86-536-15164

A GEOPHYSICAL REPORT
ON A
MAGNETOMETER SURVEY
ON THE
WARD I CLAIM GROUP
HARDIE MOUNTAIN, KAMLOOPS MINING DIVISION, B.C.

MINING DIVISION.....KAMLOOPS

NTS LOCATION..... 92I/15W

LATITUDE.....50° 50.40'

LONGITUDE.....120° 45.5'

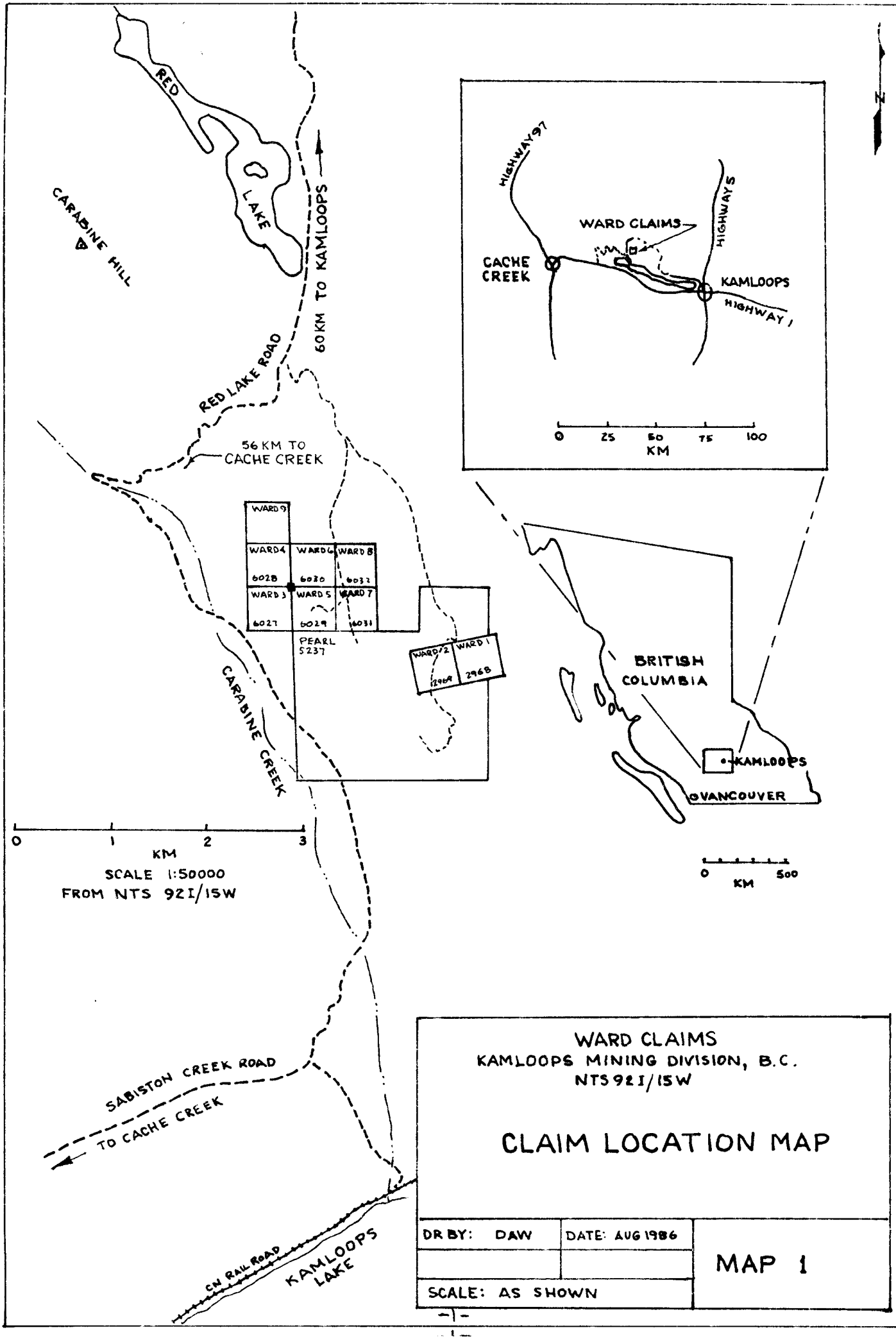
OWNER/OPERATOR.....DAVID A. WARD

AUTHOR OF REPORT.....DAVID A. WARD

JULY - AUGUST 1986

TABLE OF CONTENTS

LIST OF MAPS AND FIGURES



WARD CLAIMS
KAMLOOPS MINING DIVISION, B.C.
NTS 92I/15W

CLAIM LOCATION MAP

DR BY: DAW	DATE: AUG 1986	MAP 1
SCALE: AS SHOWN		

SUMMARY

A magnetometer survey was completed over the Ward I group of claims located on the west flank of Hardie Mountain between Kamloops Lake and Red Lake.

Access to the claims is by way of the combined Sabiston Creek-Carabine Creek-Red Lake-Tranquille River road and old logging roads.

The claims are mainly covered with soil but appear to be underlain by Upper Triassic Nicola volcanics according to Monger and McMillan (1984). These rocks have been intruded by several felsic stocks. The volcanics and two of the stocks have been sheared and brecciated by faults with various strikes. However, one group of faults has a northwesterly trend while another group trends more northerly to northeasterly.

Some of the sheared and brecciated zones have been mineralized to varying degrees with carbonates, fine grained quartz, cinnabar and pyrite in various combinations. So far, cinnabar occurrences have been found within an area that is about 200 m wide and 2000 m long, which trends about N30°N.

The presence of both anomalous quantities of mercury and fragments of altered volcanics in the soils appear to indicate the presence of intermittent zones of hydrothermal alteration in an area that has a maximum width of about 1000 m and strikes northwesterly through the property.

The results of previous exploration work have revealed many features that match criteria used to select an area in which to explore for blind epithermal-type precious metal deposits. The following items are present on the property: a pile of calc-alkaline volcanic rocks, an extensive fault system, utramafic rocks, felsic and mafic intrusives and indicators of hydrothermal activity, such as propylization, carbonization, silicification, argillation and mercury.

The purpose of the magnetometer survey was to obtain data which could be used in conjunction with other information to better understand the bedrock geology in the immediate area of the claim group and to select areas for more intensive exploration.

A portable, precession type of magnetometer was used to measure the total magnetic field at stations on a grid established during the course of the field work which was done during the month of July and first week of August, 1986. Additional traverses with the magnetometer were made in selected areas where the bedrock was exposed and could be identified. This information together with readings taken over occasional outcrops encountered during this survey were used to assist in interpreting the results of this work.

CONCLUSIONS

The basic general geology and known mineralization of the area is the same as indicated above. However, information obtained during the course of this work allows a more detailed account of the geology to be given and indicates several areas where more extensive exploration work should be done.

A small felsic intrusive containing xenoliths of porphyritic andesite was located about 1000 m southwest of the Hardie stock and about the same distance southerly from the Dickson stock. The intrusive appears to be a monzonite. Small outcrops of diorite of various textures and composition were found to occur in a northwesterly trending zone in the vicinity of the monzonite stock. It is suggested that the monzonite and diorites are related to the same magma source. It must be noted that all rock identifications in the work are field identifications and are subject to change.

The sites of four former mineral springs were located. Two sites are close together about 200 m northwest of Pearl claim identification post 4S2E. Another site is a few meters north of identification post 2S0E. A third site is about 400 m N70°E from identification post 1S0E. It is suggested that these mineral spring deposits, composed of travertine, calcite cemented gravel or banded calcite represent the last stages of mineralization in the area. At one site it appears that deposition occurred after the region was glaciated, which suggests that hydrothermal activity has taken place over a considerable length of time in this area.

It was found that the most common volcanic rocks within the claim group are porphyritic andesites of various textures and compositions. These rocks have been intruded by small felsic plutons and apparently sheared by many northwesterly trending faults. Both field evidence and magnetic data indicate that some of these suspected shear zones, covered with soil, have been hydrothermally altered.

Total magnetic field measurements over outcrops of various types of rocks that could be identified in the field indicate that those rocks that contain cinnabar and have been hydrothermally altered in one way or another generally have magnetic values of less than about 57500 gammas (γ). The felsic intrusives have intermediate magnetic values between about 57500γ and 58000γ, while diorites and porphyritic andesites exceed 58200γ.

After contouring of the magnetic data, using the above criteria and comparing this information with data from other work which indicated areas where soils contained greater than 300 ppb of mercury, it is suggested that there are several soil covered zones that should be explored in more detail.

One of these soil covered zones extends northwesterly from the apparent south end of the Hardie stock, parallel to the suspected southwestern contact of the Hardie stock, and then through the Dickson stock.

Another soil covered zone, located about 650 m southwest of the above zone, trends about N30°W. This zone cuts across the southwest facing slope that descends to Carabine Creek valley.

A third soil covered zone occurs near to the west boundary of the claims and extends northerly in a sinuous manner to join the above zone.

Other significant areas where the total magnetic field intensity is less than 57500γ occur near the south central boundary and southeast corner of the claims.

RECOMMENDATIONS

1. Concentrate future exploration work on the zone which extends northwesterly from the south end of the Hardie stock through the Dickson stock where the total magnetic field strength was found to be less than 57500γ and includes areas where anomalous quantities of mercury were found in the soils.

2. Excavate 8 trenches about 100 m long at 100 m intervals to crosscut this zone. In the vicinity of the Hardie and Dickson stocks the trenches should be of sufficient length to expose the contacts of the stocks.

3. Have fluid inclusion studies performed on any quartz or carbonates that contain cinnabar to estimate the salt content and temperature of the hydrothermal solutions that may have been associated with quartz-cinnabar mineralization now exposed at the surface.

4. Using data from the fluid inclusion study, estimate the depth below the existing surface where the hydrothermal solutions associated with the quartz-cinnabar mineralization would probably have boiled. If there is any precious metal zone associated with the quartz-cinnabar mineralization it would probably be located above the elevation where the hydrothermal solutions would have boiled.

5. Locate core drill holes and drill to intersect hypothetical precious metal zones.

A GEOPHYSICAL REPORT ON A MAGNETOMETER SURVEY
OF THE WARD I CLAIM GROUP, HARDIE MOUNTAIN, KAMLOOPS MINING DIVISION, B.C.

INTRODUCTION

The criteria used to select an area in which to explore for epithermal type precious metal deposits include, among other things, the presence of a pile of calc-alkaline volcanic rocks, felsic intrusives, an extensive system of faults, associated ultramafic rocks, indicators of hydrothermal activity such as carbonization, silicification, argillation and the presence of indicator elements such as mercury. The Ward I group of claims contain all of the above.

Even though some exploration has been done on the property, the geology has not been well understood because the bedrock is covered with an extensive layer of soil. In order to locate mineralized areas that might be covered with soil and to better understand the geology of the area, a magnetometer survey was conducted over the property during July and August 1986, by the owner and operator, David A. Ward.

During the course of the work, approximately 26 line-kilometers of grid line were established and about 28 line-kilometers of magnetometer traverses were conducted.

PROPERTY AND OWNERSHIP

The Ward I group consists of the Ward 1 and 2 claims (record nos. 2968 and 2969, 2 post claims) and the Pearl claim (record no. 5237), originally a 16 unit claim.

All claims are owned by David A. Ward of Powell River, B.C.

LOCATION AND ACCESS

The property can be located on NTS map 921/15W at about 50°50.4'N and 120° 45.5"W. This is in the Kamloops Mining Division on the west flank of Hardie Mountain about 5.5 km north of Copper Creek Station on the CN railroad. Access is by way of the combined Sabiston Creek - Carabine Creek - Red Lake - Tranquille River Road. The property can be reached by following, for about 3.5 km to the south, an old logging road that leaves the Red Lake road about 1 km south of the south end of Red Lake.

PHYSIOGRAPHY

The property is located on a small, mainly soil covered bench and steep hillside adjacent to the east side of the Carabine Creek valley. The elevation ranges from about 1060 meters at the eastern edge of the property to 640 meters at the road along the Carabine Creek valley.

The vegetative cover is best described as being mostly park land with a mixture of open, mature Douglas Fir forest; areas of dense, closely spaced immature fir; small meadows; occasional mature Ponderosa pine and some groves of aspen. Pine grass and a variety of shrubs, plants and wild flowers occur in the open forest and meadows. In places there is an abundance of wild onions.

The only water on the property is available from either one or two springs depending on the time of year. The water from both springs is alkaline, but has been used for human consumption. Travertine has been deposited in the vicinity of the lower spring.

HISTORY OF OWNERSHIP AND PREVIOUS WORK

The first claims were staked in this area in 1895 (Stevenson 1940). All or part of the property has been known by various names that include: Hardie Mountain (Stevenson 1940, Cockfield 1948), Mercury Group (Cockfield 1948), Leir Mercury Prospect (Morrison 1970), Jim (Placer Development Ltd. 1980) and Ward Group.

D.B. Sterritt and Associates did some exploratory work for mercury in this area in 1940 and 1941. A shaft, crosscut adit and numerous pits and trenches were excavated in silicified areas of Hardie Hill (Hardie stock) where disseminated cinnabar had been found. Results of this work were described by Cockfield (1948). Mathews (1948) described in more detail the character of the rocks making up at least a part of the stock and an important structural control concerning the deposition of cinnabar found in a very local area cut by the adit.

Sterritt and Associates also dug numerous pits along a narrow, 200 meter long and narrow silicified breccia zone containing minor cinnabar exposed near the top of the west side of Dickson Hill (Dickson stock). A short northerly trending adit was excavated in the southern part of the stock (Cockfield 1948).

Savanna Creek Gas and Oil Ltd. (Leir Mercury Prospect), owned many claims in the area during the 1960's when the price of mercury was very high for a short period of time, but abandoned the claims when the price of mercury dropped very low in 1970. An extensive soil geochemical survey for mercury was completed over the Leir Prospect by Morrison (1970). This work indicated the presence of extensive areas of anomalous quantities of mercury in the soils. However, Morrison (1970) noted that it was surprising that high mercury soil anomalies were not observed near known occurrences of cinnabar, but were located in other soil covered areas.

A small soil sampling project for mercury was conducted by Ward (1982) in the vicinity of one of Morrison's sample lines. It was equally surprising to find mercury concentrations of 600, 800,1100, 1300 and 440 ppb mercury in 5 consecutive sample sites spaced 1.5 m apart in an area where Morrison found only 100 and 110 ppb of mercury in samples spaced about 30 meters apart. These contradictions remain to be explained.

A multi-element geochemical soil survey was conducted by Placer Development Ltd. (1981) when they owned over 3700 ha of claims in this area. The results of their survey are somewhat suspect in regard to mercury because their analyses indicated that many samples contained less than 5 ppb mercury, which is unusual since soils from unmineralized areas usually contain about 80 ppb Hg.

In 1984 trenches were excavated in an area north of the Pearl identification post 4S3E where Morrison reported a mercury soil anomaly (Ward 1984). Intensely altered, bleached porphyritic andesite was found in two trenches. Gypsum was associated with the intense alteration and was found in an 11 cm thick vein in a third trench associated with argillized porphyritic andesite. These trenches were in an area that Morrison had mapped as"felsite".

GEOLOGY

The geology within the claim group has been described both in general and in specific areas in different reports: Stevenson (1940), Cockfield (1948), Mathews (1948), Morrison (1970), Ewing (1980), Monger and McMillan (1984) and Ward (1985). Additional geological information was obtained during the course of the work described in this report.

In detail the geology appears to be quite complex, but it may be described in a general way. A sequence of volcanic rocks including mostly dark andesites with some basalt has been cut by diabase dykes. A strip of ultrabasic rocks across the southwest corner of the claims appears to have been faulted into contact with volcanic rocks.

Diorites of various textures and compositions have intruded the volcanic rocks in a linear zone adjacent to the area northeast of the fault contact. The bodies of diorite vary from dykes to small stocks or plugs.

Felsic plutons have also intruded the volcanic rocks in at least three places, the Hardie and Dickson stocks and another stock, monzonite (?), located during this work. These stocks may be younger than the diorites but associated with the same magma chamber. A small felsic dyke cuts the Hardie stock.

The volcanic rocks and both the Hardie and Dickson stocks were broken to various degrees along somewhat parallel, northwesterly trending faults. Tension type faults associated with the northwesterly faults trend northerly.

Silicification occurred at various places and in various amounts at the Hardie and Dickson stocks. Some of these silicified areas were refractured and cinnabar associated with fine grained quartz was deposited. In other areas the volcanic rocks were altered by argillation and addition of carbonates in various combinations and amounts. In some cases breccia zones in altered volcanics were mineralized with minor cinnabar, refractured, filled with carbonates and more cinnabar, refractured and recemented with carbonates. In other cases the volcanics have been altered to clays that contain abundant gypsum and rare cinnabar.

A late period of faulting has refractured the Hardie stock mineralization along its western contact.

It appears that, in the waning stages of glaciation in the area, a relatively thin layer of glacial material varying from a few large erratics to boulders and considerable amount of silts and clays were deposited over the bedrock in many places.

INSTRUMENTATION AND THEORY

The magnetic survey was carried out using a portable total field proton precession type of magnetometer, model MP-2, manufactured by Scintrex Ltd. of Concord, Ontario. This instrument has a range from 20,000 to 100,000 gammas (γ) in 25 overlapping steps with a total field accuracy of ± 1 gamma over the full operating range. A 5 digit LED readout displays the total magnetic field in gammas.

The magnetic method of applied geophysics consists of accurately measuring the magnetic field strength at specific locations and presenting the data in the form of magnetic profiles and contoured maps. Interpretation of these profiles and contoured maps assists in the identification of rocks, in mapping their distribution and in revealing structural features that are covered by such things as soil, glacial debris and swamps. In mining exploration the magnetic field data may be useful either for directly locating ore bodies that are strongly magnetic, or for locating areas of hydrothermal alteration or intrusion that may exist in rocks that normally contain greater quantities of magnetic minerals than the intrusives or altered areas.

The usefulness of the method depends on the magnetic field strength associated with a rock at a particular place. And this depends on the content of magnetic minerals, such as magnetite or pyrrhotite, the strenth of the earth's magnetic field at that place and the amount of permanent magnetism that the rock retains.

Since the earth's magnetic field strength has been observed to vary with time as well as place, these variations are usually taken into account in the interpretation of the data (diurnal variations).

The purpose of the study was to locate soil covered zones of hydrothermal alteration within a pile of calc-alkaline volcanic rocks. These zones may indicate the presence of epithermal mineralization at depth. It was felt that hydrothermal activity would alter or remove the magnetite usually contained in andesites or basalts. And, that the hydrothermally altered areas would consequently be indicated by significantly lower magnetic field strength when compared to unaltered calc-alkaline volcanic rocks.

SURVEY PROCEDURE

The survey was carried out over a grid which was established as a part of this work and also at other places using survey lines established during previous work on the claims and over auxiliary grids established in local areas.

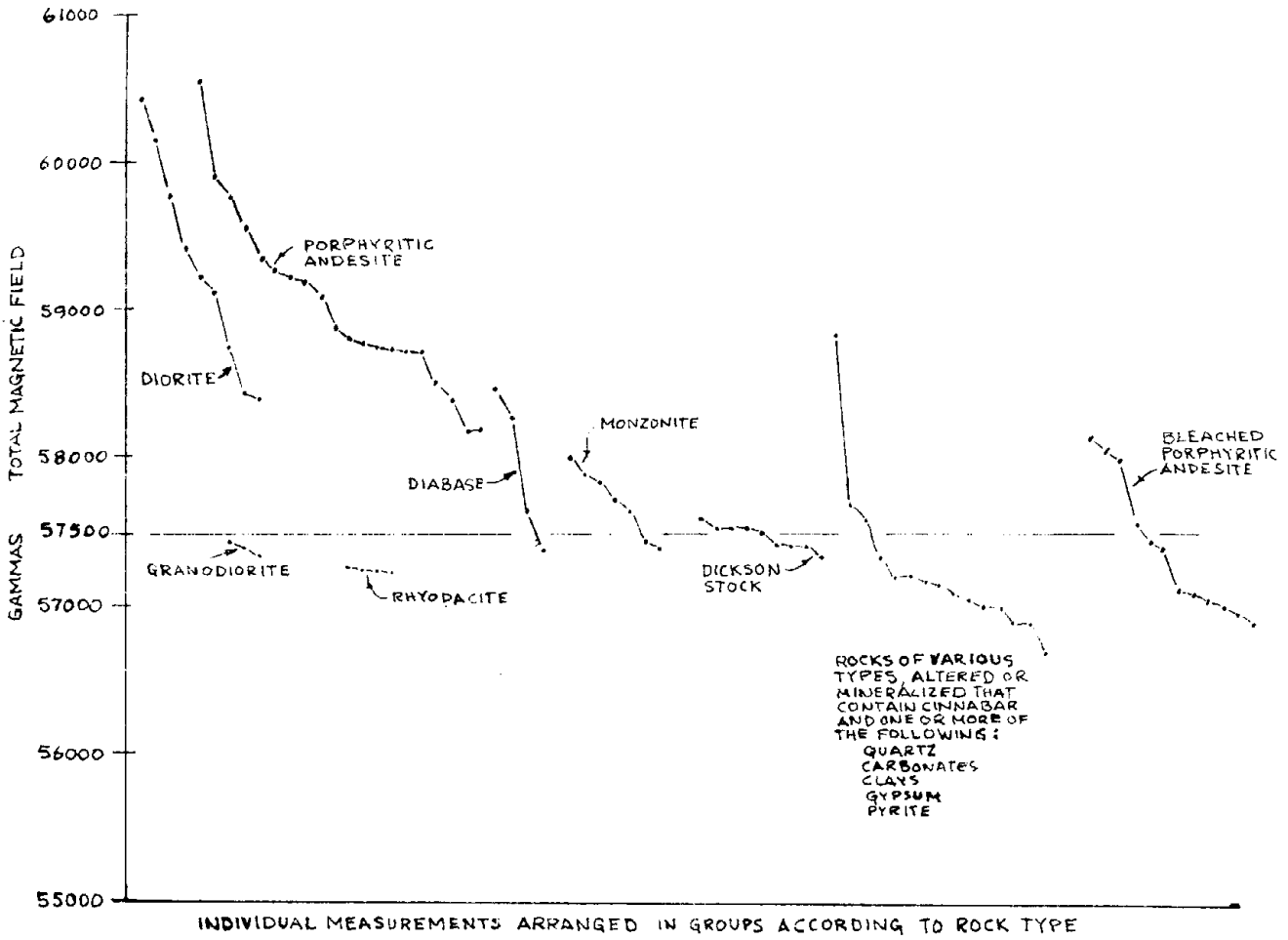
The main grid base line runs north and south along the east boundary of the Pearl claim, starting from the Pearl identification post 1S4E. Survey lines and stations were established along lines running west from the base line. An auxiliary 800 meter long north-south base line was extended north from the Pearl 4S2E identification post.

The spacing between survey lines varied from the planned 125 meters. Intervals between magnetometer reading varied depending on the circumstances encountered during the survey. Survey stations were originally established at 25 meter intervals along the lines, however, in some cases, readings were taken at 12.5, 10, 5 and 1 meter intervals where more detailed information appeared to be required.

All lines and stations were established by the use of a compass and hip chain. Actual locations at various points were established for mapping purposes by using a 1:5000 scale aerial photograph of the area.

For convenience, in this report the main survey lines are labelled A thru M from north to south. Auxiliary traverse locations are labelled ① thru ⑦ . Another auxiliary base line (N42°W) with short survey lines was established immediately to the southwest of the Hardie stock. The location of all these survey lines are shown on Map 2.

The magnetometer traverses were looped within two hours in order to correct for diurnal variations. However, it was found during preliminary plotting of the data in the form of magnetic profiles that diurnal variations were not a significant factor. The maximum diurnal variation was less than 100 gammas (γ) which is significantly less than 1600γ, the difference between hydrothermally altered rocks containing cinnabar or fine grained pyrite (mean value of about 57200γ) and unaltered andesites and diorites (mean value of about 58800γ). Consequently, all data were plotted without correcting for diurnal variation. All readings were taken with the axis of the sensor orientated north and south.



WARD CLAIMS
KAMLOOPS MINING DIVISION, B.C.
NTS 92I/15W

TOTAL MAGNETIC FIELD

OVER AREAS OF KNOWN ROCK TYPES

DRW BY: DAW	DATE: AUG 1986	FIGURE 1
	SCALE: NONE	

In order to assist in interpreting the data, magnetic readings were taken over various types of rocks which could be identified in the field. The total magnetic field strength over a rhyodacite outcropping along the Tranquille River was about 57250γ. About 57400γ were observed over a Tertiary granodiorite intrusive located about 1.5 km northwest of the claims. The mean values were about 58800γ for porphyritic andesite, 59200γ for diorites, 58100γ for diabase, 57750γ for monzonite, 57500γ for the Dickson Hill intrusive and 57200γ for hydrothermally altered rocks containing cinnabar. The data used to determine these mean values are plotted on Figure 1.

COMPILATION OF DATA

The uncorrected magnetic data were plotted as magnetic profiles as shown on Figures 2, 3, 4, 5 and 6 enclosed in the pocket at the end of this report. Various horizontal scales were used as will be noted in the figures. The vertical scale for the total magnetic field strength in all cases was maintained at 50γ/mm.

The magnetic data was contoured at 500γ intervals by graphic interpolation from the plotted magnetic profiles. The isomagnetic contours are shown on Map 3 which has a scale of 1:5000. This map is enclosed in the pocket at the end of this report. Isomagnetic contours at or below 57500γ are shown as dashed lines while those from 58000γ and above are shown as solid lines.

INTERPRETATION

During the process of establishing the survey grid and conducting the magnetometer surveys a variety of rock outcrops were encountered.

It seemed apparent that the commonest kinds of rock on the claims are dark porphyritic andesites of various textures and compositions. These andesites appear to extend in a crumpled sheet extending to the northeast of an irregular line that can be drawn from the Pearl 4S3E identification post towards the northeast a distance of about 2 km where the line appears to bend toward the northeast for about 500 meters and then it continues on toward the northwest.

Ultrabasic rocks as indicated by outcrops and pale greenish grey soil occur southwest of a line trending about N30°W from the Pearl 4S1E identification post. This band is east of and about parallel to the Carabine Creek road.

Outcrops of a fine grained, brittle, buff or tan colored dolomite (?) occur in an area adjacent to the south boundary of the Pearl claim between 4S1E and 4S2E identification posts.

What appears to be a small monzonite stock was located about 1 km southwest of the Hardie stock and about the same distance south of the Dickson stock. Zenoliths of porphyritic andesite are contained in the monzonite.

Diorites of various textures and compositions were found to outcrop intermittently in a northwesterly trending band between the porphyritic andesites to the northeast and ultrabasic rocks to the southwest.

One of the objectives of the magnetometer survey was to determine if outcrops of hydrothermally altered rocks containing cinnabar could be distinguished from unaltered outcrops of other rocks. If this distinction could be made then the magnetometer survey could assist in locating soil covered areas that might be underlain by hydrothermally altered rocks. A second objective was to correlate the magnetic data with previously obtained information on mercury soil anomalies to determine if there was a coincidence of these anomalies with areas where total magnetic field strengths were similar to those found over known outcrops of hydrothermally altered rocks containing any observable amounts of cinnabar. A third objective was to decide where to concentrate any further exploration work. This decision would be based on a comparison of various sources of information with the results of the magnetometer survey.

The data presented in Figure 1 indicates that the total magnetic field strength of unaltered volcanic rocks and diorites within the claims was significantly different from hydrothermally altered rocks, with or without cinnabar, so that a distinction between them could be based on their magnetic properties with some degree of confidence. However, the data indicate that the felsic intrusives and hydrothermally altered rocks either with or without cinnabar could not be distinguished from each other only on the basis of their magnetic properties. It was decided on the basis of this work that areas with less than 57500γ were probably underlain by any one of these three types of rocks.

It was concluded that a coincidence of areas containing more than 300 ppb Hg and less than 57500γ magnetic field strength might indicate where more exploration work should be undertaken. However several problems became evident when trying to make the correlation between the geophysical and geochemical information.

One problem involved inconsistencies found between the mapped locations of amounts of mercury in the soils and actual locations of the sample sites, old work reported by Morrison (1976). Also there is a poor fit between "A" and "B" area maps of Morrison.

Another problem is related to values that Morrison reported for soil mercury. In one case, Ward found mercury values of 600, 800, 1100, 1300 and 440 ppb Hg in 5 consecutive sample sites spaced 1.5 m apart along the southern boundary of the Ward 1 and 2 claims about 25 m east of the final claim post (Ward, 1982). According to Morrison's map in an area about 30 m north of the above area he found only 100 and 110 ppb Hg. In fact, all the samples except two, taken by Morrison in the vicinity of cinnabar mineralization associated with the Hardie stock were less than 300 ppb, a curious situation.

An attempt was made to tie the geochemical and magnetometer surveys together through points known to be common to both surveys, for example, the site of the shaft on Hardie Hill, the location of a spring, and identifiable soil sample locations of Morrison at 36N36E and 56N46E. It was found that misfits from about 150 to 300 meters existed between these points if the Hardie Hill shaft was used as a common point. The largest error involved the 56N46E site. Under these conditions overall comparisons between the two surveys could not be done with confidence. However, Map 5 illustrates the approximate relationship of areas that Morrison mapped as having greater than 300 ppb Hg and of areas found in this magnetometer survey that had less than 57500γ magnetic field strength.

On Figure 3 there is a comparison shown as overlapping profiles of a detailed magnetometer traverse, done during this work, and a geochemical soil survey for mercury (Ward 1982). Here there is a good coincidence of high mercury levels and comparatively low magnetic field strength. A linear zone of low magnetic field strength extends northwesterly from this coincident area, across the soil covered slope adjacent to the apparent southwest contact of the Hardie stock, and on towards the Dickson stock.

A more detailed magnetometer survey was undertaken in this area and the results are shown on Figures 3 and 4 in the form of profiles.

As a result of this survey and on the basis of the magnetometer readings obtained over identifiable rocks in outcrops, see Figure 1, it is suggested that a zone of hydrothermal alteration extends from the southern end of the Hardie stock, along the southwestern side of the stock and on towards the Dickson stock. This zone appears to include one or more slices of unaltered volcanic rock that parallel the strike of the zone. This zone may be mineralized with cinnabar where northerly trending tension type faults intersect this zone.

Another soil covered hydrothermally altered zone appears to be located about 650 m southwest of the above zone and cuts across the southwest facing slope that descends to the Carabine Creek valley. The zone broadens toward the northwest where Morrison found a broad area with soils containing more than 300 ppb Hg. In various places this zone overlaps other areas where the soils contain more than 300 ppb Hg.

A third soil covered hydrothermally altered zone apparently occurs nearer to the west boundary of the claims and extends northerly in a sinuous and branched manner to join the above zone. Morrison's work did not extend into this area. However, the geochemical soil survey by Placer Development Ltd. indicates that above normal quantities of mercury in the soils, up to 1072 ppb, were found in this area along their L1000S line. However, in this area their lines were spaced 650 m apart so the extent of these anomalies is not known.

Two irregular shaped areas where the total magnetic field is less than 57500γ occur near the south center and near the southeast corner of the claims. The area in the vicinity of the south center part of the claims was found to contain outcrops of a fine grained tan to buff dolomite (?) which might account for the anomaly. The irregular shaped anomaly near the southeast corner of the claims might be caused by hydrothermal alteration. Morrison mapped a small mercury soil anomaly in this area.

The first objective of the magnetometer survey has been partly achieved. That is, although a distinction can be made between altered and unaltered andesite volcanic rocks in this area, a separation between felsic intrusives and altered rocks of various types could not be made by using the magnetometer alone.

The second objective was met with limited success since some areas of less than 57500γ did coincide with areas that contained more than 300 ppb Hg.

The third objective was achieved since it has been decided to continue exploration work in the vicinity of the Hardie and Dickson stocks along the zone outlined by the 57500γ contour in this area.

BIBLIOGRAPHY

Cockfield, W. E. (1948)
Geology and mineral deposits of the Nicola map area, British Columbia, Geol. Surv. Can. Mem. 249, pp. 100-104.

Ewing, T.E. (1981)
Geology and tectonic setting of the Kamloops Group, South Central British Columbia, University of British Columbia, unpublished Ph. D. thesis.

Mathews, W.H. (1948)
"Hardie Group" in Structural geology of Canadian ore deposits, Can. Inst. Mining and Metallurgy, Geology Division, pp. 177-179.

Monger, J.W.H. and McMillan, W.J. (1984)
Bedrock geology of the Ashcroft (92 I) map area, Open File Report 980, Geol. Surv. Canada.

Morrison, Lee (1970)
Geological and geochemical studies of the Merc, La, Lee and Wedge claims, B.C. Assessment Report 2467.

Placer Development Ltd. (1981), B.C. Assessment Report 9887

Stevenson, J. S. (1940)
Mercury deposits of British Columbia, B.C. Min. Mines Bull. no. 5, pp. 45-48.

Ward, D.A., (1982), B.C. Assessment Report 10652

Ward, D. A., (1984), B.C. Assessment Report 12667

COST STATEMENT

Magnetometer Rental

Rental start up	$145.00	
11 days @ $29.00/day (22 July to 5 Aug)	319.00	
11 days insurance @ $1.16/day	12.76	
Shipping	24.00	
	$500.76	$500.76

Travel Expense

Ferry fare, 1 July	19.00	
Toll, Coquihalla highway, 2 vehicles	16.00	
Parking, 18 July, 7 August	4.00	
Ferry fare, 7 August	19.00	
4x4 Pickup use, 1 July to 7 August		
2630.5 km @ $0.30/km	789.15	
4x4 Station wagon, 1 July to 8 July		
850 km @ $0.30/km	255.00	
	$1102.15	$1102.15

Food, meals and lodging

Groceries	281.45	
Restaurant meals	195.91	
Hotel, 29 July	29.96	
	$507.32	$507.32

Miscellaneous Supplies

Hip chain thread and flagging	169.00	
Mylar film and drafting supplies	44.57	
Campstove fuel, etc.	152.93	
	$366.50	$366.50

Labour

Survey grid, 2 men, 2 July to 8 July		
14 man-days @ $150.00/day	2100.00	
Survey grid, 1 man, 9 July to 21 July		
8 man-days @ $150.00/day	1200.00	
Magnetometer survey, 1 man, 22 July to 5 Aug (includes 4 days of delays caused by shipping problems and defective equipment)		
15 days @ $150.00/day	2250.00	
	$5550.00	$5550.00

Travel time

C. Ward	2 July, Vancouver to claims, 8 hrs		
	8 July, Claims to Vancouver, 9 hrs		
	17 hrs		
	Total, 17 hrs @ $18.00/hr	$306.00	
D. Ward	1 July, Powell River to Vancouver 5 hrs		
	2 July, Vancouver to claims 8 hrs		
	16 July, Claims to Vancouver 9 hrs		
	20 July, Vancouver to claims 9 hrs		
	5 Aug , Claims to Vancouver 9 hrs		
	7 Aug , Vancouver to Powell River 5 hrs		
	45 hrs		
	Total, 45 hrs @ $18.00/hr	$810.00	
		$ 1116.00	$1116.00

Report

Data analysis and writing, 64 hrs @ $50.00/hr	$3200.00	
Drafting, 91 hrs @ $25.00/hr	2275.00	
Typing, 8 hrs @ $8.50/hr	68.00	
Reproduction cost, binders, etc.	61.20	
	$5604.20	$5604.20

Total all costs $14,746.93

Cost Apportionment:

Establishing survey grid	$ 5419.74
Magnetometer survey and report	$ 9327.19

AUTHOR'S QUALIFICATIONS

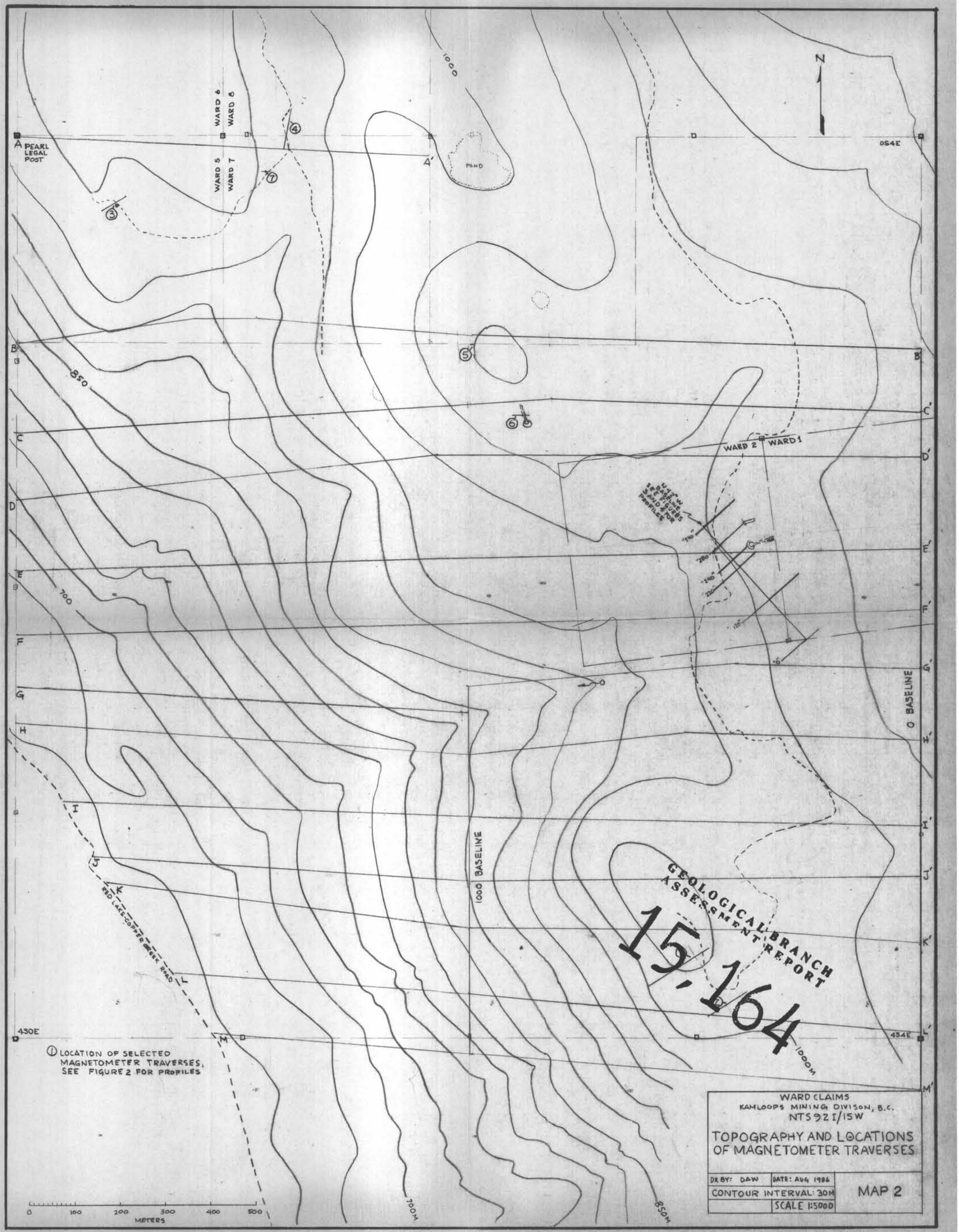
The author graduated from Washington State University in 1951 with a Batchelor of Arts in Physical Science with Honors and has had some post graduate courses in geology while pursuing a PhD in economic geology which has not been completed. He has had courses in general geology, structural geology, optical mineralogy, stratigraphic paleontology, historical geology and elements of mining.

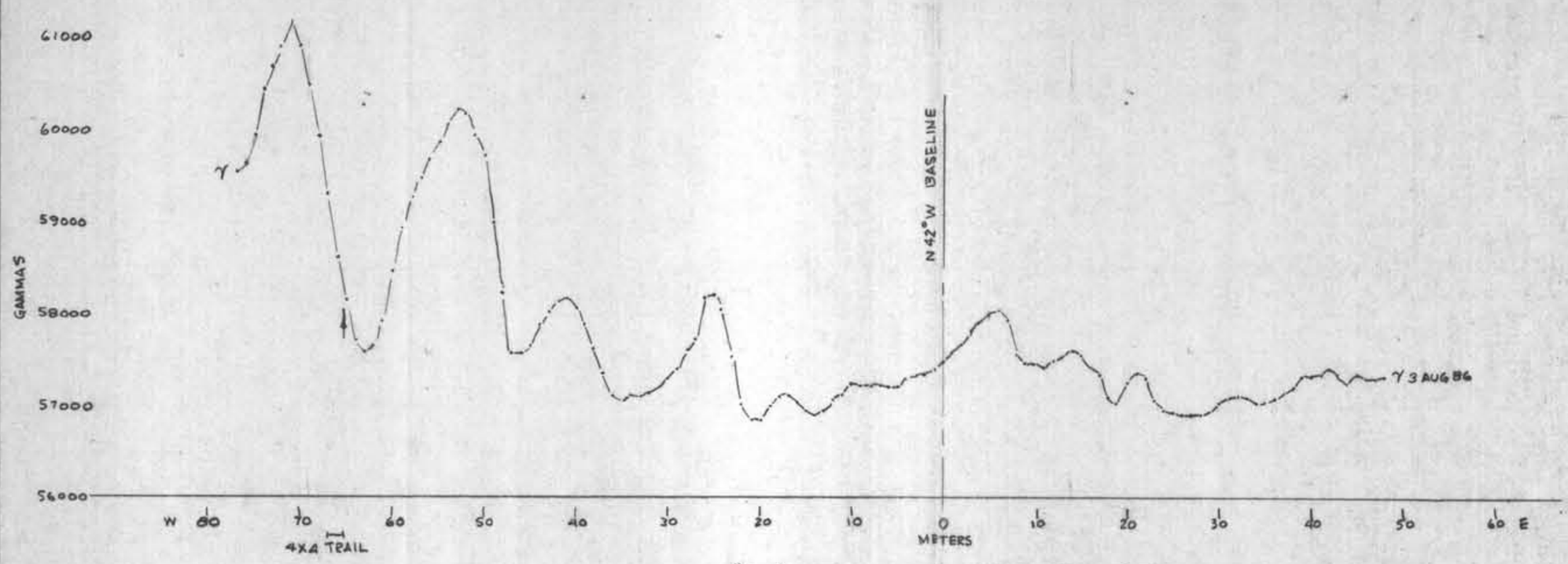
Over the past years he has been employed in a variety of occupations. Upon graduation from university he was employed by the American Zinc, Lead and Smelting Co. as a miner and was subsequently promoted to a technical assistant in the engineering department before being drafted for the Korean War. Later, he worked for the Boeing Aircraft Company as a tool design engineer. Following that, he was employed by Western States Copper Corp. to evaluate the economic potential of mineral claims in the "Four Corners" area which includes the states of Utah, Colorado, Arizona and New Mexico. He has taught chemistry, physics and mathematics and was employed as a research analyst at the Washington State Institute of Technology.

In 1967 he came to Canada and taught electronics and industrial science. He left teaching in 1976 and since that time has been engaged in a variety of enterprises including real estate, timber, farming and prospecting.

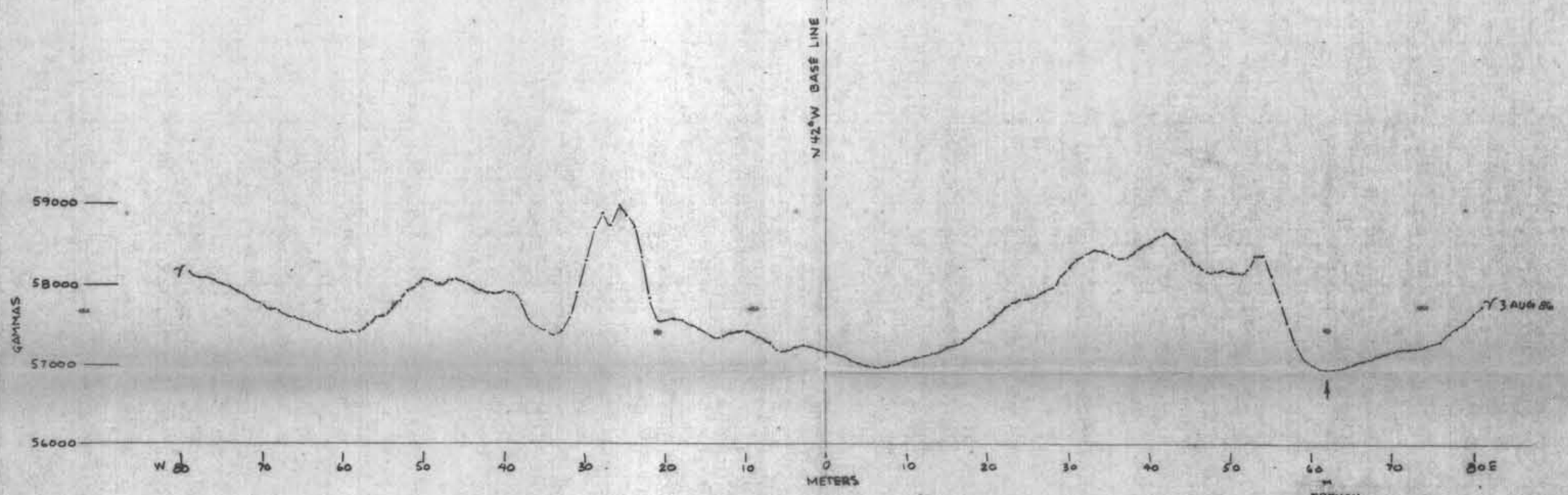
David A. Ward

David A. Ward

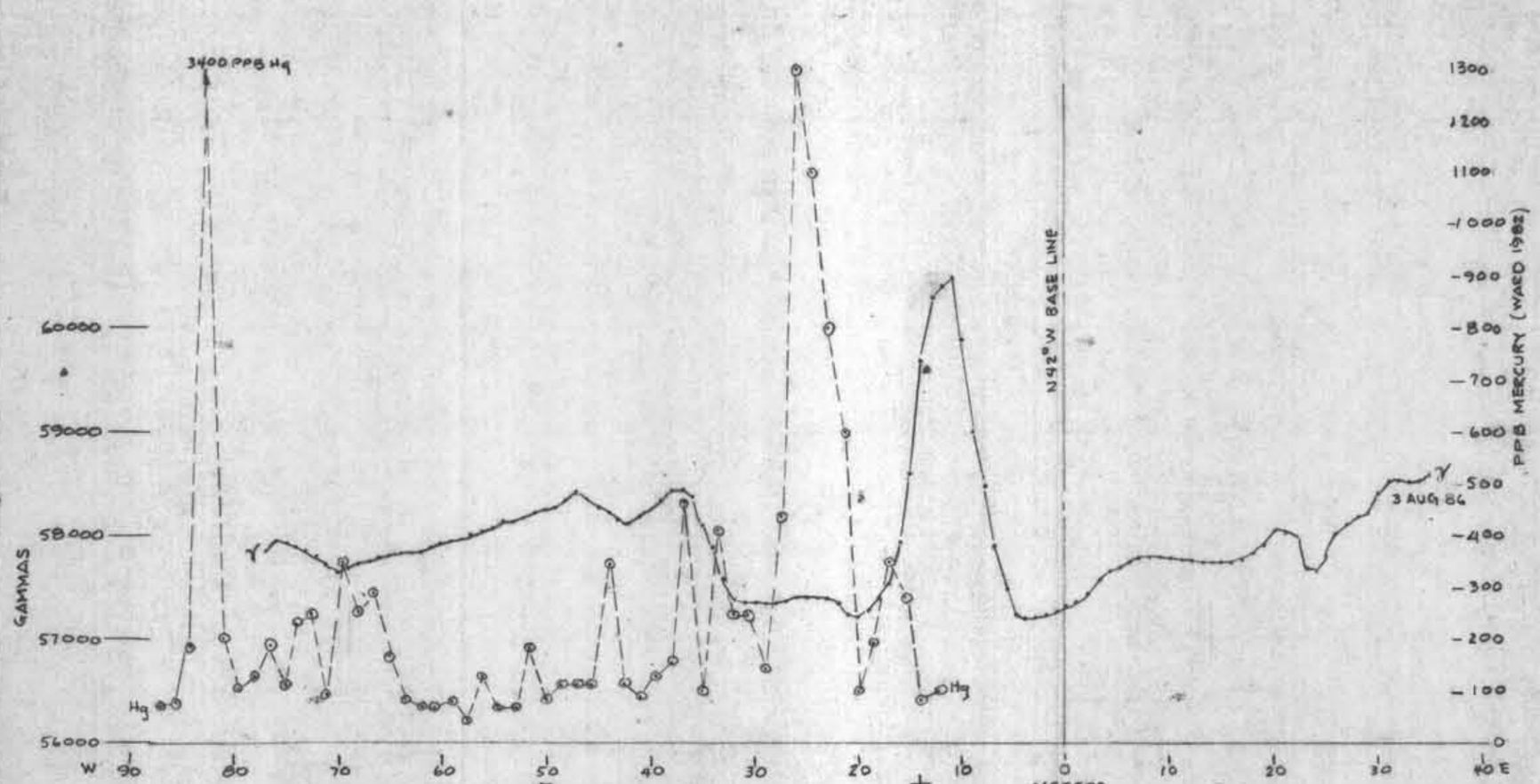

A
PEARL LEGAL POST
WARD 6
WARD 5
WARD 8
WARD 7
4
7
3
A'
1000
POND
N
054E
B
B'
5
850
C
C'
WARD 2
WARD 1
D
D'
700
E
E'
F
F'
G
G'
H
H'
I
J
J'
K
K'
L
L'
M
M'
430E
454E
1000 BASELINE
RED LAKE-COPPER CREEK ROAD
0 BASELINE
700M
850M
1000M
0
100
200
300
400
500
METERS
① LOCATION OF SELECTED MAGNETOMETER TRAVERSES, SEE FIGURE 2 FOR PROFILES
GEOLOGICAL BRANCH
ASSESSMENT REPORT
15,164
WARD CLAIMS
KAMLOOPS MINING DIVISON, B.C.
NTS 92 I/15W
TOPOGRAPHY AND LOCATIONS OF MAGNETOMETER TRAVERSES
DR BY: DAW
DATE: AUG 1986
CONTOUR INTERVAL: 30M
SCALE 1:5000
MAP 2



"220" LINE MAGNETOMETER TRAVERSE
1 METER STATIONS



"120" LINE MAGNETOMETER TRAVERSE
1 METER STATIONS



"0" LINE MAGNETOMETER TRAVERSE
1 METER STATIONS

GEOLOGICAL BRANCH
ASSESSMENT REPORT

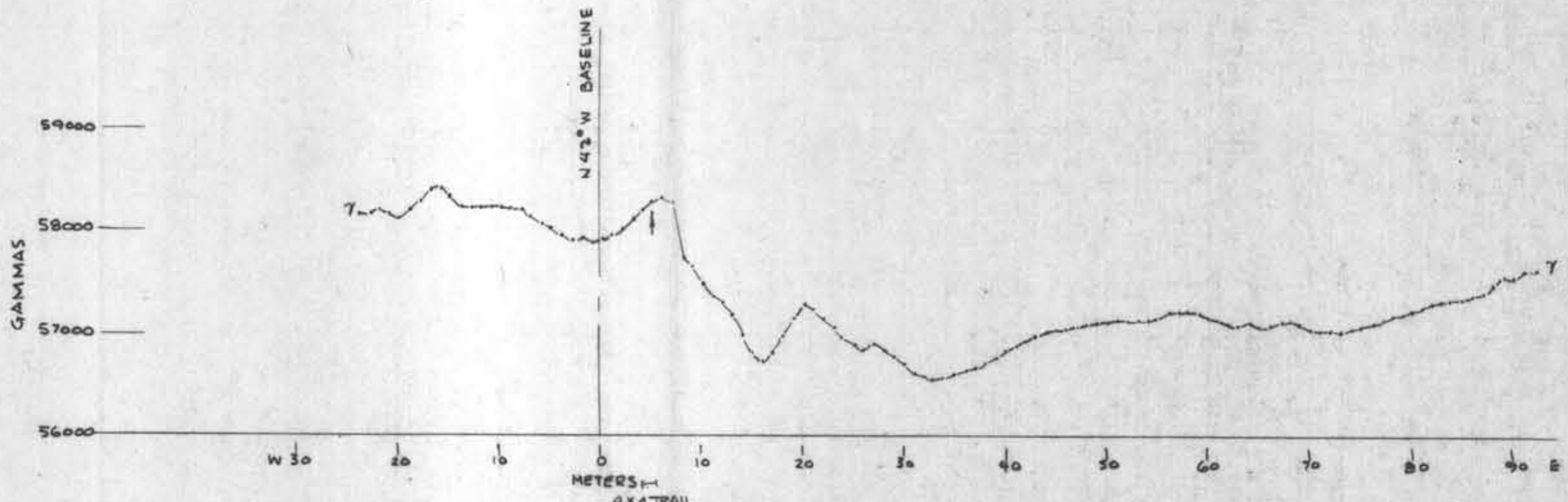
15,164

WARD CLAIMS
KAMLOOPS MINING DIVISON, B.C.
NTS 92I/15W

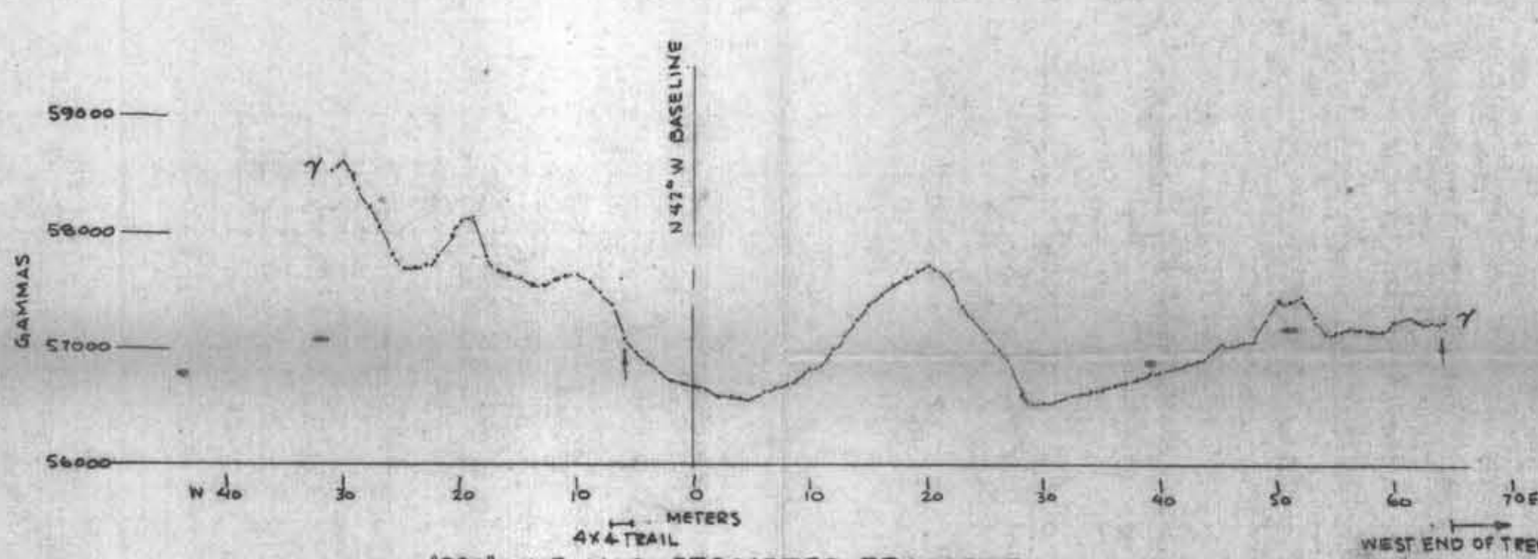
MAGNETOMETER TRAVERSES
- N42°W BASELINE
LINES "0", "120" & "220"

NOTE: SEE MAP 2 FOR SPECIFIC LOCATIONS

DR BY: DAW	DATE AUG 1986	FIGURE 3
	SCALE 1:500	

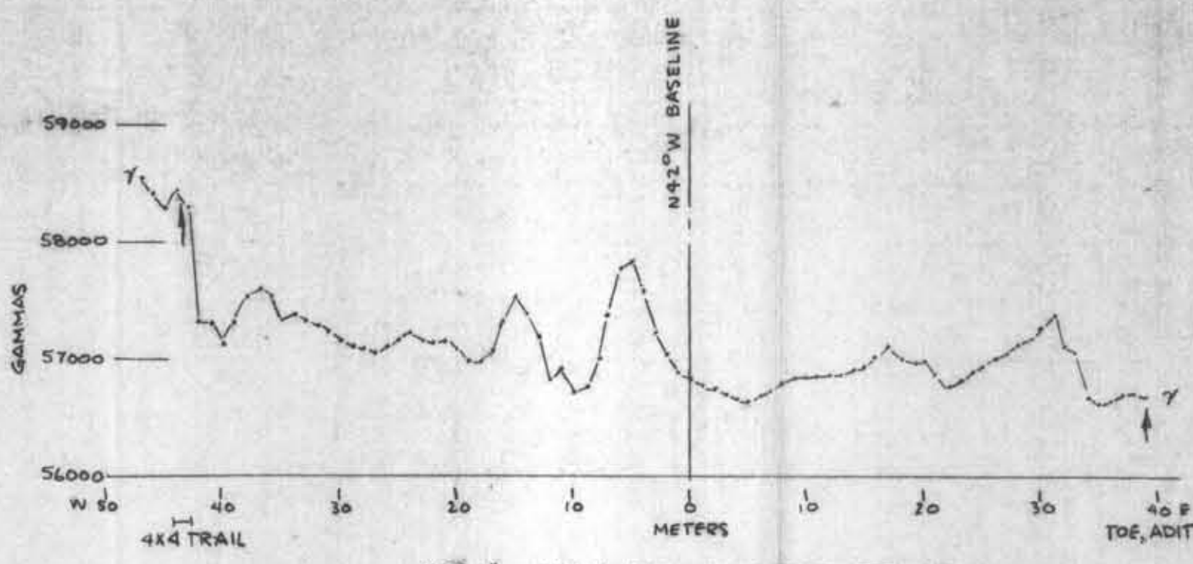


"340" LINE MAGNETOMETER TRAVERSE
1 METER STATIONS



"280" LINE MAGNETOMETER TRAVERSE
1 METER STATIONS

WEST END OF TRENCH
40M. NORTH OF ADIT
FINE GRAINED GREY ROCK,
INTENSELY SILICIFIED,
MINOR CINNABAR.



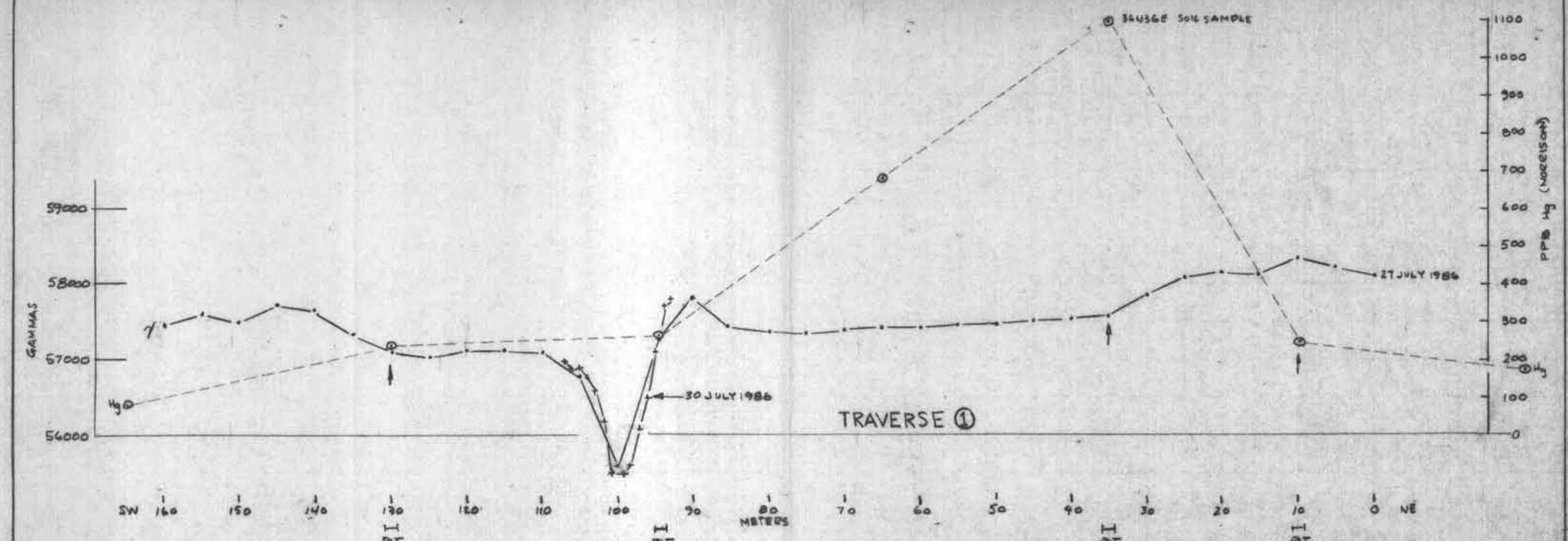
"240" LINE MAGNETOMETER TRAVERSE
1 METER STATIONS

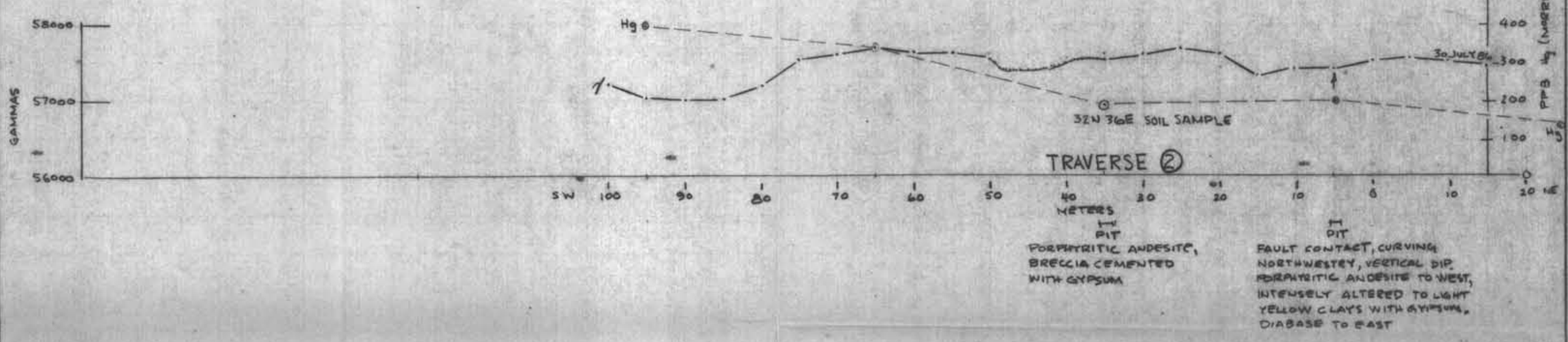
WARD CLAIMS
KAMLOOPS MINING DIVISON, B.C.
NTS 92I/15W

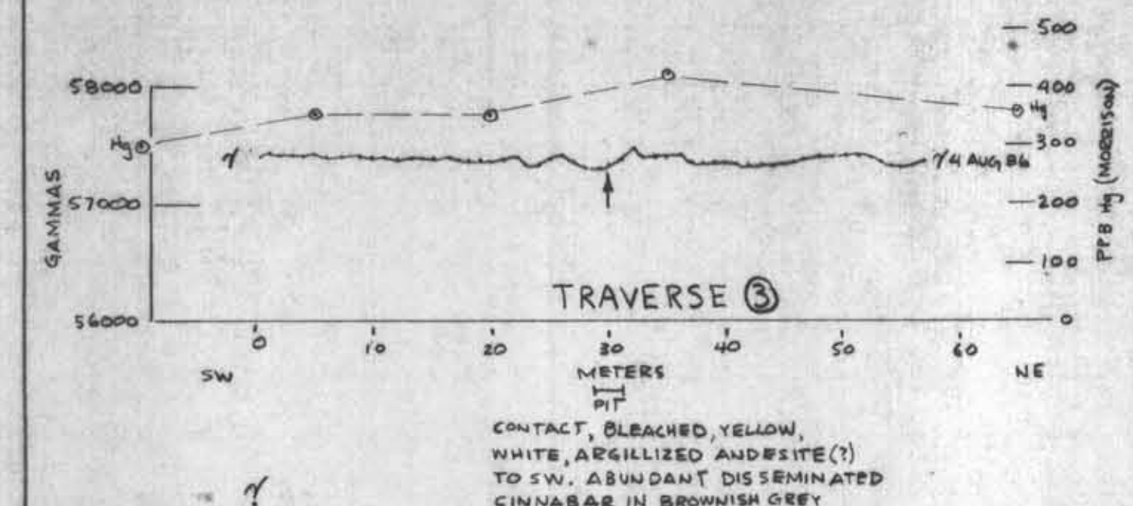
MAGNETOMETER TRAVERSES
N 42°W BASELINE
LINES "240", "280" & "340"

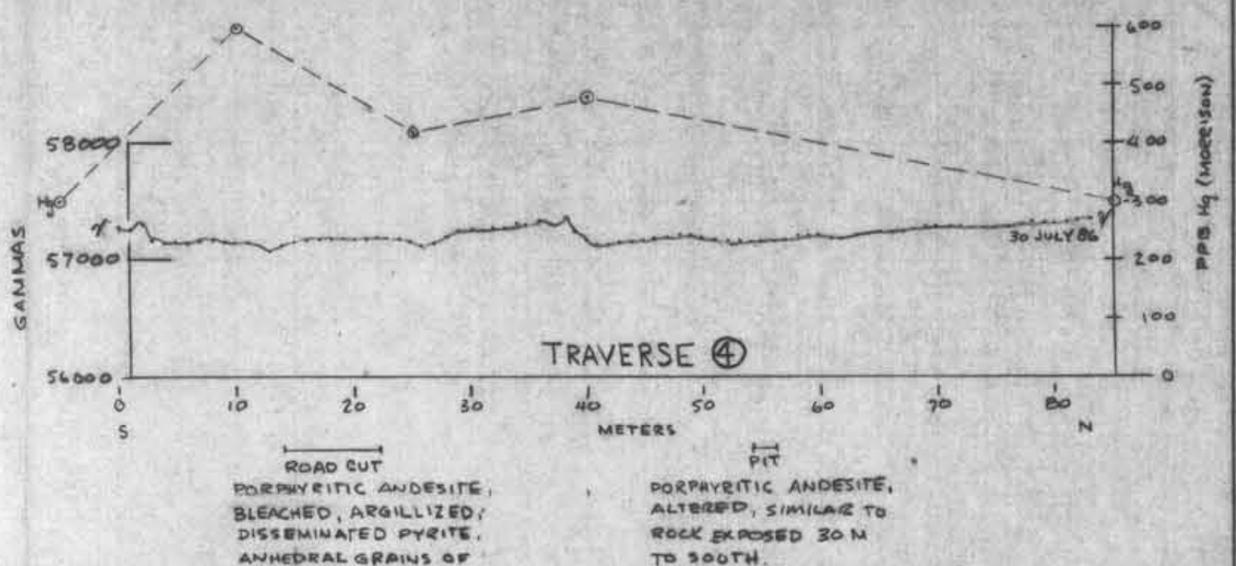
NOTE: SEE MAP 2 FOR SPECIFIC LOCATIONS

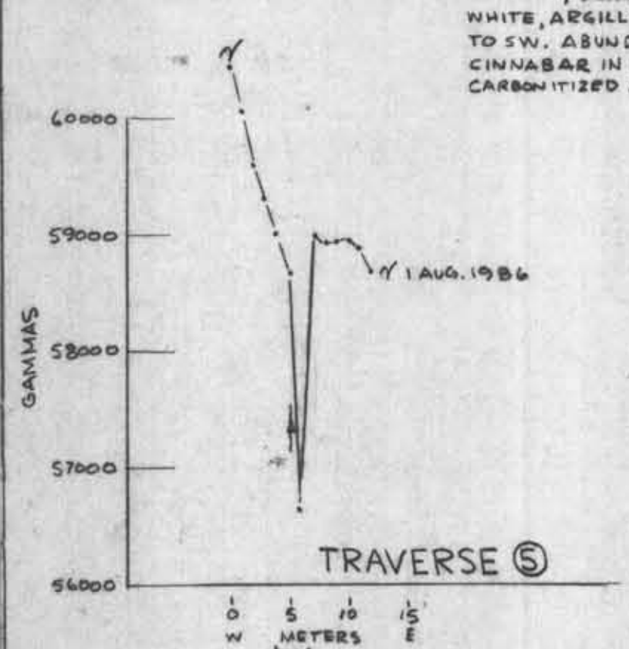
DR BY: DAW	DATE: AUG 1986	FIGURE 4
	SCALE 1:500	

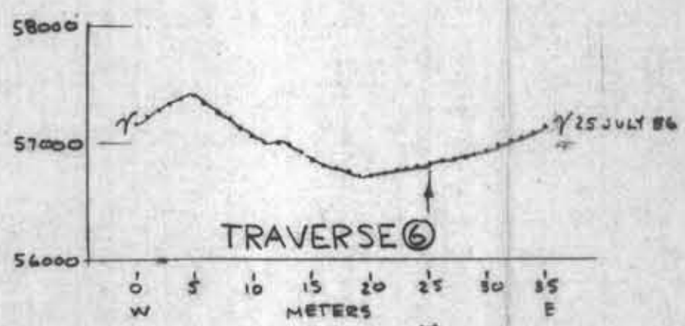


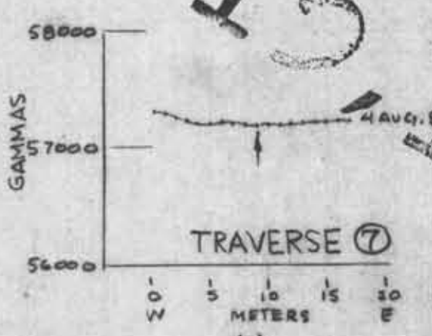












WARD CLAIMS
KAMLOOPS MINING DIVISON, B.C.
NTS 92I/15W

SELECTED MAGNETOMETER TRAVERSES

NOTE: SEE MAP 2 FOR SPECIFIC LOCATIONS

DR BY: DAW	DATE: AUG 1986	FIGURE 2
	SCALE 1:500	

PEARL
LEGAL CORNER POST

TO RED LAKE ROAD

DICKSON
STOCK

HARDIE
STOCK

N

A A' B B' C C' D D' E E' F F' G G' H H' I I' J J' K K' L L' M M'

RED LAKE AND KAMLOOPS

CACHE CREEK

GEOLOGICAL BRANCH
ASSESSMENT REPORT

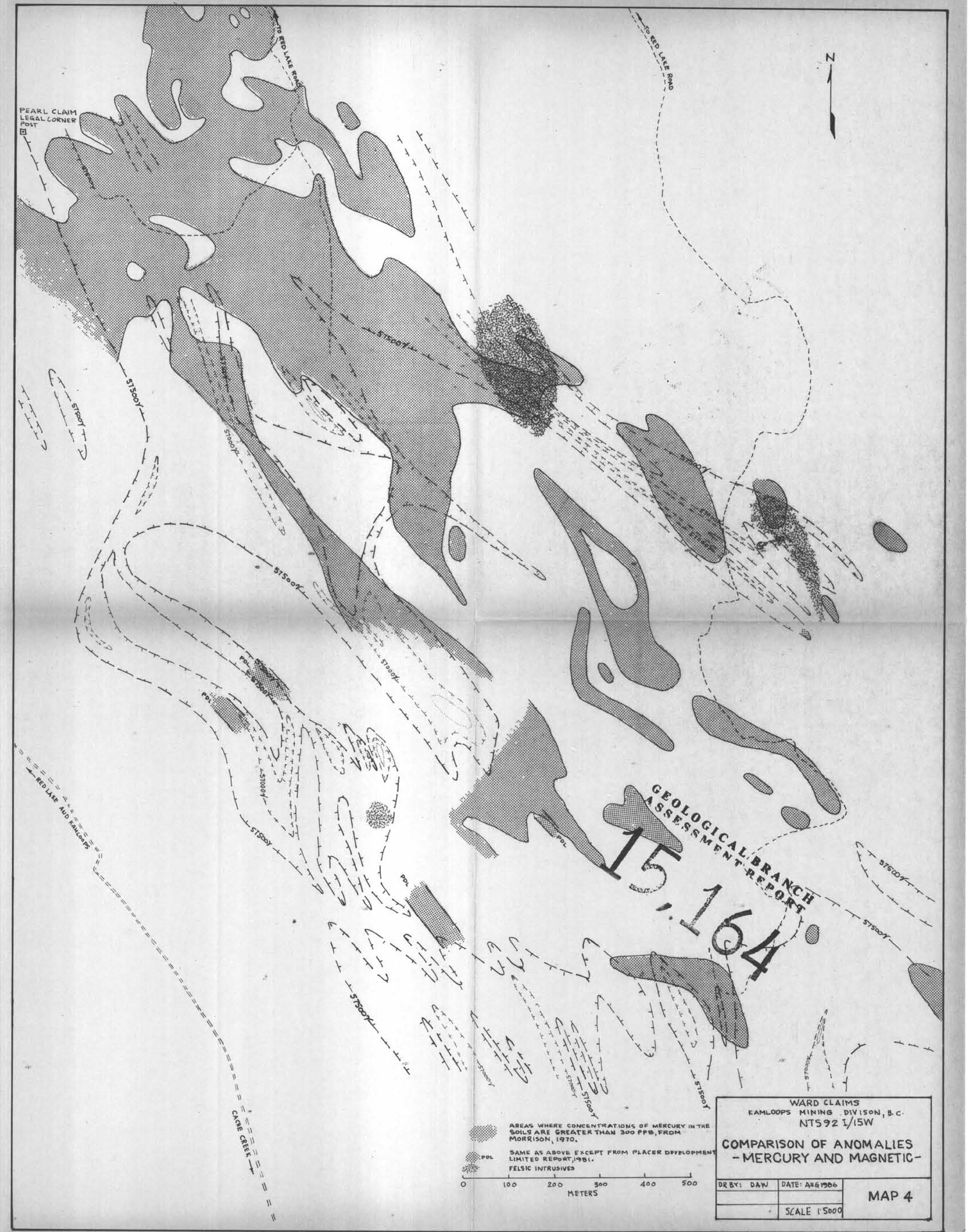
15,164

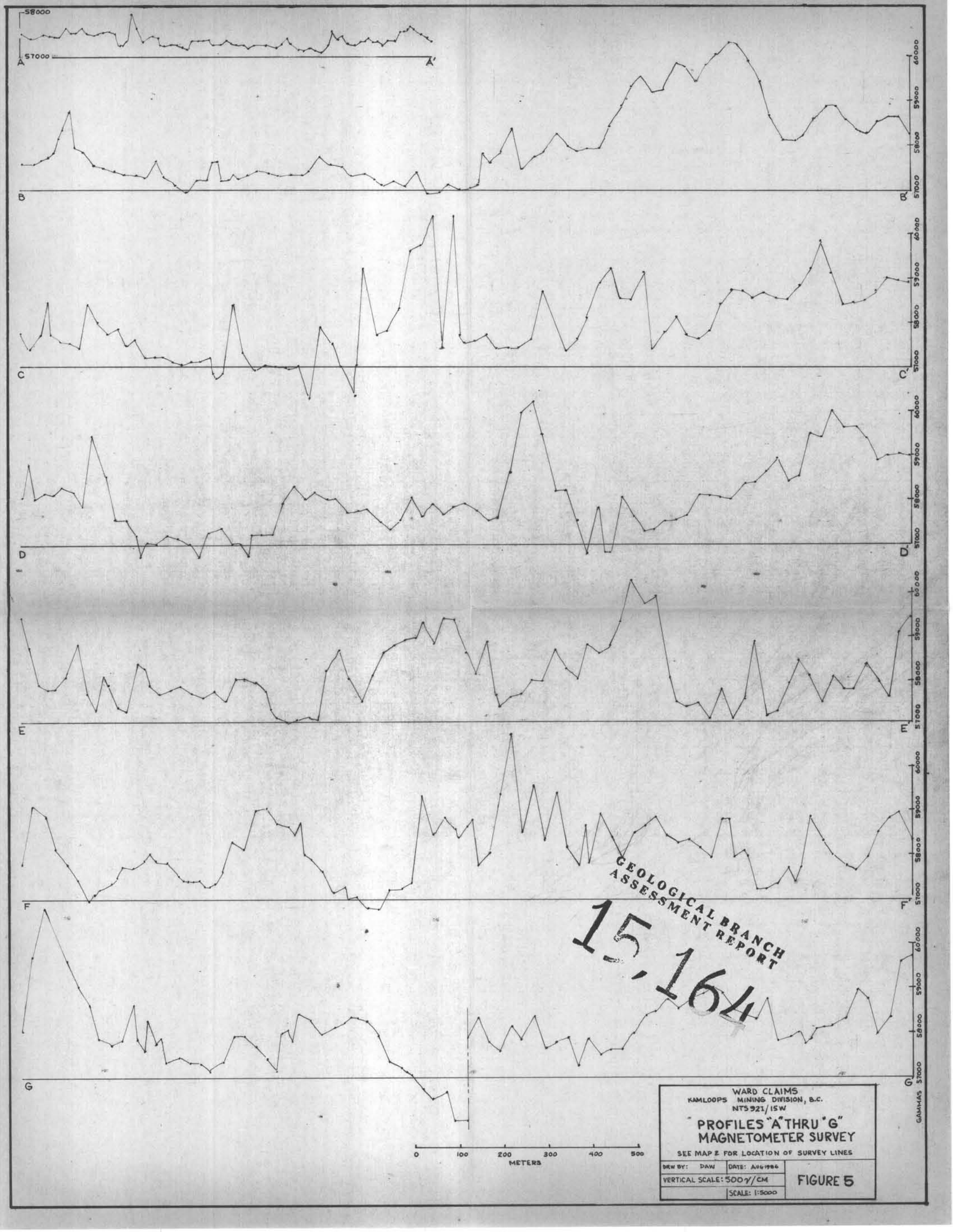
1) SEE MAP 2 FOR LOCATION OF TRAVERSE LINES IN RELATION TO TOPOGRAPHY AND PROPERTY BOUNARIES.
2) ⊣⊢ OR ⊢⊣ TICK MARKS INDICATE DIRECTION OF DECREASING TOTAL MAGNETIC FIELD STRENGTH.
3) FELSIC INTRUSIVES

0 100 200 300 400 500
METERS

WARD CLAIMS
KAMLOOPS MINING DIVISON, B.C.
NTS 92 I/15W
TOTAL FIELD
ISOMAGNETIC CONTOURS

DR BY: DAW	DATE: AUG 1986	MAP 3
500 GAMMA	INTERVALS	
	SCALE 1:5000	


N
TO RED LAKE ROAD
TO RED LAKE ROAD
PEARL CLAIM
LEGAL CORNER
POST
57500γ
57000γ
POL
RED LAKE AND KAMLOOPS
CAHE CREEK
GEOLOGICAL BRANCH
ASSESSMENT REPORT
15,164
AREAS WHERE CONCENTRATIONS OF MERCURY IN THE SOILS ARE GREATER THAN 300 PPB, FROM MORRISON, 1970.
SAME AS ABOVE EXCEPT FROM PLACER DEVELOPMENT LIMITED REPORT, 1981.
FELSIC INTRUSIVES
0 100 200 300 400 500
METERS
WARD CLAIMS
KAMLOOPS MINING DIVISON, B.C.
NTS92 I/15W
COMPARISON OF ANOMALIES
-MERCURY AND MAGNETIC-
DR BY: DAW
DATE: AUG 1986
SCALE 1:5000
MAP 4



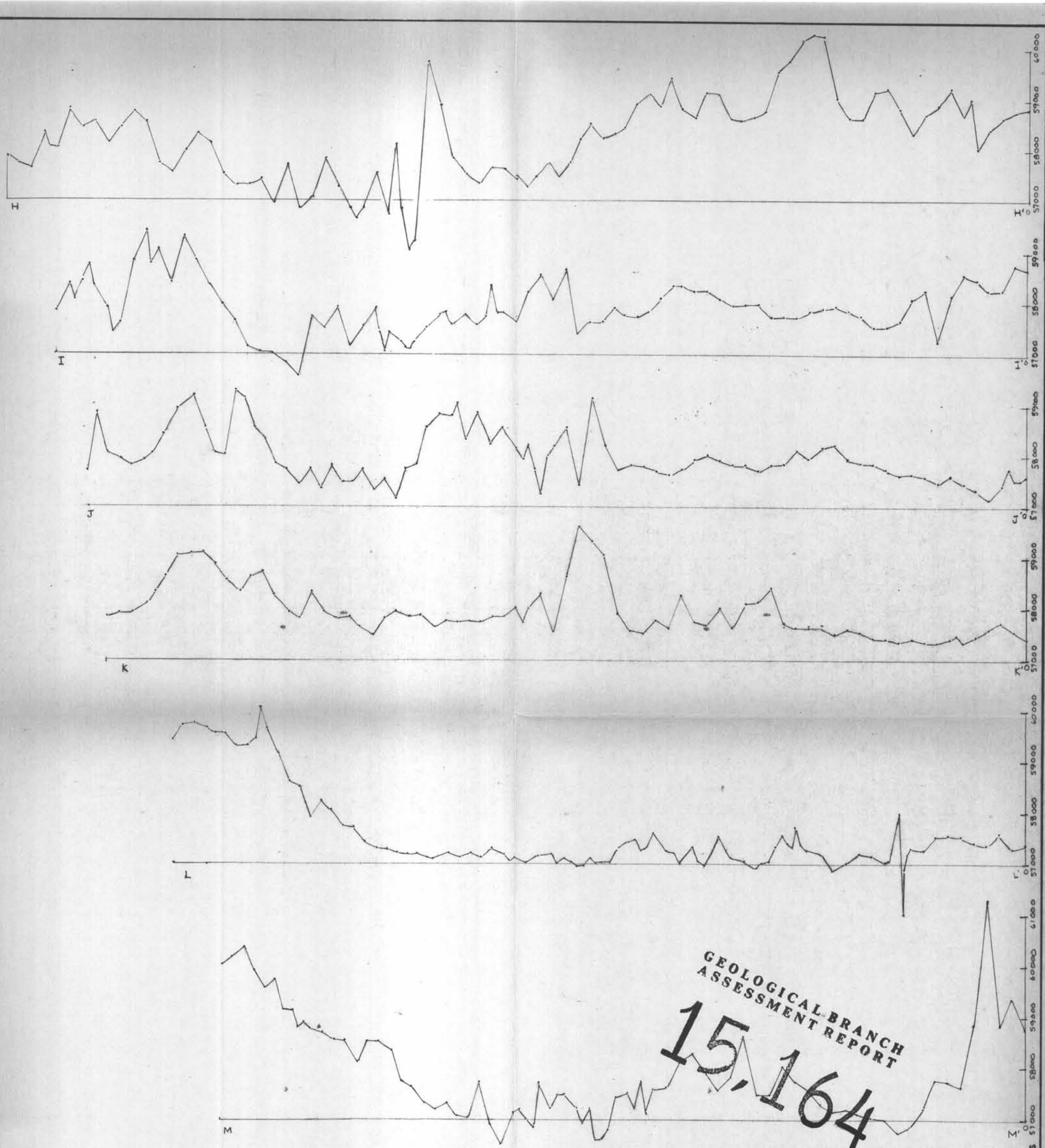
WARD CLAIMS
KAMLOOPS MINING DIVISION, B.C.
NTS 92I/15W

PROFILES "A" THRU "G" MAGNETOMETER SURVEY

SEE MAP 2 FOR LOCATION OF SURVEY LINES

DRN BY: DAW	DATE: Aug 1986
VERTICAL SCALE: 500γ/CM	
	SCALE: 1:5000

FIGURE 5



WARD CLAIMS
KAMLOOPS MINING DIVISION, B.C.
NTS 92I/15W
PROFILES "H" THRU "M"
MAGNETOMETER SURVEY
SEE MAP 2 FOR LOCATIONS OF SURVEY LINES

DRN BY: DAW	DATE: AUG 1984
VERTICAL SCALE: 500γ/cm	
	SCALE: 1:5000

FIGURE 6