Logistics Report Prepared

for

Bonanza Mining Corporation

Volterra-3DIP & Magnetometer
MC Claims

Stewart, British Columbia, Canada
Latitude: 53° 03' 30 N Longitude: 129° 56' 18” W

BCGS SHEET: 104A001

NTS SHEET: 104A/04

MINING DIVISION: Skeena

Survey conducted by SJ Geophysics Ltd.
July 2017

Report prepared by
Ross Polutnik
August 2017

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1. Survey Summary

SJ Geophysics Ltd. was contracted by Bonanza Mining Corporation to acquire Volterra-3DIP and ground magnetic data on their MC Claims project. Table 1 provides a brief summary of the project.

Client	Bonanza Mining Corporation
Project Name	MC Claims
Location (approx. centre of grid)	Latitude: 56º 03' 30" N Longitude: 129º 56' 18" W 6213000N 441550E; WGS84 UTM Zone 9N
Survey Type	Volterra 3D Induced Polarization Ground Magnetometer
Total Line Kilometres	3DIP: 11.3 km Magnetics: 9.3 km
Production Dates	July 6 – July 29, 2017

Table 1: Survey Summary

The MC Claims project is located approximately 12 km north of Stewart, BC. The project is situated on Bear River Ridge along the east slopes of Mt. Shorty Stevenson.

Numerous mineralized showings are present on the property. The mineralization consists of gold, silver, and zinc within quartz-sulphide veins hosted by volcanic-sedimentary rocks. The mineralization is associated with increased quantities of sulphides. The property was first explored from 1921-1924, followed by various others carrying out additional work in the late 1990's and early 2000's (Boyd, 2011). Previous work has included prospecting, mapping, sampling, ground magnetics, trenching, and drilling. The majority of the past work has been focused on the mineralized showings.

The objective of the Volterra-3DIP and magnetometer survey was to map the electrical and magnetic properties of the survey area and investigate if the near-surface mineralized showings are related to each other by a deeper mineralized system.

2. *Location and Access*

The MC Claims project is located in northwest British Columbia, Canada (Figure 1).

Figure 1: Overview map of the MC Claims project

The closest town to the survey area is Stewart, which is approximately 13 km south of the MC Claims project. The project area sits along the east slopes of Mt. Shorty Stevenson, west of the Bear River. The project area was accessed from the Stewart airport by helicopter. There are numerous landing zones located on the property; the majority of which lie above the tree-line. A map of the project area is shown in Figure 2.

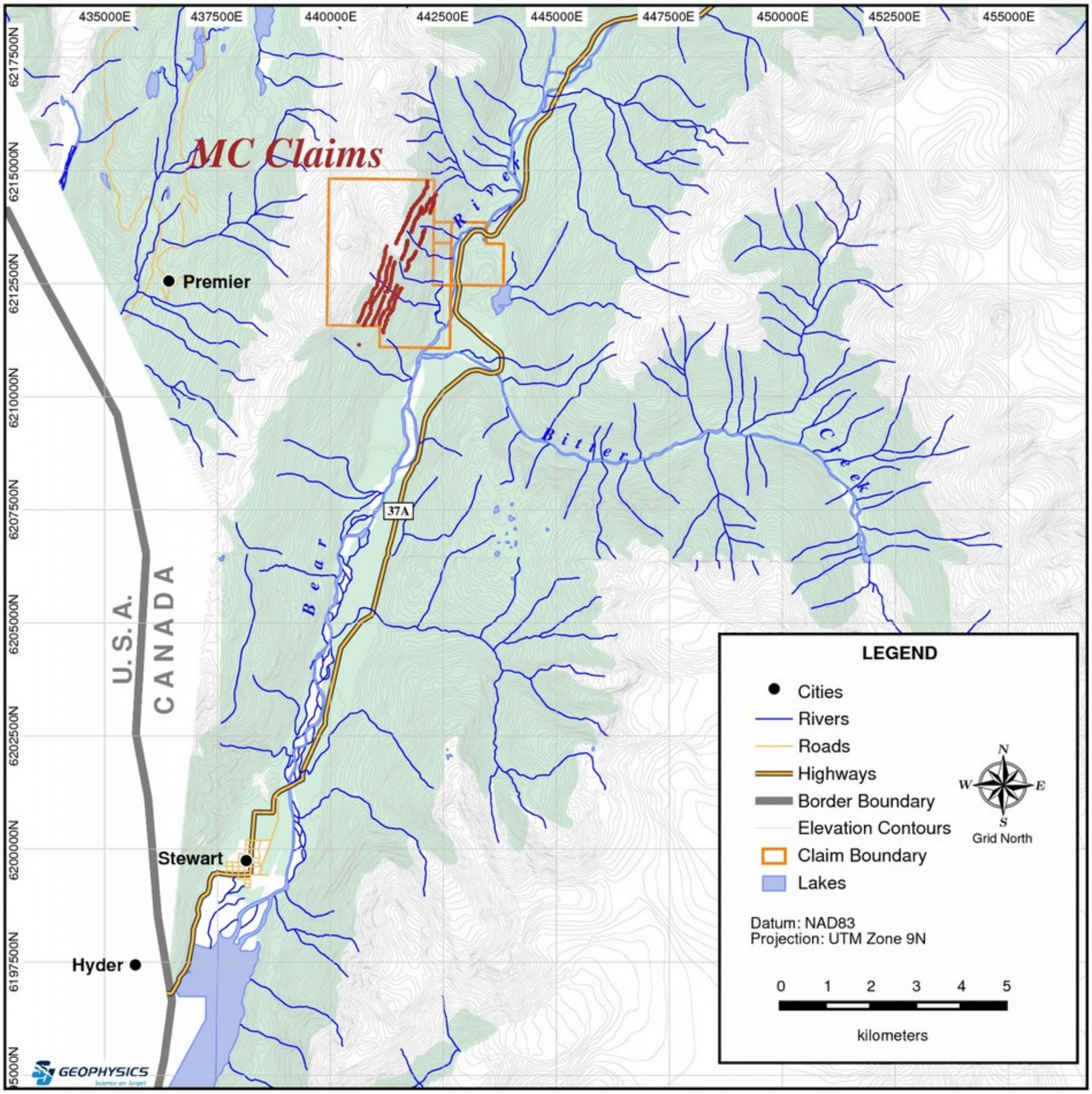

Figure 2: Location map for the MC Claims project

Stewart, BC is located within the north Coast Mountains and sits at the head of Portland Canal, a large fjord. The Stewart area has a humid and wet continental climate. The region receives significant precipitation each year with the majority in the form of snow. Summers are cool with average temperatures of 13 °C while winters are relatively warm with average temperatures of 0 °C.

Vegetation is abundant in the region. Valley bottoms and south facing slopes are typically covered in slide alder, salmon berry bushes, and devil's club, as well as western hemlock and spruce trees. Animals common in the area include: grizzly bears, black bears, mountain goats, marmots, small rodents, and bald eagles.

3. Survey Grid

The planned MC grid consisted of 7 survey lines, spaced at approximately 150 m. The proposed survey lines generally followed constant elevation contours located above or below significant cliff bands. The survey grid was separated into two parts, north and south, by a major creek gully draining a glacier located west of the survey area. It was planned that minor adjustments to the proposed survey lines would be made in the field in order to avoid steep cliffs and other terrain features that were not possible to survey. Changes would involve either adjusting the elevation of the line or introducing shorts gaps. The proposed survey grid is shown in Figure 3.

The actual MC grid consisted of 5 survey lines, with a variable line spacing from approximately 100-250 m. Two of the planned survey lines, L2750E and L2900E, were not surveyed due to very dense vegetation. Similar vegetation was encountered on the lowest elevation survey lines on the north side of the survey grid which made travel very slow. Adjustments to the survey lines were made in the field to avoid terrain features. Portions of the lines were often adjusted to higher or lower elevations, to avoid impassible cliffs. The survey grid was located in the field using hand held GPS units and stations were not flagged. The survey grid is shown is Figure 4 and the grid parameters are summarized in Table 2.

Grid	MC
Number of Surveyed Lines	3DIP: 5 Magnetometer: 5
Survey Line Azimuth	20º
Line Spacing	100 – 250 m
Station Spacing	3DIP: 50 m Magnetometer: 10 m
Elevation Range	785 – 1290 m

Table 2: Grid parameters

Both Volterra-3DIP and magnetometer data were acquired along the 5 survey lines. The line and station labels for the grid were based on a local coordinate system. Please refer to Appendix A for a detailed breakdown of the survey lines.

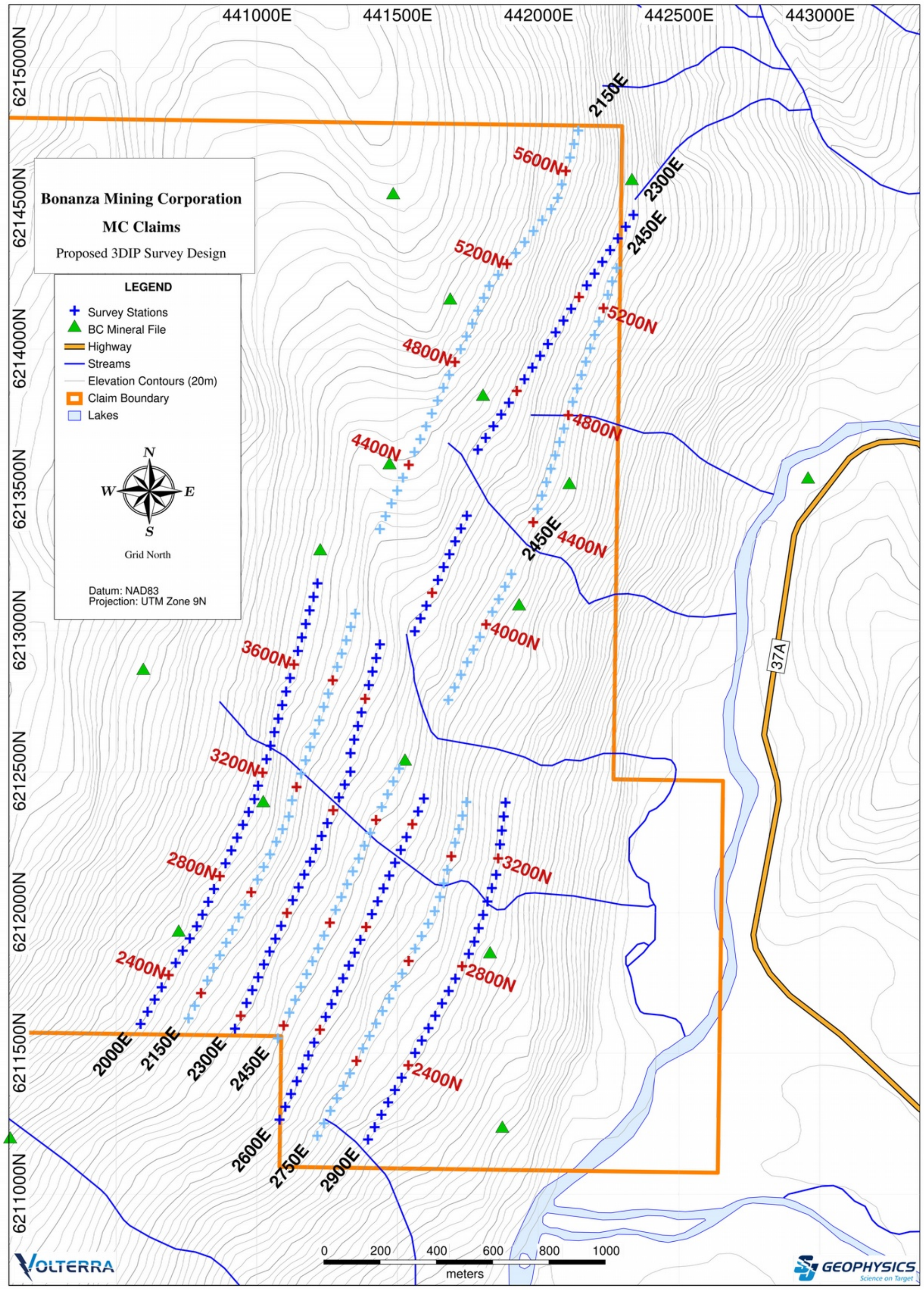

Figure 3: Grid map showing proposed MC grid

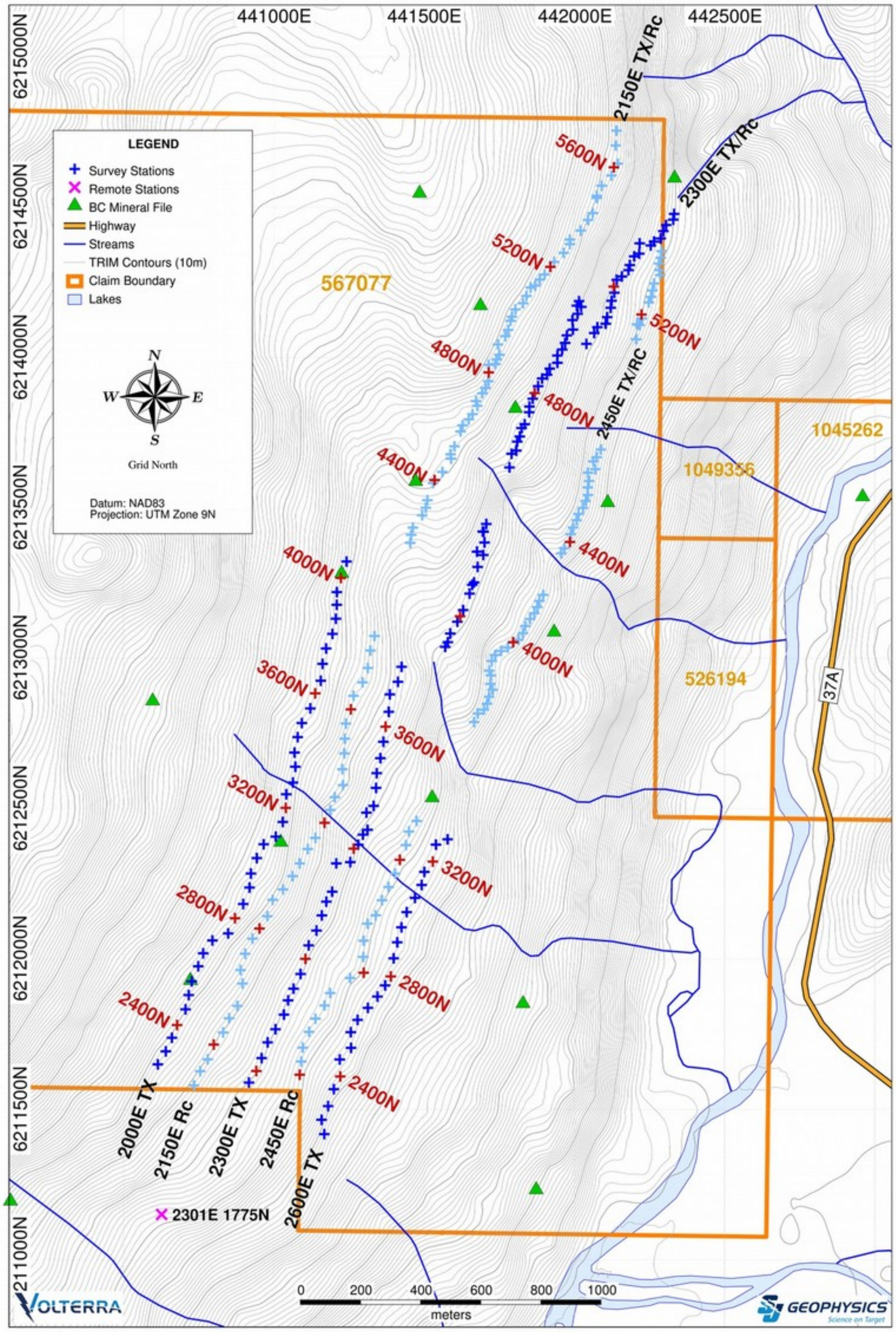

Figure 4: Grid map showing surveyed MC grid

4. Survey Parameters and Instrumentation

4.1. Volterra Distributed Acquisition System

The Volterra Distributed Acquisition System was developed internally by SJ Geophysics. The heart of the system are the Volterra data acquisition units. Each four-channel Volterra acquisition unit contains 24-bit analog-to-digital electronics that record the full waveform signal from various sensor configurations. This allows for varying suites of geophysical techniques such as induced polarization (IP), electromagnetics (EM), magnetotellurics (MT), controlled source audio-frequency magnetotellurics (CSAMT), etc. to be measured. The recorded full-waveform data is then passed through proprietary signal processing software to calculate the relevant geophysical attributes (ie. apparent resistivity/chargeability for IP surveys).

4.2. Volterra-3DIP Survey

SJ Geophysics Ltd.'s proprietary Volterra Distributed Acquisition System was utilized for the induced polarization (IP) survey. Current injections were controlled using a GDD TxII transmitter and the resulting ground response was measured using each Volterra data acquisition unit.

The distributed nature of the Volterra-3DIP system allows for highly customizable array and survey configurations. The resulting flexibility is a huge benefit when working in difficult terrain where rivers, roads, cliffs, or other obstacles can easily be avoided. The crew took full advantage of these features to optimize the field logistics and survey coverage for the challenging terrain conditions.

The transmitter and IP signal recording/processing parameters used for the survey are described in Table 3. The full instrument specifications are listed in Appendix B.

IP Transmitter	GDD TxII
Duty Cycle	50%
Waveform	Square
Cycle and Period	2 sec on / 2 sec off; 8 second
IP Signal Recording	Volterra Acquisition Unit (Dabtube)
Reading Length	70 – 120 seconds
IP Signal Processing	CSProc (SJ Geophysics proprietary software)
Vp Delay, Vp Integration	1200 ms, 600 ms
Mx Delay, # of Windows Width (Window Width)	50 ms, 26 26, 28, 30, 32, 34, 36, 39, 42, 45, 48, 52, 56, 60, 65, 70, 75, 81, 87, 94, 101, 109, 118, 128, 140, 154, 150 (50–1950 ms)
Mx Integration (Inversion)	200–1800 ms (windows 6–25)
Properties Calculated	Vp, Mx, Sp, Apparent Resistivity and Chargeability

Table 3: 3DIP transmitter and reading parameters

Receiver dipoles were set up using 50 cm long and 10 mm diameter stainless steel electrodes hammered into the ground and connected into the array with single or double conductor wire. The electrodes used for current injections were significantly larger (1 m x 15 mm) with two electrodes used at each injection site to improve ground contact. Current electrodes were connected to the current transmitter with single conductor wire.

The Volterra-3DIP system was configured using an in-line array. Details of the survey configuration are described in Table 4. For L2150 (stations 4200 – 5600) and L2300 (stations 3900 – 4300) a dipole length of 100 m was used. A dipole size of 50 m was used for all other receiver lines.

Array Type	Volterra 3D Distributed Array
Array Configuration	In-line Array
Acquisition Set	North Side: L2150E: Tx/Rc-Tx L2300E & L2450: Tx-Tx/Rc South Side: 3 Lines (Tx-Rc-Tx)
Active Array Length per Receiver Line	Minimum: 1000 Maximum: 1600
Total Active Dipoles per Current Injection	16 - 32
Dipole Length	50 m, 100 m
Current Interval	50 m

Table 4: Volterra-3DIP survey parameters

For the in-line array, receiver dipoles were laid out in a line with an in-line dipole spacing of either 50 m or 100 m. A Volterra acquisition unit was set up in the centre of each set of four dipoles, corresponding to Volterra acquisition unit every 200 m or 400 m.

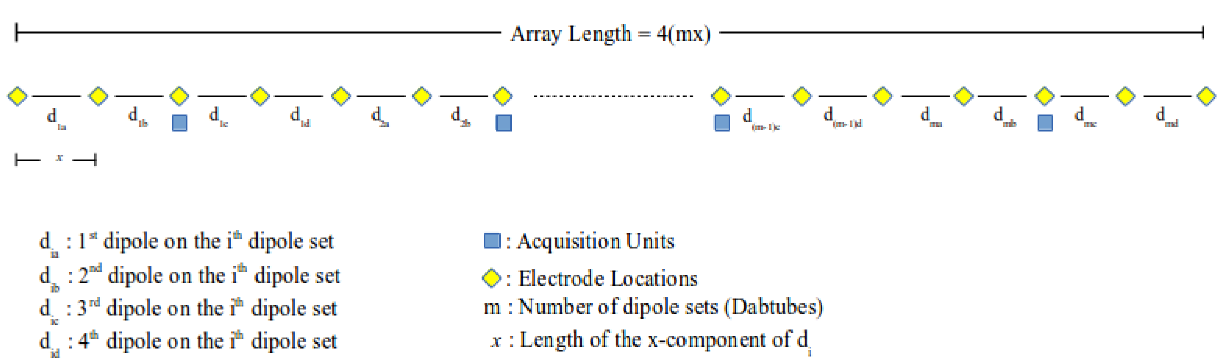

Figure 5: Schematic representation of the in-line array

One remote electrode station was utilized over the course of the survey. The location of the remote current electrode is listed in Table 5 below.

Label	Easting WGS84 UTM 9N	Northing WGS84 UTM 9N	Elevation
2301E 1775N	440627	6211151	918

Table 5: Location of 3DIP remote electrode site

4.3. Magnetometer Survey

For the magnetometer survey one GEM GSM-19T Proton Magnetometer and two GEM GSM-19W Overhauser Magnetometers with integrated GPS units were utilized. The 19-W units were used as rovers to collect total magnetic field measurements along the survey lines. The 19-T unit was set up as a base station to record diurnal variations in the magnetic field. A recording interval of 3 seconds was selected for the base station unit. Magnetic data was collected with a station spacing of 10 m. The integrated GPS units were used for the mag station locations.

The UTM locations of the magnetic base station and the calibration point are listed in Table 6. The detailed instrument specifications are described in Appendix A.

Name	Easting WGS84 UTM 9N	Northing WGS84 UTM 9N
Magnetic Base Station	441542	6213390
Magnetic Calibration Point	441535	6213377

Table 6: Locations of magnetic base station and magnetic calibration points

4.4. GPS

GPS measurements for the 3DIP survey were collected using Garmin GPSMap 64s hand-held GPS receiver units. The datum and projection used was WGS84 UTM zone 9N.

5. *Field Logistics*

The SJ Geophysics field crew consisted of one geophysicist, one field geophysicist, and three geophysical operators to perform the day-to-day operations of the survey. This team oversaw all operational aspects including field logistics, data acquisition and initial field data quality control. Table 7 lists the SJ Geophysics crew members on this project.

Crew Member Name	Role	Dates on Site
Ross Polutnik	Geophysicist	July 6 – July 24, 2017
Darren Pinkerton	Field Geophysicist	July 6 – July 23, 2017
Jay Enns	Field Geophysicist	July 24 – July 29, 2017
Victor Kulla	Geophysical Operator	July 6 – July 11, 2017
Jeff Moorcroft	Geophysical Operator	July 6 – July 29, 2017
Santiago Tomassi	Geophysical Operator	July 6 – July 29, 2017
George Jordan	Geophysical Operator	July 12 – July 23, 2017
Graeme Lillie	Geophysical Operator	July 19 – July 29, 2017
Thomas McGarry	Geophysical Operator	July 24 – July 29, 2017

Table 7: Details of the SJ Geophysics crew on site

The SJ Geophysics crew's first day on site at the MC Claims project was July 6, 2017 and they remained on site through July 29, 2017. Mobilization to Stewart, BC occurred on July 4 and July 5. Demobilization from the project site to the next project was on July 30.

During the course of the geophysical survey, the SJ Geophysics crew conducted weekly safety meetings as well as daily tailgate meetings. The safety meetings included a comprehensive review of safe work practices specific to our geophysical surveys and field operations. At the tailgate meetings, personnel discussed issues related to weather conditions (including ramifications on the survey/personal safety), encounters with or sightings of potentially problematic wildlife, efficient organization of daily tasks, helicopter usage, and any other work-related questions or concerns.

The SJ Geophysics crew was accommodated by the client at the King Edward Hotel in Stewart. Coin laundry and WiFi Internet were provided at the hotel for usage by guests. Cell phone reception was available within the town of Stewart and on portions of the survey grid having line-of-sight to Stewart.

The survey grid was accessed each day by helicopter. Helicopter services were provided by Yellowhead Helicopters in Stewart with an A-Star B2 helicopter. Numerous natural landing zones were available above treeline and were located as needed. Below treeline only a few landing zones were available consisting mainly of small meadows, rock knobs, and cliffs. Two historical drill platforms (in good condition) were used extensively as landing zones on the north side of the survey grid.

Volterra-3DIP Survey

The Volterra-3DIP survey began on the north side of the survey grid with the highest elevation survey line (L2150E) and then progressed to the lower elevation lines (L2300E and L2450E). Once the north side was completed, the crew moved to the south side higher elevation lines and then progressed to the lower elevation lines. When surveying the north side of the grid four dipoles were laid out on the south side of the major creek gully (L2150), and when on the south side dipoles were laid out on the north side of the major creek gully (L2300). This ensured data was collected across the major creek gully separating the two sides of the survey grid. No line cutting or flagging was carried out on the grid. Crew members navigated to each station by navigating to theoretical station points on their handheld GPS units' screens. Line cutting is recommended if future geophysical work is carried out on the property and will increase survey efficiency.

For acquisition of the north side of the grid, the transmitter and generators were located between L2150 and L2300 at approximately station 4250 in a small protected meadow. A rock wall, believed to be created by previous exploration parties, was utilized as a wind break. Tents and survival gear were stored at the transmitter site in case of emergency. For acquisition of the south side of the grid, the transmitter site was relocated to L2300 station 3800 for improved wire management, radio reception, and line access.

For the first acquisition set on the north side of the survey grid, receiver lines 2150E and 2300E (stations 3900-4300) were setup using 100 m dipoles. Upon review of the first day's data it was observed that the data quality was very good due to the resistive ground conditions and therefore the dipole length could be decreased in size to 50 m. This was done to improve the near-surface resolution to better image cross-cutting structures on the order of metres, to tens of metres wide. A dipole length of 50 m was used for all of the other receiver lines.

During the Volterra-3DIP survey, each acquisition day began with the setup of the Volterra acquisition units along the receiver lines and the setup of the transmitter site. If necessary, breaks in the wire linking the remote station to the transmitter were fixed.

Prior to field data acquisition, a contact resistivity test was performed using a small waveform generator attached in parallel to a given Volterra acquisition channel. This was done for each dipole in the array, and allowed the operator to identify breaks in the wire or areas of poor ground contact which could degrade input signal quality. Furthermore, this test allowed the operator to inspect the raw signal, ensuring that the Volterra acquisition units were functioning correctly, and to ensure that the receiver was synchronizing with the correct GPS time.

Upon completion of these tasks, acquisition would begin. During acquisition stages, a dedicated 'transmitter' Volterra acquisition unit and a current monitor were used to measure the current being injected at each station. By inspecting the quality of the current output, the current operator would ensure the transmitter was functioning correctly and could detect current leakage. An Android tablet with an in-house Volterra software app was used to record the current injection start time and duration. Volterra acquisition units were collected at the end of each acquisition day.

The Volterra-3DIP survey progressed more slowly then planned. This was due to complex terrain that greatly limited access and vegetation that was significantly more dense then expected. Finding suitable routes along the planned survey lines was challenging with the crew having to frequently investigate a route in advance of laying out wire to ensure it was traversable and did not end in cliffs. This was often made more troublesome by thick vegetation that made it impossible to see possible routes ahead. This process of route finding took drastically more time than was anticipated. The same issue was experienced when laying out current wire from the transmitter to each survey line as most of the lines were located along benches separated by cliff bands. The vegetation was much thicker then what was implicated by the Google Earth imagery reviewed in advance of the project and described by the client.

For example, on lines 2300E and 2450E (north of stations 4400N) the crew was unable to find a route that allowed access to the entire length of the planned survey line. For line 2300E, impassable cliffs in the middle of the line required that the south half be accessed from a landing zone in the south and the north half be accessed from the north. On line 2450E the line also had to be accessed from the south (south half) and the north (north half). No route was found linking these two sections and a gap exists in the survey line. Lines 2300E and 2450E also had line segments (~station 4400N) that were separated from the north sections of the lines by a major gully that was impassible and from the south section of the grid by another major creek gully. Access down to L2450 (stations 3700-4200N) from L2300 took an entire day to find a suitable route past a major cliff band.

Most of the survey lines were acquired with similar extents to those planned. A few of the lines were shortened by one or two stations at the ends due to cliffs. On the north side of the survey grid L2450 proved to be very challenging and was reduced in extent as a result of these access issues. From the north side, no feasible route was found south of station 5100 due to a large cliff. From the south side, thick bush and large waterfalls block the line north of station 4750.

Magnetometer Survey

The magnetometer survey was completed during setup days of the Volterra-3DIP survey. The magnetometer survey generally followed the Volterra-3DIP survey lines. Magnetometer data was not collected along sections of the lower elevation survey lines due to the very thick vegetation encountered. The thick vegetation made it difficult for the operators to travel with the magnetometers as the instrument would become stuck and the cables damaged. In addition, two hands were often required to safely traverse sections with thick vegetation along steep slopes, therefore making acquisition of the magnetic data unsafe.

Each magnetic survey day began by setting up the base station magnetometer. For the rover unit, a series of calibration measurements were taken at the established location after which survey acquisition began. Another set of calibration points were recorded at the end of each day before the base station was turned off.

Weather Delays

Stewart's location at the head of the Portland Canal and within the northern Coast Mountains of BC meant that weather was frequently a factor in accessing the survey grid. Low lying fog and mid-level cloud were common throughout the survey. The survey grid, especially the northern section, was observed to frequently be covered in thick clouds. Cold air descending from the glacier north of Mt Shorty Stevenson would hit warmer air in the Bear River valley forming thick clouds between the 1000-1200 m elevation contours that would then sit along the glacier creek gully.

There were three full weather days during the survey where the crew was unable to reach the survey grid. These occurred on July 13, Jul 26, and July 27. Delays due to fog and low laying clouds were more common. Often the crew was unable to reach the grid until 10 am and in some cases not until 1 pm.

6. Field Data Processing & Quality Assurance Procedures

6.1. Locations

Good quality location data is the first step to the successful analysis and interpretation of geophysical survey data. For each survey, Garmin GPSMAP 64s handheld GPS units were utilized to collect location information. Measurements are taken at every survey station where satellite reception was acceptable. The quality of the location data and labeling were checked every night using GPS management software such as Garmin BaseCamp or GIS packages like QGIS and GRASS. Any inconsistent measurements were discarded and the remaining points, referred to as control points, were incorporated into a database using proprietary software called Location Manager. Any missing or discarded survey station locations were re-acquired the following day.

GPS measurements typically have a much lower accuracy in the vertical direction compared to the horizontal direction. If a digital elevation model (DEM) is available for the survey area, the DEM model is compared to the GPS elevations and, if found to be of higher quality, will replace the GPS elevation points.

6.2. Volterra-3DIP Data

The Volterra-IP data go through a series of quality assurance checks both in the field and in the office to ensure that the data are of good quality. At the end of each acquisition day the recorded signal was downloaded from the Volterra acquisition units to a personal computer. The signals were then clipped to the GPS time windows of each current injection, lightly filtered for noise, and imported into SJ Geophysics' proprietary QA/QC software package called JavIP. This software package integrates location data with DCIP data in order to calculate the apparent resistivity and apparent chargeability values. JavIP contains interactive quality control tools to allow the field geophysicist to display decay curves, view a dot plot of the calculated parameters, and manually reject bad data points.

The majority of the data points flagged for removal was due to null-coupling, a phenomena typical in IP surveys related to the survey configuration. Null-coupling occurs when a receiver dipole is sub-parallel to lines of constant potential, leading to a significant decrease in signal strength and corresponding poor data quality. Additional data can also be deemed untrustworthy due to low signal quality or dipoles being inadvertently disconnected (usually due to animal activity).

After the first data quality review in the field, the database was delivered to SJ Geophysics' head office for a second review. The data were then carefully checked to ensure that erroneous data points had been removed and were not passed along to the final stage of processing: the inversion.

6.3. Magnetometer Data

All magnetometer data were subjected to a rigorous quality control procedure to ensure that only clean and reliable data are collected. In order to reduce the risk of collecting bad data, space weather was regularly monitored and the data inspected for any non-terrestrial influences present. Magnetic calibration points were measured at the beginning and end of each survey day to ensure that no operator related changes in magnetism are present in the data. The calibration data was also used to estimate the level shift present between two different rover units. Throughout the survey, field crew members made note of any metal cultural features (e.g. fences, pipelines, culverts) encountered during the survey that could cause spikes in the data.

Each night the magnetic data was downloaded to a personal computer. The dump files were then imported into a spreadsheet and corrected for the diurnal drift. The corrected data were plotted as profiles within the spreadsheet to give a field level quality check on the data before being sent to the SJ Geophysics head office for a final review.

7. Data Quality

7.1. Locations

The GPS data collected was of good quality. The highest quality data was achieved above treeline. In areas of thick bush or below large cliffs the data quality was reduced as a result of the decreased number of satellites visible in the sky.

A BC TRIM digital elevation model (DEM) was utilized for the 3D inversion to improve the quality of the elevations between the survey lines and in the area surrounding the survey grid. The DEM was compared to the GPS data and found to be of good quality. Some differences between the two elevation models was observed, primarily in areas immediately adjacent to large cliffs or where the benches separating cliff bands were narrow.

7.2. Volterra-3DIP data

The Volterra-3DIP data collected on the property was of good quality. The ground contact resistances were generally high with values between 10,000 ohm and 20,000 ohm. The contact resistance was highest along the upper elevation lines and decreased on the lower elevation lines where the vegetation was thicker and soils more developed.

Signal strength was very good due to the high apparent resistivities encountered. The voltage potentials (Vp) varied considerably across the survey area from approximately 5 mV at the furthest offsets to greater then 5 V at the near offsets. The highest Vp’s were recorded along the lines with both receiver dipoles and current injections. One issue encountered on these lines was that the near-offset dipoles would over-voltage (greater than 5 V recorded) surpassing the instrument capabilities. To resolve this issue, the crew took two readings at each station; a low current reading to ensure good near-offset data and a higher current reading to ensure good far-offset data). For the survey lines with current injections located along adjacent survey lines the measured Vp’s varied from low 10’s to 100’s of mV.

Decay curve quality was good at all voltage potentials and at both near and far offsets. Only when the measured Vp dropped into the 2-4 mV range did the decay curves become noisier.

An example of a typical set of decay curves recorded is shown in Figure 6 and more noisy decay curves are shown in Figure 7.

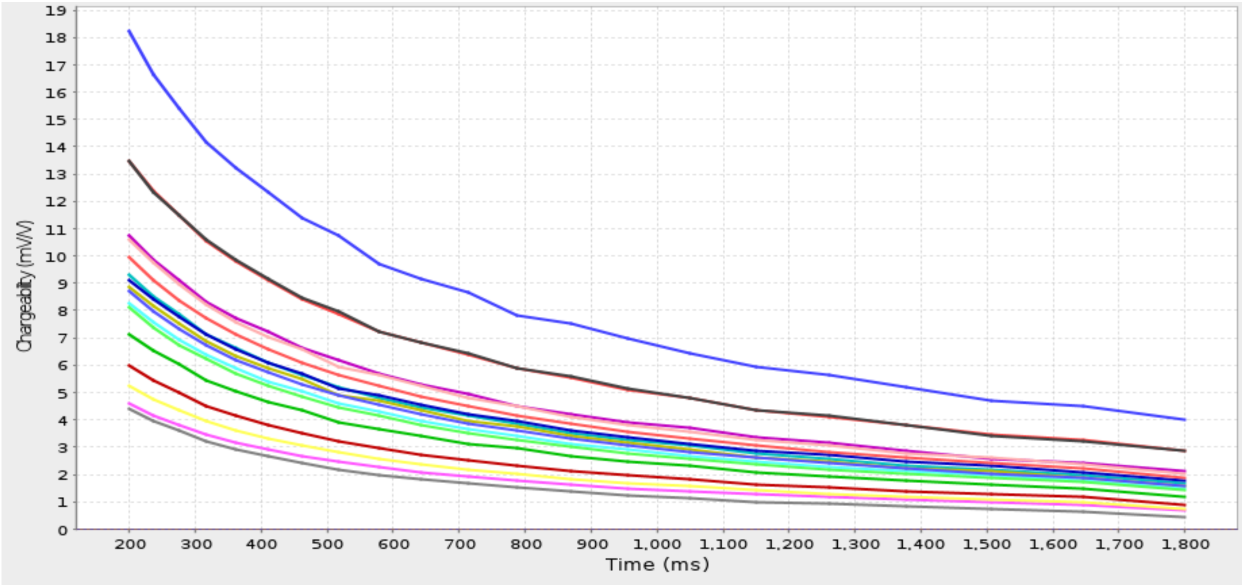

Figure 6: Example of clean decay curves

Receiver Line 2450E (south), current line 2300E station 2600N

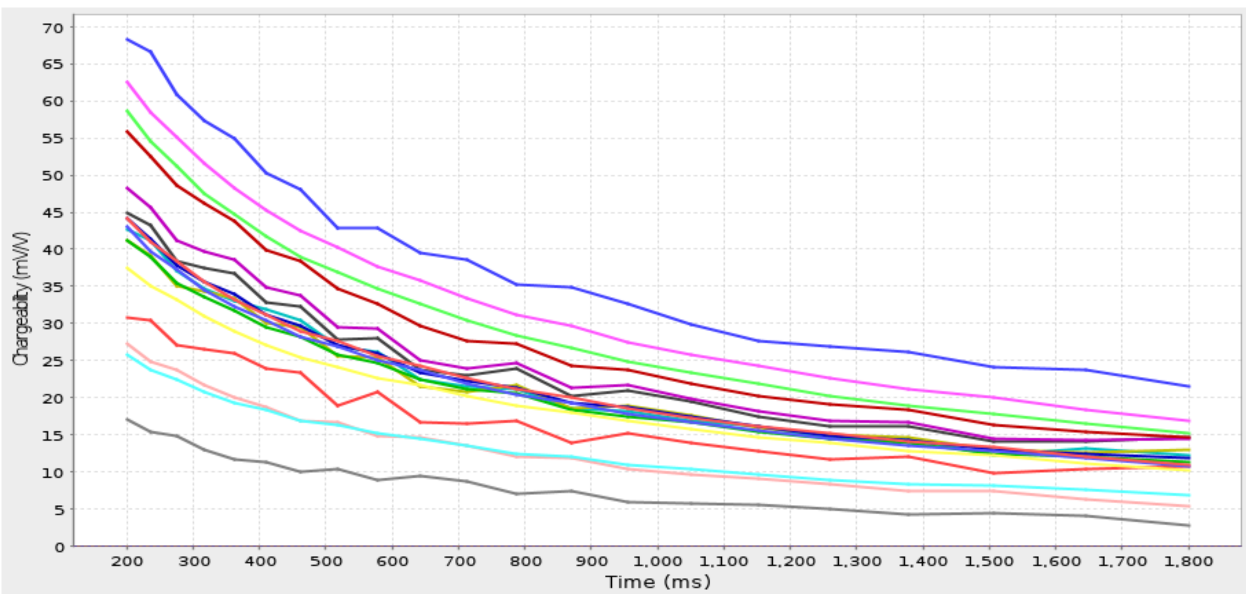

Figure 7: Example of relatively noisy decay curves

L2450E (north), current line 2300 station 4250N

On line 2150 near station 5800 a very resistive dike cross-cuts the line. The line was surveyed with 100 m dipoles and the resulting data indicated a high resistivity and negative resistivity flip on dipoles crossing the dike. To investigate this response, a 400 m section of 50 m dipoles were laid out (stations 4800-5200) and re-surveyed to test if the smaller dipole size would improve the data across the dike. The smaller dipoles improved the resolution, but also showed the positive/negative resistivity values across the dike. This confirmed that the response was real. This is most likely due to complex current paths in the ground across/below/around the dike.

7.3. Magnetometer data

The magnetometer data collected was of good quality. The daily calibration readings were generally consistent, although showed higher variations then usual between the start of day and end of day readings with average variability of 10-12 nT. This may have been a result of the base station location which had to be located in an area with some small magnetic features due to the complex terrain and logistical considerations. Given that the anomalies observed on the grid tended to be in the 100's of nT the increased variability in calibration readings was deemed not to be an issue. In areas of high magnetic gradients the operators would go back and take in-fill readings at a smaller station spacing to better resolve the magnetic feature.

8. Geophysical Inversion

The purpose of geophysical inversion is to estimate the 3D distribution of subsurface physical properties (density, resistivity, chargeability, and magnetic susceptibility) from a series of geophysical measurements collected at the surface. Unfortunately this is a challenging problem – the subsurface distribution of physical properties is complex and only a finite number of measurements can be collected. These complications lead to an under-determined problem. As a result, there are many different possible 3D physical property models that can be obtained which mathematically fit the observed data. Utilizing known geological and geophysical information to evaluate the model allows the best or most geologically realistic model to be selected and leads to a better understanding of the subsurface.

Geophysical inversions are commonly performed for every survey carried out by SJ Geophysics. Several inversion programs are available, but SJ Geophysics primarily uses the

UBC-GIF algorithms (e.g. DCIP2D, DCIP3D, MAG3D, GRAV3D) which were developed by a consortium of major mining companies under the auspices of the University of British Columbia's Geophysical Inversion Facility.

In general, multiple inversions are carried out for each dataset and the resultant inversion models are compared with known information to evaluate the model. For example, known geology, drill assays, the estimated depth of investigation, and the quality of the input data are all used during the evaluation. The most geologically reasonable model that fits the data is then chosen as the best model. When available, additional information such as geological boundaries and down-hole geophysical data can be incorporated into the inversion in order to constrain the inversion model.

Once the final inversion model is selected, the model is gridded and mapped for interpretation. Typically, cross-sections and plan maps are created, sliced at different depths beneath the surface. The inversion results can be visualized in 3D using open source software packages such as Mayavi and Paraview in both 2D and 3D views. Additional data can then be overlain to aid in interpretation and help facilitate the identification of potential drilling targets.

9. Deliverables

This logistics report and maps are provided as two paper copies and digitally in PDF format. All data including the geophysical survey and location data are also provided digitally. A brief description of the provided data is below.

- 3DIP Data - Raw DCIP data exported as a .txt file
- 3D models
  - UBC - inverted model in UBC-GIF standard format: .chg, .con, .res, sensitivity, and mesh files. UTM coordinates.
  - UBC-local - inverted model in UBC-GIF standard format: .chg, .con, .res, sensitivity, and mesh files. Local coordinates.
  - VTK - inverted model in open-source vtk format: chg, con, res, and sen files
  - XYZ - ASCII format of models are converted from UBCgif inversion models; the value of each voxel is positioned at the centre of the model cell: chg, con, res, sen files
- Location - Locations of survey stations with GPS and TRIM DEM elevations
- Maps
  - Chargeability plan maps at constant depth below topography
    - 25 m, 50 m, 75 m, 100 m, 150 m, 200 m, 250 m, 300 m, 400 m, 500 m
  - Resistivity plan maps at constant depth below topography
    - 25 m, 50 m, 75 m, 100 m, 150 m, 200 m, 250 m, 300 m, 400 m, 500 m
  - Plan maps in GeoTiff format
  - Section maps along survey lines
  - Location map of project
  - Grid map
- Reports
  - Logistics Report
  - Interpretation Report

Appendix A: Survey Details

MC Grid - 3DIP

Line	Series	Type	Start Station	End Station	Survey Length (m)
2000	E	Tx	2250	4050	1800
2150	E	Rc	2250	3850	1600
2150	E	Tx/Rc	4175	5725	1550
2300	E	Tx	2350	3800	1450
2300	E	Tx/Rc	3875	4300	425
2300	E	Tx/Rc	4550	5150	600
2300	E	Tx/Rc	4975	5550	575
2450	E	Rc	2400	3350	950
2450	E	Tx/Rc	3675	4200	525
2450	E	Tx/Rc	4350	4750	400
2450	E	Tx/Rc	5100	5425	325
2600	E	Tx	2200	3300	1100

Total Linear Metres = 11,300

Rc = Receiver Line, Tx = Transmitter Line,

MC Grid - Mag

Line	Series	Type	Start Station	End Station	Survey Length (m)
2000	E	Mag	2310	3900	1590
2150	E	Mag	2250	3850	1600
2150	E	Mag	4175	5562.5	1387.5
2300	E	Mag	2350	3800	1450
2300	E	Mag	3850	4310	460
2300	E	Mag	4550	5100	550
2300	E	Mag	5110	5550	440
2450	E	Mag	2500	3340	840
2450	E	Mag	3900	4000	100
2450	E	Mag	4470	4630	160
2450	E	Mag	5125	5425	300
2600	E	Mag	2840	3250	410

Total Linear Metres = 9,288

Mag = Magnetic Survey Line

Appendix B: Instrument Specifications

Volterra Acquisition Unit (Dabtube 8200 Series)

Technical:

Input impedance:	20 MΩ
Input overvoltage protection:	5.6 V
ADC bit resolution:	24-bit
Internal memory:	Storage Capacity 64 GB
Number of inputs:	4
Synchronization:	GPS
Selectable Sampling Rates (samples/second):	128000, 64000, 32000, 16000, 8000, 4000, 2000, 1000
Common mode rejection:	More than 80 dB (for Rs=0)
Voltage sensitivity:	Range: -5.0 to +5.0 V (24 bit)
Features	Programmable Gain, AC/DC coupling

General:

Dimensions:	Diameter: 43 mm, Length: 405 mm
Weight:	0.5 kg
Battery:	5.0 VDC nominal
Operating temperature range:	-40 ºC to 40 ºC

GDD Tx II IP Transmitter

Input voltage:	120V / 60 Hz or 240V / 50Hz (optional)
Output power:	3.6 kW maximum
Output voltage:	150 to 2400 V
Output current:	0.030 to 10 A
Time domain:	1,2,4,8 second on/off cycle
Operating temp. range:	-40^0 to $+65^0$ C
Display:	Digital LCD read to 0.001A
Dimensions (h w d):	34 x 21 x 39 cm
Weight:	20 kg

GSM-19 Magnetometer

Resolution:	0.01 nT, magnetic field and gradient
Accuracy:	0.2 nT over operating range
Gradient Tolerance:	up to 5000 nT/metre
Operating Interval:	4 seconds minimum, faster optional
Reading:	Initiated by keyboard depression, external trigger or carriage return via RS-232C
Input/Output:	6 pin weatherproof connector, RS-232C, and optional analog output
Power Requirements:	12v 300 mA peak(during polarization), 35 mA standby, 600 mA peak in gradiometer
Power Source:	Internal 12 V, 1.9 Ah sealed lead-acid battery standard, other optional External 12 V power source can be used
Battery Charger:	Input: 110/220 VAC, 50/60 Hz and/or 12VDC. Output: 12 V dual level charging
Operating Ranges Temperature:	-40 ºC to +60 º C
Battery Voltage:	10 V min to 15 V max
Dimensions:	223 x 69 x 240 mm
Console:	
Sensor staff:	4 x 450 mm sections
Sensor:	170 x 71 mm diameter
Weights:	2.1 kg
Console:	
Staff:	0.9 kg
Sensor:	1.1 kg

Appendix C: Geophysical Techniques

IP Method

The time domain IP technique energizes the ground by injecting square wave current pulses via a pair of current electrodes. During current injection, the apparent (bulk) resistivity of the ground is calculated from the measured primary voltage and the input current. Following current injection, a time decaying voltage is also measured at the receiver electrodes. This IP effect measures the amount of polarizable (or "chargeable") particles in the subsurface rock.

Under ideal circumstances, high chargeability corresponds to disseminated metallic sulfides. Unfortunately, IP responses are rarely uniquely interpretable as other rock materials are also chargeable, such as some graphitic rocks, clays, and some metamorphic rocks (e.g., serpentinite). Therefore, it is prudent from a geological perspective to incorporate other data sets to assist in interpretation.

IP and resistivity measurements are generally considered repeatable to within about five percent. However, changing field conditions, such as variable water content or electrode contact, reduce the overall repeatability. These measurements are influenced to a large degree by the rock materials near the surface or, more precisely, near the measurement electrodes. In the past, interpretation of a traditional IP pseudosection was often uncertain because strong responses located near the surface could mask a weaker one at depth. Geophysical inversion techniques help to overcome this uncertainty.

Volterra-3DIP Method

Three dimensional IP surveys are designed to take advantage of recent advances in 3D inversion techniques. Unlike conventional 2DIP, the electrode arrays in 3DIP are not restricted to an in-line geometry. This means that data can be collected from a large variety of azimuths simultaneously leading to a highly sampled dataset containing more information about the Earth's physical properties. In an ideal world, a 3DIP survey would consist of randomly located current injections and receiver dipoles with random azimuths. Unfortunately, logistical considerations usually prohibit a completely randomized approach.

The Volterra-3DIP distributed acquisition system is based on state-of-the-art 4-channel, full-waveform, 32-bit Volterra acquisition units. The system is highly flexible and can utilize any number of Volterra units. The Volterra-3DIP system's untethered, distributed design, eliminates the need for specialized receiver cables and a centralized receiver control station. The dipoles can be in any orientation, can have varying lengths, and completely avoid inaccessible areas if necessary.

A typical Volterra-3DIP configuration establishes alternating current and receiver lines in sets of 5, but can be customized based on the project. The current lines are located on adjacent lines to the receiver line and current injections are performed sequentially at fixed increments (25 m, 50 m, 100 m, 200 m) along each current line. By injecting current at multiple locations along each current line, the data acquisition rates are significantly improved over conventional surveys. Customized receiver arrays are utilized to provide greater cross-line focus for a better azimuthal distribution of the data. Cross-dipoles are frequently used to maximize signal coupling and improve the surface resolution.

Magnetic Survey Method

Magnetic intensity measurements are conducted along survey lines (normally on a regular grid) and are used to identify metallic mineralization related to magnetic materials in the ground (e.g., magnetite and/or pyrrhotite). Magnetic data can be used as a mapping tool to distinguish rock types and to identify faults, bedding, structure and alteration zones. Line and station spacing are usually determined by the size and depth of the exploration targets of interest.

The most common technique used in mineral exploration is to measure the amplitude of the magnetic field using a magnetometer. The instrument digitally records the survey line, station, total magnetic field and time of day at each station. After each day of surveying, data are downloaded to a computer for archiving and further processing.

The earth's magnetic field is continually changing (diurnal variations) so field measurements are calibrated to these variations. The most accurate technique is to establish a stationary base station magnetometer to continually monitor and record the magnetic field over the course of a day. The base station and field magnetometers are synchronized on the basis of time and computer software is used to correct the field data for the diurnal variations.