Armside Mining Ltd. (NPL)
July 12, 1979

92C044-07 SOMBRIO PLACERS

005995

92C044(9W)

PROPERTY FILE

PROPERTY FILE

Sombrio Placers 92C044

Enclosure III

92C09W

G E O C H E M I C A L   R E P O R T
O N
L O S S   C R E E K   A N D
S O M B R I O   C L A I M   G R O U P S

PROPERTY FILE

L O C A T I O N

On the West Coast of Vancouver Island, approximately 8 miles south of Port Renfrew, bounded by Loss Creek, Sombrio River and the Strait of Juan De Fuca.

Latitude approximately 48° o6' N

Longitude approximately 124° 18' W

AUTHOR

F.C. Loring, P. Eng.

A.B.L. Whittles, Ph.D.

HOLDER OF CLAIMS

ARMSIDE MINING CO. LTD. (NPL)
VICTORIA, B.C.

FIELD WORK DONE:

June 17 and 18, 1974

REPORT COMPLETED

July 10, 1974

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ASSESSMENT REPORT SUMMARY

A gravel/sand sampling project was carried out along the creeks that run through the central and western ravines on the claim area (See Figure 4). These samples were analysed for gold. Only traces were found in any of the samples.

Recommendations for the property are also made in this report.

1. PROPERTY DESCRIPTION, LOCATION AND ACCESS

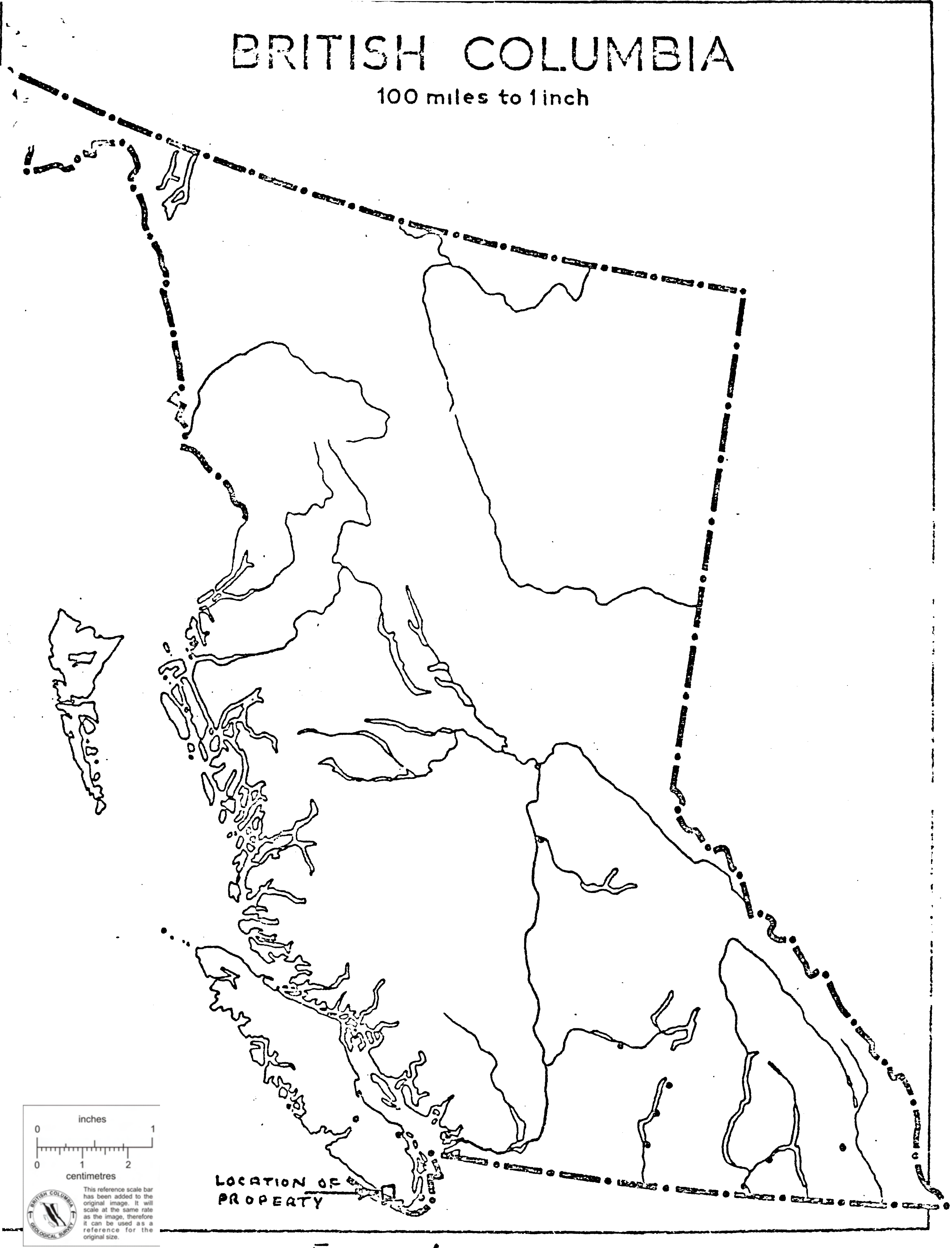
(a) LOCATION AND ACCESS

The claims and placer leases are reached by the public road going south from Port Renfrew. About 11 miles south of the Recreation Center in Port Renfrew, logging roads cut off to the left (to the south). There is a closed steel gate a short way in from the main road on the eastern side. The work described in this report was carried out from the logging road which enters the western side of the claim group.

Please refer to Figures 1, 2 and 4 for specific access details.

(b) PROPERTY DESCRIPTION

The property is, in the main, a fairly level area underlain by 200 - 400 feet depths of sand, gravel and clay. It appears to be the remains of an glacial delta. The east side is cut deeply by Loss Creek, and the west side by Sombrio River. Several run-off ravines cut the delta in the central and western portions. Much of the area has been logged off and the undergrowth has become very thick. Some large cedar and fir trees are still standing along the southern part of Loss Creek, and on the west side of the old delta.


BRITISH COLUMBIA
100 miles to 1 inch
LOCATION OF
PROPERTY
inches
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centimetres
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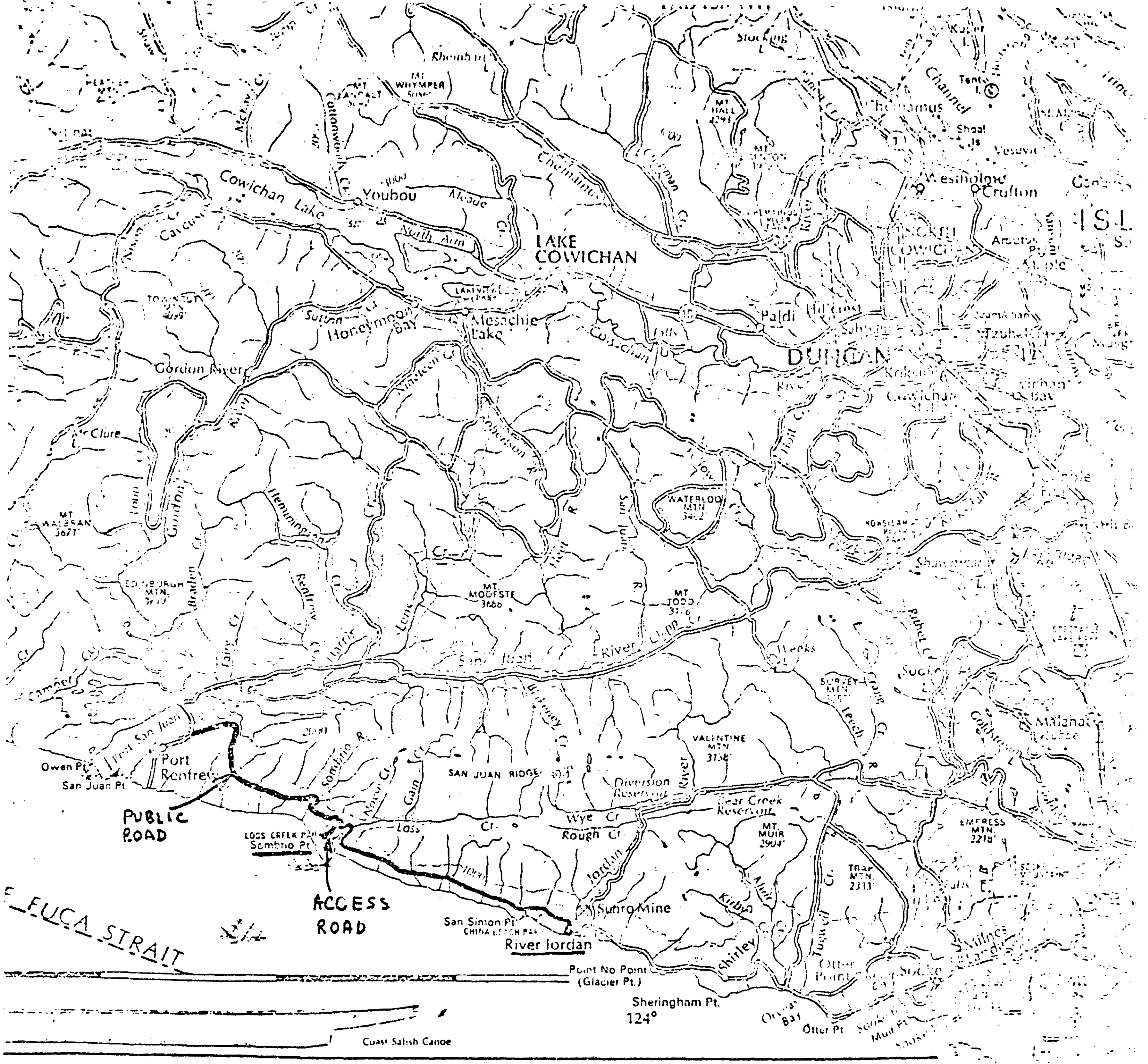
BRITISH COLUMBIA
GEOLOGICAL SURVEY

Figure 1.



DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
BRITISH COLUMBIA
HONOURABLE R. G. WILLISTON, MINISTER
R. TORRANCE, DEPUTY MINISTER OF LANDS   G. S. ANDREWS, DIRECTOR OF SURVEYS AND MAPPING
W. R. YOUNG, CHIEF GEOGRAPHER

VANCOUVER ISLAND

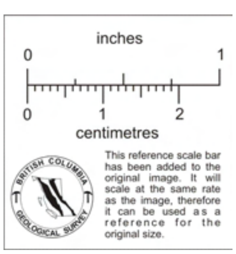
FIG. 2

Scale: 6 Miles to 1 Inch

10 5 0 10 20 30

REFERENCE

Provincial Park		HIGHWAYS AND ROADS		Municipality	CITY
Campground		Hard Surface			TOWN
Airport		Loose Surface All Weather			VILLAGE
Customs		Loose Surface Dry Weather			DISTRICT
Contours		Main Private (Logging, Mining)		Post Office	
Glacier		Trail		Settlement	
Railway (Passenger)		Road Distances in Miles		Landing	



2. OWNERSHIP

The mineral claims and placer leases are owned or leased by the Armside Mining Co. Ltd (NPL), of Victoria, B.C. These include:

Placer Lease No.	257
Placer Lease No.	258
Placer Lease No.	269
Placer Lease No.	270
Placer Lease No.	271
Placer Lease No.	272
Placer Lease No.	273
Placer Lease No.	274
Placer Lease No.	275
Placer Lease No.	276
Placer Lease No.	277
Placer Lease No.	278

Mineral Claim:	307951M (ARM. 1)
Mineral Claim:	307952M (ARM. 2)
Mineral Claim:	307953M (ARM. 3)

These are grouped together in two separate groups. The Loss Creek Group and the Sombrio Group.

3. HISTORY

Not too much information was found regarding previous work; however no careful search of the B.C. Minister of Mines Reports was undertaken. Clapp (1912) does point out that (at that time) some hydraulic work was being planned on the Sombrio River. The owners at that time stated that mining engineers had estimated gold contents at 12 cents a yard, and the total volume of the deposit to be 155,000,000 cubic yards.

It does not appear that much development did, in fact, take place although some of the old hydraulic equipment was reported found by Mr. R. Spring, who owned the property prior to Armside Mining Ltd.

4. GENERAL GEOLOGY OF THE AREA

Sombrio Point and the area inland covered by the claims and placer leases appears to lie along the Leech River Valley Fault that stretches from west of Victoria through to the coast near Sombrio Point. Rock types lying to the north of this fault (Muller, 1971) are given as Paleozoic and/or Lower Mesozoic schists and gneisses (Leech River Schists). To the south younger basalts and tuffs (Eocene) are reported. These rock types are overlain with sandstones and shales, according to Muller.

The present writer's observations confirm these findings, in the main. Most of the exposed rock was observed in the bed of Loss Creek where it leaves one canyon and before it enters the last canyon to the coast, (between lines 450N and 300S on Figure 3, on the bend or bow in the creek.) The basement rock types observed were primarily volcanics, suggesting this location is still to the south-east of the fault. However, these rocks were observed to be overlain with sandstones and conglomerates (the latter is not given on the Muller map), in the creek bed and on the east bank of the creek. The whole area to the west of the creek is covered deeply (60 - 50 feet) with recent, post-glacial, deposits of sand, clay and gravel.

Sandstone and conglomerate were also observed in the creek bed that runs through the central ravine. The coastal rocks have not been examined by the present writer.

It has been postulated (Clapp, 1912) that the area is the remains of a delta deposited by glacial and post glacial rivers which drained south-westward through the Leech River Valley.

Apart from possible mineralization of the volcanics (which is not too likely in view of the youth of these rocks) the main possibility appears to be placer gold. This gold is supposed (Clapp 1912 - p. 155) to have been derived from quartz veins and stringers in the "Leech River slates". The present writer could not locate these on the Muller Map, and feel that the source of the gold is not at all clear. It could be related to the old Sicker Volcanics or even the young Tertiary Intrusives which occurs along the Leech River Fault.

In any case there is no doubt that some gold does occur in these gravels (personal observations, and Clapp - 1912, p. 156).

5. GENERAL FIELD PROCEDURES

Two starting points were selected using aerial photographs (See Figure 4). These are located on the edge of logging roads or yarding sites. No actual surveying was done, so the locations of the stations on Figure 4 are to be considered only approximate; instead the stations were flagged on the site with ribbons marked with the station numbers. It was felt that the extra time and expense involved in making a precise survey could not be justified unless the samples analysis results were encouraging. If the results were good, survey could locate the ribons more precisely. As it turned out, the results were not encouraging. The approximate locations of the stations shown in Figure 4, were estimated from creek and ravine bank features (slides, etc.), as determined from the aerial photographs.

The samples were taken at the upstream edges of sand or gravel bars by digging down 6" or 12"; or in some cases in potholes on bedrock. These are discussed in the following section.

At most locations where samples were taken another shovelful was panned, and examined under the hand lens.

6. GEOCHEMICAL RESULTS

The following samples were taken at the upstream edge of gravel or sand bars: RL1-5, RL1-8.5, RL1-15, RL1-20, RL1-25.5, RL1-30, RL1-34, RL1-37, RL1-39, RL1-43, RL1-44, RL1-46.5; RL2-4, RL2-6, RL2-9, RL2-11, RL2-15, RL2-17.

Sample RL1-11 was taken from a 6" deep pothole in a sandstone bedrock outcrop in the creek bed.

One other outcrop was discovered in the creek bed - at station RL1-45. This was a conglomerate.

As noted, an extra shovelful was panned at most stations where a sample was taken. In most cases a fair residure of black sand and garnets were found in the bottom of the pan. Only samples RL1-30, RL1-34, RL2-6, RL2-15 had little or no black sand.

Only two samples: RL1-'43, and RL1-44; had what appeared to be visible gold in them, and in each case this consisted of one or two very small colors.

Sample RL1-8.5 had a small ($\sim \frac{1}{64}$") particle of a brassy mineral that appeared to be pyrite.

Sample RL1-43 - 150 up was taken from a large gravel exposure on the ravine bank, approximately 150 feet up from the bottom of the ravine.

None of the gold assay results appear to be encouraging, as can be seen from the Certificate of Assay, following (Figure 3).

To: Vi /entures Ltd.

PAGE No. 1

REPORT No A? 296

DATE: June 28, 1974

BONDAR-CLEGG & COMPANY LTD.

CERTIFICATE OF ASSAY

FIGURE 3

R. R. #2
Qualicum Beach, B. C. VOR 2TO
Attn: Mr. F. C. Loring

Samples submitted: June 21, 19
Results completed: June 28, 19

I hereby certify that the following are the results of assays made by us upon the herein described sand samples.

MARKED	GOLD		SILVER								TOTAL VALUE PER TON (2000 LBS.)
	Ounces per Ton	Value per Ton	Ounces per Ton	Percent	Percent	Percent	Percent	Percent	Percent	Percent	
RL1 - 5	trace										
8.5	trace										
11	trace										
15	trace										
20	trace										
25.5											
30	trace										
34	trace										
37	trace										
39	trace										
43	trace										
43 - 150 up	trace										
44	trace										
46.5	trace										
RL2 - 4	trace										
6	trace										
9	trace										
11	trace										
15	trace										
17	trace										

Registered Assayer, Province of British Columbia

8

7. INTERPRETATIONS

It certainly appears that there are no large amounts of gold distributed uniformly throughout the old river delta. (Please Refer to the 1973 Geophysical Report on the Loss Creek Claim Group for a further discussion of this Delta.) There may be several locations (certain gravel or sand beds) that carry greater amounts of gold, although none has been confirmed by a certified analysis as of yet. It is probable that these beds, if they exist, are under considerable depths of clay which probably contains very little in gold values. However, it could be that certain of these gravel beds are very rich in gold (for such is the discontinuous nature of gold bearing placers) and could more than pay for the removal of the clay overburden. This one last possibility has not been checked out by any program yet carried on this property.

8. RECOMMENDATIONS

(1) While none of the certified analyses have yet been encouraging it is recommended that the work done to date on the property be filed as assessment work for at least three years.

(2) One more small sampling program is recommended. An independent sampler should go to those sites indicated by the original owner, R. Spring, and take one sample at each site. Each sample should be split into four portions to be analysed as follows: (a) by gold fire assay (b) by spectrographic gold analysis (c) by Mr. Spring. The fourth portion should be panned and visually examined. Estimated costs for such a project are as follows:

(i)	Costs for Sampling (1 day, 10 samples)	$100
(ii)	Travel 150 miles @ 0.20	30
(iii)	Costs for Planning, visual examination of residue, packaging and shipping samples (3/4 day)	75
(iv)	Costs for plotting of field sites on map, interpreting results and writing a report (3/4 day)	75

(v)	Report Typing, blueprings, duplicating	$ 20
(vi)	Analysis	
	10 gold fire assays @ 4.00	40
	5 spectral analysis @ 20.00	100
	Shipping and postage	5
		$445.00

9. REFERENCES

(1) 1912 "Memoir No. 13, Southern Vancouver Island".

(2) 1971 "Geological Reconnaissance Map of Vancouver Island and Gulf Islands" by Muller.

(3) 1973, Geophysical Report on Loss Creek Claim Group.

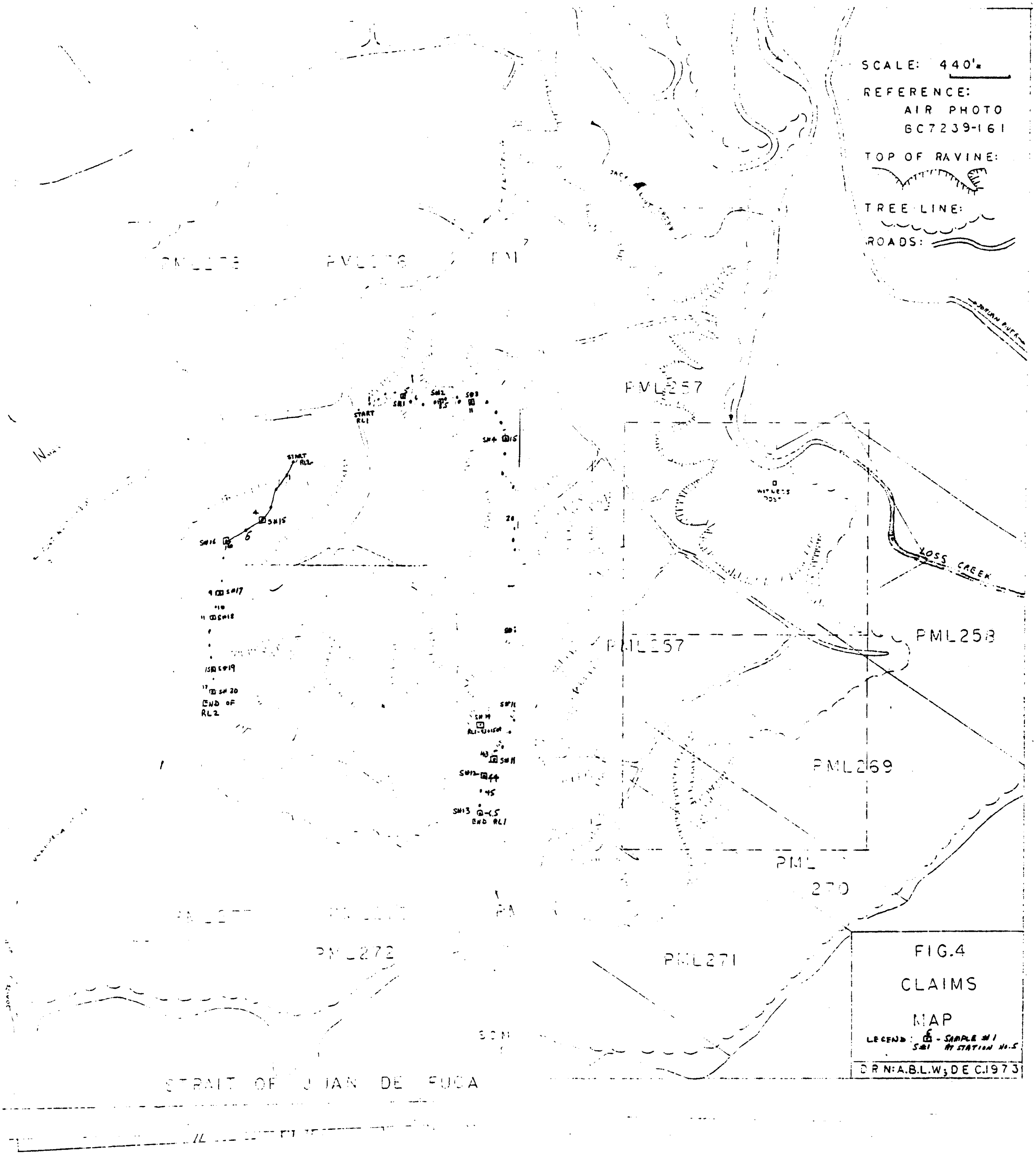


FIG.4
CLAIMS
MAP

10. APPENICES

(a) Cost Analysis

(1) Field Work

F.C. Loring and A.B.L. Whittles June 17 and 18, 1974.	$400.00
(2) Travel and Board	43.85
(3) Sample Analysis and Shipping (20 samples, gold fire assay)	106.15
(4) Plotting, Interpretation, typing, blueprints, and duplicating of report	50.00
	$600.00

(b) Resume of Technical and Field Work Experience of Dr. A.B.L. Whittles, Ph.D.

(1) University training at University of B.C. and University of Toronto, with the completion of a Ph.D. in Physics (Geophysics section) in 1964, for U.B.C.

(2) Prior experience (2 summers) with geophysical section Imperial Oil Ltd., in Alberta.

(3) Surveying experience, Buttle Lake Power Project.

(4) Four years at the B.C. Institute of Technology, teaching geophysical prospecting courses to day and evening students, and three years at Malaspina College.

(5) Consulting experience during the past seven years with companies in Vancouver, Victoria, and Calgary, including field supervision and interpretation.

(6) Presently in charge of the Geological Technology, Malaspina College, Nanaimo, and including the teaching of courses on geophysical prespecting.

(7) An active member with the Society of Exploration Geophysicists, and the B.C. Geophysical Society.

A.B.L. Whittles

Dr. A.B.L. Whittles, Ph.D.

CERTIFICATE

(c)

I, Frank C. Loring, of Qualicum Beach, B.C. hereby certify that:

1. I am a Consulting Mining Engineer, residing at R.R. #2, Qualicum Beach, B.C.

2. I am a graduate of Michigan Technological University, Houghton, Michigan, U.S.A., with B.Sc. degrees in Mining Engineering and Mechanical Engineering.

3. I have been active in the mining industry for the past twenty-five years, in the fields of exploration, production, and consulting.

4. The information for the accompanying report was obtained from the results of field work carried out in 1974, under the direction of Dr. A.B.L. Whittles, Ph.D., Geophysicist, supervised by myself.

5. I do not have any ownership in the property described in this report.

6. I am a member of the Professional Engineers Association of B.C., the Canadian Institute of Mining and Metallurgical Engineers, and the B.C. and Yukon Chamber of Mines.

DATED AT QUALICUM BEACH, B.C., THIS 15th DAY OF JULY, 1974.

F.C. Loring, P. Eng.,
Consulting Engineer.

92C044

Enclosure IV

92C09W

G E O P H Y S I C A L   R E P O R T

O N

L O S S   C R E E K   C L A I M   G R O U P

PROPERTY FILE

L O C A T I O N

On the West Coast of VAncouver Island, approximately 8 miles south of Port Renfrew, bounded by Loss Creek, Sombrio River and the Strait of Juan De Fuca.

Latitude approximately 48° o6' N

Longitude approximately 124° 18' W

AUTHOR

A.B.L. Whittles, Ph.D.

HOLDER OF CLAIMS

ARMSIDE MINING CO. LTD. (NPL)
VICTORIA, B.C.

FIELD WORK DONE:

August 9, 10, 11, 12, 23, 26 and 27, September 29 and 30, 1973

REPORT COMPLETED

December 14, 1973

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ASSESSMENT REPORT SUMMARY

Some preliminary magnetic and seismic results are presented for the Sombrio Point placer deposits.

Both types of surveys indicate the presence of deep gravel/sand/clay layers overlying a volcanic bedrock in the bowl areas explored to date. There is some indication of much deeper layers to the north of these bowl areas, along a possible extension of the Leech River Valley fault line.

The preliminary results from excavations in Bowl I are discussed along with the seismic and magnetic results.

Recommendations for further work are also made.

1. PROPERTY DESCRIPTION, LOCATION AND ACCESS

(a) LOCATION AND ACCESS

The claims and placer leases are reached by the public road going south from Port Renfrew. About 11 miles south of the Recreation Center in Port Renfrew, a logging road cuts off to the left (to the south). There is a closed steel gate a short way in from the main road. The work site is approximately 3/4 mile in from the main (public) road.

Please refer to Figures 1, 2, 3 and 4 for specific access details.

(b) PROPERTY DESCRIPTION

The property is, in the main, a fairly level area underlain by 200 - 400 feet depths of sand, gravel and clay. It appears to be the remains of an glacial delta. The east side is cut deeply by Loss Creek, and the west side by Sombrio River. Several run-off ravines cut the delta in the central and western portions. Much of the area has been logged off and the undergrowth has become very thick. Some large cedar and fir trees are still standing along the southern part of Loss Creek, and on the west side of the old delta.

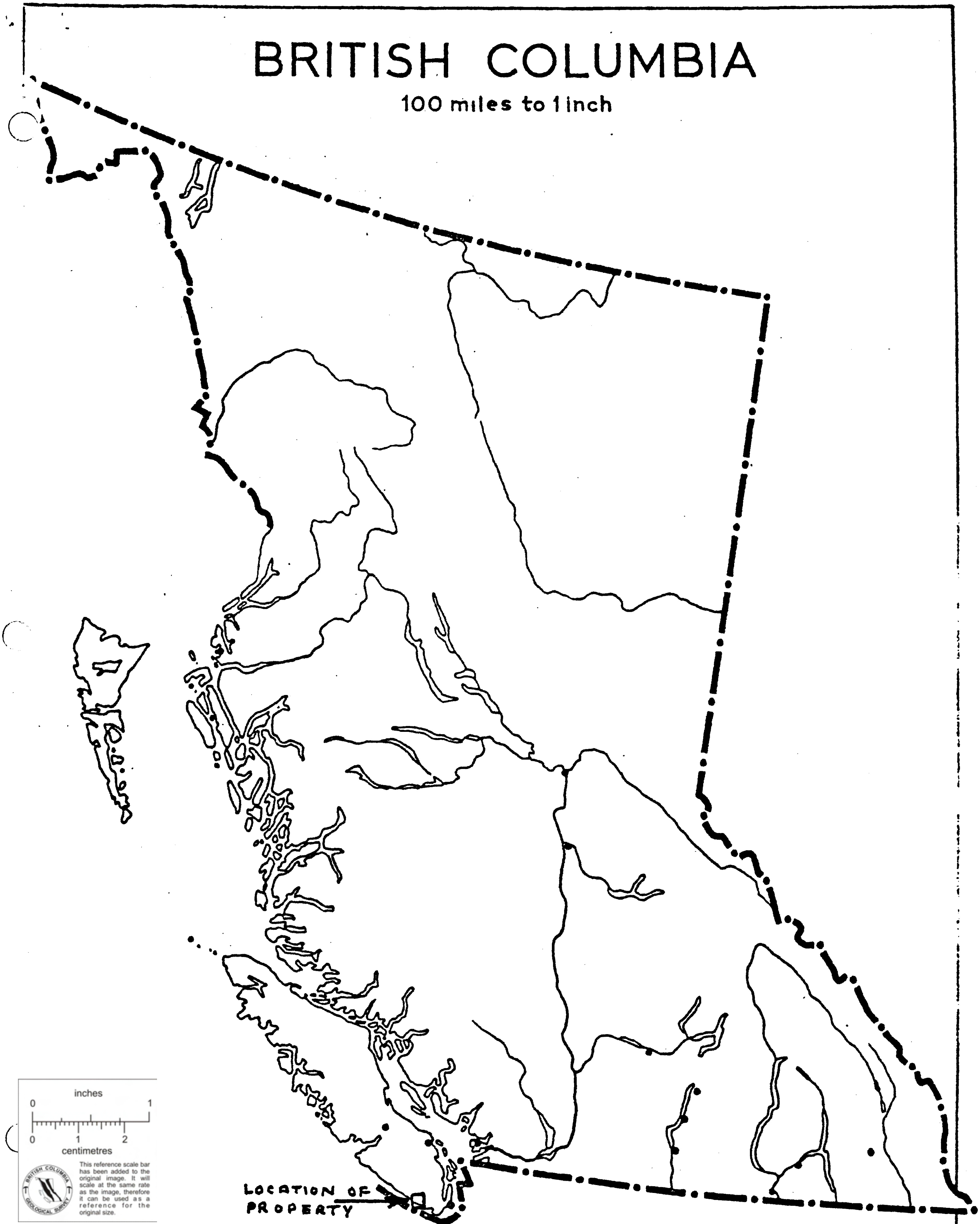
BRITISH COLUMBIA
100 miles to 1 inch
LOCATION OF PROPERTY
inches
0 1
0 1 2
centimetres
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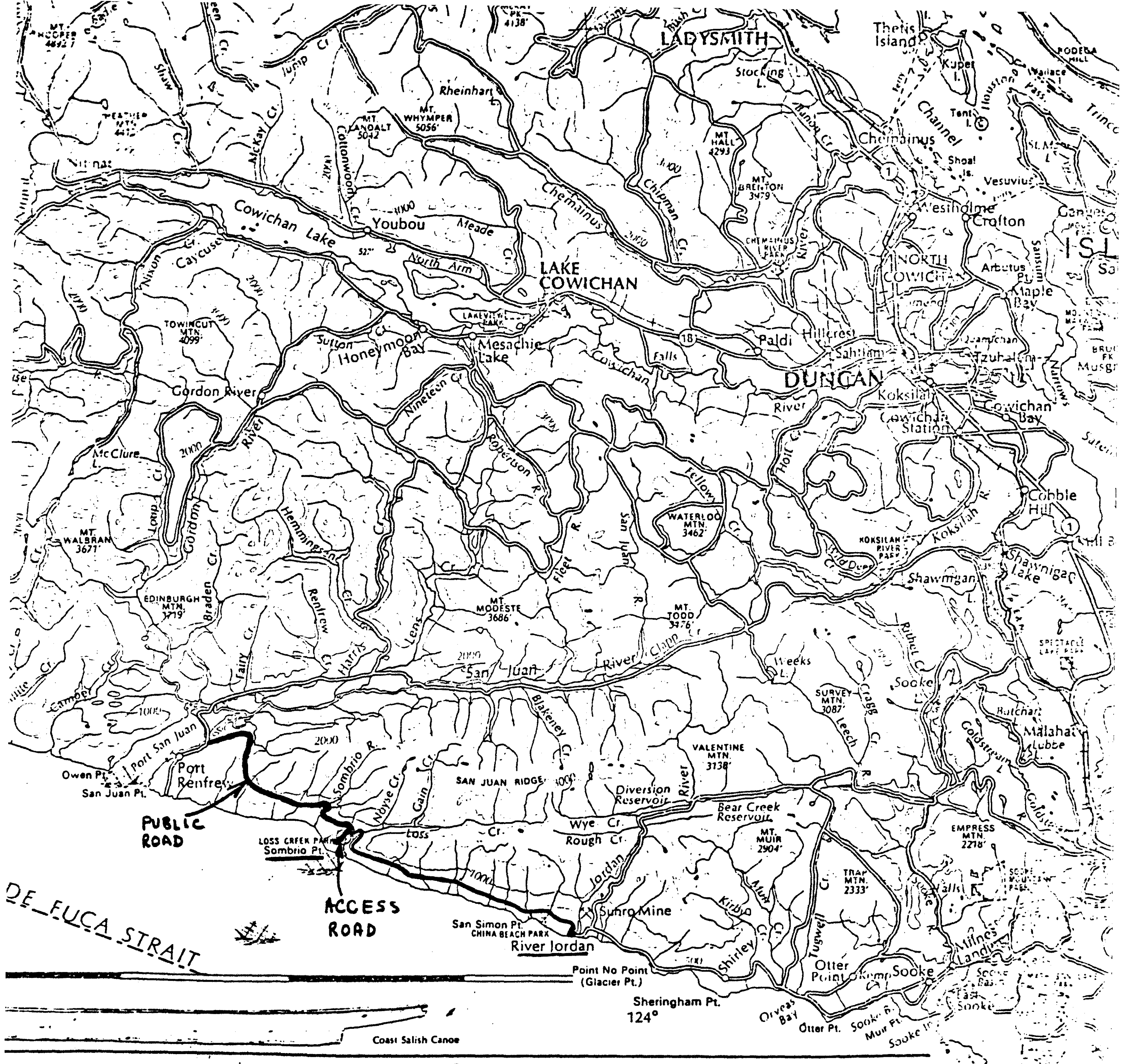
Figure 1.



DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
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W. R. YOUNG, CHIEF GEOGRAPHER

VANCOUVER ISLAND

Scale: 6 Miles to 1 Inch

10 5 0 10 20 30

FIG. 2

REFERENCE

Provincial Park	HIGHWAYS AND ROADS	Municipality — CITY
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Customs	Loose Surface Dry Weather	— DISTRICT
Contours	Main Private (Logging, Mining)	Post Office
Glacier	Trail	Settlement
Railway (Passenger)	Road Distances in Miles	Landing

Note: Elevation to 500 feet is shown coloured green, with higher elevations in shaded brown relief.

Drawn and produced by Geographic Division, Surveys and Mapping Branch, Department of Lands, Forests, and Water Resources, Victoria, B.C., 1963-67

inches
0 1
0 1 2
centimetres

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BRITISH COLUMBIA GEOLOGICAL SURVEY

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Mineral Claim:	307952M (ARM.2)
" "	307953M (ARM.3)

These are grouped together in two separate groups. The Loss Creek Group and the Sombrio Group. The geophysical work discussed in this report was done on the Loss Creek Group.

3. HISTORY

Not too much information was found regarding previous work; however no careful search of the B.C. Minister of Mines Reports was undertaken. Clapp (1912) does point out that (at that time) some hydraulic work was being planned on the Sombrio River. The owners at that time stated that mining engineers had estimated gold contents at 12 cents a yard, and the total volume of the deposit to be 155,000,000 cubic yards.

It does not appear that much development did, in fact, take place although some of the old hydraulic equipment was reported found by Mr. R. Spring, who owned the property prior to Armside Mining Ltd.

4. GENERAL GEOLOGY OF THE AREA

Sombrio Point and the area inland covered by the claims and placer leases appears to lie along the Leech River Valley Fault that stretches from west of Victoria through to the coast near Sombrio Point. Rock types lying to the north of this fault (Muller, 1971) are given as Paleozoic and/or Lower Mesozoic schists and gneisses (Leech River Schists). To the south younger basalts and tuffs (Eocene) are reported. These rock types are overlain with sandstones and shales, according to Muller.

The present writer's observations confirm these findings, in the main. Most of the exposed rock was observed in the bed of Loss Creek where it leaves one canyon and before it enters the last canyon to the coast, (between lines 450N and 300S on Figure 3, on the bend or bow in the creek.) The basement rock types observed were primarily volcanics, suggesting this location is still to the south-east of the fault. However, these rocks were observed to be overlain with sandstones and conglomerates (the latter is not given on the Muller map), in the creek bed and on the east bank of the creek (Line 250S). The whole area to the west of the creek is covered deeply (60 - 500 feet) with recent, post-glacial, deposits of sand, clay and gravel.

The seismic results suggest the basement rock is dipping to the north-west, perhaps to the Leech River Valley Fault which appears to pass out of the canyon north-east of Line 450 N, Station 500 E. It then (using areal photos as a guide) appears to strike roughly parallel to Line 450 N to an indentation (possibly a fault offset, or the result of differential weathering) at the coast.

Apart from several deep run off ravines (which expose only the glacial deposits) no other bed rock was observed on the site. The coastal rocks have not been examined by the present writer.

It has been postulated (Clapp, 1912) that the area is the remains of a delta deposited by glacial and post glacial rivers which drained south-westward through the Leech River Valley.

Apart from possible mineralization of the volcanics (which is not too likely in view of the youth of these rocks) the main possibility appears to be placer gold. This gold is supposed (Clapp 1912 - p. 155) to have been derived from quartz veins and stringers in the "Leech River slates". The present writers could not locate these on the Muller Map, and feel that the source of the gold is not at all clear. It could be related to the old Sicker Volcanics or even the young Tertiary Intrusives which occurs along the Leech River Fault.

In any case there is no doubt that some gold does occur in these gravels (personal observations, and Clapp - 1912, p. 156).

5. INSTRUMENTS USED

(a) LINE SURVEY INSTRUMENTS

Lines were surveyed and cut where necessary. A brunton compass on a tripod and a poly chain were used on most lines, although Line 1 (the base line) was laid out using a transit and a steel chain.

Distances were corrected for slope using the transit readings or Sunnto inclinometers.

A split-bubble level was used to determine the elevations of the seismic stations (See Figure 21).

(b) MAGNETOMETER

A McPhar M-700 fluxgate magnetometer was used. This unit is capable of about ±5 gammas precision. All readings were drift corrected with the base station (located about 300 feet north of the camp on a clearly marked stump). The base station reading was +135 gammas. The drift correction was made by a HP9820 computer. The program (see Appendix (b)) assumes a linear drift between base station readings.

(c) SEISMIC UNIT

There were two types of units used here:

(1) A soiltest Inc. Model 117C system, consisting of a seismic electronic timer, a geophone pickup, a hammer - trigger and a hammer plate. When the hammer (which is attached to the timer) is struck on the hammer plate, a switch attached to the hammer causes the timer to start counting; the first seismic signal of sufficient amplitude to arrive from the hammer blow, at the geophone, stops the timer. The elapsed time from hammer blow to geophone pickup is displayed as three digits on the timer. The time can be read to 0.1 of a millisecond on one range, and to 1 millisecond on the second range. Reproducability is about ± 10%. Generally speaking, the timer stops counting on the first arrival from the hammer blow privided the amplitude of this wave is large enough; if not, or if the gain of the timer is not high enough, a later

arriving pulse would stop the timer. Hence great care must be taken to insure one is always working with the first pulse of the incoming seismic wave.

(2) To overcome the inability of the Model 117C to fully show the shape of the incoming seismic wave, an alternate system was constructed. (See Figure 5A) This system used blasting caps and, if necessary, explosives in place of the hammer. When the detonation takes place, the current flowing through the electric cap stops abruptly causing a pulse in the Detonator/Scope Trigger unit (See Figure 5B). This pulse triggers the Storage Scope sweep causing it to start at a certain fixed rate (milliseconds/cm) across the oscilloscope screen. The geophone is placed on the ground a certain specified distance from the detonation and is connected to the vertical signal terminals of the Storage Scope. When the seismic wave arrives at the geophone it causes the electron beam on the Storage Scope (which is being swept horizontally across the oscilloscope screen) to move up and down vertically. The resulting trace is an accurate reproduction of the vertical component of the seismic wave which has been refracted through the layers of soil and rock beneath the surface.

The resulting oscilloscope trace of the seismic wave can be stored and displayed, or photographed. The distance from the trigger pulse to the first arrival is then measured on the photograph and converted (using the sweep's millisecond/division conversion scale) to milliseconds.

Seismic Computor Programs

These programs were set up for the HP9820 computer based on the various formulas given in Dobrin, 1960, and Heiland, 1940. The computer programs are reproduced in the Appendices, and are discussed in more detail in the sections on Tables I - VIII.

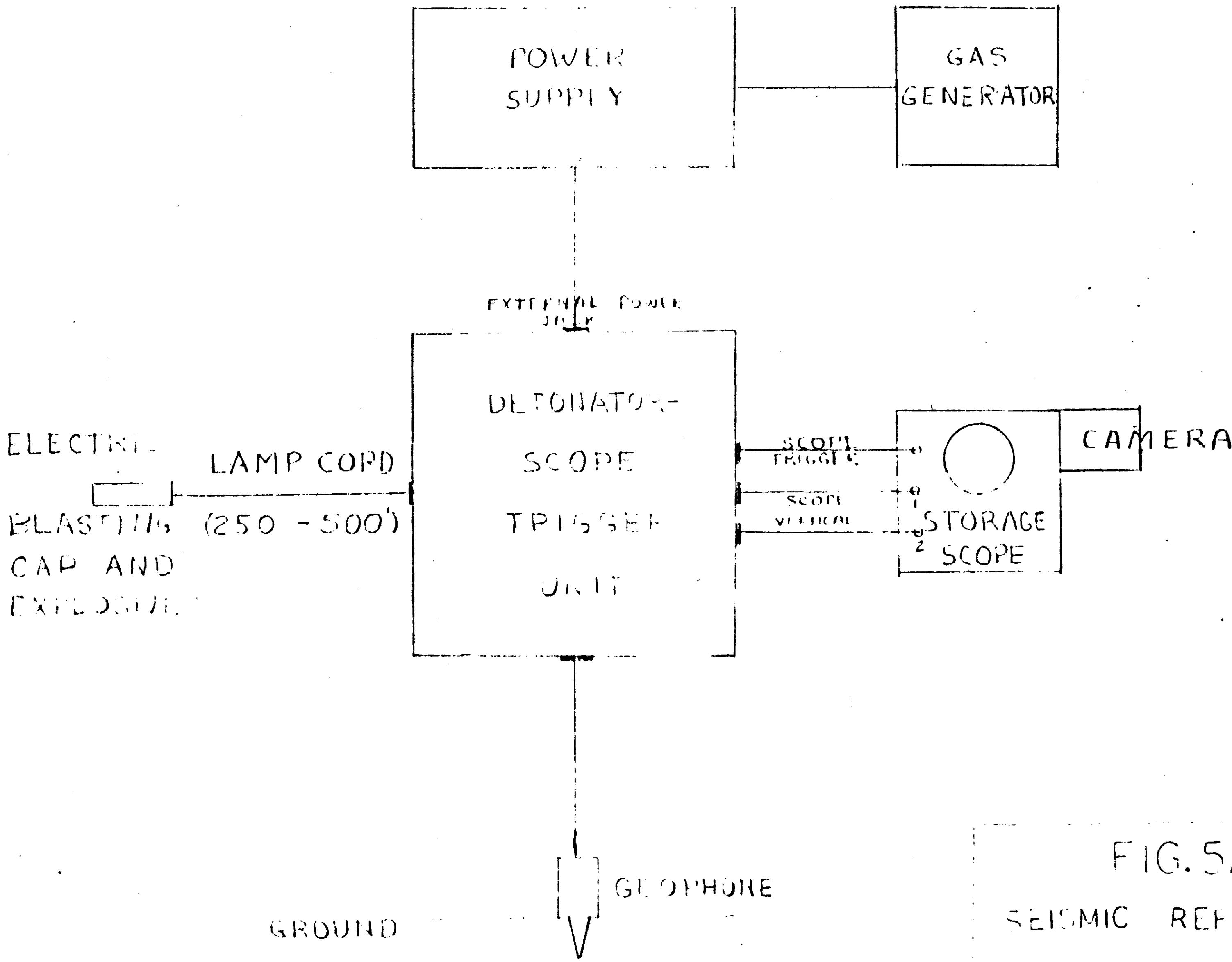


FIG. 5A
SEISMIC REFRACTION
SURVEY EQUIP.

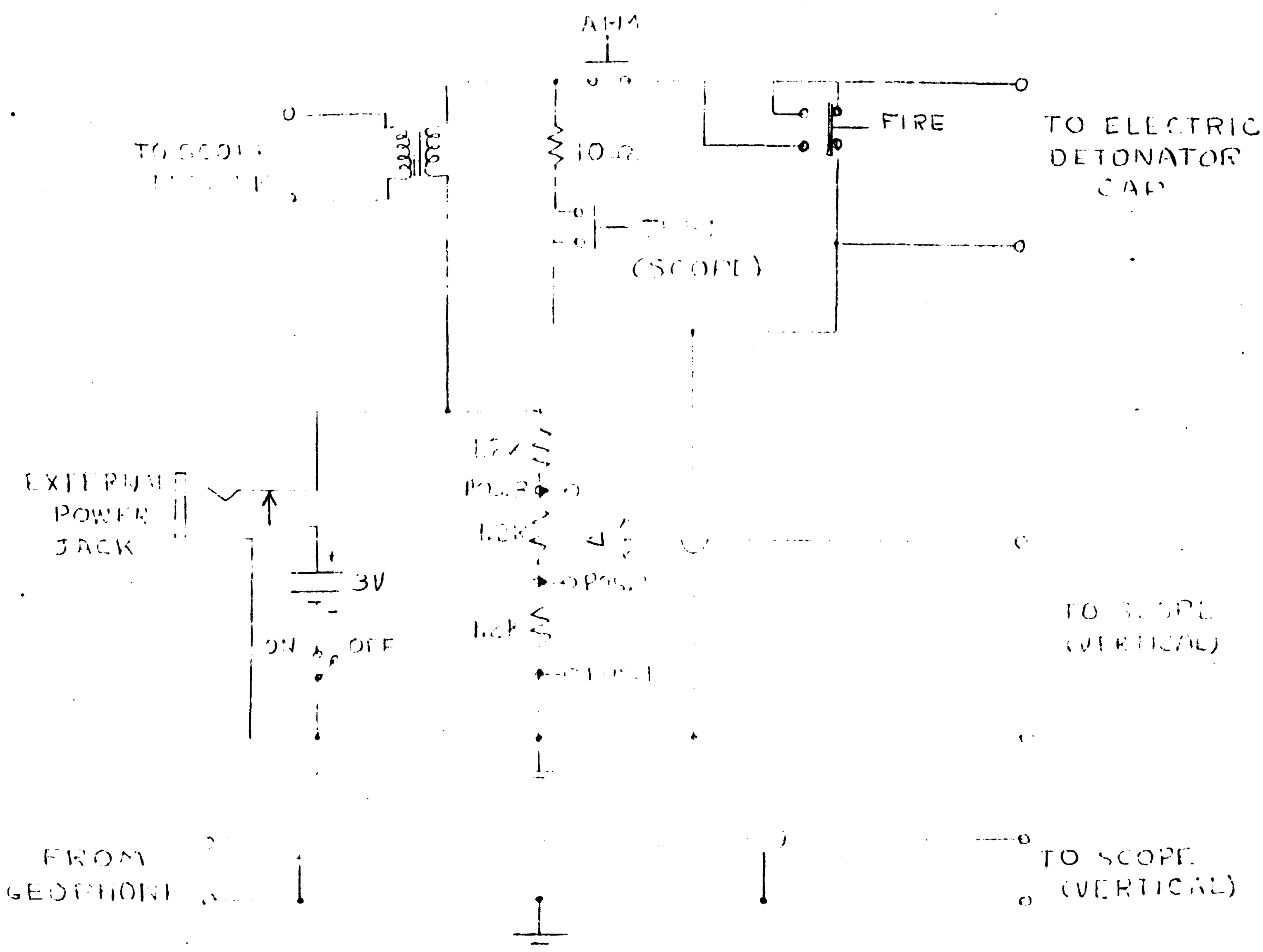


FIG. 5B

DETONATION/SCOPE TRIGGER UNIT

6. GENERAL FIELD PROCEDURES

The survey lines were laid out (See Figure 3) by surveying 560' W from the Witness Post. A base line (Line 1,Figure 3) was then surveyed N 30 W, (MAGNETIC) from 800 S to 800 N of the line from the Witness Post. Various lines were then run off of the base line, eastward and westward. Stations were measured off every 25' and flagged.

The leveling was carried out both by stadia methods (for elevations on the creek bottom) and by split-bubble leveling on the work site. The elevation of the Witness Post was set at 300' and all elevations were obtained relative to this value. The elevation of 300' was obtain approximately from government topographical maps.

7. MAGNETOMETER SURVEY RESULTS

These results are shown in Figures 19 and 20. The results divide the area into three general regions: (i) Region I - a highly variable region adjacent to the creek, including the main bowl No. I, and also the smaller bowl No. II to the south; (ii) Region II - a low magnetic level region with only small changes which lies along Line 5 and on Line 4 from about 1000 W to 1800 W (ignoring the effect of the road at 1450 W); (iii) Region III - a higher level, more variable, region which lies along Line 3A and 3B, west of Line 1 and includes the regions near the coastal edge of the old delta (1740 W, Line 3B and 2000 W Line 4).

(a) Region I

It is quite evident that these variable results are caused by the highly variable basement rocks which appear to be primarily volcanic in nature.

There are 3 higher magnetic linear features (See Figure 19) which suggest possible mineralization or shearing that is somewhat more magnetic (+1000 to +2000 γ) than the other parts of the volcanic rocks. These features correlate with the seismic results somewhat and indicate a possible basement rock ridge running from the northern part of the creek shown on Figure 19 to the southern portion of Line 3A, 750 W.

(b) Region III

The results in this region suggest that the suspected basement rock ridge in Region I extends through Line 3A at 750 W then swings roughly parallel to Line 3B and the coast. The topography of the area supports this possibility since there is a 20 foot surface ridge right along the southern coastal edge of the delta. This feature would be unusual if the delta was exclusively sand, clay and gravel as is seen in other areas near by. On the other hand this coastal ridge might be maintained in the face of erosion if there was a corresponding basement rock ridge.

(c) Region II

These results (which are low level and fairly constant) suggest the variable basement rocks in this region are quite deep. This corresponds with the seismic results which suggest these volcanic basement rocks slope fairly rapidly to the northwest into what could be the Leech River Valley fault line if projected directly out of the canyon above 450 N, 500 E. This hypothesised fault line (as inferred on the air photos) strikes roughly parallel to line 450 N intersecting Line 5 about 1100 W to 1500 W. The basement rock seismic contours seem to be roughly parallel to this supposed fault line, and the magnetic results seem to indicate a dip in the basement rocks along this line.

(d) Other comments.

It should be noted that bowl II is quite similar to bowl I in with respect to the magnetic results.

Some of the variable magnetic results at the west ends of Line 3B and Line 4, might not be caused by a basement rock ridge but instead be caused by magnetic fringing effects at the edge of the delta, which would act as the edge of a plate of more magnetic material (e.g. sand, etc., as compared to air over the ocean). Not enough readings were taken in these areas to check this possibility, but the values observed seem fairly large and in the present writer's opinion it would seem more probable there is a basement rock ridge along the coastal edge.

A magnetometer survey would seem more useful to indicate the nearness of the volcanic basement rocks than to indicate either basement topographical features, or magnetite (with the possibility of associated gold values) bearing gravel or sand beds. That is, the magnetic variations are more probably associated with changes in rock magnetism than with basement topographical features or fluvial magnetite. (See Figure 15-3, Dobrin, 1960, page 310 for an example of the relative effects.)

8. SEISMIC SURVEY RESULTS

The seismic surveys were restricted to the small region in Bowl No. I (See Figure 3). Stations were set up at 25' intervals, 225N to 450 S on lines 100 W, 150 W, 200 W, 250 W, and 300 W. The techniques used were discussed previously. The results are plotted as profiles in Figures 6 to 18, inclusive. These profiles were obtained by plotting the time of first arrival (of the seismic wave from the explosion) against distance of the explosion from the geophone (pick-up sensor). These profiles were then interpreted using a variety of different assumptions to test what effect the different assumptions had on the calculation of the depth of layers below the surface. These results are given in Tables I - VIII, and Figures 22 to 28.

General Comments on Figures 6 to 18

The reproducibility was generally good, about ±1 millisecond on reshot holes. The one exception was ±3 milliseconds (Figure 8; 75' on 200 W line). The scatter of points generally was no greater than ±2 milliseconds, except in areas of soft overburden or where the bulldozing was done in soft sand.

The detonations were, for the most part, on the surface or else dug about 1' into the ground. Most of the overburden had been cleared away by bulldozing the work site, which exposed sand on Bench C and compacted gravel on Bench B. Certain locations were fired in overburden, particularily at the extreme southern and eastern stations.

Most of the lines drawn on the seismic profiles do not go through the origin. This is due in many cases to the looser surface material, or in the case of the southern geophone locations, to overburden.

Figure 6: Line RL

Geophone was at 150 W, 225 N. This line was run from the geophone to 300 W, 200 S to avoid the soft edge of the worksite. Some thin ($<2'$) but variable overburden was encountered from 0 to 75' (on Bench B). The stations from 100' to 300' were on gravel (also Bench B). The detonations from 300' to 450' were on Bench C (sand) so a delay in the first arrivals was observed. These latter points were thus ignored in estimating the slopes.

Two layers are clearly evident.

Figure 7: 200 W Line

The geophone was at 200 W, 150 N. All the seismic points are within ±1 millisecond of the lines drawn. Most detonations were directly on the gravel of Bench B, except 350' - 450' which were on about 5' of overburden.

Two layers are evident. A possible third layer could be assumed (from about 150' to 250').

Figure 8: 200 W Line

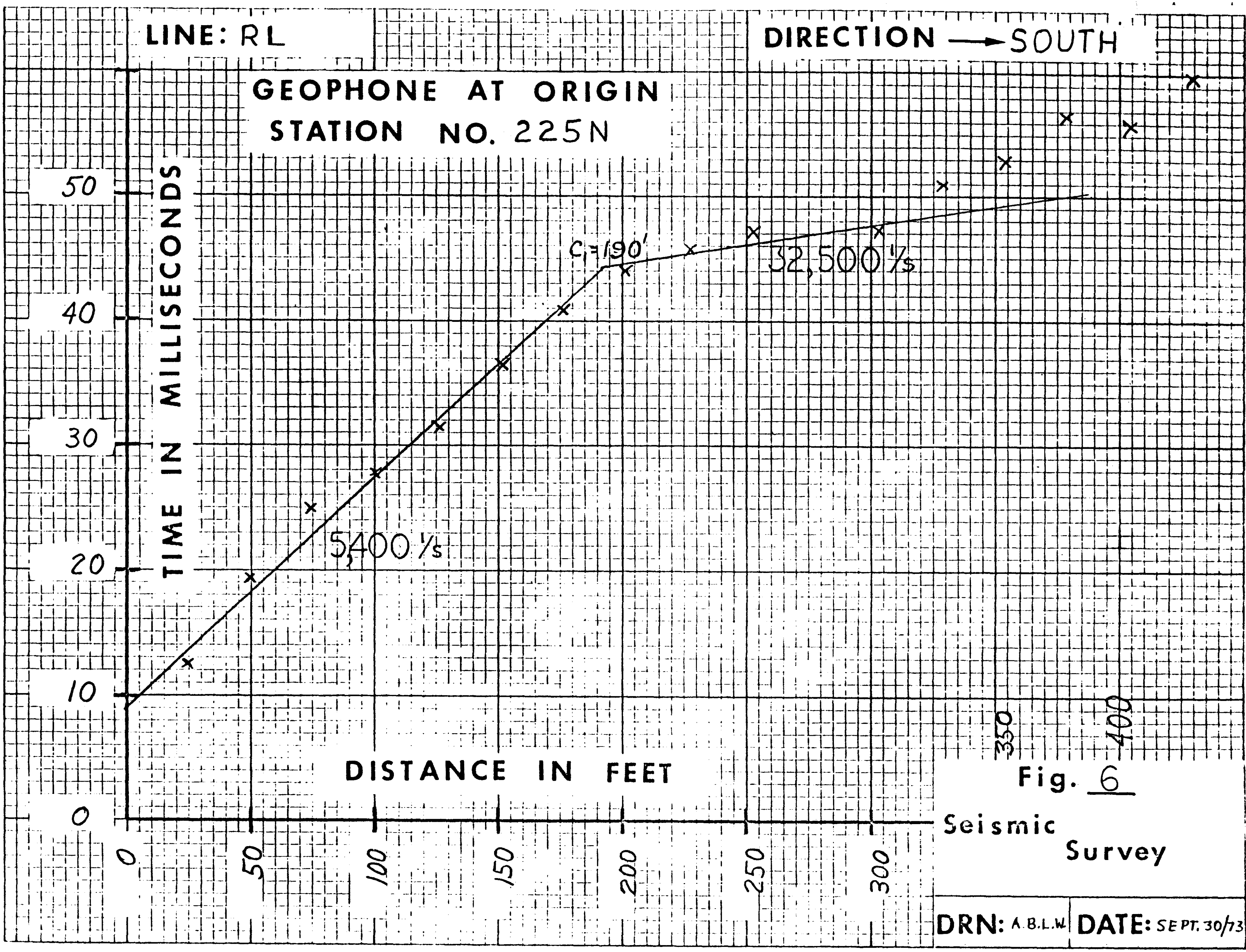
The geophone was at 200 W, 225 N. With two exceptions most of the scatter along this line is within ±1 millisecomd. Stations 75' and 150' were shot twice. The time of first arrival decreased about 6 milliseconds in the first case and 2.5 milliseconds in the second. The average of the 75' shots and the lower 150' value are within ±1 millisecond of the line.

There was some loose overburden in the vicinity of the 75' station which might explain the variability. The reason for the change in the time at the 150' station is not known.

Two layers are clearly evident.

Figure 9: 250 W Line

The geophone was 250 W, 225 N. The first 50' of this line was on Bench C (a layer of fine sand). The 50' to 175' stations were on the slope of Bench C (where C slopes down onto Bench B). Station 175' was shot twice but still remained above the line (the reproducibility was about ±1 millisecond). It


LINE: RL
DIRECTION ⟶ SOUTH
GEOPHONE AT ORIGIN
STATION NO. 225N
TIME IN MILLISECONDS
DISTANCE IN FEET
0
10
20
30
40
50
0
50
100
150
200
250
300
350
400
C_1=190'
5,400'/s
32,500'/s
Fig. 6
Seismic Survey
DRN: A.B.L.W.
DATE: SEPT. 30/73

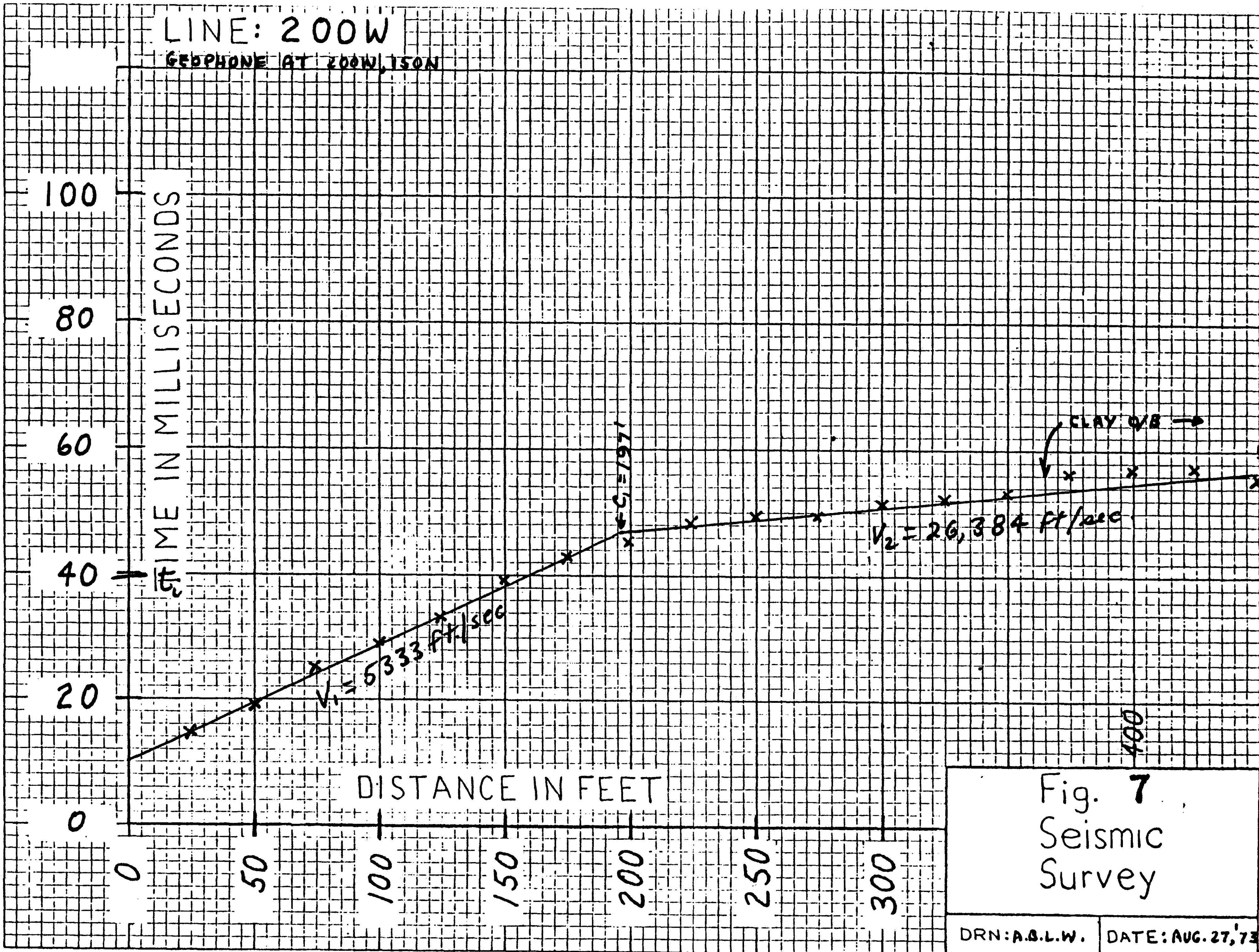
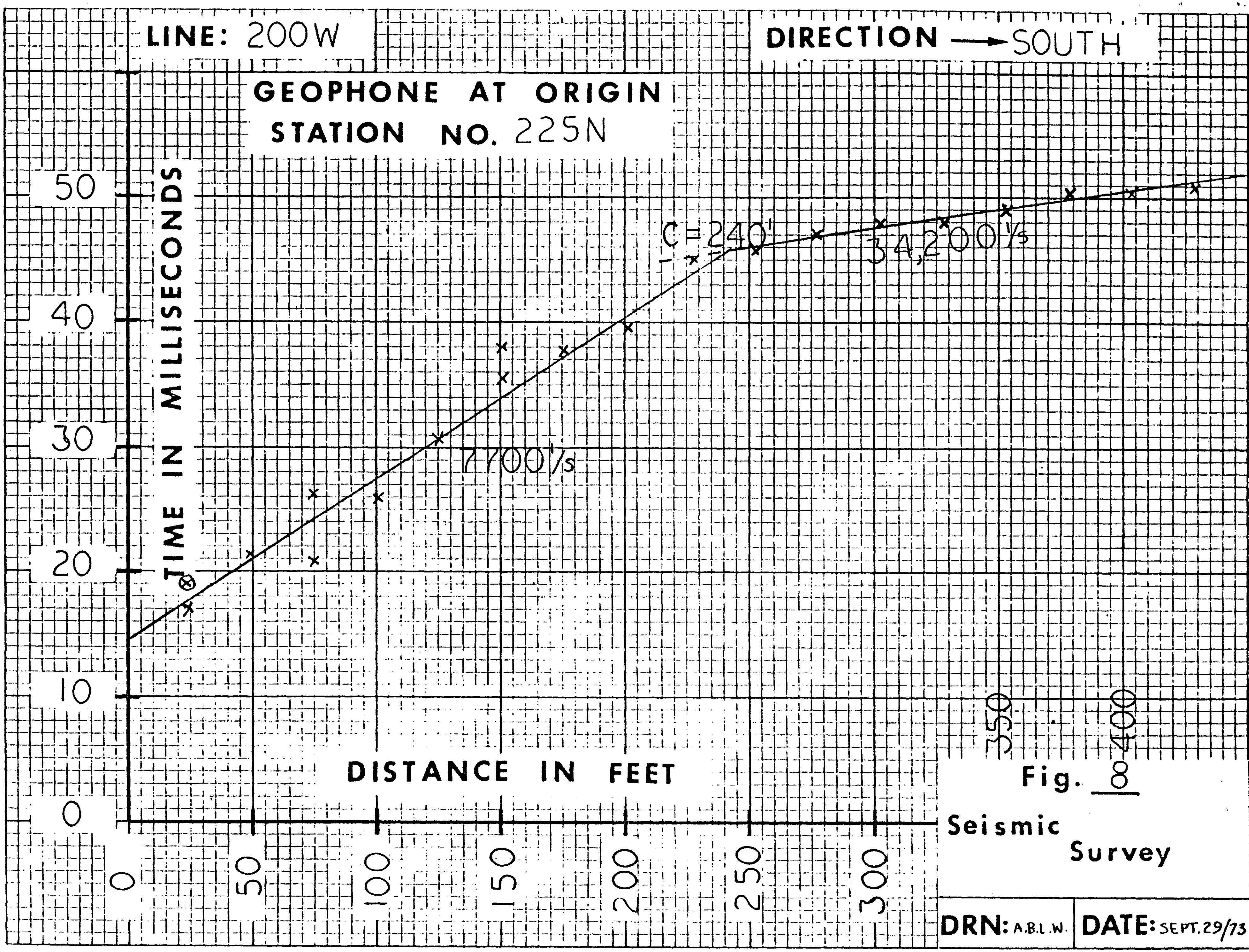


Fig. 7
Seismic Survey

DRN: A.B.L.W.	DATE: AUG. 27, '73


LINE: 200W
DIRECTION → SOUTH
GEOPHONE AT ORIGIN
STATION NO. 225N
TIME IN MILLISECONDS
DISTANCE IN FEET
0
10
20
30
40
50
0
50
100
150
200
250
300
350
400
C=240'
34,200'/s
7700'/s
Fig. 8
Seismic Survey
DRN: A.B.L.W.
DATE: SEPT. 29/73

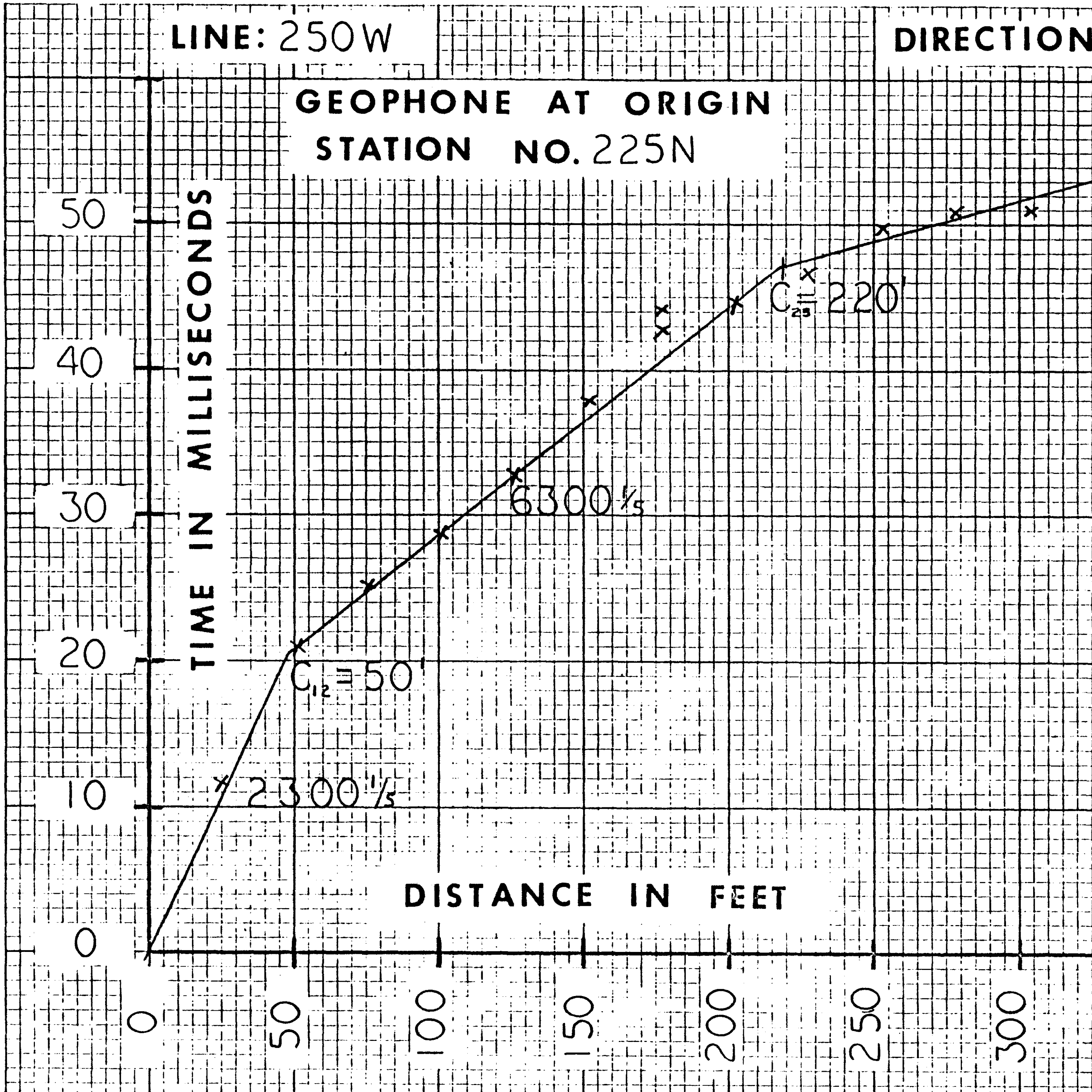


Fig. 9

Seismic Survey

DRN: A.B.L.W. DATE: NOV.20/73

coult be that the first seismic wave arrival from the third layer (bedrock) partially concelled the second layer seismic wave.

The scatter evident at 400' and 425' was due to soft soil and sand moved onto this area by bulldozing.

Three layers are evident: the sand of Bench C, the gravel of Bench B, and the bedrock.

Figure 10: 300 W Line

The geophone was at 300 W, 225 N, up on Bench C. The line along which the detonations were set off (300 W) was entirely on Bench C (which thins out at the south end). Points 375' and 400' may reflect soft material moved into this area by bulldozing.

The time value at the 75' station may reflect a partial cancellation of the first arrival from the second layer (the gravel of Bench B) with the first seismic wave arrival of the top layer. This was shot twice and was reproducible to within ±5 milliseconds.

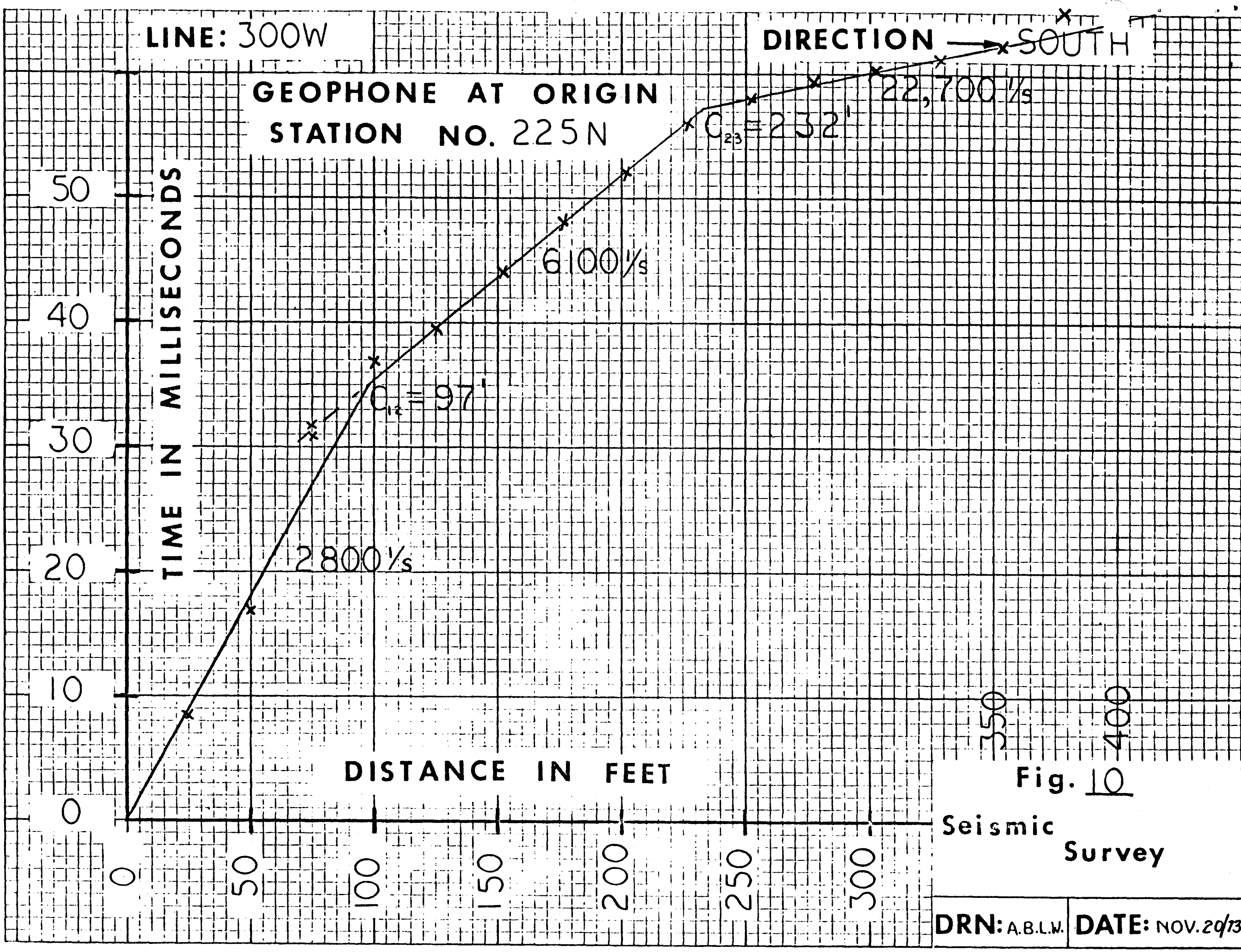
Three layers are evident, as in Figure 9.

Figure 11: 100 W, South End

The geophone was at 100 W, 400 S, on about 5'- 10' of soil above the gravel of Bench B. The shots at 25' and 50' were also on this layer of top soil: the shots at 100', 125' and 150' were on the compacted road with good contact to the gravel layer. The shots from 225' to 325' which lie above the seismic profile line were on very loose material, pushed to the edge of the work site. This layer was 10' to 15' deep and consisted of stumps and soil.

The shots at 300' and 400', which determine the line from the second layer (bedrock), were placed directly on the gravel about 50' west of line 100W, in order to obtain good coupling. The geophone was left at 100 W, 400 S.

Two layers are evident on this line.


LINE: 300W
DIRECTION → SOUTH
GEOPHONE AT ORIGIN
STATION NO. 225N
TIME IN MILLISECONDS
DISTANCE IN FEET
0
10
20
30
40
50
0
50
100
150
200
250
300
350
400
2800'/s
6100'/s
22,700'/s
C_{12} = 97'
C_{23} = 232'
Fig. 10
Seismic Survey
DRN: A.B.L.W.
DATE: NOV. 29/73

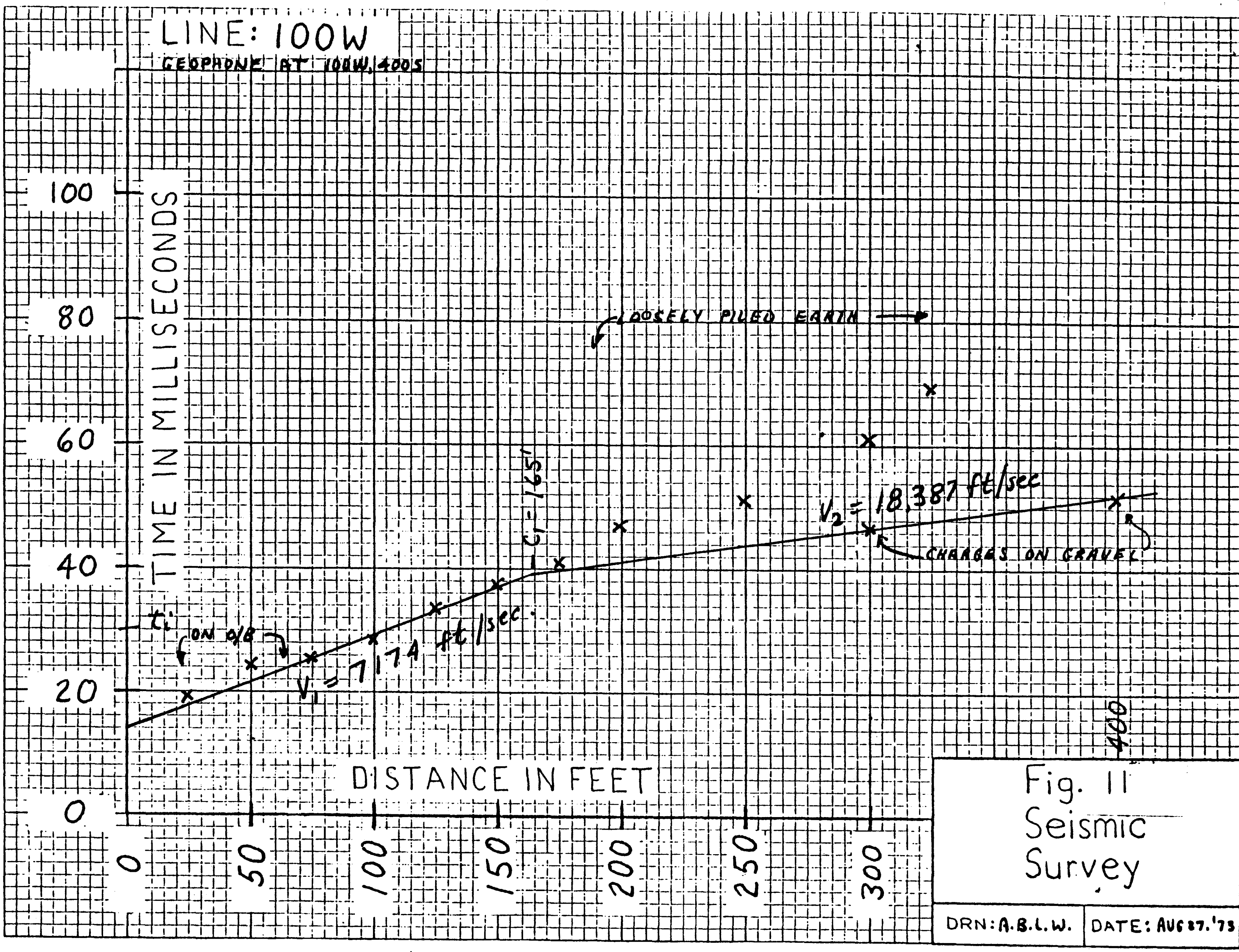


Fig. 11
Seismic Survey

Figure 12: 150 W Line

The geophone was placed at 150 W, 225 S. All data on this line came within ±1 millisecond of the seismic profile lines (an average ±4% precision). All stations and the geophone were on the gravel of Bench B.

One can infer either two or three layers, as can bee seen from the solid lines (two layer case) or the dashed lines (three layer case). The difference is withing the reproducibility of ±1 millisecond. Later, excavations indicated the top "layer" (assuming a two layer case) actually consists of a series of sand and gravel layers which became more compacted with depth. The bottom of the excavation consisted of large flat boulders of volcanic material in coarse gravel. The effect of these more compact, more dense, layers could be to bend the seismic profile slightly. It is in the "bend" that one can infer the third layer.

Figure 13: 150 W Line

The geophone was at 150 W, 400 S, on about 5' - 10' of top soil. The shots up to 100' were also on this soil layer and are somewhat variable. The remainder of the shots were all very consistant and defined two distinct layers. These shots (from 125' to 400') were on the gravel of Bench B.

A third layer could be inferred from these profiles (from 150' to 275').

Figure 14: 200 W Line

The geophone was at 200 W, 300 S, on the 5' - 10' soil layer. The shots from 0 - 75' were also on this layer and are somewhat variable. The stations 100' to 350' were on the compact gravel of Bench B, and are very reproducible as can be seen from the double shots (which reproduce to ±2 milliseconds or better.

Stations 375' to 450' were in loose material which was being cleared by the bulldozing of the work site.

Only two layers are suggested by the results.

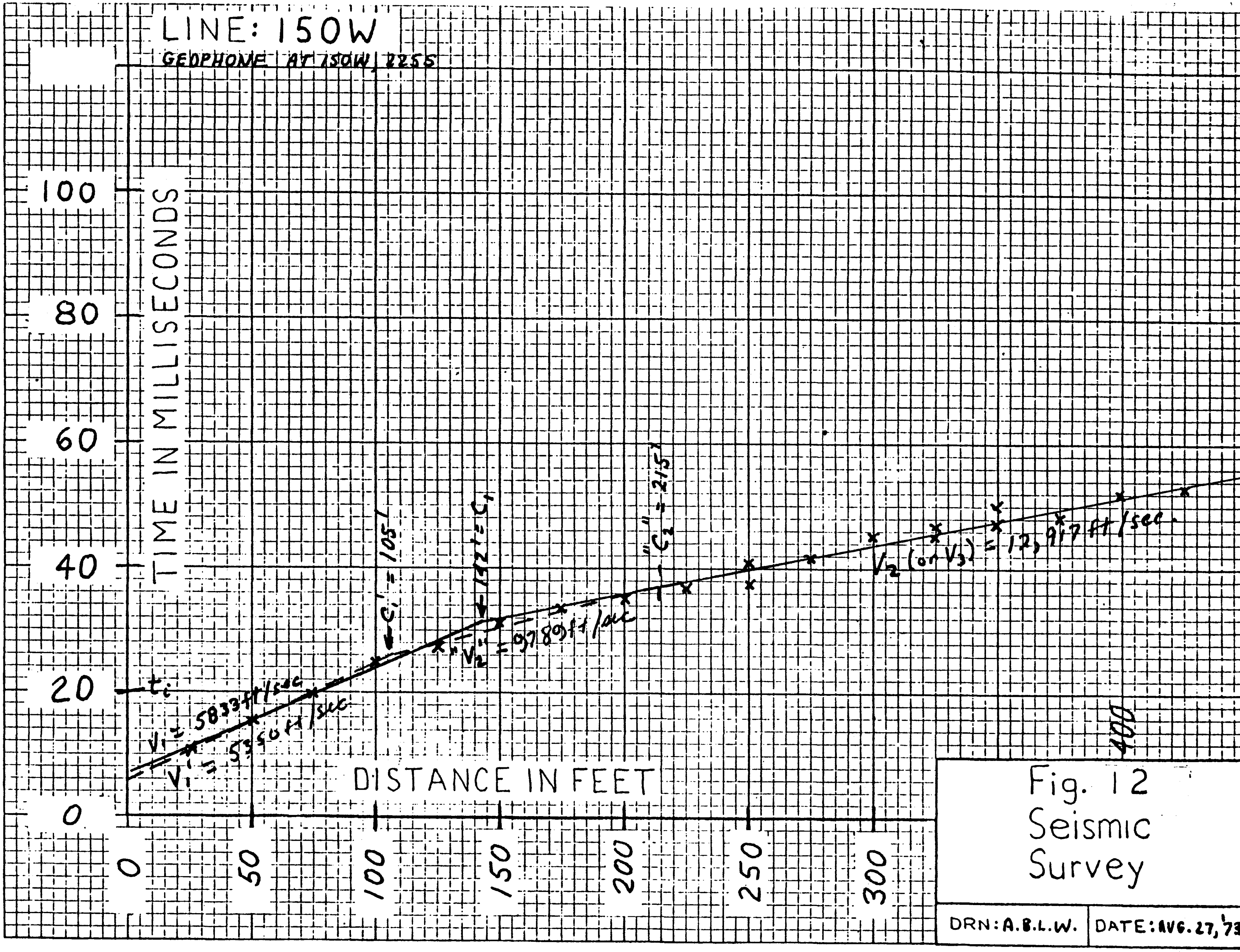


Fig. 12
Seismic
Survey

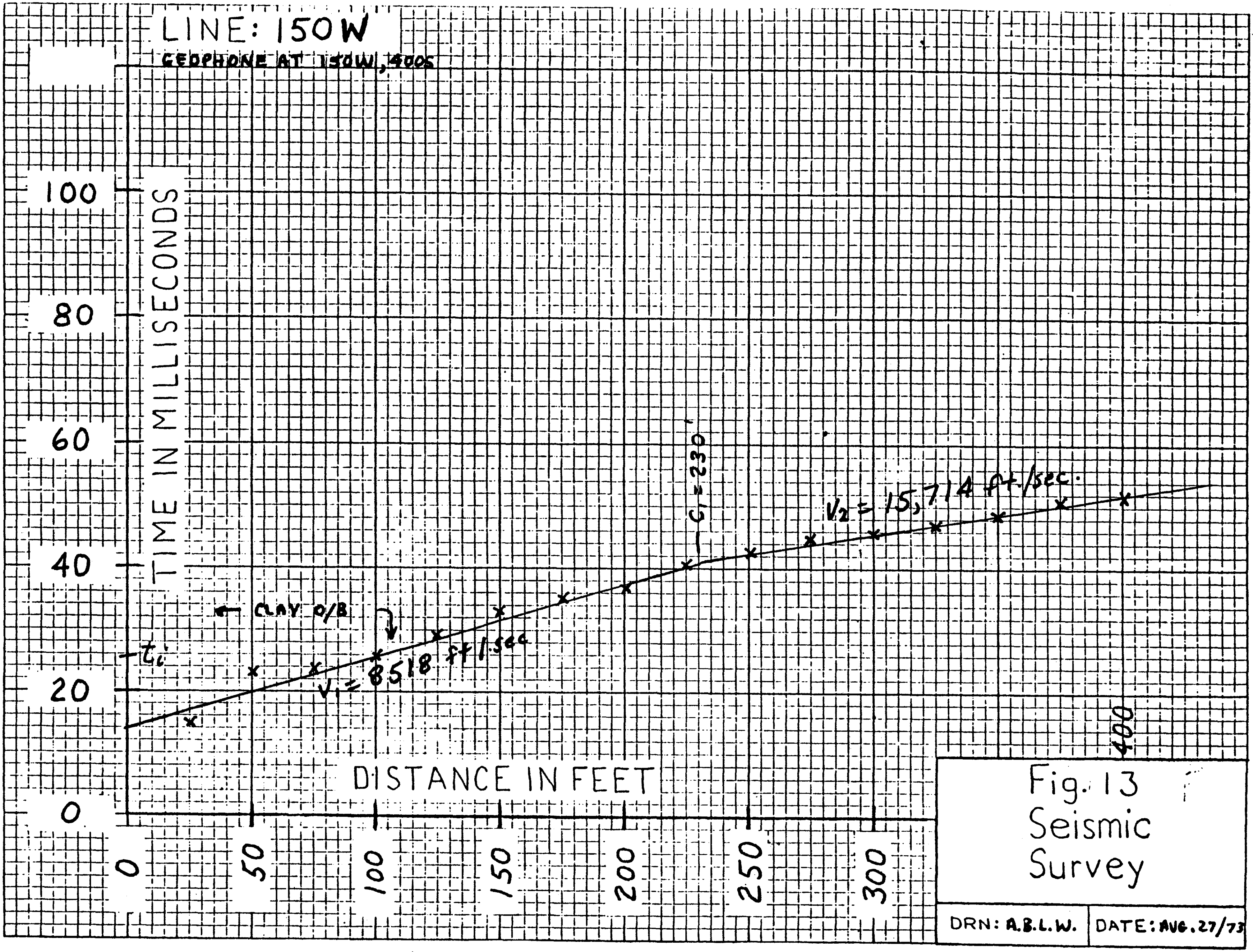


Fig. 13
Seismic
Survey

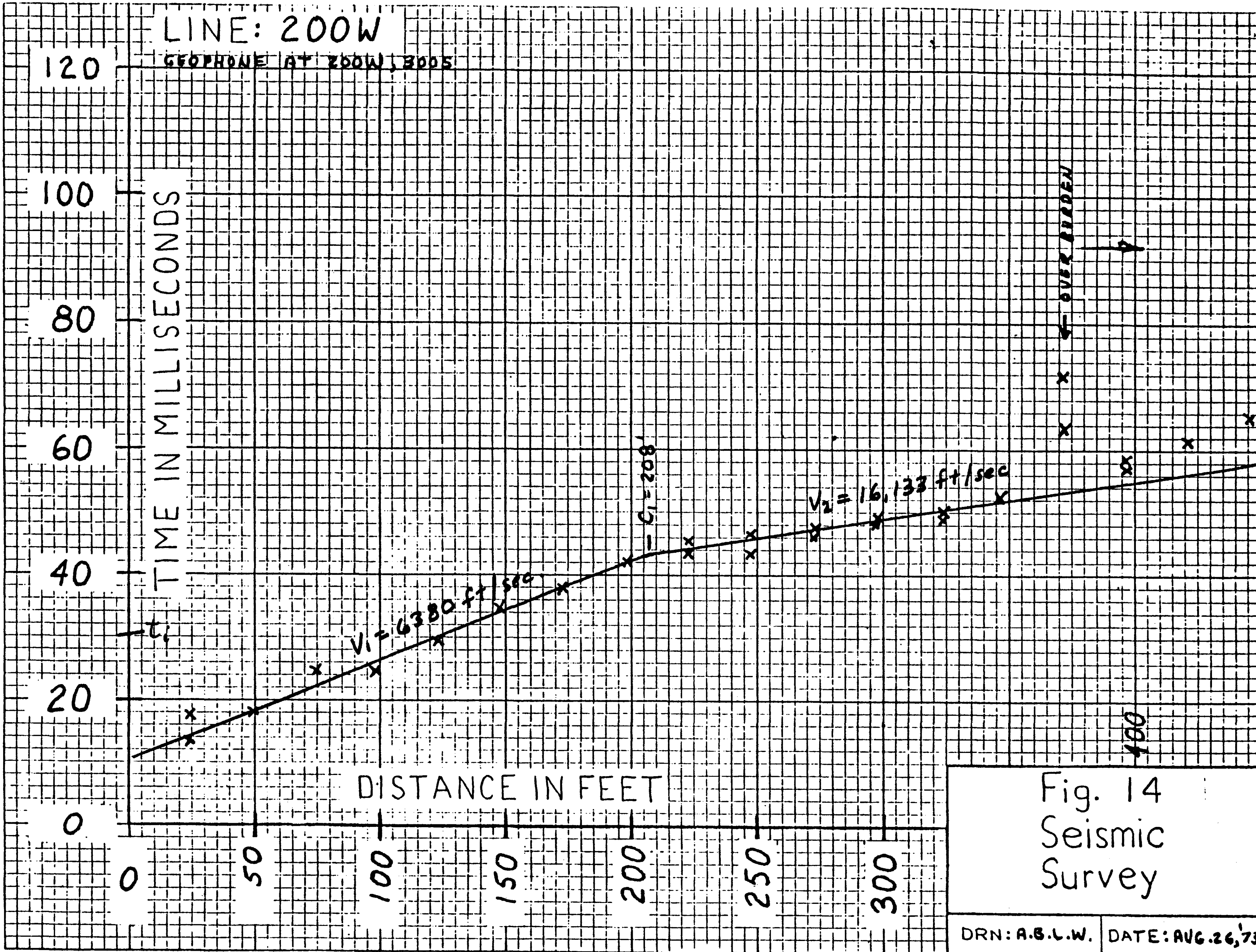


Fig. 14
Seismic
Survey

Figure 15: 200 W Line

For this profile the geophone was at 450 S, on the thick (5' - 10') layer of top soil. Stations to 75' were also on this layer and the results are quite variable.

The remaining stations were on the hard gravel surface of Bench B and are quite consistant (±1.5 milliseconds or less) with respect to the line drawn.

Two layers are suggested by the results.

Figure 16: 250 W Line

The geophone was at 250 W, 300 S on 5' - 10' of top soil, as were the shots to 75' (which are quite variable). The points from 100' to 350' were located directly on the hard gravel surface of Bench B. The Points from 375' to 450' were in loose material being worked by the bulldozer.

To check on the possible uncertainties in interpreting the data two lines were drawn for the second alyer, adjusting these to reflect the extreme fit either way. The maximum uncertainty was thus found to be about ± 10% in the velocity and ± 10% in the critical distance.

This suggests the maximum expected uncertainty would be about ±10% to ±15% in the calculated depth values.

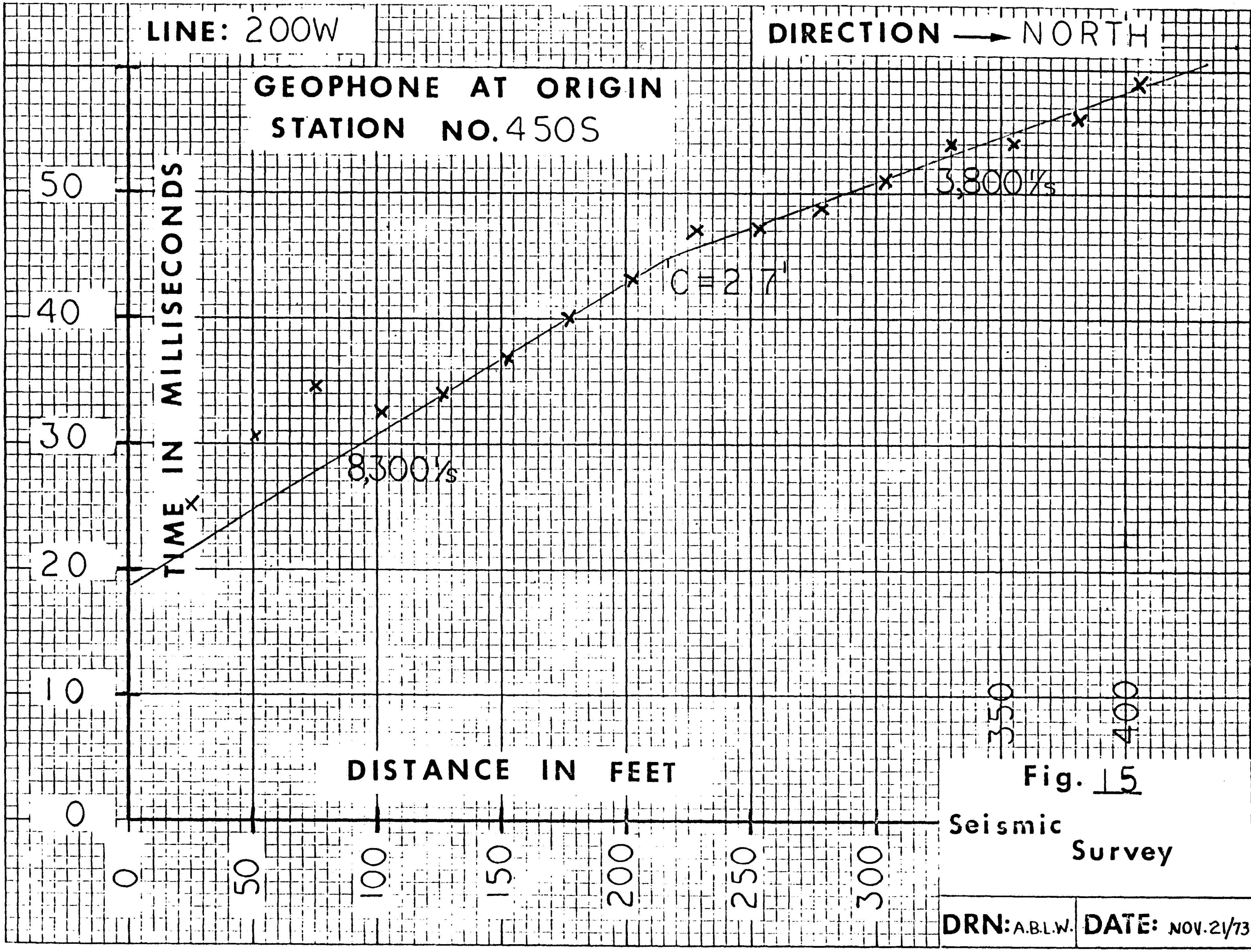
Two layers are suggested by these results.

Figure 17: 300 W Line

The geophone was at 300 W, 225 S, directly on the sandy surface of Bench C. All detonations were also on Bench C, and are within ±1.5 milliseconds of the lines drawn.

Only two layers are evident (in contrast to Figures 9 and 10, which are also along Bench C). The reason for this lies in the location of the geophone. The sandy layer at the geophone location was no more than 5 feet thick and consequently does not show up on the profile.

The station at 300' was shot 3 times, the last two reproducing within ±.5 millisecomds of the average line drawn. The first shot, farthest away from


LINE: 200W
DIRECTION → NORTH
GEOPHONE AT ORIGIN
STATION NO. 450S
TIME IN MILLISECONDS
0
10
20
30
40
50
8,300'/s
C = 27'
3,800'/s
DISTANCE IN FEET
0
50
100
150
200
250
300
350
400
Fig. 15
Seismic Survey
DRN: A.B.L.W.
DATE: NOV. 21/73

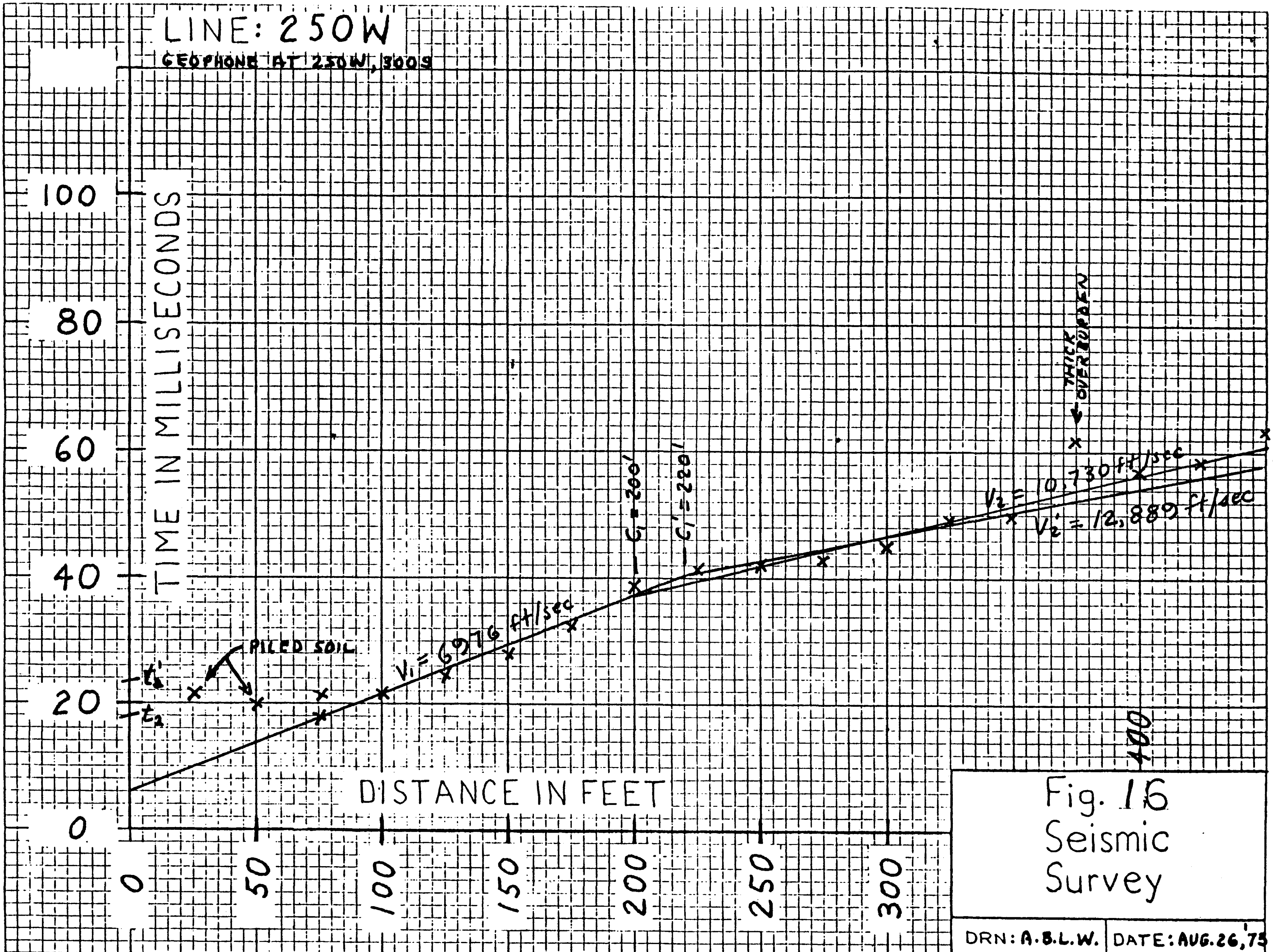


Fig. 16
Seismic
Survey

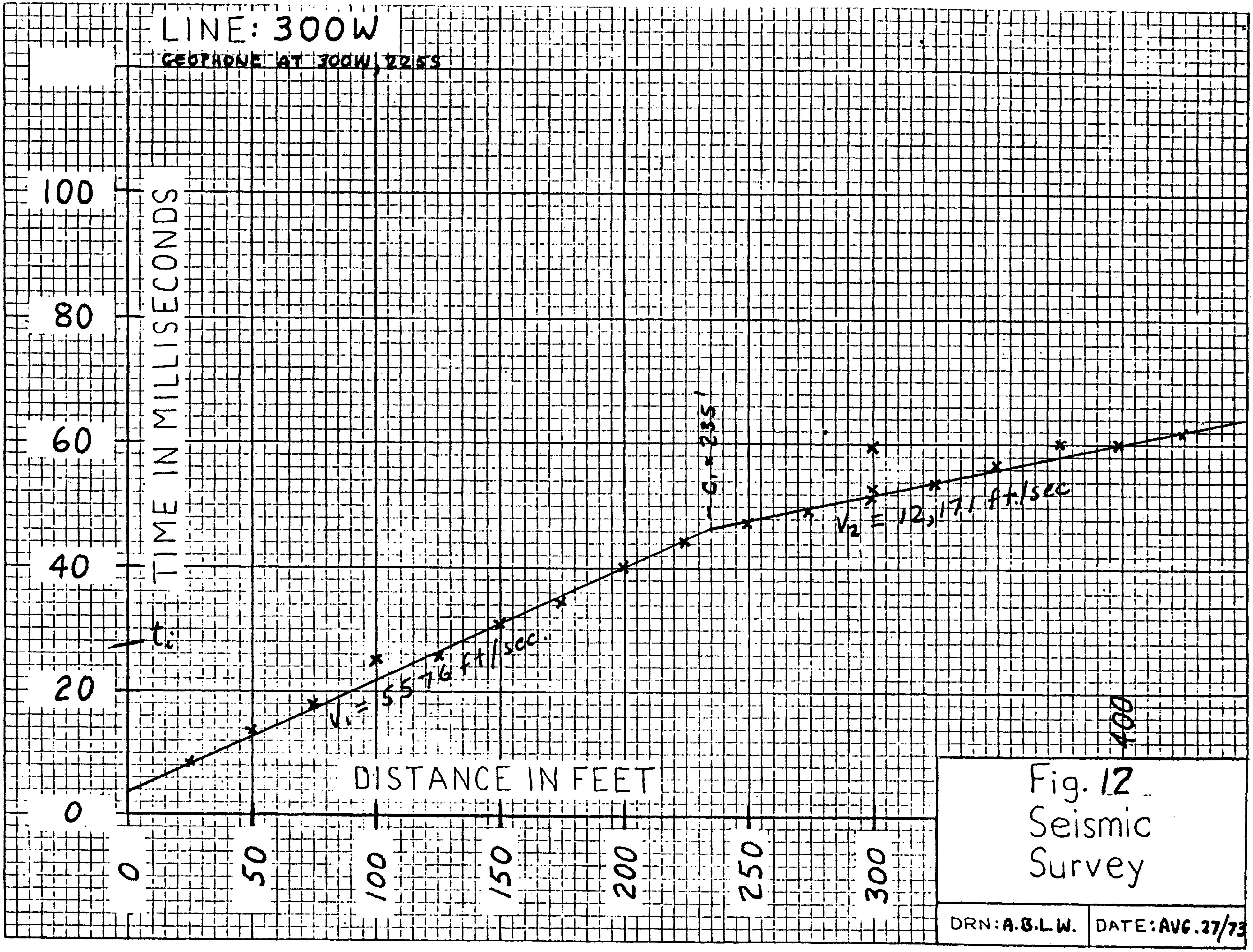


Fig. 12
Seismic
Survey

the drawn line served mainly to clear a few feet of loose material off of the station. The two following shots were directly on the sand layer.

Figure 18: 300 W Line

The geophone was at 300 W, 325 S, on Bench B, as were all the shots. All points except one are within ±.5 milliseconds of the average lines.

Three layers are evident since the sand layer was thicker at 325 S than in previous location (Figure 17). The depth of the first (sand) layer was calculated as 17' for this profile as compared to 29' found when the geophone was at 225 N. Observations made of Bench C indicate this is exactly what one would expect from the seismic results since Bench C is considerably higher at the north side of bowl I.

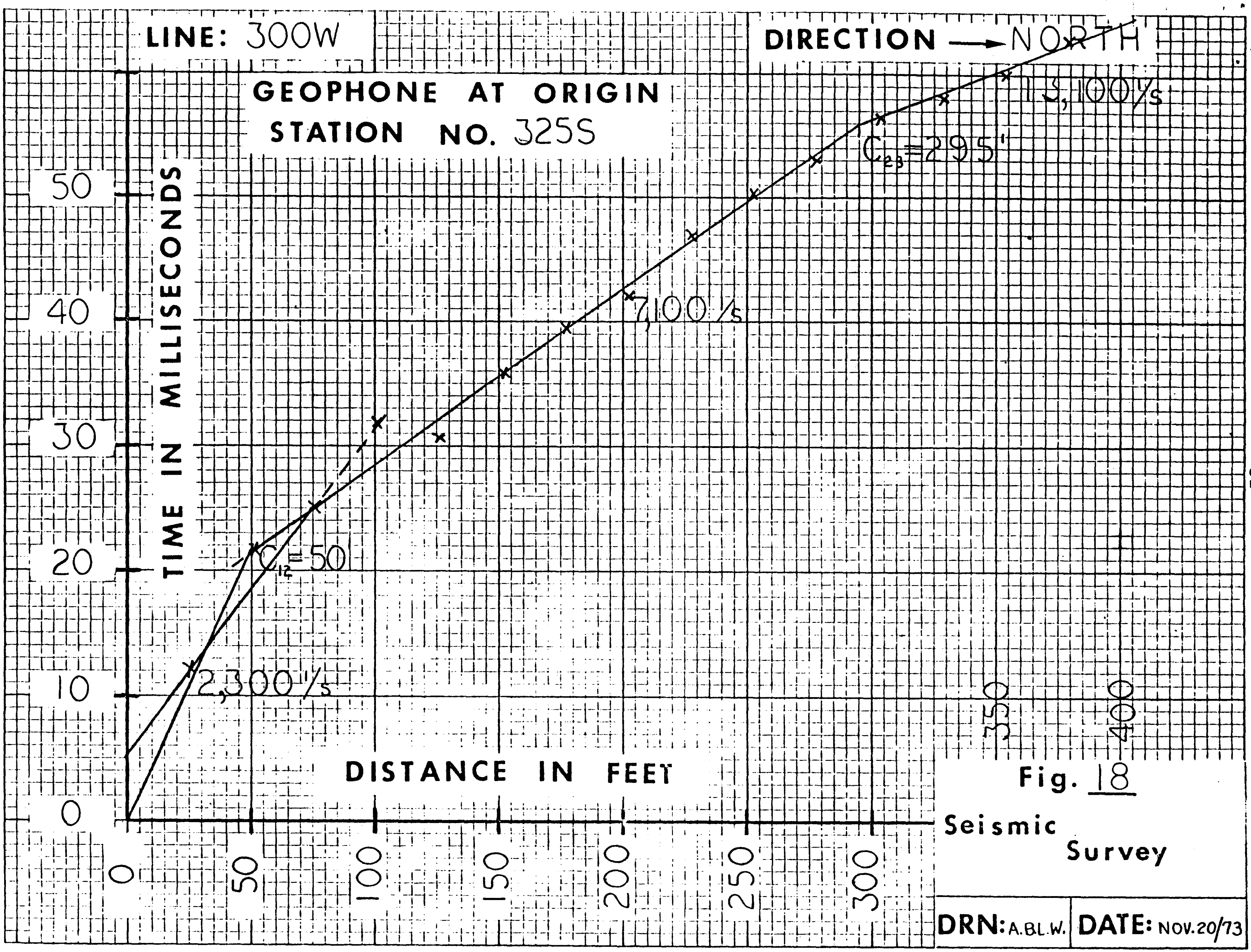


Fig. 18

Seismic Survey

General Comments on Depth Calculations

These calculations are based on a number of different assumptions as discussed in detail following.

Contour maps have been prepared on the basis of the various tables assembled for the various assumptions made. These contour maps should be considered as only general guidelines, since the indicated uncertainties are in the order of 10 - 15%. That is, a depth of 80 feet should read 80 ± 10 feet. This could result in a considerable shift of the contours drawn.

Thus the features to the extreme north and south of the surveyed area may not exist.

Table I (Two Layer, Zero Dip - Figure 22)

These results are interpreted from the various profiles assuming a two layer case (fluvial deposits over bedrock) and no dip in the beds. A computer program was used based on the formulas given by Dobrin, 1960, page 73 and Heiland page 509. The location of the depth to bedrock points is assumed to be ½ way between geophone location and the "critical point" C, on the profiles. (Actually this would not matter, if the beds were actually flat lying). Once the depths below surface of the top layer was calculated the elevations of the surface (relative to the Witness Post at ON, OW set at 300') were obtained from the leveling results (Figure 21-the surface topographical contour map) for the area. By subtracting the "depth to bedrock" from the "elevation of surface" one obtains the "elevation of the bedrock". This was plotted as Figure 22, using the leveling results for bedrock along the creek bed as another set of "elevations of bedrock", and then contouring.

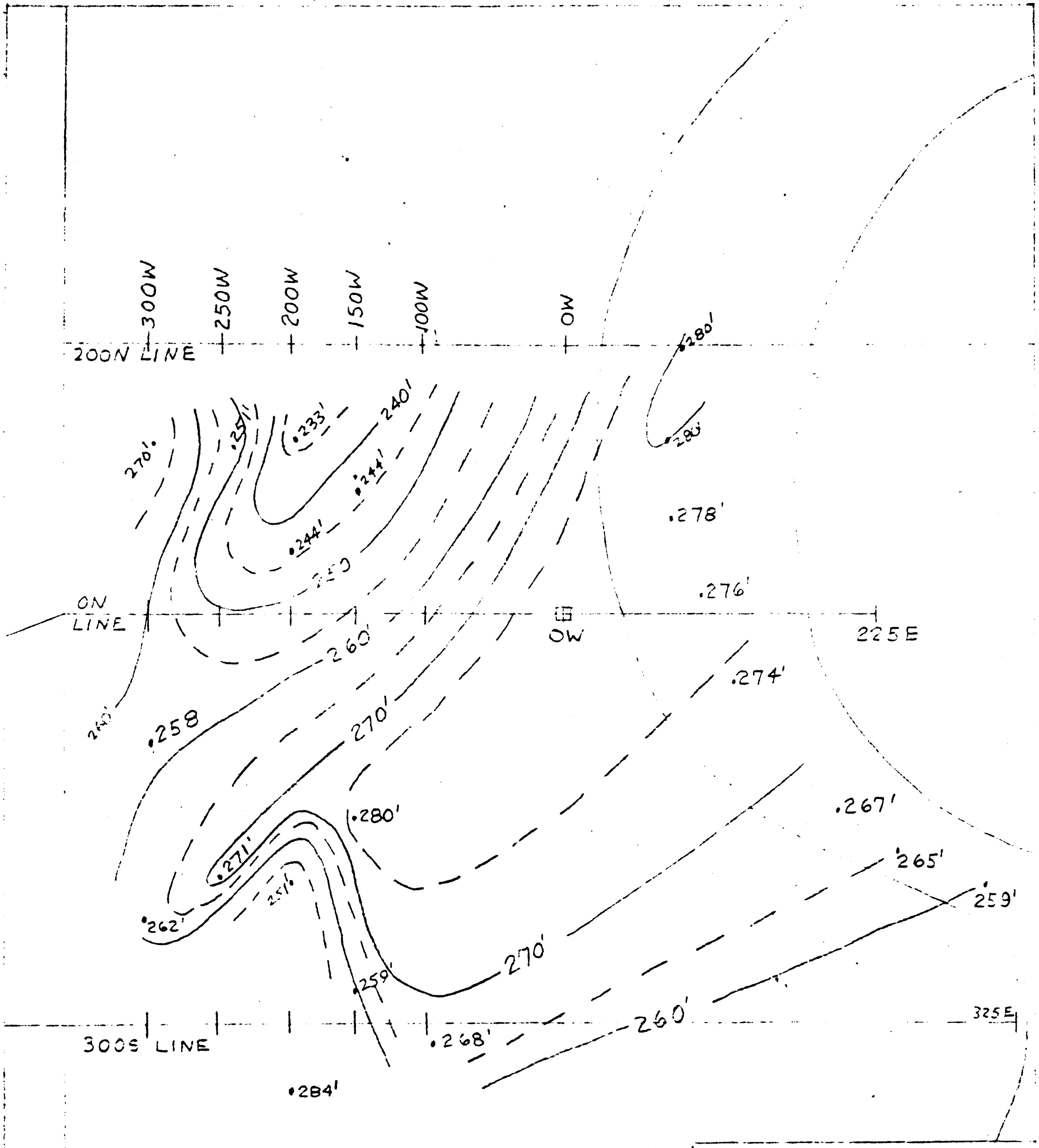
The results indicate that a ridge of basement rock extends from 200N, 100E through ON, OW to 150S, 150W roughly parallel to the high magnetic linear zone in Figure 19. There is some indication of a basement rock "valley" running south from 200S, 200W which might be an older stream bed. It is interesting to note, however, that this "valley" heads directly for the creek where it straightens out for the final run (through a straight canyon) to the ocean. That is; the "notch" in the contours at 200S, 200W may indicate the continuation of the straight part of the canyon that opens directly to the ocean (Figure 29). Note, however, there is one higher elevation value still further south (at 200W, 350S).

The contours also suggest a shallow dip south from the basement rock ridge, and a steeper dip to the northwest into the area which might contain an extension of the Leech River Valley fault. The situation on that (north) side is, however, fairly complex as the contours show.

Table I: Elevation of Bedrock Assuming Two Layers on Bench B, Three on Bench C, Zero Dip, and Using the Critical Depth Method of Calculation

Figure	Location	Elevation of Surface (feet)	Depth to Bedrock	Depth of Sand Layer Bench C	Elevation of Bedrock (feet)	Velocity Sand Layer Bench C	Velocity of Gravel Layer Bench B	Bedrock Velocities (ft/sec.)
6	150W, 125N	324	80		244		5400	32,500
7	200W, 50 N	324	80		244		5300	26,400
8	200W, 125N	328	95		233		7700	34,200
9	250W, 125N	341	90	16	251	(2300)	6300	17,900
10	300W, 125N	353	(80) - 87	29	273 - 266	(2800)	6100	22,700
11	100W, 320S	323	55		268		7200	18,400
12	150W, 150S	323	43		280		5800	12,900
13	150W, 285S	321	62		259		8500	15,700
14	200W, 200S	319	68		251		6400	16,100
15	200W, 350S	337	53		284		8300	13,800
16	250W, 200S	324	46 60 53		271		7000	11,800
17	300W, 100S	330	72		258		5600	12,200
18	300W, 225S	340	(77) - 80	17	263 - 260	(2300)	7100	13,100
	Averages		71				6700	19,000

The "Elevations of Bedrock" were plotted and contoured in Figure 22.



SCALE 1" = 100'

FIG. 22
BEDROCK CONTOUR
TABLE I DATA

DRN. A B.L.W., Nov. 25, 1973

The velocities of the basement rock average about 19000 feet/second (Table I) which places it in the igneous rock variety (e.g. probably volcanic as seen in the creek bed). These results are, however, highly variable (ranging from 12,200 to 34,200) and in no consistant pattern. The reason for this is discussed under Table VII.

The velocities of the upper layer (See Figure 27) present a more consistant pattern, ranging from 5300'/second in the northern portion to 8500'/second in the south. The lower velocity values fit in the normal range for fluvial deposits but the higher values do not. This could indicate either a much more consolidated fluvial deposit in the southern portion (gravel and sand well cemented with clay, gravel and large boulders of basement rock, or even sandstone or conglomerate). All are equally possible with the present data since the observed gravel beds are quite cemented with clay and contain large boulders, and there is sandstone and conglomerate in the creek.

For this reason the data was reinterpreted as dipping beds in Tables II to VII.

<u>Table II, III and IV</u> (Two Layers Dipping beds approx. 4° North) Figure 23.

These results were interpreted in a similar fashion to Table I but a dip of approximately 4° was first obtained from the reverse profile shots (on Line 200W), using formulas in Dobrin, 1960, pages 82-83. It was then assumed that all lines were dipping in the same direction. This is obviously not totally correct as Figures 22 and 23 indicate, but roughly correct over most of the lines run. Actually two values for the dip of bedrock was calculated from Figures <u>7</u> and <u>14</u> first assuming the V_1 values to be as shown on these figures, then averaging the V_1 values. Table II (Dip 4.23°) was obtained in the first instance, while Table III (Dip 3.82°) was obtained when the average V_1 was used. As can be seen the results for either Tables II or III are almost identical and both these results would seem, in fact, very similar to Table I.

Table II: Depth to Bedrock and Bedrock Velocities, Assuming Two Layers, and a 4.23° Dip to the northwest. The Time Intercept Method of Calculation Was Used.

Figure	Location	Depth to Bedrock (feet)	Corrected Bedrock Velocity V2 (ft/sec.)
6	150N, 225N	82	23,100
7	200W, 150N	89	20,000
8	200W, 225N	99	26,000
9	250W, 225N	72	15,200
10	300W, 225N	92	18,100
11	100W, 400S	53	22,000
12	150W, 225S	41	15,000
13	150W, 400S	58	18,000
14	200W, 300S	60	20,000
15	200W, 450S	59	12,700
16	250W, 300S	70	13,000
17	300W, 225S	70	14,000
18	300W, 325S	81	11,900
	Averages	71	18,100

Table III: Depth to Bedrock and Bedrock Velocities, Assuming Two Layers, and a 3.82° Dip to the Northwest. The Time Intercept Method of Calculation Was Used.

Figure	Location	Depth to Bedrock (feet)	Corrected Bedrock Velocity V2 (ft./sec.)
6	150W, 225N	80	23,100
7	200W, 150N	80	20,000
8	200W, 225N	94	26,000
9	250W, 225N	70	22,000
10	300W, 225N	90	18,000
11	100W, 400S	53	22,000
12	150W, 225S	41	15,000
13	150W, 400S	59	18,000
14	200W, 300S	54	20,000
15	200W, 450S	55	12,700
16	250W, 300S	70	13,000
17	300W, 225S	70	14,000
18	300W, 325S	78	11,900
	Averages	69	18,100

Table IV: Elevation of Bedrock. Depth Values Averaged from Tables II and III. Average Dip Assumed 4° to the Northwest. Time Intercept Method of Calculation Was Used, and Two Layers were Assumed on Bench B, Three on Bench C.

Figure	Location	Elevation of Surface (feet)	Depth of Sand Layer Bench C	Depth to Bedrock (feet) (From Surface)	Elevation of The Bedrock (feet)
6	150W, 225N	324		83	241
7	200N, 150N	331		85	246
8	200W, 225N	328		99	229
9	250W, 225N	341	16	76 *	265
10	300W, 225N	353	29	92	261
11	100W, 400S	324		53	271
12	150W, 225S	323		41	282
13	150W, 400S	326		59	267
14	200W, 300S	326		57	269
15	200W, 450S	337		59	278
16	250W, 300S	329		70	259
17	300W, 225S	328		70	258
18	300W, 325S	340	17	81	259

The "Average Elevations of the Bedrock" were plotted and contoured on Figure 23.

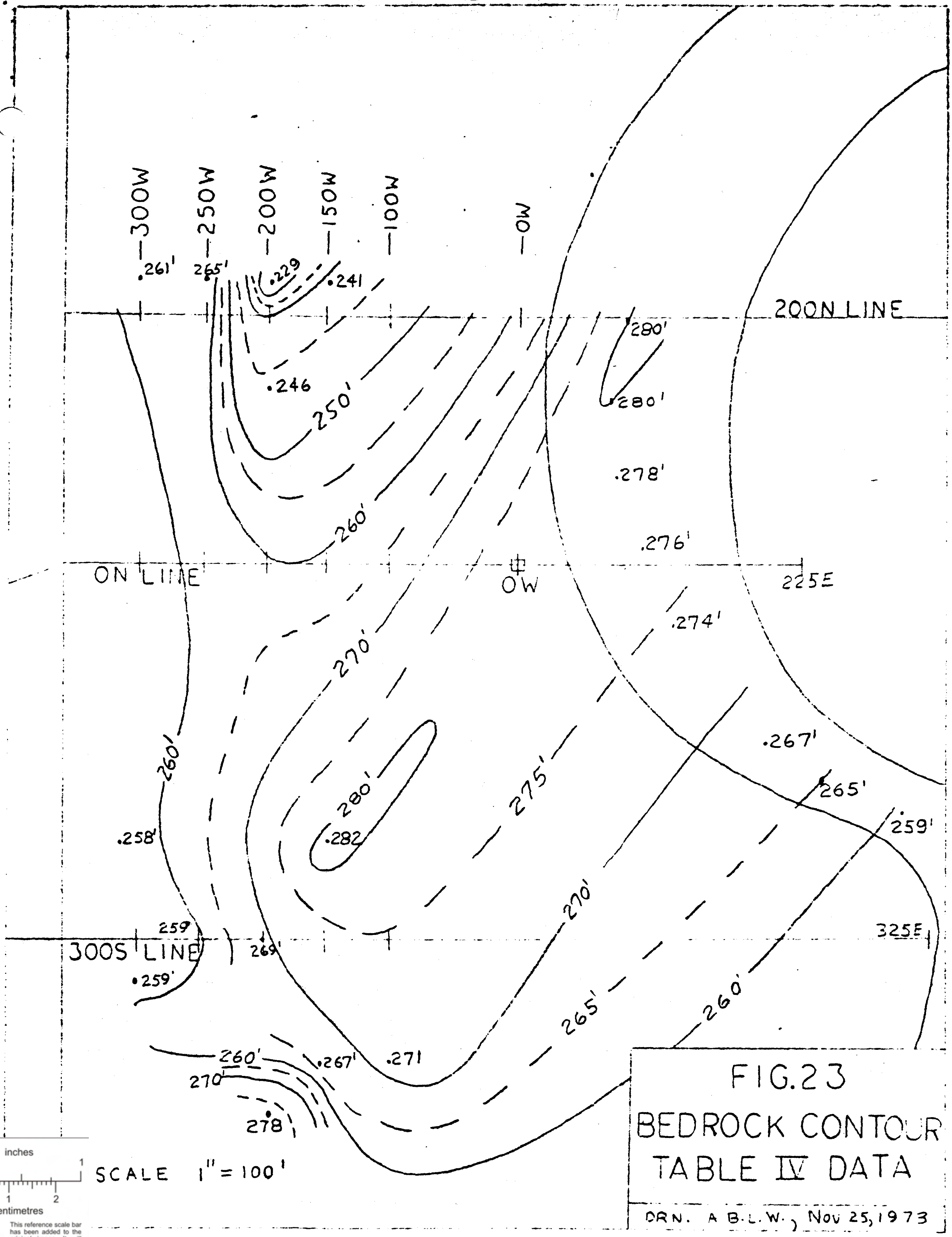


FIG.23
BEDROCK CONTOUR
TABLE IV DATA

DRN. A B.L.W., Nov 25, 1973

One can conclude that the dip is not too important in the present calculations, as far as the depth is concerned.

The elevation of bedrock (obtained as with Table I), was averaged for Table II and III and appears in Table IV, which was used to plot figure 23.

The results are similar to Figure 22 from Table I except the bedrock contours are somewhat shifted. The contours of Figure 23 are likely to be more exact since the computation is for directly below the geophone.

The resulting basement contours display the same features as discussed under the Table I discussion. The same comments also apply to the V1 velocities.

The V2 velocities (of the basement rock) are a bit more consistant (range of 13,000 to 26,000) than under Table I, since this corrected velocity is more sensitive to the dip. This will be discussed further under Table VII.

Table V (Figure 24)

This table was computed from the seismic profiles assuming a 4^{o} dip to the northwest on all lines, and using the "Critical Distance" method of computation rather than the "Time Intercept Method". The computer program used was based on the formulas in Heiland, pages 522-525.

The results are very similar to the previous figures 22 and 23. A central ridge in the bedrock runs south under Bowl I. It slopes off more gently to the southeast and more steeply to the northwest. There appears to be a "valley" in the bedrock running south-southeast to the creek (the straight portion which runs straight to the ocean), as observed on the areal photos, and sketched in Figure 29.

Note that two independent calculations were made for Figures 9, 10 and 18. The first ignores the sand layer and just calculates the depth assuming two layers. In the Second calculation, the figures in the (   ), the critical distance was calculated by subtracting: $C_{23} - C_{13}$ = "corrected" Critical Distance. Once the depth was found using this "Corrected Critical Distance", the depth of the top sand layer (as obtained from Table I) was added on to get the total depth to bedrock.

The results agree closely for both methods of calculation.

Table V: Elevations of Bedrock. Depth Values Obtained Using the Critical Distance Method Assuming the Average Dip to be 4° to the Northwest, and Two Layers on Bench B, Three Layers on Bench C.

Figure	Location	Elevation of the Surface (feet)	Depth to Bedrock (feet)	Elevation of Bedrock (feet)
6	150W, 225N	324	82	242
7	200W, 150N	331	82	249
8	200W, 225N	328	97	221
9	250W, 225N	341	79, (63 + 16)*	262, (262)*
10	300W, 225N	353	90, (51 + 29)*	263, (273)*
11	100W, 400S	324	53	271
12	150W, 225S	323	42	281
13	150W, 400S	326	60	266
14	200W, 300S	326	67	259
15	200W, 450S	337	51	286
16	250W, 300S	329	53	276
17	300W, 225S	328	70	258
18	300W, 325S	340	76, (64 + 17)*	264, (259)*

The "Elevation of Bedrock" was plotted and contoured on Figure 24.

*(   ) Figures corrected in Critical Distances for the sand Layer of Bench C, then the thickness of this layer was added on from Table I.

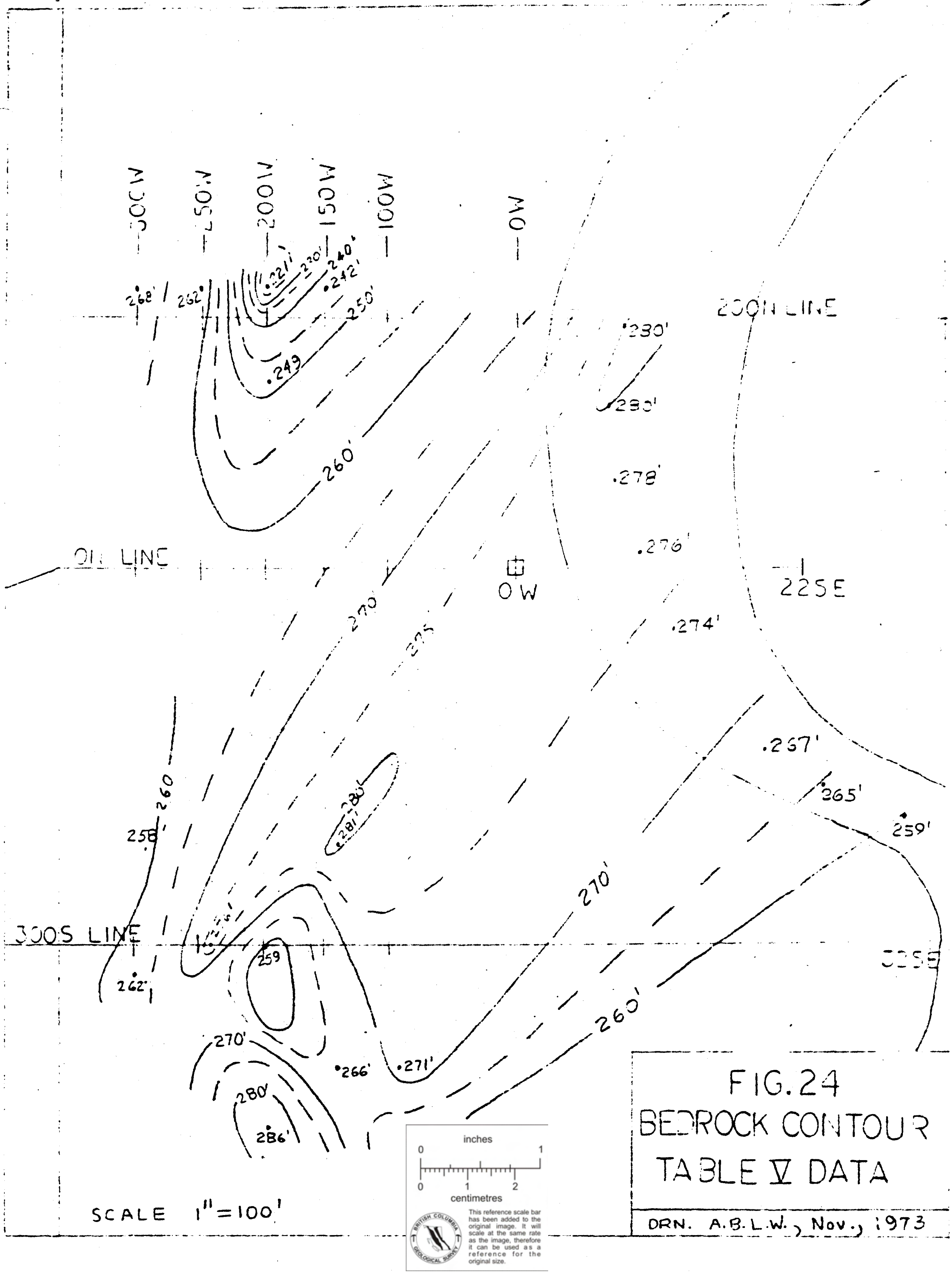


FIG. 24
BEDROCK CONTOUR
TABLE V DATA

DRN. A.B.L.W., Nov., 1973

Table VI (Figure 25)

This table was computed to see if the V2 values could not be interpreted more consistantly. The bedrock contour maps of Figures 22, 23 and 24 were used as first approximations from which the dips of the bedrock along various lines were estimated. Two layers were assumed on Bench B, and three on Bench C, and different dips for each line. The "Time Intercept Method" was used to recalculate the depths to bedrock and the V2 values (Dobrin, pages 82-83 formulas formed the basis of the computer program).

Note in Table VI the various dips that are assumed (some zero, some south, and some to the north). The zero values were assumed for the lines shown since these lines go up and down over the basement rock ridge and average about zero dip.

The results (See Figure 25) are very similar to those in Figure 22 and 24.

Table VII (Figures 26 and 27)

As a check, the depths to bedrock were recomputed using the "Critical Depth Method", based on formulas given in Heiland - pages 522-25.

The results are very similar to those of Table VI, and Figures 24, 22 and 25.

The velocities V2 of bedrock are more consistant in Tables VI and VII than those calculated with the other assumptions. The bedrock velocities range from 12,000 feet/second to 20,200 feet/second (average: 15,200 ft./sec.) which place them in the igneous rack range. These results and the top layer's velocities (which are the same as those given in Table I) are plotted in Figure 27.

The more consistant nature of these velocity results suggest that Figure 26 probably most closely conforms to the correct bedrock contours.

There appear to be definite changes in the velocities of the layers in different parts of the map area.

The bedrock velocities appear to be higher in the northern part of the map area, as compared to the southern. It is possible that this indicates a cap of sandstone/conglomerate over volcanics in the southern part.

The top layers velocity increases somewhat in the southern part although the values are not too different from those in the northern part of Bowl I.

Table VI: Depth to Bedrock and Bedrock Velocities, Assuming Two Layers on Bench B, and Three on Bench C, and Various Dips. The Time Intercept Method of Calculation Was Used.

Figure	Location	Elevation of Surface (ft.)	Depth to Bedrock (ft.)	Elevation of Bedrock (ft.)	Corrected Bedrock Velocity V2 (ft/sec.)	Assumed Dip
6	150W, 225N	324	82	242	27,000	2° NW
7	200W, 150N	331	87	244	18,000	-5.7° NW
8	200W, 225N	328	100	218	25,000	5° NW
9	250W, 225N	341	76	265	22,000	4° NW
10	300W, 225N	353	91	262	19,100	3° NW
11	100W, 400S	324	57	267	15,000	-5.0°SE
			56		16,000	-4.0°SE
12	150W, 225S	323	43	280	12,000	0
13	150W, 400S	326	65	261	14,000	-5.5° SE
			64		14,000	-4.0° SE
14	200W, 300S	326	95	221	13,000	-5.5° SE
			94		14,000	-4.0° SE
15	200W, 450S	337	56	281	13,900	0
16	250W, 300S	329	53	276	12,000	0
17	300W, 225S	328	72	256	12,000	0
18	300W, 325S	340	77	263	13,100	0
		Averages	73		16,700	

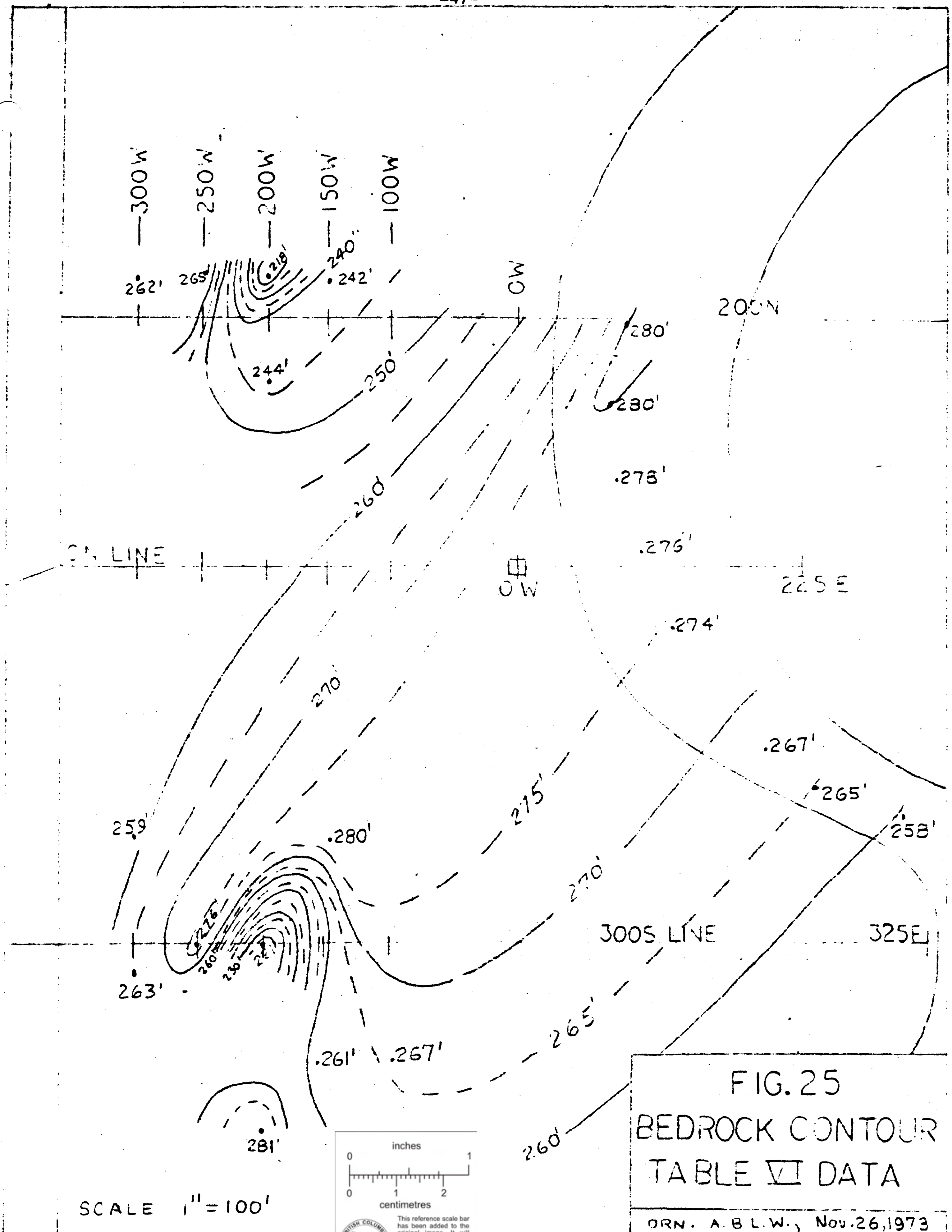


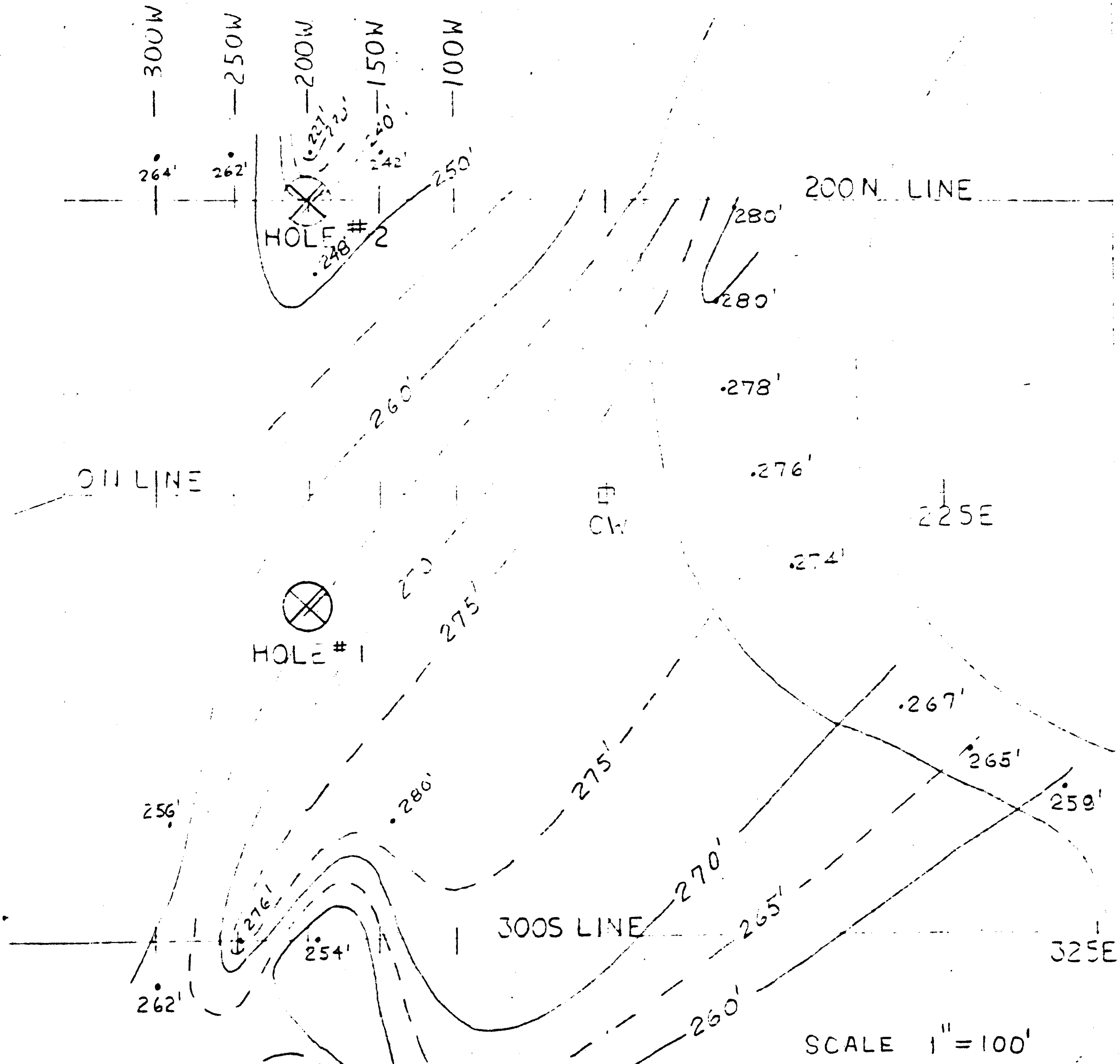
FIG. 25
BEDROCK CONTOUR
TABLE VI DATA

Table VII: Depth to Bedrock and Bedrock Velocities, Assuming Two Layers for Bench B and Three for Bench C, and Various Dips. The "Critical Distance Method" of Calculation Was Used.

Figure	Location	Elevation of Surface (ft.)	Depth to Bedrock (ft.)	Elevation of Bedrock (ft.)	Corrected Bedrock Velocity V2 (ft/sec)	Assumed Dip
6	150W, 225N	324	82	242	20,000	-6° NW
7	200W, 150N	331	83	248	18,000	-5.7° NW
8	200W, 225N	328	101	227	20,200	-9° NW
9	250W, 225N	341	79, (63 + 16)*	262, (262)*	15,200; (15,200)*	-4° NW
10	300W, 225N	353	89, (51 + 29)*	264, (255)*	18,100; (18,100)*	-3° NW
11	100W, 400S	324	57 57	267	15,000 16,000	-5.0° SE -4.0° SE
12	150W, 225S	323	43	280	13,000	0
13	150W, 400S	326	67 66	260	14,000 14,000	-5.5° SE -4.0° SE
14	200W, 300S	326	72	254	13,000	-5.5° SE
15	200W, 450S	337	53	284	13,800	0
16	250W, 300S	329	53	276	12,000	0
17	300W, 225S	328	72	256	12,000	0
18	300W, 325S	344	80, (67 + 17)*	264, (260)*	13,100; (13,100)*	0
		Averages	72		15,200	

The "Elevations of Bedrock" were plotted and contoured on Figure 26.

* See Table V.



SCALE 1" = 100'

FIG.26
BEDROCK CONTOUR
TABLE VII DATA

DRN. A.B.L.W. Nov. 27, 1973

⊗ LOCATION OF EXCAVATIONS

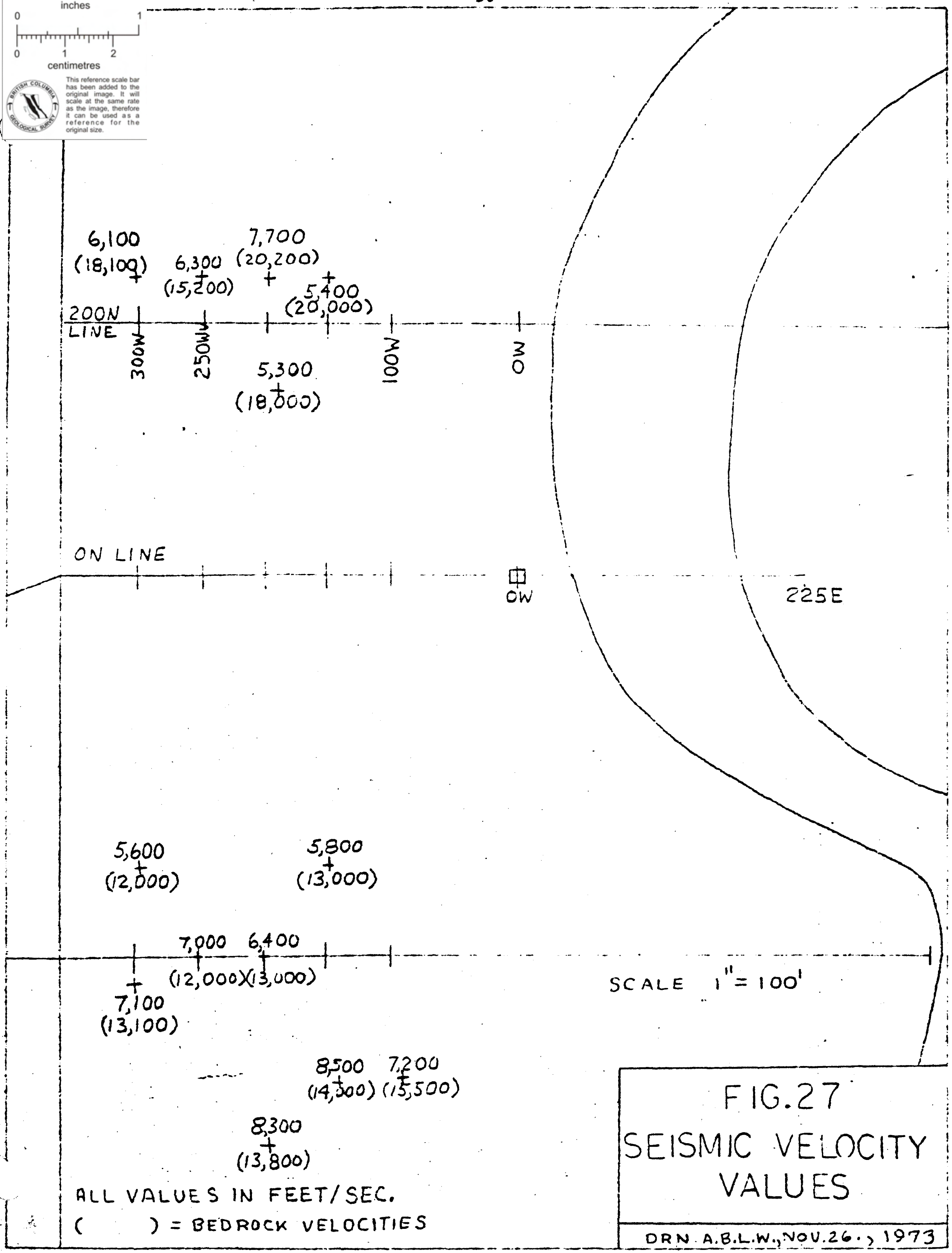


FIG.27
SEISMIC VELOCITY VALUES

Table VIII (Figure 28)

These results were computed assuming three layers and zero dip. The computer program used was based on the formulas given by Dobrin, page 75 (Time Intercept Method), and checked by the "Critical Distance" method (Heiland, pages 509-512).

Note that some assumptions had to be made for Figures 11, 13, and 16 since the overburden delay times near the origin of these profiles were very irregular. Hence certain velocities and time intercepts were assumed. The elevations calculated for these three figures are for general guidance only. Only two "Critical Depth" calculations could be made (for Figures 12 and 7) and these checked closely with the results using the "Time Intercept Method". Not all the data is plotted since some of the diagrams gave no indication of an "extra" layer.

Table VIII is plotted on Figure 28, which shows the contours for the assumed second layer. The velocities involved appear to be in the sandstone-conglomerated range but could also be wet, well cemented (with clay), gravel or sand. The shape of the contours themselves suggest this since they conform quite closely to the topography. The surface deposits around Bench B on which the seismic work was done would compress the underlying areas as one moved from the bench to higher surface elevations.

If, in fact, there are three layers under Bench B (gravel, a more consolidated layer, volcanics) the second layer is not very deep under the work site. The computed values range from 12 to 29 feet with an average of approximately 20 feet.

If there is no second more consolidated layer, the depth of the top layer (gravel/sand/clay) over the bedrock, would range from 43 to 83 feet averaging about 60 feet (Table VII).

Table VIII: Assuming a Three Layer Case, Zero Dip. The "Time Intercept Method" of Calculation Was Used.

Figure	Location	Elevation of Surface (feet)	Depth to second Layer (ft)	Depth to Bedrock (feet)	Elevation of second Layer (ft)	Elevation of Bedrock (feet)	V1	V2	V3
14	200W, 300S	319	14	76	305	243	4400	5800	16,000
16	250W, 300S	324	(21)***	(58)	(303)	266	4800**	5500*	12,000
17	300W, 225S	330	22	74	308	256	4800	5300	12,000
12	150N, 225S	323	(29)	(60)	294	26	5400	9789	13,000
7	200W, 150 N	324	12	83	312	241	4900	5300	26,000
13	150W, 400S	321	(21)	(67)	(300)	254	4800**	5500*	16,000
11	100W, 400S	323	(21)	(77)	(302)	246	4800**	5500*	18,000
		Averages	(20) 16	(70) 78			4900	6550	17,000

V1 = velocity of upper layer (top layer)
V2 = velocity of second layer
V3 = velocity of third layer (bedrock)

* This velocity is the average of Figures 14, 17, and 7.
** This velocity is the average of Figures 14, 17, 12, and 7.
*** This Depth values given in Brackets ( ) are for general guidance only since they are based on velocity and time intercept averages of the other figures.

The "Elevation of Bedrock" was plotted and contoured in Figure 26, while the "Elevation of Second Layer" was plotted and contoured in Figure 28.

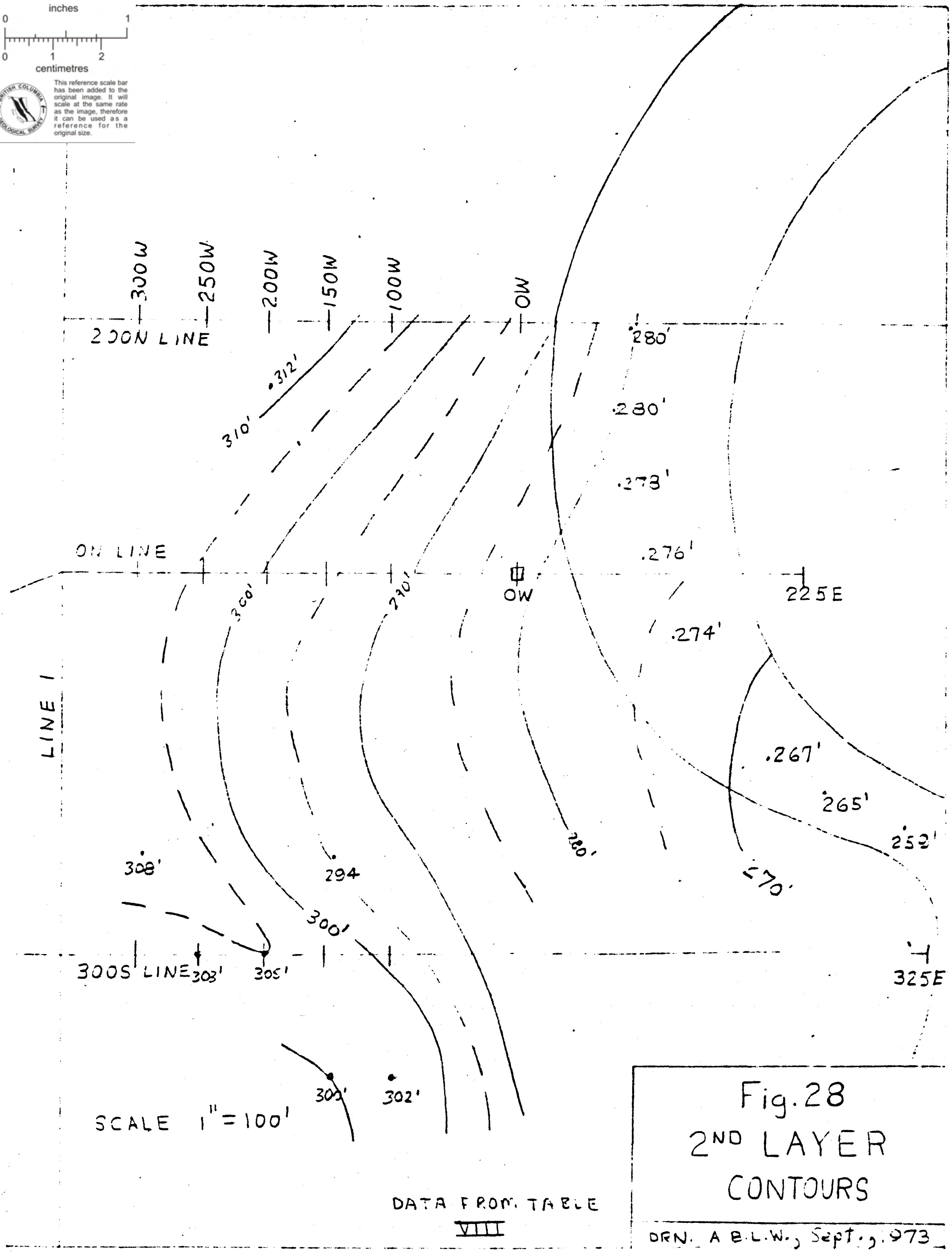


Fig. 28
2ND LAYER
CONTOURS

DATA FROM TABLE VIII

DRN. A.B.L.W., Sept., 1973

9. SOME PRELIMINARY RESULTS FROM EXCAVATIONS

The following information should be considered only approximate since it is not based on the actual logs of the excavations but on verbal communications to the present writer from Mr. R. Spring. The official log will accompany the Mining Engineer's report on the property; the material presented here is only to provide a background to the seismic results and interpretation.

Hole No. 1 was located on Bench B at about 75S, 200W and is about 35' deep. The material and depths from the surface are approsimately as follows: clean gravel and boulders (0 to 13'); brownish consolidated gravel and boulders (13' to 29'); coarse compact sand (29' to 30'); compacted gravel containing large flat rocks of basalt (30 to 35' - bottom of hole).

Hole No. 2 was located about 200N, 200W and extends about 65' below the surface. The material and depths are; sand (0 to 14', top layer of Bench C); gravel (14' to 26'); clay (26' to 65' - bottom of hole. The clay grades down from a fairly light grey form to a dense dark grey form at the bottom of the hole.

These results suggest certain interpretations for the seismic work.

(a) It <u>may</u> be difficult to distinguish clay from gravel on the basis of the seismic velocities. If, however, the clay observed in Hole No. 2 terminates a short distance to the south of this location it would <u>not</u> appear as a distinct layer on the seismic results. On the other hand it would probably lead to higher velocities being observed to the north - which corresponds exactly to what is found north of the 200N line. Both the upper layer and the bedrock velocities are higher than those for the points between the 150N and 200S lines.

(b) Applying this same hypothesis to the southern results (on, or south of, the 300S line) it <u>is possible</u> that the clay layer would reappear in the vicinity of the 300S line. However, the bedrock velocities in this region are quite low and it is more probable that the high top layer velocities at the extreme southern end are due an increasing percentage of large basaltic boulders in the gravel.

(c) The top layer seismic velocities in the extreme southern part seem range slightly higher in seismic velocity (5600 - 8500 ^{1}/sec) than in the north (5300 - 7700 ^{1}/sec). This suggests that the gravel is more continuous with depth in the southern part of Bowl I, and contains a higher portion of more dense (and higher seismic velocity) material such as the flat volcanic rocks at the bottom of Hole No. 1.

(d) The sand layer of Bench C does seem to have a distinctly lower velocity (2300 - 2800 ^{1}/sec).

It is obvious from the excavations that these various delta deposits are not continuous across the map area. This feature is an important one in planning the development of this property.

10. INTERPRETATIONS

(a) Bedrock

One of the objectives of the magnetic and seismic surveys was to obtain a picture of the rock structures under the ancient gravel/sand/clay delta.

The most probable structure is sketched (not to scale) in Figure 29. Three prominent features are evident in this hypothesized structure.

(1) The continuation of the Leech River Valley Fault is indicated by:

- (a) a linear continuation of this fault out of the upper canyon on Loss Creek as seen on the areal photos;
- (b) shoreline features (evident on the areal photos) which could be interpreted as a fault offset feature and/or a change of rock type the harder volcanic rock to the souteast resulting in a hard rock shoreline, and a softer rock to the northwest which is reflected in the sandy shoreline (schists?);
- (c) Low magnetic values in this zone which suggest the bedrock is deeper;
- (d) seismic inferred contours for bedrock which indicate a dip downward to the hypothesized extrapolation of the Leech River Valley Fault.

(2) The basement rock ridge is suggested by:

- (a) strong magnetic variations having linear characteristics which run roughly parrallel or along the seismic inferred bedrock ridge (the strong variations suggest the bedrock is closer to the surface, i.e. a ridge);
- (b) seismic inferred contours which connect with bedrock in the creek and dip downward to the northwest and souteast.

(3) A possible bedrock "canyon" is suggested by:

- (a) seismic results giving a deeper bedrock value in one location which is:
- (b) just upstream, and in line, with the straight segment of the Loss Creek canyon which empties into the ocean.

These three features seem to fit the data obtained best, although it should be noted that there are several other possible interpretations. One possibility which might be considered, involves that of a consolidated sediment such as sandstone/conglomerate overlying the bedrock. The presence of a consolidated sediment would change the nature of the planned operation from placer development to hardrock development.

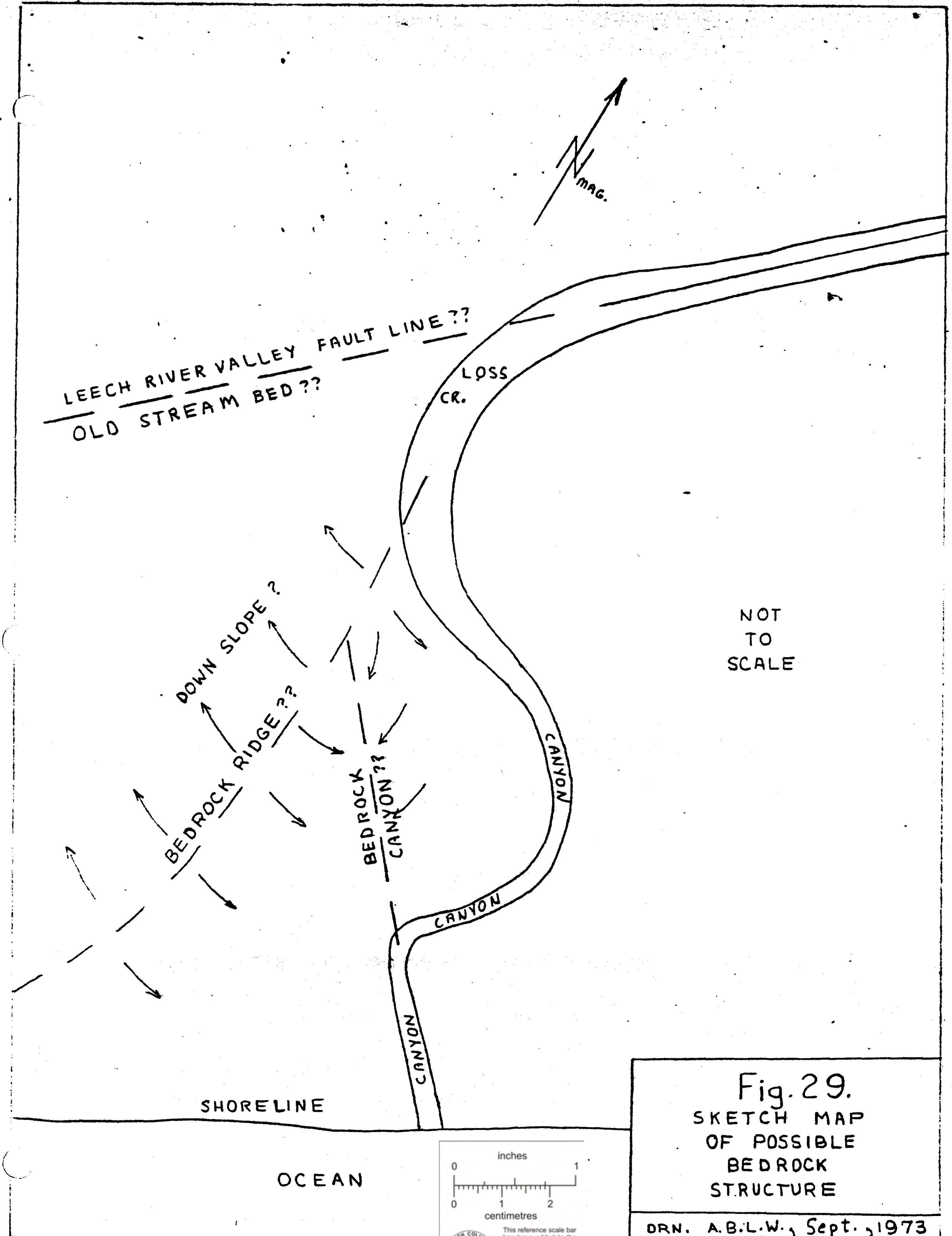


Fig. 29.
SKETCH MAP OF POSSIBLE BEDROCK STRUCTURE

DRN. A.B.L.W., Sept., 1973

(b) Layers above the Bedrock: A Possible Working Hypothesis

Several layers, although not evident from the seismic results, are visible in the excavations. The presence of clay in Hole No. 2 suggests an initial deposition of clay under offshore delta conditions (alternately, it could be a pocket of clay formed in a large pool).

It is then possible this clay was partly eroded away in the southern parts of Bowl I and gravel deposited there.

It is then hypothesized that the main delta was formed following the retreat of the glaciers during the end of the last ice age.

Subsequently, Bowl I was cut by Loss Creek to its present form. It is possible the clean gravel above the more consolidated dirty material in Hole No. 1 was reworked during this last stage. If so, it might be the most promising zone for placer deposits, containing much of the heavy material from the reworked Bowl.

11. RECOMMENDATIONS

(1) Future developmental work may as well be planned assuming Figure 29 as the guideline to bedrock structure.

(2) One or two drill holes might be placed to test for the possibility of a consolidate sediemnt second layer lying above the bedrock. Best locations are 200W, 300S and 200W, 150N, according to Table VIII since these locations indicate the shallowest depth to a possible second layer.

(3) Buildings and worked-material dumps should be kept out of Bowl II and as far to the northwest of Bowl I as is possible, or even kept right out of Bowl I. The material at the bottom of these two Bowls probably is the remains of material which once covered the Bowls to the same depth as the other parts of the delta (100' - 200'). Hence all the heavy minerals originally in this material would tend to collect at the bottoms of Bowls I and II, while the lighter material was washed down the creek to the ocean. Since the heavy minerals would first be concentrated when the delta was being formed, then further concentrated when the Bowls were being cut out, the bottoms of these Bowls hold the greatest promise of economic placer deposits than any other zones so far explored.

(4) The possible bedrock canyon discussed in 5 (ii) following and, the possible old river channel along the extrapolated Leech River Valley Fault are also interesting areas for development; however, they are farther away from the present site of operations and more difficult and expensive to develop.

(5) Further seismic exploration might be attempted:

- (i) along the main access road from the camp to the main Port Renfrew-Jordon River road, right across the possible extension of the Leech River Valley Fault (refraction and possibly reflection surveys); and,
- (ii) above the region suspected of being an extension of the linear portion of the canyon of Loss Creek that empties directly into the ocean (refraction survey).
- (iii) in the central and western ravines which cut through the old delta.

(6)Physical exploration, trenching and panning might be attempted in the suspected canyon area mentioned in 5 (ii) preceeding.

(7) A general reconnaisance magnetic survey might be considered for the rest of the delta area covered by staking, followed up by detailed magnetic surveys in areas of strong magnetic variation, and seismic surveys over areas where the proximity of bedrock is indicated.

SIGNED:

A.B.L. Whittles

Dr. A.B.L. Whittles

12. REFERENCES

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(2) 1940, "Exploration Geophysics", by C.A. Heiland. Reprinted: Hafner Publication 1968

(3) 1960, "Introduction to Geophysical Prospecting", McGraw-Hill Book Co. Inc. by M.B. Dobrin

(4) 1971, "Geological Reconnaissance Map of Vancouver Island and Gulf Islands", Muller

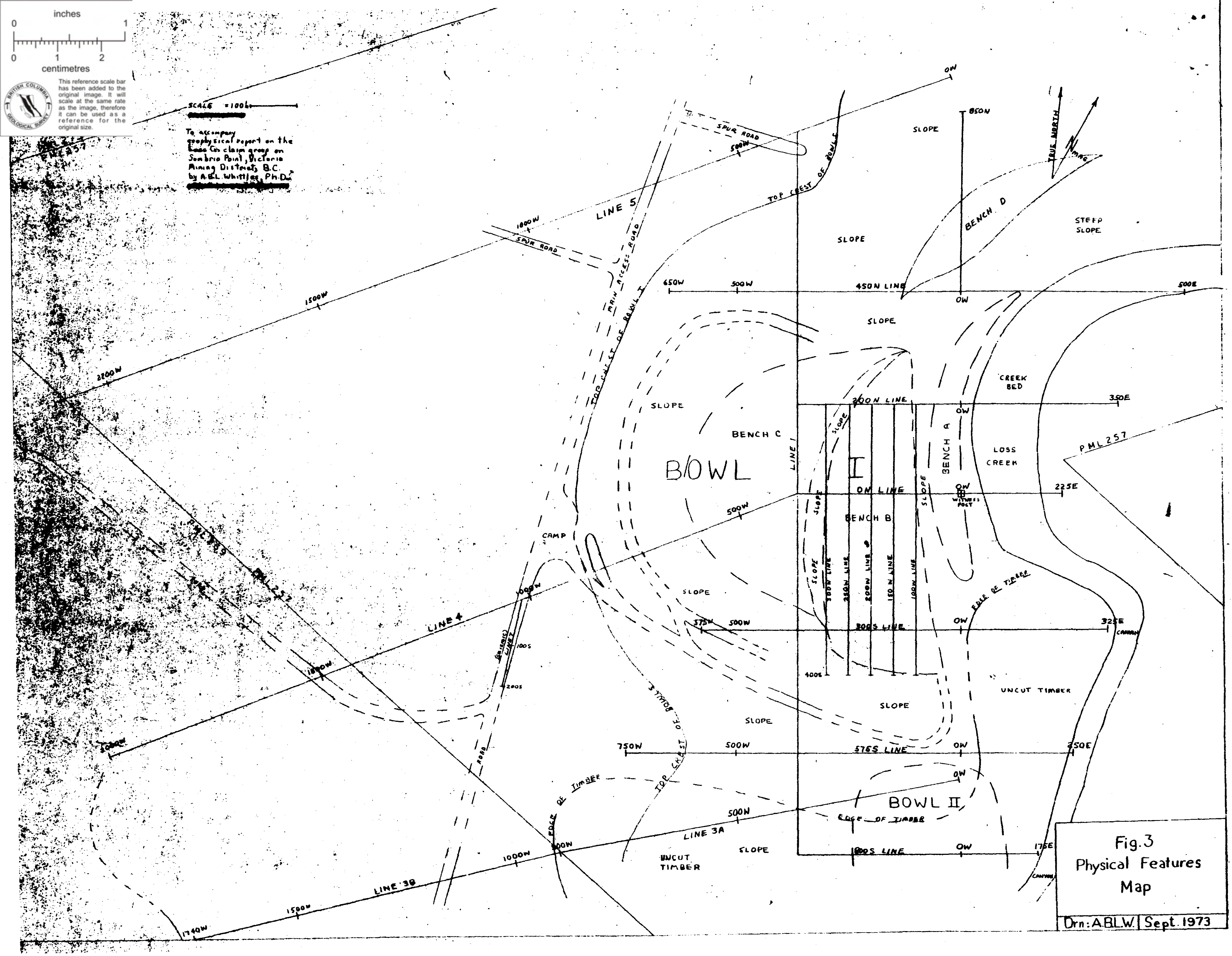
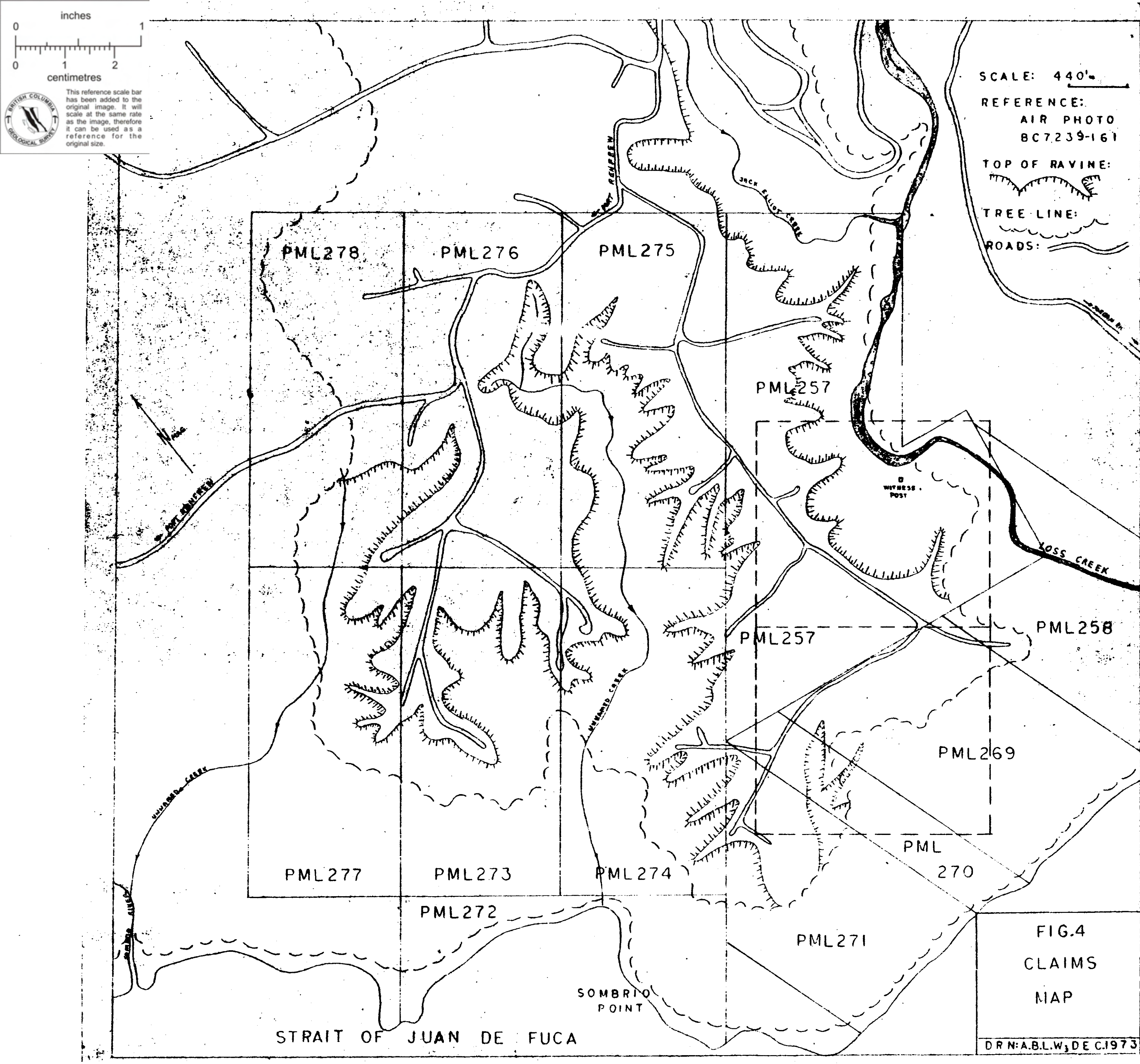


Fig. 3
Physical Features Map
Drn: A.B.L.W. | Sept. 1973


inches
0
1
0
1
2
centimetres
BRITISH COLUMBIA GEOLOGICAL SURVEY
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.
SCALE: 440'=
REFERENCE:
AIR PHOTO
BC7239-161
TOP OF RAVINE:
TREE LINE:
ROADS:
PML278
PML276
PML275
PML257
PML257
PML258
PML269
PML
270
PML277
PML273
PML274
PML272
PML271
WITNESS POST
LOSS CREEK
JACK ELLIOT CREEK
UNNAMED CREEK
UNNAMED CREEK
SOMBRIO POINT
STRAIT OF JUAN DE FUCA
FIG.4
CLAIMS
MAP
DRN: A.B.L.W; DEC.1973

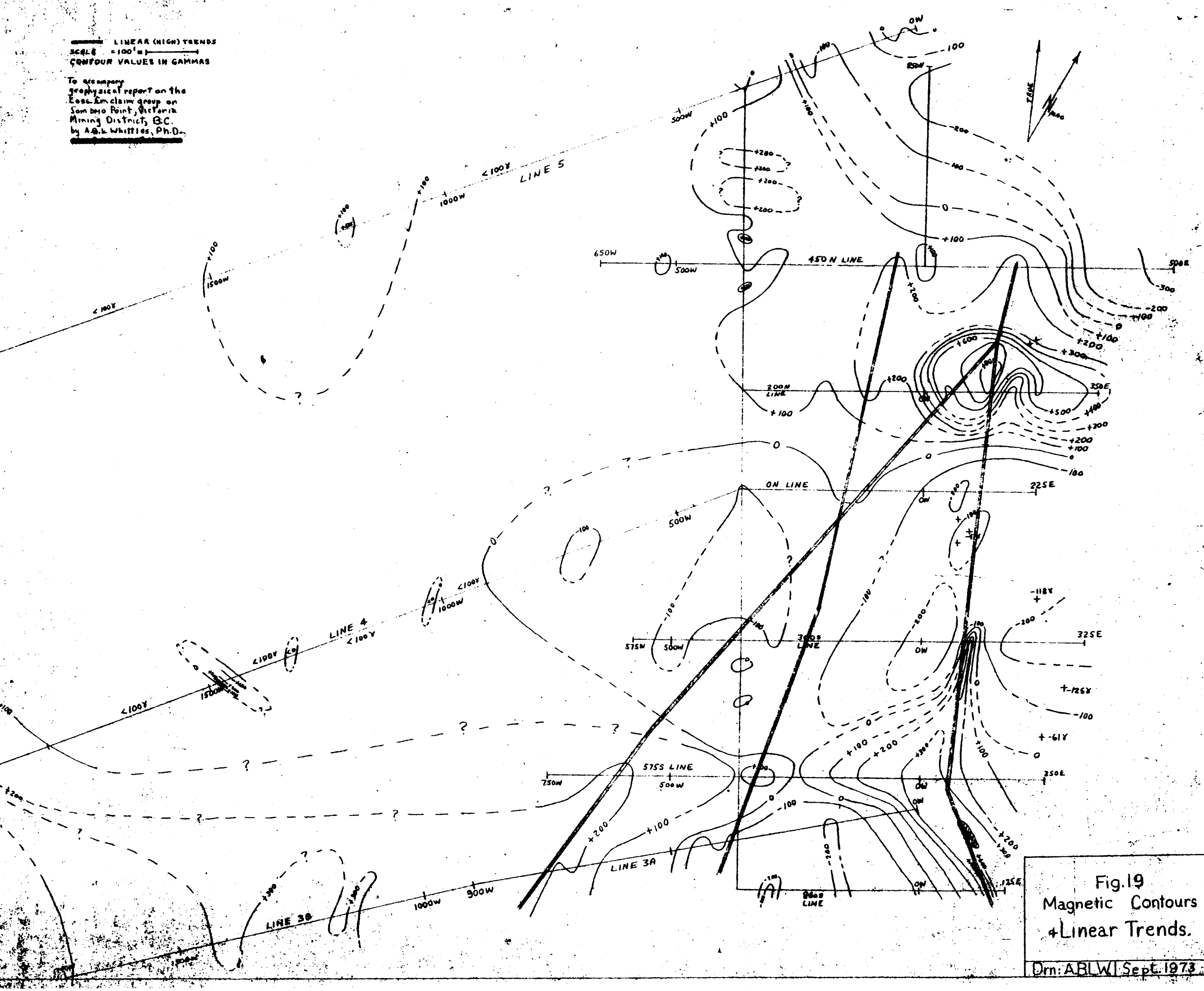


Fig.19
Magnetic Contours
+ Linear Trends.

Drn: ABLW Sept. 1973

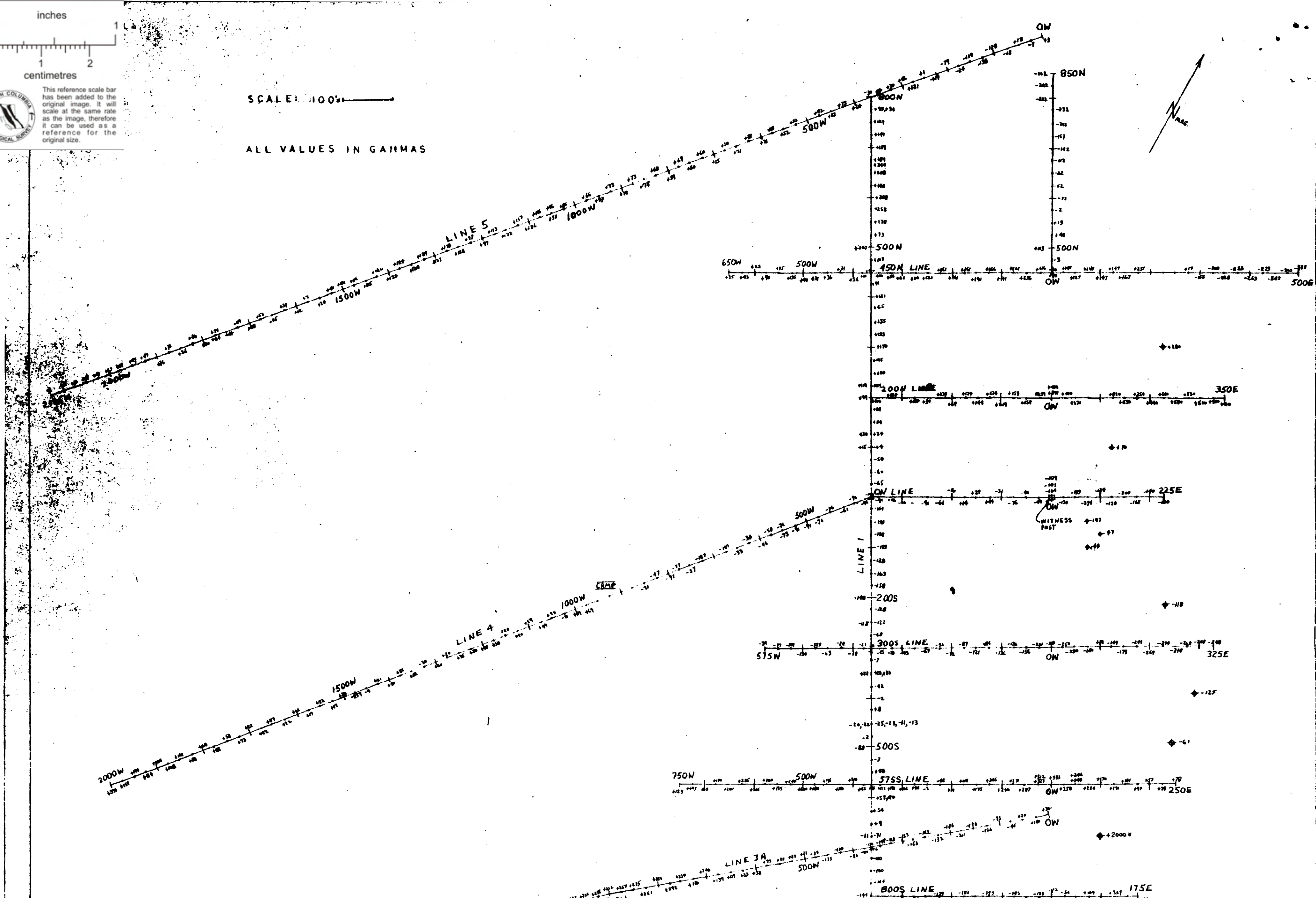


FIG.20
CORRECTED
MAGNETIC
VALUES

DRN: A.B.L.W. | DEC. 2, 1973

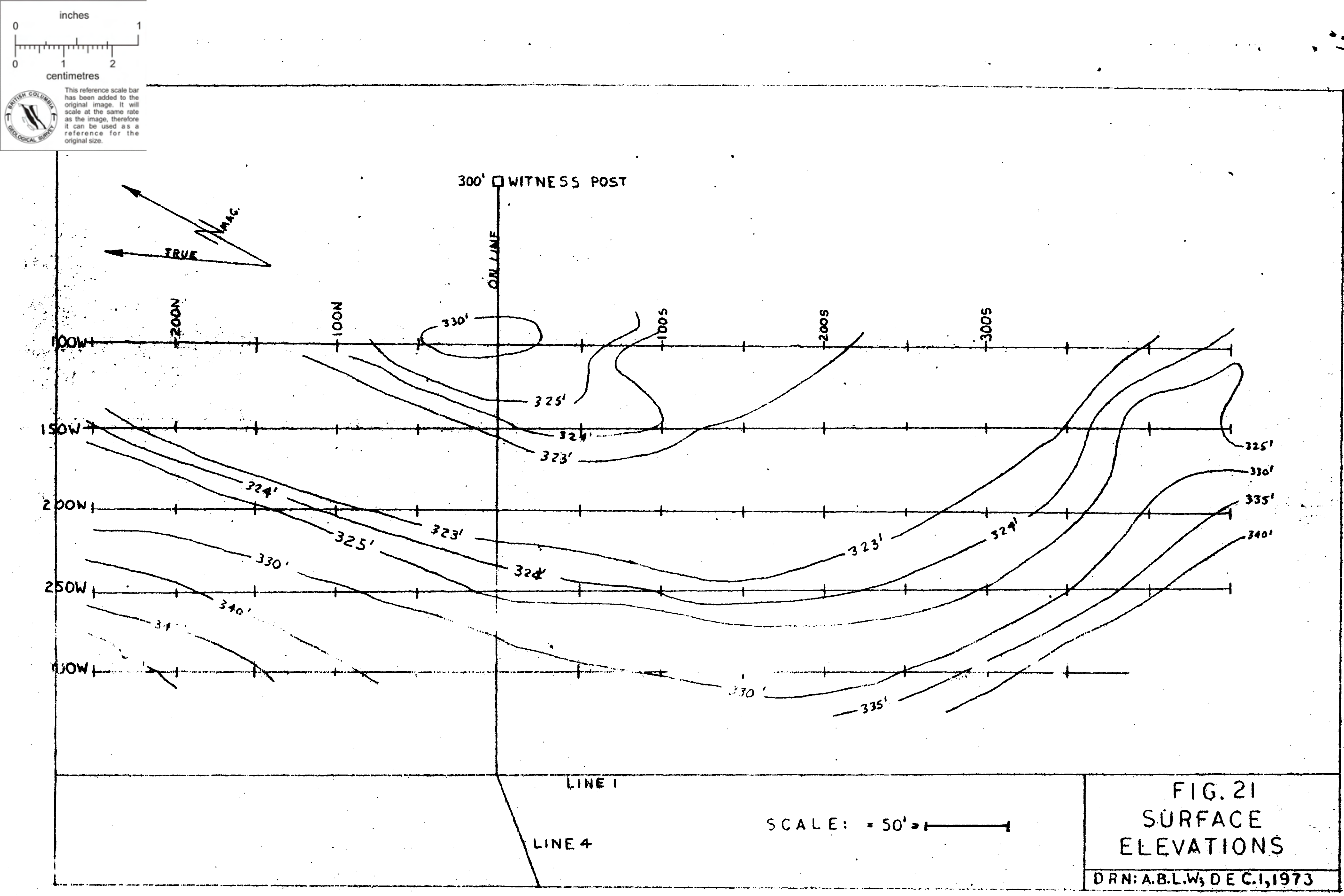


FIG. 21
SURFACE
ELEVATIONS

DRN: A.B.L.W; DEC.1, 1973

13. APPENDICES

(a) COST ANALYSIS

(1)	Time provided by Dr. A.B.L. Whittles	
	(a) Aug. 9, 10, 11, 12, 23, 26 and 27; and Sept. 29 and 13, 1973; 9 days	$ 900.00
	(b) Computing, plotting, interpretation of data, report writing: Sept. 1, 2, 3 and 22; Oct. 6, 7, 13, 14; Nov. 11, 12, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29;a total of 14 days' time	1,400.00
(2)	Time and costs of other Personnel	
	(a) T. Avery (5 days - electronic technician)	250.00
	(b) F. Loring (3 days - surveying)	300.00
	(c) D. Guttridge, J. Scholtens, R. Miller, (9 days - surveying and line cutting)	1,350.00
	(d) R. Miller (2 days - plotting results)	200.00
	(e) R. Spring (6 days - line cutting crew member and explosives man)	300.00
(3)	Mileage	
	Dr. A.B.L. Whittles: 1200 miles (truck and Trailer)	230.00
(4)	Trailer Costs, Board and Room	
	2 men for 4 days; one man for 4 days	120.00
(5)	Other Costs	
	(a) Explosives and Caps (Seismic Work; approximately 250 detonations)	100.00
	(b) Maps and areal photos	20.00
	(c) Blueprints, duplicating (7 copies for each of two reports: preliminary - company, and present, reports)	90.00
	(d) Polaroid Film for Seismic Unit	30.00
	(e) Typing (preliminary and present reports)	45.00
	TOTAL COSTS	$ 5,335.00

(b) Computer Programs HP9820A

Magnetic Drift Correction

```
0:
SPC 2;FXD 1⊢
1:
PRT "DRIFT","COR
RECTION","PROGRA
M";SPC 1⊢
2:
ENT "BASE RDG.ST
ART",R0,"BASE RD
G.FINISH",R1⊢
3:
ENT "TIME BRS-HR
S",R2,"TIME BRS-
MIN",X;X/60+R2→R
2;0→X⊢
4:
ENT "TIME BRF-HR
",R3,"TIME BRF-M
IN",X;X/60+R3→R3
;0→X⊢
5:
ENT "BASE STAT.L
EVEL",R4⊢
6:
ENT "LINE/STATIO
N",R6,"READING",
R7⊢
7:
ENT "TIME READIN
G-HRS",R8,"TIME
READING-MIN",X;X
/60+R8→R8;0→X⊢
8:
(R0-R1)(R8-R2)/(
R3-R2)+(R7-R0)+R
4→R5⊢
9:
PRT "LINE STATIO
N=",R6⊢
10:
PRT "CORR.RDG.="
,R5;SPC 1;GTO 6⊢
11:
END ⊢
R115
```

Seismic Program

```
0:
SPC 4;FXD 0⊢
1:
PRT "TWO LAYER",
"SEISMIC PROGRAM
","ZERO SLOPE";
SPC 2⊢
2:
ENT "CRITICAL DI
ST.Ci",R0,"VELOC
ITY V1",R1,"VELO
CITY V2",R2⊢
3:
F((R2-R1)/(R2+R1
)),+.5+RE+R3⊢
4:
PRT "DEPTH TO","
FIRST LAYER=",R3

5:
PRT "VELOCITY V1
",R1⊢
6:
PRT "VELOCITY V2
",R2⊢
7:
END ⊢
R140
```

Computer Programs (Continued)

Seismic Programs

```
0:
SPC 4;FXD 2⊢
1:
PRT "TWO LAYER",
"SEISMIC PROGRAM
","FOR ONE PROFI
LE","DIPPING BED
S"⊢
2:
PRT "WHEN ANGLE
OF","DIP IS KNOW
N","USING CRITIC
AL","DISTANCES";
SPC 2⊢
3:
ENT "VELOCITY V1
",R1,"VELOCITY V
2",R2⊢
4:
ENT "CRITICAL DI
ST.",R3,"ANGLE
OF DIP",R4⊢
5:
PRT "IF GEOPHONE
","IS UP","SLOPE
 ENTER 1";SPC 1⊢
6:
PRT "IF GEOPHONE
","IS DOWN","SLO
PE ENTER 2";SPC
2⊢
7:
ENT "ENTER 1 OR
2",A⊢
8:
IF A=2;GTO 10⊢
9:
ASN (R1/R2)-R4→R
5;GTO 11⊢
10:
ASN (R1/R2)+R4→R
5⊢
11:
R1/SIN R5→R6⊢
12:
R3*(1-R1/R2)/(2*
COS R5*COS R4)→R
7⊢
13:
PRT "VELOCITY V1
=",R1⊢
14:
PRT "CORRECTED V
2=",R6⊢
15:
PRT "VERTICAL DE
PTH","TO SECOND
LAYER=",R7⊢
16:
PRT "ANGLE OF DI
P=",R4,"
 DEGREES"⊢
17:
IF A=1;PRT "UP D
IP";SPC 2;GTO 3⊢
18:
IF A=2;PRT "DOWN
 DIP";SPC 2;GTO
3⊢
19:
END ⊢
R90
```

```
0:
SPC 4;FXD 2⊢
1:
PRT "TWO LAYER",
"SEISMIC PROGRAM
","FOR REVERSE",
"SHOOTING AND"⊢
2:
PRT "DIPPING BED
S";SPC 2⊢
3:
PRT "VELOCITY V2
","UP SLOPE","IS
 LARGEST";SPC 1⊢
4:
ENT "VELOCITY V1
",R1,"VELOCITY V
2 DN",R2,"VELOCI
TY V2 UP",R3⊢
5:
PRT "TIME INTERC
.UP","IS LARGEST
";SPC 2⊢
6:
ENT "TIME INTERC
.UP",R5,"TIME IN
TERC DN",R4⊢
7:
.5*(ASN (R1/R2)+
ASN (R1/R3))→R6⊢
8:
.5*(ASN (R1/R2)-
ASN (R1/R3))→R7⊢
9:
R1/SIN R6→R8⊢
10:
R1*R5/(2*COS R6*
COS R7)→R9⊢
11:
R1*R4/(2*COS R6*
COS R7)→R10⊢
12:
PRT "VELOCITY V1
=",R1⊢
13:
PRT "CORRECTED V
2=",R8⊢
14:
PRT "ANGLE OF DI
P=",R7,"
 DEGREES"⊢
15:
PRT "VERTICAL DE
PTH","UP SLOPE="
,R10⊢
16:
PRT "VERTICAL DE
PTH","DOWN SLOPE
=",R9⊢
17:
END ⊢
R49
```

Seismic Programs

```
0:
SPC 4;FXD 2⊢
1:
PRT "IF TITLE IS
 TO","BE SKIPPED
","ENTER 1";SPC
2;ENT "SKIP TITL
E?",A⊢
2:
IF A=1;GTO 5⊢
3:
PRT "TWO LAYER",
"SEISMIC PROGRAM
","FOR REVERSE",
"SHOOTING AND"⊢
4:
PRT "DIPPING BED
S","USING CRITIC
AL","DISTANCES";
SPC 2⊢
5:
PRT "VELOCITY V2
","UP SLOPE","IS
 LARGEST";SPC 1⊢
6:
ENT "VELOCITY V1
",R1,"VELOCITY V
2 DN",R2,"VELOCI
TY V2 UP",R3⊢
7:
PRT "CRIT. DIST.
UP","IS LARGEST"
;SPC 2⊢
8:
ENT "CRIT.DIST.U
P",R5,"CRIT.DIST
.DOWN",R4⊢
9:
.5*(ASN (R1/R2)+
ASN (R1/R3))→R6⊢
10:
.5*(ASN (R1/R2)-
ASN (R1/R3))→R7⊢
11:
R1/SIN R6→R8⊢
12:
R5*(1-R1/R3)/(2*
COS R6*COS R7)→R
9⊢
13:
R4*(1-R1/R2)/(2*
COS R6*COS R7)→R
10⊢
14:
PRT "VELOCITY V1
=",R1⊢
15:
PRT "CORRECTED V
2=",R8⊢
16:
PRT "ANGLE OF DI
P=",R7,"
 DEGREES"⊢
17:
PRT "VERTICAL DE
PTH","UP SLOPE="
,R10⊢
18:
PRT "VERTICAL DE
PTH","DOWN SLOPE
=",R9⊢
19:
END ⊢
R85
```

```
0:
SPC 4;FXD 2⊢
1:
PRT "TWO LAYER",
"SEISMIC PROGRAM
","FOR ONE PROFI
LE","DIPPING BED
S"⊢
2:
PRT "WHEN ANGLE
OF","DIP IS KNOW
N";SPC 2⊢
3:
ENT "VELOCITY V1
",R1,"VELOCITY V
2",R2⊢
4:
ENT "TIME INTERC
EPT",R3,"ANGLE O
F DIP",R4⊢
5:
PRT "IF SHOOTING
 UP","SLOPE ENTE
R 1";SPC 1⊢
6:
PRT "IF SHOOTING
 DOWN","SLOPE EN
TER 2";SPC 2⊢
7:
ENT "ENTER 1 OR
2",A⊢
8:
IF A=1;GTO 10⊢
9:
ASN (R1/R2)-R4→R
5;GTO 11⊢
10:
ASN (R1/R2)+R4→R
5⊢
11:
R1/SIN R5→R6⊢
12:
R1*R3/(2*COS R5*
COS R4)→R7⊢
13:
PRT "VELOCITY V1
=",R1⊢
14:
PRT "CORRECTED V
2=",R6⊢
15:
PRT "VERTICAL DE
PTH","TO SECOND
LAYER=",R7⊢
16:
PRT "ANGLE OF DI
P=",R4,"
 DEGREES"⊢
17:
IF A=1;PRT "UP D
IP"⊢
18:
IF A=2;PRT "DOWN
 DIP";SPC 2⊢
19:
END ⊢
R99
```

Seismic Programs

```
0:
SPC 4;FXD 0⊢
1:
PRT "THREE LAYER
","SEISMIC PROGR
AM","ZERO SLOPE"
;SPC 2⊢
2:
ENT "VELOCITY V1
",R1,"VELOCITY V
2",R2,"VELOCITY
V3",R3⊢
3:
ENT "TIME INT.2N
D SEG",R4,"TIME
INT.3RD SEG",R5⊢
4:
R4*R1*R2*.5/√(R2
*R2-R1*R1)→R0⊢
5:
R3*R3→A;R2*R2→B;
R1*R1→C;R3*R2/√(
A-B)→X;2*R0*√(A-
C)/(R0*R1)→Y⊢
6:
(R5-Y)*.5*X→R6⊢
7:
R0+R6→R7⊢
8:
PRT "VELOCITY V1
=",R1⊢
9:
PRT "VELOCITY V2
=",R2⊢
10:
PRT "VELOCITY V3
=",R3⊢
11:
PRT "DEPTH TO","
FIRST LAYER=",R0
⊢
12:
PRT "DEPTH TO","
SECOND LAYER","F
ROM SURFACE=",R7
⊢
13:
PRT "THICKNESS O
F","SECOND LAYER
=",R6;GTO 2⊢
14:
END ⊢
R108
```

```
0:
SPC 4;FXD 0⊢
1:
PRT "THREE LAYER
","SEISMIC PROGR
AM","ZERO SLOPE"
,"USING CRITICAL
"⊢
2:
PRT "DISTANCES";
SPC 2⊢
3:
ENT "VELOCITY V1
",R1,"VELOCITY V
2",R2,"VELOCITY
V3",R3⊢
4:
ENT "CRIT.DIST.C
12",R4,"CRIT.DIS
T.C23",R5⊢
5:
ASN (R1/R2)→R6⊢
6:
R4*(1-SIN R6)/(2
*COS R6)→R0⊢
7:
ASN (R2/R3)→R8⊢
8:
ASN (R1/R3)→R10⊢
9:
.5*R5*√((R3-R2)/
(R3+R2))+R0*(
COS R6-COS R10)/
(SIN R6*COS R8)→
R9⊢
10:
R0+R9→R7⊢
11:
PRT "VELOCITY V1
=",R1⊢
12:
PRT "VELOCITY V2
=",R2⊢
13:
PRT "VELOCITY V3
=",R3⊢
14:
PRT "DEPTH TO","
FIRST LAYER=",R0
⊢
15:
PRT "DEPTH TO","
SECOND LAYER","F
ROM SURFACE=",R7
⊢
16:
PRT "THICKNESS O
F","SECOND LAYER
=",R9;SPC 2;GTO
3⊢
17:
END ⊢
R104
```

(c) <u>Resume of Experience of Other Field Workers</u>

D. Guttridge and J. Scholtens are former students of the Geological Technology, Malaspina College and had about 1 year of previous surveying experience prior to their work on the survey crew for the present report.

Mr. Loring, P. Eng. is a graduate Mining Engineer with 25 years of mining, surveying and exploration experience. Mr.Loring is a registered B.C. Engineer.

Mr. T. Avery, electronic technician, helped design, test and operate the photographic seismic equipment, under the direction of Dr. A.B.L. Whittles. Mr. Avery has approximately 20 years radio, TV, and electronic experience, and is presently in charge of the Electrical - Electronics Technology, Malaspina College, Nanaimo.

Mr. R. Spring has had many years of experience as a prospector. He also possesses a B.C. Explosives license.

Mr. R. Miller is a graduate of Ryerson Polytechnical Institute, Toronto, and has approximately 10 years engineering experience involving railroad and road work, drainage and sewage facilities, surveying for placer and mineral leases. Mr. Miller supervised the layout of the present leases and mineral claims discussed in this report and the leveling work required to obtain the elevations used in the seismic work.

(d) Resume of Technical and Field Work Experience of Dr. A.B.L. Whittles, Ph.D.

(1) University training at University of B.C. and University of Toronto, with the completion of a Ph.D. in Physics (Geophysics section) in 1964, for U.B.C.

(2) Prior experience (2 summers) with geophysical section Imperial Oil Ltd., in Alberta.

(3) Surveying experience, Buttle Lake Power Project.

(4) Four years at the B.C. Institute of Technology, teaching geophysical prospecting courses to day and evening students, and three years at Malaspina College.

(5) Consulting experience during the past seven years with companies in Vancouver, Victoria, and Calgary, including field supervision and interpretation.

(6) Presently in charge of the Geological Technology, Malaspina College, Nanaimo, and including the teaching of courses on geophysical prospecting.

(7) An active member with the Society of Exploration Geophysicists, and the B.C. Geophysical Society.

A.B.L. Whittles

Dr. A.B.L. Whittles, Ph.D.