the relative positions and orientations of the four lines (these positions should be reconciled to a good quality map of the area).

Data Interpretation Technique

The seismic refraction data collected at Trond Gulch were interpreted with the aid of a microcomputer executing programs known as The GREMLIN™ Package. The GREMLIN™ Package is a set of programs that employs a technique known as the generalized reciprocal method of interpreting seismic refraction data (Palmer, 1980). This technique requires that sufficient data be recorded in the field to detail each refracting horizon. This requirement should have been met by the field recording procedure discussed above.

The GREMLIN™ Programs perform two basic functions. The first function is to allow the determination of the seismic velocity of each refracting horizon. The second function is to present a profile of the subsurface. The software can handle considerable complexity in the geology along

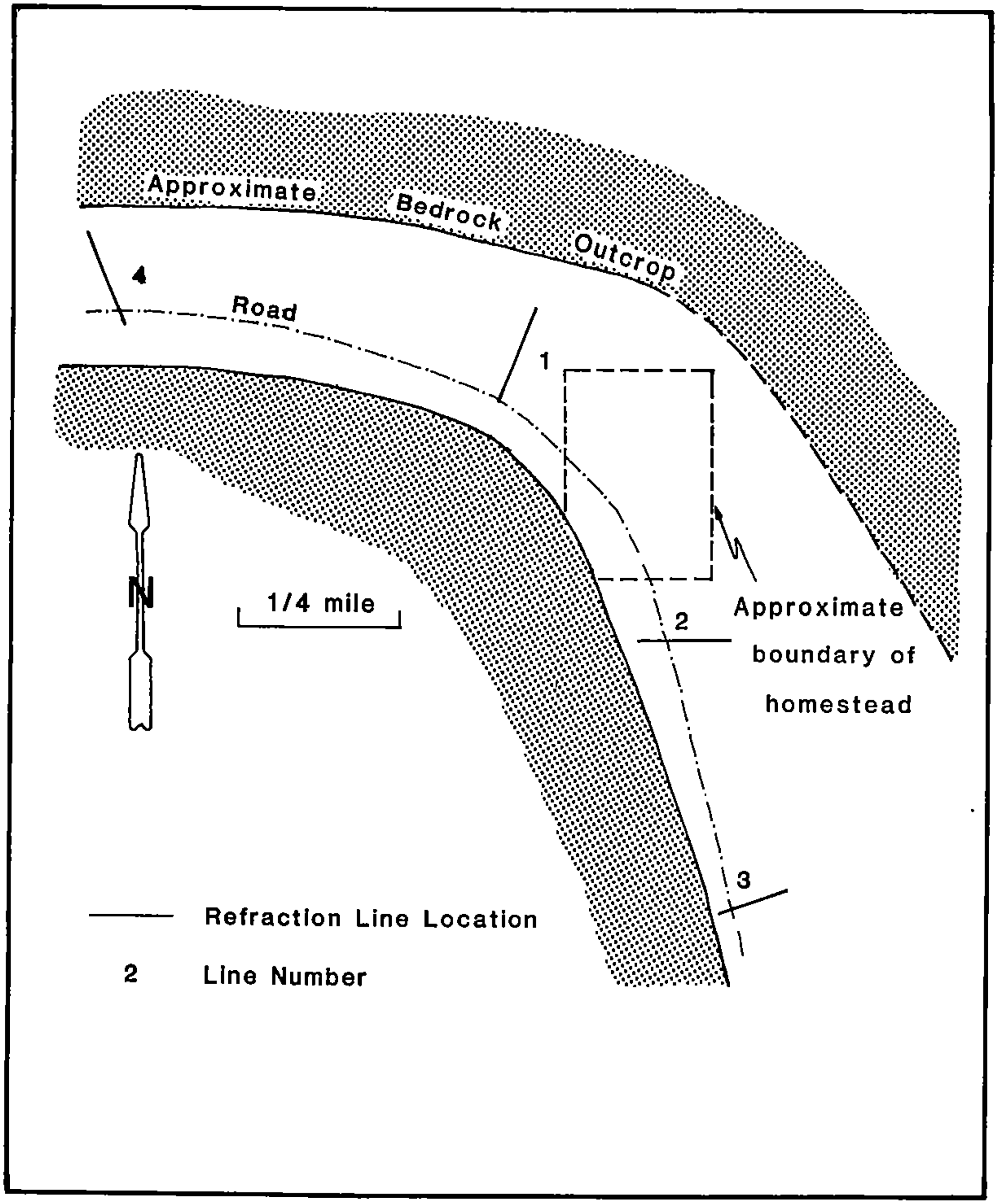


Figure 3. Sketch map indicating approximate locations of Trond Gulch seismic survey lines.

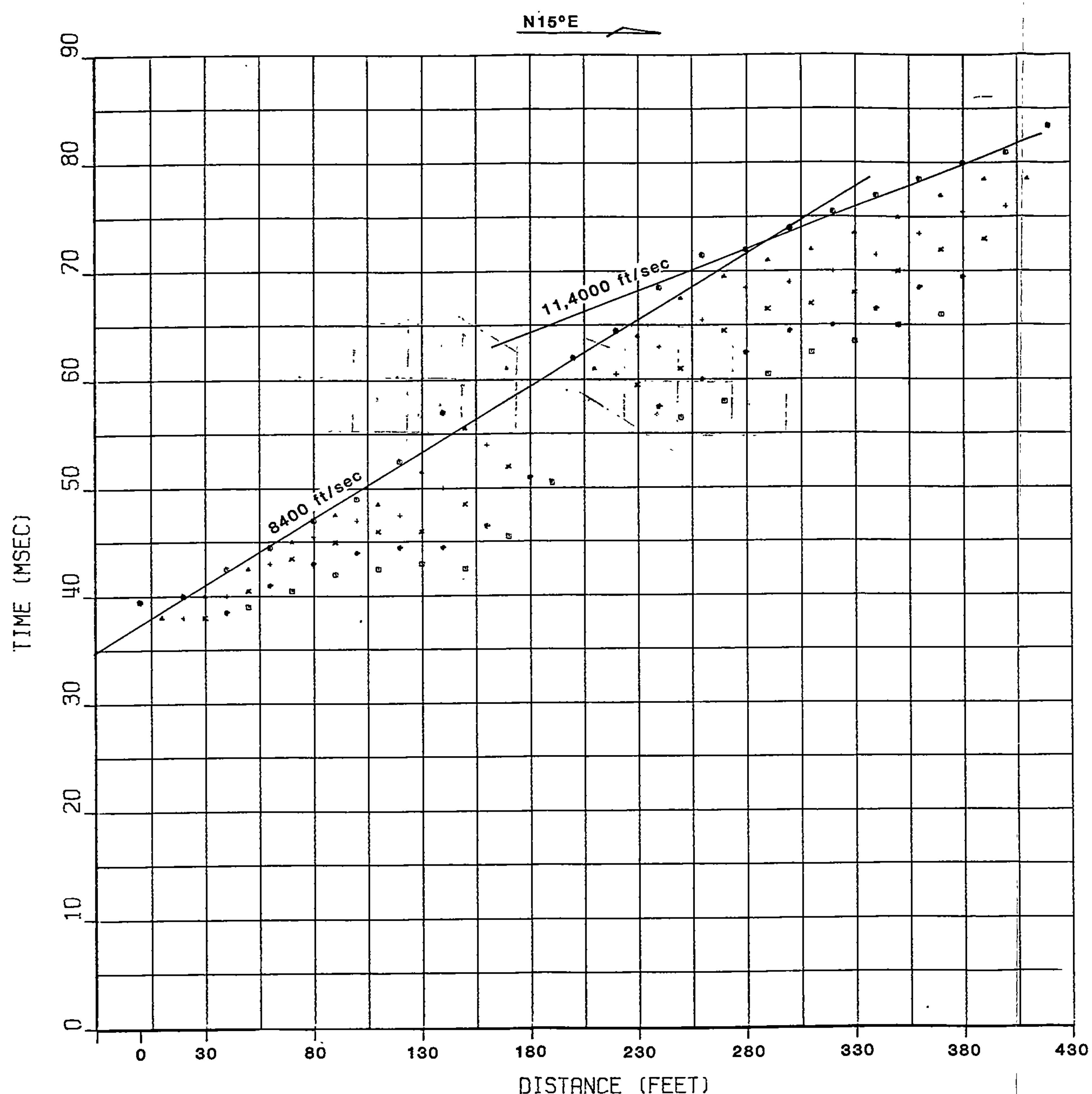
each refraction line. As many as six different horizons can be evaluated. In each of the six horizons, as many as 10 lateral velocity variations can be taken into account. The present study did not encounter any situations that were this complex.

The first stage in processing the refraction data with The GREMLIN™ Package is to measure the first break arrival times for each of the twelve traces on each of the records from each recording location. This task is aided by the computer. Each record, in turn, is placed on a sensitized digitizer surface. The interpreter touches a stylus to the first break position on each trace of the record. The computer automatically scales the touched point on the sensitized surface to arrival time in milliseconds. Moreover, the arrival time and offset distance are stored on disk, a table of offset distances and arrival times is printed, and a time distance graph is plotted (Fig. 4). All of this occurs almost simultaneously as far as the interpreter is concerned. The records from one shooting location can be timed in this manner in approximately fifteen minutes. Manually timing, tabulating, and plotting a similar amount of data would require 30 to 60 minutes. In Figure 4, the overlap of the geophone locations can be seen in the manner in which the arrival times are plotted.

The second stage in the interpretation is to determine from the time distance graph how many refractors are being mapped by the refracted signals. This task is made easier by the multiplicity of data. For example, in Figure 4, the two forward direction (left to right) arrival time curves which extend from 0 to 220 are almost parallel. This indicates that the refracted signals are returning from the same subsurface refracting horizon. Where the two lines are not parallel (from 0 to 20), the recorded signals did not return from the same horizon. The entire graph is studied in this manner to determine which arrivals on the time distance graph can be related to each refracting surface.

After separating the arrivals according to the refracting horizon each represents, the arrival times are composited or "phantomed" to give one time distance graph that represents the arrivals from one horizon along the entire line. Redpath (1973) discusses the phantoming exercise in detail. Figure 5 is the composite time distance graph for the interpreted bedrock refractor for Line #1.

The next stage in The GREMLIN™ Procedure is the analysis of the refractor velocity. The computer generates the refractor velocity functions following the equations presented by Palmer (1980). Figure 6 is the velocity analysis graph for the bedrock along Line #1. The nature of the points plotted for the XY equal 0 case are determined by the interpreter to best define the velocities of the refracting horizon. The inverse of the slope of each line gives the velocity of the refractor along that segment of the line. In this case, two distinctive straight lines can be seen. The corresponding velocities are 8400 and 11,400 feet per second (ft/s), respectively. These velocities are lower than velocities usually attributed to bedrock. However, a fractured bedrock surface could exhibit such low velocities.



XY SYMBOLS

- 0 FEET
- 20
- 40
- 60
- 80
- 100

DATA PROCESSING WITH
THE GREMLIN™ PACKAGE

GREMLIN IS A TRADEMARK OF
GEO-COMPU-GRAPH, INC.
SPOKANE, WA

Figure 6. Velocity analysis graph for time distance data from Line #1.

GEO-COMPU-GRAPH, INC.
SPOKANE, WASHINGTON

VELOCITY ANALYSIS

LINE
MCFARLAND LINE 1
TROND GULCH, BC

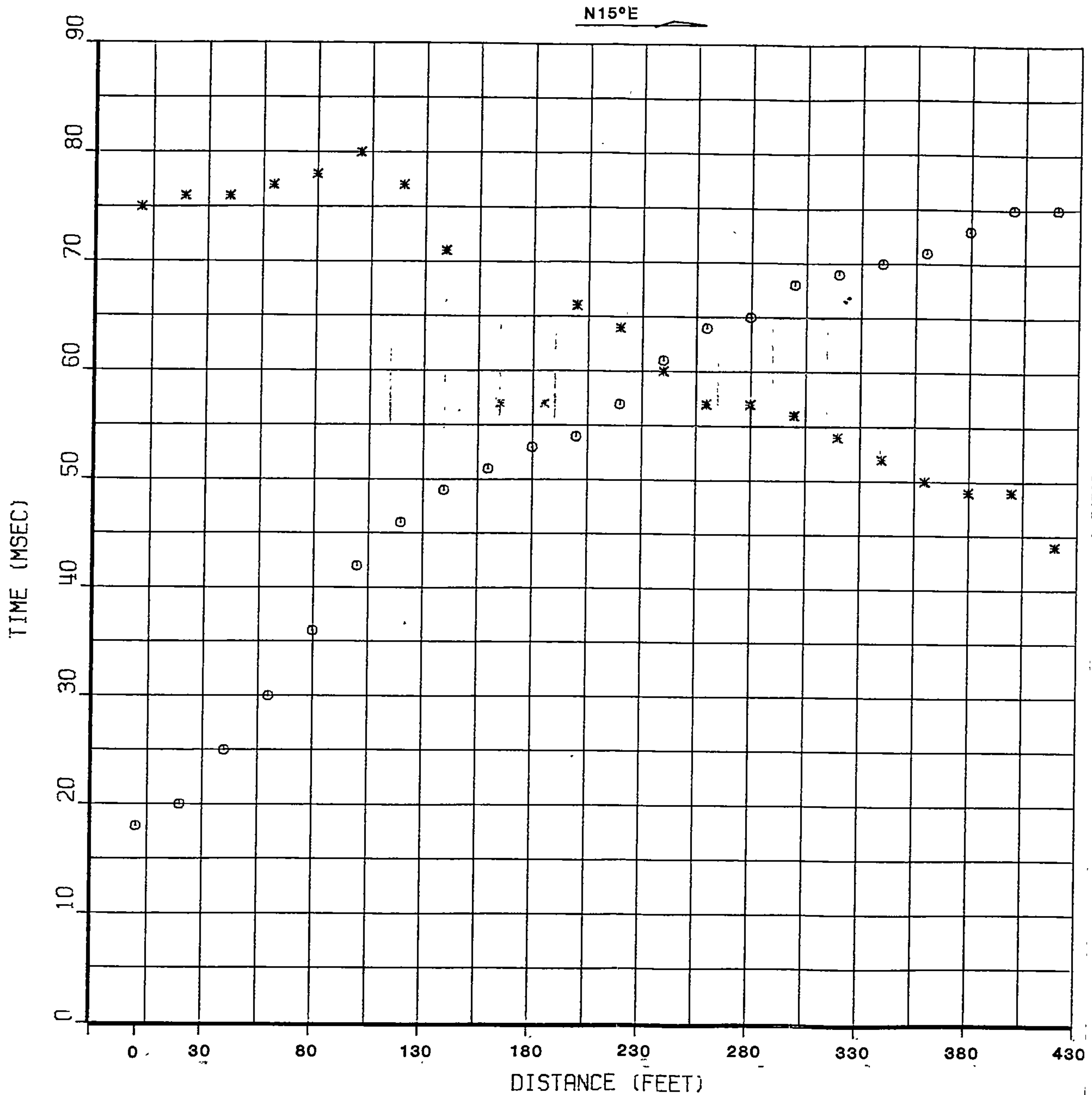


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Figure 5. Composite time distance graph, Line #1.

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TIME DISTANCE GRAPH

LINE
MCFARLAND LINE 1
TROND GULCH, BC

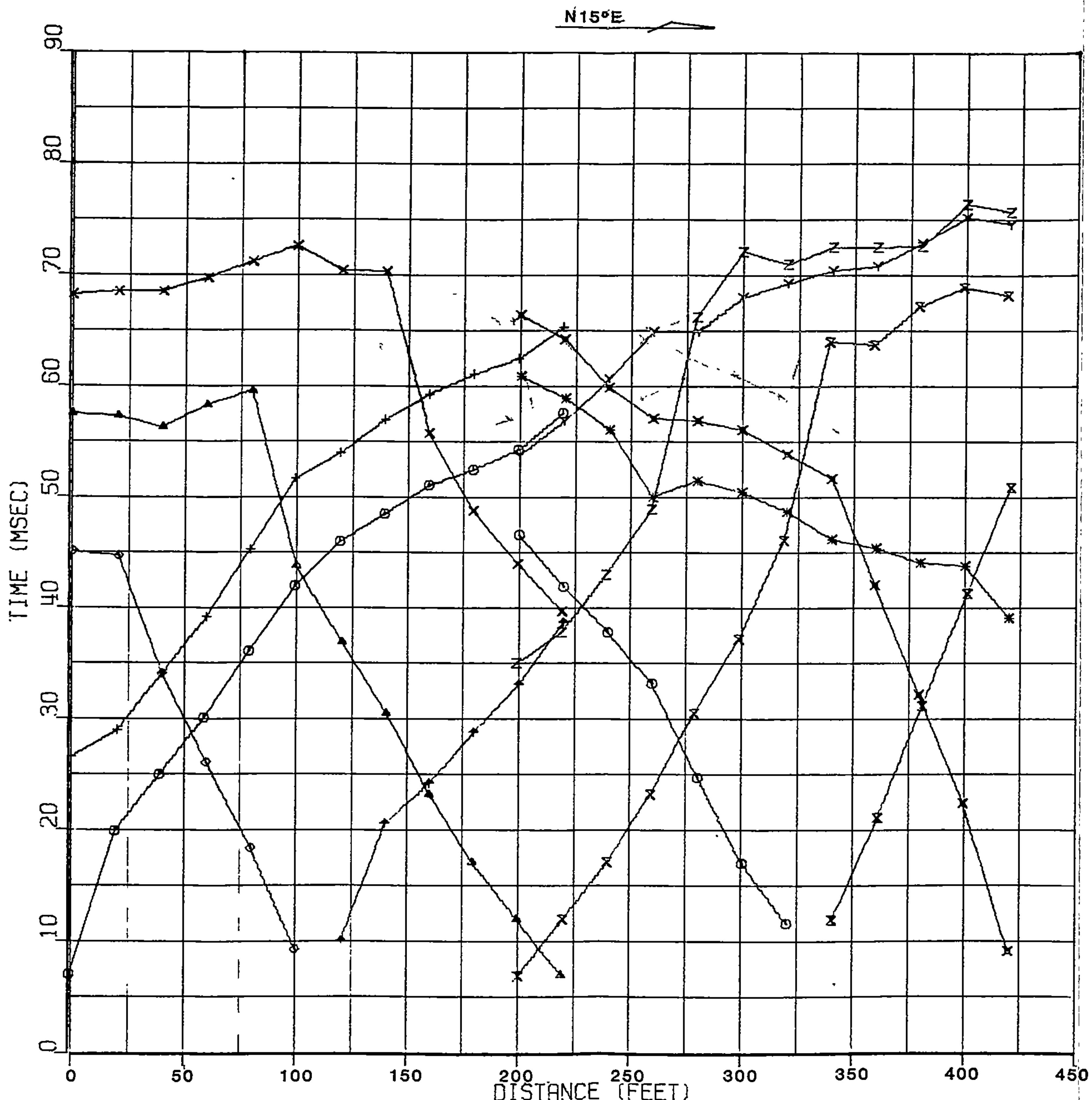

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Figure 4. Time distance graph of all data recorded along Line #1.

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TRAVEL TIME DATA

LINE
MCFARLAND #1
TROND GULCH, BC

The velocities of the materials overlying the bedrock refractor are not defined as well as the velocities of the bedrock. Because continuous coverage of the overlying refractors was not obtained in the field (this is a time consuming task), less sophisticated means were used to estimate the velocities and thicknesses of the overlying layers. The estimates are based upon the data presented in the time distance graph (Fig. 4).

The final stage in the computer assisted data interpretation is the generation of the cross section of the earth based upon the refraction arrivals. The final interpretation plot for the data from Line #1 is Figure 7. The surface topography is drawn, and below each geophone point is a symbol representing the depth to a refracting horizon. Lines have been drawn manually to indicate the horizons, and the velocities of the various layers have been posted.

The bedrock surface is represented by the smooth curve that connects tangent lines to the computer drawn arcs. Narrow channels incised into the bedrock are of importance to the present study. The arcs give a graphic indication of the smallest size of channel that the refraction method could detect. This is a limitation of the method itself, not a limitation of the data that were collected, the survey design, or the interpretation technique.

A drill hole had been previously drilled near the middle of Line #1. The interpreted depth to the bedrock at the drill site is approximately 93 feet; the drilled depth was reported to be 95 feet. The GREMLIN™ Package in no way relies upon the known depth in making its calculations. The drilled depth and the calculated depth can be compared to give an indication of the resolution of the refraction method and the interpretation scheme applied.

Of particular importance in the close agreement of the drilled and interpreted depths along Line #1 is that the subsurface geology appears to satisfy one basic presumption in refraction surveying. That is, no extensive refracting horizon in the subsurface appears to have a velocity greater than the layer overlying it.

(GREMLIN is a trademark of Geo-Compu-Graph, Inc.)

Interpretation

The same interpretation procedure described above was applied to the data from Lines #2, #3, and #4. The time distance graphs, the composite time distance graphs, and the final interpretation plots are all included in the following pages (Figs. 8 through 18). On each computer drafted interpretation plot, the layer boundaries and velocities have been added. The bedrock velocities vary across the study area. This is attributed to different degrees of fracturing in the bedrock and possibly to the effect of crossing the fracture set at different

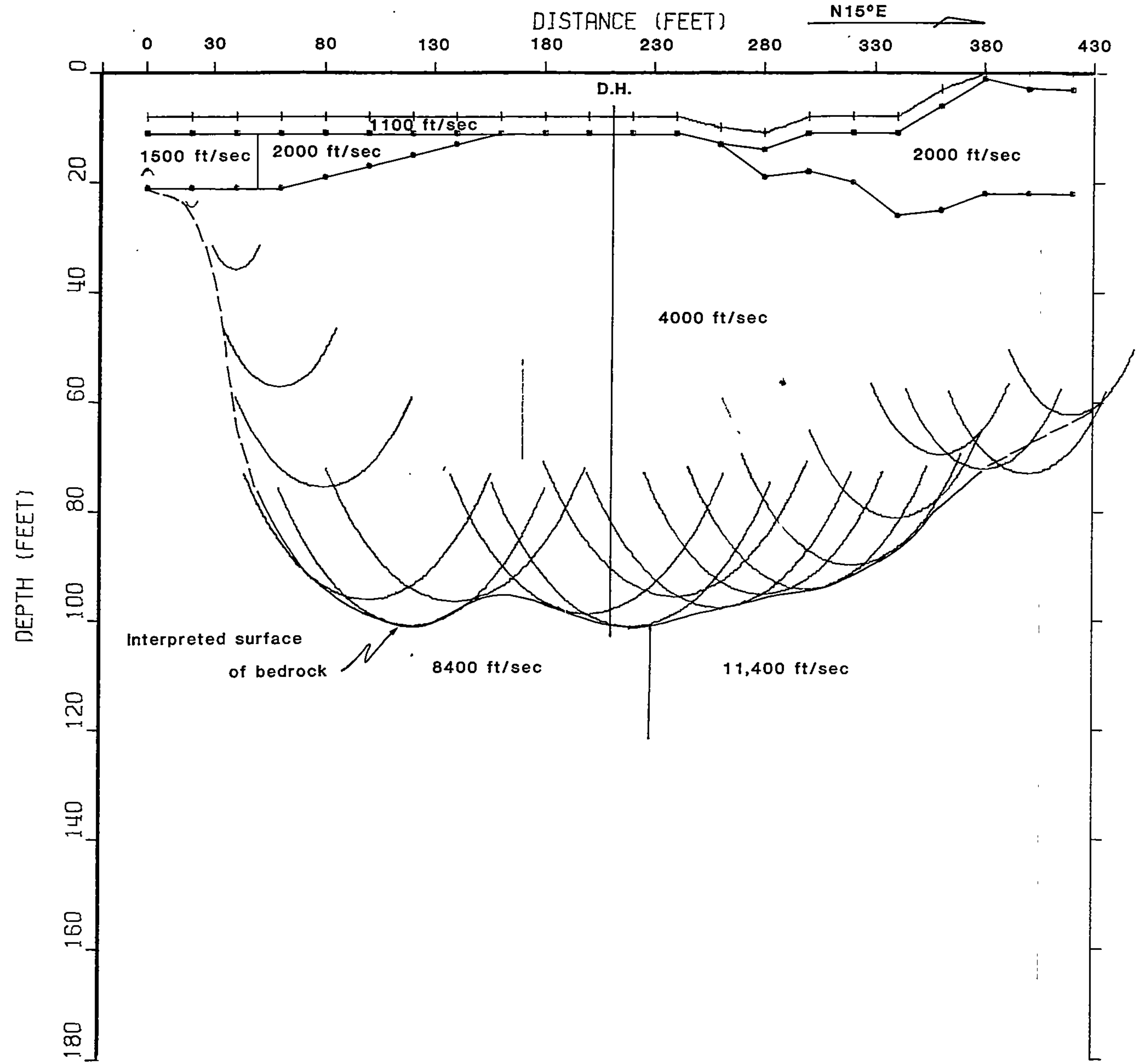

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Figure 7. Computer assisted interpretation, Line #1.

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DEPTH SECTION

LINE
MCFARLAND LINE 1
TROND GULCH, BC

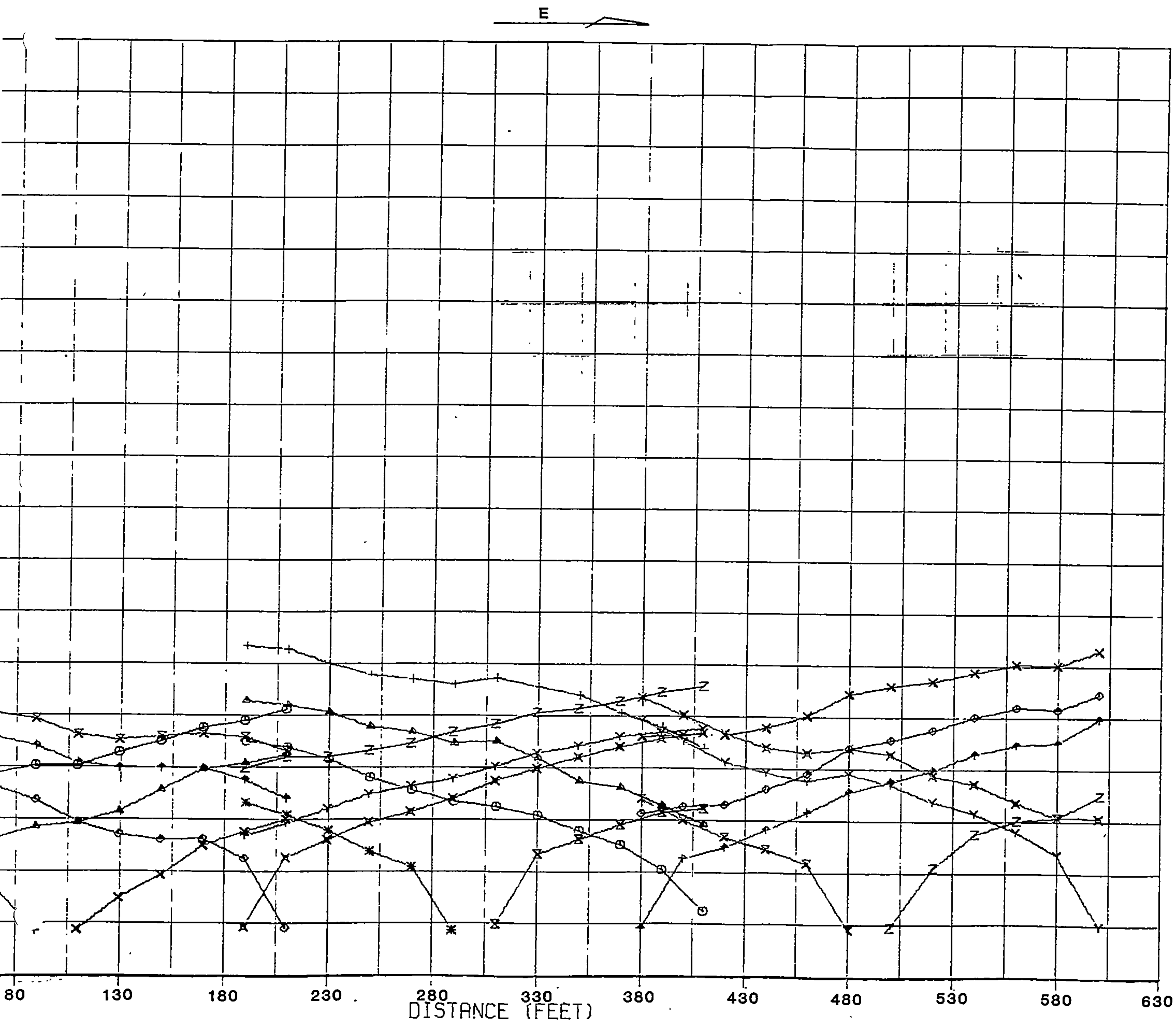

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Figure 8. Time distance graph of all data recorded along Line #2.

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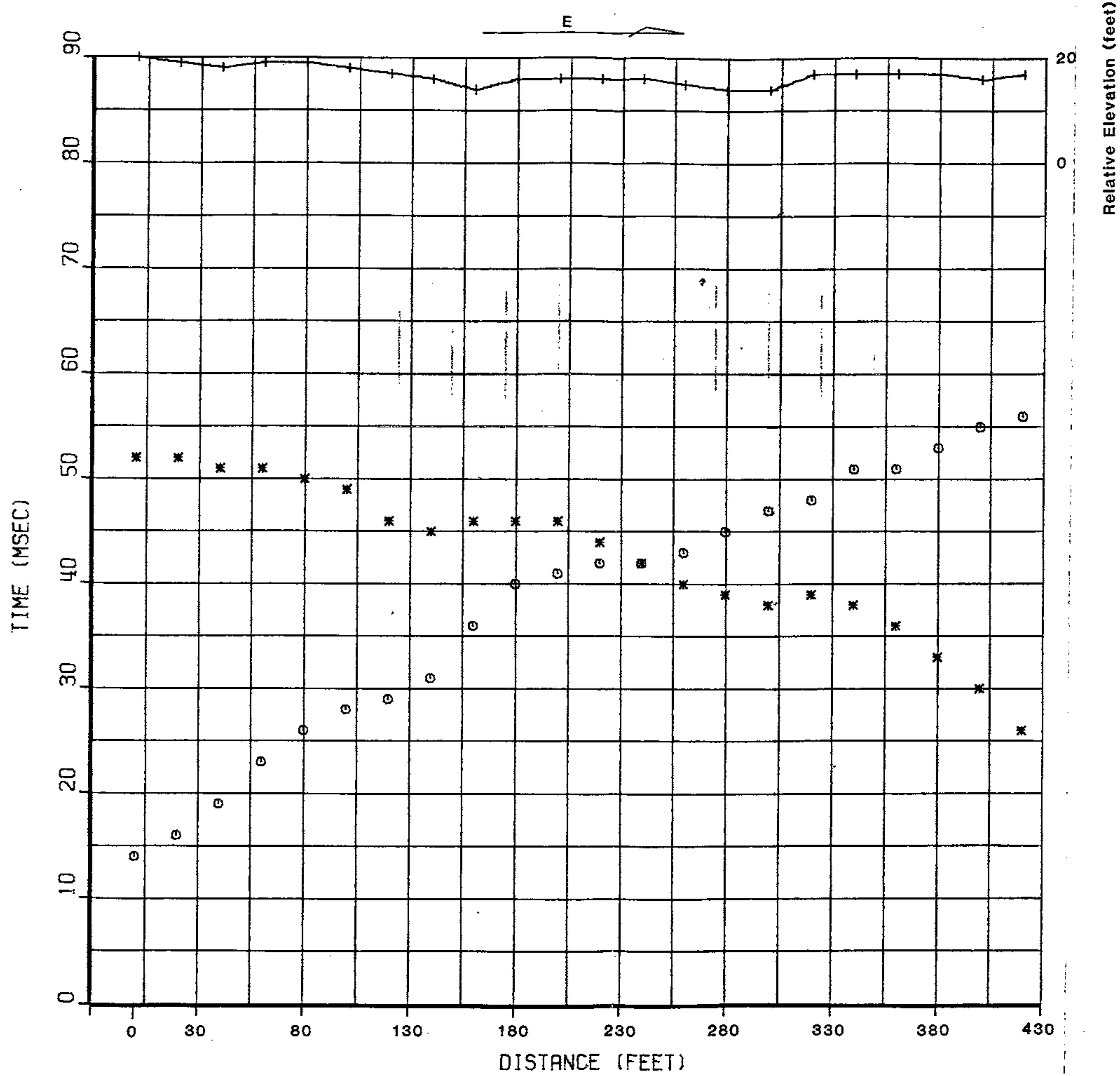
SPOKANE, WA

TRAVEL TIME DATA

LINE
MCFARLAND #2
TROND GULCH, BC



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SPOKANE, WA

Figure 9. Composite time distance graph, Line #2, Part 1

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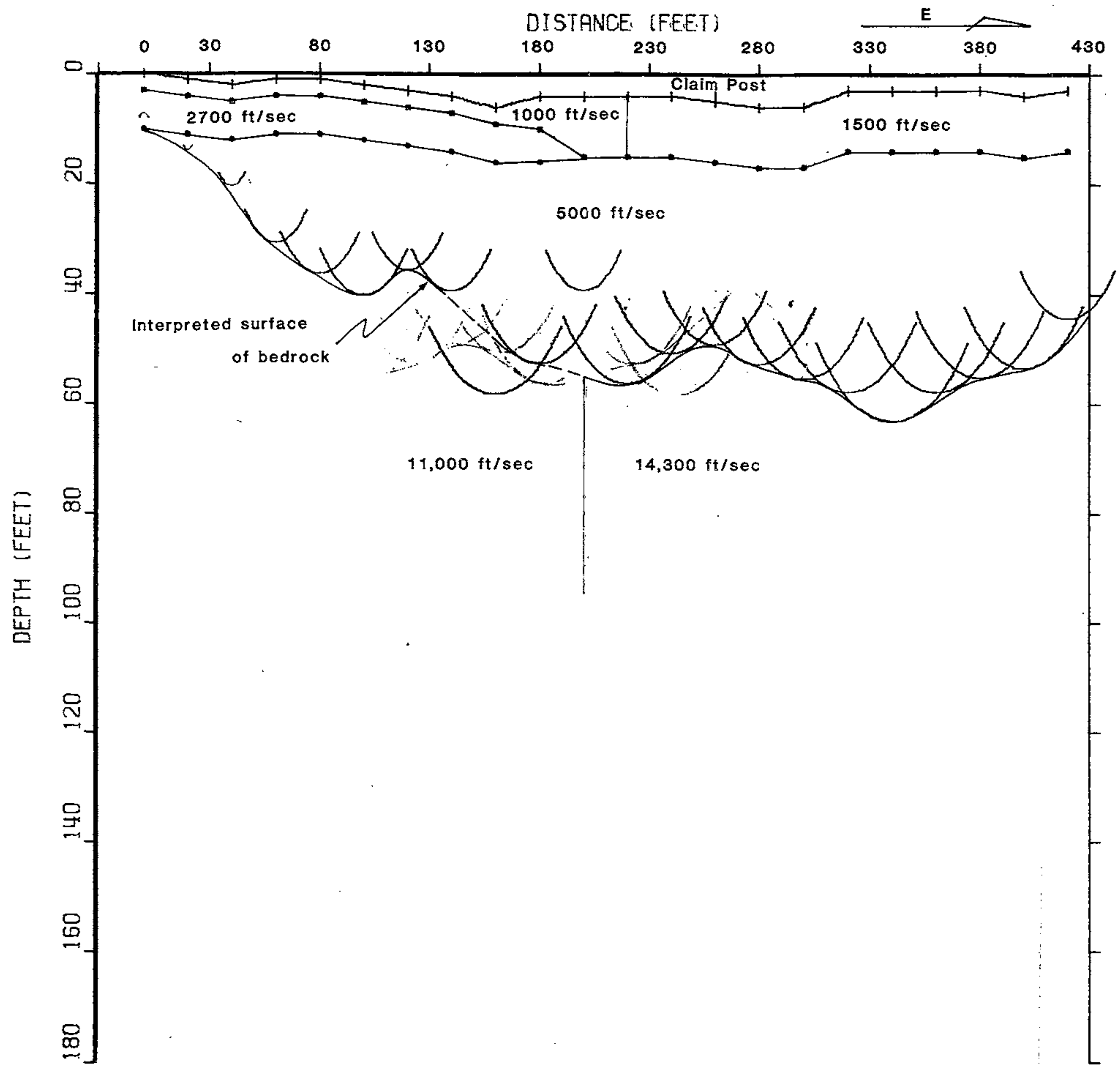
SPOKANE, WASHINGTON

TIME DISTANCE GRAPH

LINE
MCFARLAND #2, PAIR 1
TROND GULCH, BC



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SPOKANE, WA

Figure 10. Computer assisted interpretation, Line #2, Part 1.

GEO-COMPU-GRAPH. INC. SPOKANE. WASHINGTON
DEPTH SECTION
LINE MCFARLAND #2. PAIR 1 TROND GULCH. BC

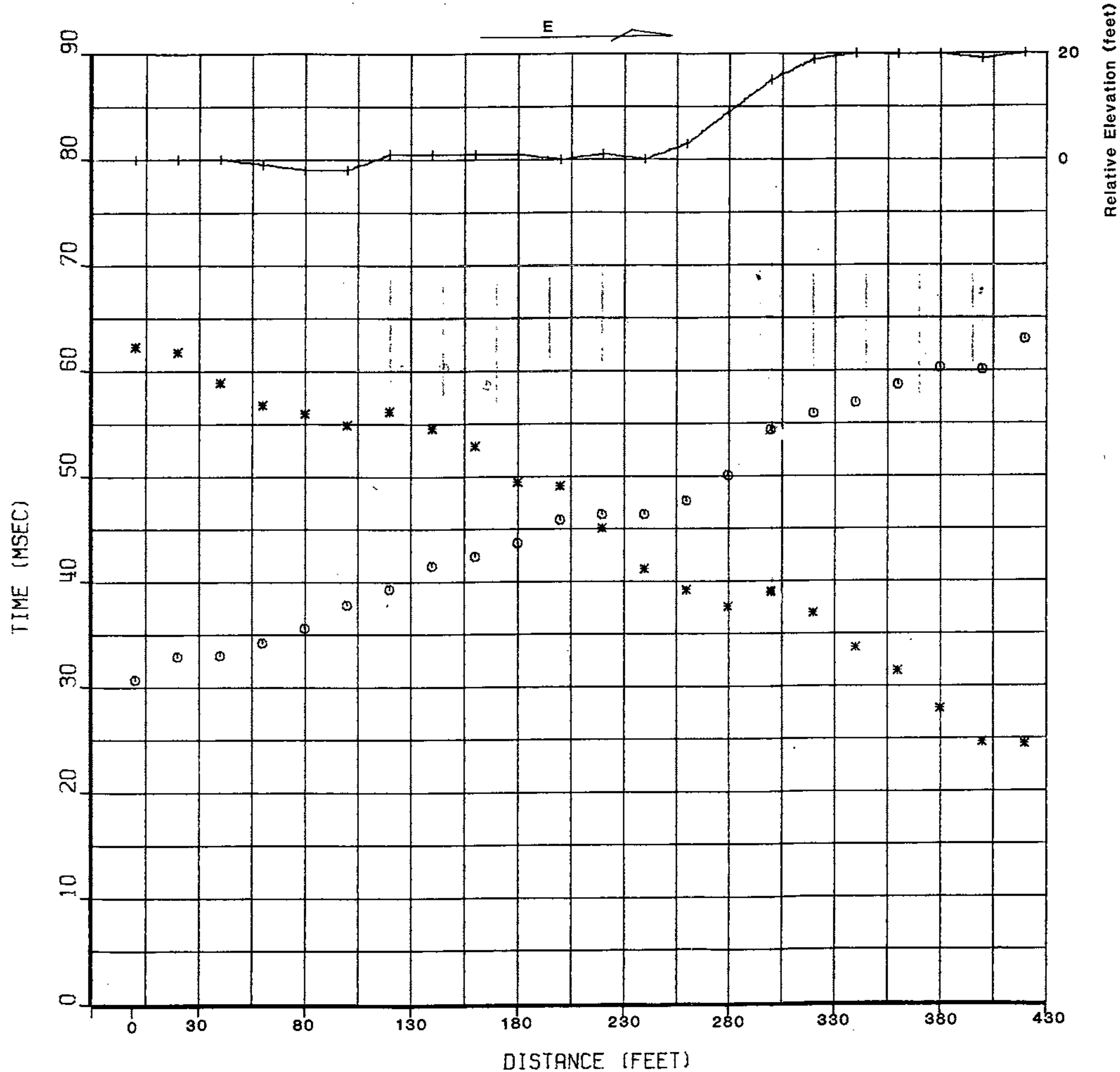

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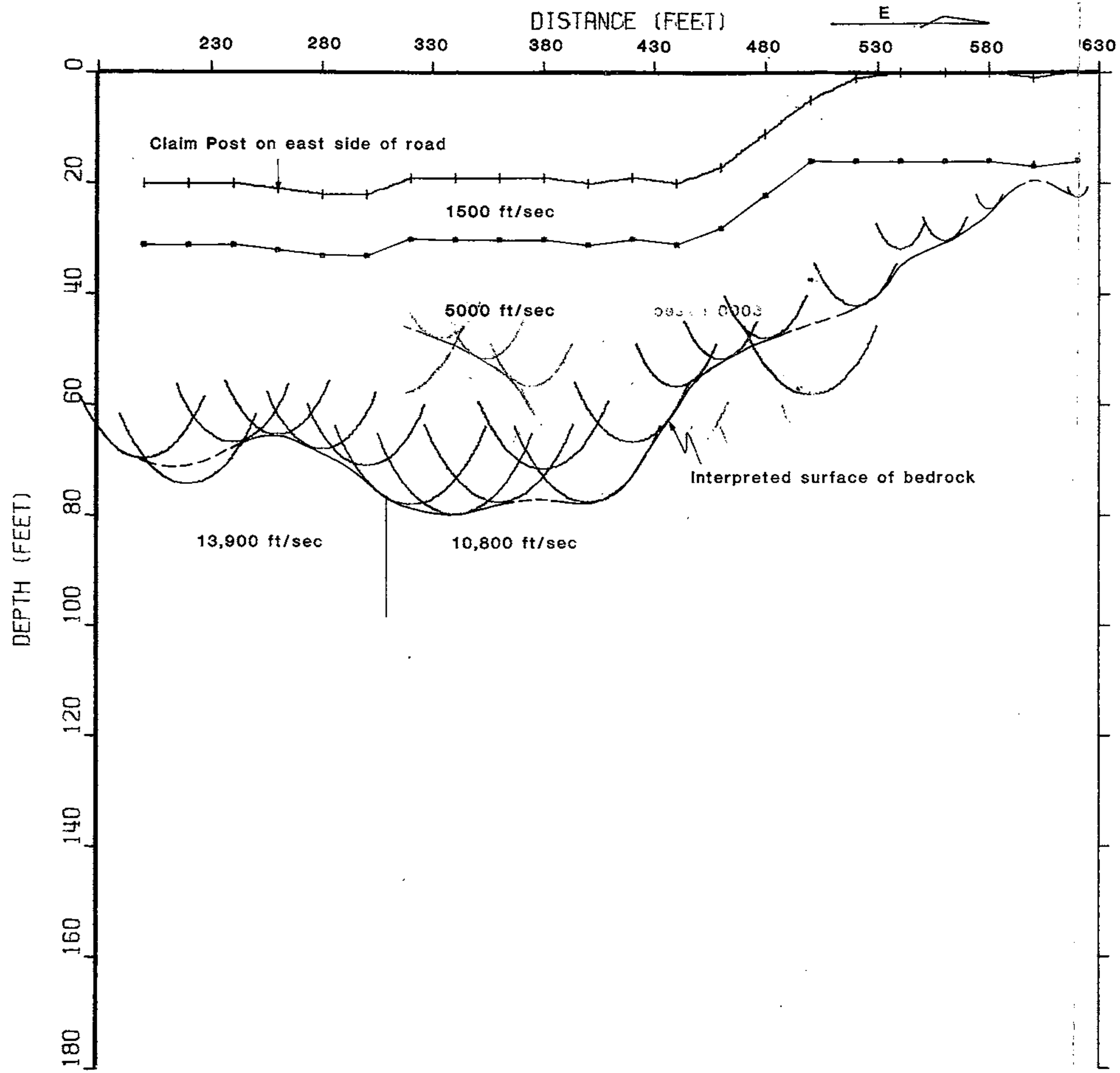
Figure 11. Composite time distance graph, Line #2, Part 1.

GEO-COMPU-GRAPH. INC
SPOKANE. WASHINGTON

TIME DISTANCE GRAPH

LINE
MCFARLAND #2. PAIR 2
TROND GULCH. BC



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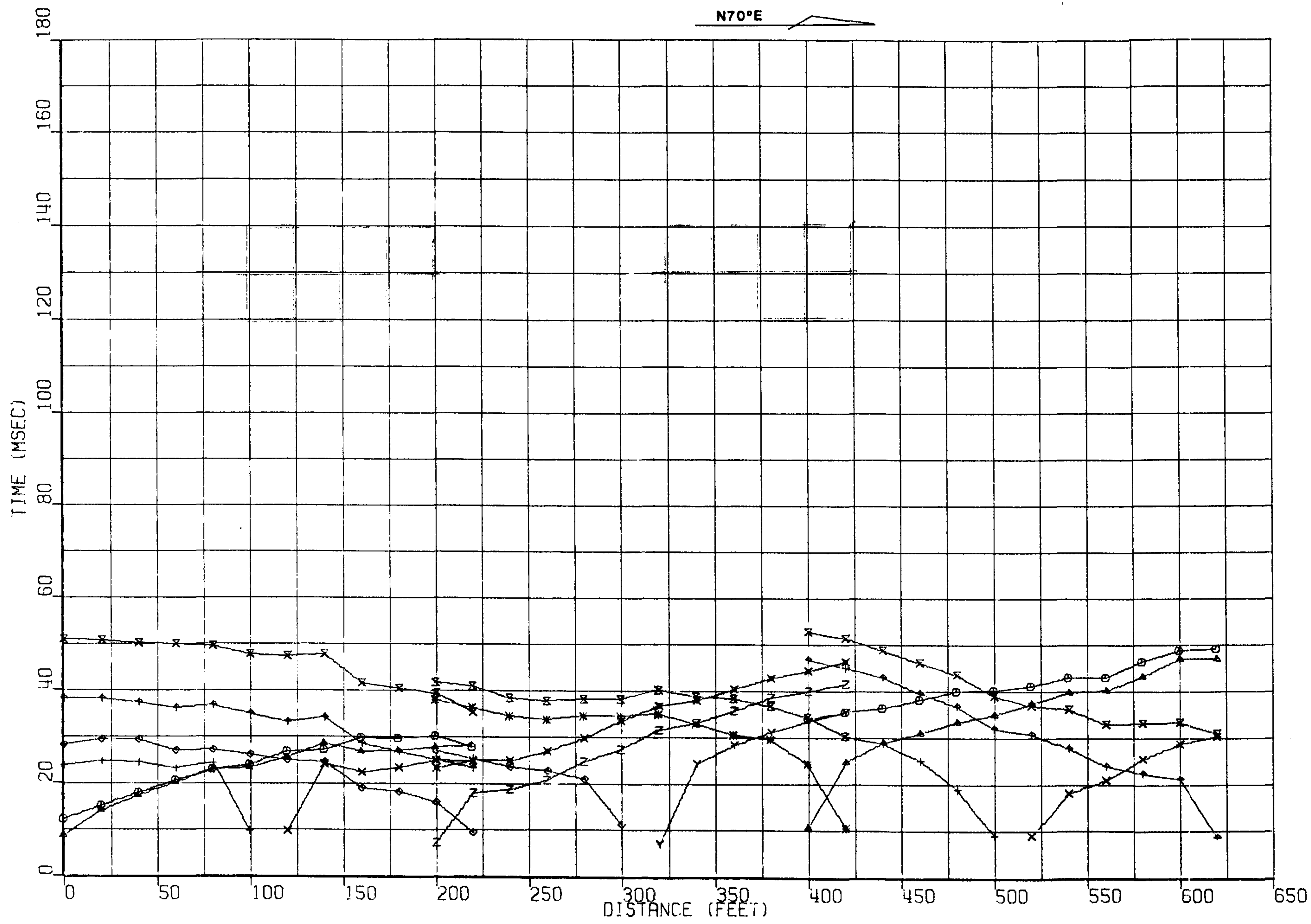
SPOKANE, WA

Figure 12. Computer assisted interpretation, Line #2, Part 2.

GEO-COMPU-GRAPH. INC
SPOKANE. WASHINGTON

DEPTH SECTION

LINE
MCFARLAND #2. PAIR 2
TROND GULCH. BC



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SPOKANE, WA

Figure 13. Time distance graph of all data recorded along Line #3.

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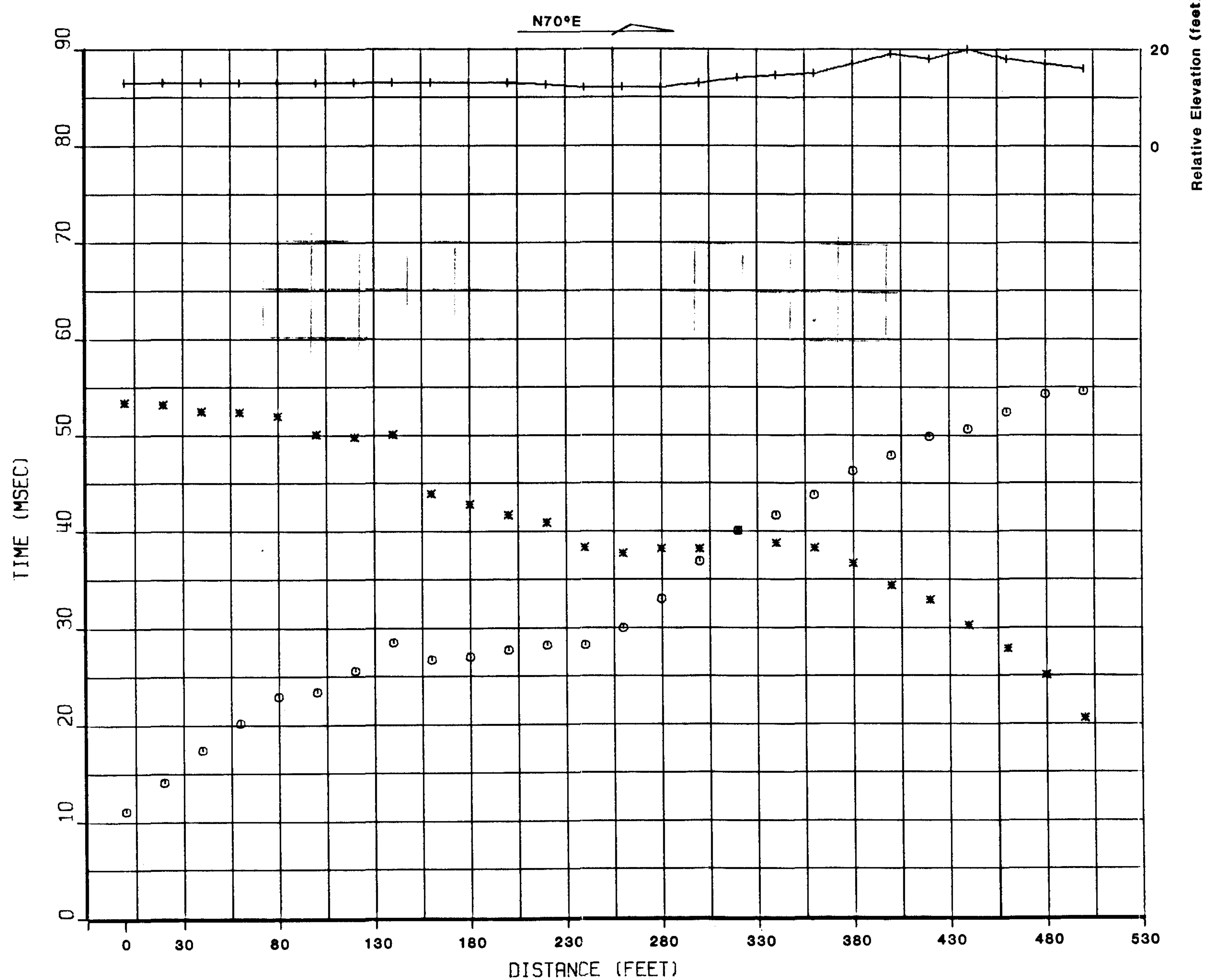
SPOKANE. WA

TRAVEL TIME DATA

LINE
MCFARLAND
TROND GULCH. BC



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SPOKANE, WA

Figure 14. Composite time distance graph, Line #3.

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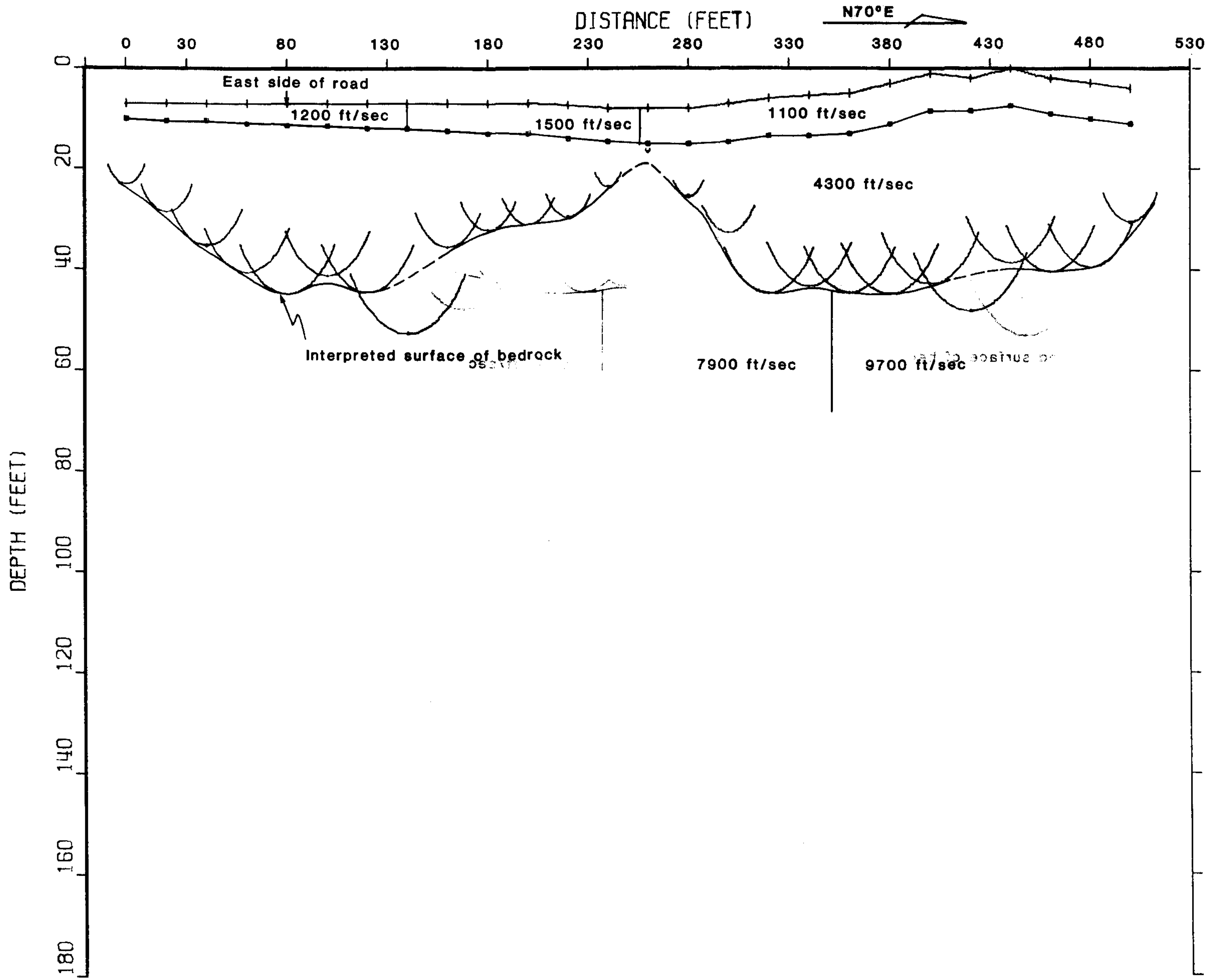
SPOKANE, WA

TIME DISTANCE GRAPH

LINE
MCFARLAND LINE 3
TROND GULCH, BC



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SPOKANE, WA

Figure 15. Computer assisted interpretation, Line #3.

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SPOKANE. WA

DEPTH SECTION

LINE
MCFARLAND LINE 3
TROND GULCH. BC

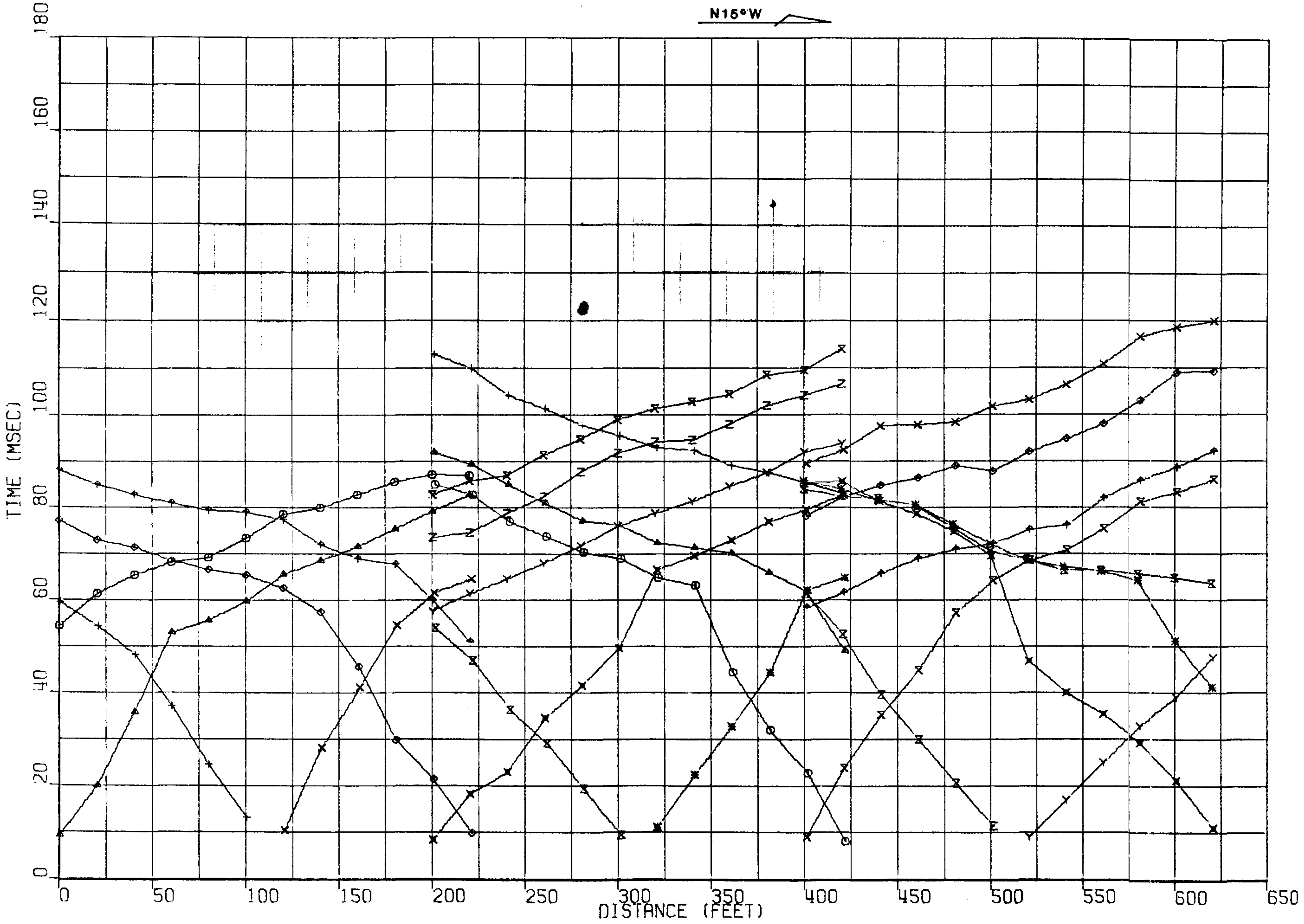

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Figure 16. Time distance graph of all data recorded along Line #4.

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SPOKANE, WA

TRAVEL TIME DATA

LINE
MCFARLAND
TROND GULCH, BC

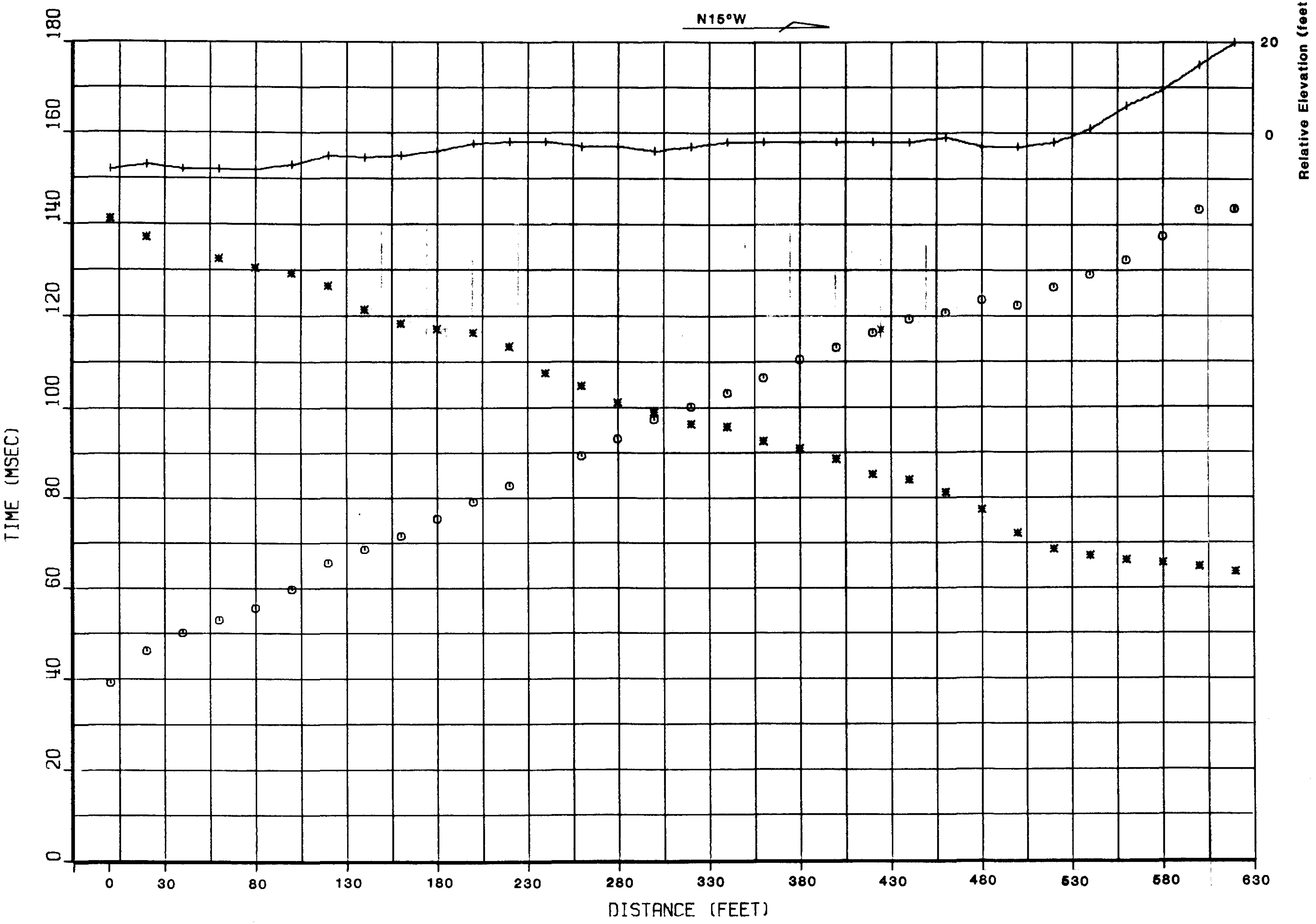

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Figure 17. Composite time distance graph, Line #4.

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TIME DISTANCE GRAPH

LINE
MCFARLAND LINE 4
TROND GULCH. BC

orientations as a function of line direction.

Two general velocity ranges occur above the bedrock. Material in the range of velocities less than 4000 ft/s can be considered to be unsaturated alluvium. Velocities in the range of 1000 to 2000 ft/s are usually considered to be dry, relatively uncompacted soil. The materials exhibiting velocities greater than 4000 ft/s are probably saturated alluvium. No further statement about the composition of the unconsolidated sediments can be made based upon the refraction data.

Line #2 is presented in two parts (Figs. 8 through 12). The two parts overlap approximately 200 feet. Comparison of the two computer plotted cross sections (Figs 10 and 12) will give an idea of the effects of interpreter subjectivity on the final cross section.

Conclusions and Recommendations

The surface of the bedrock in Trond Gulch was mapped with the seismic refraction method along four lines. The bedrock appears to increase in depth from the southeastern part of the study area (Line #3) to the northwestern part (Line #4). The present survey, with its lines widely spaced, is unable to clearly indicate the presence of any channel incised into bedrock throughout the study area. Future seismic work should be conducted along lines that are more closely spaced.

Future seismic work should include the use of an engineer's level to more accurately determine the relative elevation changes along each survey line and the relative elevations of adjacent lines. In areas where the depth to the bedrock is greater than 50 feet, a larger energy source should be considered. Small explosive charges would speed data acquisition and provide clearer first break arrivals on the seismic records. The extra cost of the explosives would be offset by the faster data acquisition rate.

The refraction survey at Trond Gulch met with minimal operational and geologic problems. The refraction method should be considered for detailed mapping of the bedrock surface if gold bearing strata can be identified through drilling in the valley.

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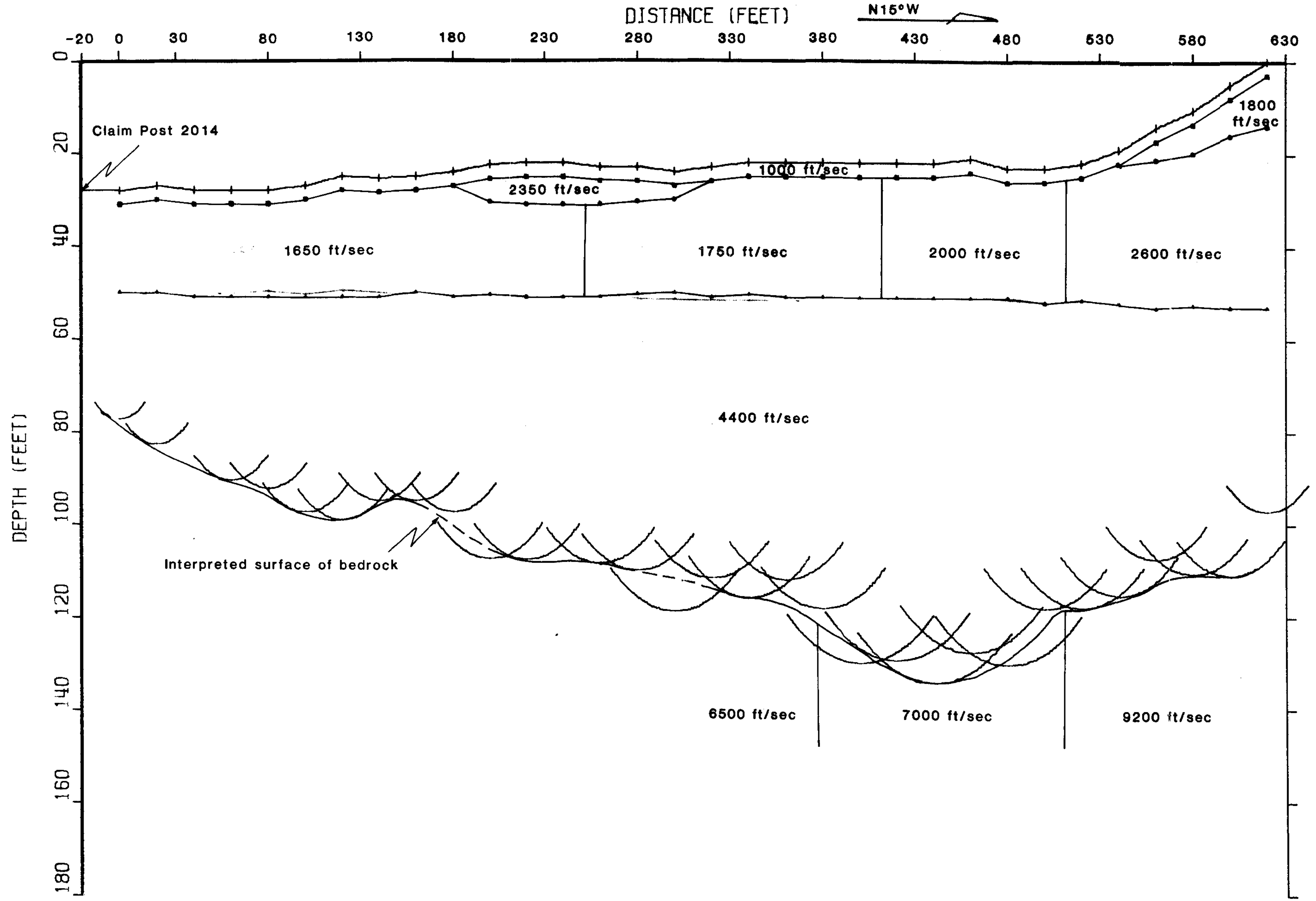

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Figure 18. Computer assisted interpretation, Line #4.

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DEPTH SECTION

LINE
MCFARLAND LINE 4
TROND GULCH. BC