GEOPHYSICAL REPORT

ON

RESISTIVITY AND
INDUCED POLARIZATION SURVEYS

OVER A PORTION OF THE

AMETHYST VALLEY CLAIM

OXIDE PEAK, TOODOGGONE RIVER AREA

OMINECA MINING DISTRICT, BRITISH COLUMBIA

PROPERTY DESCRIPTION

57° 29’N Latitude
127° 09’ W Longitude
N.T.S. 94E/6

SURVEY PERIOD

August 21, 1994

WRITTEN FOR

ROBERT CARD
#711 - 475 Howe Street
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WRITTEN BY

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DATED

November 15, 1994
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SUMMARY

A resistivity and induced polarization survey was carried out along one line over the Mist Vein located within the Amethyst Valley claim owned by Robert Card.

The survey was carried out using a Huntec Mark IV receiver operating in the time-domain mode. The array used was dipole-dipole, read to twelve separations, with a dipole length and reading interval of 30 m. One line was surveyed for a total length of 840 m. The results were plotted in pseudosection and plan, and contoured.

The purpose of the work was to determine the dip, especially the direction, of the Mist Vein. The secondary purpose was to locate additional alteration zones at depth that were not apparent on surface.
CONCLUSIONS

1. The resistivity survey responded to the alteration of the Mist Vein as a resistivity low sitting on a westerly-dipping footwall. Therefore, the dip of the vein, which closely parallels the footwall, dips westerly.

2. The resistivity survey also revealed three additional resistivity lows that dip westerly. Therefore, these could reflect alteration zones associated with epithermal veins.

RECOMMENDATIONS

It is recommended to continue the survey to both the north and south in order to determine the strike length of the Mist Vein. Also, if an excavator can be walked in to the Mist Vein showing, it should be trenches in order to understand the geology of the vein system more accurately.
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INTRODUCTION AND GENERAL REMARKS

This report discusses the instrumentation, theory, field procedure and results of a resistivity and induced polarization ("IP") survey carried out over the Mist Vein located within the Amethyst Valley claim adjacent to Oxide Peak within the Toodoggone Mining Camp.

The work was carried out on August 21, 1994 under the field direction of the writer. One geophysical technician as well as three helpers completed the crew of five.

The main purpose of the geophysics was to determine the dip, and especially the direction, of the Mist Vein. The outcropping indicated an easterly dip, but the associated alteration zone indicated it should dip westerly. The alteration zone is expected to respond as a resistivity low.
The secondary purpose was to locate additional epithermal veins by locating resistivity lows that would be indicative of alteration zones.

The purpose of the IP survey was to map any sulphide mineralization associated with the Mist Vein.

PROPERTY AND OWNERSHIP (From Burton’s Report)

Claims consist of the 20 unit Kidview, Record number 5706, which has a current expiry date of August 22, 1995, and the 20 unit Amethyst Valley, Record number 5707, which also has a current expiry date of August 22, 1995, should the work described within this report be accepted for assessment credits. Staked in 1983, assessment work is now at $200 per unit per year.

LOCATION AND ACCESS (From Burton’s Report)

The property is in northwestern British Columbia in the Toodoggone Mining Camp. The camp is generally reached by fixed wing aircraft from either Terrace or Smithers to the Sturdee airstrip. Alternatively, road access is available from McLeod Lake some 160 kilometers north of Prince George. For most of the way the road is private and there is a user fee of $500 per vehicle. It takes a long day from Prince George to drive in, and there are no gas, food or accommodation services on the road. The road closes in the fall when the snow comes.

The property is about 30 kilometers north of the Sturdee airstrip. From the Sturdee Airstrip the road has branches northeast to the Baker mine and 8 kilometers north to the Lawyers mine. From the Lawyers mine road there is an open helicopter landing area for the last section of the trip to the property. About a half hour flight by helicopter, some 8
kilometers north, up the McClair or Moosehorn Creeks is the easiest flight route. There are several bulldozer/excavator trails to other properties that follow the same general routes that could be used and extended to bring a surface access trailer road directly to the Mist Vein.

The claims are in the Omineca Mining Division in N.T.S. 94E 6 and 11. Latitude is 127° 00' West, Longitude is 57° 29' North. U.T.M. coordinates are E610000 and N638000.

**HISTORY OF PREVIOUS WORK**

In 1990, Burton Consulting Inc. carried out prospecting and hand-trenching on the Mist Vein.

**AREA GEOLOGY** (From Burton's Report)

The Toodoggone Group of Lower to Middle Jurassic volcanic rocks are the host for most of the precious metal mineralization in this camp. They overlie the Takla Group Volcanics of Upper Triassic Age.

Toodoggone rocks are in fault contact on the eastern edge with Permian Age Asitka limestones. To the west the Upper Cretaceous and younger rocks of the Sustut Group unconformably overly the Toodoggone rocks. Some areas of Toodoggone rocks are intruded by Omineca intrusions of Jurassic and Cretaceous ages.

The precious metal deposits in the camp are all epithermal and have been shown to extend from surface sulfotaric hot spring type of deposits to low pH clay alteration zone, to breccias, and deeper types of the various epithermal classes.

The Toodoggone Group has three principle subdivisions, the Upper Volcanic-Sedimentary?, the Upper Volcanic, and the Lower Volcanic.
The Lower are andesitic maroon and green porphyritic flows and pyroclastics. The Upper Volcanics are intermediate alkalic trachytes, crystal tuffs, lithic tuffs, dust tuffs, and quartz feldspar porphyries. Many of the trachytes are orange colored from iron pneumotectically altered to hematite. There are also explosive volcanism with intrusion of syenomonzonite bodies and brecciation.

The brecciation along major faults and splays resulted in silicification and epithermal mineralization such as the major northwesterly regional fault systems like the McClair fault and subsidiary splays. These are thought to be important channelways for the formation of the sulphide rich zones (now gossans) and the precious metal mineralization.

PROPERTY GEOLOGY AND DESCRIPTION OF VEINS (From Burton’s Report)

The primary area of interest is the projected MIST VEIN. This vein system has been traced for 190 meters, is open along strike in both directions, and has a well developed hangingwall alteration zone that is strong enough and large enough so that it could contain a large enough tonnage to be economic. The clay alteration zone has a maximum width on the hangingwall of 20 to 50 meters, and the sericitic hangingwall and outer alteration has a maximum width of at least 25 meters.

There are at least three other alteration zones west of the Mist vein that are similar in character but have not been explored to see if they are well enough developed to be economically significant.

The Mist Vein, at an elevation of 1850 meters, is 900 meters southwest from 2011 Peak, and 650 meters east from the alpine lake. It is in a small saddle along the westerly trending ridge crest. The discovery area is on the saddle ridge, trenching to the north and south is on the lower slopes of the ridge, so the depth of overburden gradually increases.
Trenching for the next phase should be with an excavator-type digger on a tracked turntable such as a Cat 225 or similar machine.

**INSTRUMENTATION**

The transmitter used for the induced polarization-resistivity survey was a Model IPT-1 manufactured by Phoenix Geophysics Ltd. of Markham, Ontario. It was powered by a 2.5 kw motor generator, Model MG-2, also manufactured by Phoenix.

The receiver used was a model Mark IV manufactured by Huntec ('70) Limited of Scarborough, Ontario. This is state of the art equipment with software-controlled functions, programmable through the front panel.

**THEORY**

When a voltage is applied to the ground, electrical current flows, mainly in the electrolyte-filled capillaries within the rock. If the capillaries also contain certain mineral particles that transport current by electrons (mostly sulphides, some oxides and graphite), then the ionic charges build up at the particle-electrolyte interface, positives ones where the current enters the particle and negatives ones where it leaves. This accumulation of charge creates a voltage that tends to oppose the current flow across the interface. When the current is switched off, the created voltage slowly decreases as the accumulated ions diffuse back into the electrolyte. This type of induced polarization phenomena is known as electrode polarization.

A similar effect occurs if clay particles are present in the conducting medium. Charged clay particles attract oppositely-charged ions from the surrounding electrolyte; when the current stops, the ions slowly diffuse back to their equilibrium state. This process is
known as membrane polarization and gives rise to induced polarization effects even in the absence of metallic-type conductors.

Most IP surveys are carried out by taking measurements in the “time-domain” or the “frequency-domain”.

![TRANSMITTED WAVEFORM](image1)

![RECORDED VOLTAGE](image2)

Time-domain measurements involve sampling the waveform at intervals after the current is switched off, to derive a dimensionless parameter, the chargeability “M”, which is a measure of the strength of the induced polarization effect. Measurements in the frequency domain are based on the fact that the resistance produced at the electrolyte-charged particle interface decreases with increasing frequency. The difference between apparent resistivity readings at a high and low frequency is expressed as the percentage frequency effect, or “PFE”.

The quantity, apparent resistivity, $\rho_a$, computed from electrical survey results is only the true earth resistivity in a homogenous sub-surface. When vertical (and lateral) variations in electrical properties occur, as they always will in the real world, the apparent resistivity will be influenced by the various layers, depending on their depth relatives to the electrode spacing. A single reading cannot therefore be attributed to a particular depth.
The ability of the ground to transmit electricity is, in the absence of metallic-type conductors, almost completely dependent on the volume, nature and content of the pore space. Empirical relationships can be derived linking the formation resistivity to the pore water resistivity, as a function of porosity. Such a formula is Archie’s Law, which states (assuming complete saturation) in clean formations:

\[
\frac{R_w}{R_{fo}} = \phi^{-2}
\]

Where:
- \( R_w \) is formation resistivity
- \( R_{fo} \) is pore water resistivity
- \( \phi \) is porosity

**SURVEY PROCEDURE**

One line of surveying was carried out in a due west direction along the top of a westerly trending ridge. The length of the line is 840 m.

The IP and resistivity measurements were taken in the time-domain mode using an 8-second square wave charge cycle (2-seconds positive charge, 2-seconds off, 2-seconds negative charge, 2-seconds off). The delay time used after the charge shuts off was 200 milliseconds and the integration time used was 1,500 milliseconds divided into 10 windows.

The array chosen was the dipole-dipole, shown as follows:
The dipole length and reading interval was chosen to be 30 meters. The lines were read to twelve separations, which gives a theoretical depth penetration of 210 m (about 700 feet).

Stainless steel stakes were used for current electrodes as well as for the potential electrodes.

**COMPILATION OF DATA**

All the data were reduced by a computer software program developed by Geosoft Inc. of Toronto, Ontario. Parts of this program have been modified by Geotronics Surveys Inc. for its own applications. The computerized data reduction included the resistivity calculations, pseudosection plotting, survey plan plotting and contouring.

The chargeability (IP) values are read directly from the instrument and no data processing is therefore required prior to plotting. The resistivity values are derived from current and voltage readings taken in the field. These values are combined with the geometrical factor appropriate for the dipole-dipole array to compute the apparent resistivities.

All the data has been plotted in pseudosection form at a scale of 1:2,500. Each value is plotted at a point formed from the intersection of a line drawn from the mid-point of each of the two dipoles. The results of this method of plotting is the farther the dipoles are separated, the deeper is the reading. The resistivity pseudosection is plotted on the upper part of the map for each of the lines, and the chargeability pseudosection is plotted on the lower part.

The IP pseudosection was contoured at an interval of 5 milliseconds and the resistivity pseudosection was contoured at a logarithmic to the base 10.
DISCUSSION OF RESULTS

The Mist Vein occurs at about 185W on the survey line. To its immediate west occurs a resistivity low that is undoubtedly reflecting the epithermal alteration associated with the Mist Vein. In an epithermal system, the vein always occurs on the footwall (unless the system has been overturned), and therefore the resistivity results indicate the Mist Vein to dip westerly.

Three additional westerly dipping resistivity lows are shown to the west of the Mist Vein. One subcrops at 255W, one at 360W, and the third one at 450W. These lows also could be reflecting epithermal alteration zones, and therefore an epithermal vein would be occurring within the footwall of each system. The dip of these three zones is also westerly.

The only significant results within the chargeability pseudosection occur within the Mist Vein footwall, which is relatively unaltered. These results probably reflect sulphides, but they are not likely associated with the epithermal system.

David G. Mark, P.Geo.,
Geophysicist
REFERENCES

the July 1990 Exploration Program, Oxide Peak and 2011 Peak Property,
Amethyst Valley and Kidview Claims, Toodoggone River Area, Omineca
M.D., B.C. for Clipper Minerals Ltd., Burton Consulting Inc., February
GEOPHYSICIST'S CERTIFICATE

I, DAVID G. MARK, of the City of Vancouver, in the Province of British Columbia, do hereby certify that:

I am a Consulting Geophysicist of Geotronics Surveys Ltd., with offices at #405 - 535 Howe Street, Vancouver, British Columbia.

I further certify that:

1. I am registered as a Professional Geoscientist with the Association of Professional Engineers and Geoscientists of the Province of British Columbia.

2. I am a graduate of the University of British Columbia (1968) and hold a B.Sc. degree in Geophysics.

3. I have been practicing my profession for the past 26 years, and have been active in the mining industry for the past 29 years.

4. This report is compiled from data obtained from an IP and resistivity survey carried out within the Amethyst Valley Claim on August 21, 1994.

5. I do not hold any interest in the property, nor do I expect to receive any interest as a result of writing this report.

November 15, 1994

David G. Mark, P.Geo.,
Geophysicist
AFFIDAVIT OF EXPENSES

An I.P. and resistivity survey was carried out over a portion of the Amethyst Valley Claim on August 21, 1994, adjacent to Oxide Peak in the Toodoggone River area, Omineca Mining Division, British Columbia, to the value of the following:

Field:
- 5-man crew, 1.2 days @ $1,300/day $1,560.00
- Room & Board, 1 day @ $75/man for 5 men 375.00
- Helicopter, 2.7 hours @ $640/hour 1,728.00
- Helicopter fuel 475.00
- Truck rental 100.00 $4,238.00

Data Reduction & Report:
- Senior geophysicist, 10 hrs. @ $45/hr. $450.00
- Computer-aided data reduction & drafting, 4 hrs. @ $50/hr. 200.00
- Typing, printing, photocopying 250.00 900.00

GRAND TOTAL $5,138.00

Respectfully submitted,

GEOTRONICS SURVEYS LTD.

David G. Mark, P.Geo.,
Geophysicist
CLIPPER MINERALS LTD.

NTS: 94E/6

KILometres

OXIDE PEAK CLS.

Location Map
TOODOGGONE AREA, B.C.

Burton Consulting Inc.

JANUARY, 1991