1813

GEOPHYSICAL and GEOCHEMICAL REPORT

on portions of the

Adair, Ski, August and Atan Claims

owned by

Tournigan Mining Explorations Ltd.

and situated in the

McDame Area, Liard M.D.

Northern British Columbia

Lat. 59°10'N : Long. 129°15'W

N.T.S. 104P

Work completed between August 12th and 23rd, 1968

by

Geo-X Surveys Ltd.

Report by

D.R. Cochrane, P.Eng.

and

J.P. Cerne, M.S.

September 13th, 1968

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TELEX 04-50404

GEO-X SURVEYS LTD. 627 HORNBY STREET, VANCOUVER 1, B. C.

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1. SUMMARY and CONCLUSIONS:

During the latter part of August, 1968, Geo-X Surveys Ltd. of Vancouver, B.C. conducted just over 12 line miles of geochemical and geophysical surveys on behalf of Tournigan Mining and Explorations Ltd. The surveyed area is situated in the Cassiar district of northern British Columbia, and covered a portion of the Atan claim group, The claims are located around Atan Lake, some two miles northeast of the abandoned settlement of McDame Post.

Geological mapping by H. Galbrielse of the Geological Survey of Canada, indicates the area surveyed lies on the west flank of an anticlinorium whose axis trends in a northwesterly direction. The area close to the claims was mapped as Lower Cambrian limestones and dolomites with minor interbedded shales. A barite and galena occurrence has been reported near Atan Lake, and barite is present on the south shore of the lake on the claims. A copper showing was uncovered by Mr. J. Hembling, and is situated a few hundred feet south of the barite occurrence. Immediately north of the Atan claim group, Dresser Industries Inc. holds claims covering a galena-barite prospect.

The ground control grid was cut and flagged by Tournigan personnel, and consists of a north 45° west base line, and parallel cross lines 500 feet apart. A total of seven separate pieces of geophysical-geochemical information was collected at nearly 300 different stations spaced at 200 foot intervals along the cross lines.

A Hewitt Enterprises pulse type IP unit was utilized for the self potential, resistivity and induced polarization portion of the surveys. A Wenner electrode array was employed with an "a" spacing of 200 feet. Geochemical soil samples were collected at the front electrode position, air dried in the field camp, shipped to Vancouver and analyzed by T.S.L. Laboratories Ltd. for their copper, zinc, lead and silver content. Hot HCl extraction was employed.

Preliminary data processing was completed early in September and revealed:

(a) that approximately 40 percent of the area surveyed was characterized by weak to strongly anomalous induced polarization response;

(b) several specific areas within the high IP response area exhibited special effects often attributable to sulphide polarization;

(c) there were areas of close correlation with self potential and resistivity changes;

(d) there was rather scattered, but interesting geochemical copper, zinc and lead content in soils.

The area surveyed contains only a few outcrops, and a large area of high IP response. Thus, selection of small high priority target areas is extremely difficult. Consequently, fourth order trend and residual surface computer analyses were applied in the hope of eliminating relatively low priority areas and to aid in overall interpretation. This method of data processing is commonly employed in the mineral industry, and proposes to simplify the results. In doing so however, the number of individual "pieces" of information increased from 2076 to 4288. Consequently, a large graphic presentation accompanies this textual report.

The computer work was completed by Computrex Ltd. of Calgary, Alberta, using a General Electric 625 computer.

A summary of the geophysical surveys is presented in section 13, and need not be repeated here. Basically, there are seven induced polarization anomalies, some of which exhibit effects indicative of sulphides. Trend analysis had the effect of verifying the "local anomaly nature" of five of these anomalies, thereby emphasising their importance. In addition, two other areas of possible IP interest were delineated by computer processing. Polarization is not the result of the presence of magnetite, at least in the induced polarization anomaly #2 area, as a short magnetometer traverse (MF-1) indicated only small magnetic changes ($\pm$ 50 gammas).

A summary of the geochemical results and discussion is presented in section 15, to which the reader is referred for details.

A certain amount of structural interpretation is shown in Figure 23, and is based on the collected information and computer results. In addition, air photos of the claim area and mapping by Gabrielse has indicated some possible fault zones. The most important appears to be a fault obliquely intersecting Atan Lake from the northeast, which coincides with a sharp change in resistivity, an air photo linear and disruption of the induced polarization response. It lies almost precisely in an area marked by Gabrielse as an assumed fault and may involve several hundred feet of right hand separation.

The following areas of overlapping geophysical and/or geochemical interest warrent further investigation. They are tabulated in descending order of priority as follows:

A. South of Atan Lake and east of the base line, centered between 20 and 30+00 north, 2 to 5+00 east. This area is the prime geochemical target and is characterized by relatively high contents of overlapping lead, zinc and copper in the upper B soil horizon. IP anomaly #1 is coincident and self potential anomaly #2 flanks the IP high to the south.

B. The area in and around the base line at 55+00 north. This section contains IP anomlay #3 which is flanked to the east by self potential anomaly #3 and zinc anomaly #3 and to the west by the resistivity low. Within this resistivity low , and just southwest of IP anomaly #3 are overlapping residual high copper and zinc anomalies.

C. In and around 17+00east on line 35+00 north. This is the southeast end of IP anomaly #2, is close to the indicated fault and resistivity low, and coincides with zinc residual #4.

D. In and around the base line near 40+00 north. IP anomaly #4 is situated here and is overlapped by a moderately anomalous zinc residual. It lies on the east end of the large resistivity low.

E. Immediately west of the base line, between 10 and 15+00 north. An IP high is located in this area and is bounded by two self potential anomalies. Zinc residual high #2 overlaps.

F. In and around 20+00 west and 25+00 north where coincident IP anomaly #6, resistivity anomaly #3 and a copper residual high is located.

Perhaps the most expedient method of further investigation would be bulldozer trenching and geological mapping. If this proved encouraging, diamond drilling would be necessary.

Respectfully submitted,

Vancouver, B.C.

D. R. Cochrane, P.Eng.

J. Cerne, M.S.

2. INTRODUCTION;

Between August 12th and 23rd, 1968, a total of 12.6 line miles of induced polarization, and 12.0 line miles of geochemical soil sampling surveys were completed on portions of the Adair, Ski, August and Atan mineral claims. The claims are situated in the McDame area, Liard Mining Division, northern British Columbia, and are owned by Tournigan Mining Explorations Ltd. The surveys were conducted by Geo-X Surveys Ltd., of Vancouver, B.C.

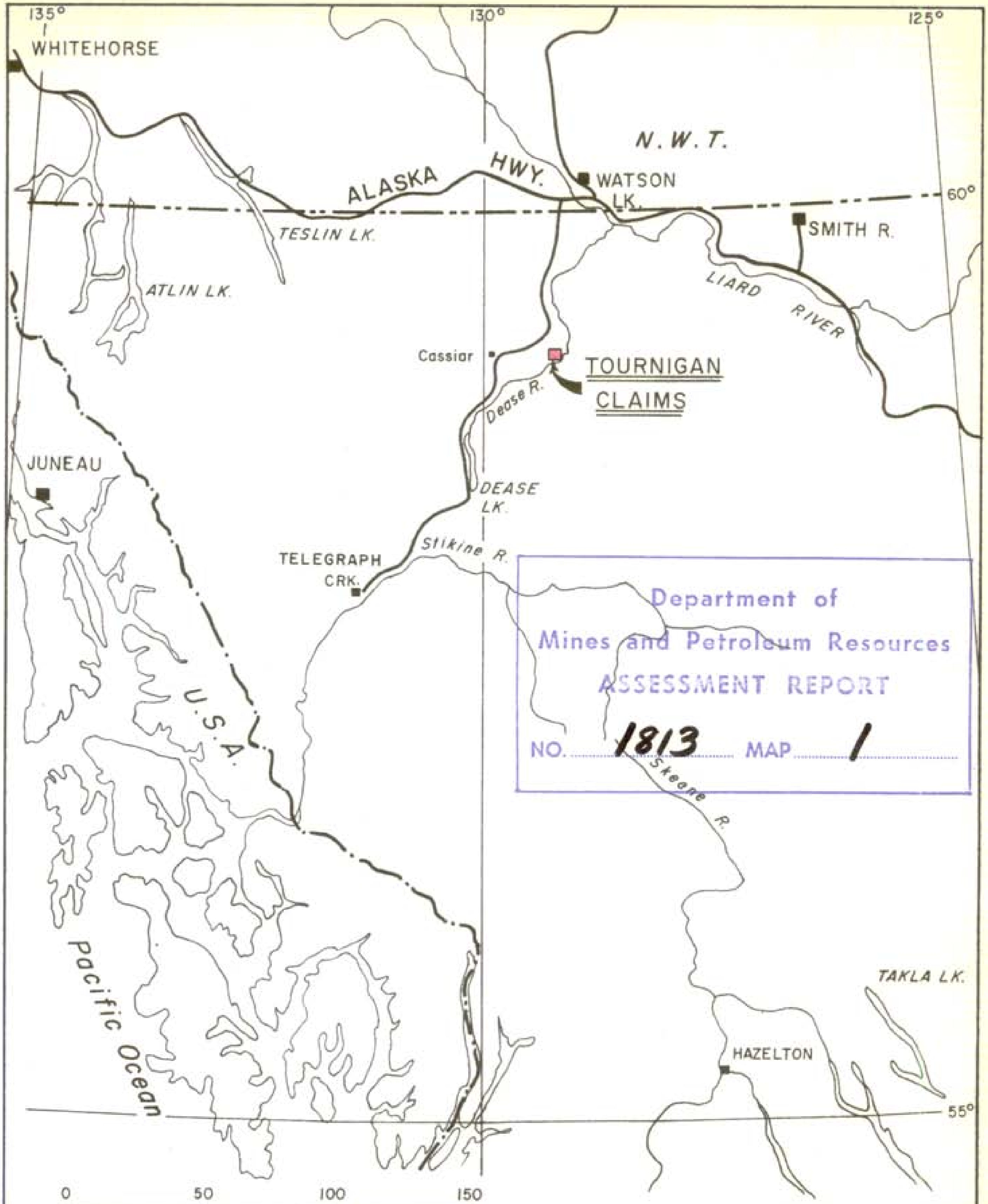
Initial data reduction and processing was completed by Geo-X Surveys Ltd. Further computer processing was done by Computrex Ltd. of Calgary, Alberta.

This report describes the field and data processing procedures and discusses the results of the surveys.

3. LOCATION and ACCESS:

The property is situated immediately east of the now abandoned settlement of McDame Post on the Dease River, northern British Columbia. Normal access is by 4x4 truck as follows:

west from the town of Watson Lake, Yukon, to mile 650 of the Alaska Highway; south on the Cassiar road, past Good Hope Lake to the McDame Post road to McDame (a distance of approximately 8 miles); finally, east along the north bank of the Dease River to the campsite and claim groups.



TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, B.C.

LOCATION MAP

GEO-X SURVEYS LTD.	DRAWN R.K.	CKD. [illegible]	JOB. NO. 1049
	APPR'D.	DATE Sept., 1968	FIG. NO. 1

The Alaska Highway and Cassiar roads are all-weather gravel roads, however, the McDame road is a narrow dirt track, often impassible after a heavy rain.

A float equipped light plane may land on Atan Lake, or on the Dease River, close to the campsite.

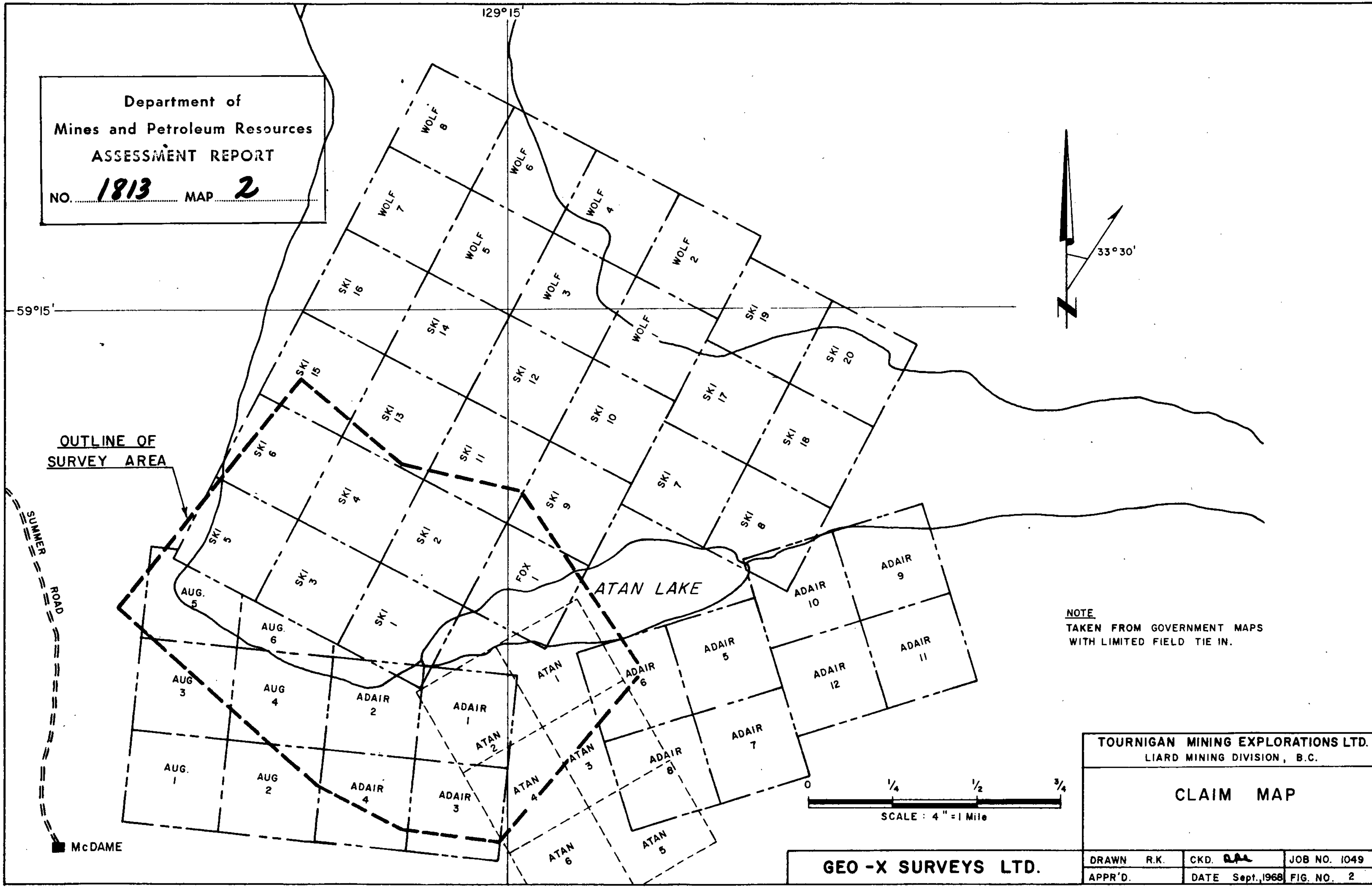
4. CLAIMS and OWNERSHIP:

The claims, known as the Atan group, are situated in the Liard Mining Division, and owned outright by Tournigan Mining Explorations Ltd., registered office - Suite 915, Burrard Building, Vancouver 5, B.C.

The following table summarizes pertinent claims data:

Name:	Tag No.	Record No.	Ann. Date
Atan #1 to #6 incl.		28358-28363 incl.	Late Sept.
Atan #7 & #8	932513-932514		Aug.27
August 1-6 incl.	932501-932506 incl.		Aug. 5
Wolf #'s 1,3,5,7		26927,29,31,33	May 16
Fox #1		26935	May 16
Adair #1 to #8 incl.		26936-26943 incl.	May 16
Adair #10 & #12		26945,26947	May 16
Ski #1 to #18 incl.		26948-26965 incl.	May 16

The Atan group consists of a total of 39 claims from the Wolf, Fox, Adair, Ski and Atan claims. The remainder have not yet been grouped. The recent exploration work took place on a portion of the above described claims.


Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1813 MAP 2
129°15'
59°15'
33°30'
WOLF 8
WOLF 7
WOLF 6
WOLF 5
WOLF 4
WOLF 3
WOLF 2
WOLF
SKI 1
SKI 2
SKI 3
SKI 4
SKI 5
SKI 6
SKI 7
SKI 8
SKI 9
SKI 10
SKI 11
SKI 12
SKI 13
SKI 14
SKI 15
SKI 16
SKI 17
SKI 18
SKI 19
SKI 20
FOX 1
ATAN LAKE
AUG. 1
AUG 2
AUG 3
AUG 4
AUG. 5
AUG. 6
ADAIR 1
ADAIR 2
ADAIR 3
ADAIR 4
ADAIR 5
ADAIR 6
ADAIR 7
ADAIR 8
ADAIR 9
ADAIR 10
ADAIR 11
ADAIR 12
ATAN 1
ATAN 2
ATAN 3
ATAN 4
ATAN 5
ATAN 6
OUTLINE OF SURVEY AREA
SUMMER ROAD
McDAME
NOTE
TAKEN FROM GOVERNMENT MAPS WITH LIMITED FIELD TIE IN.
0 1/4 1/2 3/4
SCALE : 4" = 1 Mile
GEO - X SURVEYS LTD.
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, B.C.
CLAIM MAP
DRAWN R.K.
CKD.
JOB NO. 1049
APPR'D.
DATE Sept., 1968
FIG. NO. 2

5. GEOMORPHOLOGY:

The Atan claim group is situated close to the east boundary of the Stikine Range of the Cassiar Mountain Physiographic division of British Columbia; and immediately west of the Liard Plain. The immediate area is a reasonably rugged mountainous region exhibiting many features characteristic of a complex geologic history and alpine glaciation. The highest peak in the vicinity is Blackfox Mountain, rising to 7022 feet above mean sea level. The McDame River flows northeasterly through the mountains within a broad "U" shaped valley (elevation just less than 2500 feet above mean sea level). The property is situated within this valley, at the foot of an unnamed peak which rises to over 6000 feet to the north of the area surveyed.

Geological mapping by H. Gaibrielse (G.S.C. Memoir 319, 1963) shows that the claims lie on the west flank of an anticlinorium, composed of a lower Paleozoic and upper Proterozoic miogeosynclinal rock sequences. The area close to the claims was mapped as Upper Atan Group, consisting mainly of limestones and dolomites with minor interbedded shales. M.F. Ayler (personal communication) has advised that the bedding varies in strike from N10°W to N62°W, and in dip from 45° southwest to vertical in the area south of Atan Lake and north of the McDame River.

Gabrielse's investigation has shown that the McDame region contains a series of northwesterly trending linaments, possibly longitudinal faults. South of McDame, a number of northeasterly trending cross faults were located. He has indicated an "assumed" fault, striking southwest and obliquely intersecting Atan Lake, near the area surveyed. Air photo linears (Dept. of Energy, Mines and Resources, Air Photo Division, photos A-11556-315 and 316) of the claim area support this assumption, and this fault is discussed later in the "Resistivity" section of this report. There are, in addition, a series of nearly east-west trending photo linears in and about Atan Lake, suggesting that the lake is fault scarp controlled.

6. GROUND CONTROL GRID:

The ground control gird was established by Tournigan Mines personnel, under the supervision of Mr. J. Hembling. The base line is layed out N-45°W and extends from the north bank of the McDame River, across the west end of Atan Lake, and into the Ski #6 claim. The base line was cut out by axe and chain saw and flagged at 200-foot intervals. Parallel cross lines extend from 10+00 to 75+00 north, and are chained from about 25+00 west to 20+00 east (on the average).

It was within the above described ground control grid that the surveys were conducted.

The outline of Atan Lake shown on maps accompanying this report, was enlarged from air photograph A-11556-316. Claim outlines and posts were compiled from field observation and the government claim map.

7. INDUCED POLARIZATION FIELD PROCEDURE:

A Hewitt Enterprises Pulse Type IP unit was utilized on the Tournigan Mining Explorations surveys. The instrument specifications are presented in Appendix IV.

The standard Wenner electrode array was employed with an "a" spacing (one-third the distance between the current electrodes) of 200 feet. A brief description of the field procedure follows:

Prior to voltage application, the self potential is observed and recorded (between two pots, 200 feet apart).

Normally, a voltage of 250, 500 or 1000 volts is impressed between the front and back aluminum or steel electrodes which are spaced 600 feet apart. During the four second voltage application, the dV (impressed EMF in millivolts) and the I (current in milliamperes) is read and recorded. 0.3 seconds after the cessation of pulse, the residual voltage is integrated for 0.8 seconds (on integration function one), during which time the IP decay (in millivolts) is recorded. From these data, the self potential, apparent resistivity, and normalized IP may be calculated, as described in the preliminary data processing section of this report.

At each station, several pulses are initiated and the IP response must have agreed well before the instrument is moved ahead. Most of the survey was completed with single integration of the decay voltage (I.F. 1) with several re-checks on the double integration setting (I.F. 3).

Four and eight second pulses were initiated at several stations and are used for interpretive purposes. The operator's notes include remarks on the transience of the IP response, and the stability of the primary voltage, which are factors used in differentiation of polarization.

The electrode and pot cables were cut to 200 and 400 foot lengths (plus 10% for slope) and, in effect, the survey crew rechained the lines. The front stake man flagged each station (wrote line and station position with felt pen on orange flagging) so that the actual station position of the geophysical and geochemical values may be located on the property.

8. PRELIMINARY INDUCED POLARIZATION DATA PROCESSING:

The following information was recorded by Mr. N. Wilson, the instrument operator, at each pulse station:

1. The property, operator's initials, job and page number, "a" spacing, transit interval and remarks on topography.
2. The line and station co-ordinates;
3. The self potential reading in millivolts (S.P. mv);

4. The current in milliamperes (I ma);

5. The impressed emf in millivolts (dV mv);

6. The induced polarization decay voltage in millivolts (IP mv);

7. The resistor- capacitor switch (R.C.);

8. The current electrode voltage switch value;

9. The integration function switch (I.F.);

10. The pulse time in seconds.

From this data, the apparent resistivity is calculated from the following relation:

$$\rho = \frac{2\pi \times a \times dV}{I(ma)}$$

Where: ρ = apparent resistivity in ohm-feet

π = 3.1416

"a" = 1/3 distance between the current electrodes

The normalized IP value is obtained by utilization of the following relation:

$$IP\ norm = \frac{IP(mv) \times 100 \times k}{dV(mv)}$$

Where: IP norm = normalized IP in millivolt seconds per millivolt or milliseconds

K = a constant depending on the IF setting

A specific example from the data collected at 20+00N; 16+00W:

Pulse No.	I(ma)	dV	IP(mv)	R.C.	S.P.	I.F.	Remarks
1	80	240	5	1	+39	1	1000 v
2	80	240	6	1		1	
3	80	240	6	1		1	

$$\therefore \rho = \frac{1256.62 \times 240}{80} = 3770 \text{ ohm feet}$$

$$\text{IP norm} = \frac{6 \times 100 \times 1}{240} = 2.5 \text{ milliseconds}$$

These calculations were completed for each station, on an Olivetti Underwood 101 computer.

The final apparent resistivity and normalized IP values were plotted on a map (scale 1" : 400 feet) at a point midway between the receiving pots (ie: 100 feet in front of the instrument position).

The plan of normalized IP was contoured in 10.0 millisecond intervals (see Figure 10) and the apparent resistivity plan was contoured at the 1000, 2500, and 6000 ohm-foot mark. (see Figure 7).

9. GEOCHEMICAL SOIL SAMPLING FIELD PROCEDURE:

The soil samples used for geochemical analysis were collected at the front electrode. This person's job was to dig a hole with pick or grub hoe; flag and number the sample site; collect the sample; write the sample site description on a standard form; then proceed with the electrode connection.

At the start of the survey, the author excavated a test pit to inspect soil horizons (30N on the base line). A well developed upper B horizon was present some 5 inches below the surface and consisted of transported red, pebbly clay. An additional 85 soil samples were collected by the author during the first two days of work. The depth at which soil samples were taken varied from 2 inches to 14 inches; and averaged approximately 5 inches. The soil sampler, Mr. J. Wiggins, recorded, on standard field note forms, the following information:

1. Line and station number;
2. Depth of sample.
3. Horizon sampled;
4. Soil classification: sandy-clay, boulder clay, etc.
5. Colour: red-brown, grey brown, etc.
6. Remarks: such as "level", gentle slope, southeast, etc.

The soil samples were placed in a standard water resistant geochemical bag, and folded shut. The line and station number was marked on the back and front of the sample bag and then placed in a clean plastic ore sack. At the end of each day's collection, the samples were rechecked for correct numbers, arranged in order and strung on a wire, which was strung up to air dry samples.

After drying, they were crated and shipped to the Vancouver office of Geo-X Surveys, where they were uncrated, an inventory made, and check samples prepared. The check samples were picked at random, split, repackaged and the sample checks lettered (A to H inclusive) rather than numbered.

All samples were then sent to T.S.L. Laboratories 325 Howe Street, Vancouver, B.C.. Their method of analysis (described in Appendix V) is a hot HCl metal extraction. Copper, zinc, lead and silver analysis (in part per million) were completed on each of the samples collected.

10. PRELIMINARY GEOCHEMICAL DATA PROCESSING:

The initial certificate of analysis from T.S.L. Laboratories Ltd. was Report No. V 4539-1. After investigation of the check samples, dissatisfaction of the silver and zinc analyses was expressed to the laboratory. T.S.L. kindly agreed to re-run each of the samples twice again for their zinc and silver content. These results (three analysis for silver on each sample, and three analysis for zinc on each sample, including the original) were forwarded in Report No. V 4539-1.

The following summary indicates the overall accuracy of zinc analysis:

1. Original zinc analysis (163 samples)

(a) Arithmetic mean	83.6
(b) Standard deviation	57.3

2. First check of zinc (163 samples)

(a) Arithmetic mean	88.4
(b) Standard Deviation	52.6

3. Second check of zinc (163 samples)

(a) Arithmetic mean	96.4
(b) Standard deviation	57.2

The zinc content of individual samples sometimes differed considerably (for example of check sample A and sample 15 north, 8 east, we have the following:

Analysis	1	2	3	4	5	6
Zn content (ppm)	80	62	92	66	77	89

However, the relative contrast between individual samples made during the same analytical run, was much the same, even if the "average" had shifted slightly.

In summary, the re-runs only emphasized the fact that geochemical data are simply semi-quantitative results, since there are inherent errors in sampling, splitting samples, analysis, etc., in addition to various types of metallic ion bonding, and soil types within each sample, as well as throughout the area sampled.

The metal content of each sample as reported in the original run is presented in this report. The arithmetic mean and standard deviation, in addition to the frequency histograms were used as a guide to classification. The following table is a summary:

Metal	Arith. Mean	Stand. Dev.	Possibly Anom.	Probably Anom.
Zinc	83.6 ppm	57.3 ppm	130-179 ppm	180 ppm
Copper	12.4	8.5	20- 39	40
Lead	13.9	6.4	20- 39	40
Silver	approx0.5	-	1.0-1.4	1.5

Maps, showing the distribution of these metals in the upper B soil horizon, were contoured on the basis of the above categories (see Figures 13, 16, 19 and 20).

11. COMPUTER DATA PROCESSING of GEOPHYSICAL and GEOCHEMICAL DATA:

(a) Introduction:

Early in September, 1968, after completion of the preliminary data processing, four important factors emerged:

(1) a relatively large section of the area surveyed was characterized by high induced polarization response;

(2) several areas exhibited "special effects" often indicative of sulphides;

(3) there was scattered but interesting geochemical coincidence with the IP survey

(4) there was close correlation of the IP with anomalous apparent resistivity and self potential values.

The surveys had, on the basis of preliminary data processing, indicated a rather large area of interest, and most of this area is covered with overburden. The problem, then, is to try to choose the most prominent and potentially the highest priority sections of the large "indicated" anomalous zone. Consequently, it was decided to proceed with additional data processing in order to aid in (a) the selection of the highest priority target areas and, (b) aid in the interpretation of these data.

(b) Theory Outline:

Because of the semi-quantatative nature of the majority of information, trend surface and residual analysis was employed. The purpose was to filter, or smooth out, local irregularities (by least squares mathematical means) and thus emphasize the overall regional trend. The statistically calculated trend data was then subtracted from the original information, leaving what is called the residual surface. High residual values are points which deviate significantly from the regional trend and are, therefore, local anomalies.

The induced polarization, resistivity, geochemical zinc values and geochemical copper values (since these exhibited the highest contrast and response), were processed by computer. The original results, then, were treated as if response was largely lithologic (or regional) in nature, and that variation after this regional response was subtracted was the important feature, and was thereby emphasized.

This may or may not be a valid geological assumption, however, it is more "real" than simply superimposing a flat, rather arbitrarily chosen plain (threashold value) through the original data surface and indicating that every value above (or below) the plain is, therefore arbitrarily anomalous (and should be investigated).

With the Tournigan Mining and Explorations' IP data especially, the area designated as "anomalous" by this empirical method, would be so large, that further investigation would be extremely costly.

The following is a summary of the technique of least squares fitting, and for ease of exposition, the case of a first degree trend surface will be cited.

The equation of a first degree trend is:

$$Z_n = a + bX_n + cY_n \qquad \underline{\text{Equation 1}}$$

Where a, b anc c are constants, and X_n and Y_n are cartesian co-ordinates and Z_n a data point.

In order to solve Equation 1 (in order to "best fit" a given set of data points) the constants a, b and c must be determined. By the technique of least squares, the following quantity must be minimized:

$$S = \sum_n (Zn - Zn')2 \qquad \underline{\text{Equation 2}}$$

Here Z_n are the data and Z'_n the trend surfaces values. Since Z'_n satisfies Equation 1, then

$$S = \sum_n (Z_n - a - bX_n - cY_n)^2 \qquad \underline{\text{Equation 3}}$$

Utilizing the max-min concept from the calculus, Equation 3 yields

$$\sum_n Z_n = aN + b\sum_n X_n + c\sum_n Y_n \qquad \underline{\text{Equation 4}}$$

$$\sum_n X_n Z_n = a\sum_n X_n + b\sum_n X_n^2 + c\sum_n X_n Y_n \qquad \underline{\text{Equation 5}}$$

$$\sum_n Y_n Z_n = a\sum_n Y_n + b\sum_n X_n Y_n + c\sum_n Y_n^2 \qquad \underline{\text{Equation 6}}$$

Equations 4, 5 and 6 can be solved for a, b and c. Then, for any X and Y, a Z is determined from equation 1. Z lies on a planar surface which best approximates the set of data. The residuals are the distances of the data points above or below the planar surface. Of course, the fourth degree surface does a better job of representing regional trends, and consequently, residuals from a fourth degree surface are physically more meaningful.

The calculation of a fourth degree surface follows the same procedure, except that fifteen constants must be determined, as compared with the three constants found above. To simplify the laborious algebra, normality of variables is commonly assumed. This means that the trend surfaces and residuals are most meaningful in the center of the map area, since the coordinate distribution most closely approximates a normal curve in the center of the distribution. Our method of dealing with the problem of normality of the data is described in the next section.

(c) Data Preparation:

The first step in data processing is the superposition of a coordinate system on the ground control grid. The coordinate system used should be such that each X and Y value used corresponds with one set of all the variable values. Because soil sample stations alternate with IP and resistivity stations, the variables do not fall neatly on the same coordinate points. To simplify the data processing, the origin of the geochemical data was shifted, with respect to the IP and resistivity origins, one unit in the positive X direction. Thus, the X axis was placed on line 10+00N; for the IP and resistivity, the origin was taken at 28+00W; for the geochemical data, the origin was placed at 27+00W. This had the effect of moving the geochemical data onto the IP and resistivity stations, thus simplifying the tabulating process. After the trend surface analysis, the geochemical results were shifted so as to correspond with their original position. A sample of the tabulating process follows.

On line 15+00N, at 5+00W, the following information was recorded:

Induced polarization	6.4
Resistivity	1257

On line 15+00N, at 4+00W, the following was recorded:

Geochem. soil sample (ppm Zn)	162
Geochem. soil sample (ppm Cu)	10

This information was tabulated as follows:

X	Y	Z_1	Z_2	Z_3	Z_4
+23	+5	6.4	1257	162	10

Before the tabulated data was forwarded for processing, one step further was taken. Data analysis involves statistical tests, and statistical tests are designed for data which is normally distributed. For this reason, we determined the departure of the data from normality, and improved the normality by using $\log_{10}$ in all statistical computations.

The procedure utilized was as follows: the skewness (β_i) and kurtosis (β_{ii}) of a data sample (about 30% of the data) was compared with that of the $\log_{10}$ of the sampled data. The necessary calculations were performed with the aid of the Geo-X Olivetti Underwood Programma 101 computer. The relevant equations are:

$$\beta_i = \left(\frac{\sum_n X_n^3}{N}\right)^2 \Big/ \left(\frac{\sum_n X_n^2}{N}\right)^3$$

$$\beta_{ii} = \frac{\sum_n X_n^4}{N} \Big/ \left(\frac{\sum_n X^2}{N}\right)^2$$

As a sample distribution approaches normality, β_i approaches zero and β_{ii} approaches a value of 3. For the IP values, skewness of the $\log_{10}$ of the data was smaller, by a factor of 10, than the skewness of the data. Kurtosis was unaffected by taking logs. For the apparent resistivity, the $\log_{10}$ data skewness was smaller by a factor of 4, and the kurtosis was slightly improved. Greater improvements were observed for the comparison of $\log_{10}$ geochem data. As a result, we used $\log_{10}$ of the data in all statistical tests. The previously discussed sample of tabulated data was then as follows:

X	Y	Z_1	Z_2	Z_3	Z_4
+23	+5	0.8061	3.0993	2.2095	1.0000

In this form, the data was sent on to Computrex Ltd. of Calgary Alberta. A total of 560 geochemical values, 271 IP and 274 resistivity values were forwarded.

d. Computrex Procedure:

The tabulated X, Y and four Z values forwarded to Computrex were punched onto standard cards. The trend surface and residuals were calculated in Montreal on the General Electric 625 Computer. These data were then returned to Calgary, where they were plotted using a Calcomp 770-663 plotter computer unit. Three maps, a fourth order trend surface, print out monitor and contoured fourth order residuals were prepared for each of the four sets of information.

12. DISCUSSION OF RESULTS:

(a) Self Potential:

The self potential values are essentially a by-product of the process of induced polarization and resistivity surveying. However, it is often useful information when the "a" spacing and transit interval are equal, as they were on the Tournigan Mining McDame property survey. The self potential results, because of the field array employed (Wenner), may be categorized by their "first derivative" values rather than discrete high or low values in themselves. This is necessary since each line, or section of line completed on separate days or in different directions are independent of adjacent lines or line sections.

The self potential results in millivolts are presented in plan in Figure 6. The reader is referred to this map for the following discussion.

Self potential values ranged from a high of 275 mv to a low of -354 mv. Anomalous self potential areas are designated by hatched linears in Figure 6, and are areas where the self potential gradient (first derivative) exceeds 0.5 millivolts per foot.

In general, the self potential anomalies are dominently westerly or northwesterly directed. Four areas of moderate to highly anomalous SP values were located and these are designated SP anomalies #1 to #4 inclusive. Several additional areas of smaller response are indicated on the accompanying self potential plan..

The largest change recorded is designated SP anomaly #1 and it is situated at 15+00E on line 45+00N. At this station a total change of 462 millivolts was recorded within 200 feet (gradient of 2.31 mv per foot).

S.P. anomaly #2 is situated at 10+00E on line 10+00N. In this area a total change of 424 millivolts in ground potential was recorded (2.12 millivolts per foot).

S.P. Anomaly #3 is a negative gradient extending from 10+00E; 50+00N to 3+00E; 60+00N. It trends westerly and attains a maximum amplitude of 1.40 millivolts per foot.

S.P. anomaly #4 extends from 9+00W; 50+00N to 7+00W; 55+00N. Maximum rate change is 1.23 millivolts per foot.

The origin of self potential anomalies has been the subject of considerable speculation. Spontaneous earth potential differences are known to be caused by local topography, however this is not believed to be a critical factor in the anomalies 1, 3 and 4 areas. Self potential effects are often observed over underground water channels, graphite, shear zones and changes in soil and rock types, in addition to battery effects over sulphides.

There is no suitable method of differentiation of the cause of anomalies on the basis of the self potential results alone. However, a change in soil types was observed close to the SP anomaly #3 and anomaly #4 areas. The soil type changed from sandy to sandy clay overburden.

Of special interest is the response obtained over a sulphide occurence immediately north of self potential anomalies #3 and #4. Here, a change of 1.43 millivolts per foot was observed, and believed to be attributable to the presence of the sulphides (mainly galena).

(b) Apparent Resistivity:

The final arithmetic apparent resistivity results in ohm-feet are presented in Figure 7. The frequency distribution of apparent resistivity values is shown in Figure 3 (Frequency Histogram). Individual results,(in ohm-feet) ranged from a low of 209 to a high of 11,519. The arithmetic mean of 291 values is 2402.8 and the standard deviation (σ) 1768.1 ohm-feet. Resistivity frequency distribution is multimodal and positively skewed (moment skewness of 6.8489) and quite peaked (moment kurtosis 12.2270). The primary mode lies between 1000 and 1500 ohm-feet (23% of the total population) and secondary mode between 2500 and 3000 ohm-feet (11.4% of the total population), tertiary mode between 6000 and 6500 ohm-feet.

The apparent resistivity (Figure 7) was contoured at 1000, 2500 and 6000 ohm-feet intervals.

Apparent resistivity trends are dominently west directed, with a well developed south west directed trend near line 30+00N.

The iso-apparent resistivity plan is simply an expression of the lateral variation of resistivity of the ground within the range of depth within which the major part of the current flows (in this instance less than 200 feet). Thus, without additional vertical information, interpretation is necessarily a "simplified" approximation (ie: a simple geometrical lateral representation of actual three dimensional bedrock conditions).

In general, resistivity lows are often caused by subsurface ground water, faults and shears in addition to sulphide mineralization. Resistivity highs are often indicative of massive (unaltered and unmineralized) bedrock.

There are several areas of very rapid rate change in the resistivity values and these are worthy of note. They occur at:

(1) Between lines 30N and 35N (east of the lake). Seven values on line 30N averaged 537 ohm-feet, whereas seven corresponding values 500 feet north, on line 35N, averaged 3391 ohm-feet. This disruption continues between the west half of the lines.

(2) On line 65+00N, between stations 13+00W (12,566 ohm-feet) and 19+00W (1005 ohm-feet) and,

(3) Line 15+00N, between stations 9+00W (7872 ohm-feet) and 7+00W (1676 ohm-feet).

Rapid changes in apparent resistivity,as described above, are often indicative of faults. The lateral discontinuity of resistivity between lines 30 and 35 north is nearly coincident with an airphoto linear, and close to an "assumed" fault indicated by H. Gabrielse (G.S.C. map 1110 A). These factors are good evidence for the presence of a major fault zone striking southwest between lines 30 and 35 north, with possible splaying at the northwest end of Atan Lake. Similarly, good evidence of a fault existing through Atan Lake and along the north side of the lake, less than 1000 ohm-feet resistivity low was found. Several additional subsidiary faults are indicated by resistivity and air photo data, and are all compiled in Figure 23.

A second feature of the iso-resistivity plan is critical to the interpretation and is discussed below.

Many of the individual lithologic units are characterized by similar resistivity response. A very striking feature of Figure 7, is the similarity of response in the area south of Atan Lake and east of the base line; with the area north of the lake and east of the base line. These areas exhibit trends and parallel responses which strongly suggest that the same series of steeply dipping lithologic units underlie both areas. If this inferrence is correct, it involves several hundred feet of right hand separation along the indicated major fault between lines 30 and 35 north..

The fourth order trend surface of the $\log_{10}$ of resistivity is presented as Figure 8. The coefficient of correlation of the surface is 0.476, indicating a moderately good fit was achieved.

NOTE: the coefficient of correlation is the most useful indication of the "goodness of fit". It is defined as:

$$r = \sqrt{1 - \frac{s_y^2}{\sigma_y^2}}$$

s_y = standard error or measurement = $\sqrt{\frac{\Sigma(d^2)}{N}}$
σ = standard deviation
d = deviation of actual values from theoretical
N = number of points

A coefficient of 0.0, defines a wholly imperfect relationship, whereas a coefficient of unity (r = 1) defines a wholly perfect relationship. (Normally coefficients greater than 0.35 indicate an acceptible fit).

The trend surface features a well developed resistivity low centered near the geographical center of the area surveyed. In three dimension, it may be thought of as the lowest part of a "saddle" surface, falling off rapidly at each end of the east-west trending medial axis. Noses, or hills of high resistivity impinge from the south and north-northwest. The precise cause of this resistivity low is not known. However, since it may be fault bounded, and is "along strike" from Atan Lake, and is similar in size and shape to the Lake, it is possible that the low is a product of fairly thick, damp overburden within the lake fault block extension. Several changes in soil type were noted in the area of the resistivity low, and an undetermined thickness of humus (swamp) observed between lines 45 and 50 north at 15+00W, which may be a remnant of a lake extension.

The residual surface of the apparent resistivity values is presented as Figure 9. This surface is a iso-resistivity plan of the amount "left" after the fourth order trend calculations are subtracted from the original data.

The resistivity residuals are quite complex; however, overall trends are predominently east-west, and there is a very crude symetrical distribution of residuals about a west trending axis.

Of special note are the negative residual values, since these indicate conductive zones. The residuals are classified as follows:

(1) moderagely to strongly negatively anomalous (-4000 and below);
(2) weakly to moderately negatively anomalous (-2000 to -3999);

Three residual resistivity anomalies are evident.

Resistivity anomaly #1 is situated north of Atan Lake, near line 30+00N. Computer extrapolation into an area not surveyed (Atan Lake) suggests that this anomaly may be more extensive than indicated by the original data.

Resistivity anomaly #2 is centered around 6+00W, 55+00N and extends south-easterly to a second low at 6+00W, 45+00N. Maximum abnormality is -8463 at the former center.

Resistivity anomaly #3 is situated along the west end of line 25+00N. Maximum abnormality is -3656.

A weak to moderate residual resistivity anomaly extends between the far east sections of lines 50 and 60 north; and another zone is evident at the west end of line 65 north.

Computer analysis of the apparent resistivity data of the Tournigan Mining survey has indicated that the above described anomalies are areas which deviate significantly from the regional trend. Anomalies one and two are situated in areas of original data abnormalities; however, the area of abnormality in the residual anomaly one zone has been enlarged whereas that of the #2 anomaly has been decreased. Residual anomaly #3 is very well defined and lies within an area not indicated as exceptionally anomalous by the original data. This is also the case with the weak to moderately anomalous zone between east ends of lines 50 and 60 north.

(c) Induced Polarization:

A total of 298 normalized induced polarization results, in milliseconds, are presented in Figure 10. The arithmetic mean is 12.2 ms., standard deviation (σ) is 9.8 ms.; and range 0.0 to 47.3 ms.

Relatively speaking, the induced polarization results from the McDame property of Tournigan Mining are much higher than average. Often induced polarization background is between 2 and 6 ms., and usually considered equivalent to approximately one percent scattered pyrite. In these cases, I.P. response in excess of 10 ms. is often considered anomalous. For example, a producing copper mine in southern B.C. is characterized by response just slightly over 9 ms. with the Hewitt Pulse type unit.

Based on the original induced polarization results, and statitical data, the following classification of induced polarization results can be made on the Tournigan Mining McDame area survey:

Value (milliseconds)	Classification
0.0 to 2.9	anomalously low
3.0 to 11.9	background
12.0 to 21.9	weakly anomalous
22.0 to 31.9	moderately anomalous
greater than 32.0	strongly anomalous

Based on this classification, we have some 40 percent of the area surveyed which is categorized as weakly to strongly anomalous.

Sulphide minerals often polarize in such a manner that trained operators may observe a difference in polarization types. These "special effects" were noted in the following areas, and are indicative of sulphide rather than membrane type polarization:

Area	Characteristic
60N; 2+00W	dV increase during pulse
55N; B.L.	8 sec/4sec. pulse ratio 1.33
" "	dV increase during pulse
55N; 2+00E	dV increases slightly during pulse
45N; 13+00E	8 sec/4 sec. pulse ratio 2.0
45N; 14+00E	dV increases during pulse
" "	8 sec/4 sec. pulse ratio 1.30
20N; 2+00E	dV increases during pulse
10N; 17+00E	dV increases during pulse

Several additional stations exhibited characteristics indicative of faults. Of special note are two negative IP responses observed at 5+00W and 30+00N and 11+00W, 15+00N. This may be caused by a relatively good polarizer located between a pot and electrode close to a relatively poor polarizer between the two pots. Two consecutive stations, at the extreme east end of line 50+00N exhibited zero IP response. This is sometimes indicative of highly fractured unmineralized bedrock. Three stations were noted for telluric noise.

Of special interest is the noise recorded at 6+00W, 45+00N, almost coincident with the position of the assumed fault extending from Atan Lake.

Figure 10, the normalized pulse IP plan, clearly shows a preponderance of west to northwest directed iso-induced polarization trends. North directed cross trends are featured in two areas: one in the south central area (10+00N, near the base line), and a second between 60+00N on the base line, and 75+00N, 12+00E.

Original data induced polarization anomalies are classified and rated according to the amplitude of response, areal extent and "special effect" characteristics.

IP anomaly one is situated south of Atan Lake and east of the base line. Maximum response was 47.3 milliseconds, and a special effect was observed at the southeast corner of the anomaly. The original data anomaly is approximately 2000 feet long and over 1200 feet wide. Apparently, it continues to the southeast into an area not surveyed, and abrubtly terminates westerly, near the shore of Atan Lake.

IP anomaly #2 is situated north of Atan Lake and east of the base line. It trends almost due east-west, and is approximately 2000 feet long and up to 1200 feet wide. Maximum response is 38.5 milliseconds. The overall similarities of anomaly #1 and anomaly #2 are obvious and striking. They are similar in many of the same ways in which the resistivity response is similar in the two areas.

IP anomaly #3 is centered on the base line at 55+00N. IP anomalies #4 and #5, situated south and north of #3 respectively, are in fact, part of the same high response area.

The fourth order trend surface of $\log_{10}$ induced polarization data is presented as Figure 11. The coefficient of correlation of the surface is 0.6706. One of the most evident features is the development of an elliptical "bowl" shaped low situated on the west portion of the area surveyed. The trend surface shows increasing response in all directions from this low, the most noticable occuring near the south central section of the grid, where a parabolic shaped high has been featured. To the east of this high, (and into an area not surveyed) extrapolation has indicated extremely low values.

The fourth order residual surface is shown in Figure 12. This surface is extremely complex and irregular. The trends are still predominently west to northwest directed; however, north cross trends are more evident. Areas of high positive residual data are anomalous, and have been categorized as follows:

Values	Category
2.0 to 9.9	weakly anomalous
10.0 to 19.9	moderately anomalous
greater than 20	strongly anomalous

Based on these categories, the residual surface has indicated as anomalous all the previously discussed original data anomalies (however reduced their areal extent somewhat), and located several areas as weakly anomalous that were not obvious in the original data plan. The original anomaly numbering system has been retained in presentation (viz: anomalies 1 to 5 respectively) and a sixth anomaly added.

IP anomaly #6 is centered at 19+00W on line 30N and extends about 500 feet southeast and 500 feet northwest.

A second area designated as a weak residual anomaly is centered at 10+00W, 25+00N.

It is of importance to note here that even if the induced polarization data is treated as if there was considerable regional (or lithologic) bias, the areas previously designated as anomalous are still maintained as anomalous. Mathematical analysis of the data has not essentially changed the importance of the IP response, and therefore, they require further, and serious, investigation. In addition, by changing the background so to speak, with trend analysis, two additional areas of interesting induced polarization response were outlined.

13. SUMMARY DISCUSSION OF THE GEOPHYSICAL SURVEYS

Just over 12 line miles of coincident self-potential, resistivity and induced polarization surveys were completed recently for Tournigan Mining and Explorations Ltd. on their property near McDame, B.C. The original results of these surveys are presented in Figures 6, 7, and 10, respectively, and a compilation of the original data in Figure 21. Various anomalies and abnormalities are very apparent, especially with respect to induced polarization. In addition, four self-potential anomalies were encountered and a widespread "less than 1000 ohm feet" resistivity low. The cause of the self-potential effects are not definitely known, however there is evidence of soil type change in S.P. anomalies #3 and #4 areas. On the other hand, a self-potential anomaly was recorded over a known sulphide occurrence immediately to the northwest.

Resistivity changes (lows) accompany increased moisture content in soils in addition to changes from the increase of conductivity attributable to sulphides. There is some evidence to support the view that the large resistivity low encountered west of Atan Lake may be due to the former possibility. The resistivity survey is often a guide to structure, and an interpretation of lithologic trends, and positions of indicated faults was prepared largely from resistivity data with reference to the additional six separate surveys. The general interpretation map is presented as Figure 23.

I.P. response ranged from 0.0 to over 40 milliseconds, and based on original data statistics, some 40 percent of the area surveyed may be classed as weakly to strongly anomalous. In addition, several areas exhibited special response often indicative of sulphides.

Fortunately, a known sulphide occurrence is present immediately northwest of the area surveyed and similar I.P., S.P. and resistivity response was observed, including the special effects. Samples from the showing were tested in a test cell for their relative polarization and returned the following:

Sample	Normalized Induced Polarization in M.S.
Pure Barite	0.6
Galena and host rock	15.0

The induced polarization anomaly, in many respects, conformed to the inferred lithologic trend. Thus in order to aid in delineation of target areas, a fourth order trend surface and residual surface analyses were applied to apparent resistivity and induced polarization data.

The residual data (original data minus the calculated trend surface) outlined the areas previously indicated as anomalous, as residually high also, thus confirming their importance. In addition to other areas of interesting induced polarization, response became apparent.

There is a final total of seven areas exhibiting high induced polarization response. The strongest six of these have been designated I.P. anomalies #1 to #6 inclusive. I.P. anomalies #2, 3, 4, and 5, are situated within the same general high response area, whereas #1 and #6 are somewhat removed.

14. DISCUSSION OF GEOCHEMICAL RESULTS:

(a) Zinc Content of the Upper B Soil Horizon:

The zinc content of the soil samples offered one of the best contrasts of the four metals determined. Values ranged from a low of 10 ppm to a high of 375 ppm. The arithmetic average is 83.6 and standard deviation 57.3 ppm. The values are hot HCl extraction method determined.

The arithmetic average compares favourably with those reported by others (eg; 50 ppm average on the Russian Plain, as reported by Vinogradov, 1959, in "The Geochemistry of Rare and Dispersed Chemical Elements in Soils").

The distribution of zinc value classes with respect to population, is shown in Figure 5(a). The histogram is multimodal, with two principal modes each containing close to 12% of the total population, the lowest between 40 and 45 ppm and a second between 80 and 85 ppm. The distribution is positive skewed (moment skewness 5.7637) and peaked (moment Kurtosis 10.3612).

Based on the statistical data, the following categories may be established:

Value (ppm)	Category
10 to 129	Background
130 to 179	Possibly anomalous
greater than 180	Probably anomalous

The zinc content of soil samples was plotted and contoured on the above described basis, and is presented as Figure 13. A total of five separate areas with zinc content greater than 180 ppm are present, however three of these areas are only "one sample" high's. They are all enclosed in possibly anomalous envelopes (130 to 179 ppm).

Zinc anomaly #1 is situated immediately south of the south shore of Atan Lake. The "probably" anomalous area is wishbone shaped and contains three high values (220, 290 and 375 ppm). It apparently terminates abruptly to the west, but may extend east into an area not sampled.

Zinc anomaly #2 is centered some 1200 feet south of zinc anomaly #1. One "probably" anomalous value (375 ppm) is enclosed in an irregular shaped "possibly" anomalous envelope.

Zinc highs number 3 and 4 are much smaller than, but situated close to, IP anomalies #2 and #3.

A fifth area of interesting zinc content in upper B soil horizon was located at the extreme west end of line 15+00N. A value of 270 ppm was encountered here.

The fourth order trend surface of the $\log_{10}$ of zinc content is presented as Figure 14. The coefficient of correlation of the surface is 0.5149. It features rather an unusual high, striking north across the area sampled, from the southwest corner, and trends "across' the known lithologic trend. The surface shows that values fall off sharply to the east, and more gently to the west.

The trend surface strongly suggests that the overall, general distribution of zinc in soils is not primarily lithologic in nature. However, within the +60 trend surface contour, by far the majority of the soil descriptions were "pebbly sand", whereas outside this high (especially to the north and west) much of the soil was described as clayey sand or sandy clay.

The contoured fourth order residuals are presented in plan in Figure 15. The residual values are classified as follows:

Classification	Value (ppm)
Weakly anomalous residual	25 - 99
Moderately anomalous residual	100 - 149
Strongly anomalous residual	greater than 150

Subtraction of the trend surface (variable background) from the original data, has, in some respects, altered the priority of individual zinc high's. More priority was awarded the northwest area (that area underlain by mixtures of clayey sand, sandy clay, and pebbly sand) than to the area to the south and southwest (underlain dominently by pebbly sand). Relative anomaly numbers were retained and zinc in soil residual anomalies #1 through #4 are situated in the same areas as original data anomalies of corresponding designation. However, their extent, amplitude and size has been altered somewhat. Two additional areas of strongly residual abnormality were emphasized by trend analysis. These are designated anomalies #5 (situated at 17+00W, 60+00N) and #6 (at 11+00W, 65+00N) and were not readily apparent on the original data plan.

(b) <u>Copper Content of the Upper B Soil Horizon</u>:

The copper content of the McDame area soils ranged from a low of 5 to a high of 120 parts per million (hot HCl extraction). The arithmetic mean of the 300 copper determinations is 12.5 and standard deviation 8.5 ppm. The frequency distribution of values is presented in Figure 4(a). The curve is positive skewed (log normal) and the moment skewness 2.6574. It is moderately peaked, with a moment Kurtosis 6.7458. There is one very prominent mode, between 10 and 20 ppm. and this area represents some 68.4% of the total population.

On the basis of these statistical data, the following original copper content categories may be established:

Category	Value (ppm)
Background	7 to 19
Possibly anomalous	20 to 39
Probably anomalous	greater than 40

The average copper content of soil in the McDame area property is somewhat lower than usual (world average roughly 20 ppm). and therefore shifts the threshold values downward.

For the following discussion, refer to Figure 16.

Two areas of probably anomalous copper content were located by soil sampling. These are designated copper anomalies #1 and #2. Copper anomaly #1, situated south of Atan Lake (and coincident with IP anomalies #1 and Zinc #1) exhibits a maximum value of 120 ppm. at station 5+00E on line 20+00N. The only other high result was located on the next line north at 3+00E.

Copper anomaly #2 is situated west of the base line at the southend of the area sampled. It is coincident with zinc anomaly #2, and contains values of 40 and 44 ppm.

The fourth order trend surface of $\log_{10}$ of copper content is presented as Figure 17. The coefficent of correlation of the surface is 0.4414.

The copper trend surface is somewhat similar to the zinc trend surface. A north trending copper high is featured in the south corner of the area surveyed, and this is flanked to the northwest by a kidney shaped low; and to the northeast by a parabolic low. Overall trends within the greater part of the grid area are northerly, with northwest directed trends predominating near the north end of the grid. As was the case with the zinc content trend, the copper trend indicates "cross structure" highs which are apparently more related to soil types than to lithology. Most of the trend surface highs are situated in areas described as pebbly sand overburden, and lows in areas of mixed soil varieties (especially clayey sand, sand, humus and pebbly sand).

Care must be taken in interpretation of data from the corners of trend surfaces and residual surfaces. These areas are often not covered by the actual ground surveys and are extrapolated from the data close by. Thus, the high trend surface values in the extreme north and extreme south corners of Figure 17, must be highly suspect.

The residual surface of the copper content is presented in Figure 18. Two prevailing trends are apparent; the primary trend, northwest; and secondary trend north to northeast. The following categories of positive residuals may be established:

Category	Value
Weakly anomalous residual	1 to 4
Moderately anomalous residual	5 to 9
Strongly anomalous residual	greater than 10

Based on this classification (with the trend surface subtraction of background), three additional areas of strong residual abnormality emerge. The original copper content anomalies numbers 1 and 2 have been retained, and anomaly two must still be considered interesting even though trend surface subtraction (due to extrapolation of values in the area) has greatly reduced the amplitude of this copper high.

The additional residual copper positives are centered in the following areas:

residual copper #3: 30+00N; 21+00W
Residual copper #4: 40+00N; 15+00W
residual copper #5: 60+00N; 12+00W

However, each of these residual copper highs are quite limited in extent.

Trend surface and residual surface analysis of the copper content in the upper B soil horizon, has shifted the priority of areas somewhat. Higher priority has been awarded the area underlain by mixed soil varieties, and lower priority to the area of predominently pebbly sand overburden. Consequently, an additional three "anomalous" copper areas have been indicated, however, these are quite restricted in lateral extent.

(c) Lead Content of the Upper B Soil Horizon:

The lead content of the McDame area soils ranged from a low of 4 to a high of 52 parts per million. The arithmetic mean of 300 analysis is 13.9, and standard deviation 6.4 ppm.

A frequency histogram of the population of lead is numbered Figure 4(b). The primary mode lies between 10 and 20 ppm. and accounts for about 67% of the total population. A secondary mode lies between 40 and 50 ppm.

The range and contrast of lead is not excessive, and therefore these data were not further processed. However, results are shown in Figure 19, and contoured at 20, 30 and 40 ppm where applicable. The following categories may be established:

Category	Range (ppm)
Background	0-19
Possibly anomalous	20-39
Probably anomalous	greater than 40

Only one area falls in the "probably" anomalous category, and this is situated south of Atan Lake, in the same area as IP anomaly #1, zinc anomaly #1 and copper anomaly #1.

A second area of "possibly" anomalous lead content is located north of Atan Lake, and centered close to the assumed major fault between lines 30 and 35 north.

(d) Silver Content of the Upper B Soil Horizon:

The silver content of the upper B soil horizon is presented in plan as Figure 20. Individual values ranged from less than 0.5 (limit of detection) to 2 parts per million. In general, these results are relatively low. The frequency distribution of silver is shown in Figure 5(b), and features a mode between 0.5 and 1.0 ppm. Well over 90 percent of the silver content of the soils falls within the less than 0.5 to 1.5 ppm range.

Two areas of slight interest are shown in Figure 20. The first is two small patches of +1.5 values , located south of the Atan Lake and east of the base line, in the aame general area as the other relatively high metal values. A second is located on the south corner of the area surveyed, where one 2 ppm content was encountered.

It is rather interesting to note the abundance of 1 ppm values across the south section of the area sampled, almost coincident with an assumed fault. Similarily, there are a number of west directed trends situated west of Atan Lake which approximately correspond with the assumed faults in this area.

15. SUMMARY DISCUSSION OF THE GEOCHEMICAL SURVEY

The overall geochemical response of zinc, copper, lead and silver in the soils of the Tournigan McDame area property was not overly impressive. Zinc content provided the best contrast and range, however the average copper and lead content was relatively low. Moderately low contrast was provided by silver content.

These overall conditions may only be due to a predominance of one of two basic factors:

(a) only small amounts of these metals are actually present in the underlying bedrock,

(b) failure or partial failure of these metals to migrate from the bedrock into the upper B horizon.

The simplest explanation, of course, is the former. However, a certain amount of support for the latter explanation exists in the data.

Quite often the character of the bedrock is a prime factor to be considered in geochemical evaluation (in addition to soil varieties, types, organic content, ground water, organisms, topography, etc.), and, in general, metals are not easily dissolved from limestones. This is partially due to the rather high calcareous portion of the soil horizon overlying the bedrock, which "fixes" the metals, either by precipitation or adsorption. Consequently little is actually available for migration and redeposition even though the bedrock may contain appreciable quantities of these metals. Some support for this proposition was found in the metals content of a variety of soil types. One soil sample, collected at 40+00 north; 18+00 west, was a white marl (highly calcareous) soil, and five samples on various parts of the grid were collected from A horizon humus. Their metal content is compared with the overall averages below:

	Cu	Pb	Zn	Ag
Overall average (300 samples)	12.5	13.9	80	~ 1
One marl sample	18	10	75	1.5
Average of five humus samples	9	8	21	0.5

"A" horizon humus samples are often high in metals, since these areas (swamps and muskegs) are "traps", and the organic compounds chelate metals, forming tightly bonded organic compounds. However, within the area sampled, a five sample average content of Cu, Zn, Pb and Ag, was considerably less than the overall average. On the other hand, the marly "soil" contained near average content of these metals. This may be due to, at least partial failure of the metals to be mobilized adequately from the limey soil within the area surveyed. It also suggests that "probably" anomalous metal areas previously described have not been widely removed from their place of origin.

Fourth order trend surface analysis of the zinc and copper content of the soil samples collected, indicated an increase in these metals along a trend, (a) nearly perpendicular to the indicated lithologic trends, and (b) contrary to the direction of prime geophysical response. Further investigation revealed that the regional positive zinc and copper content corresponds well with an area of overburden described almost wholly as pebbly sand. The section of the property in which the trend surface lows were outlined, is underlain by various soil types - primarily sandy clay, clayey sand, and humus, with a few patches of pebbly sand. It appears then, that the pebbly sand-band provided the best porous medium for ground waters. Removal of the trend surface "background" from the original data had the effect of slightly increasing the priority of the clayey sand - sandy clay overburden area (with poor permeability), and decreasing the priority in the permeable predominantly pebbly sand overburden area. Consequently, additional areas of interesting zinc and copper content of the soils were outlined.

By far the most interesting section of the area surveyed, containing above average zinc, copper, lead, and to a small extent silver, is situated south of Atan Lake and east of the base line. The zinc content in this vicinity was up to over four times the average content, copper over nine times, lead over three times, and there was a slight increase in the silver content.

A second area of interest is a coincident copper and zinc residual high centered between 10 and 15+00 west on line 60+00 north. Additional areas of metal content in soil interest are outlined on the geochemical compilation map, Figure 22.

It is rather interesting to note the lack of correlation of the metal values with the indicated geological trends. Several different contour intervals were selected on the different metal distributions maps, and many of the trends were unrelated to the inferred lithological trends, and more related to soil types.

The silver content plan (Figure 20) shows considerable bias with the "assumed" and indicated fault zones.

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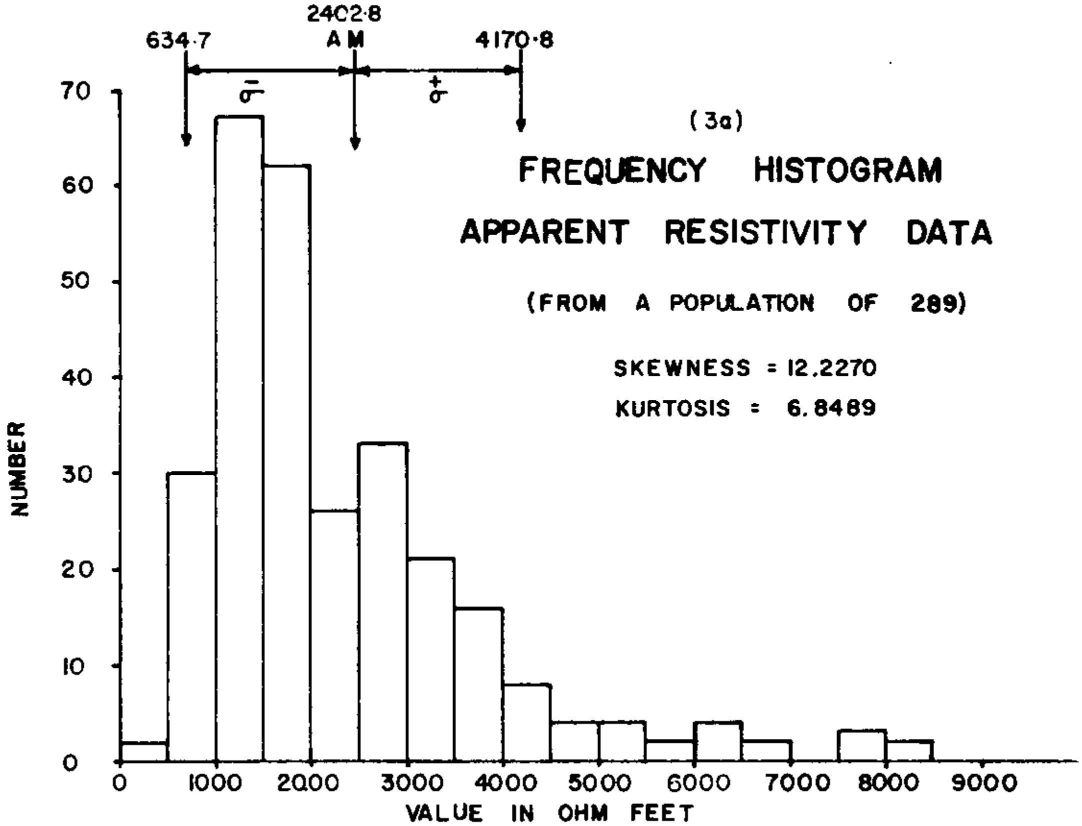


(3a)

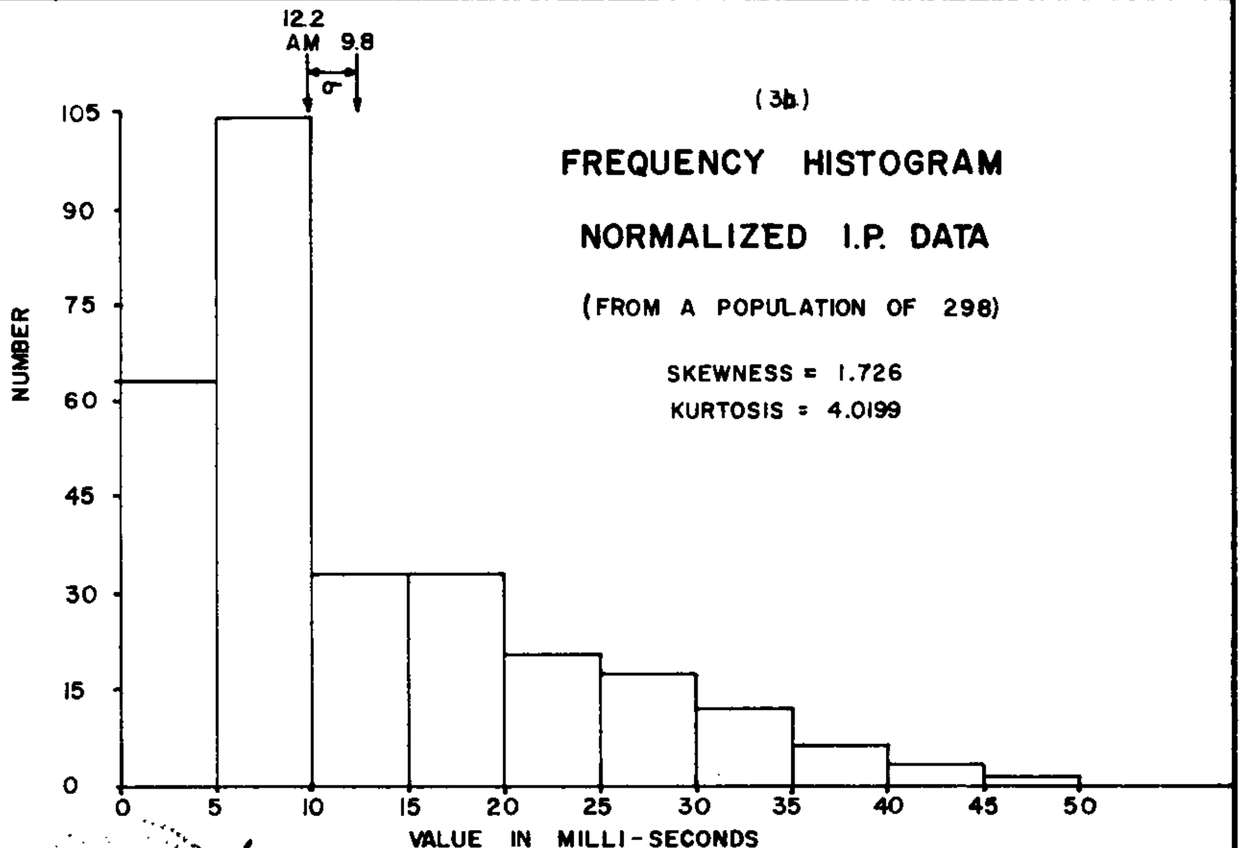
FREQUENCY HISTOGRAM

APPARENT RESISTIVITY DATA

(FROM A POPULATION OF 289)

SKEWNESS = 12.2270

KURTOSIS = 6.8489



(3b)

FREQUENCY HISTOGRAM

NORMALIZED I.P. DATA

(FROM A POPULATION OF 298)

SKEWNESS = 1.726

KURTOSIS = 4.0199

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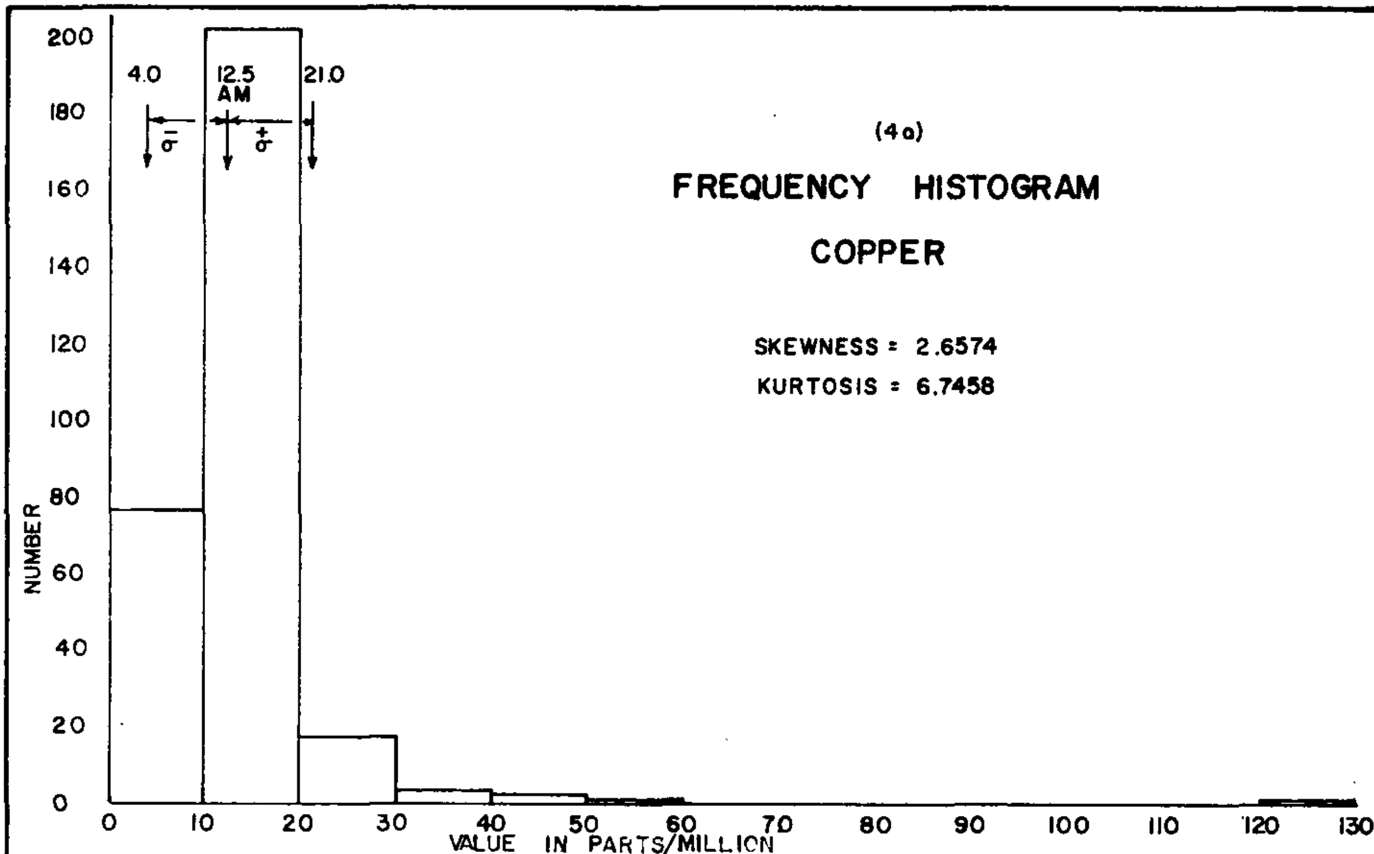
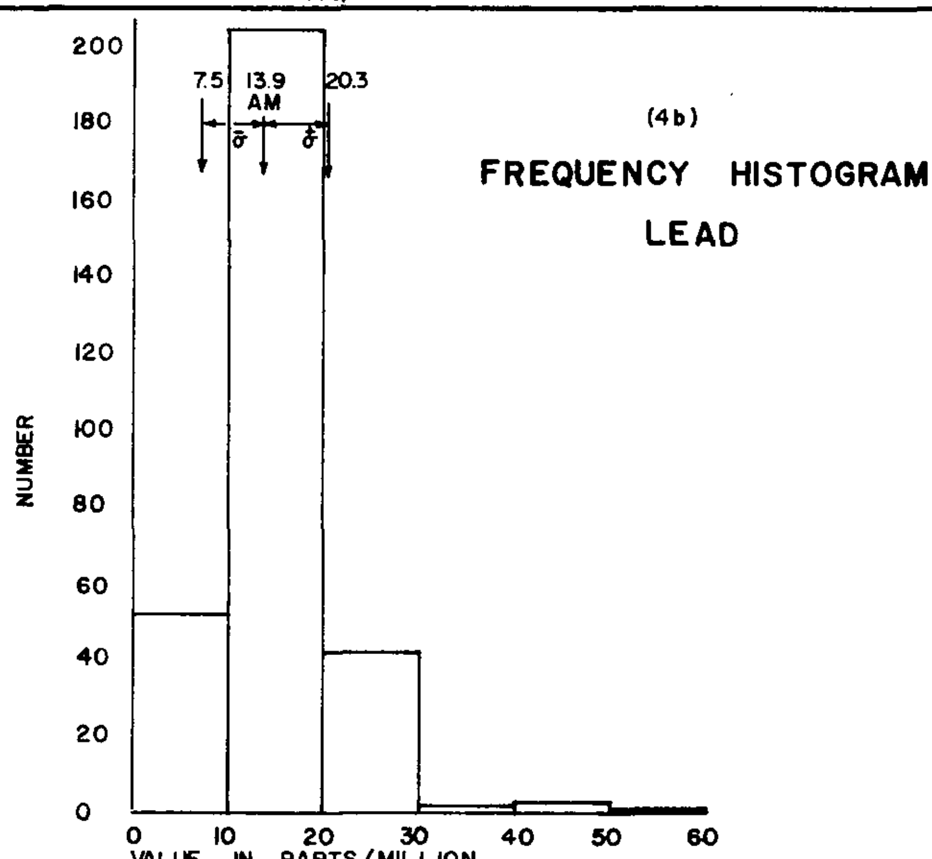
LIARD MINING DIVISION, B.C.

FREQUENCY HISTOGRAMS

GEO-X SURVEYS LTD.	DRAWN D.E.Y.	CKD. JC	JOB NO. 1049
	APPR'D. D.P.L.	DATE Sept., 1968	FIG. NO. 3



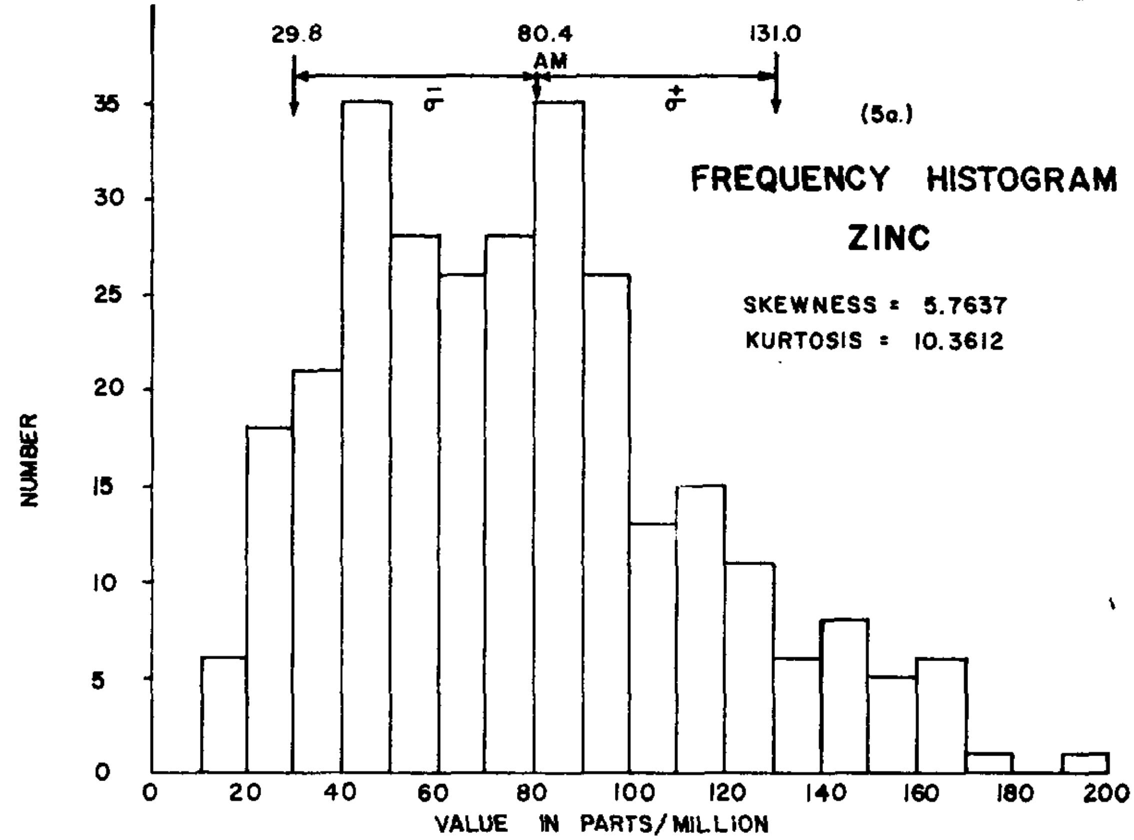


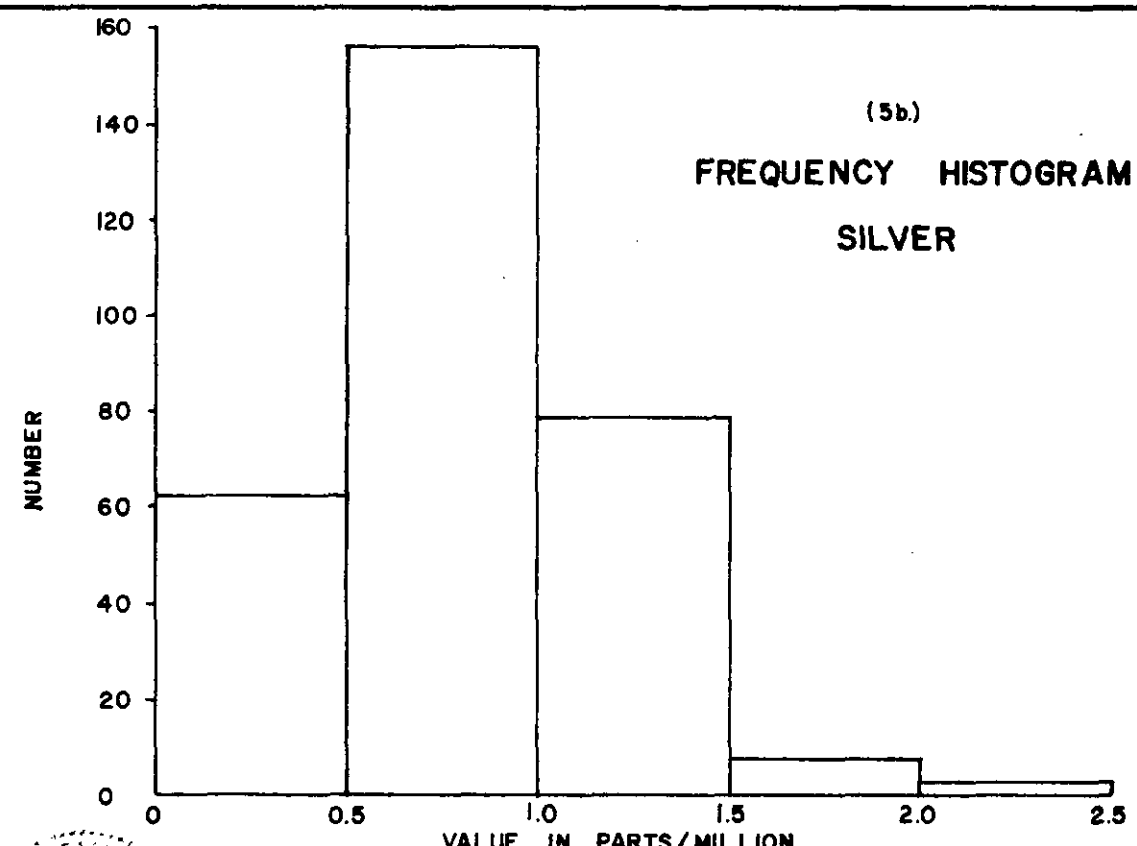
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, B. C.

FREQUENCY HISTOGRAMS

GEO-X SURVEYS LTD.

DRAWN D.E.Y.	CKD. JC	JOB NO. 1048
APPR'D. D.R.L.	DATE Sept., 1968	FIG NO. 4





TOURNIGAN MINING EXPLORATIONS LTD. LIARD MINING DIVISION, B.C.		
FREQUENCY HISTOGRAMS		
DRAWN D.E.Y.	CKD. JC	JOB NO. 1049
APPR'D. D.A.C.	DATE Sept., 1968	FIG. NO. 5

GEO-X SURVEYS LTD.

APPENDIX I

PERSONNEL

Name:	COCHRANE, Donald Robert
Education:	B.Sc. - University of Toronto M.Sc. (Eng.) - Queen's University
Professional Associations:	Professional Engineer, registered in British Columbia, Ontario, Saskatchewan. Member of M.C.I.M.M., M.E.I.C., M.G.A.C., M.M.A.C.
Experience:	Engaged in the profession since 1962 while employed with Noranda Exploration Co. Ltd., Quebec Cartier Mines Ltd., Meridian Exploration Syndicate. Experience in West Indies, Central and South America, U.S.A. and Canada.

APPENDIX I

PERSONNEL

NAME: CERNE, James

EDUCATION:

B.S. Geology (June 1967)
Case Institute of Technology - Cleveland, Ohio.

M.S. Geophysics (August 1968)
California Institute of Technology - Pasadena, California.

EXPERIENCE:

July 1965 - June 1967 - Metallurgy Dept., Case Institute of Technology - Student Asst.

June - September 1967 - N.A.S.A. Manned Spacecraft CNT. Lunar and Earth Sciences Div., Geophysics Group, Houston, Texas.

September 1967 - August 1968 - California Institute of Technology, Seismological Laboratory, Graduate Research Asst.

September 1968 - present. Employed by Geo-X Surveys Ltd. as Geophysicist.

APPENDIX I

PERSONNEL

Name:	WILSON, Norman George Robert
Education:	Junior Matriculation equiv., Grade 13 Math.
	2nd Year National Electrical Engineering.
Experience:	12 years Royal Air Force - Radar Technician.
	6 months British Government Communications - Radio Technician.
	Presently employed by Geo-X Surveys Ltd., since October 22nd, 1967 doing Induced Polarization, Electromagnetic and Magnetometer Surveys under Professional supervision.

APPENDIX I

PERSONNEL

Name:	KEY, Robert A.
Education:	Grade XII Diploma. 1 year Petroleum Geology at the Institute of Technology and Arts in Calgary.
Experience:	2 years in Steam Heating Design Drafting. 12 years with Mobil Oil Canada Limited, Senior Draftsman.

APPENDIX I

PERSONNEL

Name:	YIP, David Edward
Education:	Grade 12 - Majors: Science, Mathematics, Social Studies and Industrial Arts. Lake Cowichan Secondary School 1 year - Vancouver Vocational Institute - Drafting Training.
Experience:	Presently employed by Geo-X Surveys Ltd. since November 27, 1967 as Draftsman.

APPENDIX II

Personnel and Dates Worked

The following Geo-X Surveys Ltd. personnel were employed on the Tournigan Mining and Explorations project on the dates set out below:

D.R. Cochrane	P.Eng. Data processing, reduction and report preparation.	July 23, Aug. 5, 9-10, 12-17, 23, 25 and 27. Sept. 2-4, 10-11, 18 & 26. Oct. 8-11, and 14-18.
J. Cerne	Geophysicist, data processing, report preparation.	Sept. 13, 16, 18-19. Oct. 7-11.
N. Wilson	Instrument operator	Aug. 12-23.
J. Wiggins	Soil sampler	Aug. 15-23.
D. Yip	Drafting	Jul. 25-26. Aug. 28-29. Sept. 3-4, 11-12. Oct. 11, 15-18.
R. Key	Drafting	Aug. 26, 28-30. Sept. 11-12, 25, 27-30. Oct. 1, 3-4, 7-11, 15-18.

APPENDIX III

COST BREAKDOWN

The following is a cost breakdown of an I.P. and Geochemical Survey conducted by Geo-X Surveys Ltd. for Tournigan Mining Explorations Limited over the Adair, Ski, August and Atan claims in the McDame, B.C. area.

13 line miles as per Agreement dated July 25, 1968.		$6,050.00
Data preparation, computer data processing, special interpretation and report.		
Computer/plotter time	$ 405.00	
D.R. Cochrane - 6 days @ $125.00	$ 750.00	
J. Cerne - 5 days @ $80.00	$ 400.00	
Drafting and technical - 38 hrs. @ $7.50/hr.	$ 285.00	
		$1,840.00
		$7,890.00

S.L.Sandner, Pres.

S.L.Sandner

GENERAL SPECIFICATIONS OF THE HEWITT PULSE TYPE INDUCED POLARIZATION UNIT.

Transmitter Unit

Current pulse period (D.C. Pulse Manual initiated timer	1 - 10 seconds
Current measuring ranges	0 - 500 0 - 1000 Milliamperes 0 - 5000
Internal voltage converter 27 volt D.C. 350 watt output with belt back batteries	250 500 volts D.C. 1000 Nominal

500 watts using 27 volts aircraft batteries.

Transmitter can switch up to 3 amps at 1000 volts from generator or battery supply with resistive load. The switching is done internally in the transmitter unit. Remote control output can switch up to 10 kilowatts of power by using a separate control unit. A remote control cord is supplied with auxiliary equipment.

Receiver Unit

Self Potential Range	0 - 1000 millivolts 1 millivolt resolution
Impressed EMF Ranges	0 - 30 0 - 100 millivolts 0 - 300 0 - 1000
Input Terminals with Three Combinations	$P_1 - P_2$ $P_1 - P_0$ $P_2 - P_0$
Induced Polarization Ranges	0 - 30 0 - 60 millivolt 0 - 90 seconds
Integration Time Periods	.8 seconds 1.6 seconds

Tandem Integration Time Periods	1.6 seconds 3.2 seconds
Input Filtering	3 ranges plus 4 integration combinations
Delay Time from Cessation of Current Pulse	.3 seconds

(Combined Photo Electric Coupled Receiver and Transmitter)

Operation Temperature -25° F - 120° F

POWER SUPPLY

Receiver Unit	4 Eveready E136 Mercury Batteries 2 Eveready E134 Mercury Batteries 2 Eveready E401 Mercury Batteries
Transmitter Unit	Sealed Rechargeable 8 amp. hr. belt pack capable of driving the converter at 350 watts for a minimum of one day's operation before recharge.

Manufactured by Hewitt Enterprises, Box 978A, Sandy, Utah, 84070
Phone: 801 571-0157

Specifications for MF-1 Fluxgate Magnetometer

Maximum Sensitivity:	20 gammas (per scale division) on 1000 gamma range.
Readability:	5 gammas (1/4 scale division) on 1000 gamma range.
Ranges: (Full Scale)	1,000 Gammas 3,000 gammas 10,000 gammas 30,000 gammas 100,000 gammas
Maximum Range:	± 100,000 gammas
Latitude Adjustment Range:	10,000 to 75,000 gammas, Northern hemisphere convertible to: 10,000 to 75,000 gammas, Southern hemisphere or ± 30,000 gammas equatorial.
Dimensions: (including Battery Case)	7" x 4" x 16"
Weight: (including Battery Case)	9 lbs.
Batteries:	12 flashlight batteries ("C" cell)

APPENDIX V

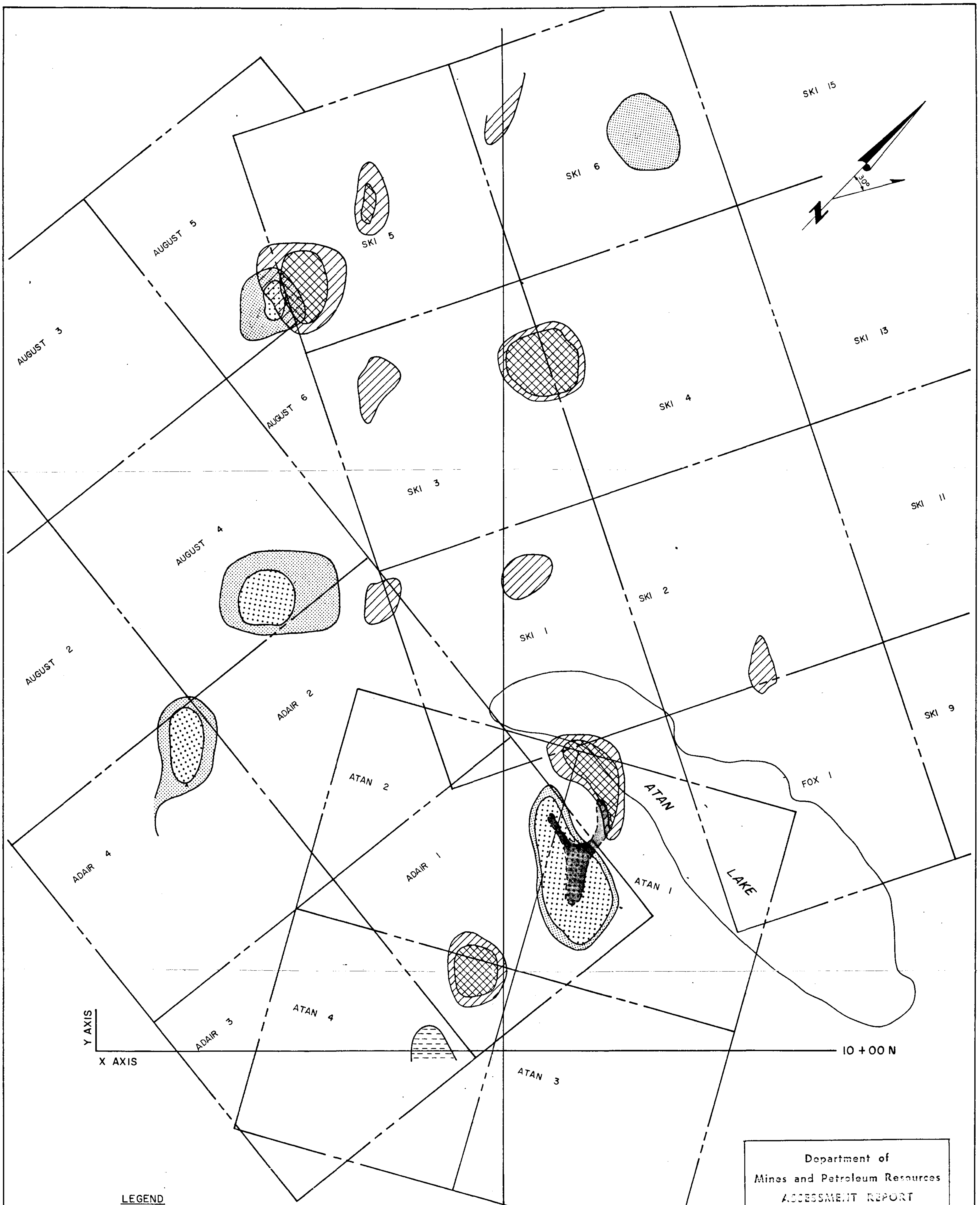
Methods of Determination of Copper, Lead, Zinc, Silver, Nickel and Cobalt in Geochemical Samples, As described by T.S.L. Laboratories Limited in a Communication with Geo-X Surveys, June 21st, 1968.

The fines are separated to minus 80 mesh through a nylon mesh.

1 gram sample is digested with Nitric Acid, and the volume brought to 10 mils.

This solution is submitted to the Atomic Absorption Spectophotometer and the elements are read and compared against appropriate standards. The analytical lines used are:

Copper	3274
Lead	2833
Silver	3280
Nickel	2320
Cobalt	2407



LEGEND

ZINC
Moderate Residual
Strong Residual

COPPER
Moderate Residual
Strong Residual
Strong Original

LEAD
Probably Anomalous

Department of
Mines and Petroleum Resources
ACCESSMENT REPORT
NO. 1813 MAP 3

0 400 800 1200
SCALE : FEET

1813

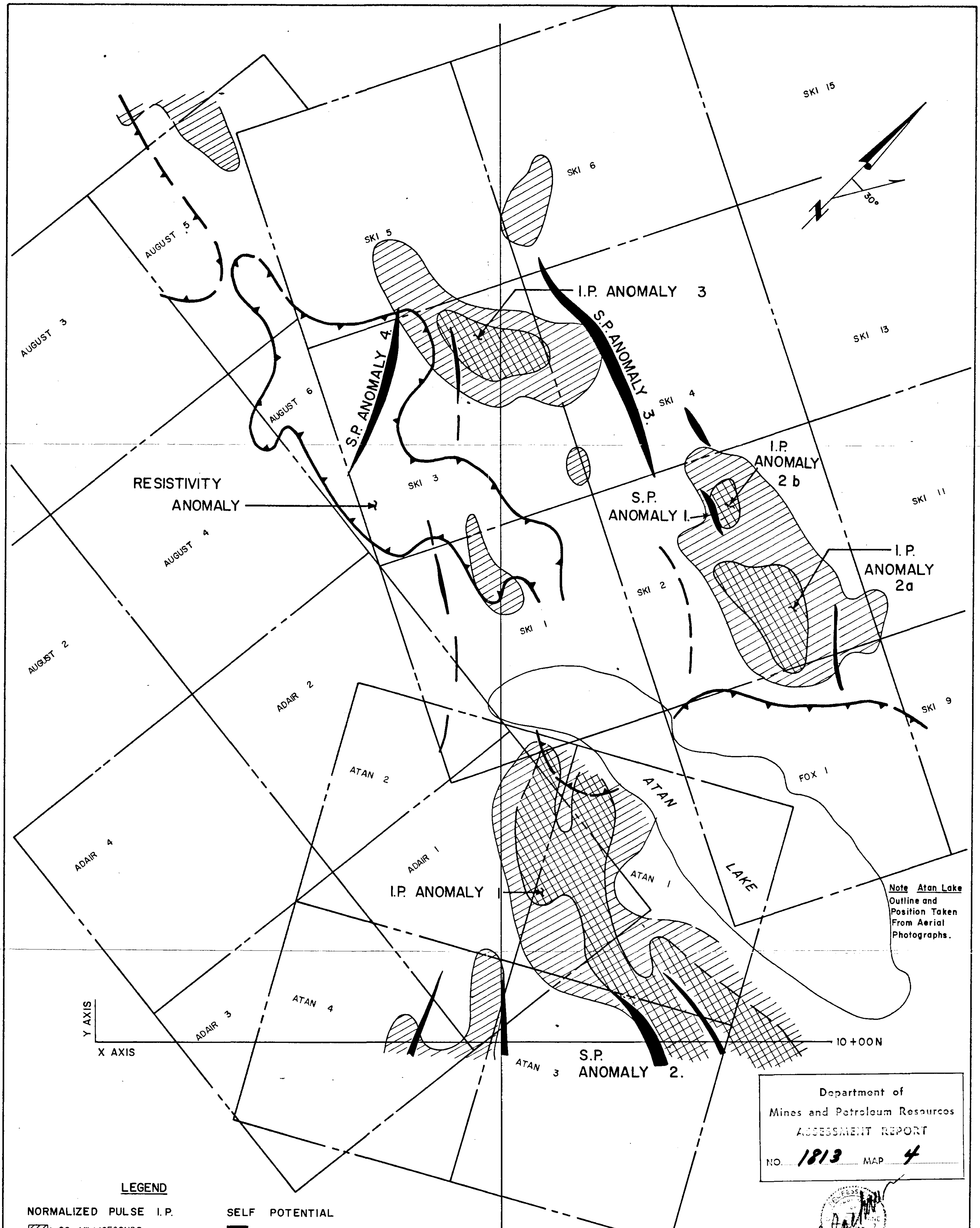
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION BRITISH COLUMBIA

COMPILATION OF
GEOCHEMICAL DATA
(ORIGINAL & RESIDUAL)

DRAWN		JOB NO.	FIG. NO.
CHECKED			
APPROVED		1049	22
DATE			

GEO-X SURVEYS LTD.

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE
SKI, ADAIR, ATAN, & AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD.
SITUATED NEAR McDAME B.C. IN THE LIARD MINING DIVISION,
BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C.
DATED SEPTEMBER 1968



Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1813 MAP 4

LEGEND

NORMALIZED PULSE I.P.

- >20 MILLISECONDS
- >30 MILLISECONDS

APPARENT RESISTIVITY

- < 1000 OHM FEET

SELF POTENTIAL

- >0.5 MILLIVOLTS / FOOT

1813

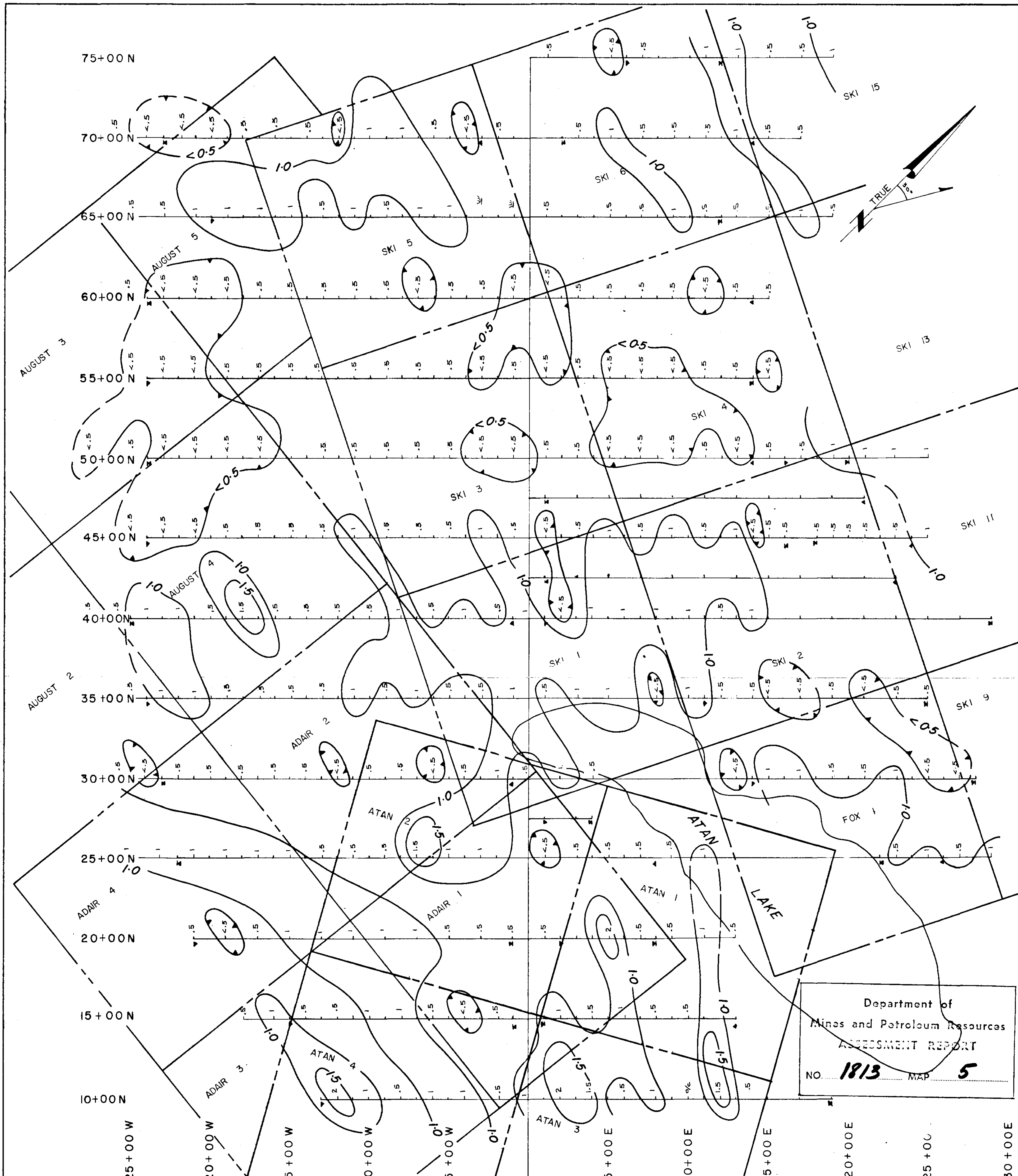
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

COMPILATION OF GEOPHYSICAL (ORIGINAL) DATA

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, & AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME B.C. IN THE LIARD MINING DIVISION BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER, B.C. DATED SEPTEMBER 1968

GEO-X SURVEYS Ltd.

		JOB NO.	FIG. NO.
DRAWN	R.C.	1049	21
CHECKED			
APPROVED			
DATE	SEPT., 1968		



0 400 800 1200

SCALE : FEET

TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

GEOCHEMICAL SOIL SAMPLING
SILVER (p.p.m.)

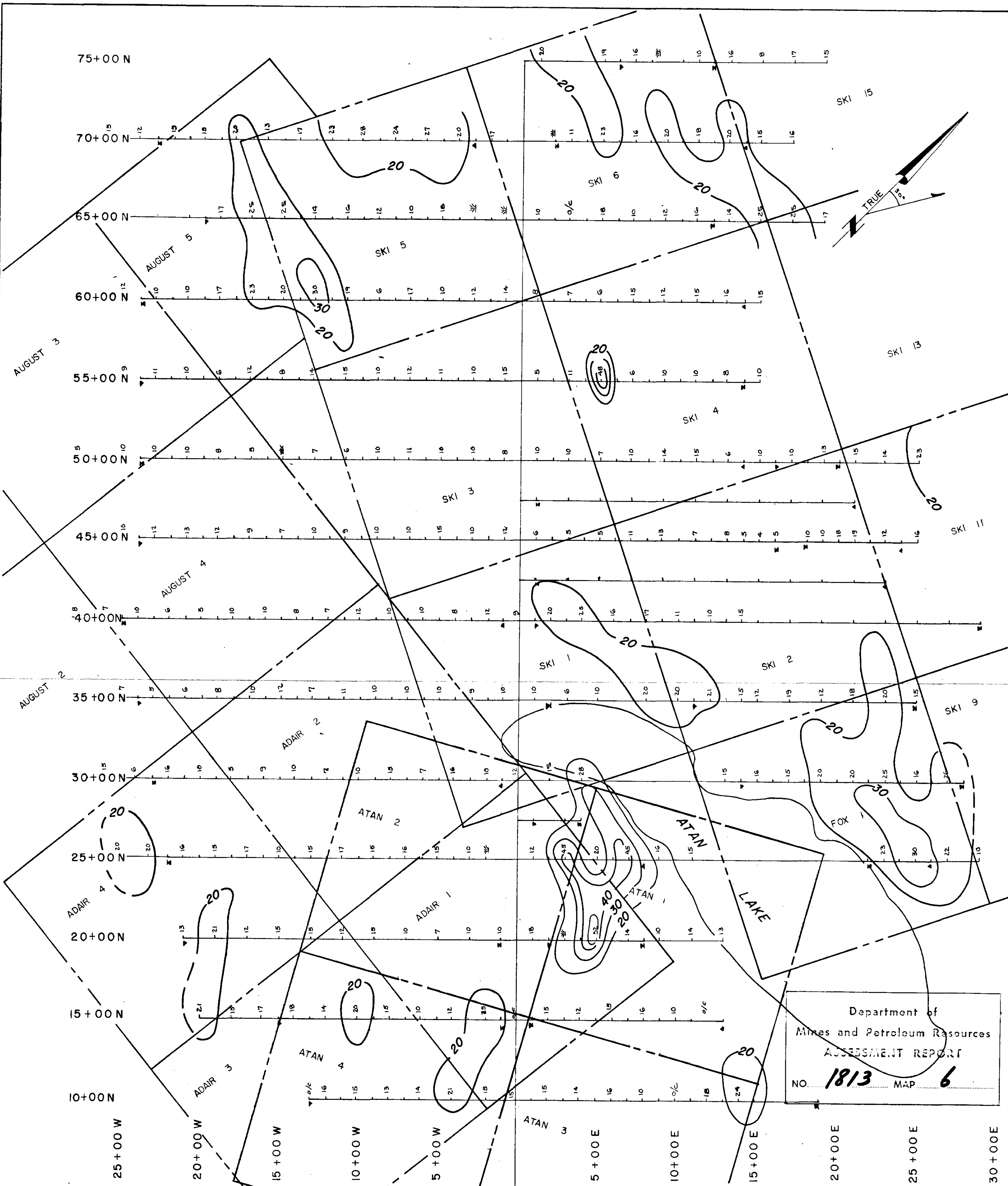
(3)

DRAWN	R.K.	JOB NO	FIG. NO.
CHECKED	CRL	1049	20
APPROVED			
DATE	SEPT., 1968		

GEO-X SURVEYS Ltd.

1813

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C. DATED SEPTEMBER 1968



0 400 800 1200

SCALE : FEET

1813

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B. C.
DATED SEPTEMBER 1968

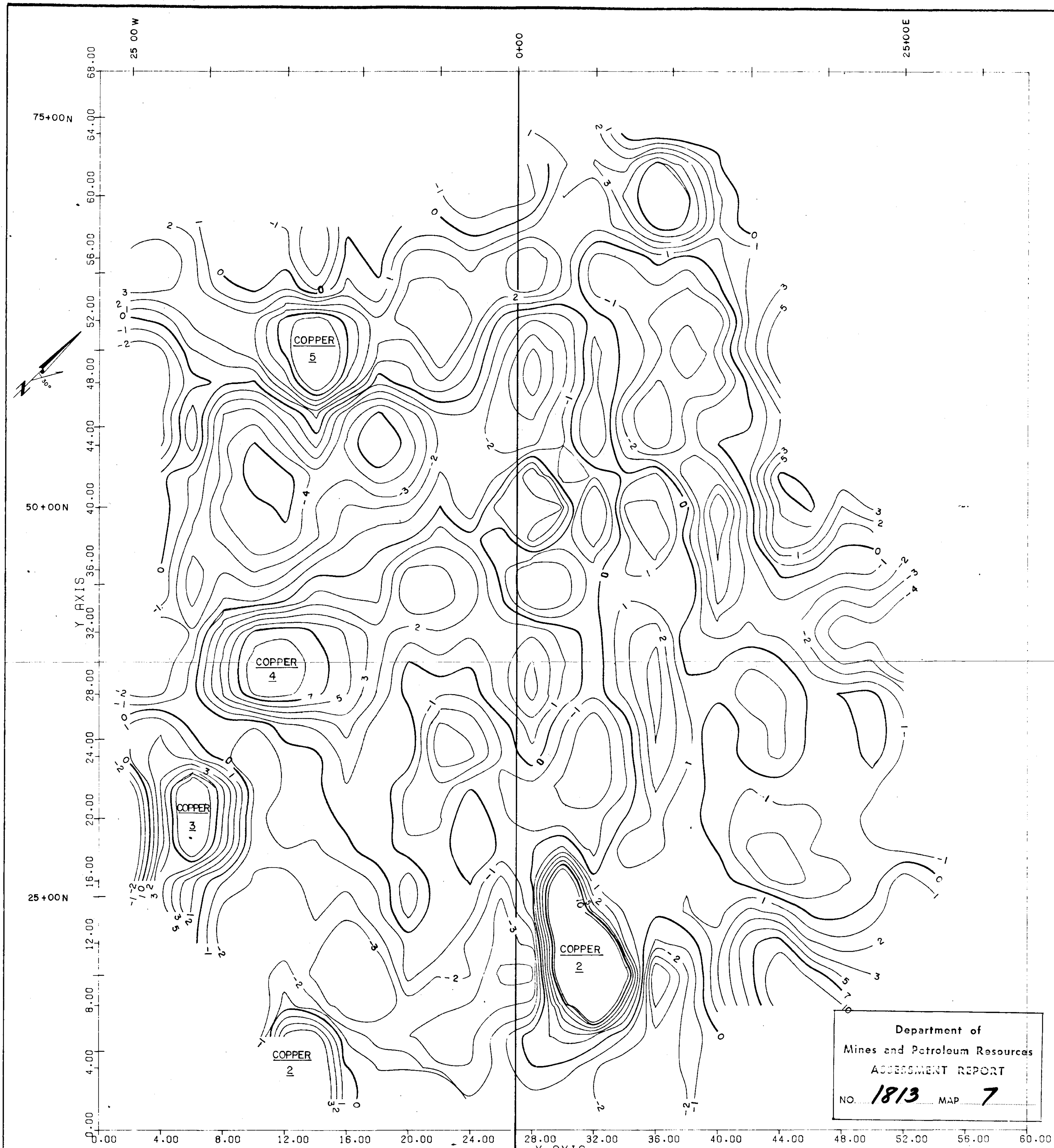
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

GEOCHEMICAL SOIL SAMPLING
LEAD (p.p.m.)

(4)

GEO-X SURVEYS Ltd.

DRAWN	R.K.	JOB NO	FIG. NO.
CHECKED	DRC	1049	19
APPROVED			
DATE	SEPT., 1968		



SCALE : FEET 0 400 800 1200

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE
SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD.
SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION,
BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C.
DATED SEPTEMBER 1968

1813

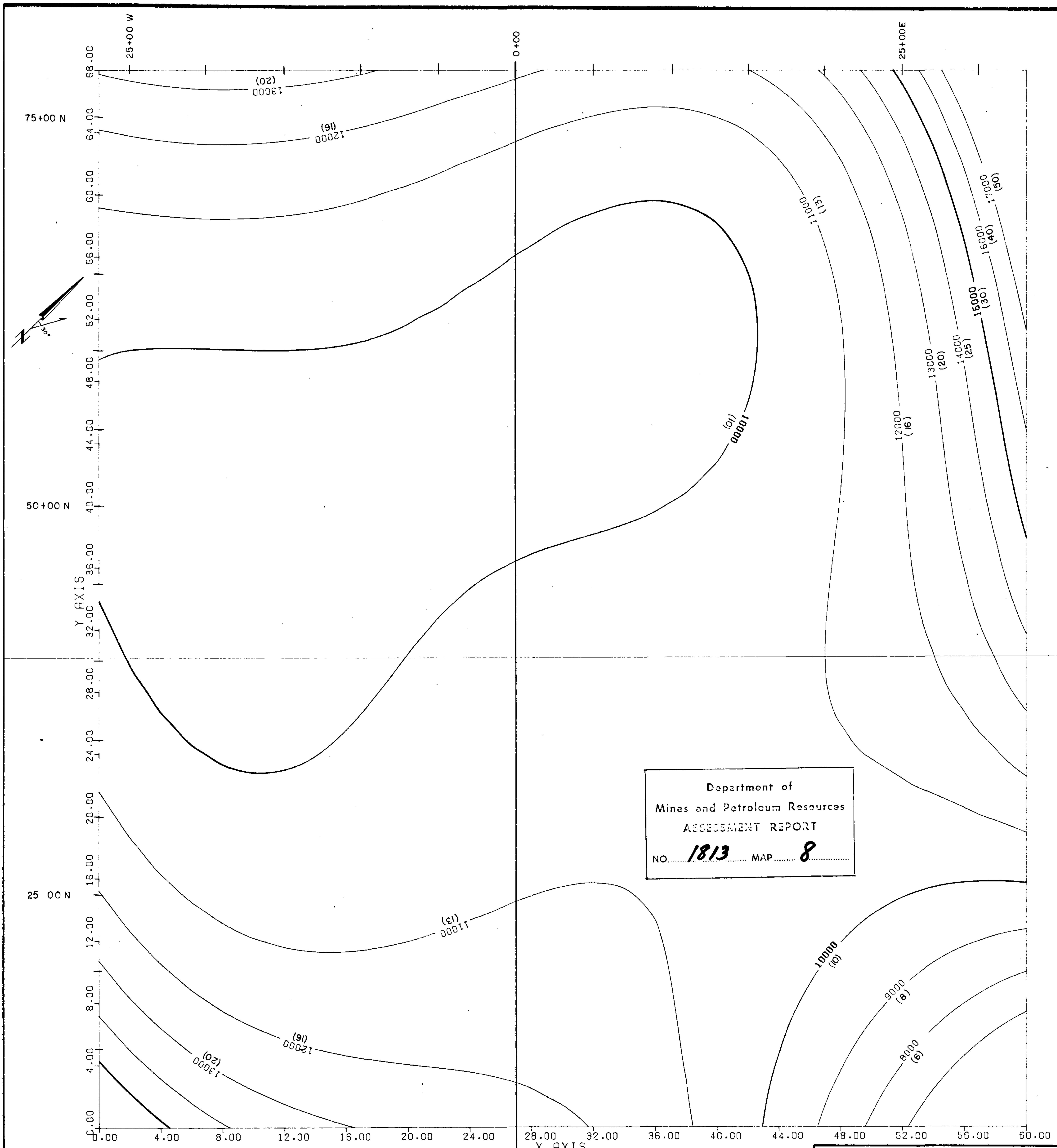
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

RESIDUALS OF COPPER

(5)

GEO-X SURVEYS LTD.

DRAWN	COMPUTREX	JOB NO.	FIG. NO.
CHECKED	D.R.C.	1049	18
APPROVED			
DATE	SEPT., 1968		



(20) APPROXIMATE ANTI-LOGARITHM

TO ACCOMPANY THE GEOPHYSICAL REPORT ON THE SKI, ADAIR
ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD.
SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION,
BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER, B.C.
DATED SEPTEMBER 1968

1813

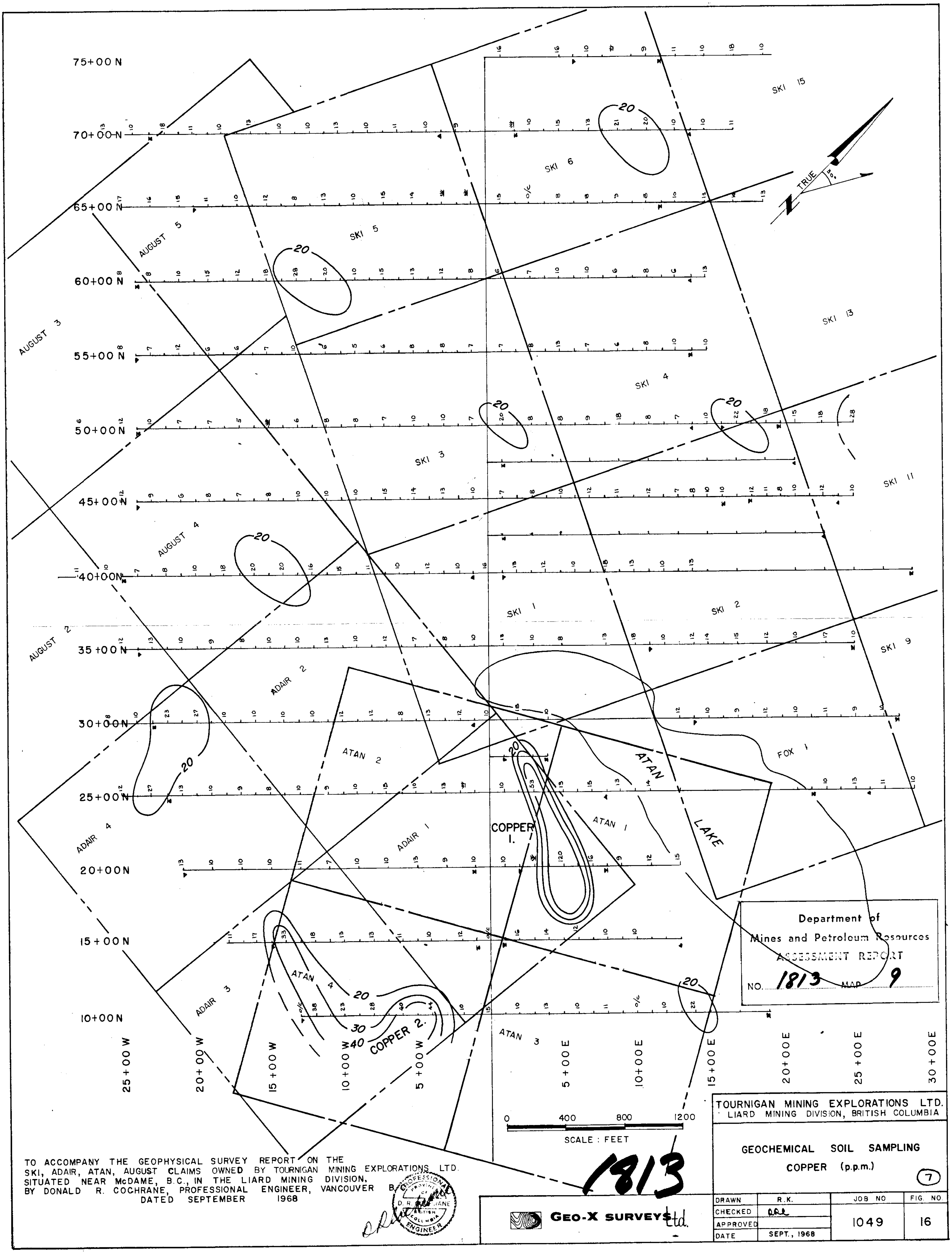
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

FOURTH ORDER TREND SURFACE
OF
LOG OF COPPER VALUES

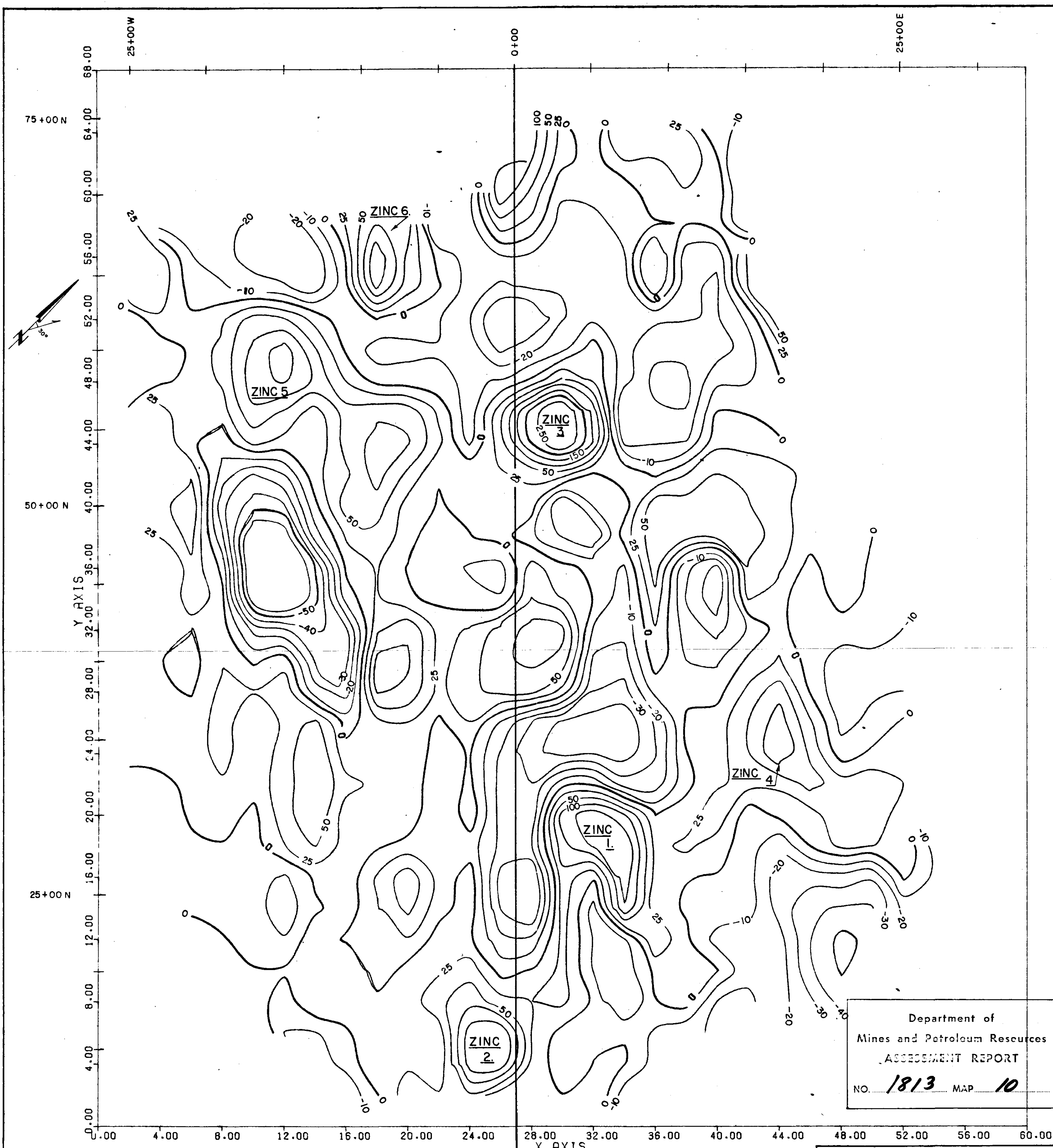
(6)

GEO-X SURVEYS LTD.

DRAWN	COMPUTREX	JOB NO.	FIG. NO.
CHECKED	DRC	1049	17
APPROVED			
DATE	SEPT., 1968		



75+00 N
70+00 N
65+00 N
60+00 N
55+00 N
50+00 N
45+00 N
40+00 N
35+00 N
30+00 N
25+00 N
20+00 N
15+00 N
10+00 N
25+00 W
20+00 W
15+00 W
10+00 W
5+00 W
5+00 E
10+00 E
15+00 E
20+00 E
25+00 E
30+00 E
SKI 15
SKI 6
SKI 5
SKI 13
SKI 4
SKI 3
SKI 11
SKI 1
SKI 2
SKI 9
AUGUST 5
AUGUST 3
AUGUST 4
AUGUST 2
ADAIR 2
ADAIR 4
ADAIR 1
ADAIR 3
ATAN 2
ATAN 1
ATAN 4
ATAN 3
ATAN LAKE
FOX 1
COPPER 1.
COPPER 2.
TRUE
30°
0 400 800 1200
SCALE : FEET
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1813 MAP 9
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA
GEOCHEMICAL SOIL SAMPLING
COPPER (p.p.m.)
7
DRAWN R.K.
CHECKED
APPROVED
DATE SEPT., 1968
JOB NO 1049
FIG. NO 16
GEO-X SURVEYS Ltd.
1813
TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C. DATED SEPTEMBER 1968
PROFESSIONAL ENGINEER BRITISH COLUMBIA



0 400 800 1200

SCALE: FEET

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C.

DATED SEPTEMBER 1968

1813

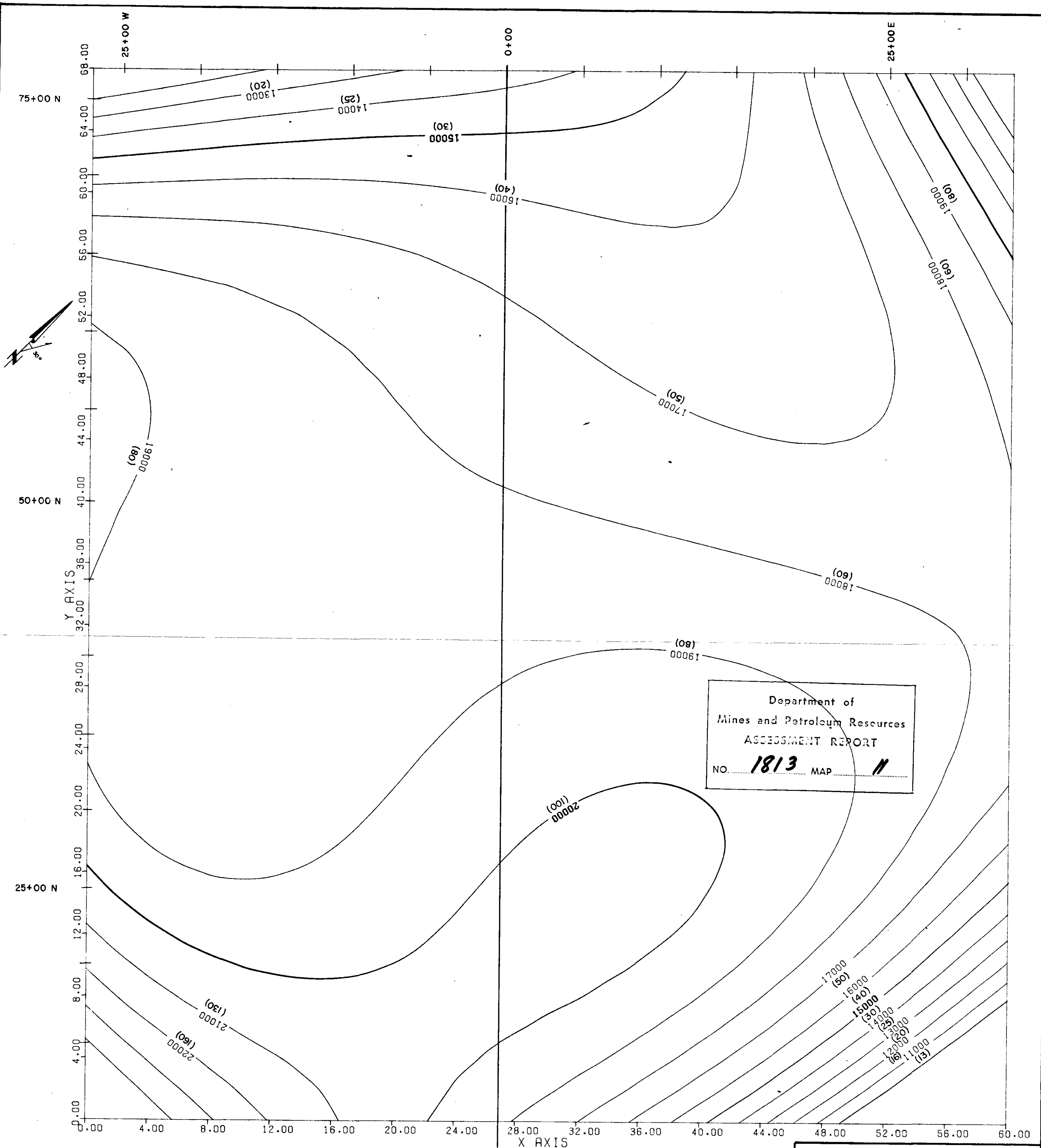
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION BRITISH COLUMBIA

RESIDUALS OF ZINC

(8)

GEO-X SURVEYS LTD.

DRAWN	COMPUTREX	JOB. NO.	FIG. NO.
CHECKED	[signature]	1049	15
APPROVED			
DATE	SEPT., 1968		



(160) APPROXIMATE ANTI-LOGARITHM

0 400 800 1200

SCALE: FEET

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER, B.C.
DATED SEPTEMBER 1968

D. R. Cochrane

1813

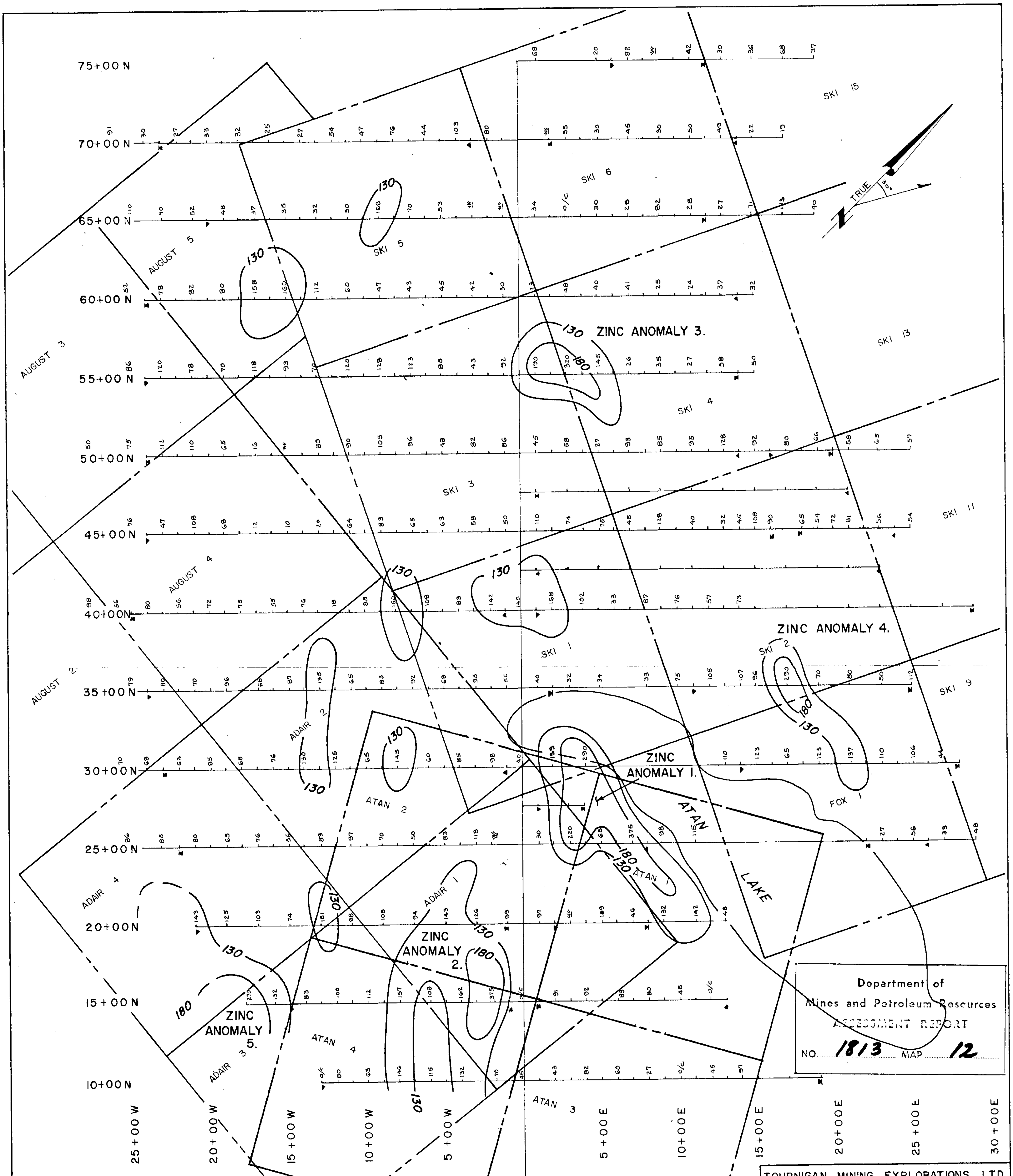
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

FOURTH ORDER TREND SURFACE
OF
LOG OF ZINC VALUES

(9)

GEO-X SURVEYS LTD.

DRAWN	COMPUTREX	JOB NO.	FIG. NO
CHECKED	D.R.C.	1049	14
APPROVED			
DATE	SEPT., 1968		



0 400 800 1200

SCALE : FEET

1813

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION. BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B. C.
DATED SEPTEMBER 1968

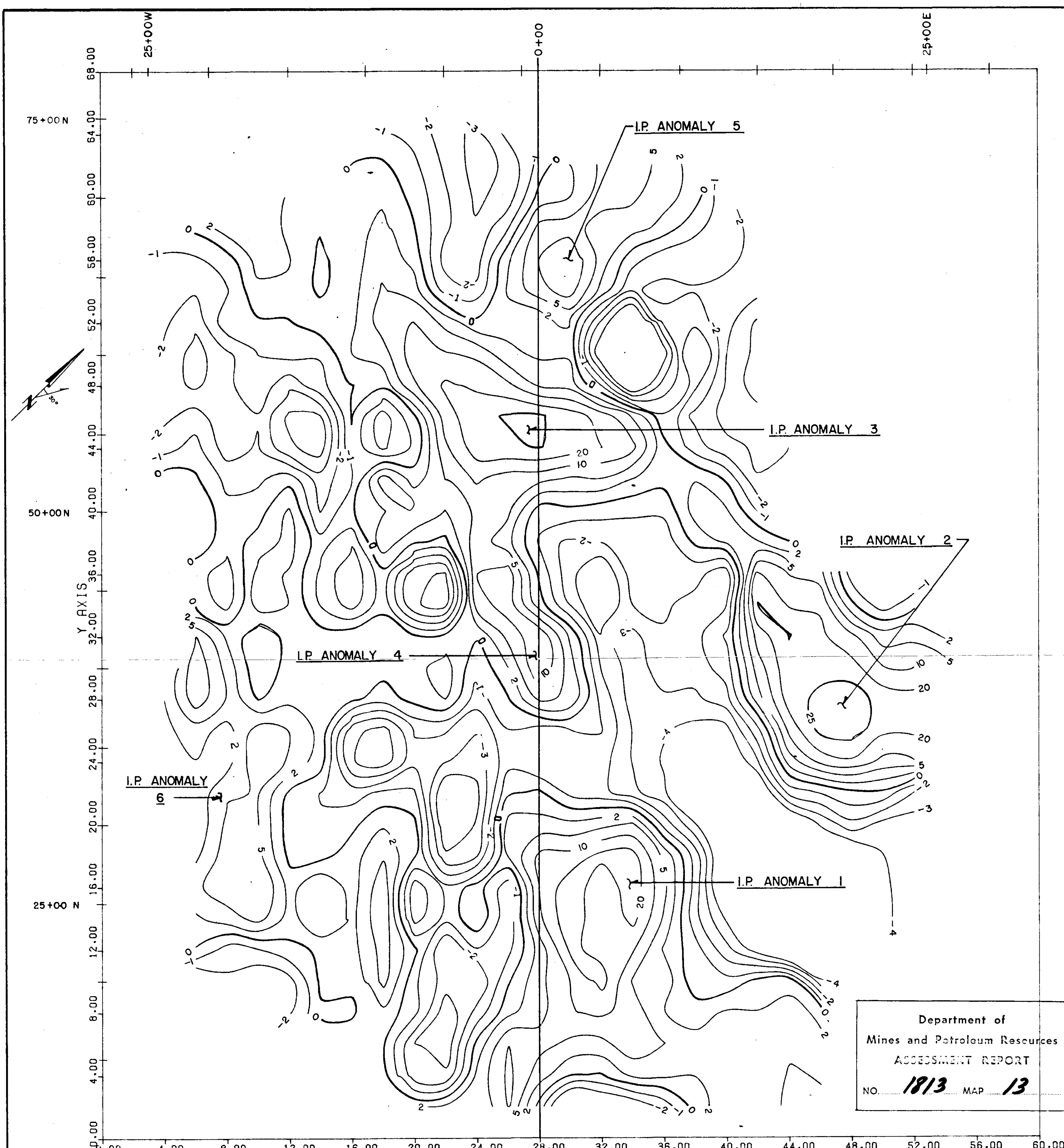
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

GEOCHEMICAL SOIL SAMPLING
ZINC (p.p.m)

(10)

GEO-X SURVEYS Ltd.

DRAWN	R.K.	JOB NO	FIG. NO.
CHECKED		1049	13
APPROVED			
DATE	SEPT., 1968		



TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATION LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C. DATED SEPTEMBER 1968

1813

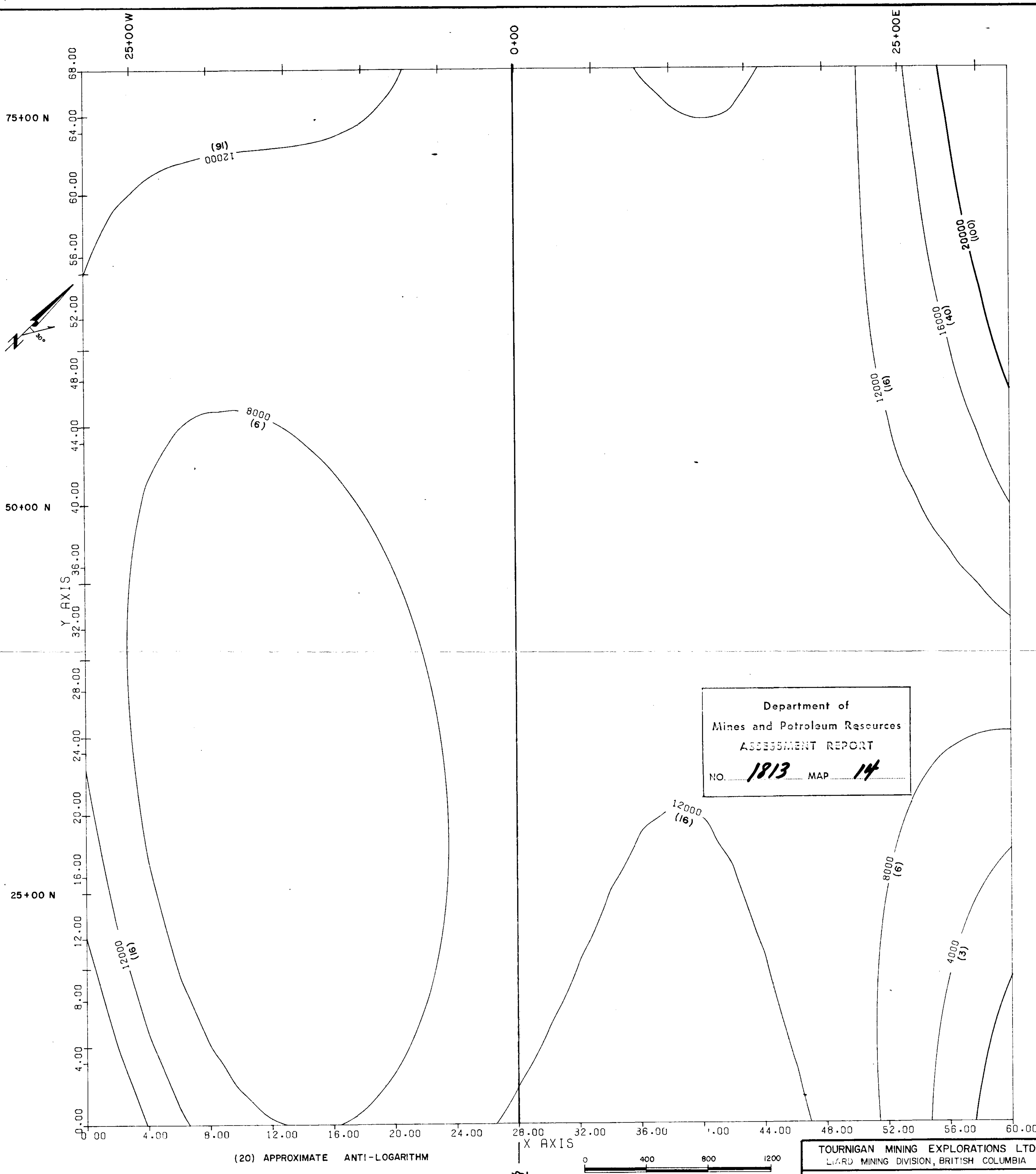
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

RESIDUALS OF NORMALIZED INDUCED POLARIZATION

(11)

GEO-X SURVEYS LTD.

DRAWN	COMPUTREX	JOB NO.	FIG. NO.
CHECKED	D.R.C.	1049	12
APPROVED			
DATE	SEPT., 1968		



1813

TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

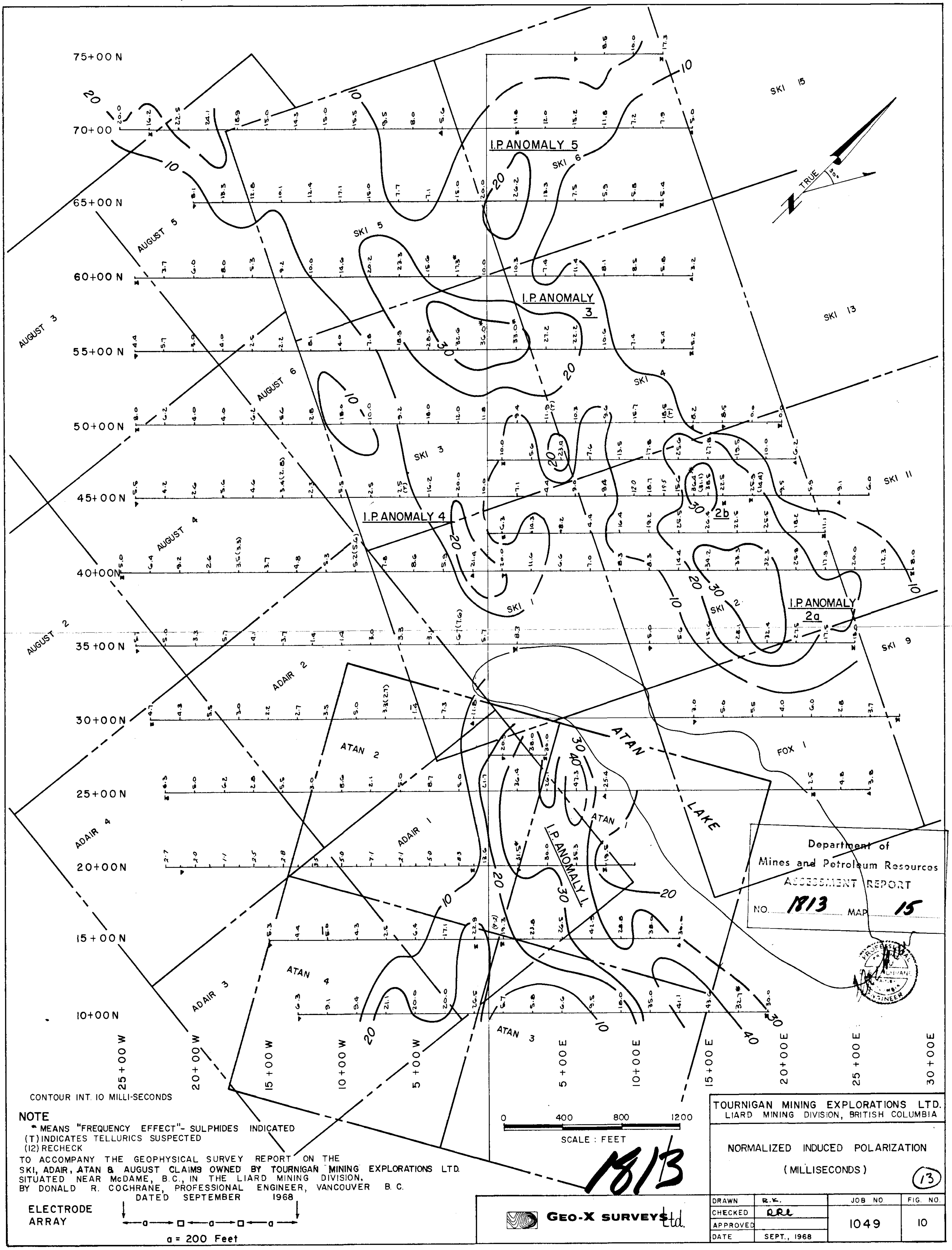
FOURTH ORDER TREND SURFACE
OF LOG OF
NORMALIZED INDUCED POLARIZATION

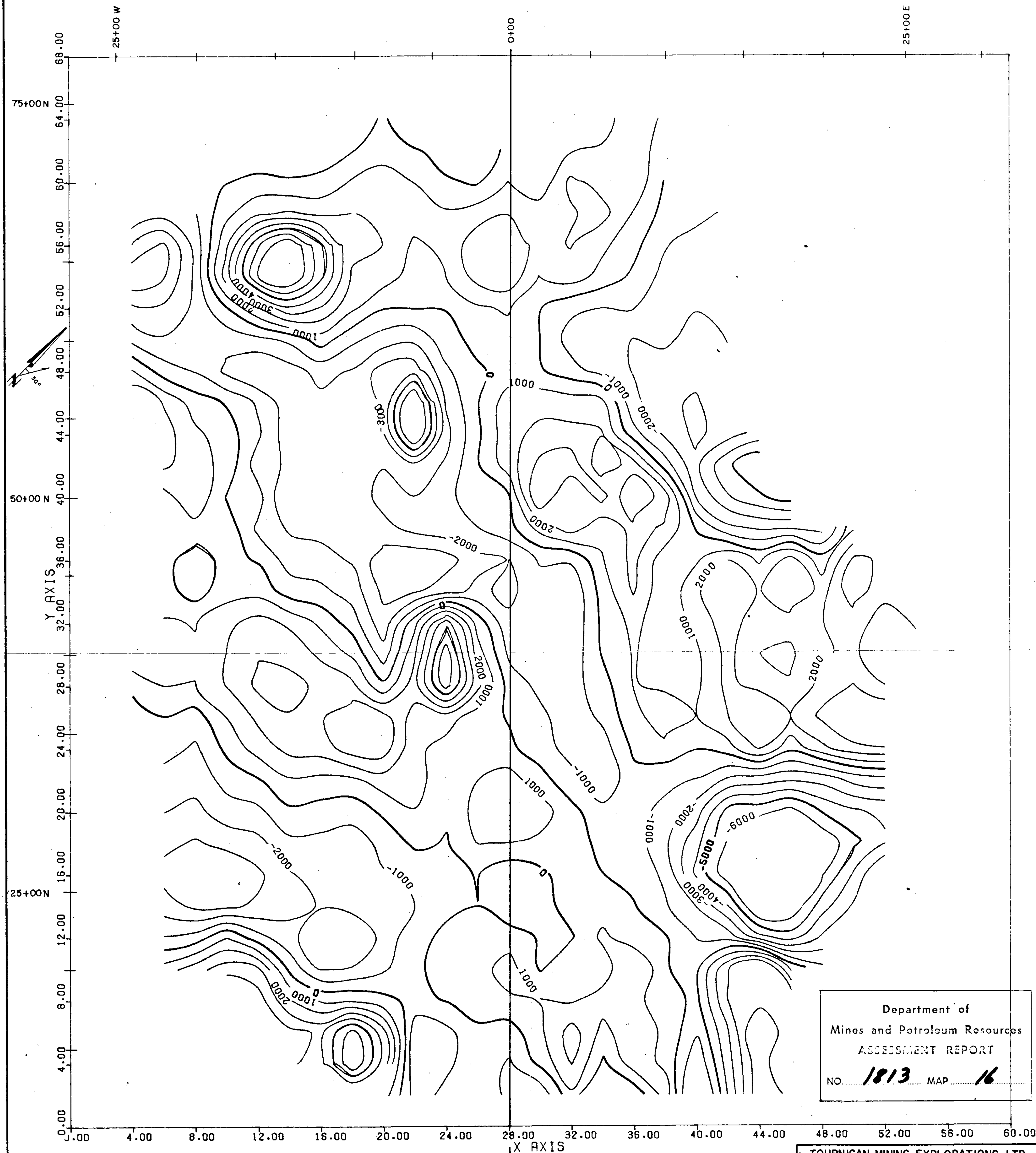
(12)

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE
SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD.
SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION,
BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C.
DATED SEPTEMBER 1968

GEO-X SURVEYS LTD.

DRAWN	COMPUTREX	JOB NO.	FIG. NO.
CHECKED	DRC	1049	11
APPROVED			
DATE	SEPT., 1968		


TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA
NORMALIZED INDUCED POLARIZATION
(MILLISECONDS)
13
DRAWN R.K.
CHECKED
APPROVED
DATE SEPT., 1968
JOB NO 1049
FIG. NO. 10
GEO-X SURVEYS Ltd.
CONTOUR INT. 10 MILLI-SECONDS
NOTE
* MEANS "FREQUENCY EFFECT"- SULPHIDES INDICATED
(T) INDICATES TELLURICS SUSPECTED
(12) RECHECK
TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE
SKI, ADAIR, ATAN & AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD.
SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION,
BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B. C.
DATED SEPTEMBER 1968
ELECTRODE ARRAY
a = 200 Feet
SCALE : FEET
0
400
800
1200
1813
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1813 MAP 15
I.P. ANOMALY 5
I.P. ANOMALY 3
I.P. ANOMALY 4
I.P. ANOMALY 2a
2b
I.P. ANOMALY 1
ATAN LAKE
TRUE
30°
75+00 N
70+00
65+00 N
60+00 N
55+00 N
50+00 N
45+00 N
40+00N
35+00 N
30+00N
25+00 N
20+00N
15+00 N
10+00 N
25+00 W
20+00 W
15+00 W
10+00 W
5+00 W
5+00 E
10+00 E
15+00 E
20+00 E
25+00 E
30+00 E
SKI 15
SKI 13
SKI 11
SKI 9
SKI 6
SKI 5
SKI 4
SKI 3
SKI 2
SKI 1
FOX 1
AUGUST 5
AUGUST 3
AUGUST 6
AUGUST 4
AUGUST 2
ADAIR 2
ADAIR 4
ADAIR 1
ADAIR 3
ATAN 2
ATAN 4
ATAN 3
ATAN



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1813 MAP 16

0 400 800 1200
SCALE : FEET

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE
SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD.
SITUATED NEAR McDAME B.C., IN THE LIARD MINING DIVISION,
BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C.
DATED SEPTEMBER 1968

1813

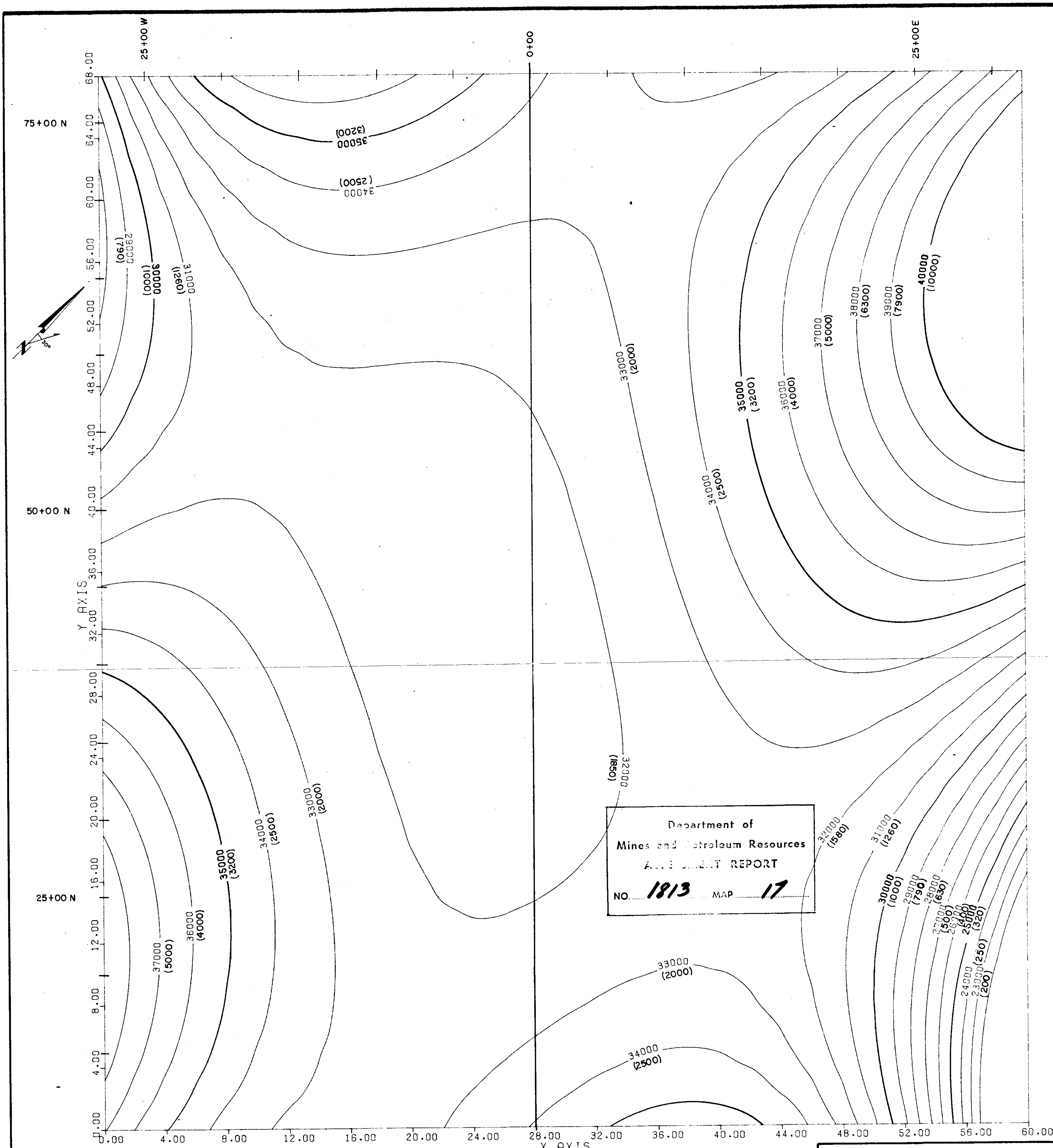
GEO - X SURVEYS LTD.

TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

RESIDUALS OF APPARENT RESISTIVITY

(14)

DRAWN	COMPUTREX	JOB NO.	FIG. NO.
CHECKED	DRC	1049	9
APPROVED			
DATE	SEPT. 1968		



(2000) APPROXIMATE ANTI-LOGARITHM

SCALE : FEET 0 400 800 1200

Department of Mines and Petroleum Resources ASSESSMENT REPORT NO. 1813 MAP 17

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C. DATED SEPTEMBER 1968

D.R. Cochrane

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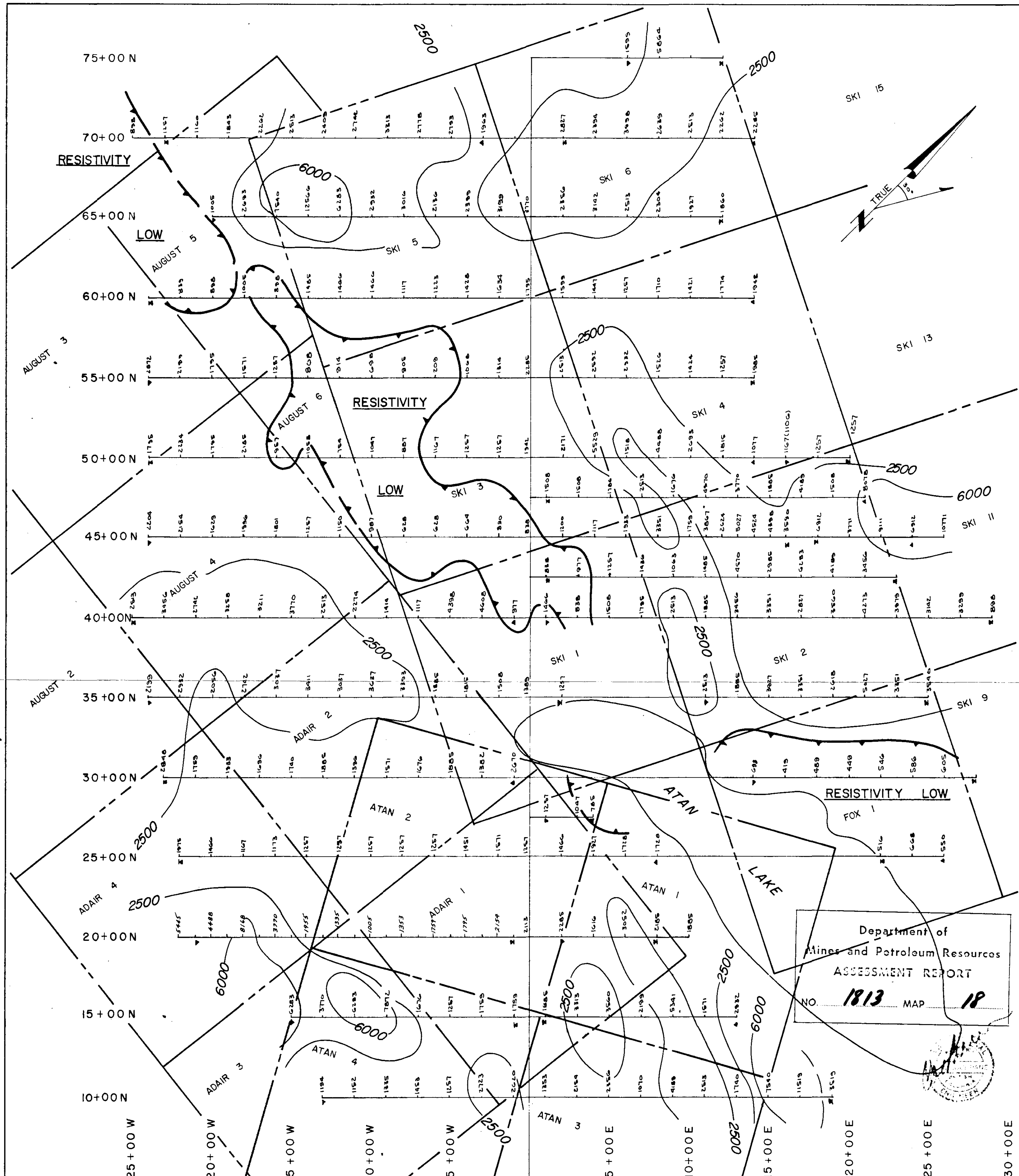
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

FOURTH ORDER TREND SURFACE OF LOG OF APPARENT RESISTIVITY (15)

GEO-X SURVEYS LTD.

DRAWN	COMPUTREX	JOB NO.	FIG. NO.
CHECKED	D.R.C.	1049	8
APPROVED			
DATE	SEPT., 1968		



TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN & AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME, B.C., IN THE LIARD MINING DIVISION, BY DONALD R. COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C.
DATED SEPTEMBER 1968

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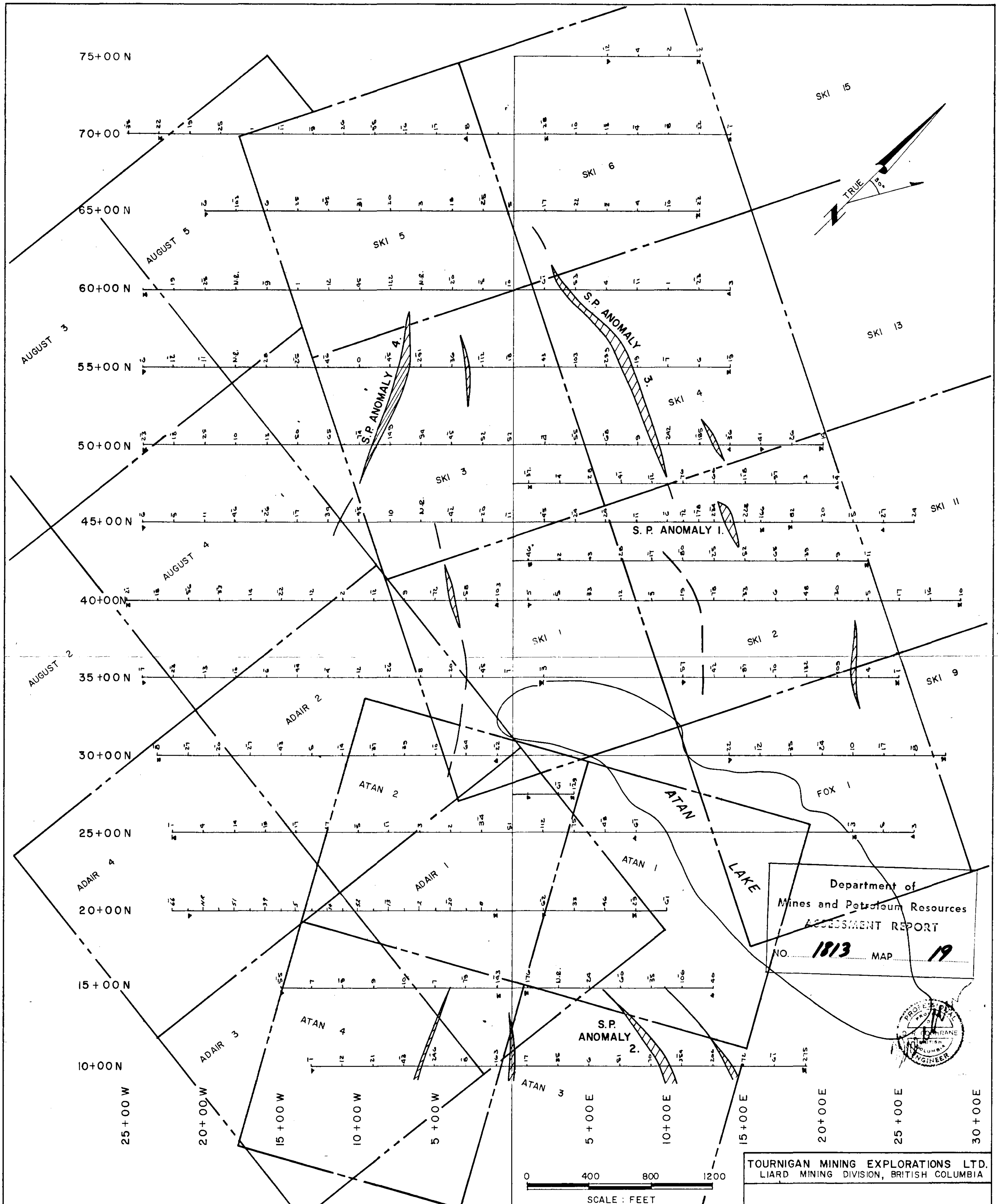
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

APPARENT RESISTIVITY
(OHM FEET)
(D.C.)

(16)

GEO-X SURVEYS Ltd.

DRAWN	R.K	JOB NO	FIG. NO.
CHECKED	D.R.C	1049	7
APPROVED			
DATE	SEPT., 1968		



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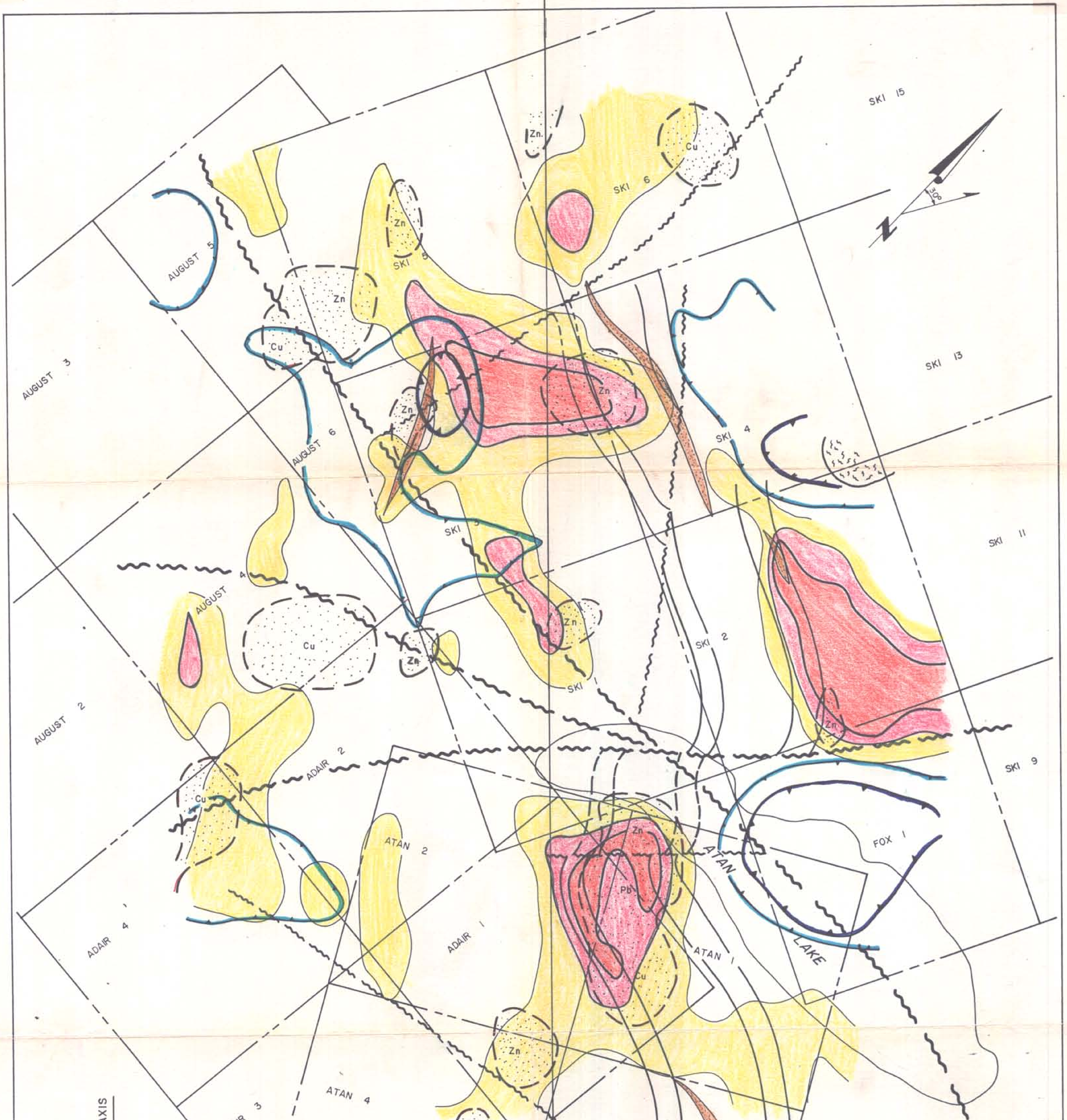
TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION, BRITISH COLUMBIA

SELF POTENTIAL
(MILLIVOLTS)

(17)

GEO-X SURVEYS Ltd.

DRAWN	R.K.	JOB NO	FIG. NO.
CHECKED	DRC	1049	6
APPROVED			
DATE	SEPT., 1968		



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1813 MAP 20

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. R. COCHRANE

1813

LEGEND

INFERRED LITHOLOGIC TREND

SELF POTENTIAL ANOMALY

INDICATED FAULT - MAJOR

" " - MINOR

HIGHLY FRACTURED BEDROCK INDICATED

WEAK TO MODERATE NEGATIVE RESISTIVITY RESIDUAL

MODERATE TO STRONG " " "

WEAK INDUCED POLARIZATION RESIDUAL

MODERATE " " "

STRONG " " "

GEOCHEMICAL - AREA OF RESIDUAL OR ORIGINAL DATA

GEOCHEMICAL HIGH, WITH SYMBOL FOR HIGH METAL PRESENT.

Cu - Copper, Zn - Zinc, Pb - Lead, Ag - Silver

0 400 800 1200

SCALE : FEET

TO ACCOMPANY THE GEOPHYSICAL SURVEY REPORT ON THE SKI, ADAIR, ATAN, & AUGUST CLAIMS OWNED BY TOURNIGAN MINING EXPLORATIONS LTD. SITUATED NEAR McDAME B.C. IN THE LIARD MINING DIVISION, BY DONALD R COCHRANE, PROFESSIONAL ENGINEER, VANCOUVER B.C.
DATED SEPTEMBER 1968

TOURNIGAN MINING EXPLORATIONS LTD.
LIARD MINING DIVISION BRITISH COLUMBIA

GENERAL COMPILATION
&
INTERPRETATION

(18)

GEO-X SURVEYS LTD.

DRAWN		JOB NO.	FIG. NO.
CHECKED			
APPROVED		1049	23
DATE			