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REPORT ON INDUCED POLARIZATION SURVEY ON SOME CL CLAIMS HIGHLAND VALLEY AREA, BRITISH COLUMBIA ON BEHALF OF NEW INDIAN MINES & VANANDA EXPLORATIONS LTD.

by

Jon G. Baird, B.Sc., P.Eng.

November 14, 1969

	Name	Record No.
CLAIMS:	CL 60	46816
	CL 62 - 64	46818 - 46820
	CL 66 - 69	46822 - 46825

LOCATION:
Highland Valley Area
About 22 miles southeast of Ashcroft, B.C.
Kamloops Mining Division
120° 50° NW

DATES:
September 28 to October 11, 1969

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SUMMARY

The present induced polarization survey has extended an area of increased chargeability responses which had been partly covered by previous induced polarization surveys. The amplitude of the observed IP responses could be caused by disseminations of about 1% by volume of metallically conducting mineralization such as sulphide mineralization but whose character is as yet unknown.

Since the anomalous zone is believed to lie within an area underlain by the favorable granitic rocks of the Guichon Batholith, diamond drilling appears to be warranted. Two drill holes each 400' in length are herein recommended.

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ON BEHALF OF
NEW INDIAN MINES & VANANDA EXPLORATIONS LTD.

INTRODUCTION

During the period September 28 to October 11, 1969, a geophysical field party executed an induced polarization survey on some CL claims in the Highland Valley area, British Columbia on behalf of New Indian Mines and Vananda Explorations Ltd. The survey was under the direction of Mr. Peter Keller, and experienced geophysical operator on the staff of Seigel Associates Ltd. Overall supervision was provided by the writer.

The property lies about 22 miles southeast of Ashcroft, B.C. and is reached by truck using an unimproved road northwards from the Highland Valley Road. The location of the CL claims is shown on Plate 1, on a scale of 1" = 8 miles. Glacial drift covers most of the surface of the property and topographic relief is moderate. The elevation of the survey area is about one mile above sea level.

The claims covered, in whole or part, by this survey are listed on the title page of this report and are shown on Plate 2 on a scale of 1" = 400'. These claims are held jointly by New Indian Mines Limited and Vananda Explorations Ltd.

Seigel Mk VI time-domain (pulse-type) induced polarization equipment has been employed on this property. The transmitting unit had a rating of 2.5 kw and equal on and off times of 2.0 seconds. The receiving unit was a remote, ground-pulse type triggered by the rising and falling primary voltages set up in the ground by the transmitter. The integration of the transient polarization voltages takes place for 0.65 seconds after a 0.45 second delay time following the termination of the current-on pulse.

The purpose of an induced polarization survey is to map the subsurface distribution of metallically conducting mineralization beneath the grids covered. In the present area such mineralization could include bornite, chalcopyrite, molybdenite, pyrite and other metallic sulphide minerals. As well, many other minerals such as graphite, magnetite and sericite can give responses not always distinguishable from sulphide mineralization.

The accompanying copy of H.O. Seigel's paper entitled "Three Recent Irish Discovery Case Histories Using Pulse Type Induced Polarization" gives a description of the phenomena involved in this type of survey, the equipment employed, the field procedures and the nature of the results obtained over various base metal ore bodies.

For the present survey, grid lines were cut oriented north-south at 300' intervals. The three electrode array with electrode spacings of 400' and 200' was employed. Station intervals were 200'.

Previous induced polarization surveys have been carried out near part of the survey area by Seigel Associates in December 1968 and by Huntec Limited in the spring of 1966. The results of these surveys have been incorporated in the present report where they give additional detail in anomalous areas.

GEOLOGY

A description of the geology of the area including and surrounding the present claims is found in GSC Memoir 249 "Geology and Mineral Deposits of Nicola Map Area, British Columbia" by W. E. Cockfield, 1961. In addition, K. Northcote has mapped the geology of the Guichon Creek Batholith and his maps on the scale of 1" = 1 mile have been made available to the writer. Northcote shows the Guichon Creek Batholith as a series of differentiated granitic and granodioritic rocks.

The present property is shown as being underlain by these acidic intrusive rocks.

The Highland Valley area, centered on the Guichon Creek Batholith, is well known for the occurrence of disseminated copper deposits. The target of the present surveys was one of these low grade, large tonnage deposits, the upper surface of which would occur within 300' of the ground surface.

The results of geochemical and magnetometer surveys carried out under the direction of F. Hemsworth, P.Eng. have been made available to the writer.

DISCUSSION OF RESULTS

Plates 3 and 4, on the scale of 1" = 400', show the chargeability results for the 200' and 400' electrode spacings respectively. A 2.0 millisecond contour interval has been used and areas exhibiting chargeabilities in excess of 8.0 milliseconds have been shaded. Different symbols explained in the legend have been used to show from which survey the data plotted on lines H through K are taken.

The chargeability maps indicate that the background chargeability values range from 1.0 to 5.0 milliseconds with a median value of approximately 3.5 milliseconds. This is well within the non-metallic chargeability range for the intrusive rocks believed to underlie the survey area under conditions of varying overburden depth. With this background a uniform distribution of 1% by volume of metallically conducting mineralization in the subsurface would be expected to add approximately 6.0 milliseconds to the background level. Chargeabilities in excess of 8.0 milliseconds are considered worthy of further investigation since deposits of very low concentrations of copper and molybdenum of sufficient dimensions may have economic significance.

A northeasterly trending zone exhibiting chargeabilities in excess of 8.0 milliseconds can be seen running from 12 N on line J off the grid at 27 N on lines F and G. A good deal of detail surveying employing varying electrode spacings was executed on line H by Seigel Associates in December 1968, and the results of this work are described in the writer's report of January 15, 1969. The profiles on Plate 3 of that report indicate a peak chargeability response of 18.0 milliseconds for the 100' spacing at 17 N on line H. A quantitative interpretation of the results reveals that the metallically conducting mineralization may be as much as 2% by volume and have a northly dip. The body comes to within 25' of the surface between 14 N and 17 N. Further detailed observations on lines F, G, I and J would allow similar precise quantitative interpretations however the present data indicate that the anomalous portions of these profiles are underlain by rocks containing approximately 1% by volume of metallically conducting material which comes to within at least 100' of the ground surface.

Plates 5 and 6, on the scale of 1" = 400', show the resistivity results for the 200' and 400' electrode spacings respectively. A 200 ohm-metre contour interval has been employed and areas exhibiting resistivities in excess of 800 ohm-metres have been shaded.

The resistivity range for most of the area surveyed is from 100 to 800 ohm-metres. Only a small percentage of the grid area exhibits resistivities in excess of 800 ohm-metres and the maximum observed resistivity value is 2,160 ohm-metres occurring on line I. These resistivity observations are quite normal for the overburden covered granitic rocks of the Highland Valley area. Changes in resistivities may be affected as much by changes in the type and thickness of overburden as by changes in the character of the bedrocks. Since the overburden is expected to have a lower resistivity than the bedrocks, the high resistivity areas may indicate places where the overburden thins, perhaps due to a rise in the bedrock surface. It is noted that the area of highest resistivities occurs on the north-west flank of the high chargeability area. Experience in the Highland Valley area allows the interpretation that the overburden may be only a few feet thick in this area.

The magnetometer survey carried out by Mr. Hemsworth covers lines D through K from station 15 S to station 27 N. The range of magnetic intensities is from below 1000 to in excess of 2000 gammas. There is no distinct magnetic pattern, however an area of increased magnetic intensities is noted to correspond with the high resistivity observations centered at 20 N on lines H and I. As for the resistivities, the magnetic intensities may be affected by changes in the depth to the bedrock surface. The interpretation that the high resistivity areas may indicate a shallowing of the overburden may therefore be supported by the magnetic data.

The results of the geochemical survey reveal only one above background Cu value taken on line H at 23 N. This location is near the general area of the high chargeability responses although one high value is hardly sufficient to determine a geochemical anomaly.

CONCLUSIONS AND RECOMMENDATIONS

The present induced polarization survey has indicated one area at least 400' in width by 2000' in length which exhibits above normal chargeability responses. These responses are interpreted as being due to disseminations of from 1% to 2% by volume of metallically conducting mineralization. In the present geological environment it appears that there is a real possibility that the chargeability increases may be due to concentrations of sulphide mineralization.

Although a diamond drill hole has already been executed near 18 N on L H, for reasons explained in the writer's report of January 15, 1969, a new hole seems to be warranted. In addition, a second hole near the north end of line G is proposed on the basis of the present induced polarization results. The proposed holes are as follows:

Hole	Collar	Inclination	Bearing	Length
DH#10	LH, 18+60 N	-45°	South	400'
DH#12	LG, 26+50 N	-45°	South	400'

If diamond drilling reveals that sulphide mineralization is indeed the cause of the present anomaly, further induced polarization surveying might be executed to completely delimit the north end of the present zone of high chargeabilities.

Respectfully submitted
SEIGEL ASSOCIATES LIMITED,

Jon G. Baird, B.Sc., P.Eng.
Geophysicist

Vancouver, B.C.
November 14, 1969

Richard O. Crosby, B.Sc., P.Eng.
Geophysicist

DOMINION OF CANADA:
PROVINCE OF BRITISH COLUMBIA.
TO WIT:

In the Matter of a geophysical survey on behalf of New Indian Mines & Vananda Explorations Limited

I, E.M. Flett for Seigel Associates Limited

of 750 - 890 West Pender Street, Vancouver

in the Province of British Columbia, do solemnly declare that an induced polarization survey has been executed on some CL claims in the Highland Valley area, British Columbia between September 28 to October 11, 1969. The following expenses were incurred:

(1)	Wages:			
	P. Keller	14 days @ $35.00/day	$490.00	
	D. Lorimer	14 days @ $27.50/day	385.00	
	R. McKenzie	14 days @ $27.50/day	385.00	
	H. Fuchs	14 days @ $27.50/day	385.00	
	J. Aarum	14 days @ $27.50/day	385.00	
	A. Matter	14 days @ $27.50/day	385.00	$2,415.00
(2)	Transportation & shipping to the job.			15.80
(3)	Transportation on the job.			305.88
(4)	Food & Living Expenses.			895.23
(5)	Use of geophysical equipment	14 days @ $50.00/day		700.00
(6)	Paid to Seigel Associates Limited to cover geophysicist's supervision, calculating, plotting and fairdrawing data and preparation of final reports.			783.09
				$5,115.00

And I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the "Canada Evidence Act."

Declared before me at the City of Vancouver, in the Province of British Columbia, this 12th day of December, 1969, A.D.

E M Flett

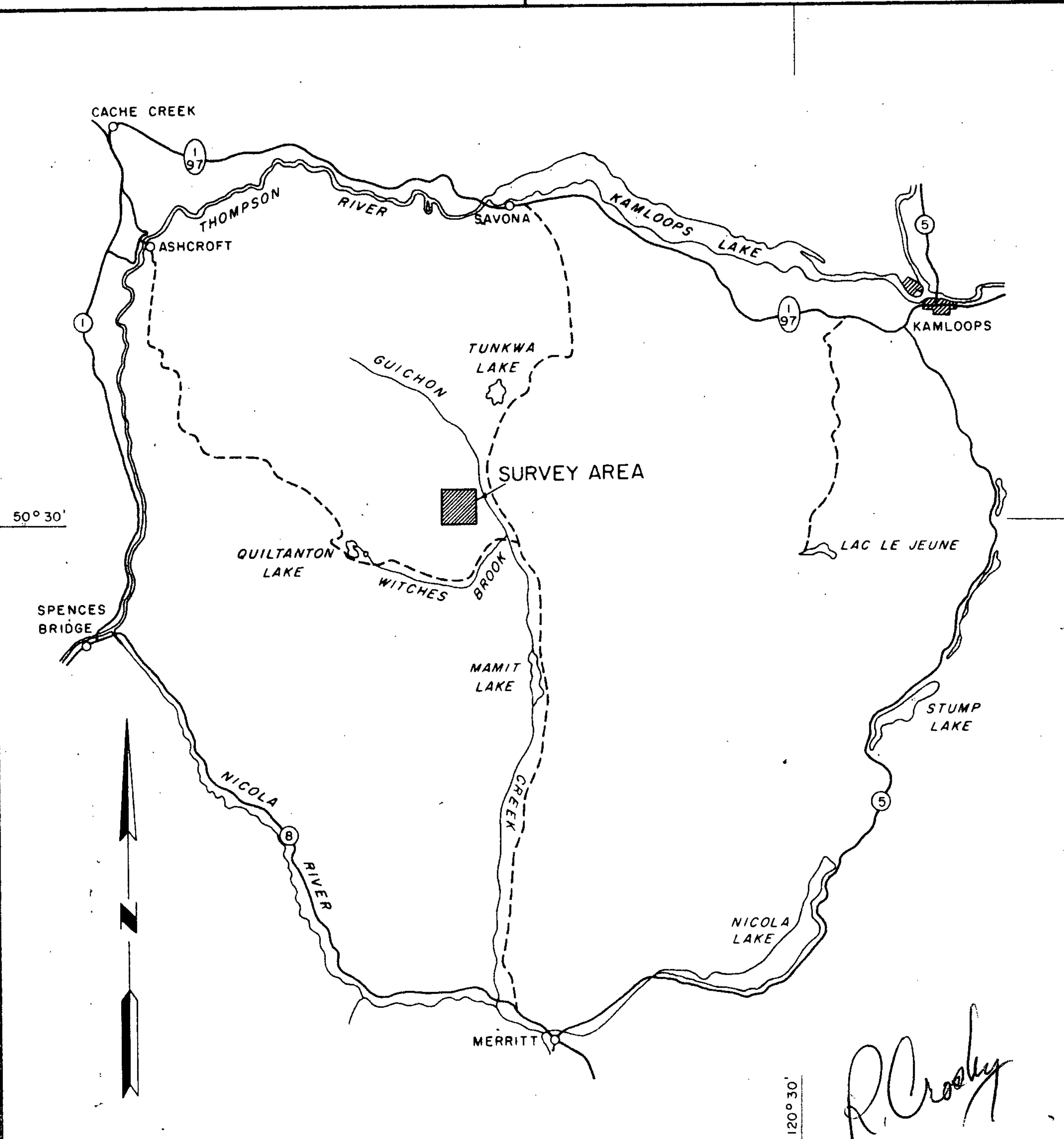
G. Paul Sub-mining Recorder

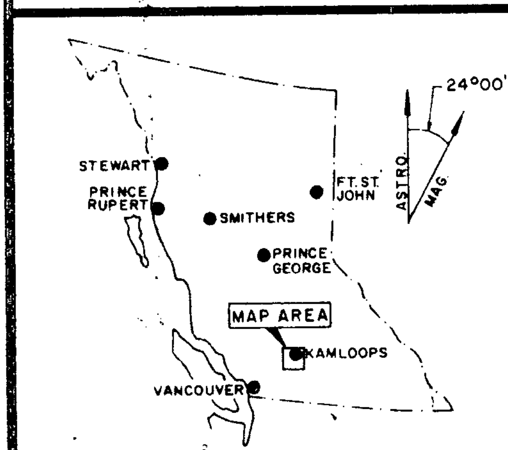
A Commissioner for taking Affidavits within British Columbia or
A Notary Public in and for the Province of British Columbia.

In the Matter of

Statutory Declaration

(CANADA EVIDENCE ACT)





BRITISH COLUMBIA

NEW INDIAN MINES AND VANANDA EXPLORATIONS LTD.

LOCATION MAP

CL- CLAIMS

HIGHLAND VALLEY AREA, B.C.

8 0 8 16

SCALE IN MILES

SURVEY BY
SEIGEL ASSOCIATES LIMITED
JULY 1969

PLATE I

Department of

Mines and Petroleum Resources

ASSESSMENT REPORT

NO. 2114 MAP #1

Harold O. Seigel

President,
Harold O. Seigel & Assoc., Ltd.,
Downsview, Ontario

Annual General Meeting,
Toronto, March, 1965

Three Recent Irish Discovery Case Histories Using Pulse-Type Induced Polarization

Transactions, Volume LXVIII, 1965, pp. 343-348

ABSTRACT

In the intensive Irish exploration program which has followed the discovery of the Tynagh deposit (Northgate Exploration, Ltd.) in 1962, three base metal discoveries have been made to date. These include the lead-zinc-silver deposits at Silvermines (Consolidated Mogul Mines, Ltd.), which are now being readied for production, the copper-silver deposit at Gortdrum (Gortdrum Mines, Ltd.) and the lead-zinc deposits near Keel (Rio Tinto-Zinc Ltd.). Each of these discoveries is the result of a combined geological-geochemical-geophysical exploration sequence in which pulse-type induced polarization surveys defined the precise location and lateral extent of the near-surface metallic sulphide mineralization and guided the initial drilling program. Whereas the Silvermines mineralization is, in part, composed of massive sulphides, the other two deposits are characterized by generally less than 5 per cent conducting sulphides and constitute an excellent demonstration of the unique merits of the pulse-type induced polarization system.

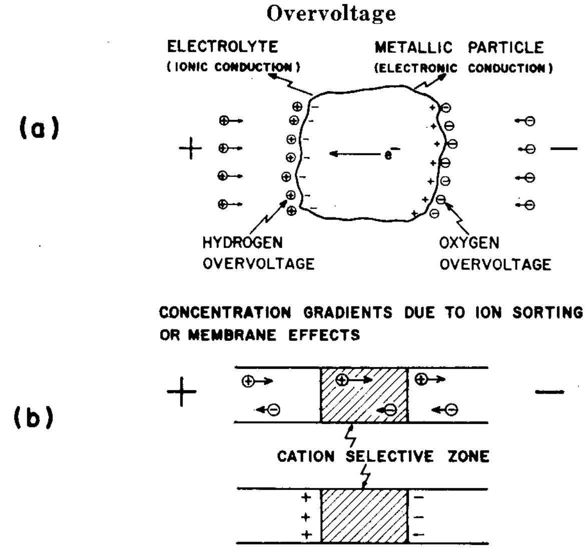


Figure 1.—Induced Polarization Agents.

Introduction

FOR the benefit of those who are unfamiliar with the induced polarization method in general or with the pulse-type method in particular, a few introductory remarks will be directed on the system employed in the present case histories. Those who wish a fuller treatment of the subject are directed to Seigel (1962),* which paper also includes an extensive list of references.

Induced polarization, in its broadest sense, means a separation of charge to form an effective dipolar (polarized) distribution of electrical charges throughout a medium under the action of an applied electric field. When current is caused to pass across the interface between an electrolyte and a metallic conducting body (Figure 1a) double layers of charge are built up at the interface, in the phenomenon known to the electrochemists as "overvoltage." This is the phenomenon which can be utilized for the detection of the metallic conducting rock-forming minerals such as most sulphides, arsenides, a few oxides and, unfortunately, graphite. In addition, effective dipolar charge distributions occur to some extent in all rocks, due to ion-sorting or membrane effects in the fine capillaries in which the current is passing (Figure 1b). Induced polarization responses may therefore arise from metallic or non-metallic agencies. Fortunately, the latter generally fall within fairly low and narrow limits for almost all rock types, although there is still no reliable general criterion for differentiating overvoltage responses from graphite and metallic sulphides, or for distinguishing between the responses of one type of sulphide and another. Despite these limitations, the induced polarization method has amply demonstrated its value in mineral exploration since its initial development as a useful exploration tool in 1948. (Wait *et al.*, 1953).**

*Seigel, H. O., "Induced Polarization and its Role in Mineral Exploration," C.I.M. *Bulletin*, Vol. 55, No. 600, pp. 242-249; *Transactions*, Vol. LXV, pp. 151-158; 1962.

**"Overvoltage Research and Geophysical Applications," *Pergamon Press*, 1959, edited by J. R. Wait.

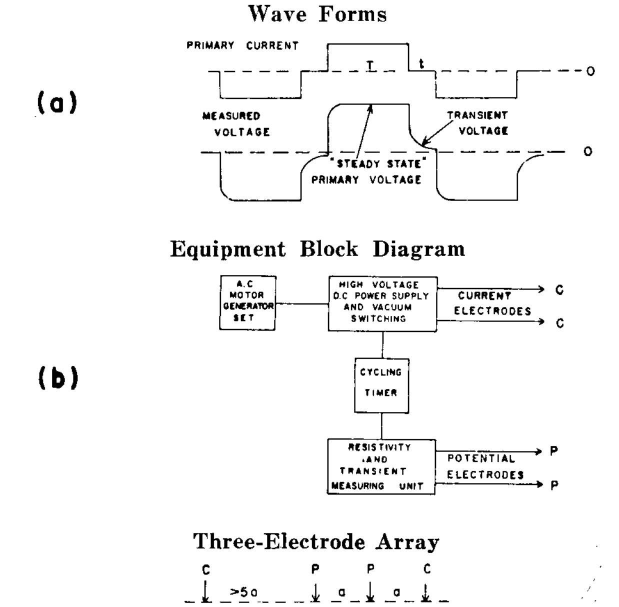


Figure 2.—The Pulse System.

Description of Method

For the present program, the pulse or time-domain system was employed. As shown on Figure 2a, the primary current wave form consists of square wave pulses of 1.5 seconds duration, separated by a 0.5-second gap and alternately reversed in direction. The polarization voltages established during the current-on time decay slowly during the current-off time. They are amplified, integrated over the current-off time and divided by the amplitude of the steady-state voltage measured during the current-on time. In this way, we determine the "chargeability;" i.e., the induced polarization property of the region under investigation. The units of chargeability are milliseconds. Normal (non-metallic) background chargeabilities in most rocks range from 1 millisecond to 5 milliseconds. A distribution of 1 per cent, by volume, of metallic conducting material of an average range of particle size may be expected to increase the response level by about 3 milliseconds, which is readily visible.

The pulse system provides an absolute measurement of induced polarization; i.e., the significant measurement is made in the absence of the primary field. As such, it is inherently more sensitive than the frequency variation system, wherein two measurements are compared, both of which are made in the presence of the primary field. This is a critical consideration when mineralized bodies of low sulphide content, small size or great depth are being sought.

Figure 2b shows a block diagram of the apparatus employed and the electrode array used. The spacing "a" of the three-electrode array determines the effective depth of penetration of the survey and is selected to give adequate penetration to the depth desired. By varying the electrode spacing over an anomalous area and comparing the responses on the various spacings, one may obtain an estimate of the depth of burial of the source and its dip, etc.

A photograph of the type of apparatus employed on these surveys is shown in Figure 3. This is known as Seigel Mk V equipment and consists of the following major components: (a) a 1,200-watt A.C. motor-generator set, (b) a power control unit capable of supplying up to 1000 volts and 2 amperes D.C. output current and (c) a measuring unit. All of these items are packboard-mounted for maximum portability.

Figure 4 shows a typical instrumental set-up in Ireland. In the normal operating procedure, the electronic chassis are set up in a tent and cables are fed out to the line being surveyed. As the line crew is prepared, both mentally and by apparel, to work under all types of weather conditions, the survey is not stopped by rain, etc. This is important in Ireland, where, traditionally, there are no more than 60 rain-free days a year.

For the primary survey coverage on most properties, an electrode spacing of 200 to 300 ft. was generally employed, with a station interval of 200 ft. and a line separation of 300 to 500 ft. On anomalous areas located by the primary coverage, more closely spaced stations and lines are employed, as well as additional spacings to supply the detail necessary for subsequent drilling, etc.

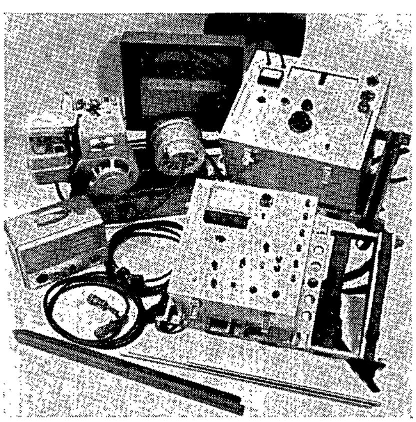


Figure 3.—(above)—The Seigel Mk V Induced Polarization Unit.

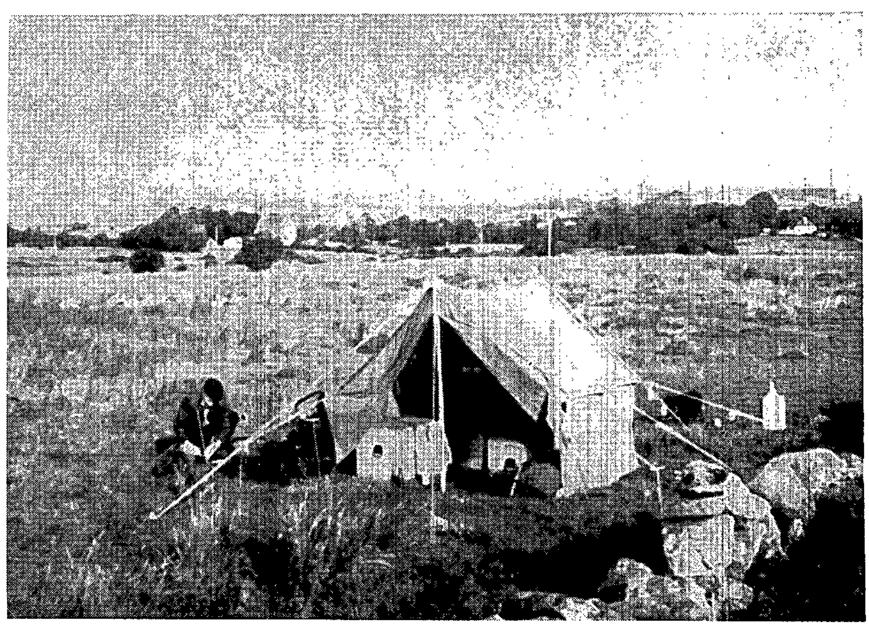


Figure 4.—(right)—Typical Field Operational Base in Ireland.

Case Histories

In presenting the three case histories that follow, it must be made perfectly clear at the outset that these mineral discoveries are the product of teamwork, involving geological, geochemical and geophysical phases. It is on the basis of the first two phases that the areas for geophysical investigation have been selected. As the writer and his organization have been concerned only with the geophysical phase, this paper will, naturally, appear to emphasize it. The contribution of others to the broader exploration program must not be minimized, however.

In January, 1962, a large lead-zinc-silver deposit of a very unusual type was discovered near Tynagh, Co. Galway, in the Republic of Ireland. This deposit includes both a supergene enriched, partly oxidized upper zone and a sulphide primary zone and lies in dolomitic reef limestones of Carboniferous age near a fault contact with Devonian sandstones. Similar rock types and contacts occur in many parts of Ireland, so that an extensive program of exploration was initiated by a number of mining companies, starting in the summer of 1962. Although the pace has slowed up somewhat from the hectic days of 1962 and early 1963, this exploration program continues to the present time.

The usual exploration sequence, although not followed in detail by all companies, is as follows:

1 . . . .

A selection of areas is made, based on the good government geological maps available. As nearly as possible, rock types and structures similar to those of the Tynagh deposit are sought. Those areas with known mineral showings are given high priority, of course.

2 . . . .

The stream sediments in the drainage pattern are sampled and analyzed for significant amounts of copper, lead and zinc. Soil samples may also be taken, often on a regular grid basis, and analyzed. In this fashion, areas of abnormal metal content may be broadly defined. In detail, such geochemical sampling has often been hampered by man-made contamination and confused by soil transport by glacial, fluvial or human agencies.

3 . . . .

Geophysical surveys, primarily the induced polarization type, are then conducted to map the subsurface distribution of sulphide mineralization and to provide guidance for a drilling program thereon.

This exploration program has already been remarkably successful, resulting, to date, in a new lead-zinc-silver mine-to-be at Silvermines, Co. Tipperary, for Consolidated Mogul Mines, Ltd., the probable copper-silver mine-to-be at Gortdrum, Cos. Tipperary and Limerick, for Gortdrum Mines, Ltd., and the interesting lead-zinc prospect at Keel, Co. Longford, for the Rio Tinto-Zinc group (Riofinex Ltd.). Figure 5 shows the location of the various recent mineral discoveries in Ireland. Despite a remarkable similarity in geological setting, the deposits are widely separated geographically, over a length of 80 miles, and no two are located on what can be called the same structure. This bodes well for the possibility of further discoveries being made in Ireland.

Each of the three case histories will be discussed below.

Silvermines Deposit

As the very name of the area implies, the Silvermines region had been known, for many centuries, as a locality mineralized with lead, zinc and silver. Metal production had taken place at several periods in the past, although at the time of the present investigations the mines were dormant. The very prominent Silvermines fault, striking about N 70°E, was known to be the significant control in the region, with the old mines and prospect pits scattered along its length over a distance of about 2 miles. Due to the past mining activity and transport by both drainage and man, a very extensive area gave rise to extremely high geochemical indications in lead and zinc. The induced polarization survey executed in late 1962 and early 1963 covered much of the concession area on 800-ft. sections and the geologically interesting portion thereof on 400-ft. sections. The three-electrode array, with 200-ft. electrode spacing, was employed on all lines, and spacings of 100 ft. and 400 ft. were also employed on the 400-ft. detail lines. In all, approximately 5 miles of the strike length of the Silvermines fault were covered by the present survey, 2½ miles in detail. At least ten distinct zones of abnormally high polarization were indicated, of which about half lay in the Silvermines mineralized belt and its extensions to the west and east.

One of these zones, designated the Garryard, has responded favourably to the subsequent drilling, resulting in the discovery of a mineable orebody.

To date, the announced proven tonnage figures include 12 million tons averaging approximately 8 per cent zinc, 3 per cent lead and 1 ounce of silver in the Garryard zone. This zone lies to the west of the zone from which the previous production had taken place.

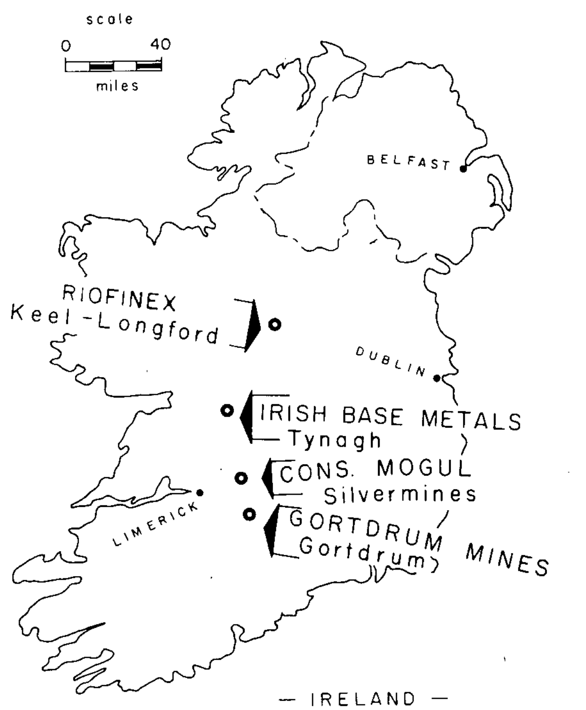


Figure 5.—Location Plan of Recent Mineral Discoveries in Ireland.

Figure 6 shows a typical discovery profile across the main ore zone, on the section 38,400E. The 200-ft. electrode spacing results, both chargeability and resistivity, are shown in profile form. The geologic section, as deduced from nine drill holes, is shown below the geophysical profiles. In a fashion almost identical to that of the Tynagh deposit, the Silvermines orebody is located in gently north-dipping dolomitic limestones adajacent to a fault contact with the Devonian "Old Red" sandstone. The mineralization here is composed of both massive and disseminated sulphides, with the former composed of a high percentage of pyrite. The mineralization is essentially conformable, in two distinct horizons, and is therefore flatly dipping except in the vicinity of the fault, where the dips are much steeper, perhaps due to "drag folding" on the fault.

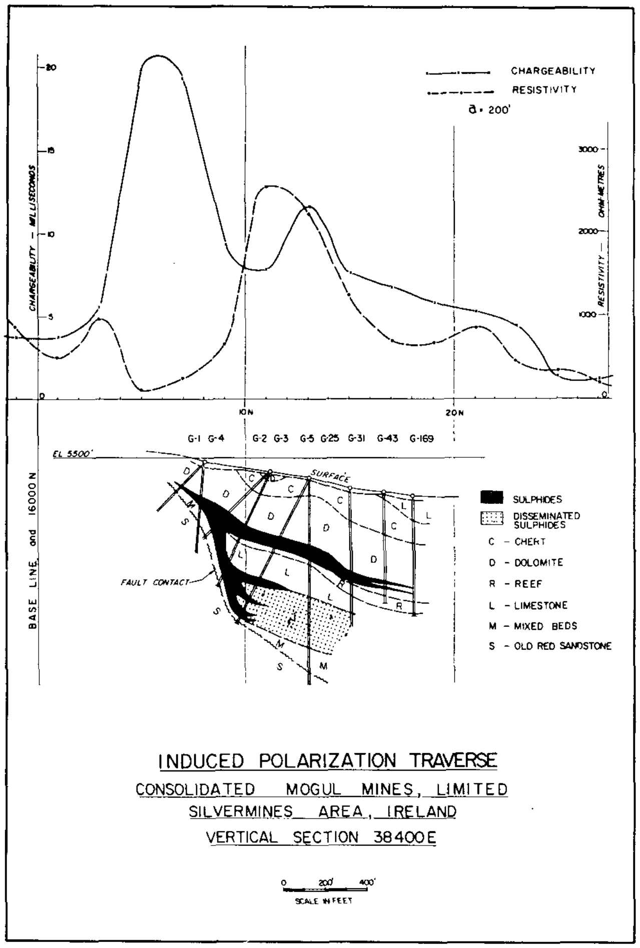


Figure 6.—Typical Discovery Traverse, Silvermines Deposit.

Because of the high pyritic content of the mineralization near the fault, along which it comes closest to the ground surface, we see both a marked increase in chargeability and a sharp decrease in resistivity in that vicinity. From a normal background of 2-4 milliseconds, the chargeability curve rises to a peak response of 20 milliseconds over the sub-outcrop of the body on this section. The subsidiary peak of about 12 milliseconds near 11N is believed to be due to disseminated pyrite in the chert horizon.

Figure 7 shows the multiple spacing chargeability results on the same section, using electrode spacing of 100, 200 and 400 ft. and the three-electrode array. On comparing the results with the various spacings, two items of interest may be noted; firstly, the progressive increase in peak amplitude with spacing, testifying to the increase of mineralization with depth, even down to a depth of 300 ft., and, secondly, the presence of buried material of high polarization at depth beneath section 10N to 18N on this line. The latter is undoubtedly due to the down-dip extension of the upper mineralized horizon, which is present at depths of 300 to 400 ft. over this region.

The induced polarization results on the Silvermines deposit were quite definitive and have provided good guidance for the exploratory drilling. It is true, however, that the massive sulphide portions of this deposit would be amenable to detection by the more conventional electrical methods, such as electromagnetic induction or resistivity. As such, it is not as good a test of the capabilities of the induced polarization method as are the two case histories which follow.

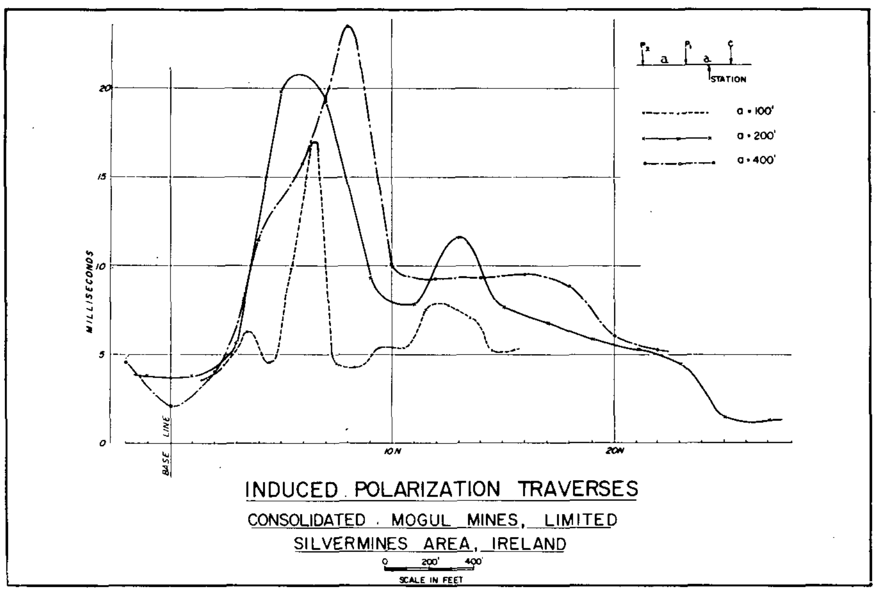


Figure 7.—Multiple Spacing Results, Silvermines Deposit.

Gortdrum Deposit

The Gortdrum area, near the mutual border of Cos. Limerick and Tipperary, was originally selected to cover the eastern extension of the former Oola Mines lead-zinc deposit, some 3 miles to the west. Regional geochemical sampling of the stream sediments in this area, followed by soil traverses, indicated a moderately strong copper soil anomaly. Induced polarization surveys were carried out in May, 1963, and January, 1964, leading to the localization of the sulphide mineralization associated with the geochemical anomaly. As there was a 300-ft. lateral displacement between the centers of the geophysical and geochemical indications and the surface topography is very gentle, it was initially queried as to whether the two indications

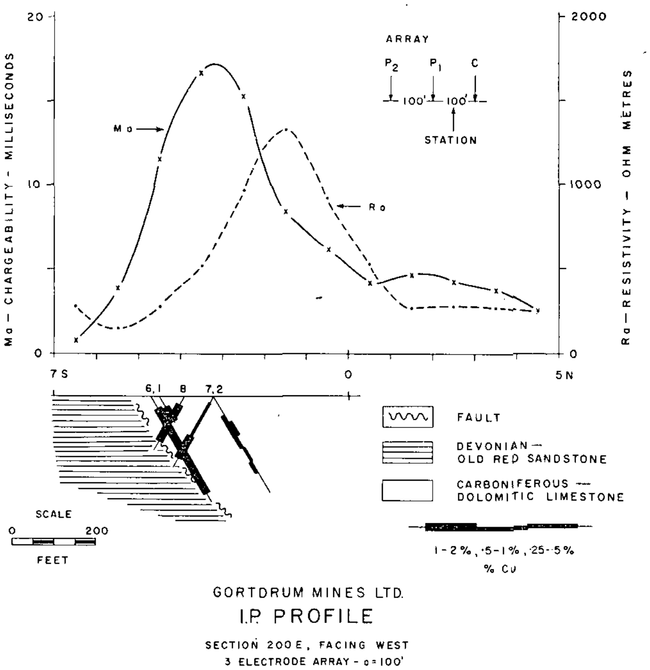


Figure 8.—Typical Discovery Traverse, Gortdrum Deposit.

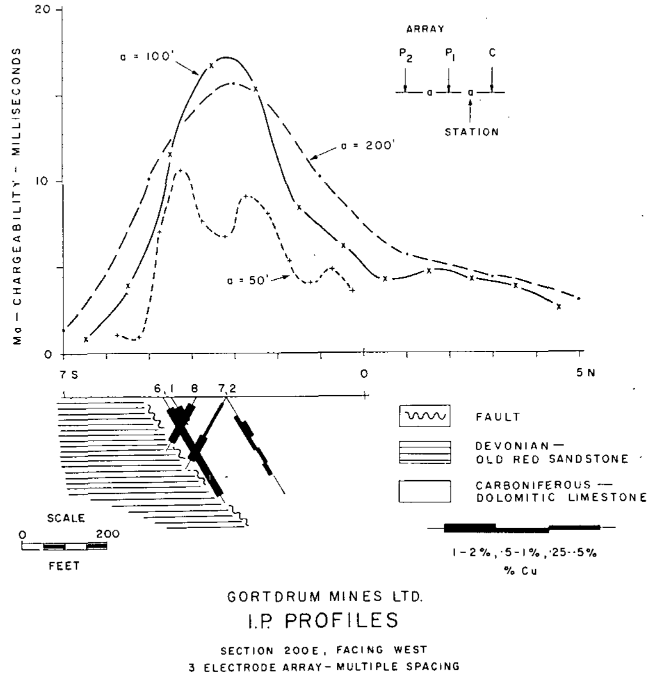


Figure 9.—Multiple Spacing Results, Gortdrum Deposit.

were related. The subsequent drilling has fully confirmed the geophysical predictions.

On the initial two geophysical programs, the three-electrode array with 100-ft. spacing was employed, as a relatively shallow source of the geochemical anomaly was expected. The survey lines were at 200-ft. intervals. Figure 8 presents a typical discovery traverse, showing both the chargeability and resistivity profiles as well as the corresponding geologic section. A peak chargeability of about 17 milliseconds is observed, rising from the normal background of 2-4 milliseconds. There is no resistivity expression of the mineralized zone, lying as it does on the flank of a high-resistivity area.

Figure 9 shows the chargeability profiles for electrode spacings of 50, 100 and 200 ft. Points of special interest deduced from these profiles include the following:

1.—The extremely sharp cut-off of the high chargeability levels on the south side of the area and the gradual drop-off in level on the north side. This was inconsistent with the thought of a bedded-type deposit conformable with the limestones, which are known to dip flatly to the south. A fault or other contact was postulated, dipping steeply, probably to the north. The initial drill holes on the section (Nos. 1, 2 and 6) were drilled to the north on the original geologic-dip premise, but the later holes (e.g., Nos. 7 and 8) have all been drilled to the south.

2.—The high-polarization material does not quite outcrop, but still comes within about 25 ft. of the ground surface across a width of about 200 ft., including two or more lenses. This material extends to at least 200 ft. in depth.

The actual drilling results confirm the presence of a zone of finely disseminated chalcocite and bornite, with very minor chalcopyrite, in dolomitic limestones. The mineralization is somewhat erratically distributed but, in general, increases as one approaches a north-dipping fault, which brings the limestones into contact with the Devonian Old Red sandstones. This fault has been found to strike about N 70°E. Geologically, therefore, this environment is almost identical to that of the Tynagh and Silvermines deposits. The mineralization in the Gortdrum area is quite different, however, both in type and amount. The average grade of the deposit is less than 2 per cent copper, with about 0.65 ounce of silver for each 1 per cent copper (although considerable potential open-pit tonnage may exist), so that the average sulphide content, by volume, is 3 per cent or less. The high chargeability responses observed over this deposit are a remarkable tribute to the sensitivity of the pulse-type induced polarization method, particularly when dealing with truly disseminated-type sulphide mineralization with a small average particle size.

As development drilling is still in progress on this deposit, no over-all grade or tonnage figures have as yet been released.

Keel Deposit

The deposits near Keel and Longford, Co. Longford, occur on a known limestone-sandstone contact, which is, no doubt, one of the reasons why exploration interest was attracted thereto. Soil sampling traverses by Riofinex Ltd., an exploration subsidiary of Rio Tinto-Zinc Corporation, Ltd., established the presence of anomalous lead and zinc concentrations. A horizontal-loop electromagnetic survey was initially executed in another attempt to determine the source of the geochemical indications, but with negative results. This was followed by induced polarization surveys in November and December, 1962. The three-electrode array, with an electrode spacing of 200 ft., was employed on the reconnaissance survey. Anomalous chargeability zones were indicated and exploratory drilling commenced shortly thereafter. Although no publication of results has been made, they are of some potential interest, as drilling has continued, at intervals, to the present time.

Figure 10 shows a typical section across the prospect, presenting the geophysical and geochemical results in profile form, as well as the geological section interpreted from three holes. The relationship between the mineralized horizon, the geophysical peak and the geochemical peaks is a matter of considerable interest. The sub-outcrop of the mineralized horizon and the geophysical peak are in good agreement (see also Figure 11). The lead peak is displaced about 400 - 500 ft. down slope to the south. The zinc peak is displaced still another 300 ft. to the south. The actual topographic slope is only 1-2 degrees to the south, so that this displacement is difficult to account for on the basis of soil creep. There is only a minor resistivity depression associated with the mineralization, indicating why the electromagnetic survey failed to give any positive response to it.

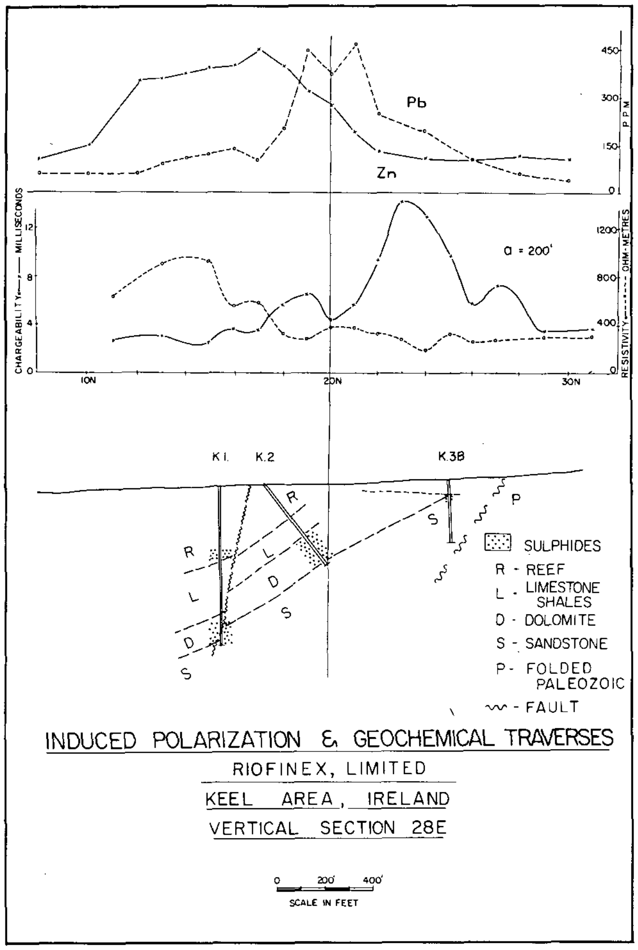


Figure 10.—Typical Discovery Traverse, Keel Deposit.

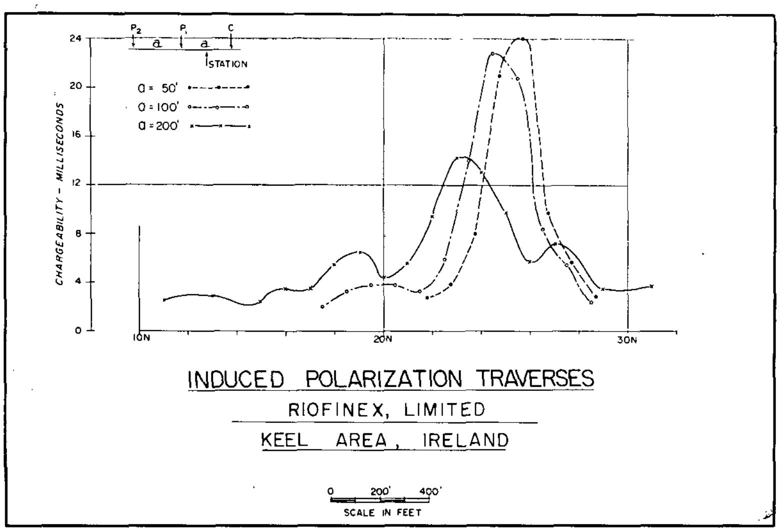


Figure 11.—Multiple Spacing Results, Keel Deposit.

The mineralization itself is primarily sphalerite, with some galena and, on the average, less than 5 per cent pyrite. It is found to lie primarily in a dolomite horizon adjacent to a contact with sandstone. In this case, the contact may be largely a depositional one and not due to a fault. Mineralization occurs to a minor extent in the sandstone as well.

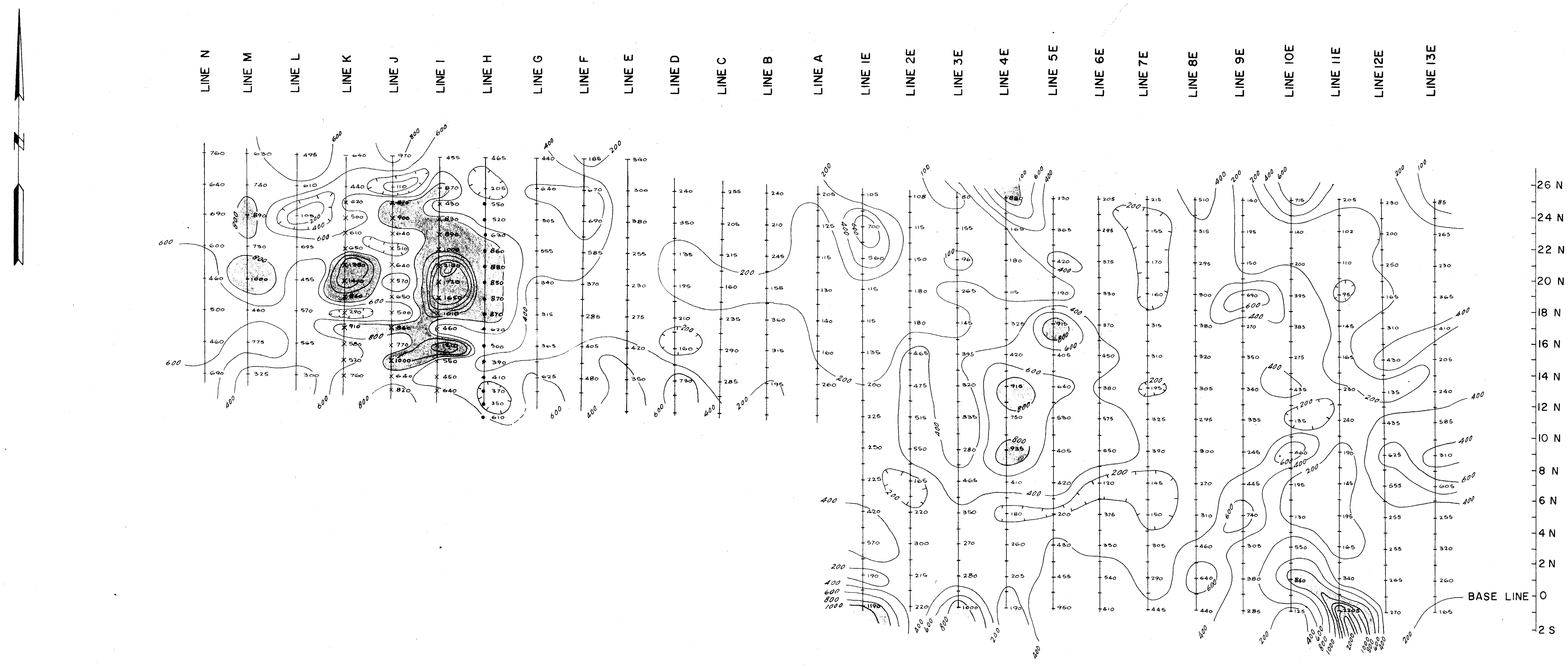
Figure 11 shows the chargeability results of the multiple spacing profiles on this section. Spacings of 50, 100 and 200 ft. were used. The progressive step-out of the peak values to the south with the increase in electrode spacing indicates the effect of the relatively flat dip to the south of the mineralization. The sub-outcrop of the mineralization is near station 26N, at a depth of less than 25 ft. As hole K3B, only 100 ft. away, intersected almost 60 ft. of overburden one must conclude that the bedrock surface is rather irregular in this area. The peak chargeability of 24 milliseconds would suggest a metallic conductor content of the order of 6 to 12 per cent, by volume, in this area.

It is the writer's hope that he has not given the impression that every induced polarization anomaly in Ireland inevitably defines an orebody, or that every exploration venture there is crowned with success. Aside from effects due to the many man-made conductors, such as grounded power lines, rabbit fences and buried pipe lines, there are certain carbonaceous sediments, in particular the Calp limestone, which overlies the ore-bearing dolomitic limestone in some places, which yield high polarization responses. Fortunately, the areal distribution of the latter is usually broad enough to suggest a formational origin. Also, fortunately, the Calp is, stratigraphically, sufficiently well separated from the ore-bearing limestones so that the effect from these two horizons may be resolved. With the geological and geochemical information available, one can usually determine whether a particular induced polarization indication warrants investigation by drilling. Despite its limitations, the pulse-type induced polarization method has well demonstrated its application to a broad range of base metal exploration problems in Ireland.

Acknowledgments

The writer wishes to express his thanks to Consolidated Mogul Mines, Ltd., and Dr. W. W. Weber, to Gortdrum Mines, Ltd. and Dr. D. R. Derry, and to Rio Tinto-Zinc Corp. Ltd. and Mr. Jocelyn Pereira, for their kind permission to present the geophysical and other details relating to their respective mineral discoveries. In addition, the writer wishes to acknowledge the able assistance of the staff of Canadian Aero Mineral Surveys, Ltd., with which our company, Harold O. Seigel & Associates Ltd., has acted on a co-operative basis in Ireland.

(*Reprinted from The Canadian Mining and Metallurgical Bulletin, November*, 1965)
Printed in Canada



LEGEND:

460 LINE TRACE WITH RESISTIVITY IN OHM-METRES FROM PRESENT SURVEY

400 LINE TRACE WITH VALUES IN OHM-METRES FROM PREVIOUS SEIGEL SURVEY

705 LINE TRACE WITH RESISTIVITY VALUES FROM PREVIOUS HUNTEC SURVEY

400 RESISTIVITY-CONTOURS WITH 200 OHM-METRES CONTOUR INTERVAL

NOTES:

THREE ELECTRODE ARRAY,
ELECTRODE SPACING a = 200'
MOVING CURRENT ELECTRODE SOUTH OF ARRAY

TO ACCOMPANY A GEOPHYSICAL REPORT
BY J. G. BAIRD DATED NOVEMBER 14, 1969

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2114 MAP #5

PLATE 5 2114

NEW INDIAN MINES AND
VANANDA EXPLORATIONS LTD.

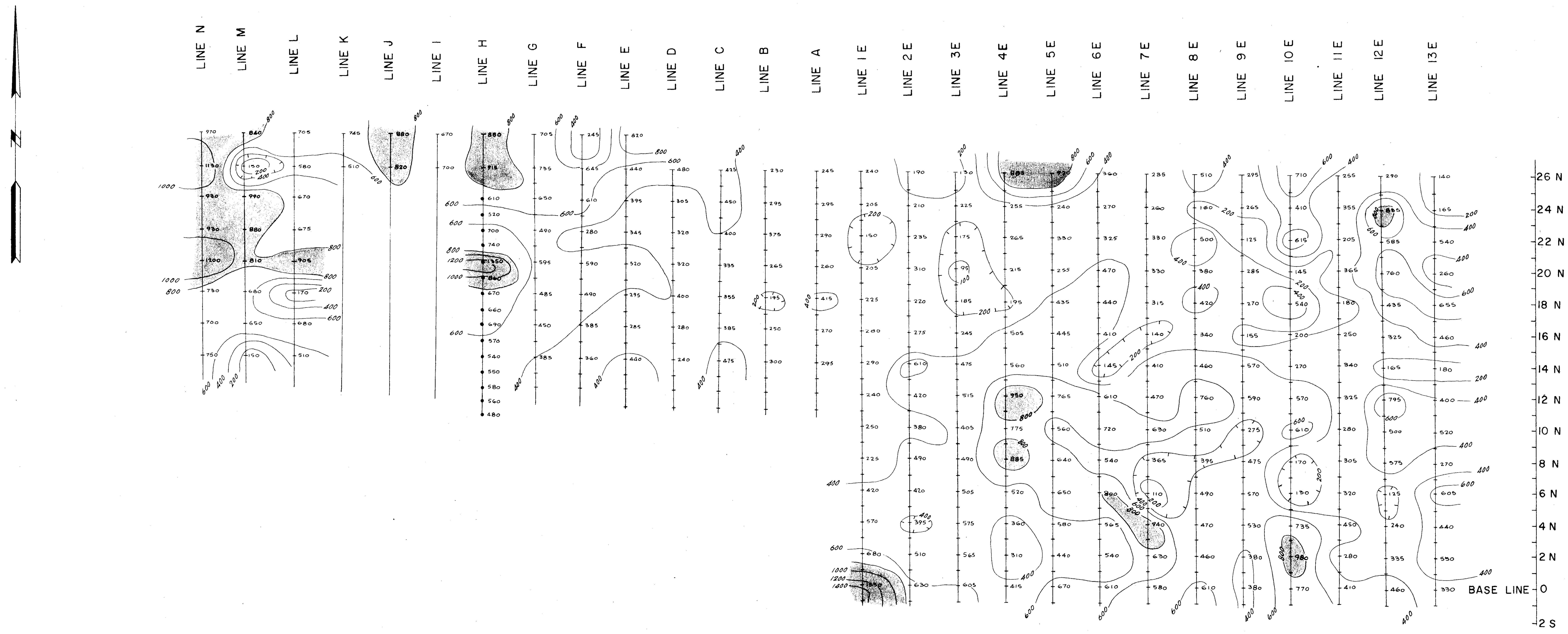
HIGHLAND VALLEY AREA, BRITISH COLUMBIA
CL-CLAIMS

INDUCED POLARIZATION SURVEY

RESISTIVITY CONTOUR PLAN
ELECTRODE SPACING 200'
SCALE: 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
OCTOBER 1969

R. Crosby



LEGEND:

400 LINE TRACE WITH RESISTIVITY VALUES IN OHM-METRES FROM PRESENT SURVEY

250 LINE TRACE WITH VALUES IN OHM-METRES PREVIOUS SEIGEL SURVEY

400 RESISTIVITY-CONTOURS WITH 200 OHM-METRE CONTOUR INTERVAL

NOTES:

THREE ELECTRODE ARRAY,
ELECTRODE SPACING a = 400'
MOVING CURRENT ELECTRODE SOUTH OF ARRAY

TO ACCOMPANY A GEOPHYSICAL REPORT
BY J. G. BAIRD DATED NOVEMBER 14, 1969

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2114 MAP #6

PLATE 6 2114

NEW INDIAN MINES AND VANANDA EXPLORATIONS LTD.

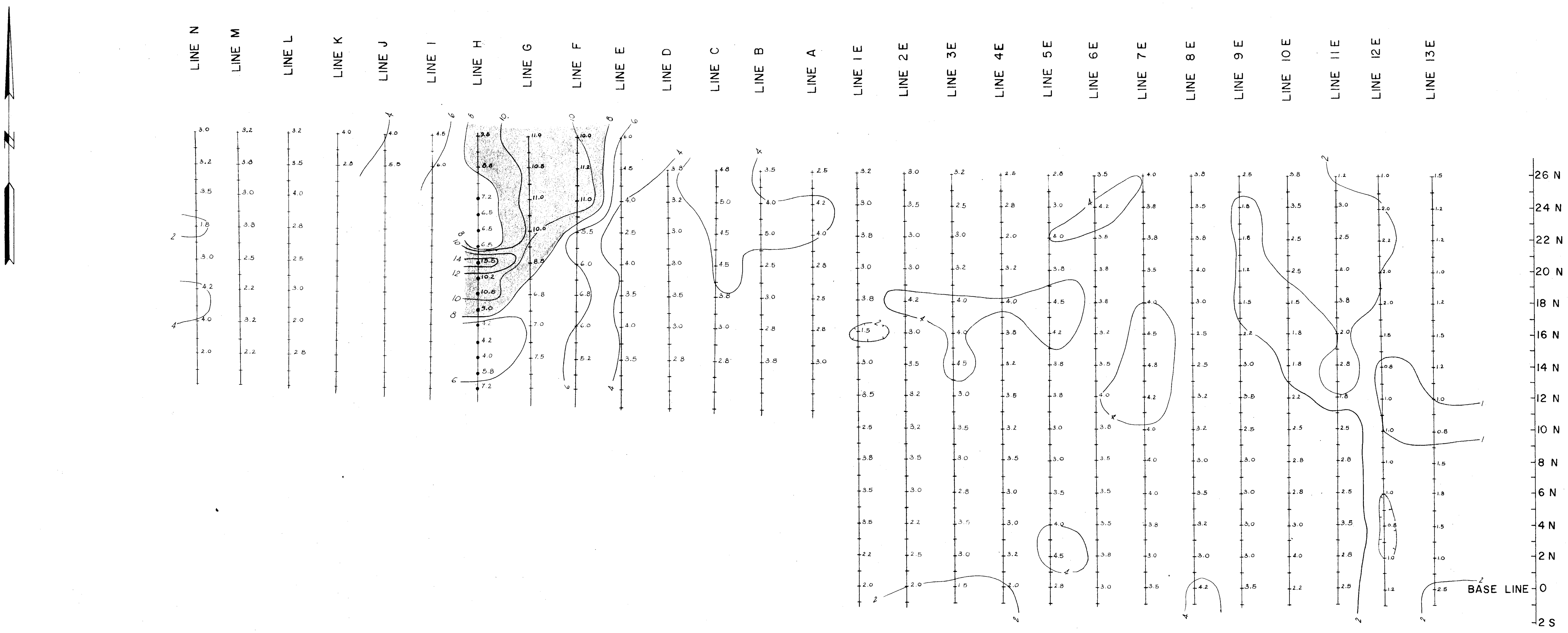
HIGHLAND VALLEY AREA, BRITISH COLUMBIA
CL-CLAIMS

INDUCED POLARIZATION SURVEY

RESISTIVITY CONTOUR PLAN
ELECTRODE SPACING 400'
SCALE: 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
OCTOBER 1969

R. Crosby



LEGEND:

LINE TRACE WITH CHARGEABILITY VALUES FROM PRESENT SURVEY IN MILLISECONDS

CHARGEABILITY VALUES FROM PREVIOUS SEIGEL SURVEY IN MILLISECONDS

—2— CHARGEABILITY CONTOURS WITH 2 MILLISECOND CONTOUR INTERVAL

NOTES:

SEIGEL MK VI INDUCED POLARIZATION DATA
THREE ELECTRODE ARRAY,
ELECTRODE SPACING a = 400'
MOVING CURRENT ELECTRODE SOUTH OF ARRAY

TO ACCOMPANY A GEOPHYSICAL REPORT
BY J. G. BAIRD DATED NOVEMBER 14, 1969

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2114 MAP #4

PLATE 4 2114

NEW INDIAN MINES AND VANANDA EXPLORATIONS LTD.

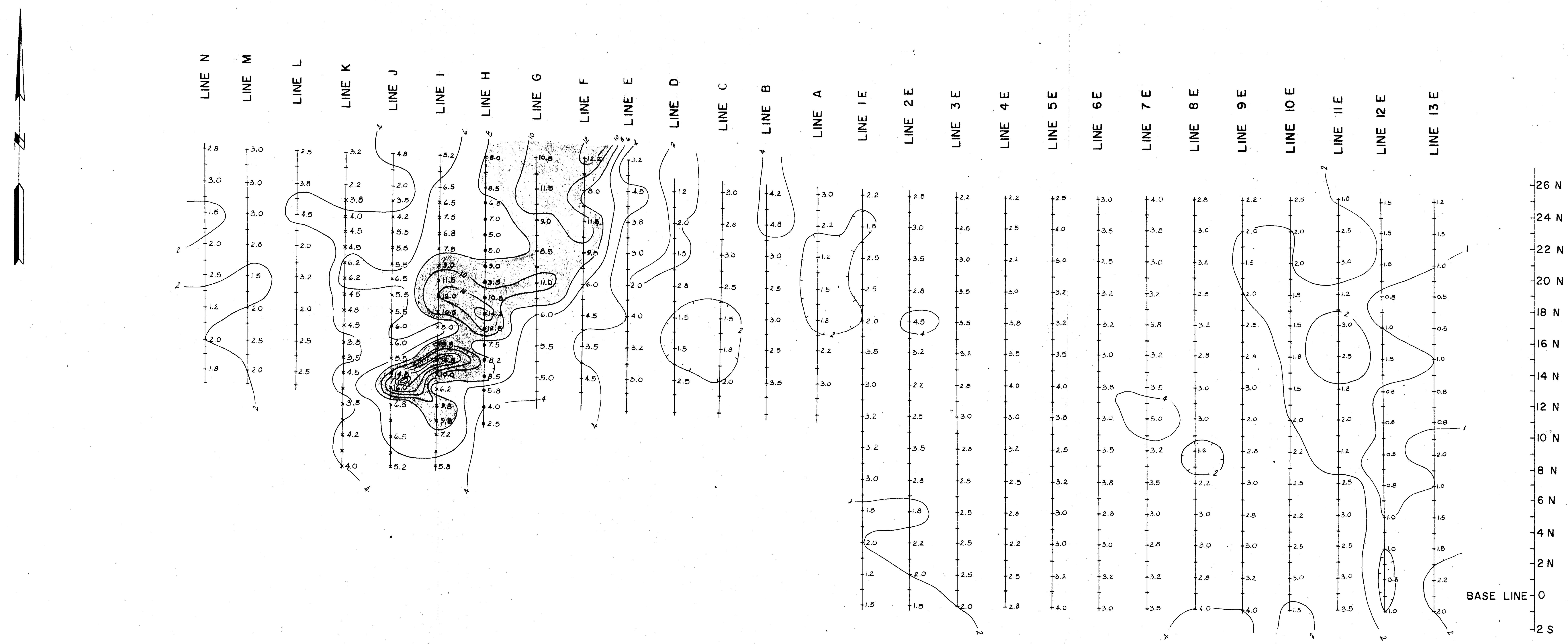
HIGHLAND VALLEY AREA, BRITISH COLUMBIA
CL-CLAIMS

INDUCED POLARIZATION SURVEY

CHARGEABILITY CONTOUR PLAN
ELECTRODE SPACING 400'
SCALE: 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
OCTOBER 1969

R. Crosby



LEGEND:

LINE TRACE WITH CHARGEABILITY VALUES FROM PRESENT SURVEY IN MILLISECONDS

CHARGEABILITY VALUES FROM PREVIOUS SEIGEL SURVEY IN MILLISECONDS

CHARGEABILITY VALUES FROM PREVIOUS HUNTEC SURVEY EXPRESSED IN SEIGEL MILLISECONDS

CHARGEABILITY CONTOURS WITH 2 MILLISECOND CONTOUR INTERVAL

NOTES:

SEIGEL MK VI INDUCED POLARIZATION DATA FOR SEIGEL SURVEYS
THREE ELECTRODE ARRAY,
ELECTRODE SPACING a = 200'
MOVING CURRENT ELECTRODE SOUTH OF ARRAY

TO ACCOMPANY A GEOPHYSICAL REPORT
BY J. G. BAIRD, DATED NOVEMBER 14, 1969

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2114 MAP #3

PLATE 3 2114

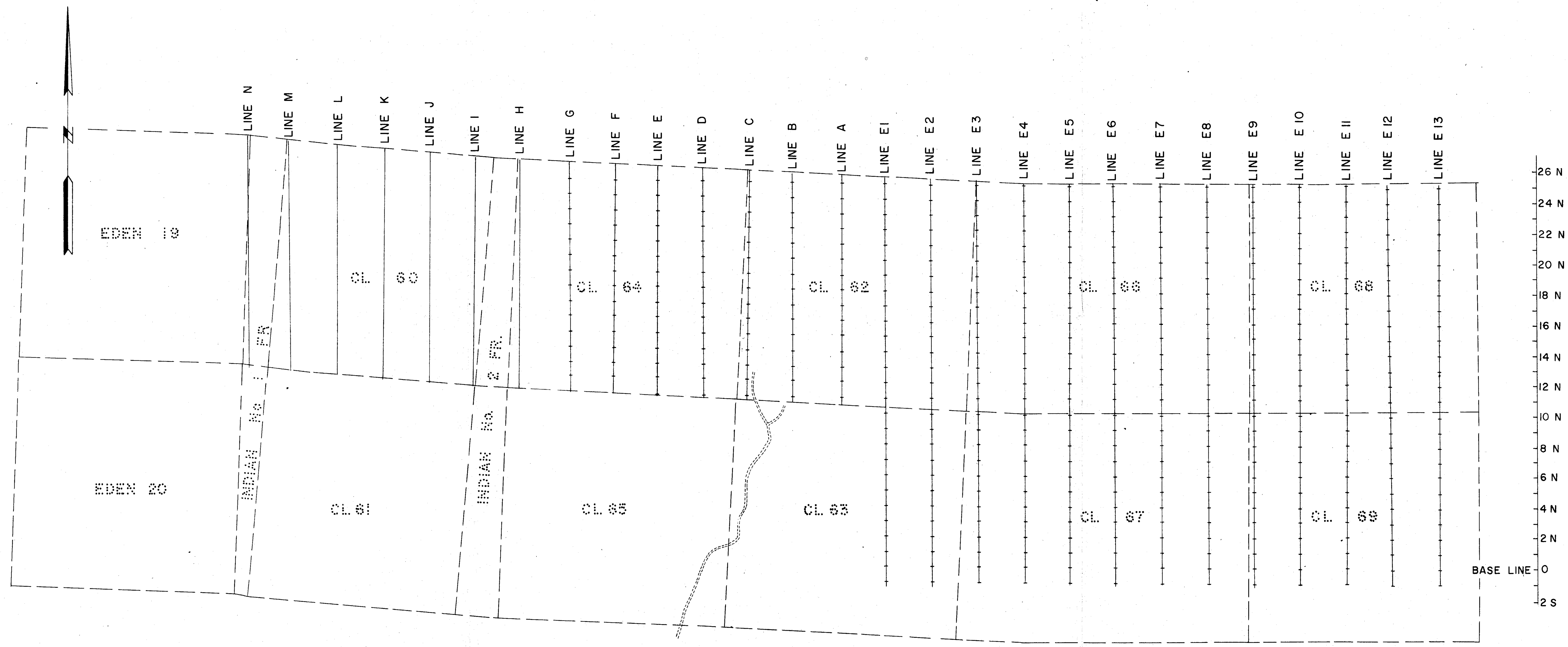
NEW INDIAN MINES AND VANANDA EXPLORATIONS LTD.

HIGHLAND VALLEY AREA, BRITISH COLUMBIA
CL-CLAIMS

INDUCED POLARIZATION SURVEY

CHARGEABILITY CONTOUR PLAN
ELECTRODE SPACING 200'
SCALE: 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
OCTOBER 1969



2114

PLATE 2

NEW INDIAN MINES AND VANANDA EXPLORATIONS LTD.

HIGHLAND VALLEY AREA, BRITISH COLUMBIA

CL-CLAIMS

INDUCED POLARIZATION SURVEY

CLAIMS AND GRID PLAN

SCALE: 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
OCTOBER 1969

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2114 MAP #2

TO ACCOMPANY A GEOPHYSICAL REPORT
BY J. G. BAIRD DATED NOVEMBER .., 1969

R. Crosby