# GEOLOGICAL-GEOPHYSICAL REPORT
ON
PRELIMINARY GEOLOGICAL MAPPING AND RECONNAISSANCE
GEOPHYSICAL (VLF-EM 16) SURVEY OF
FORTY MINERAL CLAIMS IN BARKERVILLE AREA,
CARIBOO MINING DIVISION, BRITISH COLUMBIA
LONGITUDE 121°31'W, LATITUDE 53°04'N
N.T.S. 93H/4E

For

JACK ST. MARS Etal
670 Mont Royal Blvd.
North Vancouver, B.C.

By

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

April 1980

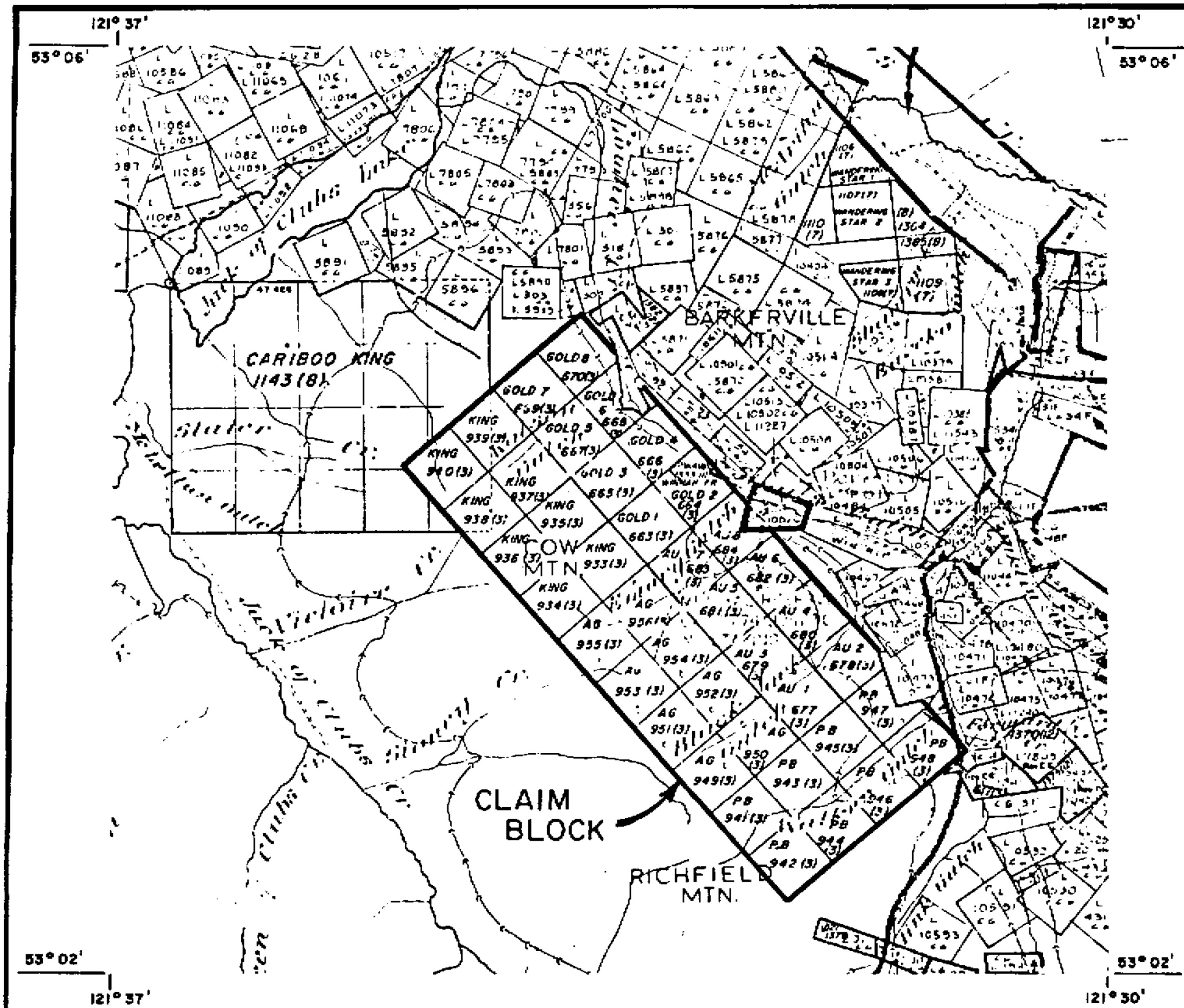
# TABLE OF CONTENTS



## APPENDIX



## ILLUSTRATIONS




# JACK ST. MARS et al

## BARKERVILLE LODE GOLD PROSPECT

CARIBOO MINING DIVISION, BRITISH COLUMBIA

MAP No. M 93H/4E

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
W. H. MYERS

Expiry Date: June 16, 198[illegible]

# CLAIM LOCATION MAP

AU 1-8, 677-684; GOLD 1-8, 663-670; AG 1-8, 949-956; PB 1-8, 941, 948; KING 933-940

SCALE: 1: 50,000

1000 0 1000 2000 3000 4000 METERS

FROM MAP 93H/4E APRIL 17, 1980

To accompany Report "Geological - Geophysical Survey of Lode Claims".

Wm Howard Myers, P. Eng (B.C.) P. Geol. (Alta),
CONSULTANT, VANCOUVER B.C. APRIL 1980

## ABSTRACT

The forty mineral claims, in the name of Jack St. Mars, are located approximately two miles south-southeast of the town of Wells, B.C. The claims adjoin to the southwest the crown grants covering the Cariboo Gold Quartz and Isle of Mountain mines located near Wells, B.C. The claims are all contiguous and are in good standing. The claims are all two post claims with the location line trending north 40 west. The acquiring of the claims was recommended by the writer, Wm. Howard Myers, consulting geologist and geophysicist, as a good area to test the various geophysical methods used to explore for various minerals. The area is fairly accessible and some regional geology is known and published.

The reconnaissance geological mapping and general VLF-EM-16 profiles have produced some information but not too conclusive. Airborne electromag coverage of the claim block as well as the general area is highly recommended. This type of work could very well outline the major northerly trending fault zones and also give information on rock types as well as possible mineralized zones.

# GEOLOGICAL-GEOPHYSICAL REPORT ON THE RECONNAISSANCE GEOLOGICAL MAPPING AND ELECTROMAG (VLF-EM-16) SURVEY ON THE FORTY (40) MINERAL CLAIMS IN THE BARKERVILLE AREA

## INTRODUCTION

The geological and geophysical work on the forty mineral claims in the Barkerville area as well as this report on the results of the work were commissioned by Mr. Jack St. Mars, owner of the claims. The monies spent on the fieldwork and the report was claimed as assessment work on the entire 40 claims. The assessment work affidavit was filed on March 6th, 1980.

The forty claims together with their record no. and anniversary date are tabulated below:

| Name | Record Nos. | Anniversary Date |
|---|---|---|
| AU 1-8 | 677-684 | March 20, 1978 |
| Gold 1-8 | 663-670 | March 20, 1978 |
| AG 1-8 | 949-956 | March 9, 1979 |
| PB 1-8 | 941-948 | March 9, 1979 |
| King (8 claims) | 933-940 | March 8, 1979 |

The forty claims are located in the general Barkerville Area some 2 miles south-southeast of the village of Wells, British Columbia. The property is located at approximately 53°04'North latitude and 121°34'West longitude in the Cariboo Mining Division, British Columbia. The claims are all contiguous and are in good standing. The claims were all grouped when assessment work was filed on March 6th, 1980. The claims were staked as two post claims during 1978 and 1979 with a general north forty west bearing on location line. The claims are plotted on the Department of Mines and Petroleum Resources Map M 93H/4E. The claims are adjacent to and in some instances overlap slightly a series of Crown grant claims on Barkerville Mountain and Lowhee Creek and Stouts Gulch.

The claims are readily accessible by trail from the restored town of Barkerville. The northwestern portion of the claim block is accessible by the trail up Stouts Gulch and Lowhee Creek from Barkerville. The southeastern portion of the claim block is readily accessible from the old trail and the original trail to Barkerville from the town of Stanley. A 66 foot road allowance along this trail to Stanley is reserved for the Crown. Access to the central portion of the claim block can be gained quite easily by the old B.C. water ditch which cuts through the claim block from the southeast to the northwest. As can be noted on the map VLF-EM-16 profiles were run along a portion of this ditch. These trails and ditches are very accessible by skidoo in winter. The southeastern portion of the claim block is located along the divide between Richfield and Cow Mountains. This divide intersects the Stanley Trail to the south and there are numerous cat trails to the divide. The divide has large areas of no trees and is quite open. The streams from the divide such as Watson Gulch, Envoy Gulch, Black Jack and Walker Gulch are quite deeply incised and rough to traverse.

The area of the claims is moderate to rugged terrain. as noted earlier the divide between Cow Mountain and Richfield Mountain near the southeastern portion of the claim block is fairly flat and quite open. Very rugged terrain is encountered near the eastward flowing streams from the divide. Elevations in the area of the claims varies from 6000 feet on Cow and Richfield Mountains to 4400 on Stouts Gulch.

The climate in the area of the claims is moderate to cold. This portion of British Columbia does experience Chinook conditions during the winter months and the climate becomes very moderate for brief periods. Snowfall in the area is moderate to heavy. The area of the claims often gets 10 feet of snowfall in average years. The majority of the snow falls in January and February. Most of the snow is gone by the first week in May except for higher elevations and shaded areas. Field conditions are very good in early May for field mapping and ground geophysical surveys before the underbrush comes out.

The field work, consisting of reconnaissance geological field mapping and ground electromag VLF-EM-16 surveys is tabulated below together with cost of the report.

**VLF-EM-16 Electromag Fieldwork**

| | |
|---|---|
| April 3, 23, 24, 25;<br>September 16, 18, 19, 20, 25, 26, 27, 28, 1979:<br>12 days @ $150/day | $1,800.00 |
| Plotting VLF Data on Profiles<br>7 days @ $150/day | 1,050.00 |
| Geological Field Mapping & Checking<br>July - Sept., 1979<br>5 days @ $150/day | 750.00 |
| Preparing Report | 350.00 |
| Drafting Maps & Profiles | 138.00 |
| Typing Report & Assemblage | 115.00 |
| | $4,203.00 |

During the 5 days in the field carrying out geological mapping and checking rock outcrops, no effort was made to map the different geological formations. During this time outcrops were checked for structure and stratigraphy which would be useful in interpreting the electromag data. Areas were examined for possible faulting and facies changes on a general basis which could be related to possible VLF-EM-16 electromag data on the profiles. Possible changes on significant data are plotted on the electromag profiles included in the report.

The fieldwork with the VLF-EM-16 Electromag was not carried out in the conventional or normal fashion. The normal use of this type of electromag is to run parallel lines or grid at optimum spacing of lines and stations. Most of the Electromag (VLF-EM-16) work on the claims was experimental in nature.

The lines were run over areas of fairly well known geology both structural and stratigraphic with postulated changes covered by the survey. The VLF-EM-16 lines were run over areas of known or mapped faults as well as a mineralized zone known as the B.C. Vein. Each day of the electromag fieldwork, the same area of one profile was run to check for possible disturbance due to diurnal changes. In all cases the profile was duplicated as subsequent fieldwork was not carried out. Only two days were lost due to interference. The station used for most of the VLF-EM-16 electromag work was Seattle, Washington MLK/NPG 18.6 KHz.

The published maps and reports used in the preparation of this report are tabulated in the Bibliography in the Appendix of the report.

The equipment used to carry out the VLF-EM-16 survey on the claims was manufactured by Geonics Limited, 2 Thorncliffe Drive, Toronto, Ontario, Canada. The serial number of the unit used was 291. It is more commonly recognized as a Crone EM-16 VLF electromagnetometer. Station spacing varied as noted. Station MLK/NPG 18.6 KHz located in Seattle, Washington, was used over most of the area. The data was plotted on profiles which are included in the back 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 about 1861, the general Cariboo Area has produced many millions of dollars worth of gold from both lode and place operations.

During the gold rush there were thousands of prospectors and gold miners operating small individual placer diggings centered near Barkerville. Some quite rich placer deposits were worked on Lightning, Williams and Keithley Creeks. During the gold rush numerous mineral or lode gold deposits or outcrops were prospected with adits and or shafts. Later on two lode gold mines were opened up in the immediate vicinity of the village of Wells. The last lode gold mine was closed down in 1967 after producing several million dollars in gold for some 20 years. A recent mine has been opened up to the northwest of the town along the strike of the other two extinct lode mines. The claim block is located immediately southeast of the old mines along the strike in the opposite direction. In the past year the exploration for lode gold in the general Barkerville Area has increased very substantially.

## GEOLOGY

Bedrock though concealed over a large portion of the claim block by rock debris and vegetation, outcrops on the tops of the ridges, on steeper slopes and at various places along the stream beds where hydraulicking has been carried out for placer gold. The rock debris consists mainly of morainal matter and landslide material in the steeper creeks.

Bedrock in the area of the claim block consists of quartzite, argillite, slate and limestone of the Cariboo Series of Precambrian age. In the northern portion of the claim block the rocks are mapped as the Richfield Formation by Hanson (Memoir #181). The remainder of the area has been mapped as the Richfield Member Undivided. In both instances the primary rock type is argillite with varying amounts of limestone, quartz and some quartzite. Near the southern portion of the claim block in Walker Gulch and the divide or Richfield Mountain there is an increase in the amount and number and size of quartz veins. On Richfield Mountain some of the quartz veins are over two feet wide and strike NE-SW. A great deal of quartz porphyry in the form of a large sill, from 3 to 5 feet thick, is reported in the underground workings at the headwaters of Mink Gulch near the south end of the claim block. The sill is reported by Hanson (Memoir #181) to contain a great deal of quartz in irregular veinlets and in gash veins. Many of the veins in the sill contains pyrite.

The area of the claim block structurally is located on the north-eastern edge of the Lightning Creek Anticlinorum. The rocks are intensely folded and common parallelism of schistosity and bedding in the limbs and hinges of folds suggest that inter-stratal slip during the development of the major structure has, in some way, produced the bedded schistosity and the folds. (Paper 72-35) G.S.C.

Detail mapping in the area by Hanson indicates a general north-south and also some northeast-southwest trending major fault trends. The Lowhee, Rainbow and Grouse Faults all have a northerly trend with local or minor variations in direction. Sub-sequent geological work maps other northerly trending faults along Williams Creek, Black Jack Creek and Antler Creek. (Bulletin 280 G.S.C.), R.W. Boyle, 1979.

Gold mineralization in the general area of the claims as observed in the underground workings at the Cariboo Gold Quartz Mine and also Island Mountain Mine, occurs in two general types or forms namely, with quartz veins and pyrite and as a replacement type orebody in limestone in form of massive sulfides. Mineralization occurs in fractures at or near the intersection of major structural trends in the area.

## RESULTS

An examination of the outcrop of bedrock in the area of the claim work indicates a marked increase in the number and size of quartz veins in the south and southwestern part of the area. Outcrops are more numerous in this area and bedrock is primarly argillite with quartz veins and some limestone and quartzite. Some of the argillite contains pyrite in the form of cubes and also as veinlets with the quartz veins. Near the headwaters of Walker Gulch, in the southeastern portion of the claim block, quartz veins were very abundant and there appeared to be an increase in pyrite also. A sample of the argillite bedrock exposed in the creek bed gave a trace of gold. VLF-EM-16 electromag profiles up Walkers Gulch and Mink Gulch in this area show strong conductors in portions of the area. The anomaly on Walker Gulch appears to have a good shape and furthur geophysical exploration should be carried out in this general area and to the west on the divide between Richfield and Cow Mountain.

Other electromag profiles which were run over known areas of possible fault structures, mineralized veins etc. are enclosed with the report. The location of these profiles is shown on the enclosed map showing claims and geology. The results of the electromag survey on the different profiles is tabulated below under the appropriate profile.

## Mink Gulch (1)

The broad band of increased conductivity near the headwaters of Mink Gulch is difficult to explain. In this general area underground workings indicate considerable quartz porphyry. The response on the electromag not normal or what might be expected, possibly due to surface conditions. The Williams Creek - Black Jack Gulch Fault projects into this area but has not been identified.

## Walker Gulch (2)

Entire profile is on bedrock or near bedrock since the entire creek has been worked for placer gold.

The possible fault zone from station #27 to 34 is on the projection of the Williams Creek - Black Jack Gulch fault trend. A marked increase in the size and number of quartz boulders in the stream as noted on the profile was very obvious. Bedrock also had numerous quartz veins in this area with iron oxide staining.

## Richfield Mountain (3)

The high conductivity at the start of the profile is the same area of high conductivity near the headwaters of Mink Gulch. It is very possible that bedrock is deep on the remainder of the profile. No bedrock outcrops were observed in this immediate area which is the northeast flank of Richfield Mt.

## B.C. Dutch (4)

The value of this profile is questionable due to the numerous changes in direction of the profile. The overburden could also be fairly deep on most of the profile. The Williams Creek - Black Jack Gulch fault projects into the profile in the vicinity of stations 45 to 50 and may possibly be shown on the profile at that point.

## B.C. Vein (5)

This profile as well as parts of other profiles was run at a slight oblique angle to the primary field of Seattle Station. The location of the B.C. vein is shown on the profile. The vein is a mineralized shear zone and was explored with a shaft and drifts along the zone. There is no record of gold production from this vein. It does contain pyrite and gold values. There is also considerable overburden along parts of the profile.

## Regional Profile (Part 1 Northern)

Both portions of this profile were run along a trail up Stouts Gulch and the old trail up Williams Creek to Stanley. The trails cross fault zones mapped by Hanson and others in this general area. Part No.1 crosses the Waoming Fault which crosses Stouts Gulch near Station #1. Near the confluence of Stouts Gulch and Williams Creek another possible fault zone is noted on the profile near station #25. Another possible fault zone on the profile between stations 60 and 70 is also recorded. The Black Jack Gulch Fault which has been mapped along Williams Creek near Barkerville has not been identified to the west. Either one or both of these zones may represent the fault or fault zones. Another possible fault zone is indicated near stations 114 to 117 near the mouth of Walker Gulch.

## Regional Profile (No.2)

This profile covers the southeast extension of the regional profile near the southeast portion of the claim block. A possible fault zone is indicated on the profile from station 167 to station 183. The zone is very wide and to the south, strong conductivity is recorded near the headwaters of Mink Gulch. Further southeast along the line of the profile the overburden is possibly quite deep especially in the swamp near end of profile.

## CONCLUSIONS

The VLF-EM-16 electromag can be used to gain some possible subsurface data to assist in reconnaissance geological mapping. The wide range of responses, recorded by the VLF-EM-16, almost precludes its use in any detail work. The responses to a variety of structural conditions such as faults with water and without water, limit its use in this area, however, in some areas it would be very useful to map general fault trends or lines of weakness. The VLF-EM-16 response to various rock types, and the variations of the response due probably or partially to surface conditions, makes its use somewhat doubtful in this field.

In most areas it is questionable if the use of the VLF-EM-16 in the normal method of grids, whether the data obtained would be worth cost of cutting lines and carrying out survey. The use of the VLF electromag to supplement geological mapping and obtain data along existing trails, roads or stream beds where access is good, is recommended.

## RECOMMENDATIONS

It is recommended that further detail geological mapping and more definitive geophysical exploration, such as the vertical or horizontal loop electromag surveys be carried out in the area of the claim block. This work should be designed to get more information on the northerly trending faults which can be projected into the area of the claims.

Respectfully submitted,

Wm. HOWARD MYERS,
P.Eng., (B.C.), P.Geol.(Alta.)
Geophysical-Geological Consultant
Vancouver, B.C.

April 1980

PROFESSIONAL PROVINCE OF W. H. MYERS BRITISH COLUMBIA ENGINEER

Expiry Date: June 16, 1981

## BIBLIOGRAPHY

Geological Survey of Canada
Memoir #181, G. Harrison, 1935
Paper 72-35, R.B. Campbell, E.W. Mountjoy and F.G. Young, 1973
Bulletin 280, 1979, R.W. Boyle
Maps 336A
" 2395 (south portion)
" 2394 (north portion)

# 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, British Columbia. I have been actively engaged in my profession as an independent consultant in both oil and mining since 1952. Prior to 1952 I spent 11 years primarily in geophysical exploration work for both oil and minerals. I am a professional geologist member, P.Geol. #16704 of the Association of Professional Engineers, Geologists and Geophysicists of Alberta, and a non-resident member, P.Eng. of the Professional Engineers of British Columbia.

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

For the past 16 years, since 1964, I have spent the majority of my time in British Columbia primarily engaged in mineral exploration work.

Information for this report is from published and unpublished maps and reports together with my fieldwork in the general Cariboo area over the past fifteen years. The published maps and reports used in the preparation of this report are listed in the Bibliography in the Appendix of the report.

The work in the field with the VLF-EM-16 and the geological mapping is detailed in the introduction of the report.

I have an undisclosed 1/3 interest in the claim block.

Wm. HOWARD MYERS
P.Eng. (B.C.), P.Geol. (Alta.)
Geological-Geophysical Consultant
Vancouver, B.C.

April, 1980

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
W. H. MYERS

Expiry Date: June 16, 1981

GEONICS LIMITED
2 Thorncliffe Park Drive, Toronto 17, Ontario, Canada  Telephone: 425-1821 Area Code 416

## EM16 CASE HISTORIES

The attached case histories are examples of the capability of the VLF electromagnetic system in various conditions.

The direction in which the readings have been taken are indicated by an arrow. All VLF survey maps should be so marked as an aid to interpretation.

Figure 1 - This profile shows two conductive zones. The anomaly at the left shows a reverse quadrature slope thus also indicating the presence of conductive overburden covering the bedrock conductor. The indicated depth to the conductor is calculated at one-half the distance between the positive and negative maximums. The anomaly at the right shows some positive quadrature slope, indicating a medium conductor.

Figure 2 - This profile shows a medium conductor. The right hand positive in-phase component has a long "tail" indicating the dip direction of the conductive zone.

Figure 3 - This anomaly is caused by a vertical zone of graphitic slate covered by approximately 85 feet of conductive clay. The in-phase anomaly is considerably reduced in amplitude. The quadrature shows a typically strong reverse slope.

Figure 4 - This anomaly is the result of a weak conductor. The location of the conductor is at the center of the slope, not at the actual zero-crossing.

Figure 5 - This shows a simplified example of EM16 used underground. By taking readings in two directions, using different primary field sources, one can locate ore pockets precisely. Only the in-phase profiles are shown in this figure.

## PRINCIPLE OF OPERATION

The VLF-transmitting stations operating for communications with submarines have a vertical antenna. The antenna current is thus vertical, creating a concentric horizontal magnetic field around them. When these magnetic fields meet conductive bodies in the ground, there will be secondary fields radiating from these bodies. This equipment measures the vertical components of these secondary fields.

The EM16 is simply a sensitive receiver covering the frequency band of the new VLF-transmitting stations with means of measuring the vertical field components.

The receiver has two inputs, with two receiving coils built into the instrument. One coil has normally vertical axis and the other is horizontal.

The signal from one of the coils (vertical axis) is first minimized by tilting the instrument. The tilt-angle is calibrated in percentage. The remaining signal in this coil is finally balanced out by a measured percentage of a signal from the other coil, after being shifted by $90^o$. This coil is normally parallel to the primary field.

Thus, if the secondary signals are small compared to the primary horizontal field, the mechanical tilt-angle is an accurate measure of the vertical real-component, and the compensation $\pi/2$-signal from the horizontal coil is a measure of the quadrature vertical signal.

## SELECTION OF THE STATION

The magnetic field lines from the station are at right angles to the direction of the station. Always select a station which gives the field approximately at right angles to the main strike of the ore bodies or geological structure of the area you are presently working on. In other words, the strike of geology should point to the transmitter. Of course, $\pm 45^o$ variations are quite tolerable in practice.

The selection of the proper transmitting station is done by plug-in units inside the receiver. The equipment takes two selector-units simultaneously. A switch is provided for quick switching between these two stations.

To change a plug-in unit, open the cover on top of the instrument, and insert the proper plug. Then close the cover again.

Here is a list of some of the stations useful in Canada and United States.

| | | |
|---|---|---|
| Station NAA: | Cutler, Maine | Freq. 17.8 kHz |
| Station NPG: | Seattle, Washington | Freq. 18.6 kHz |
| Station NSS: | Annapolis, Maryland | Freq. 21.4 kHz |
| Station NBA: | Panama | Freq. 24.0 kHz |
| For European use GBR: | Rugby, England | Freq. 16.0 kHz |
| NWC: | Australia | Freq. 22.3 kHz |

When ordering an instrument, consult Geonics for latest information for best selection of stations.

## TAKING A READING

The direction of the survey lines should be selected approximately along the lines of the primary magnetic field, at right angles to the direction to the station being used. Before starting the survey, the instrument can be used to orient oneself in that respect. By turning the instrument sideways, the signal is minimum when the instrument is pointing towards the station, thus indicating that the magnetic field is at right angles to the receiving coil inside the handle.

To take a reading, first orient the reference coil (in the lower end of the handle) along the magnetic lines. Swing the instrument back and forth for minimum sound intensity in the speaker. Use the volume control to set the sound level for comfortable listening. Then use your left hand to adjust the quadrature component dial on the front left corner of the instrument to further minimize the sound. After finding the minimum signal strength on both adjustments, read the inclinometer by looking into the small lens. Also, mark down the quadrature reading.

While travelling to the next location you can, if you wish, keep the instrument in operating position. If fast changes in the readings occur, you might take extra stations to pinpoint accurately the details of anomaly.

The dials inside the inclinometer are calibrated in positive and negative percentages. If the instrument is facing 180° from the original direction of travel, the polarities of the readings will be reversed. Therefore, in the same area take the readings always facing in the same direction even when travelling in opposite way along the lines.

The lower end of the handle, will as a rule, point towards the conductor. The instrument is so calibrated that when approaching the conductor, the angles are positive in the in-phase component. Turn always in the same direction for readings and mark all this on your notes, maps, etc.

## THE INCLINOMETER DIALS

The in-phase percentage scale is on the right. The left scale is the secant of the slope of the ground surface. You can use it to "calculate" your distance to the next station along the slope of the mountain.

(1) Open both eyes

(2) Aim the hairline along the slope to the next station to about your eye level height above ground

(3) Read on the left scale directly the distance necessary to measure along the slope to advance 100 (ft) horizontally

We feel that this will make your reconnaissance work easier. The outside scale on the inclinometer is calibrated in degrees just in case you have use for it.

## PLOTTING THE RESULTS

For easy interpretation of the results, it is good practice to plot the actual curves directly on the survey line map using suitable scales for the percentage readings. The horizontal scale should be the same as your other maps on the area for convenience.

## INTERPRETATION

The VLF primary field's magnetic component is horizontal. Local conductivity inhomogeneties will add vertical components. The total field is then tilted locally on both sides of a local conductor. This local vertical field is not always in the same phase as the primary field on the ground surface. The EM16 measures the in-phase and quadrature components of the vertical field.

When the primary field penetrates the conductive ground and rock, the wave length of the wave becomes very short, maybe only few tens of meters, depending on conductivity and frequency.

At the same time the wave travels practically directly downwards. The amplitude of the field also decreases very fast, completely disappearing within one wavelength. The magnetic field remains, however, horizontal.

Figure 7 shows graphically the length and phase angle of the primary field penetrating into a conductive material.

The phase shift in radians per meter and the attenuation in nepers per meter (1/e) is:

$$\beta = \alpha = \left(\frac{\omega \mu \sigma}{2}\right)^{\frac{1}{2}} \quad \text{where} \quad \omega = 2\pi f, \quad \mu = \mu_0 \mu_r = 4\pi \times 10^{-7}$$

$\sigma$ = conductivity mho/m

Figure 7 also reminds of the fact that all secondary fields have a small (or large in poor conductors) positive phase shift in the target itself due to its resistive component, and that the secondary fields have another negative phase shift while penetrating back to surface from the upper edge of the target.

The targets are located somewhere in the depth scale (phase shift scale in this case). Suppose we have semi-infinite vertical sheet target starting from the surface. Figure 8 shows that the total integrated primary field inphase and quadrature flux has a value of + 0.5 and - 0.5 respectively.

These two charts can be used to analyze the inphase and quadrature readings taken on both sides of the target. If one knows the actual conductivity of the overburden and the rock, the task is easier. Because of the many variables involved the precise analysis is usually impossible.

Mostly encountered and easily solved problem is, however, the separation of surface conductors from the more interesting ones at depth. This is easily done by observing the negative quadrature signals compared to the usually positive or zero ones from the surface targets. See the sample profiles 9 and 10. This way we can often tell if we have a more interesting sulfide target under a swamp for example.

Another use for the quadrature polarity is in the following a fault or a shear zone. Normally these weak conductors give a fair amount of positive (the quadrature follows the in-phase polarity) quadrature. When we have a local sulfide concentration in these structures, we get a negative quadrature response.

5

All the interpretation is made easier by other indication of the depth to the target. The horizontal distance between the maximum positive and negative readings is about the same as the actual depth from the ground surface to the centre of the effective area of the conductive body. This point is not the centre of the body, but somewhat closer to the upper edge.

Theoretically for spherical conductor, the depth

$h = \Delta X$ where $\Delta X$ is the horizontal distance between the max. points of the vertical field $H_z$.

The radius $a = 1.3\,h\,\sqrt[3]{H_z(\max)}$.

For cylindrical body $h = 0.86\,\Delta X$

The radius $a = 1.22\,h\,\sqrt{H_z(\max)}$.

In these equations $H_z = 1$ means 100% on the equipment dial.

The determination of the depth is generally more reliable than the estimation of the actual dimension a. The real component of $H_z$, which we should use in these calculations, decreases proportionally for a poorer conductor and with the depth in conductive material.

One can also draw some conclusions about the dip and shape of the upper area of the conductor by observing the smaller details of the profile. See the modelling curves.

A vertical sheet type conductor, if it comes close to the surface, gives a sharp gradient of large amplitude and slow roll-off on both sides.

Horizontal sheet should give a single polarity on the edge of it, and again the opposite way on the other edge.

When looking at the plotted curves, one notices that two adjacent conductors may modify the shape of the anomalies for each one. In cases like this, one has to look for the steepest gradients of the vertical (plotted) field, rather than for the actual zero-crossings. Forget the word "cross-over". Look for the centres of slopes on the in-phase for location of targets.

6

As with any EM, the largest and best conductors give the highest ratio of in-phase to quadrature components. In VLF however, the surrounding conductive material influences the results so much that it is almost an irrelevant statement except in a few cases. Also in practice most of the ore bodies are composed of different individual sections, and therefore one cannot use the in-phase/quadrature ratio as the sole indicator of the conductivity-size factor. In other words the characteristic response curves are flat, much flatter than with modelling.

## SOME NOTES FROM THE FIELD

It has been shown in practice that this instrument can be used (in proper areas) also underground in mines. The rails and pipes may cause background variations. It was found in one mine even at 1400 foot level, that the signal strength was good. By taking readings at two directions at each station, one could obtain a very good indication about the location of the ore pockets in otherwise difficult geology.

On the other hand a thick layer of conductive clay can suppress the secondary field to a negligibly small value.

In mountainous areas one can expect a smooth rolling background variation. However, the actual sharper anomalies induced by conductive mineral zones can be usually easily recognized.

Faults and shear-zones can give anomalies, but not without a reason. There must be conductivity associated with them. Reverse quadrature may indicate sulfide deposits in these structures.

Geonics invites any comments and interesting observations with the EM16 for the benefit of all users. These can be kept confidential if so desired.

## SERVICING

Changing the batteries is done by removing the cover and changing the penlight batteries one by one. Please notice the polarities marked on each individual cell. To test the condition of the batteries, turn the instrument on, press the push-button on the front panel. There should be a whistling sound in the loudspeaker if the batteries are in useable condition. If the sound is not heard, the battery voltage may be low.

It may be occasionally necessary to clean the contacts of the plug-in unit. For this, use a clean rag that is very slightly moistened with oil. The oily rag is good also for the battery terminals.

If any repairs are necessary, we recommend that the instrument be shipped to Geonics Limited for a thorough check-up and testing with proper measuring instruments.

## PHOTOGRAPHS

Figure 1 shows the insertion of the station selector plug-in units in the EM16.

Figure 2 shows how to use the instrument to find the direction of the primary field. Swing the instrument horizontally for minimum signal.

Figure 3 shows that you are now facing in the survey line direction along the primary field. The transmitter is on your left or right.

Figure 4 shows that you are approaching a conductor. In-phase readings are positive. Quadrature may be negative if target is deeper.

Figure 5 you have passed over the conductor already. In-phase dial shows negative value. Quadrature could be positive if deeper target was behind you.

Figure 6 shows a sample profile over a massive sulfide target.

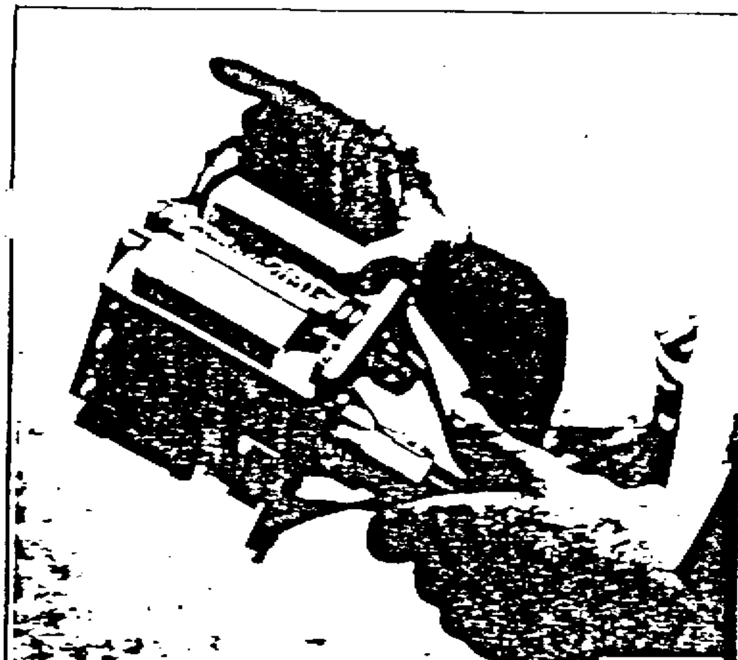


Fig.1

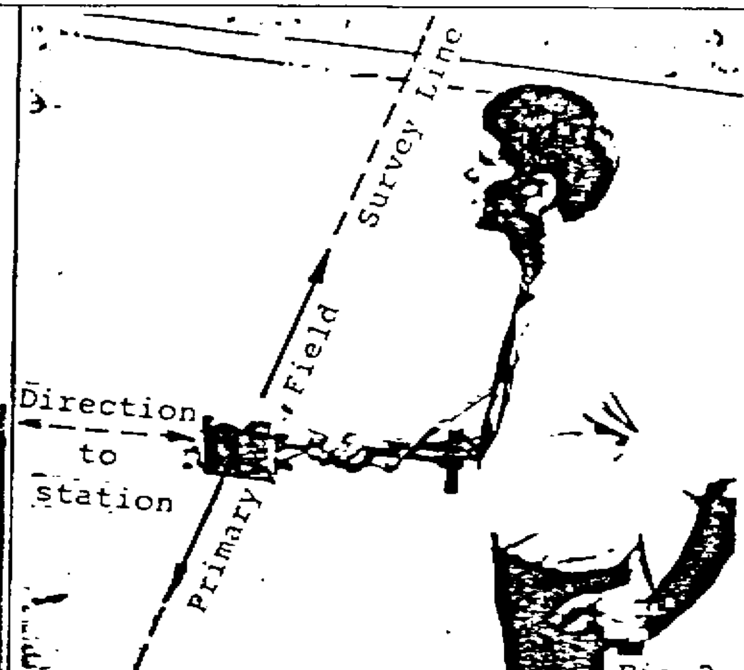



Fig.2

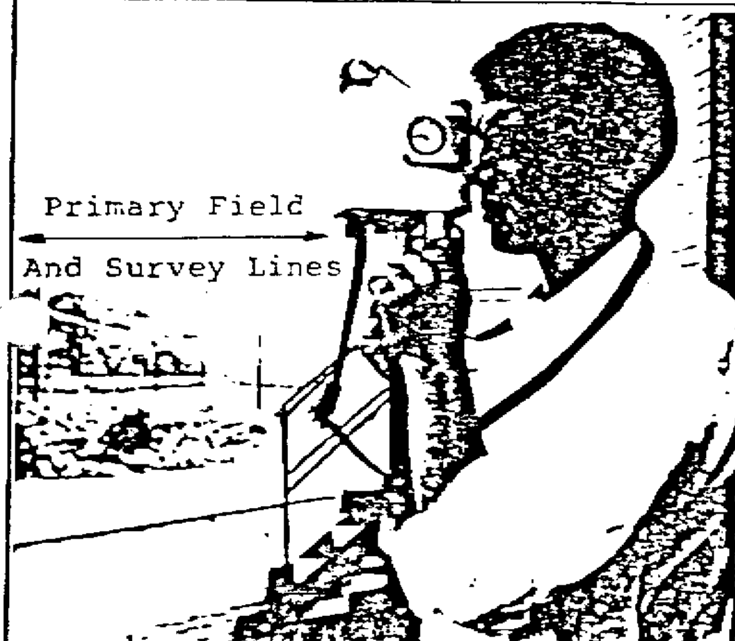



Fig.3

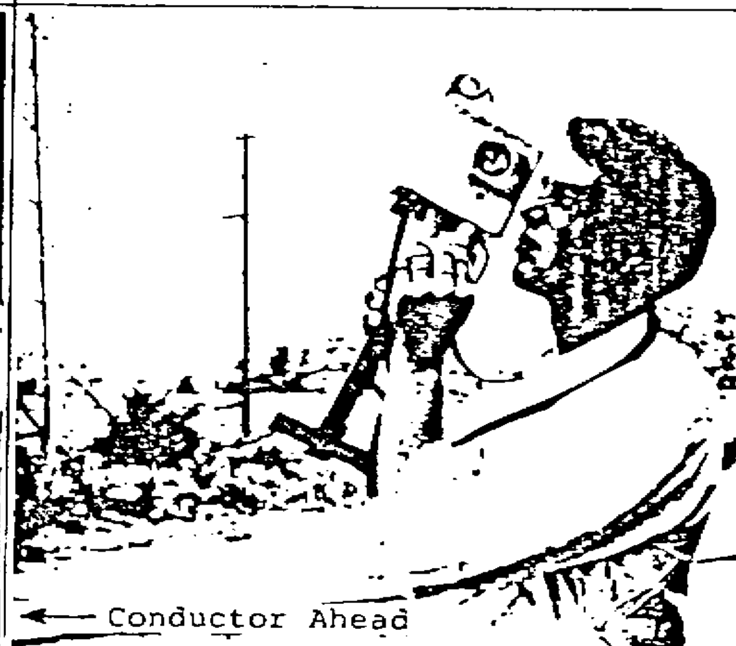



Fig.4

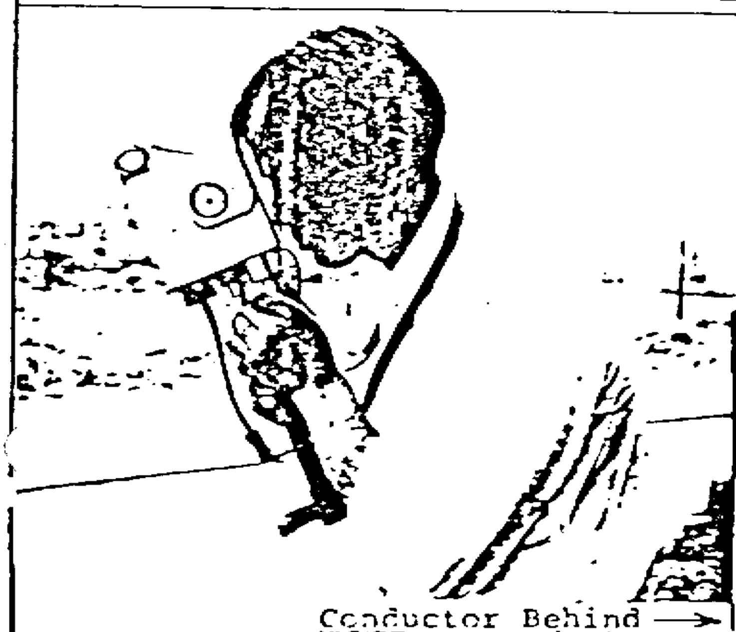



Fig.5

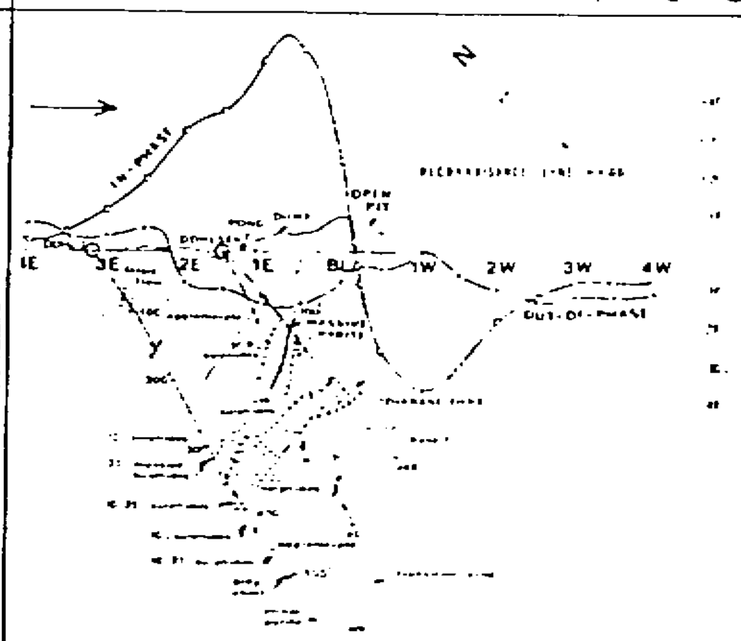



Fig.6

MINK GULCH #1 log ①

WALKER GULCH
# 2 log (2)

RICHFIELD MT
# 3
log 3

B.C. DITCH
No 4 log 4

B. C. VEIN
No 5 log 5

PROFILE 6.109 (6)
15 M
APRIL 3, 1979
Barkerville Gold Prospect
Regional Profile - VLF-EM16
April 3-10, 1979 Spacing 15 M
Station: Seattle NPG
Scale 1" = 25 Metres
Part No. 1
MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 8179
PROFESSIONAL PROVINCE OF W. H. MYERS BRITISH COLUMBIA ENGINEER
Expiry Date: June 16, 1981


Profile 6
#2
log
7
MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 8179
Barkerville Gold Prospect
Regional Profile - VLF EM16
April 3-10, 1979 Spacing 15 M
Station: Seattle NPG
Scale 1" = 25 Metres
Part No 2
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
W. H. MYERS
Expiry Date: June 16, 1981

WELLS, B.C.
MOSQUITO CREEK MINE
Mosquito Creek
ISLAND MOUNTAIN
JACK OF CLUBS LAKE
CARIBOO GOLD QUARTZ
RAINBOW FAULT
LOWHEE CREEK
LOWHEE FAULT
POSS. EXTENSION OF GOLD FINCH FAULT (B.C. GOV. REP. 1946)
B.C. VEIN
WAOMING FAULT
BARKERVILLE
BARKERVILLE FAULT
Stouts Gulch
Wilsons Gulch
Emory Gulch
Black Jack Gulch
Walker Gulch
William Creek
Mink Gulch
B.C. DITCH
RICHFIELD MTN.
PROPERTY BOUNDARY
GOLD 1
GOLD 2
GOLD 3
GOLD 4
GOLD 5
GOLD 6
GOLD 7
GOLD 8
AU 1
AU 2
AU 3
AU 4
AU 5
AU 6
AU 7
AU 8
AG 1
AG 2
AG 3
AG 4
AG 5
AG 6
AG 7
AG 8
KING 933
KING 934
KING 935
KING 936
KING 937
KING 938
KING 939
KING 940
PB 1
PB 2
PB 3
PB 4
PB 5
PB 6
PB 7
PB 8
No. 1
No. 2
No. 3
No. 4
No. 5
No. 6 (1)
No. 6 (2)
35°
65°
45°
60°
50°
80°
LEGEND
CARIBOO SERIES
PRECAMBRIAN
6 BARKERVILLE FORMATION : Limestone, sericite schist, graphite schist, argillite, quartzite.
5 RICHFIELD FORMATION, BAKER MEMBER : Fissile and non-fissile calcareous quartzite, limestone
4 RICHFIELD FORMATION, RAINBOW MEMBER : Fissile and non-fissile, interbedded argillite and quartzite; limestone
3 RICHFIELD FORMATION, B.C. MEMBER : Argillite
2 RICHFIELD FORMATION, LOWHEE MEMBER : Fissile and non-fissile quartzite, limestone
1 RICHFIELD FORMATION, BASAL MEMBER : Argillite
RICHFIELD FORMATION, UNDIVIDED
GEOLOGICAL BOUNDARY – Defined, assumed
FAULT
ADIT
STRIKE & DIP
VLF RECONNAISSANCE PROFILES: No. 1 – 6
NOTE : Geology and faults from Memoir 181, Pub. #2394 & 2395, G. Hanson 1935.
MINERAL RESOURCES BRANCH ASSESSMENT REPORT
8179
NO.
JACK ST. MARS et al
BARKERVILLE LODE GOLD PROSPECT
CLAIM & VLF - EM 16 PROFILE LOCATION MAP
1
PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA W. H. MYERS
Expiry Date: June 16, 1981
SCALE 1 : 12,000
0 4000 FEET
0 1200 METRES
MARCH 1980
To accompany Geological – Geophysical Report by Wm Howard Myers dated March 1980
Wm Howard Myers, P. Eng (B.C.) P. Geol. (Alta), Consultant.