GEOPHYSICAL REPORT
ON
SHALLOW REFRACTION SEISMIC SURVEY
ON
PLACER MINING LEASE NO.7073
RAMOS CREEK, WINGDAM AREA
CARIBOO MINING DIVISION, BRITISH COLUMBIA
BARKERVILLE DESIGNATED PLACER AREA
MAP 93H/4W
Latitude 53°02'N; Longitude 121°58'W

For

TANACANA MINES LTD.
c/o 50 Granville Square
200 Granville Street
Vancouver, B. C.
V6C 1S4

By

Wm HOWARD MYERS, P.Eng. (B.C.), P.Geol. (Alta.)
Geophysical-Geological Consultant
427 -510 West Hastings Street
Vancouver, B. C.
V6B 1L8

October 1979

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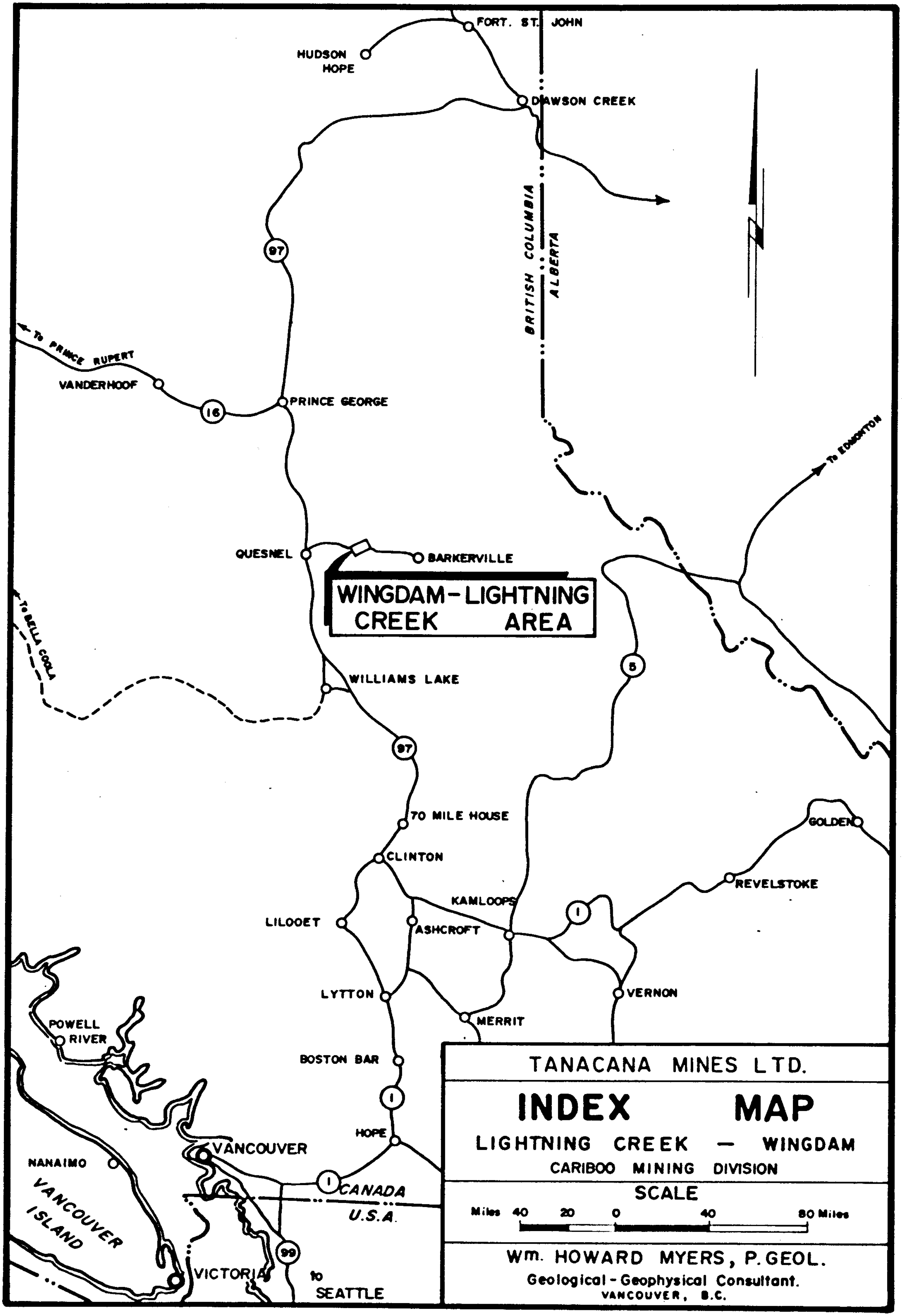
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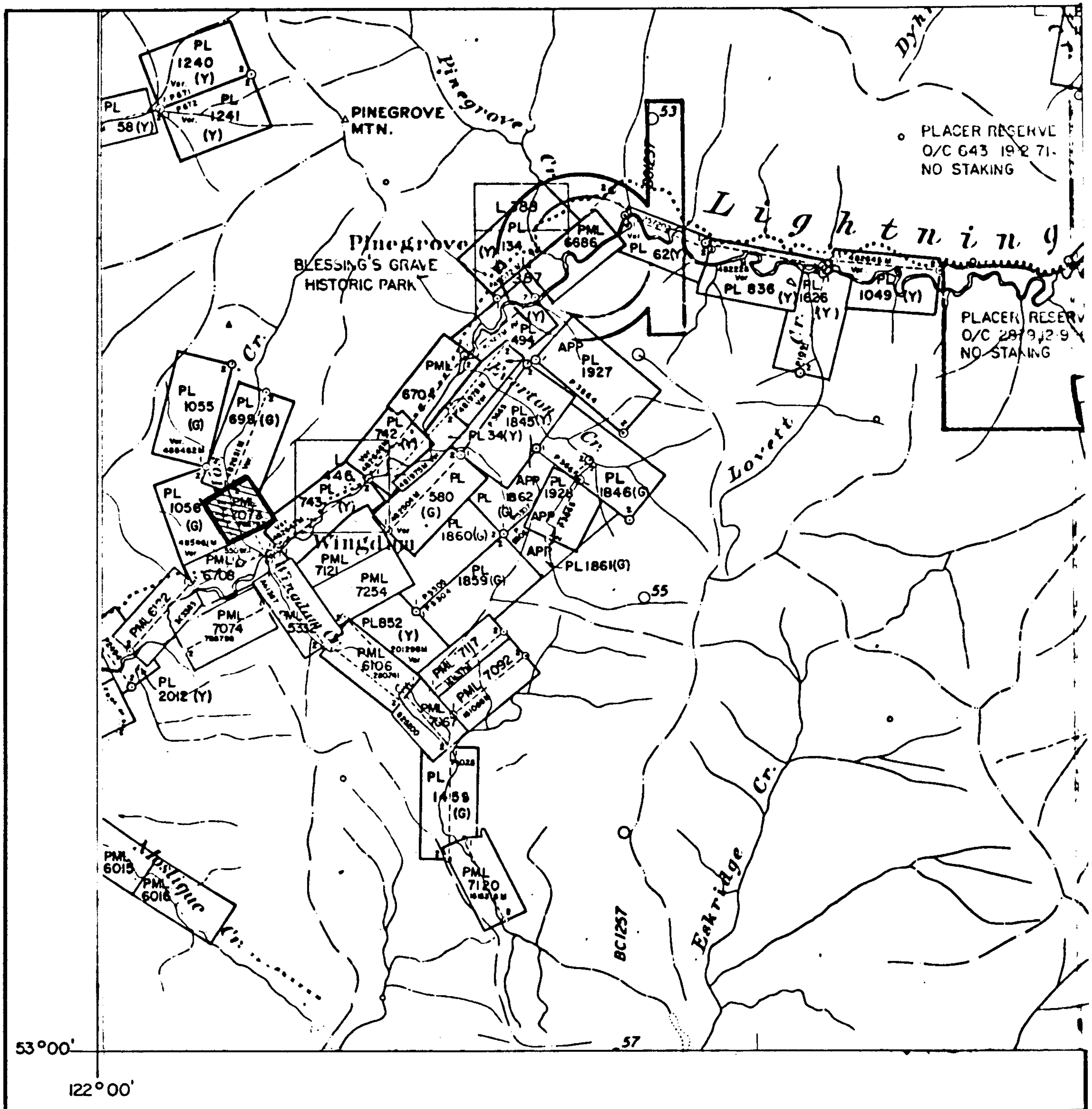
Wm. HOWARD MYERS, P. GEOL.
Geological - Geophysical Consultant.
VANCOUVER, B.C.



TANACANA MINES LTD.
VANCOUVER, BRITISH COLUMBIA

WINGDAM - LIGHTNING CREEK AREA
CARIBOO MINING DIVISION, B.C.

CLAIM LOCATION MAP OF PLACER LEASE No. 7073

SCALE

1000 500 0 1000 2000 METRES

From Map P93H/4W — Sept. 1979

WM HOWARD MYERS, P. Eng. (B.C.), P. Geol. (ALBERTA)
CONSULTANT, VANCOUVER, B.C. — OCTOBER, 1979

ABSTRACT

The shallow refraction seismic survey of Placer Mining Lease No. 7073 was carried out on a reconnaissance type survey. During the two days of field work one full day of seismic surveying was accomplished due to the inaccessability of the lease. During the survey nine separate profiles were run. The work in the field was slow due to heavy underbrush and soft surface conditions.

The quality of the data from the seismic survey is fair to poor. Bedrock is fairly shallow over most of the lease area and the depth is shown on the enclosed location map. The depth to bedrock appears to increase downstream. The velocity of the material overlying bedrock is similar to that from clay and rocks of glacial draft material. Bedrock velocities varied substantially over (8,500 to 19,000 feet per second) the lease area.

Test pits should be put down on the lease to check for possible auriferous gravels on bedrock. Possible gravel velocities were recorded near the southern portion of the lease. These indicated gravel layers were very thin and not too extensive. If a track mounted back-hoe is used then an expensive road would not be necessary. No further shallow refraction seismic work is recommended at this time.

RECONNAISSANCE TYPE REFRACTION SEISMIC SURVEY ON PPPL #7073, RAMOS CREEK, WINGDAM AREA, CARIBOO MINING DIVISION, BRITISH COLUMBIA. LAT. 53°02'N. AND LONG. 121°-58'W.

INTRODUCTION

The reconnaissance type refraction seismic survey of the placer lease as well as this report on the work was commissioned by Mr. Tom Boucher Vice-President of Tanacana Mines Ltd., owner of the lease. The monies spent for the field work and the report have been claimed as assessment work on the lease filed on June 1, 1979. Authorization to write the report was not received from Mr. Boucher until May 8, 1979 since the field results were poor and the data in general was negative. The report was further delayed waiting for topographic map to be prepared by McElhanney Surveying & Engineering of Vancouver B.C. A sketch map was made to plot the locations of the various seismic profiles. The locations are approximate and if further work is planned the profiles should be surveyed on a more accurate base map.

Placer Mining Lease No. 7073 is located on Ramos Creek which is a tributary to Lightning Creek from the north and enters the creek near the old town of Wingdam. The lease is half the size of a placer lease at the time it was staked (1320' x 2640'). At the time the lease was staked Placer Mining Lease No. 6708 located along Lightning Creek had been left off the placer map in error.

Placer Mining Lease No. 7073 was staked across Lightning Creek and tied to Placer Mining Lease No. 5332. The next year the the map was revised and lease No. 6708 restored to its original position. When this was done it cut lease No. 7073 in half as it now shows on the enclosed location map which is a portion of Map 93H4/m (Placer).

The lease is readily accessible via Provincial Highway #26 east of Quesnel to the old town site of Wingdam some twenty miles. Access to the lease from Wingdam is by trail from the old town site or up Ramos Creek from its confluence with Lightning Creek. Access to the upper end of the lease can be gained by a logging road above the creek on the north rim of the creek. The timber is quite heavy in this part of the lease.

The terrain in the area of the lease is moderate. Elevations vary from a minimum of 3200 feet above sea level to a maximum of 3800 on the northwest rim of the creek. Timber is guite heavy over most of the lease area. Immediately northwest of the lease the area has been resently logged. The underbrush is quite dense in the creek bed.

The climate in the area of the lease is moderate to cold. This portion of British Columbia does experience Chinook conditions during the winter months and the climate moderates for brief periods. Snowfall in the area is moderate to heavy. The majority of snowfalls are in December, January and February. Most of the snow is gone by the 1st of May, except for the higher elevations and shaded areas. Field conditions are very good in early May for prospecting and test work.

The published maps and reports used in this report are listed under the Bibliography in the Appendix of the report. A sketch map was prepared by the writer to show the approximate locations of the seismic profiles. The profiles are well marked in the field and if additional field work is proposed the location of the profiles should be surveyed and plotted on a more accurate map.

The theory, interpretation and field operation of shallow refraction seismic method of exploration is outlined in the publication "Shallow Refraction Seismic Exploration" by Wm Howard Myers, Consultant, November 1977, enclosed in the appendix of the report.

The field work consisting of a reconnaissance type seismic survey of Placer Mining Lease No. 7073 was carried out on August 24th and 25th 1978. A total of one full day was spent carrying out the seismic survey. The rest of the time was required to get to the lease. The survey was carried out with two men (writer and helper) in the field using two geophones on most profiles so that the additional data on dip of interphase could be obtained. The spread length was in most instances under 100 feet since bedrock was quite shallow in the area. The subsurface data was computed from the basic field data at a later date. In general it requires a day computing for every day field work (one man).

The equipment used to carry out the shallow refraction seismic survey is a Model ES-125 Signal Enchantment Seismograph. The equipment is manufactured by Geometrics Inc. 395 Java Drive, Sunnyvale, California. 94086. A copy of the brocure put out by the company for this instrument is enclosed in the appendix of the report.

HISTORY

The Cariboo area of Central British Columbia is well known for its production of both placer and lode gold. Since the gold rush, which started in 1861, the general Cariboo Area has produced many millions of dollars worth of gold from both lode and placer mining. A large portion of the gold taken from placer operations was never reported. During the gold rush there were many thousands prospectors and gold miners, operating small placer diggins centered near Barkerville. Some very rich placer deposits were worked on Lightning, Keithley and Williams Creeks. Lode gold was produced from two underground mines near Wells, B.C.

Since the gold rush there has been very little exploration work for on the production of placer gold. Some gold was produced on Lightning from a shallow bench on the south side of the creek. There is no record of any gold production from Ramos Creek in the government records. Further up Ramos Creek near the headwaters, considerable work was carried out on quartz veins in the bedrock.

GEOLOGY

Bedrock, though concealed over a large portion of the lease by rock debris and vegetation, outcrops on the ridges on steeper slopes and at various places along the stream bed. The rock debris consists mainly of morainal matter and landslide material on the steep slopes of the larger creeks.

Bedrock in the immediate area of the leases is composed of limestone, sericite schist, slate, argillite and quartzite of the Cariboo Series of Precambrian age. Gold mineralization occurs in replacement type ore bodies and in quartz veins in similiar rocks in the Wells area to the east.

The rocks of the Cariboo Series lie in the southwest limb of a broad anticlinal structure whose axis lies approximately three miles north, northeast of the lease. Bedrock immediately northeast of lease 7073 is highly faulted and altered by one of the many faults in the general area. There appears to be an ample source for possible placer gold in the area of Placer Lease No. 7073.

RESULTS OF SHALLOW REFRACTION SEISMIC SURVEY

The shallow refraction seismic survey of Placer Lease No. 7073 was in the form of a reconnaissance type survey. Individual profiles were run at various places in and near Ramos Creek. The location of each profile was marked on the ground and the approximate location plotted on the enclosed sketch map on a scale of 1" = 200 feet or 61 metres. The exact location of each profile should be surveyed and plotted on an accurate map if further exploration work or testing is planned.

The quality of the siesmic data obtained over most of the area is fair to poor. The data is below the average obtained in other parts of the area due primarily to poor surface conditions. A large part of the area is covered with moss or other soft material so that a good shock wave could not be produced. Energy propogation was also poor over a large part of the area. This is probably due to the clay and rocks just below the surface. A great deal of the creek bed was also covered with the clay and rocks instead of gravel normally in creek beds.

On each profile the depth to bedrock was computed and the depth plotted on the enclosed location map below the profile location. The type of material overlying bedrock varied considerably over the area. The material overlying bedrock had a velocity in general the equivalent of clay and rocks. Some of the rocks appeared to be quite large with intervening low velocity material or clay in many areas. The velocities of the overlying material varied very markedly and no correlation could be made. Bedrock velocities also varied substantially in the area of the survey. Bedrock velocities varied from 8,500 to 19,000 feet per second. In general bedrock velocities are higher in the downstream portion of the lease. Bedrock is also deeper in this area. On profiles Nos. 5 and 6 an intermediate velocity layer was recorded above bedrock. This intermediate layer had a typical hardpan velocity of some 5,500 to 7,000 feet per second. Possible gravel velocities were also recorded on these profiles however they were very thin and inconclusive. Bedrock is quite shallow on either side of Ramos Creek. The creek appears to be a fairly young creek which is cut sharply into the bedrock.

CONSLUSIONS

The results of the shallow refraction seismic survey on Placer Mining Lease No. 7073 are not considered diagonostic and not conclusive. The data does not warrant the building if a road to the lease for further test work for placer gold. This is further enhanced by the fact that the lease is only half size the normal lease.

RECOMMENDATIONS

It is recommended that a back-hoe be taken into the area of the lease to dig test pits to further test the lease potential. No more shallow refraction seismic work be done on the lease at this time. A track type back-hoe could be taken in without building an expensive road.

PROFESSIONAL
PROVINCE OF
W. H. MYERS
BRITISH COLUMBIA
ENGINEER

Respectfully yours,

Wm. Howard Myers, P.Eng(B.C.), P.Geol. (Alberta)
Geolphysical-Geological Consultant

October 1979

Expiry Date: June [illegible], 1979

APPENDIX

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Bulletin # 3 Douglas Lay, 1940
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Maps of the Provincial Auriferous Creeks in the Cariboo Mining Division
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Map # 336 A
Map # 563 A
Map # 564 A
Map # 335 A
Map # 562 A

CERTIFICATE

I, William Howard Myers, do hereby certify that I am an independent geological geophysical consultant with offices at Suite 427 - 510 West Hastings Street, Vancouver, B.C. I have been actively engaged in my profession as an independent consultant in both oil and mining since 1952. I have been specializing in the exploration for and production of placer gold for the past fifteen years. I am a geologist member, P. Geol. #16704, for the Association of Professional Engineers, Geologists and Geophysicists of Alberta, and non-resident member (P.Eng.) of the Professional Engineers of British Columbia.

I graduated from Fresno State College, Fresno, California, in 1939 with a B.Sc. degree in Geology. I did graduate work at Stanford University, Stanford, California, for M.S.c. degree in geology from 1939 to 1941.

Information for this report is from published and unpublished maps and reports on the general Cariboo Region of British Columbia together with my field work and studies of placer gold deposits in the area over the past fifteen years. The shallow refraction seismic survey on placer lease number 7073 on Ramos Creek was carried out on August 24th and 25th 1978. One half day of each day was spent carrying out the reconnaissance type seismic survey. One full day was spent working up the data from the field work. The location of the individual profiles is shown on the enclosed map. I have no interest in the property or securities of the company and do not expect to receive any interest in the property or securities of the company to be issued as a result of writing this report.

Wm. Howard Myers P.Eng. (B.C.)
P.Geol.(Alta.)
Geophysical-Geological Consultant

PROFESSIONAL PROVINCE OF W. H. MYERS BRITISH COLUMBIA ENGINEER

Expiry Date: June 16, 1979

October 1979

Wm. HOWARD MYERS, P.Eng. (B.C.) P.Geol.(Alta)
427 - 510 West Hastings Street
Vancouver, B. C.
V6B 1L8

May 8, 1979

Invoice #3-79

Tanacana Mines Ltd.
c/o 2780C Granville Street
Vancouver, B. C.
V6H 3J3

In Account
with
Wm. Howard Myers, Consultant

Reconnaissance refraction seismic survey
Placer Mining lease 7073, Wingdam area, Cariboo Mining
Division, British Columbia

Field work on PLM 7073

August 24th & 25th, 1978 1/2 day each total 1 day @ $250/day		$250.00
1 day computing & plotting data, map & sections @ $200/day		200.00
Preparing report		50.00
	Total	$500.00

Report to follow.

W H Myers

SHALLOW REFRACTION SEISMIC EXPLORATION

BY

Mr. Howard Myers, P.Eng. (B.C.), P.Geol. (Alta.)

November, 1977

THEORY

The quantity that is observed in the refraciton method of seismic exploration is the time between the initiation of the shock wave at the shot point by hammer blow on a steel plate or explosion and its first arrival at the detector placed at a measured distance from the shot or impact point. As the first arrivals only are usually considered in the analysis, the wave arriving at the detector first must be the one which has travelled the minimum time path between shot point and detector. By observing first arrivals for different separation distance of source and receiver, a time distance curve can be constructed representing variations of minimum time path with distance, (see figure 1 at end of text). From these variations, the nature and depth of the elastic discontinuities can be determined.

The shock waves travel through earth materials as through air, with a definite velocity and along a definite path. The velocity depends primarily upon the degree of consolidation. The travel path of the seismic waves, like the path of light waves, follows whatever course that will require the least amount of time between the source and the detector.

The travel path of shock waves for minimum travel time can be traced out by a simple relationship form a familiar low of optics known as Snell's law where $\frac{\text{Sin } i}{\text{Sin } r} = \frac{V1}{V2}$.
In the equation i is the angle of incidence and r is the angle of refraction. A shock wave will travel in a straight line through any material which has a constant velocity but will be bent if it passes through a discontinuity where there is an

abrupt change in elastic properties. In refraction seismic work, we are interested only in the rays which go down at the critical angle, become refracted parallel to the boundary and are refracted back to the detector (surface) at the critical angle. When r = 90° then the above equation (Snell's law) becomes Sin $i_c = \frac{V_1}{V_2}$.

Interpretation:

The process of refraciton seismic interpretation can be illustrated by a simple case of the single horizontal discontinuity as shown in Figure 2 at end of text. Any number of discontinuities can be recorded as long as there is sufficient thickness and velocity contrast. In the ideal case and for simple interpretation of the refraction data the velocities will be higher in succeeding layers from surface down and the thickness will be greater than the overlying layer. This is not always the case and in such instances where deeper layers are thinner and velocities lower the interpretation becomes complex and experience is necessary for accurate and definitive interpretation of the refraction data.

The field data consisting of times recorded in milliseconds and distances measured form shot point to detector are plotted on a time distance graph. A line is drawn through the points that line up in a straight line. The velocity on each segment of straight line is computed form the basic formula $V = \frac{D}{T}$. Overlays with velocity scales computed from the above formula can be made up so that a direct read out can be obtained for each segment representing different velocity layers (see figure 1 at end of text).

The thickness of a layer is computed by the means of the formula Thickness = $\frac{XV1}{2}$ $\sqrt{\frac{V2-V1}{V2+V1}}$, where XV1 is the horizontal distance from the zero point or detector to the change from velocity one to velocity two. The function $\sqrt{\frac{V2-V1}{V2+V1}}$ for the different velocities can be plotted on a graph so that a direct read out can be determined for rapid computation. In the simple two layer case where bedrock is covered with one layer of low velocity material then the depth to bedrock is the same as the thickness of the layer. In the three or more layer case the depth calculation is made with the formula $D_2 = 0.8D_1 + \frac{XV-2}{2}\sqrt{\frac{V3-V2}{V3+V2}}$ (See figure 1 at end of text).

Additional information and greater accuracy can be obtained by reversing each profile in the field. When the profile is reversed dip calculations can be made on the various interphases. The length of the profile (distance from detector to shop point) depends on the depth of penetration desired. As a rule of thumb the depth penetration is roughly one quarter of the horizontal separation. A separation of 100 feet gives 25 feet penetration. This rule is only approximate and depends on velocity of the near surface layers.

Field Operations:

The operation of the shallow refraction seismic survey in the field is relatively simple and can be done by one or two men. The horizontal distance, with ten foot intervals moves down the line and strikes a steel plate with a sledge hammer at each 10 foot interval and records the time in milliseconds on the seismic timer. The time and distance is written down with notes on changes in surface conditions and terrain for different hammer points. If the readings are anomalous then a time-distance plot is made in the field to check data. With two men in the field, one on hammer and the other recording data, progress is much more rapid. Two men can run up to twenty profiles a day where conditions are favourable along logging roads or good trails. The plotting and interpretation of the data requires almost as much time as the field work.

The equipment, consisting of two cables, geophone and sledge hammer and small steel plate and seismic timer can easily be carried by one man.

Applications:

Some of the applications or cases of the refraction seismic method of subsurface exploration are:

(a) Depth of Alluvium (Depth to Bedrock)

(b) Relief on Bedrock (Dip or irregularities)

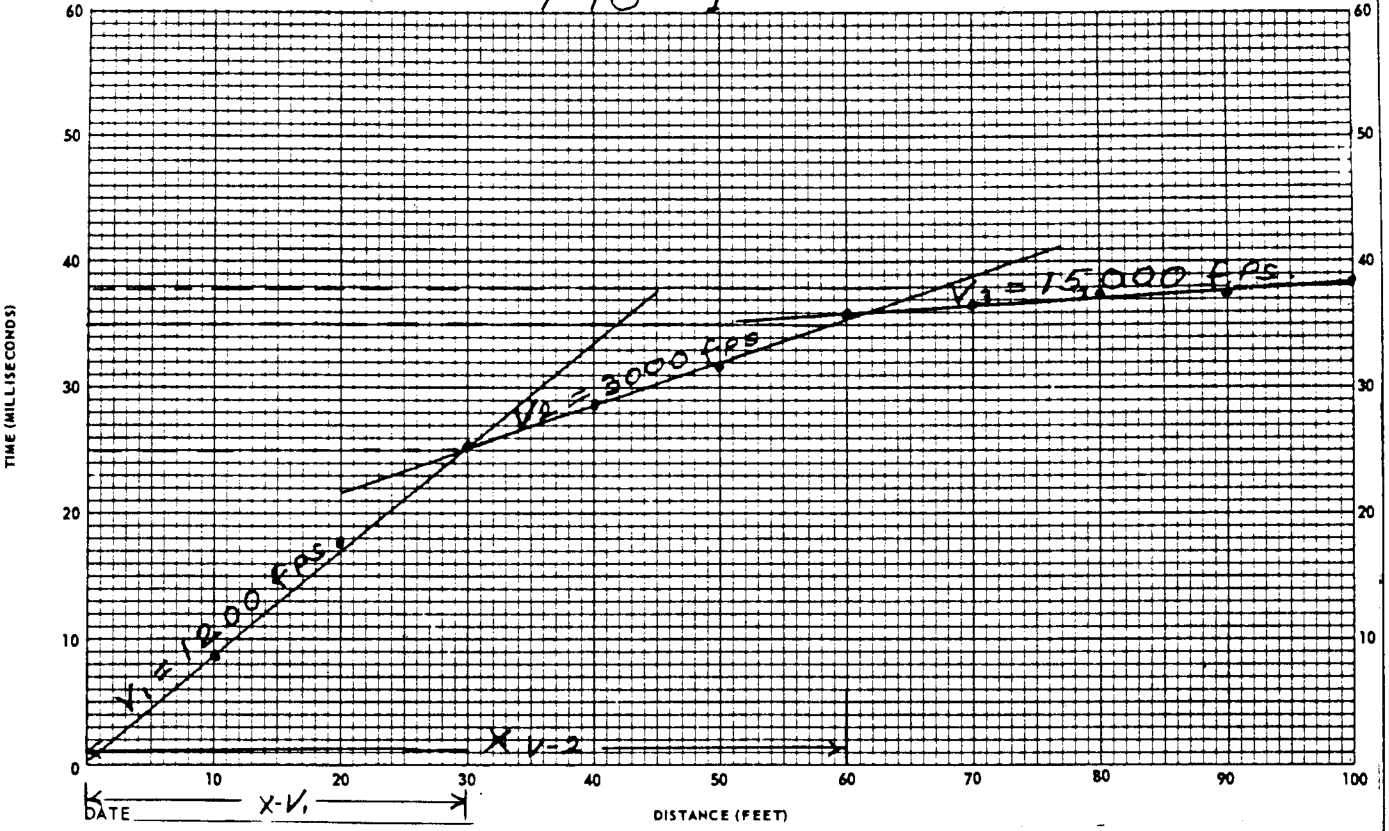
(c) Identification of material below the surface for excavation purposes such as gravels, clays and hard pan.

(d) Type of bedrock and possible weathering or faulting.

(e) Geological mapping for mineral and ground water.

The refraction seismograph is an excellent method for placer gold exploration in that all of the applicaitons listed above are useful.

FIG #1



Velocity Computation - $V = \frac{D}{T}$

$V_1 = \frac{30}{.025} = 1200$ FPS - $V_2 = \frac{30}{.010} = 3000$ FPS - $V_2 = \frac{40}{.0027} = 15,000$ FPS

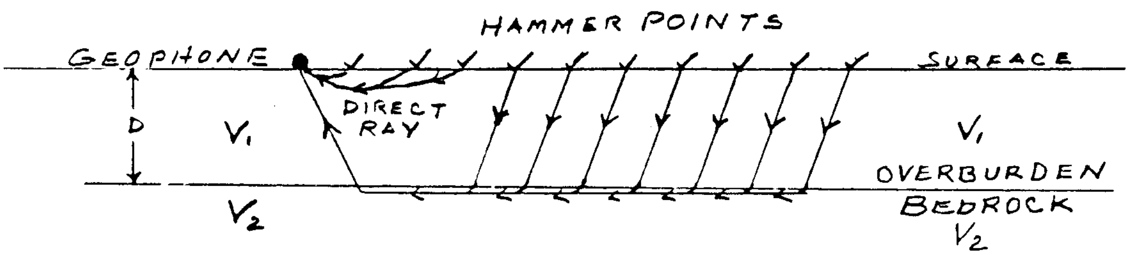
Depth Calculation - $D_1 = \frac{XV-1}{2}\sqrt{\frac{V2-V1}{V2+V1}}$ - $D_2 = \frac{XV-2}{2}\sqrt{\frac{V3-V2}{V3+V2}} + 0.8\ D_1$

$D_1 = \frac{30}{2}\sqrt{\frac{3000-1200}{3000+1200}} = 9.8'$: $D_2 = \frac{60}{2}\sqrt{\frac{15000-3000}{15000+3000}} + 0.8 \times 9.8 = 32.33$

Results:

0 - 9.8' soil: Gravel @ 9.8' Bedrock @ 32.33

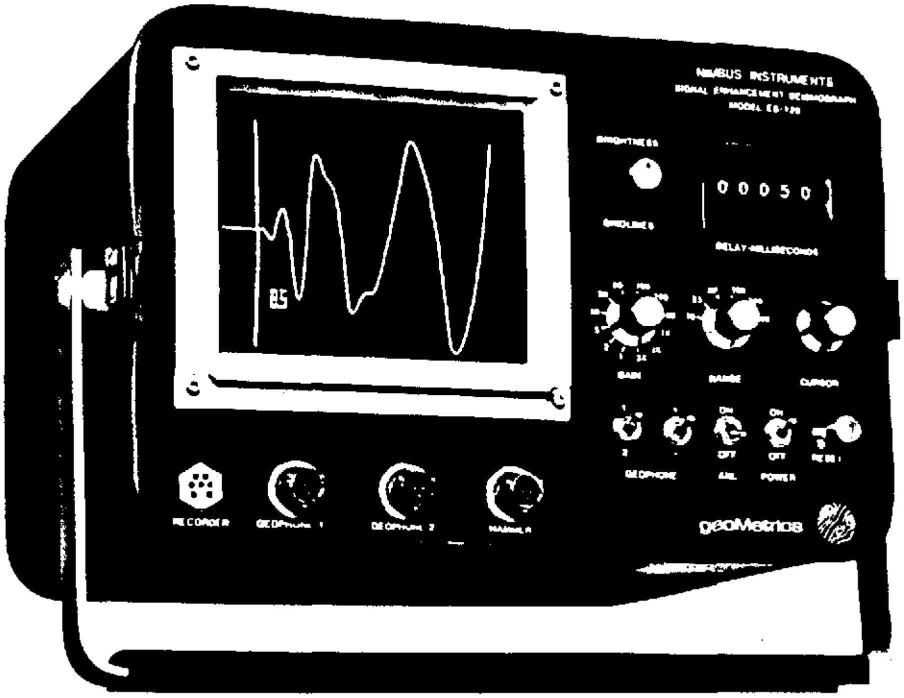
FIGURE # 2



WM. HOWARD MYERS, P. GEOL

Nimbus Instruments
A Division of geoMetrics INC

SIGNAL ENHANCEMENT EXPLORATION SEISMOGRAPH
Model ES-125



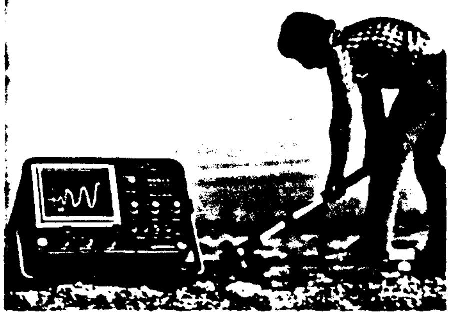
Features

- One-man operation.
- Signal enhancement for greater sensitivity, improved waveform definition and more accurate time measurements. Lets you operate under high natural and man-made background noise conditions.
- *Exclusive* automatic noise limiting and start-inhibit alarm prevents waveform loss because of transient, high-level noise being stacked into memory.
- Continuous waveform display.
- Daylight-visible CRT display—the largest available on a single-channel instrument. Special viewing hood not required. Grid lines aid readout.
- *Exclusive* vertical line cursor on CRT display. Does not distort waveform and is easier to read than conventional marker pips.
- Stepped gain control for fast reset to the same absolute value each operation.
- 100 μsec resolution.
- Memory size: 8 bits x 256 words (256 x 256 points).
- Solid state hammer switch.
- Hammer delay adjustable from 0 to 9999.9 milliseconds. Automatically added to arrival time.
- Record duration switch from 10 to 400 msec.
- 8-hour performance from internal rechargeable battery. Charger included.
- Strip chart recorder output.
- Shear wave measurement capability.
- Utilizes latest LSI technology—compact, low cost, simple to operate. Rugged, all-aluminum case.

Applications

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

SIGNAL ENHANCEMENT EXPLORATION SEISMOGRAPH
Model ES-125



The Nimbus Model ES-125 offers more convenience and performance features than any other instrument in its price range. Using time-proven, signal enhancement techniques, automatic noise limiting and the latest in electronic technology, the ES-125 is the ideal instrument for all shallow seismic exploration needs.

The Model ES-125 is an excellent instrument for professional geologists and a low-cost, easy-to-use tool for soil engineering firms, contractors and other organizations with varied subsurface exploration needs. The ES-125 is ideal for use as a teaching instrument. Its low cost may warrant having several units in operation at a time. Explosives are not required, and because the operation is simple, students can concentrate on the application rather than the instrument.

SIGNAL ENHANCEMENT

Most shallow seismic exploration utilizes sledge hammers or other mechanical sources to produce shock waves. These sources are easier and safer to use than explosives, but exploration depth can be limited when the seismic waves are masked by man-made or natural background vibrations.

Nimbus seismographs have a unique signal enhancement feature that provides greater sensitivity to weak wavefronts. As hammer impacts are repeated, the signals are added in the equipment's digital memory. As shown to right, random background signals cancel out, while the desired signal grows progressively larger. This simplifies selection of arrival times, and lets the operator survey greater distances with smaller energy sources.

NEW AUTOMATIC NOISE LIMITING

The ES-125 is the only seismograph offering automatic noise limiting, a feature which interrupts operation and lets the operator know when transient, high-level noise exceeds a preset limit. This feature alleviates the common frustration of inadvertently spoiling a good waveform, as well as wasting hammer blows and survey time, when high level noise is present. Your survey goes faster and you are sure of consistent, accurate results.

OTHER NEW FEATURES

The new ES-125 incorporates several new features not available elsewhere. Battery life has been extended to 8-hours, enough for up to three days in the field. The daylight-visible CRT is the largest available on a single-channel instrument. It produces a clear, sharp display, eliminating the need for viewing hoods or waveform controls. Its exclusive vertical CRT cursor is easier to read than marker pips and does not distort the waveform. Arrival times are displayed on the screen.

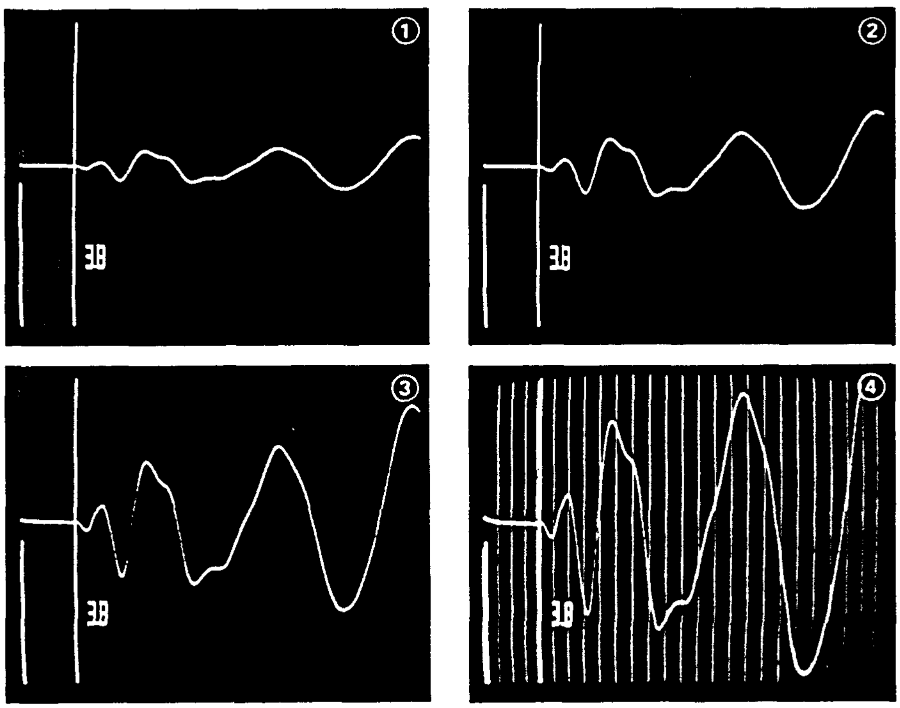
The ES-125 utilizes a stepped gain control instead of the normal volume-control type, providing for quick resetting to the same absolute value each operation. A 9999.9 millisecond delay circuit allows the operator to delete early insignificant signals and maintain the best combination of range and control settings. The delay time is automatically added to the arrival time eliminating the possibility of addition errors. For permanent record, the ES-125 adapts to standard oscilloscope cameras and strip chart recorders. Grid lines are provided so that timing information is preserved on the photograph or chart record.

Two-geophone operation is provided together with a polarity switch for shear wave surveys. A solid-state hammer switch, three times as fast as the traditional mechanical switch and having much lower timing error scatter, can be used with any hammer. The instrument is compact, lightweight, and can be easily backpacked and operated by one person. The unit comes complete with geophone, 90 meter cable, hammer switch, battery charger, striker plate and manuals.

SEISMIC EXPLORATION

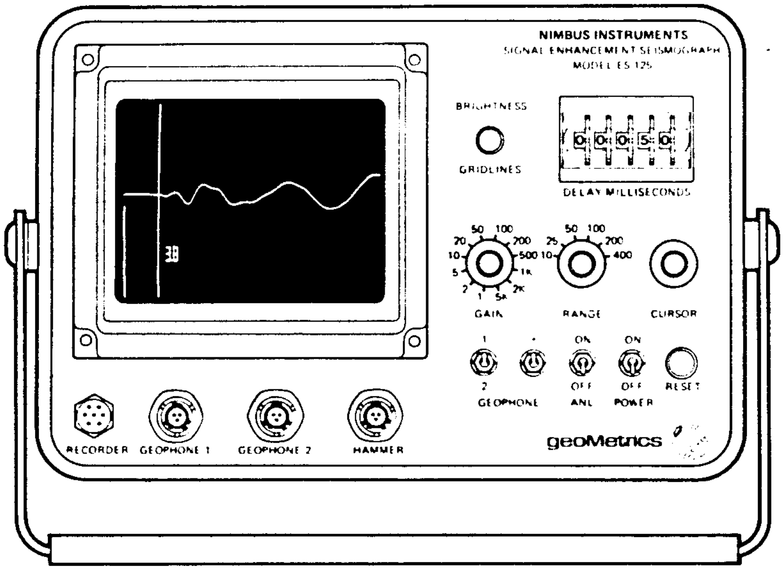
As shown to right, shock waves are generated by striking a metal plate with a hammer. The resulting waves propagate through the earth at a velocity dependent upon the compressive and shear strengths of the soil and rock. In general, shock waves travel much faster through hard, solid materials such as bedrock than through loosely packed topsoil. It is this difference that makes the seismograph useful in determining subsurface characteristics.

As illustrated, a seismograph and a vibration sensor (geophone) are set up at the point of interest. Successive hammer blows are struck at measured distances to produce shock waves for



Actual unretouched photos

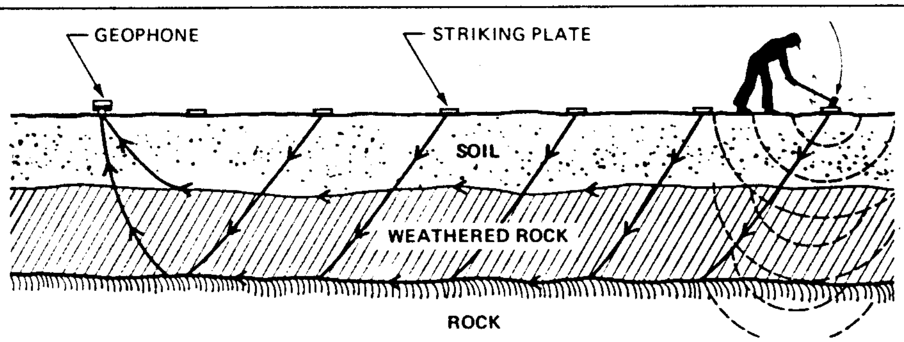
With signal enhancement, the desired signal is built up with repeated hammerblows, while unwanted background signals cancel out. Exclusive Nimbus vertical cursor simplifies line-up on point of first arrival, with time displayed simultaneously on CRT. Unique grid line feature, adjustable by front panel control, aids readout.



SIMPLE FOUR-STEP OPERATION

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

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



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

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

DATA REDUCTION

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

The depths of each layer can be calculated as follows:

$$D_1 = \frac{X_{c_1}}{2}\sqrt{\frac{V_2-V_1}{V_2+V_1}} \quad \text{and}$$

$$D_2 = 0.8\,D_1 + \frac{X_{c_2}}{2}\sqrt{\frac{V_3-V_2}{V_3+V_2}}$$

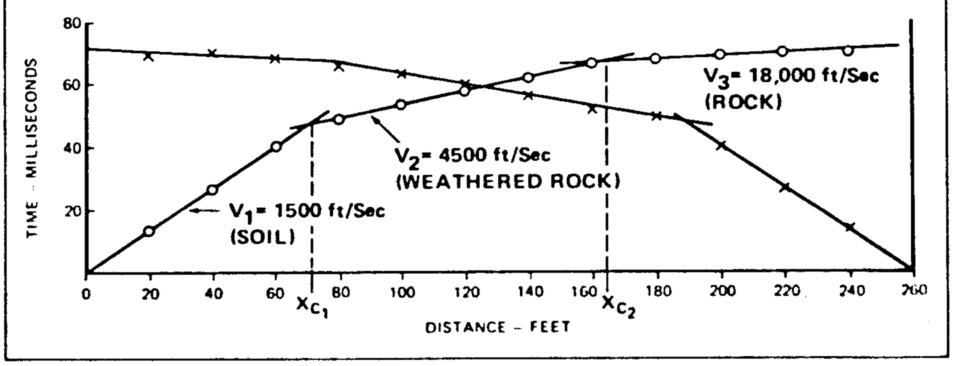
X_C = critical distances, where straight line segments intercept. V = velocity. D_1 = depth of first layer, D_2 = depth of second layer.

Irregularities, such as faults, dipping layers, large boulders, stream channels, dikes, lateral changes, etc., will produce corresponding irregularities in the time-distance graph. A number of solutions are available to solve for these various geometries by graphical means, pocket calculators or computer programs.

INTERPRETATION AND APPLICATION

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

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



Specifications

SIGNAL ENHANCEMENT

Incoming signals are sampled, digitized, and stored in a random access memory. Repeated signals are added while random noise is cancelled, or limited.

AUTOMATIC NOISE LIMITING

Background noise is monitored and start function is inhibited at adjustable levels. Noise limiting ON/OFF controlled by front panel switch.

MEMORY SIZE

8 bits x 256 words (256 x 256 points)

DISPLAY

Solid-state (except CRT) display, daylight-visible without special viewing hoods. Screen size 8 x 10 cm (3" x 4"). Continuously displays contents of memory (until erased), vertical line cursor, cursor time corrected for delay, battery level, and relative background vibrations.

TIME DISPLAY

On-screen display of cursor time to six digits. Resolution 100-microseconds on all ranges.

GRID LINES

When Brightness/Grid Line Knob is out, vertical lines are superimposed on the record to provide timing information on photographic copies of display. Time interval between grid lines varies with range switch setting to provide maximum resolution regardless of range.

NOISE LEVEL MONITOR

Leading edge of record bounces up and down in response to ground vibrations. Allows rapid selection of gain adjustment.

RECORD LENGTH

Switch selectable record duration: 10, 25, 50, 100, 200, or 400 milliseconds.

OPERATING CONTROLS

Range, Gain, 5-turn Cursor position, Delay Time, Geophone Selector, Geophone Polarity, Automatic Noise Limiter (ANL), Power, Reset, Brightness/Grid Lines.

GAIN

12-position, stepped gain control adjustable from 1 to 5000 in 1-2-5 stepping sequence.

RECORDER OUTPUT

Recorder output provides waveform and timing signals. Slow mode accesses memory in about 8 seconds so pen recorders can be used.

TIMEBASE

Crystal controlled clock synchronizes timing measurements with a basic accuracy of 0.01%.

TRIGGER

Start of record initiated by solid-state hammer switch, contact closure or saturated NPN transistor.

DELAY

Switch selected delay postpones start of record from 0 to 9999.9 milliseconds. Amount of delay is automatically added to time display so that cursor time indicates correct value without separate calculations.

POWER

Internal 7.5 AH battery provides approximately 8 hours operation. Can also be powered externally from any 12 VDC source.

BATTERY LEVEL

Indicated by vertical line on left edge of screen. Full scale approximately 14 volts, bottom edge approximately 10 volts.

BATTERY CHARGER

AC Battery Charger (110/220 V; 60/50 Hz) provides initial fast charge and automatic switchover to standby operation with light indicating that battery is charged.

PHYSICAL

Size: 28 x 18 x 28 cm (11 x 7 x 11 inches)
Weight: 7.7 kg (17 lbs)

SYSTEM INCLUDES

Seismograph, Geophone, 90 Meter (300 ft.) Hammer-geophone Extension Cable, Solid-State Hammer Switch, 110-220 volt Battery Charger, Striking Plate and Manual.

OPTIONAL ACCESSORIES

ESR-100	Strip Chart Recorder
C-5	Camera
HVB-1	High Voltage Capacitance Discharge Blaster
BP-1	Auxiliary Battery Pack (requires PC-1 and may require BC-3 depending on your application)
PC-1	Auxiliary Power Cable, ES-125 to Cigarette Lighter Plug
GH-3	Geophone, Horizontal

SPARE ITEMS*

GV-3	Geophone, vertical
EC-3	90-meter extension cable
HS-3	Solid-State Hammer Switch
SP-1	Aluminum Striker Plate
B-3	Replacement battery (two required) Globe GC-680
RP-1	Recording paper for ESR-100
BC-3	Battery charger, 110-200 VAC input, automatic fast charge

*A complete set of circuit boards and specialized hardware is available for extended operation in remote areas.

geoMetrics, INC. A SUBSIDIARY OF EG&G
395 JAVA DRIVE
SUNNYVALE CA 94086 U.S.A.
TEL (408) 734 4616
CABLE GEOMETRICS
TELEX NO 357 435

geoMetrics SERVICES (CANADA) LTD.
436 LIMESTONE CRESCENT
DOWNSVIEW (TORONTO)
ONTARIO CANADA
TEL (416) 661 1966
TELEX NO 06 22694

geoMetrics INTERNATIONAL CORP
80 ALFRED ST
MILSONS POINT
SYDNEY NSW 2061
AUSTRALIA
TEL 979 9942
TELEX NO 790 22624

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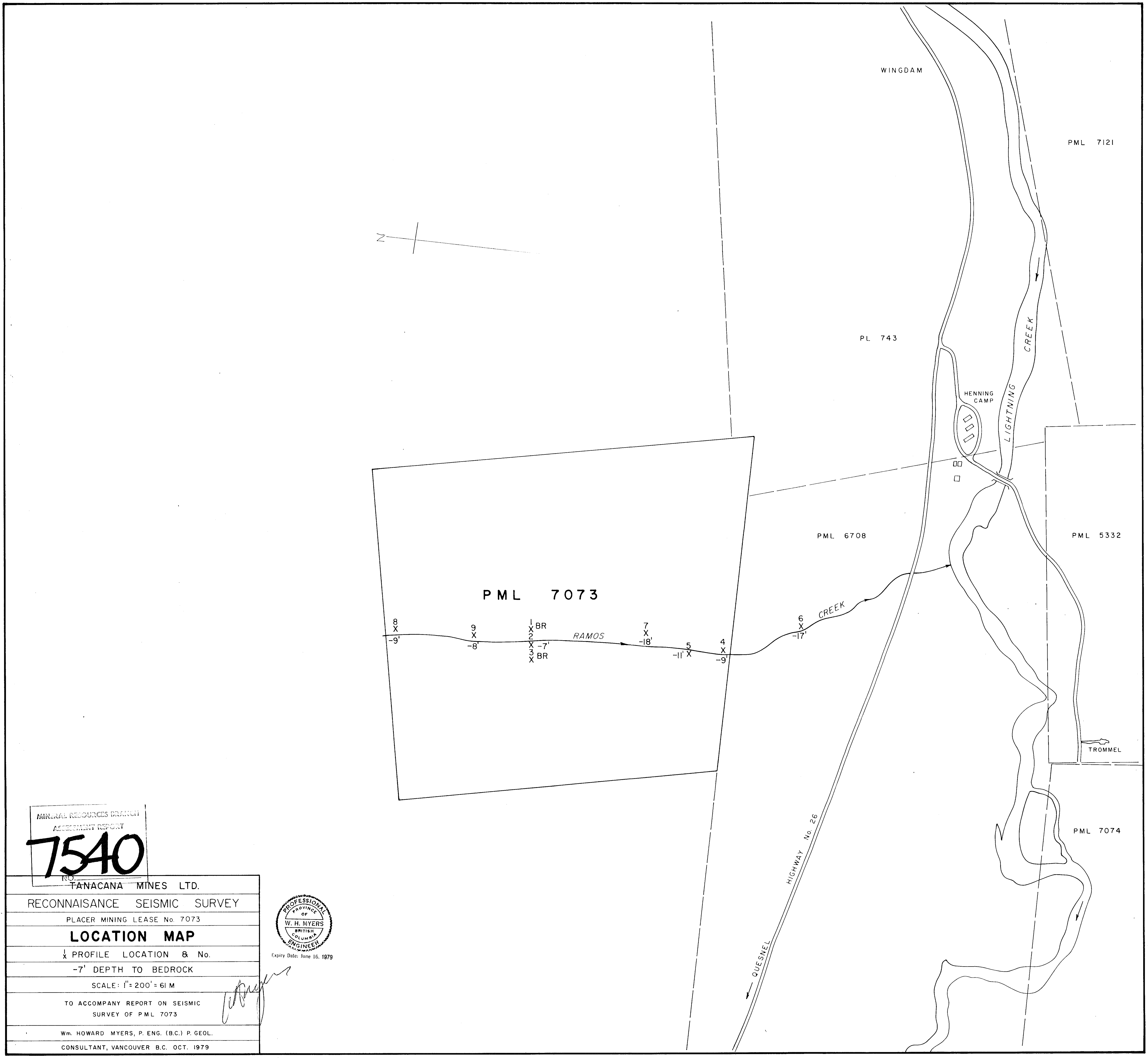

TANACANA MINES LTD.

RECONNAISANCE SEISMIC SURVEY

PLACER MINING LEASE No. 7073

LOCATION MAP

1/X PROFILE LOCATION & No.

-7' DEPTH TO BEDROCK

SCALE: 1" = 200' = 61 M

TO ACCOMPANY REPORT ON SEISMIC SURVEY OF PML 7073

Wm. HOWARD MYERS, P. ENG. (B.C.) P. GEOL.
CONSULTANT, VANCOUVER B.C. OCT. 1979

PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, W. H. MYERS

Expiry Date: June 16, 1979