Department of
Mines and Petroleum Resources
ASSESSMENT REPORT

NO. 3236 MAP

REPORT ON THE GEOLOGY

AND

A STATISTICAL ANALYSIS

OF

EXPLORATION DATA

ON

PRISM RESOURCES' ASHNOLA PROPERTY

SITUATED

IN THE

McBRIDE CREEK - ASHNOLA RIVER AREA

OSOYOOS MINING DIVISION

CENTRED 23 AIR MILES SSE OF PRINCETON, B.C.

LONGITUDE 49° 07'N; LATITUDE 120° 20'W

N.T.S. 92H/1

REPORT BY

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AND

G.H. GIROUX, B.A.Sc.

AUGUST 18, 1971

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FIGURES

INTRODUCTION

The following report is based on work done on Prism Resources' Ashnola property during the period October 1970 to July 26, 1971.

Geologic mapping started in 1966 (see Montgomery 1966) was extended to cover unmapped areas of grid. A colour air photo survey was flown of the area. From this survey, a structural interpretation was made in regard to possible faults, faint patterns and other structural lineaments.

In addition, the data, both geological and geophysical, accumulated during the summer of 1970 (see Cochrane 1970), was analyzed statistically by Alistair Sinclair with the aid of a computer.

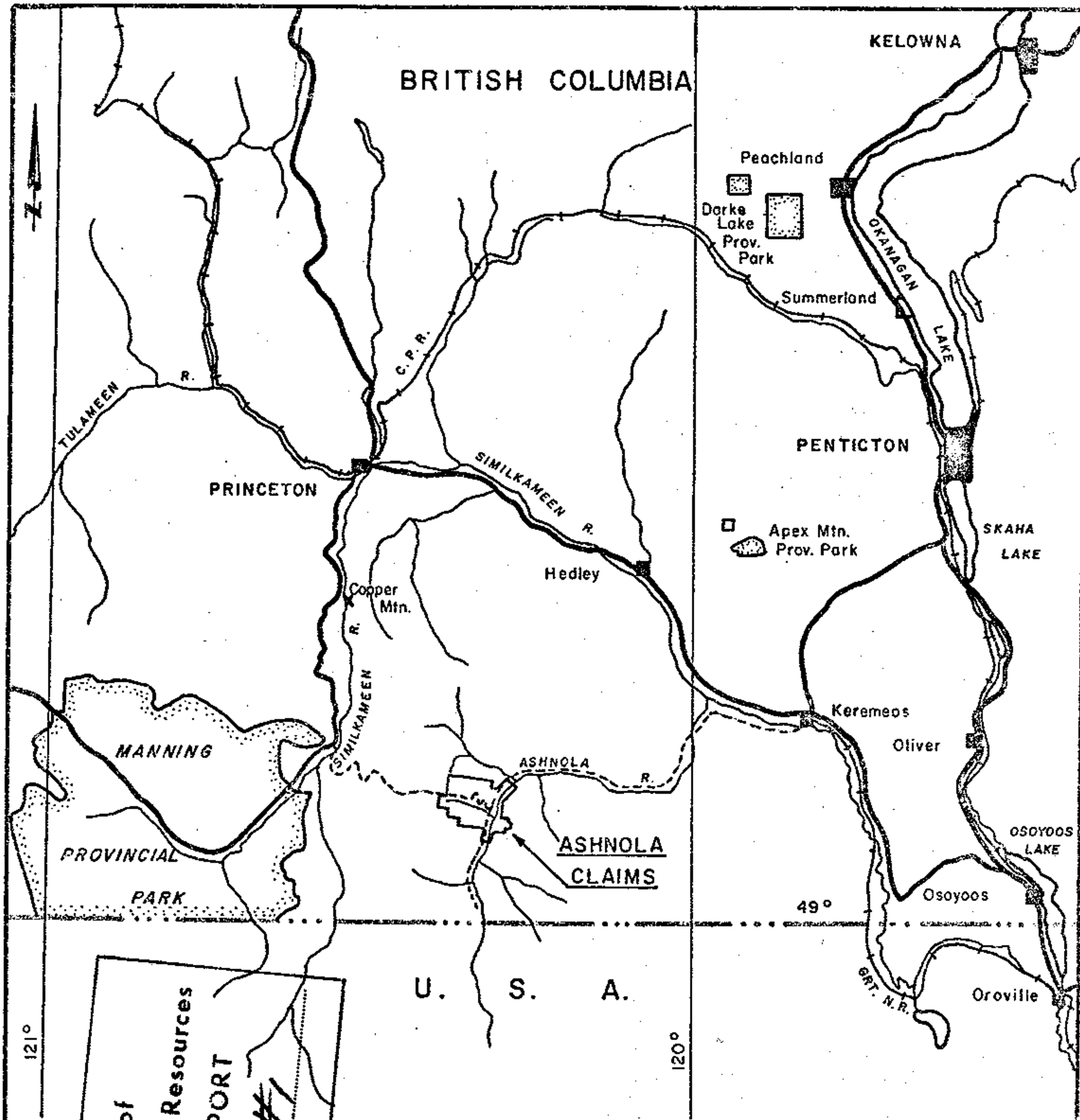
LOCATION AND ACCESS (see Figure 1, Location Map)

The Prism Ashnola copper-molybdenum property is located on McBride Creek, an easterly-flowing tributary of the Ashnola River. The map coordinates are Latitude 49° 07'N., Longitude 120° 20'W (sheet 92H/1W).

Access to the property may be had by the Ashnola River from Keremeos, B.C., a distance of 27 miles. Another road leaves Highway No. 3 at Copper Creek and runs about 15 miles in a southeasterly direction to the property.

CLAIMS AND OWNERSHIP

The Prism mining property consists of 166 located claims and fractions, in a contiguous block situated in the Osoyoos M.D. The claims are bounded on the east by the Ashnola River, on the west by Placer Mountain, and to the north and south respectively by Young and Druisseau Creeks. All claims are owned outright by Prism Resources Ltd., 805-850 West Hastings Street, Vancouver 1, B.C. The following table lists the pertinent claims data.



PRISM RESOURCES LIMITED

ASHNOLA RIVER PROPERTY

LOCATION MAP

10 0 10 20

SCALE : MILES

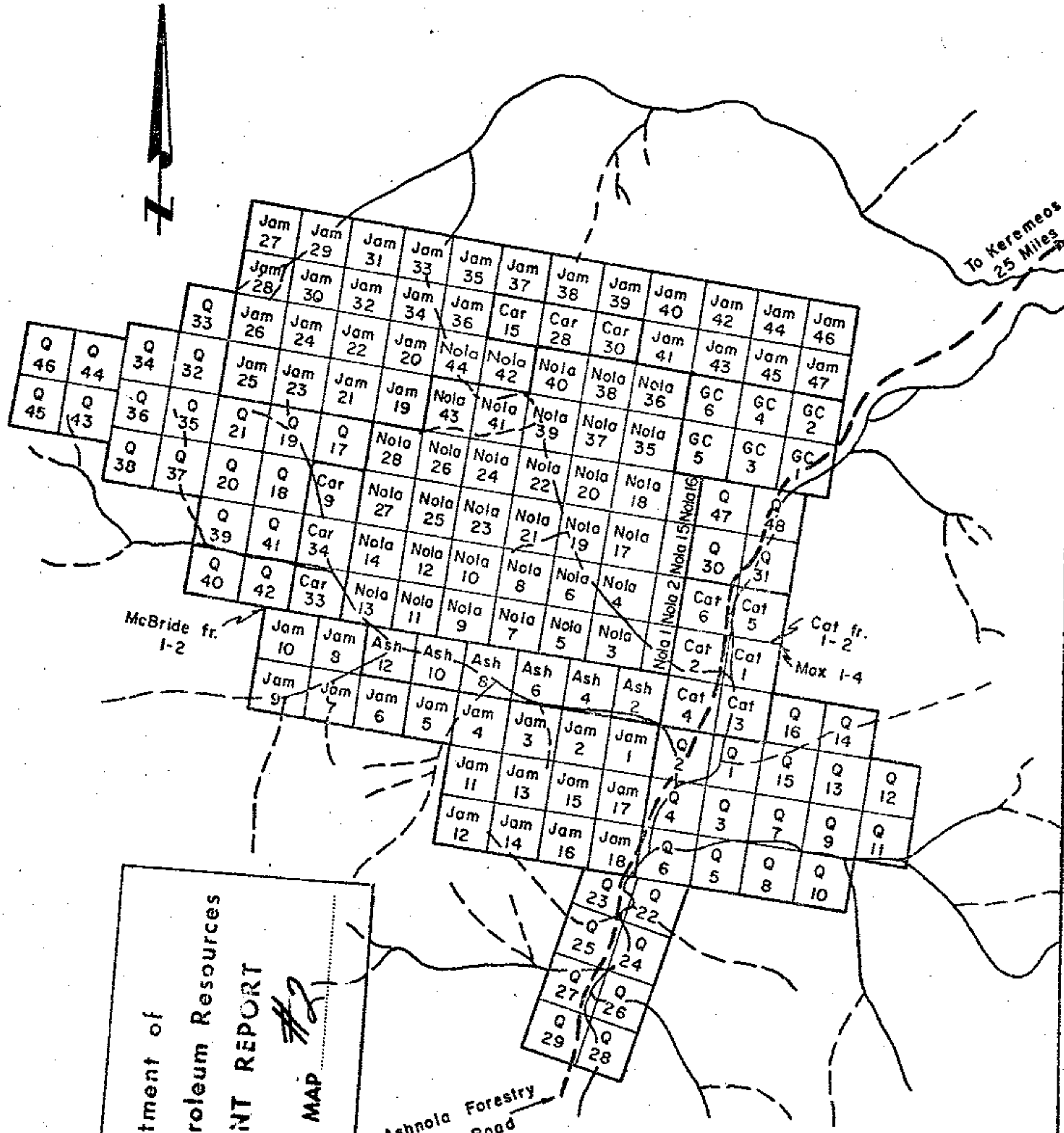
DATED: JULY 31, 1970.

FIG. 1.

Claim Name	Record Numbers	Expiry Date
Max No. 1 and 2	14731 and 14732	May 12, 1972
Max No. 3 and 4	14865 and 14866	May 19, 1972
Cat No. 1-6	15103-15108	May 27, 1972
Cat No. 1 and 2 Fr.	15407 and 15408	June 2, 1972
Ash No. 2 and 4	15360 and 15362	June 2, 1972
Ash No. 6 and 8	15364 and 15366	June 2, 1972
Ash No. 10 and 12	15368 and 15370	June 2, 1972
Nola No. 1-21	15751-15771	June 2, 1972
Nola No. 22-24	15772-15774	June 2, 1973
Nola No. 25-28	15775-15778	June 2, 1972
Nola No. 35-44	15381-15390	June 2, 1972
Nola No. 1 Fr.	15495	June 13, 1972
Car No. 9 and 15	15504 and 15510	June 13, 1972
Car No. 28 and 30	15523 and 15525	June 13, 1972
Car No. 33 and 34	15528 and 15529	June 13, 1972
Q No. 1-48	22827-22874	July 26, 1971
Jam No. 1	22774	July 26, 1971
Jam No. 2-47	22775-22820	July 26, 1971
G.C. No. 1-6	22821-22826	July 26, 1971
McBride Fr. No.1	23910	Nov. 12, 1971
McBride Fr. No. 2	23911	Nov. 12, 1971

HISTORY

The area including the claims mentioned was mapped geologically on reconnaissance scale by Rice (1947). In 1961, Kennco Explorations Ltd. conducted a detailed exploration program on part of the area, including geologic mapping, a geochemical soil survey, geophysical sur-



PRISM RESOURCES LIMITED

ASHNOLA RIVER PROPERTY

0 5000 10,000

SCALE : FEET

DATED: OCT. 5, 1970.

FIG. 2

veys (including IP) and diamond drilling of 9 AX holes totalling about 2700 feet. Meridian Exploration Syndicate staked the property in 1966 and examined it in detail that summer. Their work included a stream sediment survey, geologic mapping, a geochemical soil survey, 7000 feet of Self Potential survey, about 4.5 miles of bulldozer trenching and road building, and about 700 feet of drilling and blasting (Montgomery, 1966). In 1968, the property was under option to Quintana Minerals Corp. who drilled 6 NQ wire line holes totalling 2951 feet (Montgomery, 1968). In addition, geological mapping was done to establish alteration and mineral zoning patterns (C. Arnold and D. Lowell, 1968). Further trenching and soil sampling was carried out in the Cat Creek Drainage Basin during 1969. In 1970, a program was recommended by Dr. A.J. Sinclair (Sinclair, 1969). The work done consisted of 35 line-miles of Induced Polarization and magnetometer surveys, 13,800 feet of roads and trenches, and 1,300 geochemical samples taken (Cochrane, 1970).

GEOLOGY

The map area (Figure 3) is underlain by a succession of acid volcanics; rhyolite porphyry, lithic tuff and crystal tuff.

The rhyolite porphyry has a fine-grained grey matrix of quartz and feldspar with phenocryrts of quartz, feldspar and muscovite. Over most of the map area the rhyolite has been altered with three types of alteration visible. A pyritic (hematitic-jarositic)zone bounds the grid area in a horseshoe-shaped pattern. Within this zone a sericitic kaolinitic zone and silicified zone can be distinguished. The rhyolite, both altered and unaltered, is closely fractured, and the fractures are filled by quartz, pyrite, and in some cases, chalcopyrite and molybdenite.

A lithic tuff, possibly contemporaneous, or almost so, with the rhyolite sequence, is exposed on the south-eastern section of the grid along both sides of Cat Creek valley. This tuff contains angular and subangular fragments of rhyolite porphyry ranging in size from dust to 2 inches. The area exposed nar the center of the grid has a greener matrix than the tuff exposed east of Cat Creek, possibly due to chlorite and/or epidote from propylitic alteration.

The east-central portion of the map area consists of a dark grey crystal tuff which much resembles a porphyry in hand specimen. Crystal fragments of quartz and plagioclase along with some lithic fragments are cemented in a fine-grained matrix of glassy dust. Outcrop of this unit is very sparse and mapping was done mainly from tallus.

The succession of acid volcanics is intruded by a small plug about 2000 by 600 feet. The central portions of the intrusive are coarse-grained and porphyritic, composed of quartz, andesine, and biotite phenocrysts. The matrix is composed of anhedral, interlocking crystals of fine-grained quartz and plagioclase. Epidote and magnetite are also present in small amounts. Pyrite, chalcopyrite, and molybdenite are later minerals which cut and replace silicates and occupy fractures. The intrusion has a chilled border phase which is more basic in composition than the central part. It ranges from a fine-grained, slightly porphyritic grey dacite to a sugary-textured, brown, quartz microgabbro. The basic border is probably the result of dehydration which has caused the formation of pyroxenes instead of hornblende or biotite.

Near the mouth of Cat Creek on the eastern slope, an area of manganese oxides was exposed in a road cut. This black, earthy, porous substance known as wad contained anomalous values of copper, lead, molybdenite and zinc.

AIR PHOTO INTERPRETATION

In general, aerial photographs give geologic information of two broad types--structural and lithologic. For most areas they probably are more important for the structural information they reveal, because photographic images can be related more reliably to geometry of geologic structures than to the qualitative or subjective interpretation of composition of a formation.

Using B.C. aerial photographs, series B.C. 5207-115 through 117, and colour photographs flown privately in the spring of 1971, a composite map showing structural lineaments was compiled. (see Figure 4) The drainage area of McBride and Cat Creeks has been severely faulted with many visible on the air photos. A very rough symmetry can be seen in the northeast section with several faults radiating out from a center on the baseline approximately between 112N and 120N. An area of fault intersections such as this could be favourable for hydrothermal activity. An intrusive plug near the center of the property shows up as a roughly circular structure with different colour tones from the rhyolite that surrounds it. On the western boundary of the property, basalt can be differentiated from the rhyolite which covers most of the property. In the northeast corner a remnant basaltic flow is visible.

COMPUTER STUDY

INTRODUCTION

The Ashnola River property of Prism Resources Limited is covered by a grid of east-west lines cut at intervals of 400 feet and tied in to a north-south base line. For the past several summers, particularly that of 1970, a variety of exploration approaches have been carried out on the property (see Sinclair, 1969; Cochrane et al., 1970) with the result that a vast quantity of detailed geophysical and geochemical data in numeric form, and tied in to the above-mentioned grid, has accumulated. This situation had been anticipated in 1969 by Prism Resources' management and plans were made to analyze the data statistically once the initial stage of exploration was completed. For the past several months the writer has been conducting this program of statistical analysis.

The initial stage of the study was to compile the data on coding forms having first established an appropriate format. Coding was done by Mr. Gary Giroux. These forms were keypunched, listed and checked, and form the basic data file for the following statistical investigation.

One of the main aims of this study is to examine the potential of Q-mode factor analysis in analyzing detailed geochemical and geophysical to outline target areas for further work. This led to a minor problem in coding procedure for two variables. Chargeability and apparent resistivity values had been determined for grid positions midway between those for which all geochemical measurements were available. For Q-mode factor analysis it is essential to have a series of stations for which as many variables as possible are available. Hence, chargeability and apparent resistivity data were interpolated (linearly) to fulfill this requirement. It should be noted that this interpolation procedure has introduced a slight "smoothing" to these two variables!

ANALYSIS OF SINGLE VARIABLES

All variables in the data file established for the Ashnola property were run through a computer program which produced output plots of histograms for both arithmetic and logged (base 10) data. The main purpose of this step was to allow analysis of the frequency distributions of each variable to ascertain if transforms were required to produced close approaches to 'normal' distributions prior to more sophisticated statistical analysis. In general, it was found that all variables had to be log transformed to realize this requirement.

The histogram program used, however, provided additional information that allowed detailed analysis of each variable individually. Table I is a summary of means and standard deviations, both arithmetic and logarithmic, for each of the variables analyzed. The tendency for original data to be strongly positively skewed is obvious from an examination of the arithmetic means and standard deviations.

An additional advantage of the histogram program is output of tables for plotting cumulative probability plots. Data from these tables were plotted on cumulative probability graph paper (cf. Lepeltier, 1969) to test for the presence of two or more populations for each variable (figures 5 to 9 inclusive). A summary discussion of results for each variable is given below.

GEOPHYSICAL VARIABLES

Chargeability

A cumulative probability plot for chargeability (figure 5) suggests

TABLE I

Means and Standard Deviations of Arithmetic and Logged Exploration Data

Variable	N	Arithmetic		Logarithmic			units
		$\bar{x}$	s	$\bar{x}$	$\bar{x} - s$	$\bar{x} + s$	
CH (Chargeability)	722	23.44	12.46	20.3	11.7	35.2	milliseconds
MAG (gnd magnetometer)	773	369.5	94.1	359	279	461	gammas
RES (Apparent Resistivity)	708	535.2	328.6	452	252	809	ohm-meters
ACU (Soil A zone Cu)	712	23.3	108	8.6	3.1	23.9	ppm
AZN (Soil A zone Zn)	713	105	125	67.4	26.1	175	ppm
BCU (Soil B zone Cu)	1074	43.8	123.2	19.1	6.3	57.4	ppm
BZN (Soil B zone Zn)	734	100	117	69.4	30.8	156	ppm
BMO (Soil B zone Mo)	755	4.85	13.49	2.32	0.92	5.83	ppm
BICU (Lodgepole pine needles ash Cu)	124	139.7	36.0	136	109	172	ppm
BIZN (Lodgepole pine needles ash Zn)	124	1281	370	1231	779	1950	ppm

the presence of two prominent lognormal populations with a break in slope occurring at approximately 20.5 milliseconds. The higher population has a geometic mean of 34 milliseconds (11, -8); the lower population can be characterized with a geometric mean of 8.4 milliseconds (4.3, -3.0). The higher population correlated spatially with a rim of pyrite mineralization, about 2 miles in diameter and more-or-less centered on the property.

Ground Magnetic Data

Two breaks in slope are apparent on the ground magnetic cumulative probability plot (figure 5) at 310 and 400 gammas. The higher population appears to correlate in part with intermediate phaneritic dykes, whereas the lower population relates to areas of aphanitic acidic igneous rock.

Apparent Resistivity

The cumulative probability plot for apparent resistivity is very complex with 4 breaks in slope occurring at 370, 510, 710 and 1070 ohm-metres. Such plots are extremely difficult to interpret, but probably indicate a minimum of 3 populations, none of which can be defined precisely. The breaks in slope, however, provide significant contour values which may be an aid in interpreting the resistivity map. As shown in a later section on correlation, a strong correlation exists between apparent resistivity and ground magnetic data suggesting that variations in apparent resistivity are principally a function of character of underlying rock type.

GEOCHEMICAL VARIABLES

Soil A-zone Cu and Zn (figure 6)

Soil A-zone Cu has a cumulative probability plot indicating two populations, with breaks in slope occurring at 12 and 32 ppm Cu. These

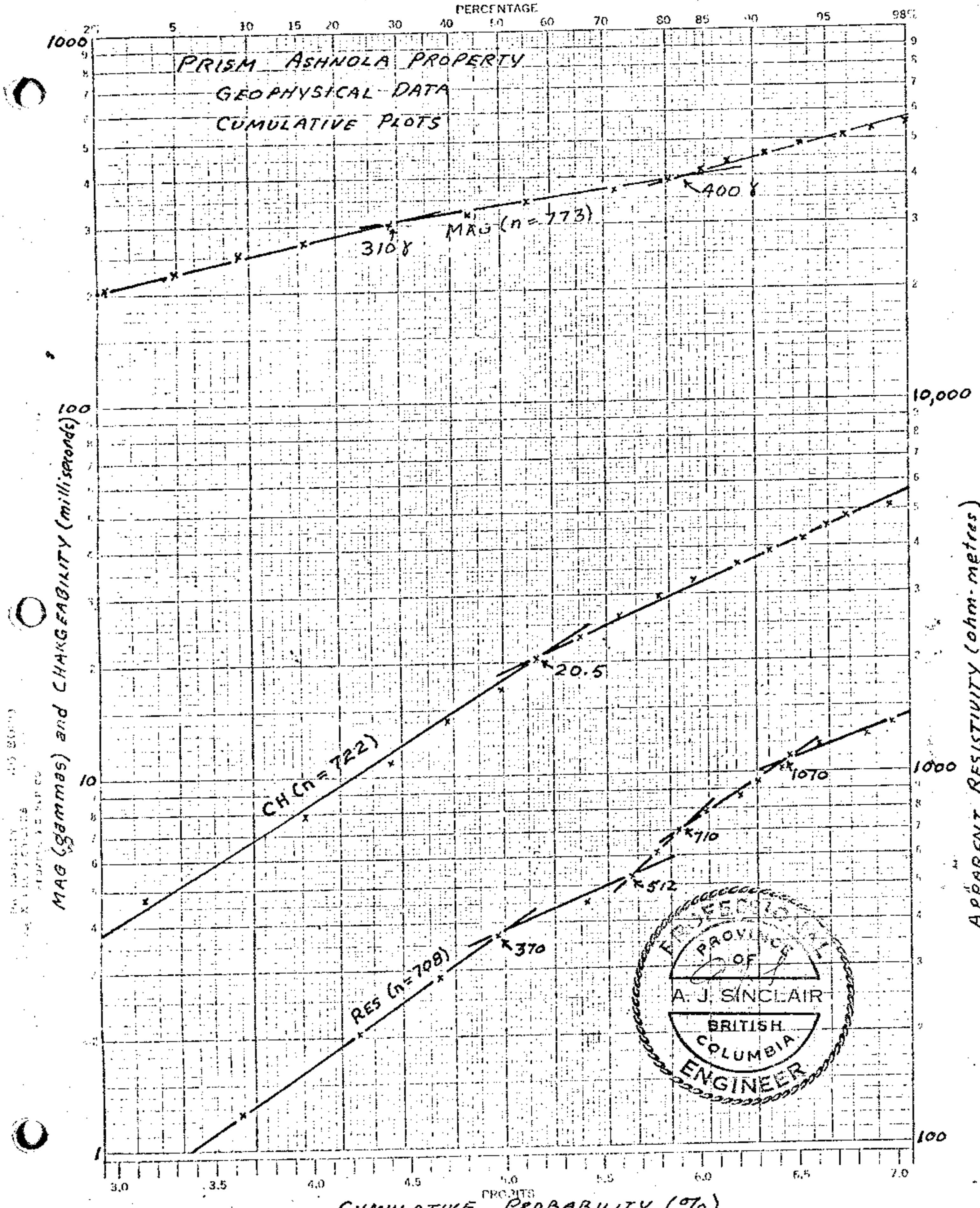
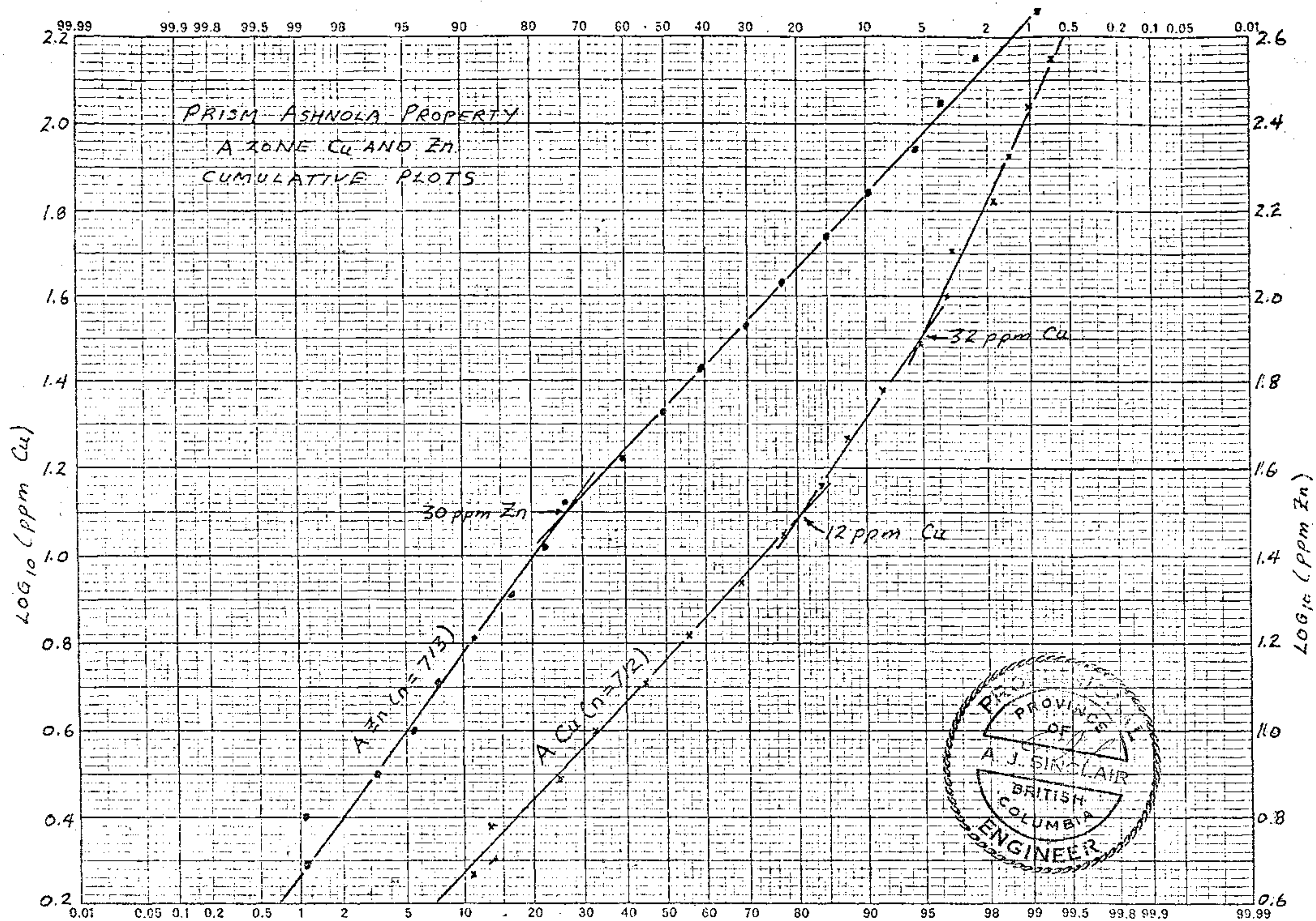

PRISM ASHNOLA PROPERTY
GEOPHYSICAL DATA
CUMULATIVE PLOTS
PERCENTAGE
MAG (n=773)
310γ
400γ
CH (n=722)
20.5
RES (n=708)
370
512
710
1070
MAG (gammas) and CHARGEABILITY (milliseconds)
APPARENT RESISTIVITY (ohm·metres)
1000
100
10
1
10,000
1000
100
PROBITS
CUMULATIVE PROBABILITY (%)
PROFESSIONAL
PROVINCE OF
A. J. SINCLAIR
BRITISH COLUMBIA
ENGINEER

Fig. 5


PRISM ASHNOLA PROPERTY
A ZONE Cu AND Zn
CUMULATIVE PLOTS
30 ppm Zn
12 ppm Cu
32 ppm Cu
A Zn (n=713)
A Cu (n=712)
LOG10 (ppm Cu)
LOG10 (ppm Zn)
CUMULATIVE PROBABILITY
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR
ENGINEER
FIG. 6

two populations are most simply and reasonably interpreted as indicating background (lower) and anomalous (higher) values. Therefore, virtually all values above 32 ppm are anomalous, those values between 12 and 32 ppm are in part anomalous and in part background, and all values below 12 ppm are background. A total of about 10 percent of the A-zone Cu values are anomalous.

The cumulative plot for soil A-zone Zn values has a single break in slope at 30 ppm Zn implying the presence of 2 populations with very little (negligible) overlap. Again, it seems most reasonable to interpret the upper population as anomalous and the lower as background with a well defined threshold separating the two.

Soil B-zone Cu and Zn (figure 7)

The general form of the cumulative probability plot for B-zone Cu is similar to that for A-zone Cu. Two populations, a lower background and a higher anomalous one, are indicated by breaks in slope at 5 and 45 ppm. Substantial overlap of the two populations is indicated. However, all values greater than 45 ppm Cu can be assumed anomalous; this includes 12 percent of the total data.

The cumulative probability plot for B-zone Zn differs appreciably from that for A-zone Zn. Two breaks in slope are evident at 21 and 103 ppm Zn implying the presence of two populations--background and anomalous. Twenty-one percent of the values lie above 103 ppm Zn and are definitely recognizable as being anomalous. The higher lognormal population has a much larger standard deviation than does the lower, the reverse situation to that for A-zone Zn data.

Soil Mo, A- and B-zones (figure 8)

Cumulative probabilitity plots for A- and B-zones Mo are shown in figure 8. Both curves have more-or-less the same form and indicate

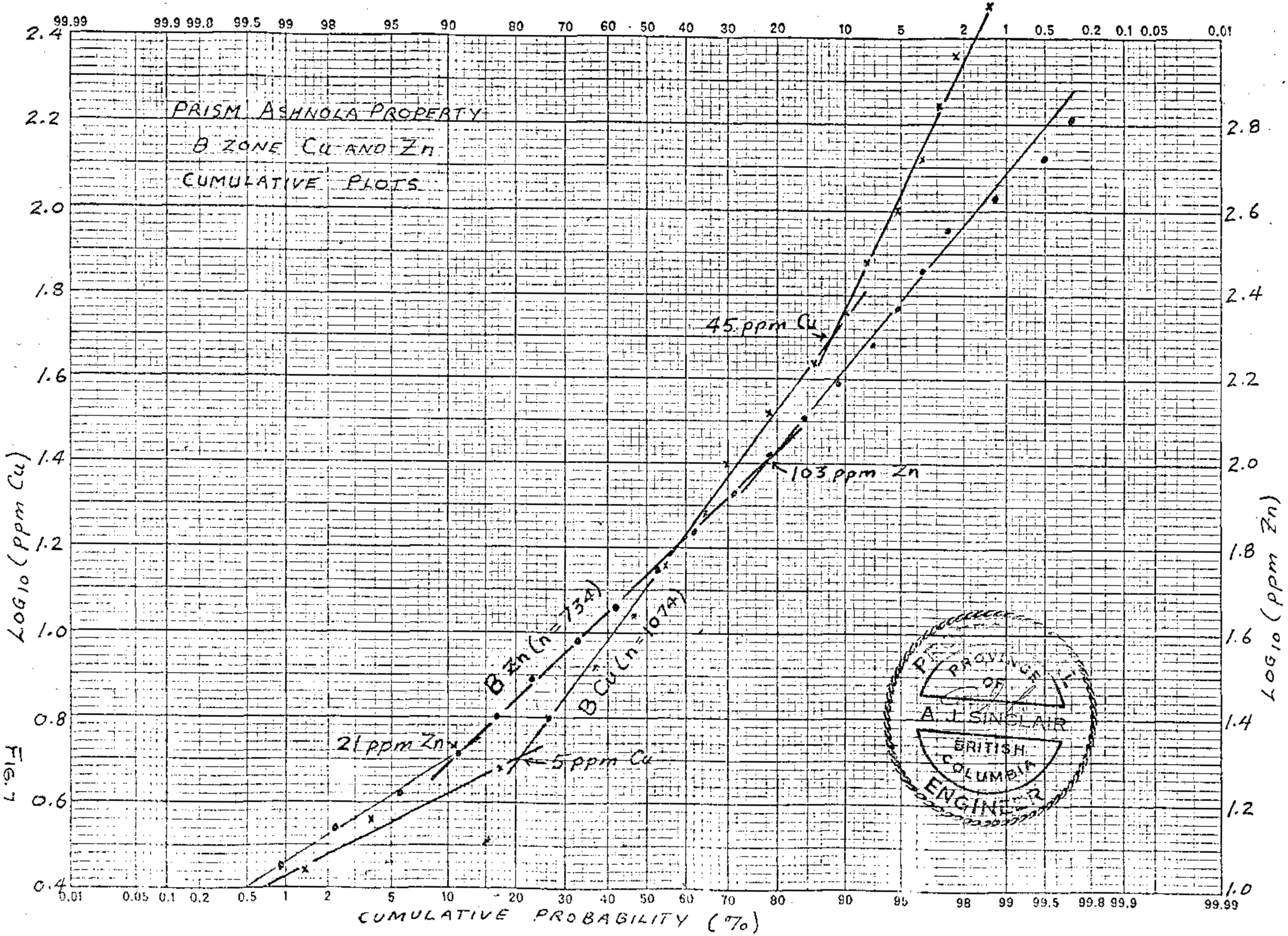
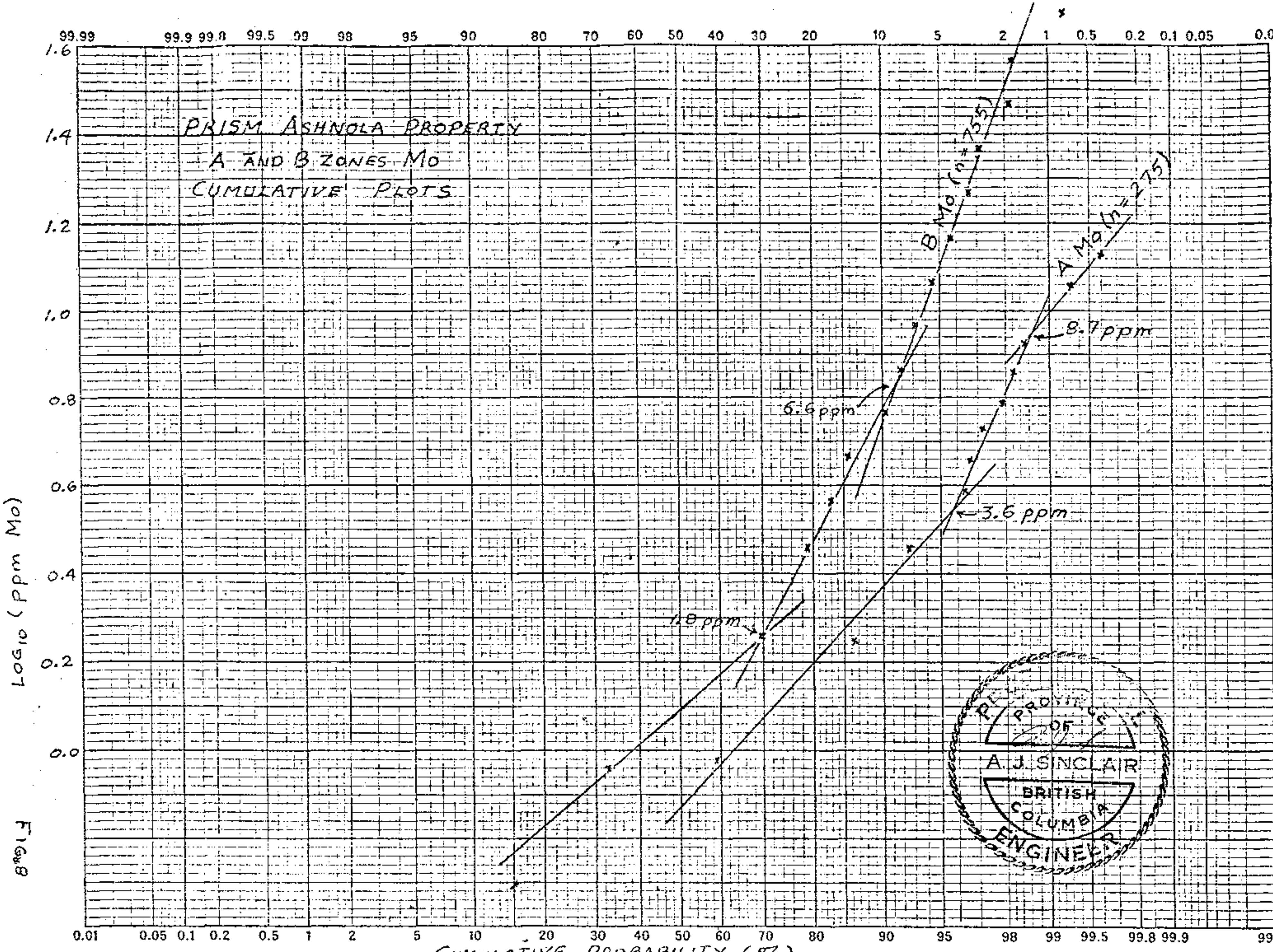

PRISM ASHNOLA PROPERTY
B ZONE Cu AND Zn
CUMULATIVE PLOTS
45 ppm Cu
103 ppm Zn
B Zn (n = 734)
B Cu (n = 1074)
21 ppm Zn
5 ppm Cu
LOG10 (ppm Cu)
LOG10 (ppm Zn)
CUMULATIVE PROBABILITY (%)
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR
ENGINEER

FIG. 7



PRISM ASHNOLA PROPERTY
A AND B ZONES Mo
CUMULATIVE PLOTS
B Mo (n=755)
A Mo (n=275)
8.7 ppm
6.6 ppm
3.6 ppm
1.8 ppm
LOG10 (ppm Mo)
CUMULATIVE PROBABILITY (%)
A. J. SINCLAIR
PROVINCE OF BRITISH COLUMBIA
ENGINEER

FIG 8

the presence of two populations, interpreted as background (lower) and anomalous (higher). Two breaks in slope are present in each cumulative curve. For B-zone data all values 7 ppm and greater are recognized as definitely anomalous--this includes 8 percent of the data. Somewhat less than half of the values between 2 and 7 ppm are also anomalous.

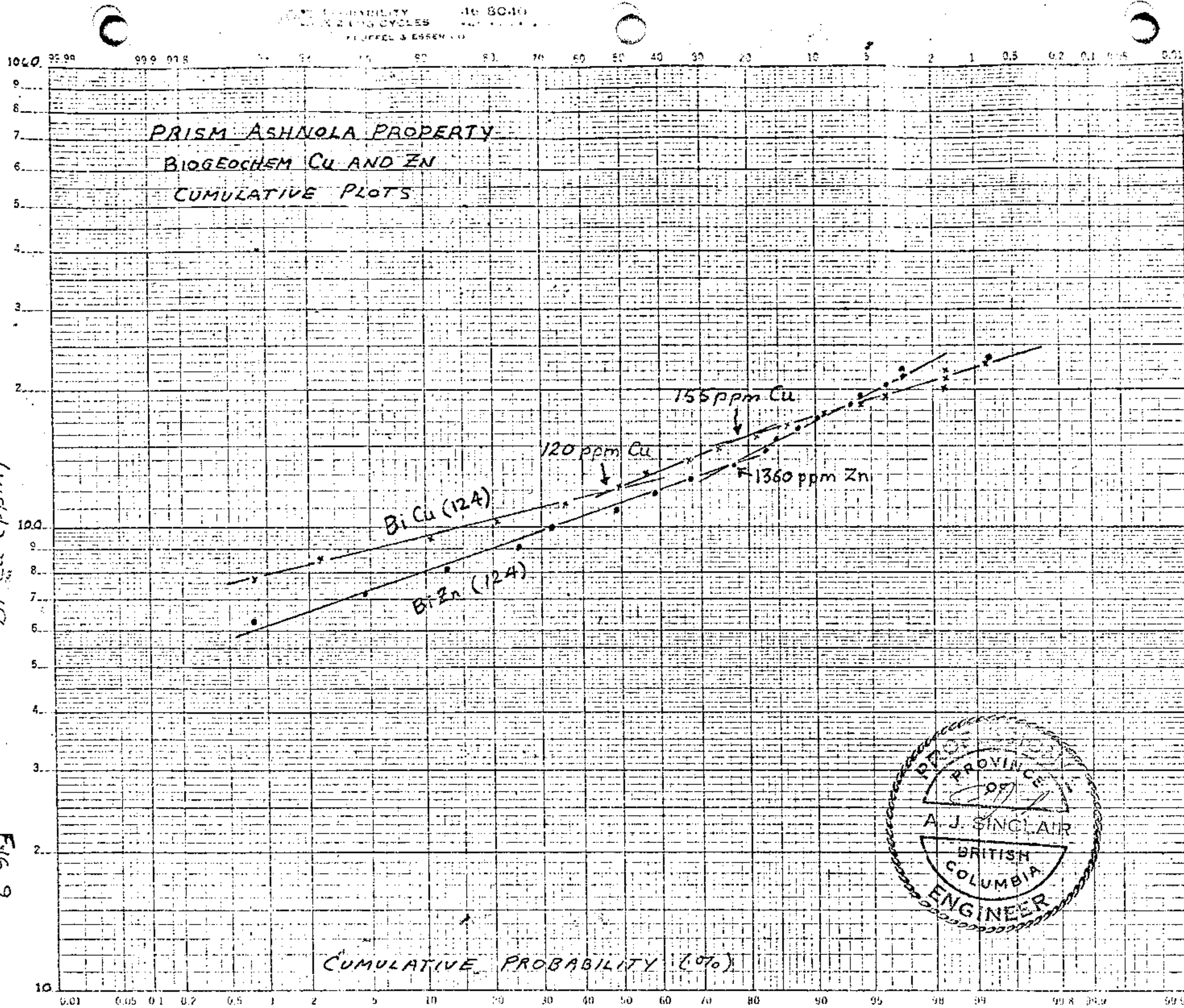
Definite A-zone anomalous values are 9 ppm Mo or greater, and account for only slightly more than one percent of the data. Even including the range of mixing of anomalous and background populations (4 to 9 ppm) only 4 percent of the data are accounted for. It would appear that A-zone Mo values are not as effective an exploration tool as are B-zone Mo values on the Ashnola property. It may be, however, that A-zone data are more discriminating and might aid in assigning priorities to B-zone anomalies.

<u>Biogeochemical Cu and Zn (figure 9)</u>

One hundred and twenty-four samples of second year growth lodgepole pine needles from an area of thick overburden west of Cat Creek were ashed and analyzed for Cu, Zn and Mo. Mo content is generally below the detection limit. Both Cu and Zn values are consistently high and both elements appea4 to include two populations. The graph for Cu has two breaks in slope at 120 and 155 ppm; the Zn plot has a single break in slope at 1360 ppm. The significance of these populations is not clear.

CORRELATIONS AMONG VARIABLES

Correlations among variables have been analyzed using only arithmetic data for 203 sample sites for which data existed for 8 variables. The resulting matrix of linear correlation coefficients is shown in table II.


PRISM ASHNOLA PROPERTY
BIOGEOCHEM CU AND ZN
CUMULATIVE PLOTS
155 ppm Cu
120 ppm Cu
1360 ppm Zn
Bi Cu (124)
Bi Zn (124)
Bi Cu (ppm)
Bi Zn (ppm)
CUMULATIVE PROBABILITY (%)
PROVINCE OF BRITISH COLUMBIA
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ENGINEER

Fig. 9

TABLE II

Correlation Coefficients for Arithmetic Data*

Variable	CH	MAG	ACU	AZN	BCU	BZN	BMO	RES
CH	1.0							
MAG	-.279	1.0						
ACU	.105	-.081	1.0					
AZN	-.023	-.039	.582	1.0				
BCU	.183	-.138	.863	.490	1.0			
BZN	.118	-.142	.740	.779	.806	1.0		
BMO	.138	-.170	.332	.083	.374	.132	1.0	
RES	-.583	.558	-.066	.082	-.084	-.018	-.091	1.0

*Absolute values greater than 0.181 are significant at the 1 percent level.

A total of 12 of the 28 correlation coefficients listed in table II are significant at the one percent level. Some of these are rather obvious associations that are to be expected. For example, consider the very high degree of correlation of BZn with ACu, AZn and BCu respectively. In fact, six of the 12 significant correlation coefficients result from inter-relations among the four variables ACu, BCu, AZn, BZn. Two additional significant correlations exist between BMo on one hand and ACu and BCu on the other. These latter two correlations are important in that they indicate a <u>partial</u> correlation between Mo and Cu in soils. Perhaps equally important is the clear absence of correlation between Mo and Zn in soils!

Chargeability has (i) a moderate negative correlation with ground magnetic data, (ii) a strong negative correlation with apparent resistivity, and (iii) a barely significant correlation with BCu. Perhaps the most important of these is the latter correlation, weak though it is!

The final significant (and very pronounced) correlation is that between apparent resistivity and ground magnetic data. This is important because it implies that much of the variation in apparent resistivity is a function of the nature of underlying bedrock.

MULTIVARIATE (Q-MODE FACTOR) ANALYSIS

Relatively little effort has been placed on investigating the usefulness of factor analysis in the isolation of target areas for detailed follow-up work in cases where detailed geochemical and geophysical surveys have produced numerous variables in numeric form. Factor analysis has been used fairly extensively to deal with multi-element geochemical data, especially on a regional scale (eg. Wilson and Sinclair, 1969; Nicol et al., 1969), but has not been applied routinely to a combination of geochemical and geophysical measurements of the type commonly obtained during property assessment in mineral exploration. Geochemical and geophysical data obtained from the Ashnola property to the end of 1970 appear suitable for such a study. Available measurements include Cu, Zn and Mo analyses of both A and B soil horizons as well as several variables obtained from induced polarization and ground magnetic surveys.

Q-MODE FACTOR ANALYSIS

Q-mode factor analysis is a procedure by which a similarity matrix (commonly a cos theta matrix) derived for sample sites (i.e. grid locations) is analyzed to extract linear combinations of variables. These linear combinations or multi-variables are called factors and commonly can be interpreted in terms of natural processes that have affected sites at which samples (or measurements) were taken. Processes include such things as various geochemical environments, mineralizing environments, metasomatism, processes involved in rock formation, and so on depending on the nature of the data under study. In the case of detailed geochemical and geophysical measurements in areas of mineral exploration, the hope is that a multi-variable (factor) will emerge from the study, that will be easily interpretable as relating to mineralization. Such a factor should consist of the right combination of variables and might, in part, correlate spatially with known areas of mineralization. Interpretation of the factors is a highly subjective procedure and is best done with a good understanding of the geology of the area and an appreciation of the significance of all variables used in the analysis. The major uses of factor analysis are (i) reduction of the number of maps involved in a detailed study by producing appreciably fewer factors than original variables, (ii) combining correlated or partially correlated variables (both positive and negative correlations) in a single new multi-variable or factor (such correlations might or might not be obvious from perusal of original data), and (iii) aiding interpretation of data in terms of fundamental processes.

Q-MODE FACTOR ANALYSIS OF ASHNOLA PROPERTY DATA

General Remarks

As indicated in an earlier section, two of the variables considered here, chargeability and apparent resistivity, are slightly smoothed versions of original data. This situation arose because Q-mode factor analysis requires that measurements of all variables pertain to a single sample site. Both chargeability and apparent resistivity values were assigned to points midway between geochemical soil sample locations; and in order to obtain all data referred to the same control points it was necessary to interpolate values of the two geophysical variables in question. A standard linear interpolation method was used.

General Factor Analysis of 8 Variables:

An initial attempt to study the usefulness of factor analysis in evaluation of detailed exploration data from Ashnola property involved 8 variables--ground magnetic data (MAG), chargeability (CH), apparent resistivity (RES), soil A-zone Cu (ACu), soil A-zone Zn (AZn), soil B-zone Cu (BCu), soil B-zone Zn (BZn), and soil B-zone Mo (BMo). Values for all variables were available for 203 grid locations. Self potential data are ignored because of the difficulty in interpretation. Biogeochemical data were omitted because of the small number of stations for which data were available.

Two hundred and three values (locations) of the eight variables were analyzed with a Q-mode factor analysis program similar to that described by Klovan (1968). Five factors were found that accounted for about 88% of the total variation in the data. Results are summarized in table III.

Contour maps of each of the 5 factors are shown in figures 10 to 14 inclusive. Several comments regarding these maps are in order. Factor values are normally in the range -1 to 1 with high negative values implying small amounts of positive variables in the factor (or conversely, large amounts of negative variables) and high positive values implying large amounts of positive variables in the factor. However, the contour program available could not contour negative values. Therefore, 1 was added to all factor values so the range shown on all maps is 0 to 2 rather than the -1 to 1 as would be expected normally. To interpret the computer output maps of factor values it is therefore necessary to subtract 1 from all contour or station values!

For ease of comparison a standard scale of 1 inch equals 400 feet has been used for all computer output maps presented here. This permits ready comparison with geological, geochemical and geophysical maps already prepared for the property. To facilitate coding of station co-ordinates, the assumption was made that linecutting resulted in a perfectly rectangular grid. In actual fact individual lines depart from rectangularity. Hence, many station locations depart somewhat from their actual ground positions. This is not a particularly serious problem, especially if positions on computer output maps are located with reference to the grid coordinate system.

TABLE III

SUMMARY OF FACTOR ANALYSIS RESULTS FOR 8 VARIABLES,

203 SITES, ASHNOLA PROPERTY

Factor	Percent Variance	Constituent Variables	Interpreted Significance
I	25.0	- AZn, BZn	Zn dispersion halo
		+ (BMo)	
II	25.2	- CH, BCu, BMo, (ACu)	Mineralization
		+ MAG, RES	
III	18.2	- CH	Pyrite rim
		+ RES, BMo, (BCu, ACu)	
IV	10.6	+ CH, MAG	
V	8.8	- BMo, BZn	
		+ BCu, ACu	

Interpretation of Factors from 8-Variable Analysis

Factor I: High negative values of factor I are high in the linear combination of AZn and BZn. Figure 10 shows that this factor is high more-or-less over the positions of the pyrite halo and it seems reasonable to interpret it as the geochemical dispersion of zinc during porphyry copper-type mineralization.

Factor II: High negative values of factor II consist of a linear combination of CH, ACu, BCu and BMo, the variables that might be expected to be high over porphyry copper-type mineralization. In fact, most of the high values of this factor are grouped over areas of known Cu-Mo mineralization, specifically the areas drilled by Kennco and Quintana. It therefore seems reasonable to interpret this factor as a Cu-Mo mineralization factor. If this is so other areas of interest are indicated in the northeastern part of the property.

Factor III: High negative values of factor II consist principally of Ch and correlate spatially with a more-or-less well defined pyrite halo.

Factor IV: Positive values of factor IV consist mainly of a linear combination of Ch and Mag values suggesting correlation with a rock parameter such as hydrothermal alteration. However, detailed examination of the distribution of values of the factor is required.

Factor V: Positive values of factor V represent a soil Cu factor. Because of the relatively low variance accounted for by this factor (8.8%) one must be cautious in attributing significance to it.

Tests of 5 and 6 Variable Factor Analysis

The 8-variable factor study indicated very strong correlation between (i) ACu and BCu, and (ii) AZn and BZn. It was therefore decided to ignore soil A-horizon results and reanalyze the remaining variables

TABLE IV

SUMMARY OF FACTOR ANALYSIS RESULTS FOR 5 VARIABLES,

203 SITES, ASHNOLA PROPERTY

Factor	Percent Variance	Constituent Variables	Interpreted Significance
I	31.4	- CH, BZn, (BCu)	
		+ RES, MAG	
II	27.1	- BCu, BZn, RES	
III	18.6	- BZn	
		+ BCu	
IV	14.2	+ CH, MAG	

TABLE V

SUMMARY OF FACTOR ANALYSIS RESULTS FOR 6 VARIABLES,

228 SITES, ASHNOLA PROPERTY

Factor	Percent Variance	Constituent Variables	Interpreted Significance
I	25.9	- CH, BZn	
		+ RES	
II	23.7	+ BZn, RES, (BCu)	
III	22.1	+ BCu, BMo	
IV	13.6	+ CH, MAG, (BCu)	

for 203 stations. BMo was also omitted to test whether or not its presence was essential in defining a mineralizing factor. Results of the 5 variable analysis of 203 sites are summarized in table IV. Although the order of factors has changed somewhat, the significant point to be made in comparing tables III and IV is that comparable factors (in terms of constituent variables) exist in both.

To further evaluate the importance of BMo in the factor analysis study the above 5 variables plus BMo values for 228 sites were reanalyzed with results summarized in table V. These results are very analogous to those in table IV (and table III as well) with essentially a one-to-one correlation between corresponding factors obtained from the two runs.

In summary, then, these preliminary studies suggest the possibility that a Mineralizing factor might well be recognized in a detailed, 5-variable factor analysis of Ashnola property data.

<u>Detailed 5-Variable Factor Analysis</u>

Having established that 5 variables provide a reasonable base for factor analysis, the Ashnola data file was searched for all stations for which 5 variables were available (430 sites were found) and these data were treated by the Q-mode program. These 430 sites provide the maximum possible coverage of the property with the data provided! A summary of results is shown in table VI and factor plots and communality are illustrated in figues 15 to 19 inclusive. A discussion of each factor follows:

<u>Factor I</u>: Positive values of this factor are a linear combination of ground magnetic and apparent resistivity data, suggesting a relationship to rock type. No effort has been made to interpret the factor in more detail.

TABLE VI

SUMMARY OF FACTOR ANALYSIS RESULTS FOR 5 VARIABLES,

430 SITES? ASHNOLA PROPERTY

Factor	Percent Variance	Constituent Variables	Interpreted Significance
I	31.9	+ MAG, RES	
		- (CH, BCu, BZn)	
II	25.6	+ BZn, (BCu, RES)	
III	19.1	+ MAG, BCu, (CH)	
IV	14.2	- BCu	
		+ CH, MAG, BZn	

Factor II: Positive values of factor II are principally a function of BZn with minor contributions from BCu and RES. The factor is unrelated spatially to known mineralization and probably, in large part, outlines a zinc dispersion pattern.

Factor III: Positive values of factor III consist mainly of MAG, BCu, with a minor contribution from chargeability values. Spatially, this factor correlated with known mineralized areas drilled by both Kennco and Quintan. It therefore seems reasonable to correlate the factor with Cu-Mo mineralization, in which case other high positive value areas should be investigated. Several such areas exist and are listed in table VII. These "anomalous" areas of interest represent widely scattered localities and priorities must be assigned. On the basis of general models of porphyry copper type mineralization one would expect Cu-Mo deposition inside the pyrite halo. Consequently, "anomalies" occurring inside the pyrite halo are assigned high priority (H). Because "anomalies" within the pyrite halo probably owe their high values to chargeability these "anomalies" are assigned lowest priority (L). By a process of elimination, the remaining "anomalies" outside the pyrite halo are assigned intermediate priority (M).

Factor IV: The explanation of this factor is not clear from a superficial examination.

Communality: In addition to the factor maps a final plot is shown of communality. Communality, mathematically, is the sum of squares of all factor values in the model. For each sample site communality should be 1.0 if the factor model perfectly explains all the variation in the data at a given site. In more realistic terms, the closer the communality is to 1.0, the better is the factor model. Interpretation is somewhat subjective, but examination of figure 19 shows that a good

TABLE VII

FACTOR III ANOMALIES INDICATED BY DETAILED

FACTOR ANALYSIS OF 5 VARIABLES AT 430 SITES

Arbitrary Number	Grid Coordinates of Anomaly Centre X	Y	Priority
1	13.4	7.2	L
2	11.8	12.8	L
3	14.0	12.0	M
4	10.6	15.2	M
5	12.4	14.4	M
6	12.7	11.2	H
7	13.5	12.0	H
8	14.3	10.4	H

proportion of the communality values are greater than 0.9 and the vast majority are greater than 0.8. This suggests that the factor model summarized in table VI provides a reasonably good description of the data variability. Of course, it says nothing about the interpretation.

However, a few stations have communality values less than 0.6. These localities are anomalous in some respect, although what significance they have will require close examination of the original data to see how it departs from original data at those localities well explained by the factor model. In summary, the important thing to note from the communality map is that if one is to accept the factor model, certain samples shown as having low communalities do not fit the model and are to be investigated closely for a reasonable explanation.

SUMMARY

1. Histogram analysis of 8 geochemical and 3 geophysical variables indicates that all have close approximations to lognormal distributions.

2. Examination of cumulative probability plots of 8 geochemical variables shows clearly that each variable is composed of two populations. These are interpreted as representing (higher) anomalous and (lower) background populations in each case, with well defined thresholds separating them.

3. Cumulative plots of geophysical variables show that chargeability and ground magnetic data are each composed of two populations. In contrast, apparent resistivity values have a complex cumulative probability plot with 4 breaks in slope suggesting the presence of at least 3 populations.

4. Linear correlation coefficients indicate a high degree of intercorrelation among AZn, ACu, BZn and BCu. BMo is moderately well correlated with both ACu and BCu but is completely uncorrelated with AZn and BZn.

5. Chargeability has a weak correlation with BCu. Apparent resistivity has a strong correlation (negative) with chargeability and a strong positive correlation with ground magnetic data. This latter correlation is important because it implies that much of the variability in apparent resistivity is a function of bedrock properties.

6. A "reconnaissance" factor of 8 variables for 203 sample sites indicates potential for the method, principally because several "reasonable" factors were obtained, one of which appears to correlate spatially with known mineralization. This latter factor, furthermore, indicates other areas of interest within and near the pyrite halo in the northeast part of the property.

7. Initial exploratory attempts to apply 5 and 6 variable factor analysis to approximately 200 sample sites gave results comparable to the 8 variable study.

8. A detailed factor analysis study of 5 variables for 430 sample sites also produced comparable results to the 8 variable study. Of particular significance was the recognition of a factor that correlated reasonably well with known mineralized areas. Furthermore, this same factor outlined several "anomalous" areas of interest in the northeast part of the property, some of which are on the inside of the pyrite halo.

ADDENDUM TO
STATISTICAL ANALYSIS OF EXPLORATION DATA
ASHNOLA RIVER PROPERTY

SUMMARY

1. Values of Ch, MAG, BCu, BMo and RES for 472 sites on the Ashnola River property were analyzed by factor analysis.

2. One factor (I) emerged that was an appropriate combination of variables (CH, BCu and BMo) as to suggest it might be an indicator of mineralization. This factor outlined part of the area drilled by Kennco but failed to indicate the area drilled by Quintana. However, a communality map picked up the area drilled by Quintan as a sharp isolated anomaly!

3. The "mineralization" factor indicated two areas with mineralization potential, in the drainage basin of Cat Creek in the eastern and north-eastern parts of the property:

   (i) Lines 112+00N and 120+00N centred on 132+00E

   (ii) Between lines 120+00E and 142+00E and lines 88+00N and 92+00N.

INTRODUCTION

In previous multivariate statistical analysis of exploration data from the Ashnola River property (Sinclair, 1971) a large gap in data existed in the center of the property in an area of considerable interest from the point of view of ore potential. The reason for this gap was that for factor analysis only those stations were used for which readings were available for all variables being considered. Many of the soil samples in the central part of the property were not analyzed for Zn, and since Zn was one of the variables considered in all previous factor analysis studies, the central data gap resulted.

To overcome this problem it was decided to reanalyze the data using only the 5 variables CH, MAG, BCu, BMo and RES. Since the factor analysis program would handle only a maximum of 500 control points some data from the west side of the property had to be omitted.

PROCEDURE AND RESULTS

The data file for Ashnola River property was searched for all stations for which the 4 variables CH, MAG, BCu and RES were recorded. The recorded value of BMo was also read but the site was not rejected if a zero value was found! In order to reduce the total number of control sites to less than 500 north-south data lines were successively eliminated starting on the west side of the property and progressing easterly. Eventually, 472 sample sites were obtained for which readings existed for the 5 variables in question. These data were analyzed with the factor program outlined in an earlier preliminary report (Sinclair, 1971).

Results are summarized in table IA. Maps of two critical factors (I and II) and communality are shown in figures 1A to 3A inclusive.

DISCUSSION OF RESULTS

Superficially, these results appear the best of all factor studies of the data to date. The main basis for this statement is the very well defined factor output that allows relative ease of interpretation. Four factors account for nearly 93 percent of the variance of the data (see table IA). Of these, two (I and II) appear most significant. Factor II is principally chargeability which is negatively correlated with B-zone Cu and Mo. As such, it outlines the pyrite halo and implies that soils in the central core are somewhat enriched in Cu and Mo relative to soils in the pyrite halo. Factor I, however, appears the most interesting, being a linear combination of charge-

TABLE I-A

SUMMARY OF FACTOR ANALYSIS RESULTS FOR 5 VARIABLES,

472 SITES, ASHNOLA PROPERTY

Factor	Percent Variance	Constituent Variables	Interpreted Significance
I	25.4	- CH, BCu, BMo	Mineralization
II	30.9	CH	Pyrite halo
		- BCu, BMo	Central Core
III	17.1	MAG, (RES)	Mag highs
IV	19.3	- RES	Resistivity (overburden and rock variations)

ability, [illegible] sely the combination one would expect to [illegible] A [illegible] igh for the factor, in part, [illegible] d by Ken [illegible] the area drilled by Quintana does [illegible] npointed rather pre- ci[illegible] [illegible] te this apparent wea[illegible] [illegible] factor I is the most lik[illegible] [illegible] rth noting that as[illegible] [illegible] appreciably lower grade [illegible]

[illegible] as being indicative of mine- [illegible] areas stand [illegible] having ore potential (see figure 1A). [illegible] 112+00N and 120+00N at 13[illegible] appears to have top priority because it [illegible] response on the inside rim [illegible] and [illegible] sporadic high values of soil [illegible] and Mo [illegible]. Furthermore, chalcopyrite and malachite have been identified [illegible] weathered exposures of rhyolite.

The second factor I anomaly covers a large area between 120+00E and [illegible]E and lines 88+00N and [illegible]. This area also occurs on the fringe of the pyrite halo but is located largely in the gap in the halo on the east side of the property. The area is covered with thick overburden and [illegible] the presence of low anomalous values in Cu and Mo [illegible] factor I anomalies mentioned above are in the drainage basin [illegible] Creek.

PROVINCE OF
A. J. SINCLAIR
BRITISH COLUMBIA
ENGINEER

COST BREAKDOWN

GEOLOGY

Geologic Mapping, Engineering, and Compilation G. Giroux--3 months @ $850/month	$2550.00
Air Photographs (colour)	$ 500.00
Air Photo Interpretation Pechiney Development Ltd. Staff	$ 500.00
TOTAL	$3550.00

GEOPHYSICS

Computer Costs	$ 400.19
Coding G. Giroux--25 days @ $40/day	$1000.00
Report Preparation Alistair Sinclair--5 days @ $150/day	$ 750.00
A.C.K. Fox--6 days @ $20/day	$ 120.00
TOTAL	$2270.19

QUALIFICATIONS

I, Alastair J. Sinclair, of 5869 Dunbar St., Vancouver 13, B.C. certify the following:

I am a graduate of the University of Toronto with the following degrees-

B.A.Sc. Geological Engineering	1957
M.A.Sc. Geology	1958

and a graduate of the University of British Columbia with the degree of Ph.D. in Geology in 1964.

I am a member of the Association of Professional Engineers in the provinces of British Columbia and Ontario.

I have practiced my profession for the past 10 years.

A.J. Sinclair, P.Eng.

August 18, 1971

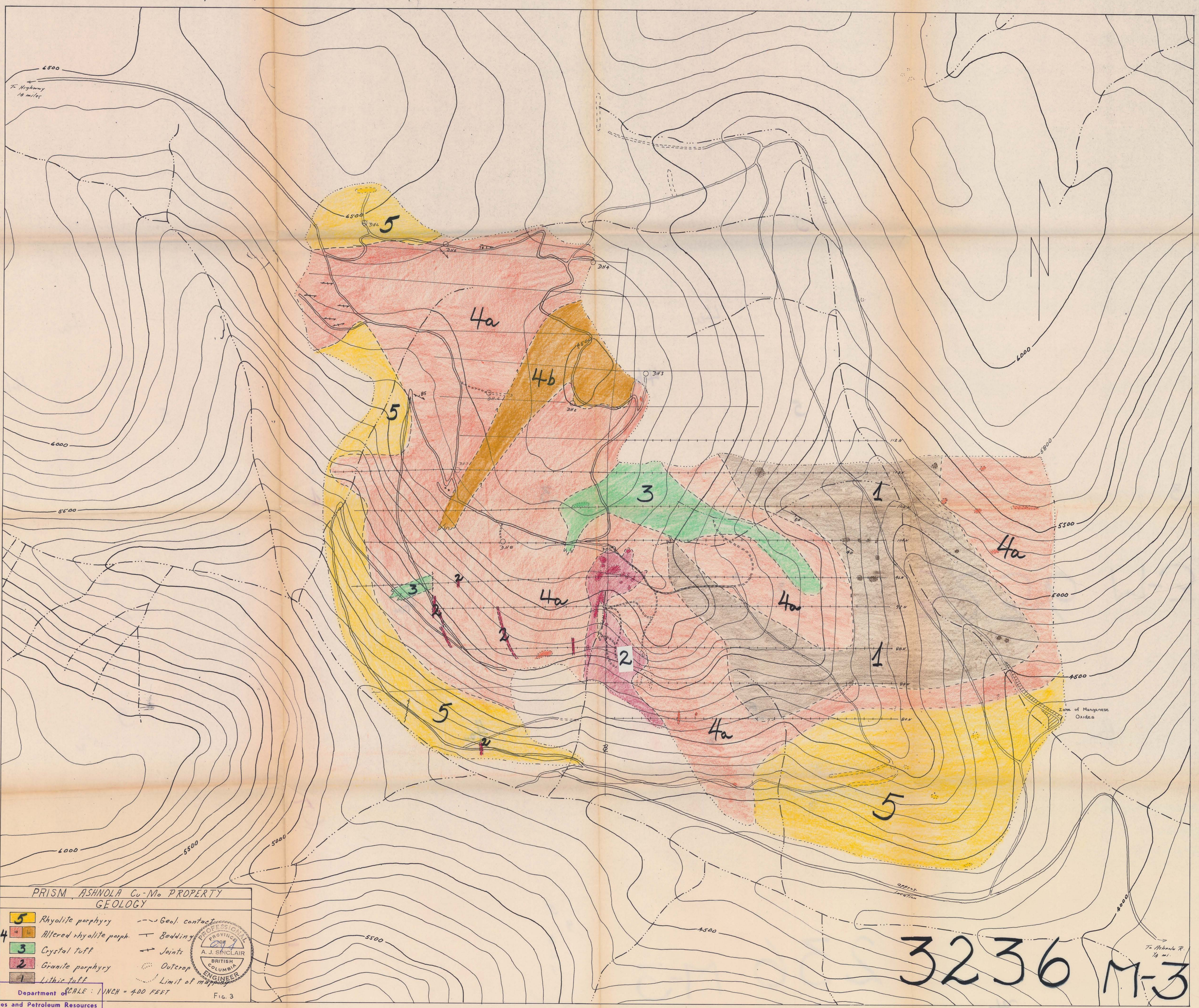
I, Gary H. Giroux, of 4061 west 38th Ave., Vancouver 13, B.C. certify the following:

I am a graduate of the University of British Columbia with a degree in Geological Engineering, 1970.

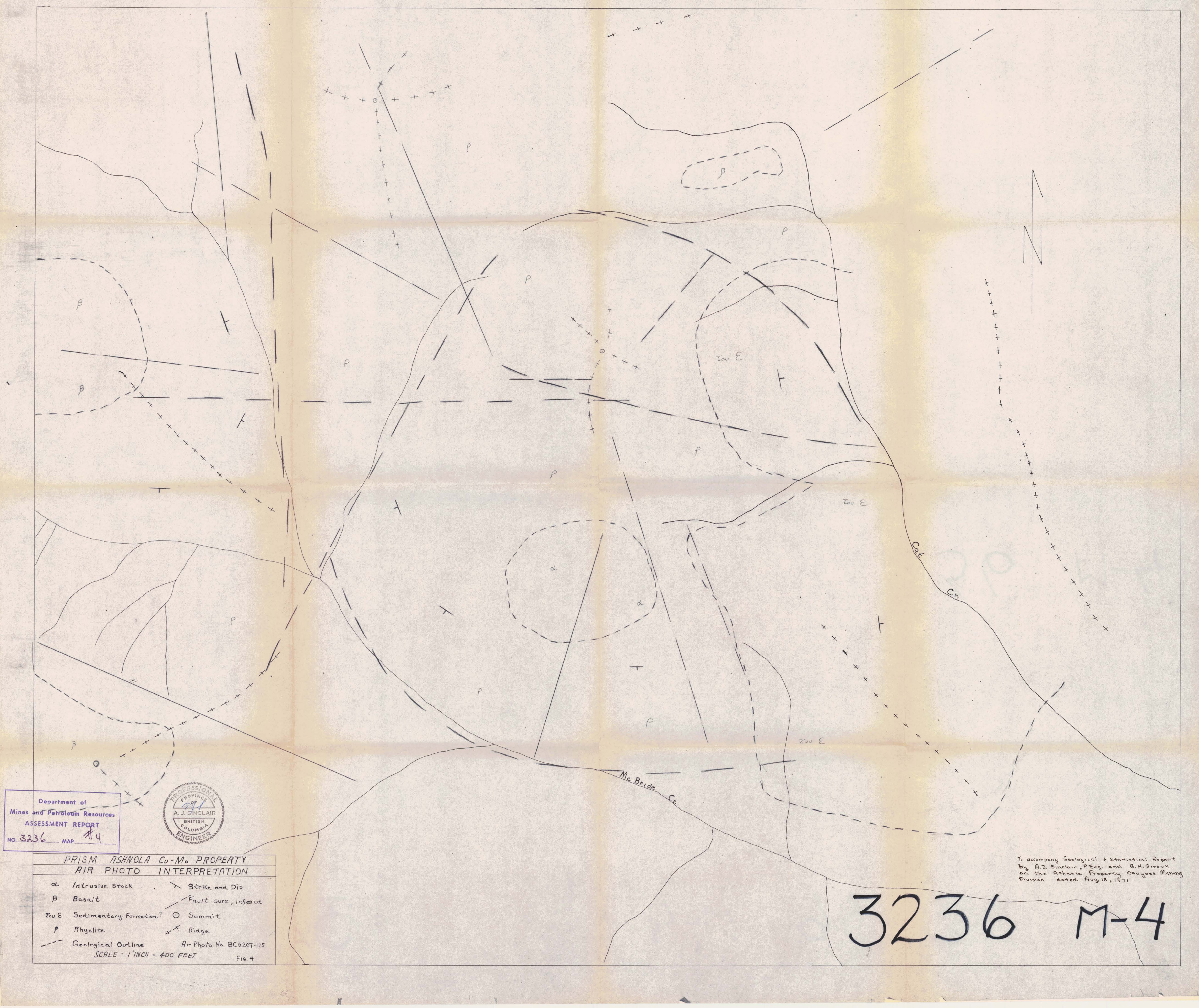
I have had 2 years field experience in British Columbia.

G.H. Giroux

August 18, 1971.



PRISM, ASHNOLA Cu-Mo PROPERTY
GEOLOGY
5 Rhyolite porphyry
4 a b Altered rhyolite porph.
3 Crystal tuff
2 Granite porphyry
1 Lithic tuff
Geol. contact
Bedding
Joints
Outcrop
Limit of mapping
SCALE: 1 INCH = 400 FEET
FIG. 3
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR
To Highway 14 miles
To Ashnola R.
Zone of Manganese Oxides
6500
6000
5500
5000
4500
4000
4a
4b
5
3
2
1
3236 M-3



Cat Cr.
Mc Bride Cr.
τou ε
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3236 MAP #4
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR
PRISM ASHNOLA Cu-Mo PROPERTY
AIR PHOTO INTERPRETATION
α Intrusive Stock
β Basalt
τou ε Sedimentary Formation?
ρ Rhyolite
Geological Outline
Strike and Dip
Fault sure, inferred
Summit
Ridge
Air Photo No. BC5207-115
SCALE: 1 INCH = 400 FEET
FIG. 4
To accompany Geological & Statistical Report
by A.J. Sinclair, P.Eng. and G.H. Giroux
on the Ashnola Property Osoyoos Mining
Division dated Aug. 18, 1971
3236 M-4

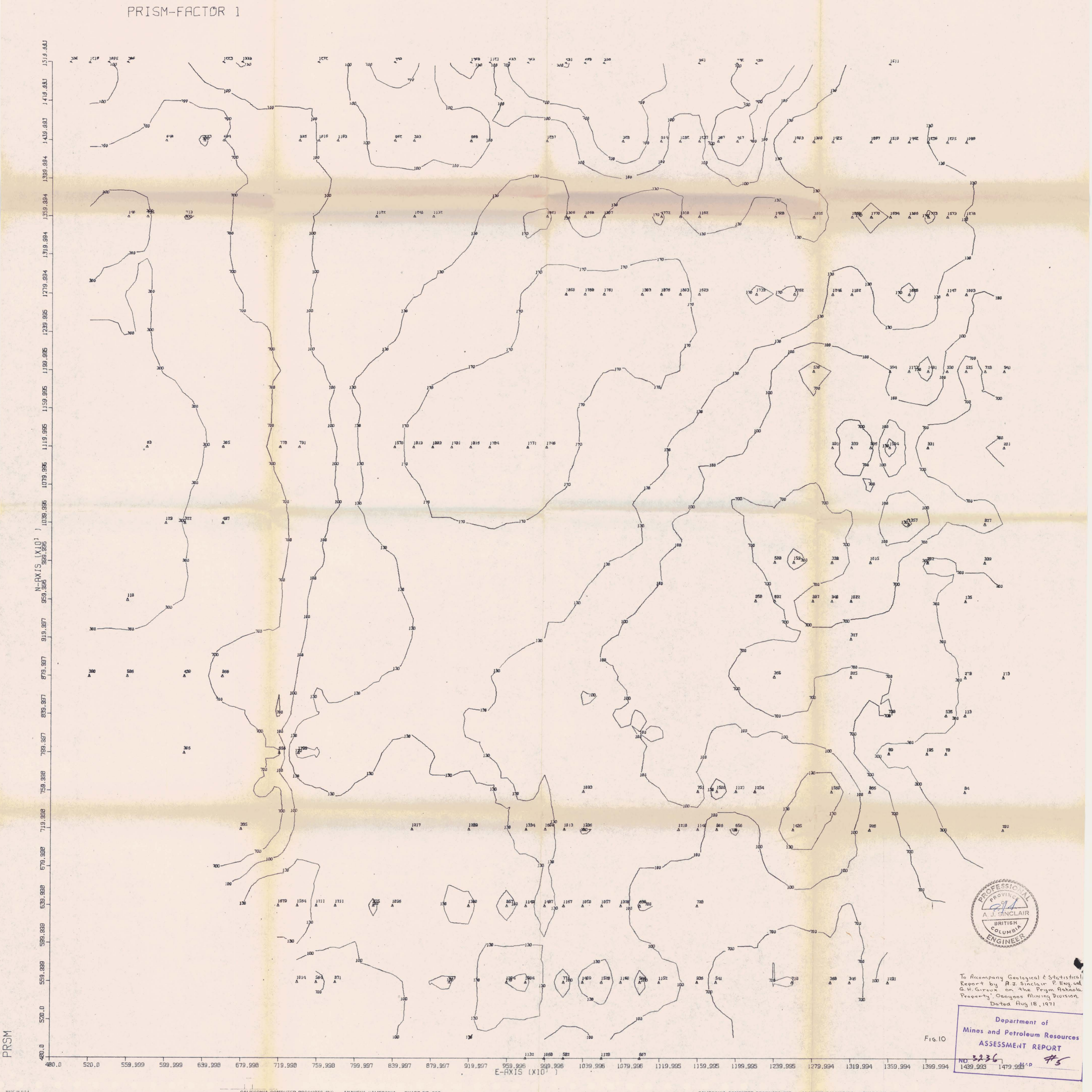
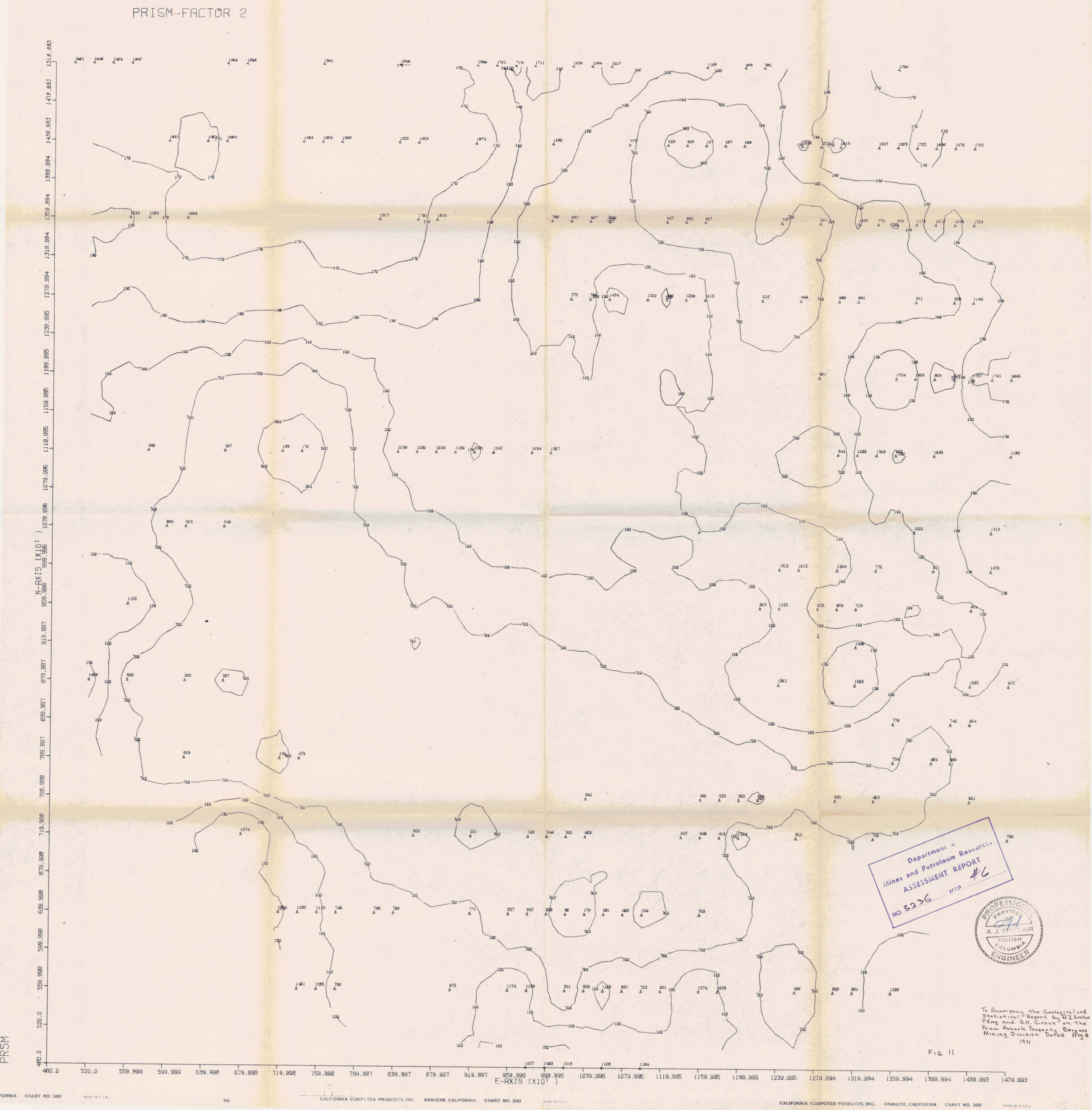

PRISM-FACTOR 1
N-AXIS (X10¹)
E-AXIS (X10¹)
PRSM
To Accompany Geological & Statistical Report by A.J. Sinclair P. Eng. and G.H. Giroux on the Prism Ashnola Property, Osoyoos Mining Division
Dated Aug 18, 1971
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO 3236 MAP #5

Fig. 10


PRISM--FACTOR 2
N-AXIS (X10¹)
E-AXIS (X10¹)
480.0
520.0
559.999
599.999
639.998
679.998
719.998
759.998
799.997
839.997
879.997
919.997
959.996
999.996
1039.996
1079.996
1119.995
1159.995
1199.995
1239.995
1279.994
1319.994
1359.994
1399.994
1439.993
1479.993
1519.993
PRSM
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3236 MAP #6
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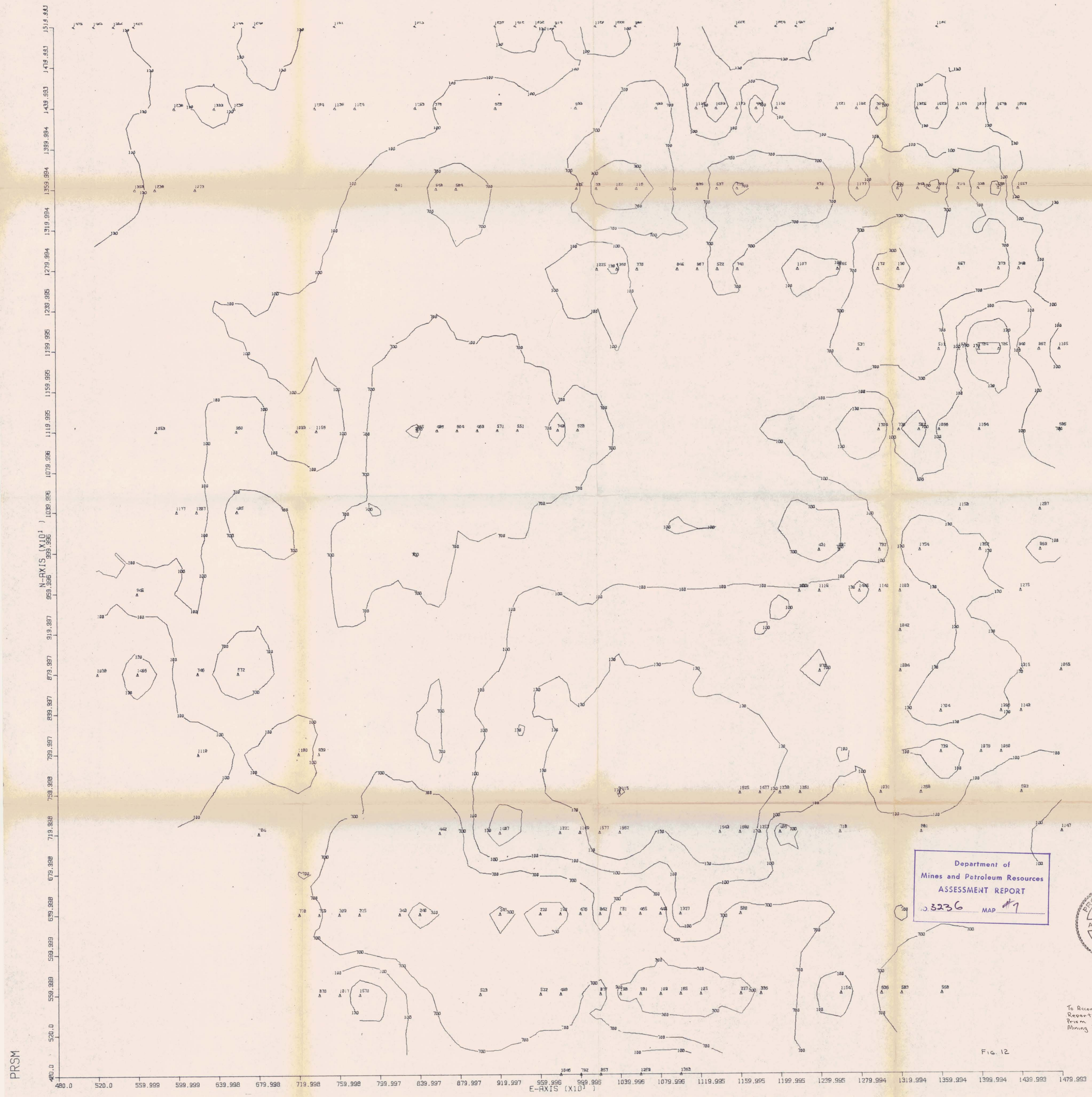
To Accompany the Geological and Statistical Report by A.J. Sinclair P.Eng. and G.H. Giroux on the Prism Ashnola Property Osoyoos Mining Division Dated Aug 18 1971

Fig. 11

PRISM-FACTOR 3



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
No. 3236 MAP #7

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A. J. SINCLAIR

To Accompany Geological & Statistical Report by A. J. Sinclair on the Prism Ashnola Property Osoyoos Mining Division Dated Aug 18, 1971

FIG. 12


PRISM -FACTOR 4
N-AXIS (X10¹)
E-AXIS (X10¹)
PRSM
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3236 MAP #8
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR
To Accompany the Geological & Statistical
Report by A.J. Sinclair P. Eng and
G.H. Giroux on the Prism Ashnola
Property, Osoyoos Mining Division
Dated Aug. 18, 1971

FIG. 13

Fig. 14

To Accompany the Geological and Statistical Report by A.J. Sinclair P.Eng. and GH Giroux on the Prism Ashnola Property Osoyoos Mining Division Dated Aug. 18, 1971

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ASSESSMENT REPORT
NO. 3236 MAP #9

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PROVINCE OF BRITISH COLUMBIA
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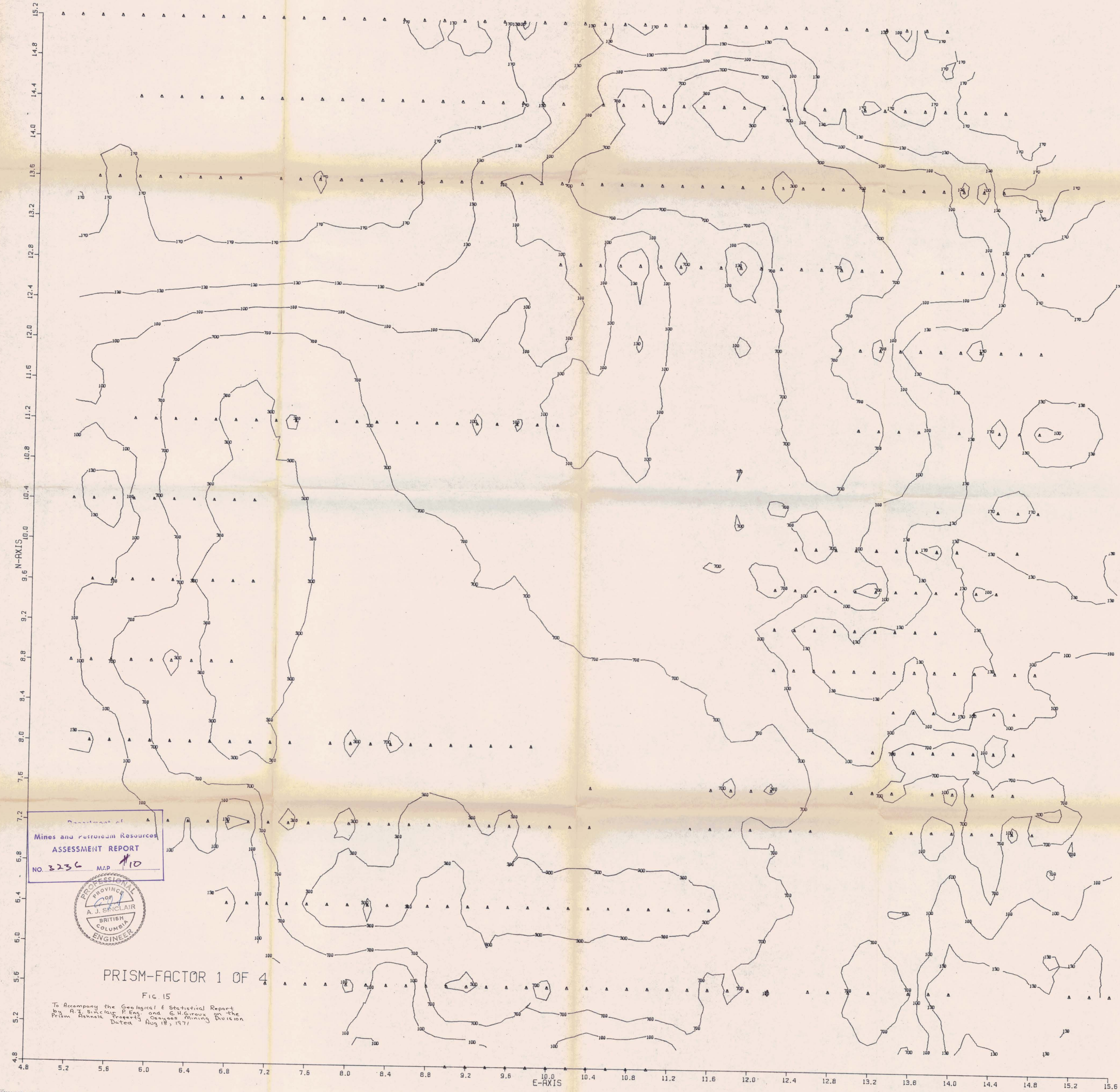
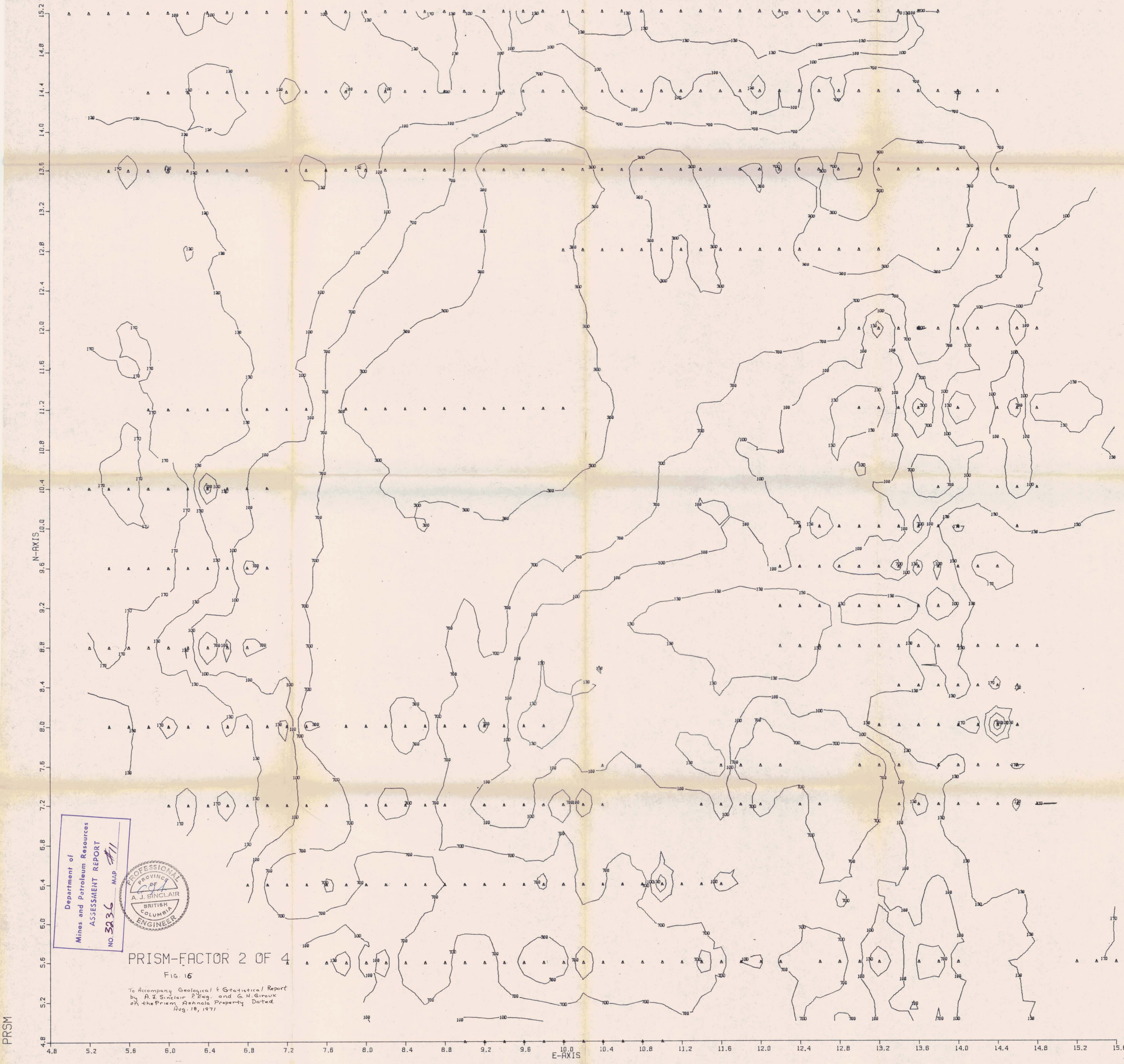


Fig. 15

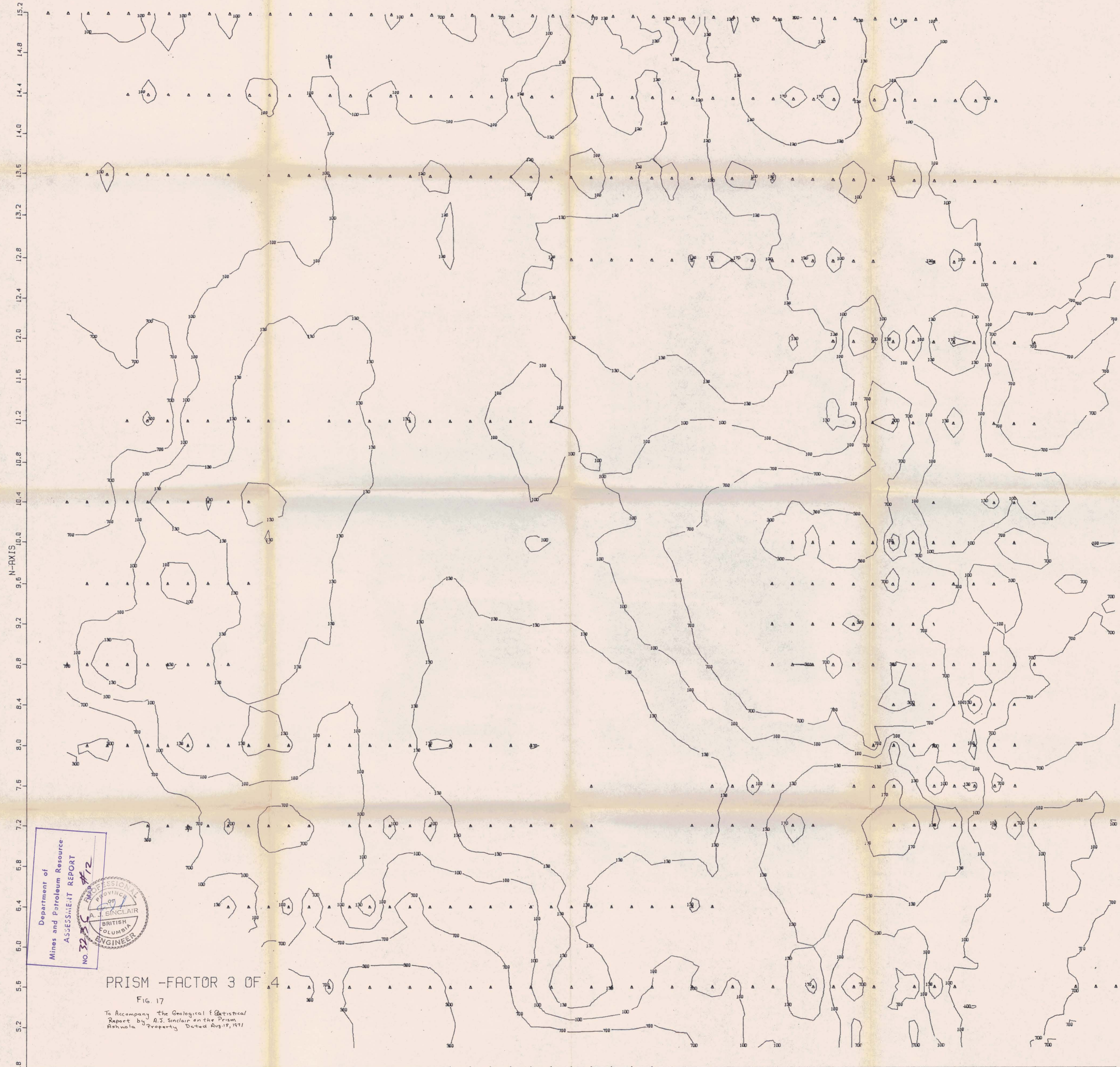
To Accompany the Geological & Statistical Report by A.J. Sinclair P.Eng. and G.H. Giroux on the Prism Ashnola Property Osoyoos Mining Division Dated Aug 18, 1971



PRISM-FACTOR 2 OF 4

FIG. 16

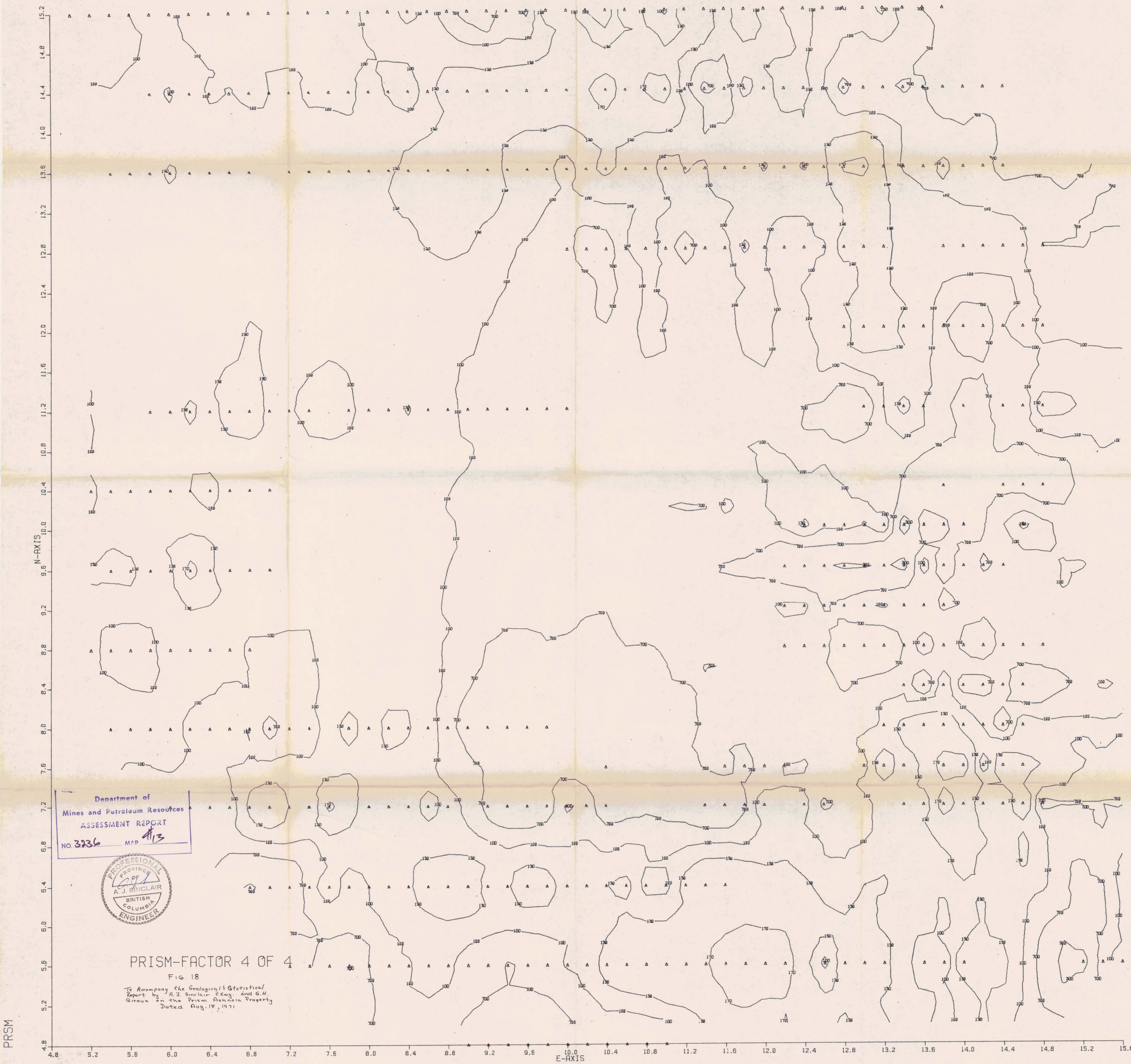
To Accompany Geological & Statistical Report by A. J. Sinclair P. Eng. and G. H. Giroux on the Prism Ashnola Property Dated Aug. 18, 1971

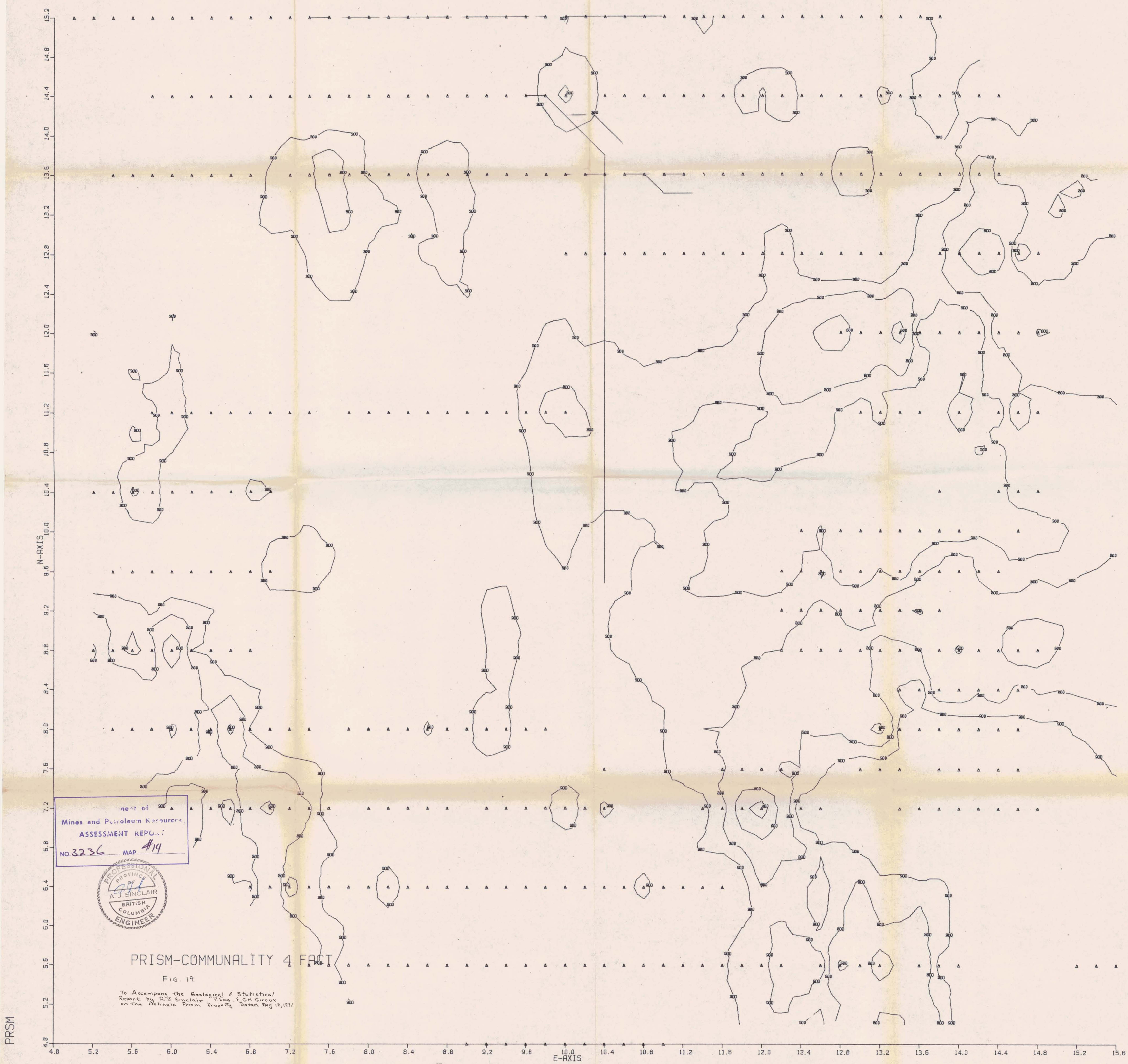


PRISM -FACTOR 3 OF 4

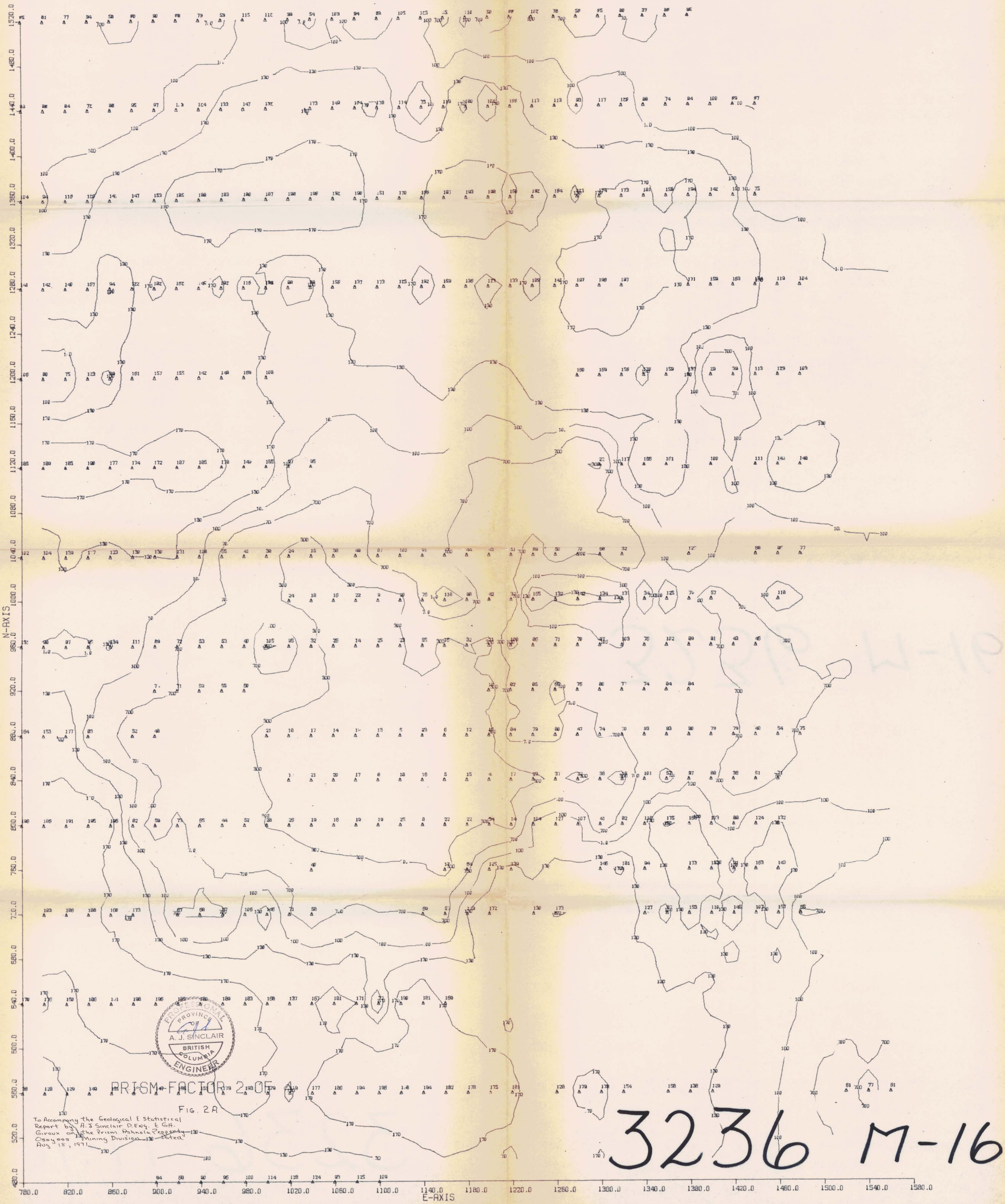
FIG. 17

To Accompany the Geological & Statistical Report by A.J. Sinclair on the Prism Ashnola Property Dated Aug. 18, 1971


PRISM-FACTOR 4 OF 4
FIG. 18
To Accompany the Geological & Statistical Report by A.J. Sinclair P.Eng. and G.H. Giroux on the Prism Ashnola Property Dated Aug. 18, 1971
N-AXIS
E-AXIS
PRSM
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3236 MAP #13
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR


PRISM-COMMUNALITY 4 FACT
FIG. 19
To Accompany the Geological & Statistical Report by A.J. Sinclair P.Eng. & G.H. Giroux on the Akhnola Prism Property Dated Aug 19, 1971
Department of Mines and Petroleum Resources ASSESSMENT REPORT NO. 3236 MAP #14
PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA A. J. SINCLAIR
N-AXIS
E-AXIS
PRSM


Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO 3236 MAP #15
N-AXIS
E-AXIS
PRISM FACTOR 1 OF 4
FIG. I-A
To Accompany the Geological & Statistical
Report by A.J. Sinclair P. Eng. and
G.H. Giroux on the Prism Ashnola Property
Osoyoos Mining Division Dated Aug. 18, 1971
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
A. J. SINCLAIR
3236 M-15
PRSM



3236 M-16

PRSM

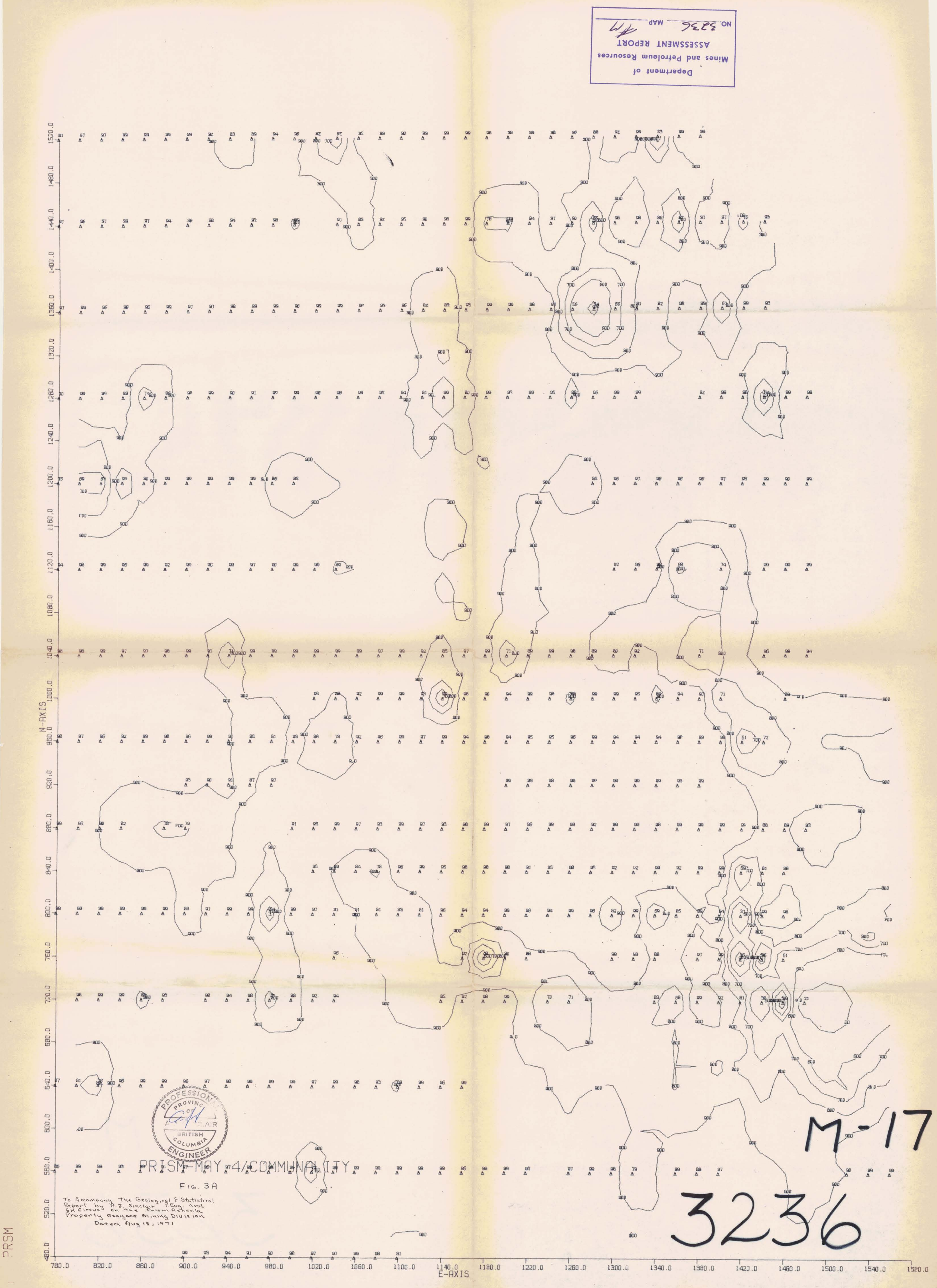


FIG. 3A

To Accompany the Geological & Statistical Report by A.J. Sinclair P.Eng. and GH Giroux on the Prism Ashnola Property Osoyoos Mining Division
Dated Aug 18, 1971

CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 300 MADE IN U.S.A.