

Ministry of Energy, Mines & Petroleum Resources Mining & Minerals Division BC Geological Survey



TYPE OF REPORT [type of survey(s)]: Geophysical Modelling TOTAL COST: 4125.00

AUTHOR(S): Welz, M., Walcott P		SIGNATURE(S): digital	
NOTICE OF WORK PERMIT NUMBER(S)/DATE(S): Oct 29th-Nov 3rd, 2	2017		YEAR OF WORK: 2017
STATEMENT OF WORK - CASH PAYMENTS EVENT NUMBER(S)/DATE(S):	5674	4729	
PROPERTY NAME: Mack/Snowpeak			
CLAIM NAME(S) (on which the work was done): Mack (1048104)			
COMMODITIES SOUGHT: Cu, Mo, Au			
MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN: 104J 014			
MINING DIVISION: Liard		NTS/BCGS: 104J08	
LATITUDE: <u>58</u> ° <u>27</u> ' <u>23</u> " LONGITUDE: <u>130</u>	0	25 '03 " (at centre of wo	ork)
DWNER(S): 1) United Mineral Services Ltd.	_ 2)		
MAILING ADDRESS: 1500-1040 WEST GEORGIA STREET			
VANCOUVER, B.C	_		
OPERATOR(S) [who paid for the work]: 1)	_ 2)		
MAILING ADDRESS:			
PROPERTY GEOLOGY KEYWORDS (lithology, age, stratigraphy, structure Molybdenum, Copper, Gold, Tungsten,Intermontane,Stikine,Ta			

TYPE OF WORK IN THIS REPORT	EXTENT OF WORK (IN METRIC UNITS)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
GEOLOGICAL (scale, area)			
Ground, mapping			
Photo interpretation			
GEOPHYSICAL (line-kilometres)			
Ground			
Electromagnetic		_	
Radiometric		_	
Solemia			
Other Interp/Inversion			4125.00
Airborne			
GEOCHEMICAL (number of samples analysed for)			
Soil		_	
Rock		_	
Other			
DRILLING (total metres; number of holes, size)			
Core		_	
Non-core		_	
RELATED TECHNICAL			
Sampling/assaying			
Petrographic			
Mineralographic			
Metallurgic			
DDCCDECTIVIC (
PREPARATORY / PHYSICAL			
Line/grid (kilometres)			
Topographic/Photogrammetric (scale, area)			
Legal surveys (scale, area)			
Road, local access (kilometres)/t			
Trench (metres)			
Underground dev. (metres)			
		TOTAL COST:	4125.00

BC Geological Survey Assessment Report 37279

EVENT # 5674729 AN ASSESSMENT REPORT

<u>ON</u>

GEOPHYSICAL PROCESSING AND REVIEW

SNOW PEAK PROJECT

Mack Claim

Dease Lake Area, British Columbia

Liard Mining Division 58° 27' 23" N, 130° 25'03" W NTS 104J/08 BCGS 104J048

Claims: 1048104

Work Dates: October 29th - November 3rd, 2017

for

UNITED MINERAL SERVICES LTD.

VANCOUVER, BRITISH COLUMBIA

by Marek Welz M.Sc. Peter E. Walcott, P.Eng

PETER E. WALCOTT & ASSOCIATES LIMITED

Coquitlam, British Columbia JANUARY 2018

TABLE OF CONTENTS

	Page
Introduction	3
Property Location and Access	4
Previous Work	6
Regional Geology	7
Property Geology	10
Purpose	11
Data Processing and Inversions	12
Discussion of Results	15
Summary, Conclusions, and Recommendations	19

APPENDIX

Cost of Survey Personnel Employed on Survey Certification References

ACCOMPANYING MAPS

Claim and Historic IP Line Location Map	Scale 1:10,000
IP Pseudo sections: 1600E, 2000E, 2800E, 3600E, 4400E	Scale 1:5,000
2D IP Modelled Sections: 1600E, 2000E, 2800E, 3600E, 4400E	Scale 1:5,000
3D Modelled Resistivity: Depth Slices (m)	Scale 1:5,000
25, 75, 125	
Claim and Airborne Magnetics Line Location Map	Scale 1:20,000
Contours of Total Magnetic Intensity (nT)	Scale 1:20,000
Contours of First Vertical Derivative (nT/m)	Scale 1:20,000
3D Magnetic Model: Depth Slices (m) MVI Susceptibility	Scale 1:20,000
100, 200, 300, 500, 700	

INTRODUCTION.

Between October 29th and November 3rd, 2017 Peter E. Walcott & Associates Limited undertook a geophysical review on historical data over the Mack Claim – Snowpeak Project for United Mineral Services Ltd.

The review utilized several historical datasets, which were digitized, processed and subsequently inverted in an effort to generate target areas for the upcoming field season.

PROPERTY LOCATION AND ACCESS.

The property is located in the Liard Mining Division of British Columbia some 25 kilometres west of the community of Dease Lake in north western British Columbia.

Access is gained via a helicopter from Dease Lake. Access may also be possible utilizing staging area along Highway 51 some 11 kilometres SSW of the project

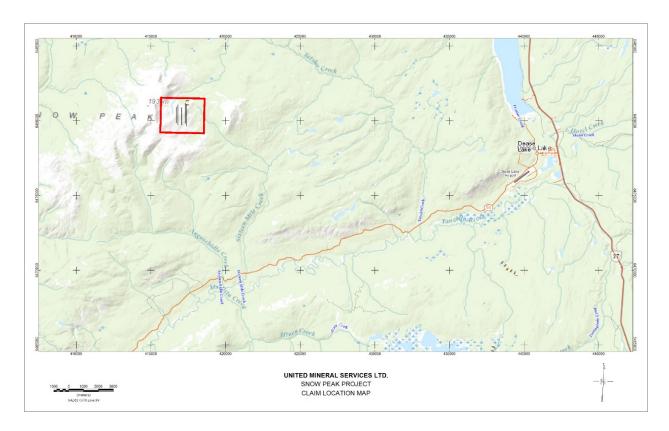


Figure 1. Property Location Map

PROPERTY LOCATION AND ACCESS con't.

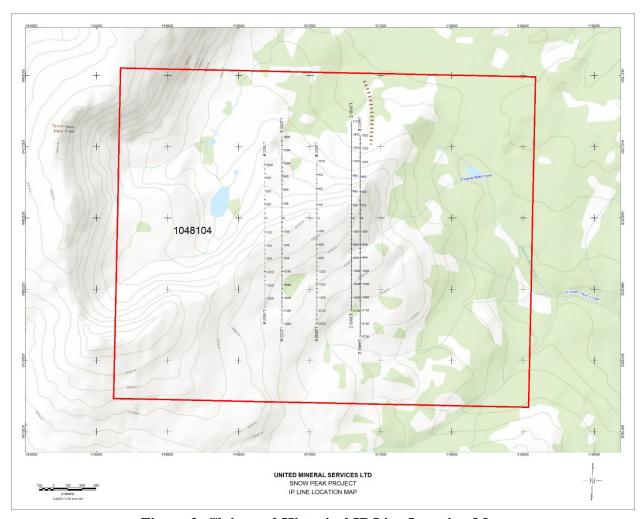


Figure 2. Claim and Historical IP Line Location Map

PREVIOUS WORK.

Sulphide mineralization has been known at Snow Peak since the early 1960's. Showings within the area were originally staked in 1966 by A. Nehase, of Dease Lake.

The claims were allowed to laps the following year and the ground remained open until 1969 when the Mack claims were staked by Tournigan Mining Ltd. Tournigan carried out geochemical and geological investigations in 1970 and 1971.

The Mack Claim Group was transferred to Tormex Resources Ltd. in 1972 (then a subsidiary of Tournigan) and additional claims were added to the group. In 1972, the soil sampling survey was expanded and a 28 line-mile vertical field magnetometer survey was carried out.

During the 1975-1976 assessment years, some road construction and trenching were carried out. Also, an IP survey over an area of approximately 750 by 900m was completed – a total of five lines. During the summer of 1979, the existing trench from 1976 was extended to the east, and two pits were dug to test the IP anomalies.

The Dease Lake Geoscience Project, part of Geoscience BC's QUEST-NW initiative, was launched in 2011 to stimulate exploration in northwestern British Columbia. The Mack project area was covered by bedrock mapping and airborne geophysical surveys as part of this initiative.

For further information the reader is referred to reports held by United Mineral Services Ltd. and to the assessment reports on the ARIS website.

REGIONAL GEOLOGY.

The Mack project is located on the Dease Lake Map Area which straddles the boundary between the Cache Creek and Stikine terranes; this boundary is marked by the King Salmon Fault. At this latitude, the Stikine terrane comprises three overlapping island arc successions: the Stikine assemblage, and the Stuhini and Hazleton groups that span 200 Ma from the Devonian to the Middle Jurassic (Figure 3).

The plutonic suites include the Devono- Carboniferous Forrest Kerr suite, the Late Triassic Stikine and Copper Mountain suites, the Early Jurassic Texas Creek suite and the Middle Jurassic Three Sisters suite (Figure 4). Early Jurassic sedimentary rocks of the Takwahoni Formation overlie the Stikine terrane and form the immediate footwall to the King Salmon fault. The Snow Peak pluton is an equidimensional, latest Cretaceous/Palaeocene granodiorite that intrudes the Early Jurassic Takwahoni sedimentary rocks (Logan et al., 2012).

REGIONAL GEOLOGY con't.

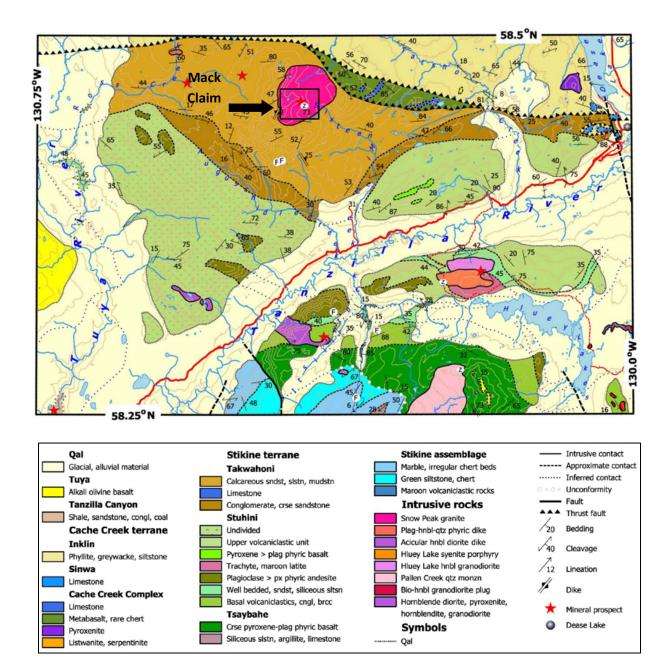


Figure 3. Regional Geology Map. (modified after Logan et al., 2012)

REGIONAL GEOLOGY con't.

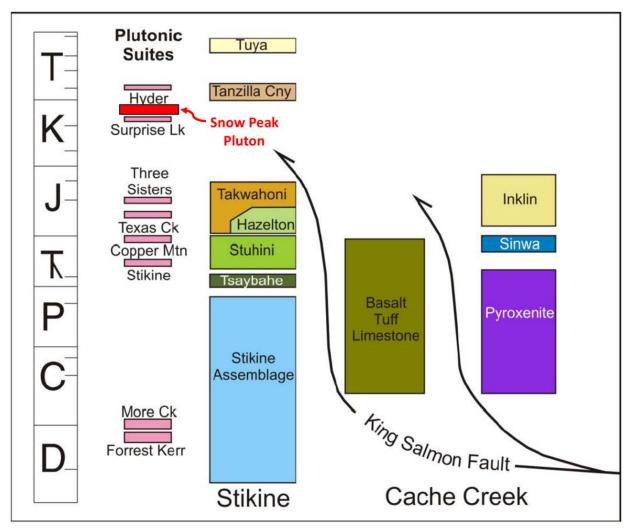


Figure 4. Schematic Stratigraphic/Plutonic/Structural Relationships. (modified after Logan et al., 2012)

PROPERTY GEOLOGY.

The Snow Peak pluton is a steep sided, equidimensional body, $\sim 12 \text{ km}^2$ in surface extent that intrudes the Early Jurassic rocks of the Takwahoni Formation at 64.4 ± 0.5 Ma (U-Pb Zircon date, Moynihan and Logan, 2012) in the Late Cretaceous/Palaeocene. The intrusion is a biotite hornblende monzodiorite to granodiorite with equigranular and locally K-feldspar porphyritic textures. Mineralization is developed along west-northwest trending brittle fracture planes in the central part of the pluton.

Mineralization

There are two metallic mineral occurrences within and around the Mack Project claim boundaries:

- 1. The main target is Mack (MINFILE 104J 014) a porphyry Mo-Au-W prospect located within the Snow Peak pluton.
- 2. A poly metallic Ag Pb Zn \pm Au quartz vein showing (Mac; MINFILE 104J 064), associated with dikes cutting Takwahoni sedimentary rocks west of the Mack Project area.

Mack is a Mo \pm Au + W prospect located in the southern part of the Snow Peak intrusion, near the headwaters of Sixteen Mile Creek. It comprises coarse-grained molybdenite and pyrite crystals, which are disseminated along steeply dipping, west-northwest trending fractures, and/or in narrow quartz veins. These rust-stained fractures are spaced at intervals of \sim 10-50 cm in a zone that extends for around 1 km (Moynihan and Logan, 2012).

PURPOSE.

The purpose of the project was to review historical data, and generate target areas for ground followup during the summer 2018 field season.

DATA PROCESSING & INVERSION.

<u>Datasets</u>

The historic geophysical datasets were obtained from the BC Ministry of Energy and Mines – Assessment Report Indexing System – ARIS and the Geoscience BC website.

The induced polarization data was obtained by the digitization of the raw pseudo sections in the ARIS report number 6354.

The magnetic data was obtained from the Quest-Northwest project, Block 1. Geoscience BC Report 2012-3.

Airborne Magnetic Processing and Inversion

The 2012 airborne magnetic data was downloaded as an Oasis Montaj GDB file. A brief QC exercise was then carried out over the dataset prior to reprocessing. The data was windowed to a 10 km x 9 km area – an area large enough to cover the magnetic feature that is believed to be associated with mineralization on the Mack Claim.

The airborne magnetic survey was flown on east-west orientated lines utilizing a nominal line spacing of some 250 metres with orthogonal tie lines at 2500 metre spacing. The reader is referred to the Geoscience BC Report 2012-2 for detailed information regarding survey parameters.

The magnetic data was then re-gridded utilizing a minimum curvature gridding algorithm with a 40 meter cell size. 2D Filtering was then applied to the resulting grid – Analytic Signal, Tilt Derivative, 1st and 2nd Vertical Derivative, and Gaussian Residual.

3D inversions were then undertaken on some 110 line kilometers utilizing a 100 meter mesh, utilizing Geosoft's Voxi along with UBC-GIF Mag3DInv, with only the former presented in this report.

DATA PROCESSING & INVERSION con't.

Induced Polarization Processing and Inversion

The 1976 induced polarization survey data was first digitized into a Geosoft compatible format from pdf pseudo sections within the ARIS report.

Digital pseudo sections were then regenerated from the newly imported data for comparison and QC checks.

As exact line locations were not available a two point transformation was created to best fit the local grid coordinates to UTM coordinates. Elevations for the electrode stations were then extracted a digital terrain model.

The induced polarization data along with respective elevation data were subsequently exported to text files suitable for import into two-dimensional and three-dimensional inversion software.

Two dimensional smooth model inversion of the resistivity and chargeability was carried out using the Geotomo RES2DINV Algorithm, an algorithm developed by Loke et al. This algorithm uses a 2-D finite element method and incorporates topography in modelling resistivity and I.P. data. Nearly uniform starting models are generated by running broad moving-average filters over the respective lines of data. Model resistivity and chargeability properties are then adjusted iteratively until the calculated data values match the observed as closely as possible, given constraints which keep the model section smooth. The smooth chargeability and resistivity models were then imported into Geosoft format for presentation at the same scale of 1:10,000 on the topographic profile.

Three dimensional smooth model inversions of the DC resistivity and chargeability were then carried out using the Geotomo RES3DINV Algorithm, and algorithm developed by Loke et-al. This algorithm uses a 3-D finite element method and incorporates topography in modeling resistivity and I.P. data.

DATA PROCESSING & INVERSION con't.

Visualization and Presentation

The I.P. data are presented as individual pseudo section plots of Percent Frequency Effect and resistivity at a scale of 1:5,000. Plots of the 21 point moving filter – illustrated on the pseudo section – for the above are also displayed in the top window to better show the location of the anomalous zones.

The inverted I.P. data are presented as individual section plots of modelled Percent Frequency Effect and resistivity also at a scale of 1:5,000.

The 3D modelled Resistivity data are presented as depth slices at 50 metre spaced depths from topography at a scale of 1:5,000.

The magnetic data are presented as plan maps of the TMI, the first vertical derivative and various depth slices at 100 + metre intervals below surface at a scale of 1: 20,000.

DISCUSSION OF RESULTS.

The 2017 geophysical review conducted over the Snow Peak Project – Mack Claim involved reprocessing and inversion of two geophysical datasets – 1976 Induced Polarization data and 2012 Geoscience BC airborne magnetics data.

The historical *Frequency Domain* IP survey was conducted in a Dipole – Dipole configuration utilizing a dipole spacing of 300 feet. The data set covers only a small area roughly at the centre of the claim – total coverage is roughly 700 metres by 1,600 metres. A total of five lines were nominally spaced at 400 feet and 800 feet. All of the lines were located were within the magnetic low. The depth of penetration of the survey was likely less than 200 metres.

Challenges were encountered with the modelling of the IP and Resistivity data. The resistivity models (2D and 3D) are reasonably consistent while the chargeability (PFE) results were inconsistent - likely due to the weaker chargeability contrast. Despite this, a deeper chargeability feature appears to be at depth proximal to an elevated resistivity response on several lines.

Results of the airborne magnetic survey show a large magnetic high covering most of the Mack claim. (Figure 5). This magnetic high is presumably the expression of the Snow Peak Pluton. The magnetic high is donut shaped with lower mag susceptibilities within the outer ring. Localized variation within the magnetic highs are highlighted by the *first vertical derivative* (Figure 6.)

A 3D magnetic inversion (Magnetization Vector Inversion) - MVI was run and results of the inversion re-affirm the donut shaped structure seen in the *first vertical derivative*.

The lower susceptibility core of the magnetic anomaly may be due to magnetite depletion and intense alteration. Localized weaker magnetic anomalies show that the core of the magnetic feature is not magnetically homogenous. A general south-west to north-east trend with several perpendicular cross cutting features is discernible.

DISCUSSION OF RESULTS con't.

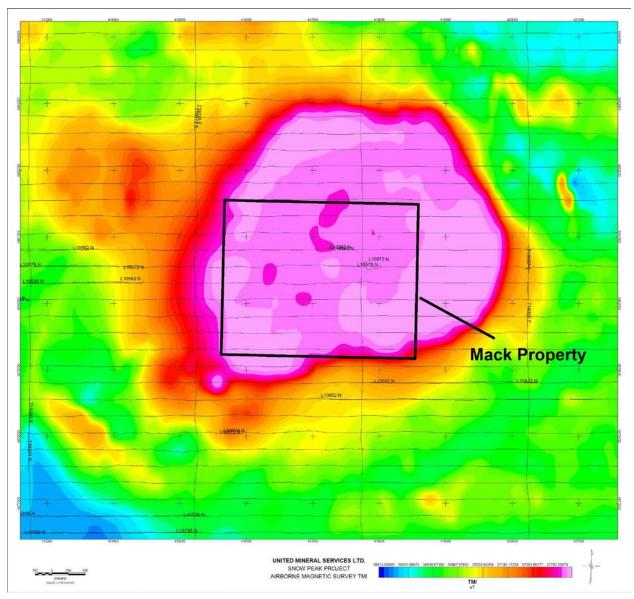


Figure 5. Airborne Magnetic Survey: Total Magnetic Intensity.

DISCUSSION OF RESULTS con't.

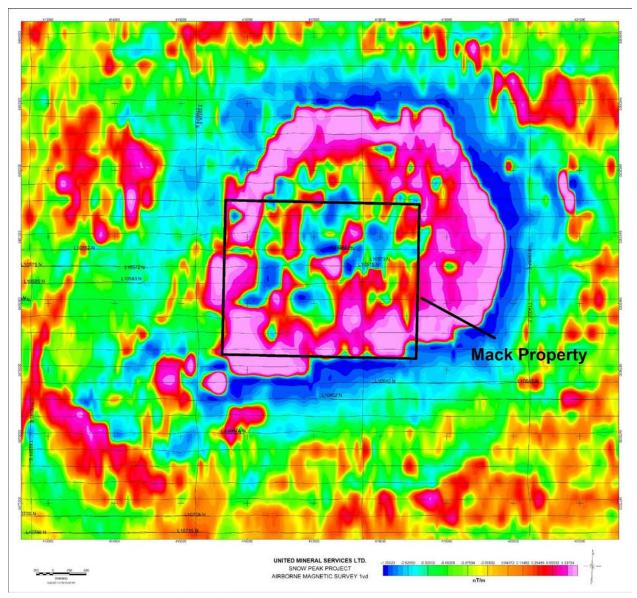


Figure 6. Airborne Magnetic Survey: First Vertical Derivative.

DISCUSSION OF RESULTS con't.

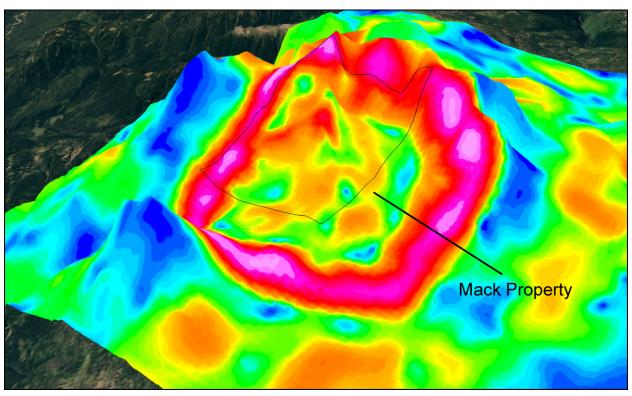


Figure 7. MVI model at depth 300 metres draped over topography (Vertical exaggeration 3:1)

Figure 7. is a depth slice of the MVI model at 300 metres draped over topography (3:1 vertical exaggeration). It is interesting to note that the modelled magnetic high partially follows the topographic highs – these topographic highs appear to be coincident with zones where the magnetic ring is seen to be more extensive.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

Between October 29^{th} and November 3^{rd} , 2017, Peter E. Walcott & Associates undertook inversion

of historic geophysical data over United Mineral Services Ltd.'s Mack claim, located west of

Dease Lake, in north-western British Columbia.

The project consisted of 2D/3D inversions of historic IP data and 3D inversion of Geoscience BC

airborne magnetic data,

Although the historical IP coverage is scant with limited survey penetration and location control

the IP survey did outline some features of potential interest.

A high resistivity feature is seen wrapping around a low resistivity feature in the centre of the grid.

This feature is associated with a chargeability feature on both its northern, and southern flank and

a NW SW trend can be discerned from the resistivity data

Processing and inversion of the airborne magnetic data shows a donut like magnetic body

containing lower susceptibility values within the magnetic outer ring. As the inside of the magnetic

feature may be associated with alteration and mineralization possibly at depth a deep penetrating

IP survey is recommended. This survey should extend beyond the edges of the magnetic anomaly

to cover the zone of interest.

Historic geochemical along with any other geological information should also be digitized to aid

design of any ground program.

Respectfully submitted,

PETER E. WALCOTT & ASSOCIATES LIMITED

Marek Welz, M.Sc.

Geophysicist

Peter E. Walcott, P.Eng

Geophysicist

Peter E. Walcott & Associates Limited Geophysical Services 2017 Geophysical Review Mack Property

APPENDIX I

COST STATEMENT.

Peter E. Walcott & Associates Limited undertook the compilation for the following rates.

Description of Work	Units	Rate	Total
Digitization and 2D/3D Modelling			
of Historic Induced Polarization	5	\$225.00	\$1,125.00
3D Magnetic Inversion (Susc & MVI)	2	\$875.00	\$1,750.00
Compilation	1	\$500.00	\$500.00
Reporting	1	\$750.00	\$750.00
			\$4,125.00

PERSONNEL EMPLOYED ON SURVEY.

Name	Occupation	Address	Dates
Peter E. Walcott	Geophysicist	111-17 Fawcett Rd.	
		Coquitlam, B.C.	
		V3K 6V2	
Marek Welz	46	44	
Alexander	"		October 29 th -
Walcott			November 3 rd ,
			2017

CERTIFICATION.

I, Peter E. Walcott of 605 Rutland Court, Coquitlam, British Columbia, hereby certify that:

- 1. I am a graduate of the University of Toronto in 1962 with a B.A.Sc. in Engineering Physics, Geophysics Option.
- 2. I have been practicing my profession for the last fifty four years.
- 3. I am a member of the Association of Professional Engineers of British Columbia and Ontario.
- 4. I hold no interest, direct or indirect in United Mineral Services, nor do I expect to receive any.

Peter E. Walcott, P.Eng

Vancouver, B.C. January 2018

CERTIFICATION.

- I, Marek Welz of 1605 West 14th Ave, Vancouver, British Columbia, hereby certify that:
 - 1. I am a graduate of the University of Alberta in 2006 with a M.Sc. in Geophysics.
 - 5. I have been practicing my profession for the last twenty five years.
 - 6. I hold no interest, direct or indirect in United Mineral Services, nor do I expect to receive any.

Marek Welz, M.Sc

Coquitlam, B.C. January 2018

REFERENCES.

Cochrane D. R., Geochemical Report on the Mack Claims, 1971, BC Assessment Report 3,207

Sadler-Brown T. L., A Report on a Geological Survey of the Mack Claims, 1976, BC Assessment Report 6,354

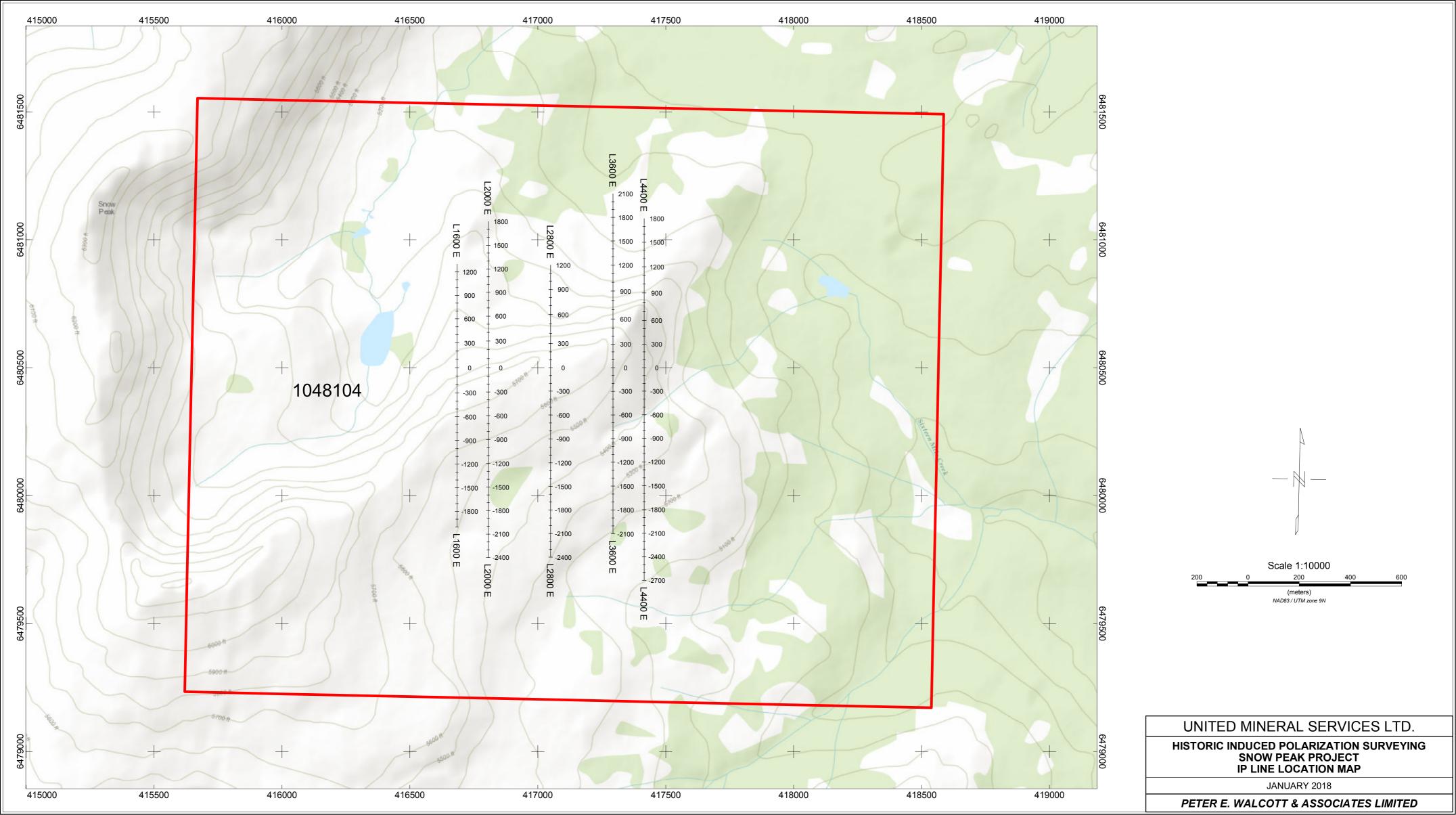
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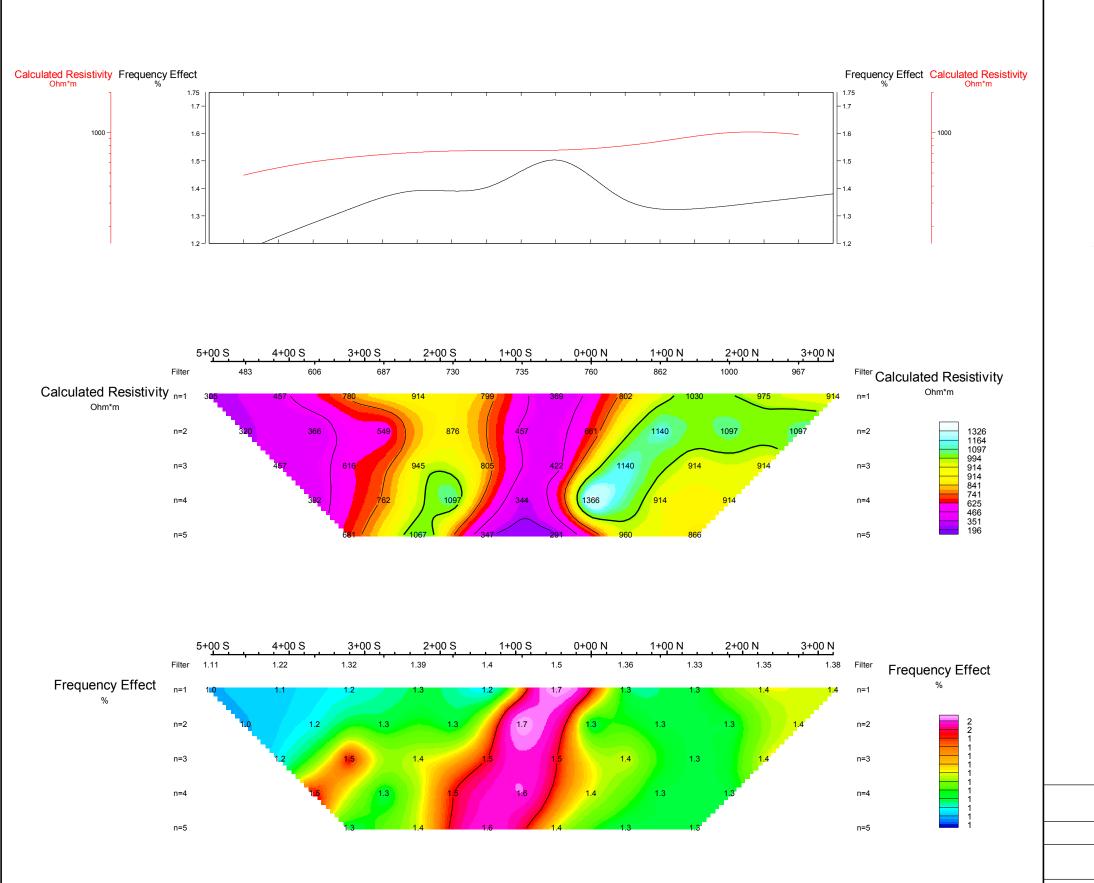
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Moynihan D.P. and Logan J.M., Dease Lake Geoscience Project, Part III: Age, Emplacement and Mineralization of the Snow Peak Pluton (NTS 104J/08), 2012

Aeroquest, Report on a Helicopter-Borne Magnetic Survey. Aeroquest Job#11-046, Geoscience BC Report 2012-2, 2012

Macleod I.N., Ellis R.G., Magnetic Vector Inversion, a simple approach to the challenge of varying direction of rock magnetization. 2013

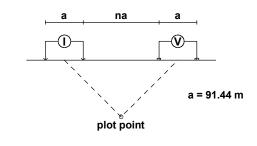




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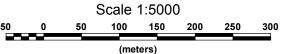
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Logarithmic Contours' 1.5, 2, 3, 5, 7.5, 10,...

HISTORIC IP DATA FREQUENCY DOMAIN Collected Summer 1976

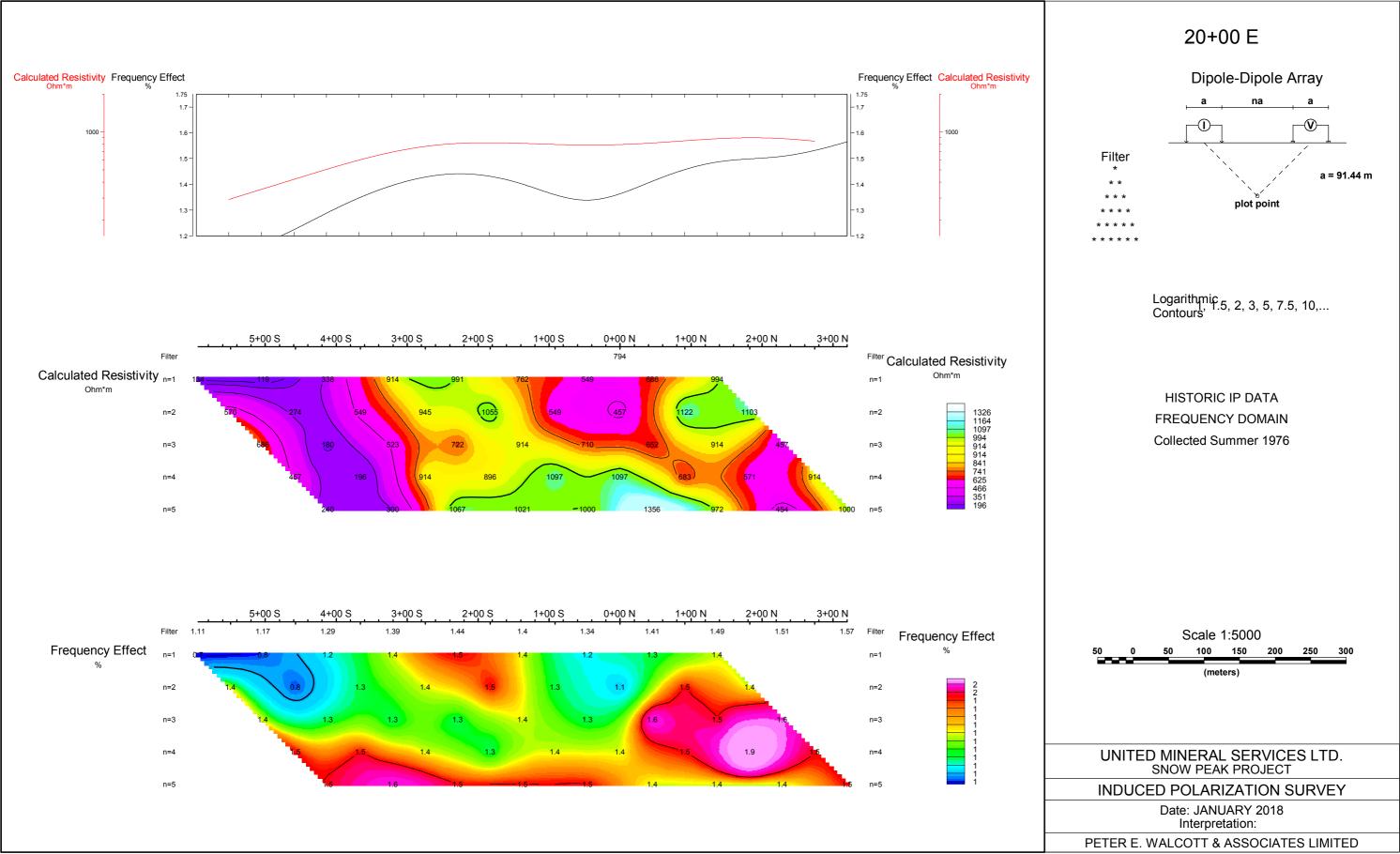


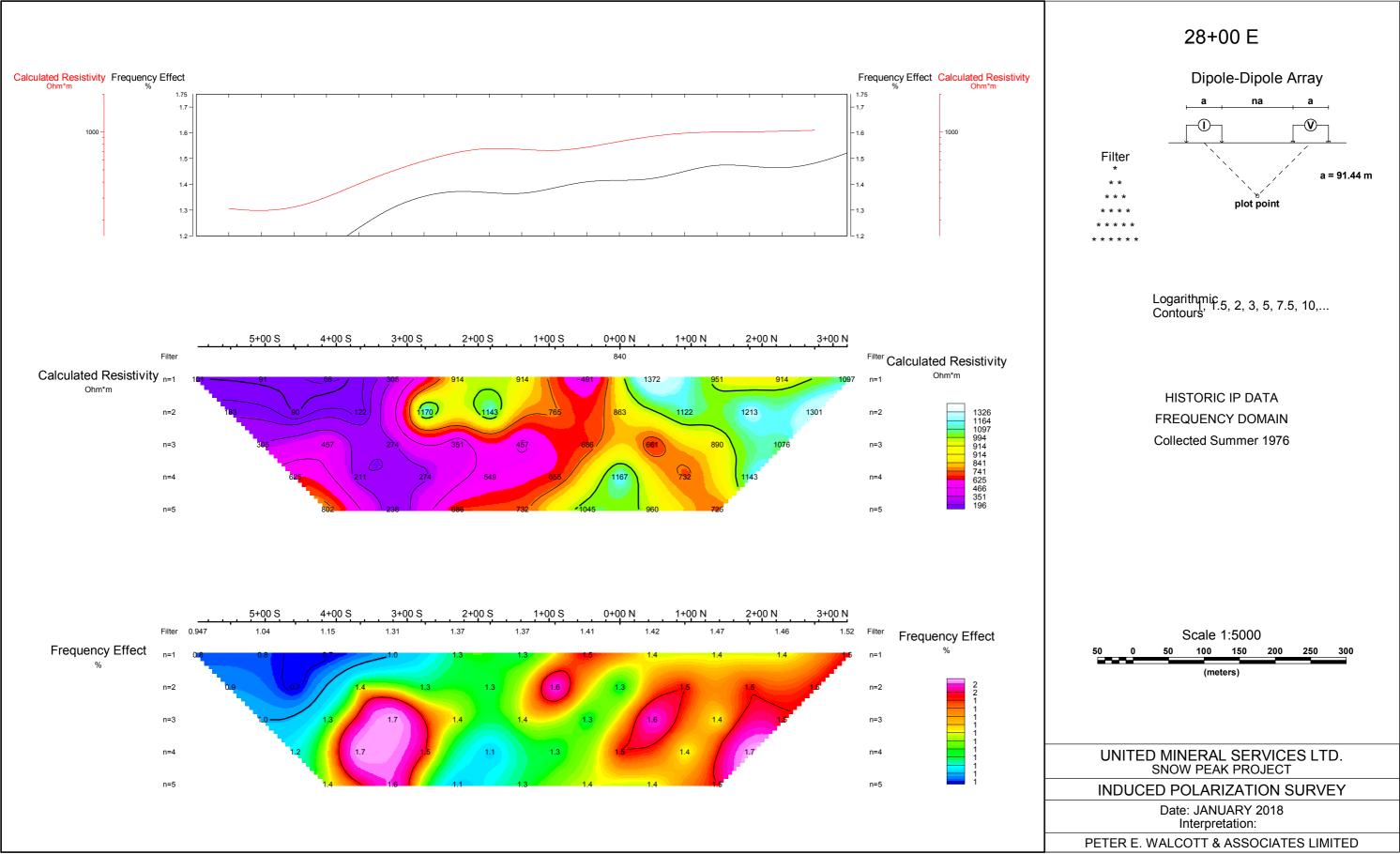
UNITED MINERAL SERVICES LTD. SNOW PEAK PROJECT

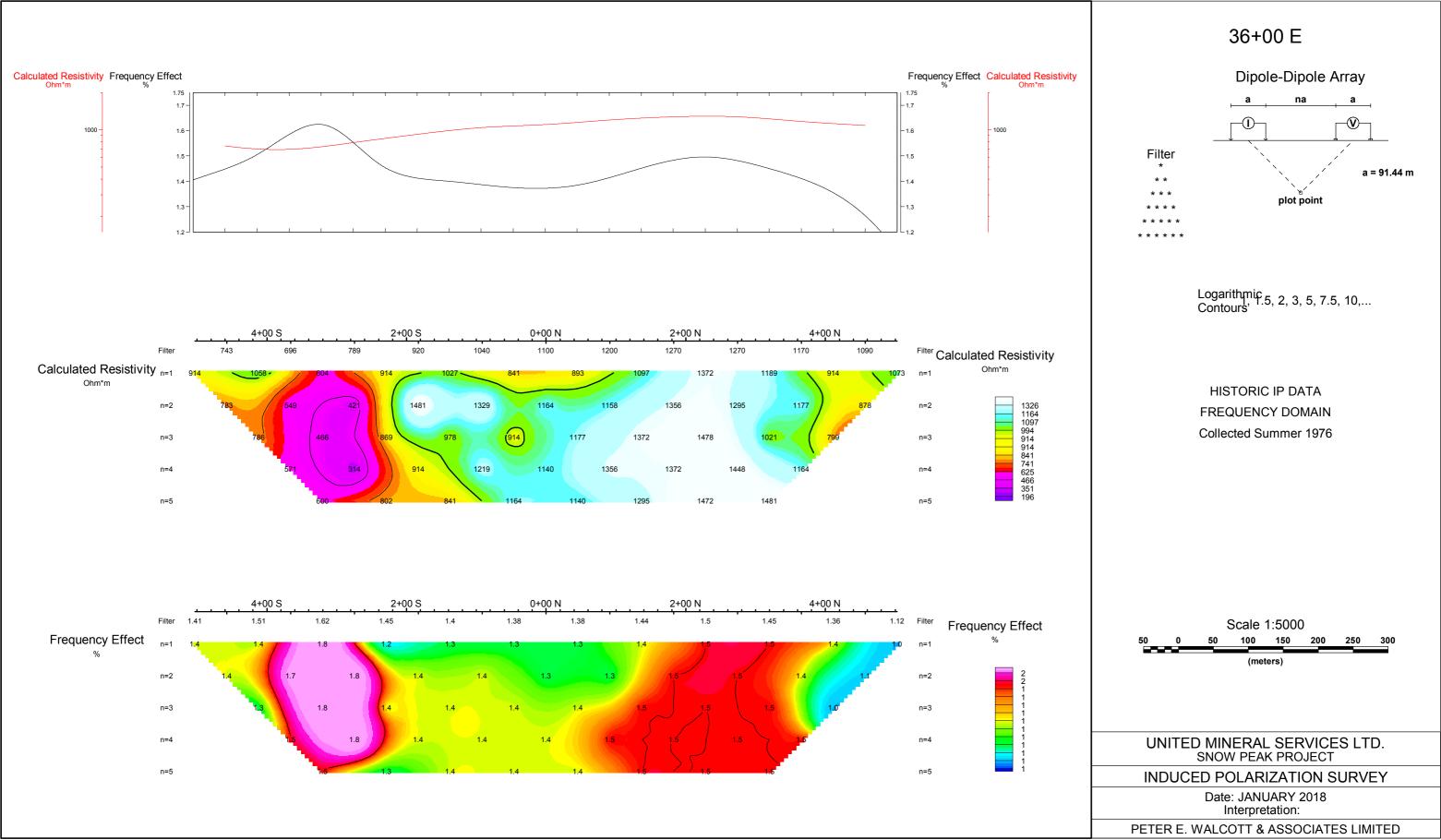
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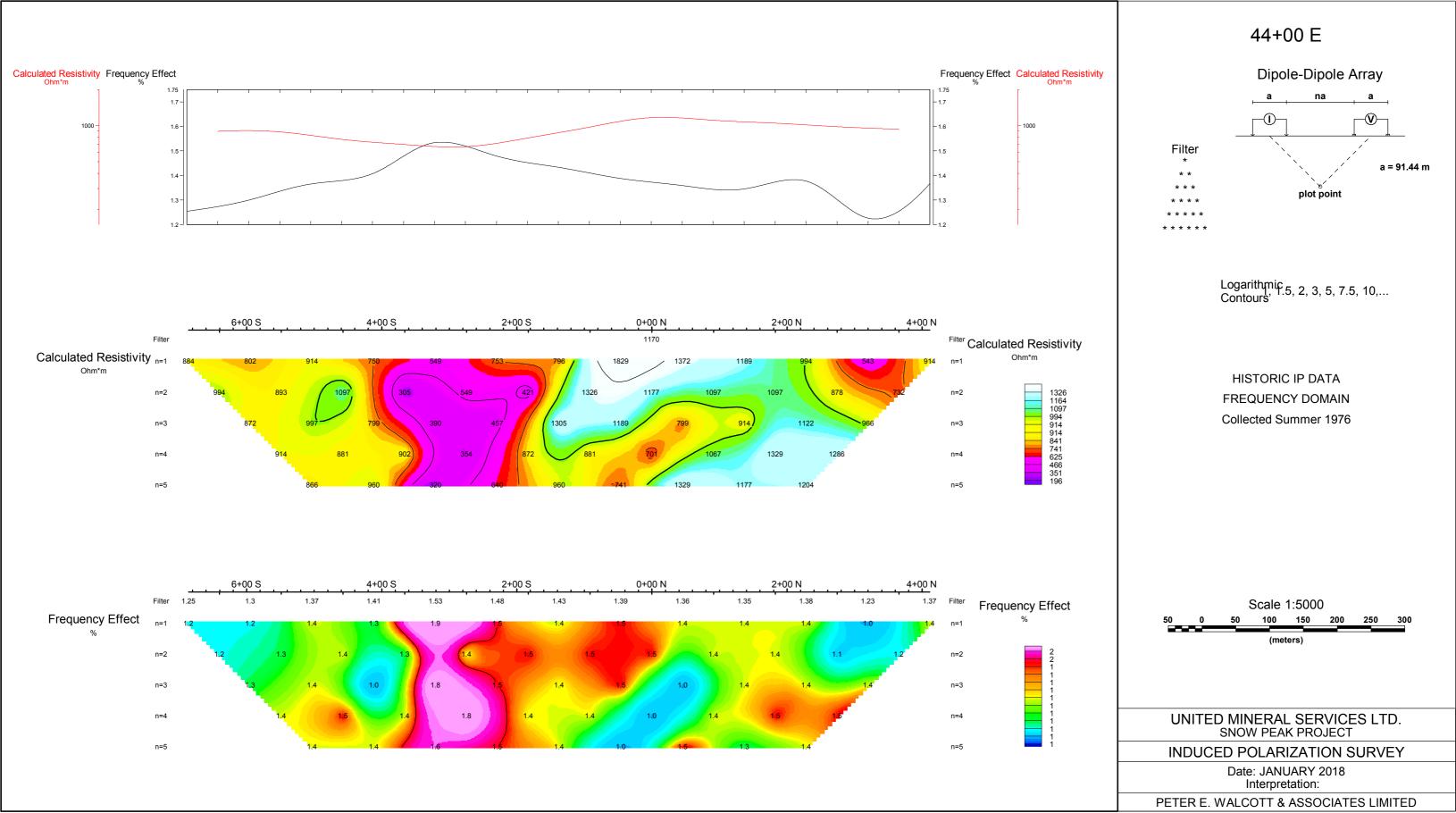
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PETER E. WALCOTT & ASSOCIATES LIMITED

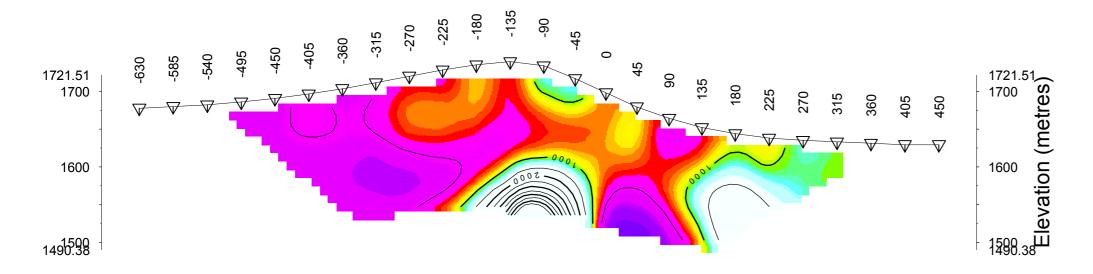




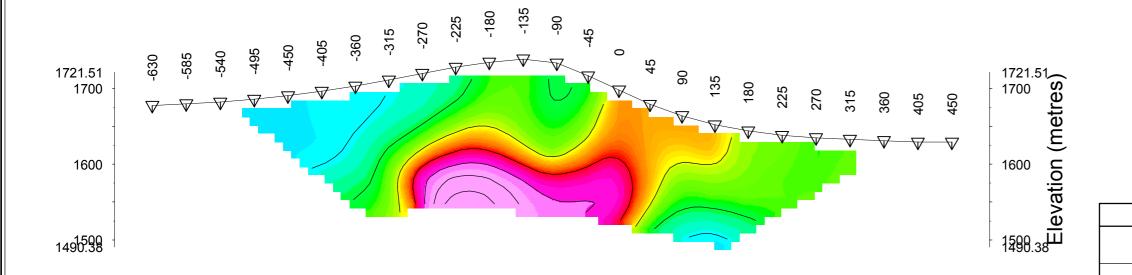




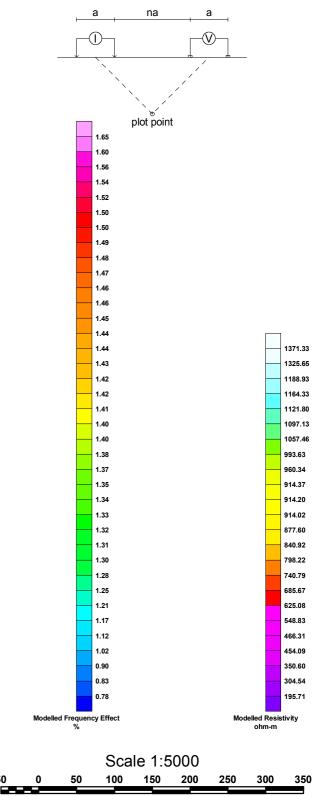
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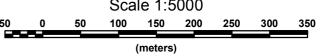


Modelled Chargeability (mV/V)



Dipole-Dipole Array





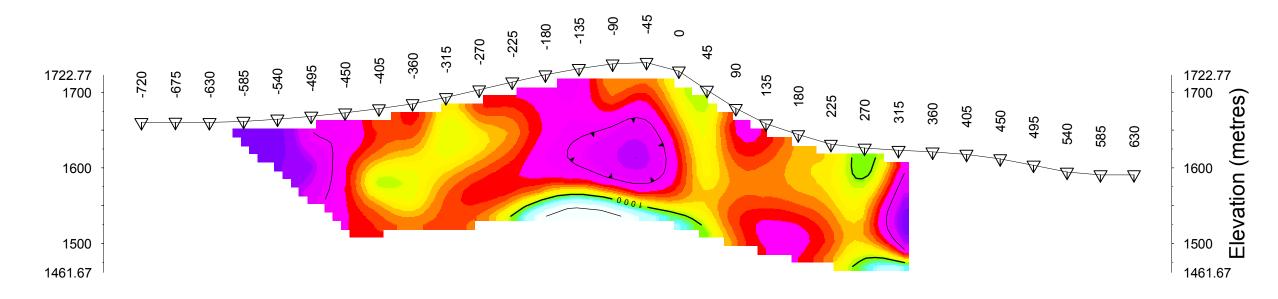
UNITED MINERAL SERVICES LTD.

INDUCED POLARIZATION SURVEY SNOW PEAK PROJECT

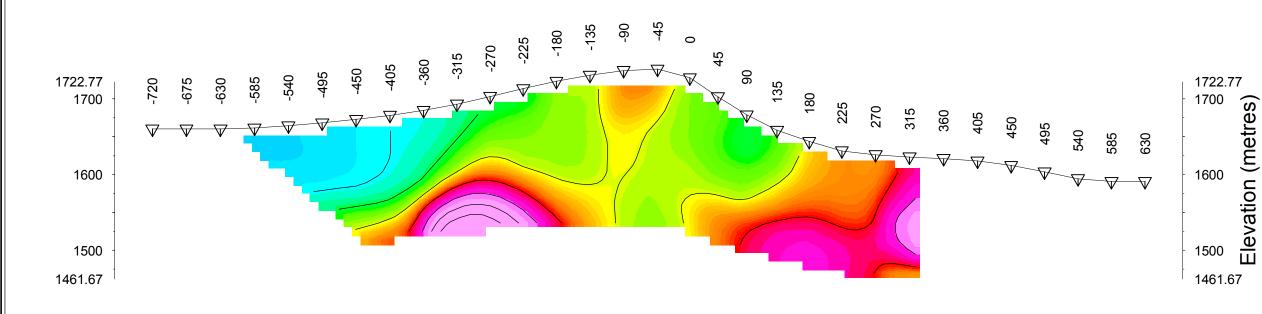
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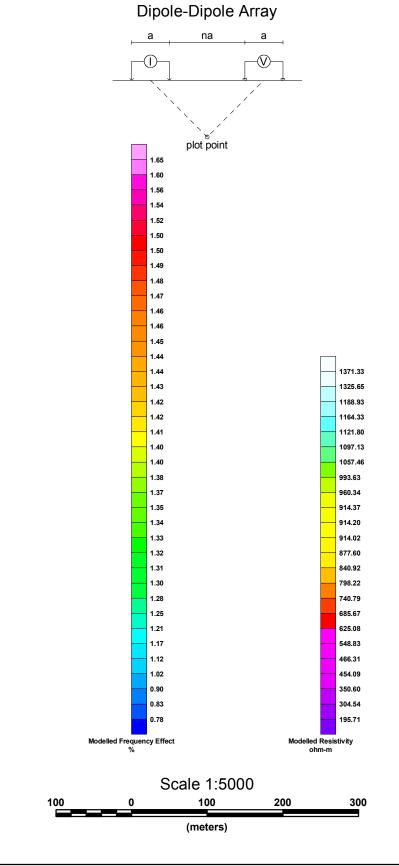
Inversion By: PETER E. WALCOTT & ASSOCIATES LIMITED





Modelled Chargeability (mV/V)





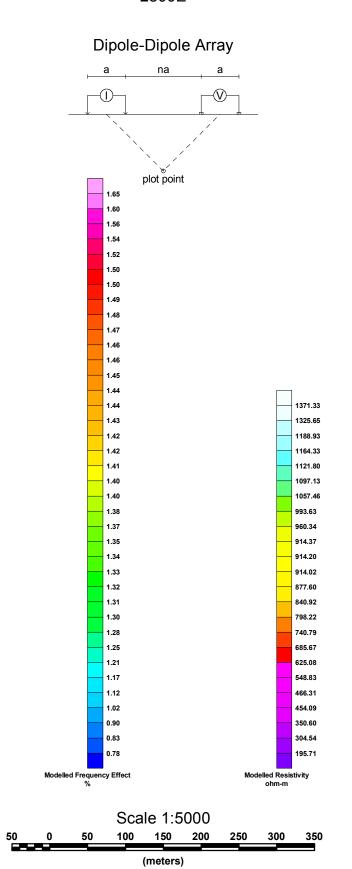
UNITED MINERAL SERVICES LTD.

INDUCED POLARIZATION SURVEY SNOW PEAK PROJECT

JANUARY 2018 RES2DINV:

Inversion By: PETER E. WALCOTT & ASSOCIATES LIMITED

2800E



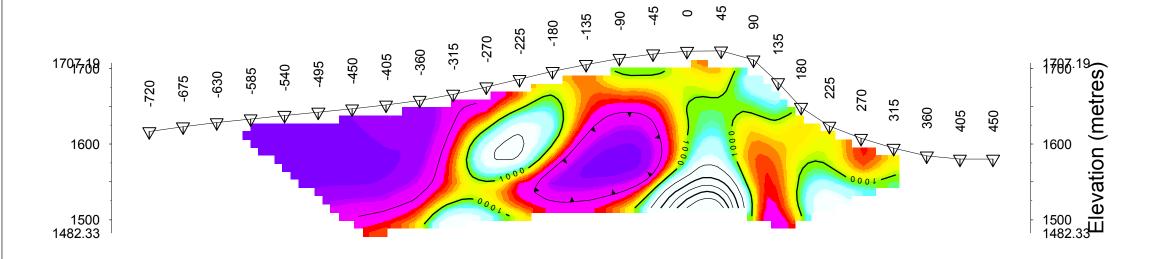


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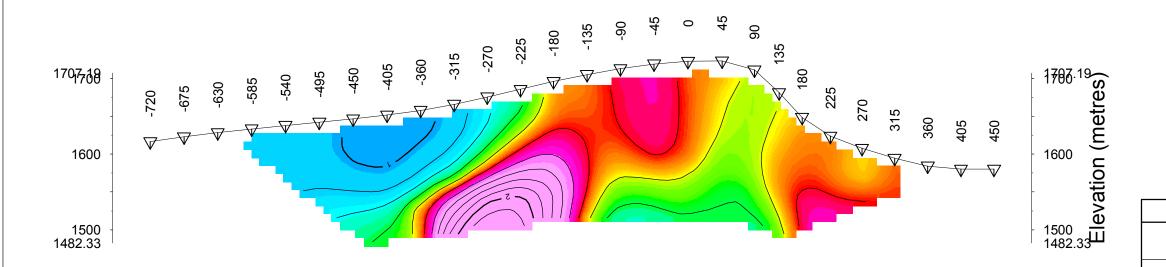
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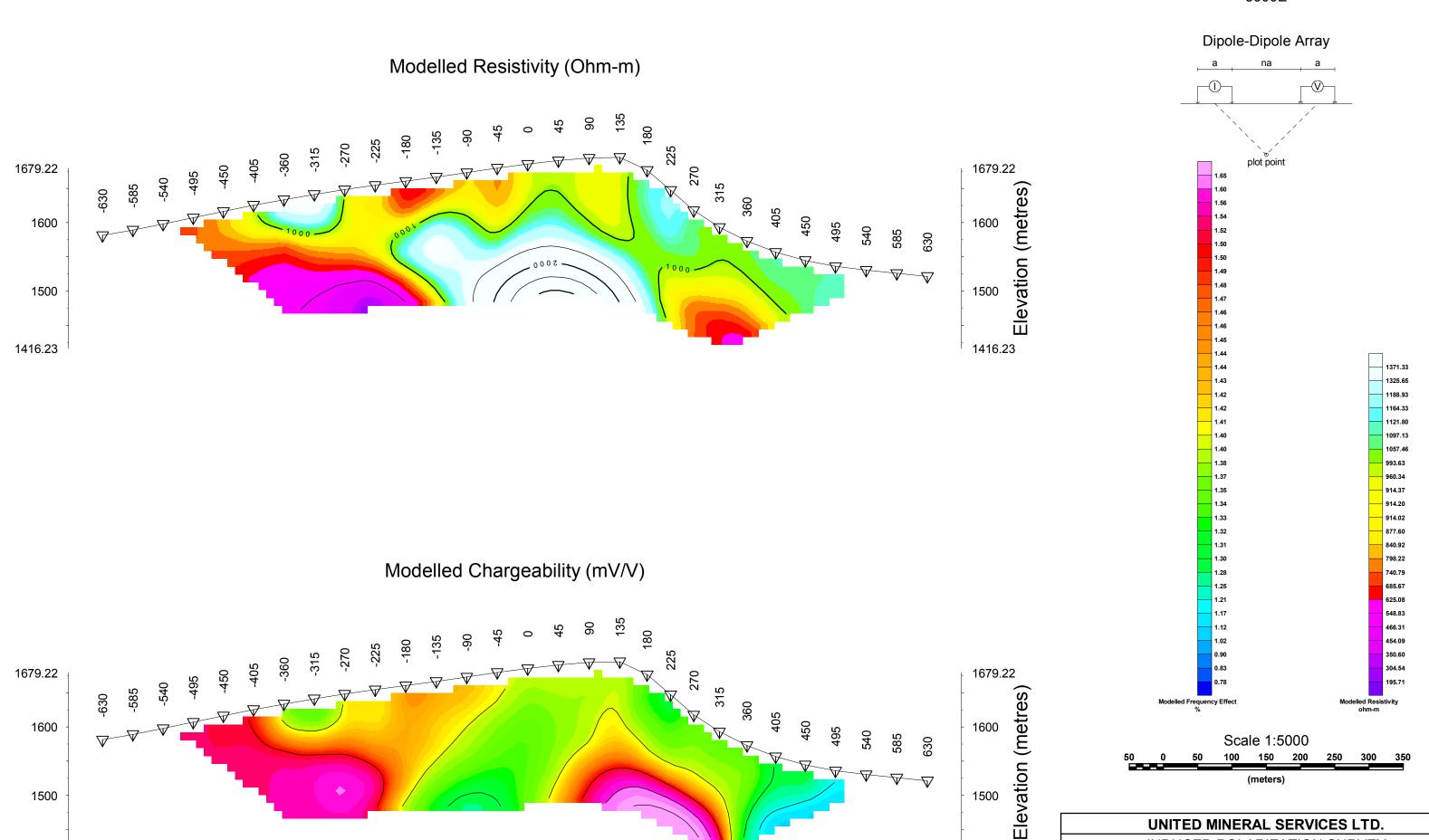
Inversion By: PETER E. WALCOTT & ASSOCIATES LIMITED

Modelled Resistivity (Ohm-m)



Modelled Chargeability (mV/V)





1500

1416.23

UNITED MINERAL SERVICES LTD. INDUCED POLARIZATION SURVEY SNOW PEAK PROJECT JANUARY 2018 RES2DINV:

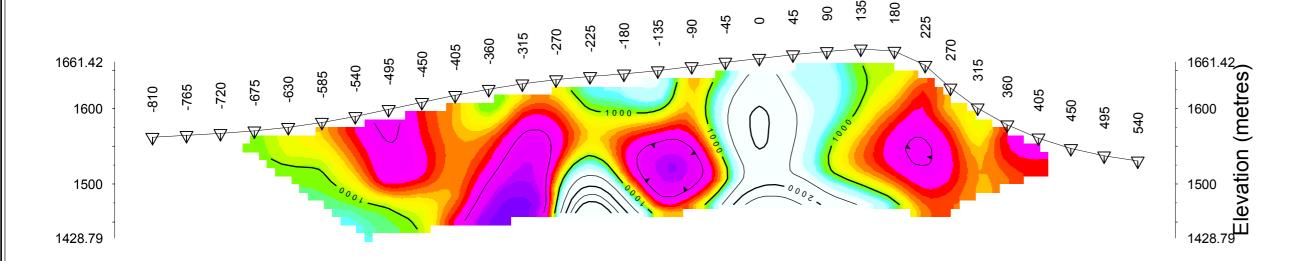
(meters)

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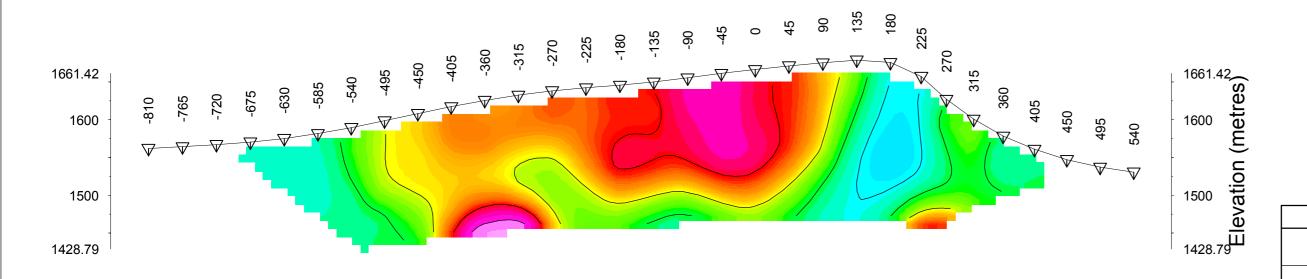
1416.23

Inversion By: PETER E. WALCOTT & ASSOCIATES LIMITED

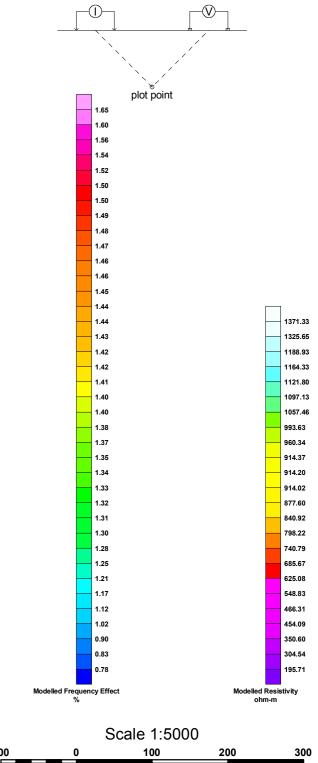
Modelled Resistivity (Ohm-m)

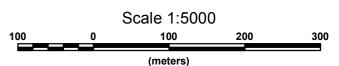


Modelled Chargeability (mV/V)



Dipole-Dipole Array





UNITED MINERAL SERVICES LTD.

INDUCED POLARIZATION SURVEY SNOW PEAK PROJECT

JANUARY 2018 RES2DINV:

Inversion By: PETER E. WALCOTT & ASSOCIATES LIMITED

