1854

REPORT ON

GEOLOGICAL, GEOPHYSICAL AND GEOCHEMICAL SURVEYS AND

PRELIMINARY DIAMOND DRILLING ON THE

TROBUTTLE MINES LIMITED PROPERTY

MORRISON LAKE

OMINECA MINING DIVISION

UNDER OPTION TO

CANADIAN SUPERIOR EXPLORATION LIMITED

CLAIMS:	Kofit 1 to 188 (55306 to 55493).
LOCATION:	Lat 55°11'N, Long. 126°17'W Morrison Lake, Omineca Mining Division 55° 126° S. E.
DATES:	October 14th to November 4th, 1968

by

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and

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Consulting Geological Engineer

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METHODS USED IN SURVEYS

(A) Geochemical Methods

1. The soil samples were taken with the aid of a 42" steel tube auger. Most of the samples were collected at a depth of 12 inches, which was the average depth of the red sandy-clay horizon being tested.

2. The samples were packaged in soil sample envelopes supplied by Canada Envelope Company of Montreal and made of "High Wet Strength, Kraft" brown paper with a wet strength of 32 lbs, measuring 3 1/2 inches by 8 1/2 inches when the flap of the envelope is folded.

3. The samples were partially dried in the field by suspending them in the bags under the roof of a tent. The bags have holes pierced in them for stringing several together for this purpose. In the laboratory, the samples were dried in a warm oven while still in the bags. The samples were screened through an 80 mesh nylon screen, the fines being used for analysis.

4. The tests for total copper and total molybdenum were all carried out in the laboratory of Barringer Research Ltd., in Toronto. No field tests were carried out.

5. The tests were performed as follows:-

   (a) Total Copper

   A sample of the fines from screening the dried sample was digested with fuming perchloric acid for four hours in a pyrex beaker. The siliceous sediment was allowed to settle and the solution diluted to a measured volume with distilled and de-metallised water. An aliquot of the test solution was then taken and analysed for copper using an atomic absorption spectophotometer manufactured by Perkins-Elmer. Carefully prepared standards were used for control and the copper analyses were carried out by Barringer Research of Toronto, as were those for total molybdenum.

   (b) Total Molybdenum

   A 1/4 gram sample of the fines was fused in a nickel crucible with 1 gram of a fusion mixture made up of 5 parts anydrous sodium carbonate, 4 parts sodium chloride and 1 part potassium nitrate. The mixture was fused until frothing ceased and allowed to cool, then 2 millilitres of water added. After standing for several hours, the solution and melt were transferred to a calibrated test tube and adjusted to 5 millilitres with water. The solution was then boiled until the melt disintegrated.

(b) Continued....

A 2 millilitre aliquot of the resulting solution was pipetted into 2 millilitres of 2 1/2% hydroxylamine hydrochloride solution contained in a test tube. The tube was shaken to liberate carbon dioxide and left to cool below 30°C. Half a millilitre of 1% dithiol solution (hydrochloric acid) was then added and the mixture shaken gently at intervals over a period of 20 minutes. The resulting green colour developed was compared with a series of similarly prepared standards containing differing amounts of molybdenum. The standard matching the colour of the sample solution was found and knowing the amount of molybdenum therein the amount of the unknown was found via the formula:-

molybdenum in p.p.m. = 10 x micrograms of molybdenum in the matching standard.

(B) Geophysical Methods

1. Magnetometer Survey:-
Readings were taken at 100 foot spacing over 16 1/2 miles of grid lines. A Sharpe Model MF-1 Direct Reading Fluxgate Magnetometer, rented from Eldrico Geophysical Sales Ltd., was used for the survey. Readings were taken while facing north, the magnetometer being held three feet above ground level and 6 to 8 inches from the body.

   Records of the diurnal variation were kept both by checking back to base stations every 2 - 3 hours and by means of a base station magnetometer, which was read every hour. Graphs relating magnetic variation to time change during each day were drawn up and used to correct field readings before plotting on maps.

2. Induced Polarization Survey:-
Detailed descriptions of methods, procedures and equipment used in the Induced Polarization survey accompany the Seigel Report, which is attached as Appendix VII.

PART "A" - GENERAL INFORMATION

1. Introduction

This report describes the geological, geophysical, geochemical and diamond drilling programme carried out by or on behalf of Canadian Superior Exploration Limited on the property of Trobuttle Exploration Limited, Morrison Lake, B.C. The work was carried out between September 13th and November 4th, 1968, following an option agreement between the two Companies. The agreement covers 188 Kofit claims and fractions and 38 Wolf claims.

Six miles of grid lines were cut on the Wolf group in preparation for an induced polarization survey over the southern part of this group of claims. Diamond drilling totalling 602 feet in five drill holes was also carried out on the Wolf claims.

Most of the physical work was carried out in the Hearne Hill area of the Kofit claims. The emphasis was put on the induced polarization survey to locate possible areas of sulphide mineralization masked by the heavy overburden. Over 21 line miles, including 5 miles of detail, were covered by the I.P. survey. Lines used were those cut by Texas Gulf Sulphur during their 1967 programme. These required clearing to facilitate the I.P. survey.

More than 16 line miles of geochemical soil sampling and magnetometer readings, both at 100-foot spacing, were also completed on lines 800 feet apart. Geological mapping was also carried out over most of the grid, but early snow covered the higher, northeastern sector before it could be traversed.

A number of target zones for further work were revealed as a result of the surveys.

2. Location and Access (see Dwg.#1)

The property consists of 188 Kofit claims and fractions which are centred around the south end of Morrison Lake at the base of Hearne Hill, and 38 Wolf claims which adjoin the Kofit group to the northwest. Hearne Hill is located 45 air miles northeast of Smithers, B.C.

Access is mainly via Omineca Air Service's fixed wing aircraft from Tyee Lake near Smithers. The campsite at the south end of Morrison Lake may also be reached by a poor 4-mile tractor road from Hatchery Arm, an arm of Babine Lake. Babine Lake is navigable from there to Smithers Landing, which is connected to Highway 16 near Smithers by a good gravel road. This route was used only to bring in a wheeled tractor which provided slow but dependable transportation on the roads existing on the property.

A helicopter based at Smithers was used to move the drilling equipment on widely-spaced holes on the Wolf claims. Access between camp and the Wolf claims was by boat and motor.

3. Physiography and Climate

Morrison Lake is a long, narrow body of water paralleling the northwesterly B.C. regional trend. It is situated in a broad valley flanked by gently rolling hills which rise more steeply towards Hearne Hill, part of a 4,500-foot ridge southeast of the end of the lake. The valley bottom and lower hills are covered by dense spruce and fir, while the higher slopes of Hearne Hill are partially open or covered by growths of poplar.

The climate is typical of the central British Columbia interior. Summers are mild with moderate rainfall, while winters are severe. Most lakes freeze in late November, but Babine Lake is open until early December. The unusually wet fall this past season slowed work and made all tasks more difficult.

4. Property History

The Morrison Lake area has been extensively explored only in recent years. Although showings on the Granisle and Newman properties to the south have been known for over 50 years, the Morrison Lake area received little attention prior to 1955. During that year, Riocanex found a strong geochemical anomaly (THM) but failed to follow it up. Noranda, in the early 1960's, carried out an extensive silt sampling programme in the area as a result of which they discovered the small Morrison disseminated copper deposit which has been subjected to over 20,000 feet of diamond drilling. In 1966, Trobuttle Exploration staked a large block of claims around the Morrison deposit over property which had been dropped by Noranda. Extensive soil sampling and magnetometer surveys were carried out on these "J" claims. Bulldozer trenching over a high copper anomaly on Hearne Hill revealed low-grade but widespread copper mineralization in a Granisle-type porphyry with associated, well mineralized breccia.

In the late summer of 1967, the property was optioned to Texas Gulf Sulphur who, because of staking irregularities, restaked the whole property as the Kofit group. An intensive diamond drilling programme in the vicinity of the showings was carried out. Results of 12 holes totalling 6,370 feet showed that very consistent but sub-economic mineralization occurred in the showings area. Grade of the split core averaged from .08 to .22% copper averaged over the length of each hole. In conjunction with the drilling programme, roadwork, trenching, geological mapping and extensive linecutting were carried out. The option was dropped in the spring of 1968. As of the date of this report, the claims are still registered in the name of Texas Gulf since the documents transferring the claims to Trobuttle have been signed but not registered.

The area covered by the Wolf claims was first staked as the Bee group in early 1965. Kerr Addison bought the claims and conducted a geochemical survey of unknown extent and an EM survey over most of the group. Although several large EM anomalies were outlined, the claims were dropped in 1967.

Trobuttle restaked 38 Wolf claims and 1 fraction over the original Bee group. A rough grid was blazed and complete magnetometer and geochemical surveys were carried out. A large copper anomaly to the west and uphill from the EM anomaly was outlined. Follow-up trenching and blasting revealed minor scattered copper and molybdenum mineralization in an unaltered granodiorite. Magnetic lows generally corresponded to Kerr Addison EM anomalies.

5. Regional Geology

Although no completed maps of the Morrison Lake-Hatchery Arm area have been compiled, N.C. Carter of the B.C. Department of Mines has published several reports regarding the geology of the area. Mr. Carter has spent several seasons in the area from Morrison Lake south to Topley Landing, including the Granisle and Newman Peninsular zones.

Volcanic rocks of andesitic composition belonging to the Triassic-Jurassic Hazelton Group underlie most of the area south of Morrison Lake. Northward, sediments of the Upper Cretaceous Sustut Group interfinger with the older rocks. These bedded sequences parallel the northwesterly regional folding trends. Small intrusive stocks, mainly dioritic in composition, intrude the bedded rocks at irregular intervals.

Late dykes and small plugs of feldspar porphyry cut most other rock units in the northern Babine area. They are of important economic significance as they are the major host rock of known copper deposits in the area. The porphyries are usually emplaced along northeasterly-trending tensional faults which cut across the regional fold trend. The small plug located on Hearne Hill is similar to others in the area but contains sub-economic copper.

PART "B" - KOFIT CLAIMS, KEARNE HILL AREA

1. Property Geology (see Dwg.#III)
   (for detailed description of rock types see Appendix II)

Hearne Hill is underlain by northwesterly-trending massive andesitic flows and tuffs, which are interbedded with lenses of greywacke, argillite and conglomerate. A small dioritic stock has intruded the bedded sequences on the western slope of Hearne Hill. The central part of the stock is a typical medium-grained quartz diorite. Grain size decreases towards the edge of the intrusive, which grades imperceptively into the surrounding andesitic rocks.

A small biotite feldspar porphyry plug, accompanied by a swarm of dykes of similar composition, cuts northeasterly across the southern end of the dioritic stock. A series of northeasterly-trending faults also strikes across the ridge in this area. Surrounding most of the porphyry plug and dykes is a dark, dense, fine-grained diorite. It has here been designated as an hybrid diorite because of its strong silicification, fracturing and peculiar dense appearance. The fine-grained diorite rimming most of the dioritic stock is a textural variation of the coarse variety probably resulting from quicker cooling. The north or Discovery Fault of the northeast set seems to be the major factor controlling alteration, fracture density and copper mineralization.

The drilling carried out by Texas Gulf showed that chalcopyrite was distributed in narrow fractures within the hybrid diorite and the porphyry plug. The best grades were found in the hybrid diorite, particularly near a porphyry contact in the vicinity of the Discovery Fault.

A small, but possibly significant, exposure of mineralized porphyry was discovered on the Nak Road just north of the South Fault. Bulldozing in this area should be carried out to determine whether or not the porphyry is in place. A moderately large copper anomaly was outlined 400 feet west of this exposure. Some unmineralized porphyry was also found in a boulder field on line 300 South near station 280 North. An I.P. anomaly in this area remains to be explained.

No outcrops are exposed in the large, flat area southwest of the Hearne Hill Fault. Several I.P. anomalies and geochemical anomalies #4 and the western extension of #1 lie in this area. Overburden is too deep for trenching.

2. Geochemistry

(a) Sampling Procedure

Soil sampling at 100-foot intervals was completed over 16½ line miles on lines 800 feet apart. Samples were collected from a brown, sandy layer occurring 6 to 18 inches below surface. A soil auger was used to collect the samples at an approximate depth of 12 inches. According to Dr. J.L. Walker of Barringer Research Limited, who carried out an orientation survey for Texas Gulf, the sandy layer is part of the "A" Soil Horizon.

(b) Discussion of Results

All copper values and molybdenum values over 2 parts per million are plotted on accompanying map, Dwg.#IV. Background values average from 25 to 30 p.p.m. copper and less than 2 p.p.m. molybdenum. For purposes of this report, 100 p.p.m. copper has been taken as threshold level between background and anomalous values. Results of the Canadian Superior soils survey correspond quite well with the survey conducted by Trobuttle in 1967. In particular, their main discovery anomaly #1 and smaller anomaly #4 to the south were almost exactly duplicated. Their anomaly #2, north of the 345N tie-line, was somewhat offset by our survey, probably due to lines running normal to the previous survey. Trobuttle #3 anomaly, which lies at 320N between lines 260 and 268E, was not detected. A new anomaly, #3B, on lines 292E (326-330N) and 300E (319-327N) was outlined in an area not sampled by Trobuttle. Geological examination of the anomaly, situated near the summit of Hearne Hill, was not completed because of early, heavy snowfall.

The upper, wider part of the most extensive (#1) anomaly is situated over the known mineralized area. The lower part, however, lying in an area of heavy overburden has not yet been explored. Accumulation of saline transported copper may account for part of this anomaly, but Dr. Walker suggests that at least part of the anomaly reflects underlying mineralization.

Anomaly #2, lying partially in a swamp, extends eastwart up a hillside which has been trenched. Some minor chalcopyrite is visible in very strongly magnetic andesites. Anomaly #4 is located on line 292E from 270N to 274N. An exposure of mineralized porphyry was found 400 feet to the east of the anomaly. Several smaller zones of high background (80-100 p.p.m.) are scattered south and west of this anomaly. Isolated one-point anomalies are scattered over the grid and are not considered of importance. Several highs along line 260E, between 296N and 330N, are probably transported from part of Noranda's orebody west of the property boundary. An I.P. anomaly over this area is probably due to the pyrite in siltstones at the eastern edge of the Noranda deposit, but detailed geochemical sampling should be completed.

Molybdenum values are generally very low, but several higher values are located within #1 and #3B copper anomalies. The only significant molybdenum anomaly lies between 327N and 330N on line 292E, where values range from 30 to 70 p.p.m. molybdenum. Snow prevented a proper evaluation of this anomaly.

3. Geophysics

(a) Magnetometer Survey

A magnetometer survey over the I.P. grid was carried out. The instrument used was a Sharpe Model MF-1 Fluxgate, direct reading, magnetometer. Readings were taken at 100-foot intervals, but closed in to 50 and 25 feet over significant magnetic relief. The survey was hampered by the late season snow and rainstorms and by severe atmospheric magnetic storms. Readings for lines 260E and 268E, north of station 296N, could not be used because of the extremely variable diurnal variations on the day they were taken.

Results of the survey are plotted on Map Dwg.#V. Two major general trends have been interpreted. A north to northwesterly magnetic trend is the most noticeable in the area, especially in the northern and southwestern parts of the grid. The trends are relatively low in magnetic intensity but background tends to rise towards the north and east in both areas. A large zone of relatively high (+1,000 gammas) magnetic relief occurs in the central part of the grid and it also trends in a north to northwesterly direction.

A series of highs and lows cut the central area of high magnetics in the secondary east to northeasterly direction. This easterly trend can also be noticed at the boundary contours of the central high area, which are bent to an east-west direction. The sharp contrast between the high +1,000 gamma area and the surrounding areas of low background is probably due to the influence of the dioritic stock.

Two significant features can be discerned in the area drilled by Texas Gulf. First, the southern boundary of the hybrid diorite is approximated by the 1,000 gamma contour which also outlines the diorite stock to the north and west. The similar magnetic character indicates that the hybrid diorite is of intrusive origin and closely related to the dioritic stock.

A second feature of interest in the drilled area is the easterly-trending, large magnetic low more or less centred over the discovery breccia zone. This low also encompasses the Discovery Fault and most of the better mineralization encountered in the Texas Gulf Sulphur drilling programme. Hematite in the showings area suggests that hydrothermal solutions oxidized part of the magnetite present in the original diorite causing a zone of relatively low magnetic relief.

The heart-shaped magnetic low to the north, centred close to the westerly-draining creeks, seems to be a topographic low. Topography, variable amounts of magnetite in the volcanic rocks, and faulting provide other variant factors to explain the magnetic picture.

(b) <u>Induced Polarization Survey</u>

Seigel Associates Limited, on behalf of Canadian Superior, carried out over 20 line miles of induced polarization survey on the Kofit claims and 6 line miles over the Wolf claims. The programme was severely hampered by very strong magnetic storms during the first month and no valid readings were taken during the first two weeks. Full details of this survey will be described in a supplementary report to be ready by mid-January, 1969.

On the Kofit claims, 16 miles of line spaced at 800 feet were surveyed with an electrode spacing of 400 feet, readings being taken every 200 feet. An additional 5 miles of detailed survey, with 400 and 200-foot electrode spacing and readings at 200 and 100-foot intervals, were carried out over anomalous areas. The detailed survey was carried out on lines 400 feet from the initial lines. A detailed traverse was also run along a road paralleling 4 Texas Gulf Sulphur diamond drill holes to correlate the known mineralization with I.P. results.

As the detailed I.P. profiles were not available at the time of writing, only general statements can be made. Background is generally very low over the southwestern, drift covered area. Near the Hearne Hill Fault, background rises to 3 to 5 milliseconds and is variable from this area northward.

An area of relatively high chargeability is located at the extreme southern ends of lines 276E and 284E. The lines were extended to further delineate the anomalies. A small geochemical high coincides with the high chargeability on line 276E at 252N. A local magnetic high may partly explain the anomaly, but not all the anomaly is coincident with high chargeability.

A wide zone of high chargeability between lines 296E and 304E extends from the showings area southward almost to the South Fault. Prospecting and geological mapping in the area south of the showings was carried out in an unsuccessful attempt to explain the anomaly. Some minor pyrite occurs in andesitic flows rich in red, earthy hematite on line 308E between 270N and 280N, but the sulphide content was insufficient to account for the anomaly. On line 300E, barren porphyry boulders, probably very near outcrop, were found near station 280N but careful searching revealed no sulphide mineralization. No geochemical anomalies coincide with the southern end of the anomaly.

The high chargeabilities on line 312E south of the baseline have not been explained.

On line 260E, a zone of high chargeability was discovered but it appears to be due to pyrite in siltstone and hornfelses found immediately to the west on the Noranda ground.

Several areas of high chargeability occur in the diorite north of the base-line, but these are accompanied by extremely high resistivities. The high magnetite content of the diorite, with some minor pyrite, is probably the major cause of these anomalies, but the area around geochemical anomaly #3B should be further investigated.

PART "C" - WOLF CLAIMS

The Wolf claims lie on the west side of Morrison Lake, 3 to 4 miles north of its outlet. The claims cover a low flat area which rises gently to the west.

1. Geology (see Map Dwg.#VI)

Northwesterly-trending sediments and andesitic flows underly much of the Wolf claim group. The Morrison Fault, following the regional northwesterly fold trend, forms a contact between the two-bedded rock units leaving the volcanics as a narrow strip along the western side of the lake. To the west of the fault, a low flat valley paralleling the fault is occupied by highly graphitic siltstones. Drill results show that only minor pyrite occurs in the siltstones.

Light-coloured feldspar porphyry dykes and sills cut both the siltstone and the andesite. In the southeast corner of the claim block, drilling and several outcrops indicate that a small sill of porphyry overlies the volcanics in this area.

A small granodiorite plug, also trending northwesterly, cuts the sediments between the "X" and "Y" base-lines on lines 8N and 16N. Sediments to the west of the contact have been hornfelsed. Quartz veins and minor aplite dykes containing chalcopyrite and molybdenite can be seen in several small and widely-scattered locations. These are probably the cause of the geochemical anomaly found in this area by Trobuttle. Two small outcrops of unmineralized granodiorite are exposed along a road near 90N, 18W, "A" base-line.

2. Induced Polarization Survey

Six miles of induced polarization survey were completed on the Wolf claims as marked on Map Dwg.#VI. Readings were taken every 200 feet on 400-foot electrode spacings.

Background over most of the property averaged 5 to 10 milliseconds, usually rising at the western ends of the lines. No responses were received over the extremely conductive graphitic siltstone zone. Two areas with chargeabilities slightly higher than background were outlined. One, on lines 64N and 72N, is covered by heavy overburden. Geochemical soil samples in the western part of this area show background values of 30 p.p.m. copper or less. The other area of relative high chargeabilities is centred around the "Y" base-line on line 0+00. Minor sulphides occurring in quartz blowouts in the granodiorite probably give rise to this anomaly.

3. Diamond Drilling

Five AX diamond drill holes totalling 602 feet were drilled on the Wolf claims by Triumph Drilling Ltd. of Burnaby, B.C. Locations of holes are plotted on Dwg.#VI, detailed logs are described in Appendix III.

Drill hole "A" was located on a magnetic anomaly. After penetrating 32 feet of overburden and another 30 feet of barren feldspar porphyry, a strong fault was encountered at 62-65 feet. Andesitic volcanics lying below this fault were very strongly magnetic, providing an answer to the anomaly.

Holes "B", "C", "C-1" and "D" were spotted on the Kerr Addison electromagnetic anomalies. Overburden was encountered in the first 48 feet of diamond drill holes "B" and "D", only about 15 feet of overburden was cut in holes "C" and "C-1" which were set up near outcrop. Angle hole "C-1" was drilled azimuth 140° at -50° after hole "C" was lost due to caving ground. Bedrock drilled in all 4 holes consisted of highly graphitic siltstones cut by occasional feldspar porphyry dykes and sills. Only minor pyrite was encountered in holes "B", "C" and "C-1". No drill core was sent to the assayer.

PART "D" - CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

Results of the surveys on the Kofit claims have indicated a number of areas of interest. The area of greatest potential at this time is the large, flat area southwest of Hearne Hill. The large southwestern extension of geochemical anomaly #1 and all of #4, plus several scattered small anomalies, are located in this area. The geochemical anomalies coincide in part with zones of high chargeability. In one case mineralized porphyry is exposed near #4 geochemical anomaly. Number 3B geochemical anomaly, located north of the known mineralized area, has not yet been explained.

Geological examination and a magnetometer survey indicate that the high chargeability areas north of the base-line could be mainly attributed to high concentrations of magnetite and minor pyrite in the diorite and volcanics. This is supported by extremely high resistivities encountered by the I.P. survey.

On the Wolf claims the induced polarization survey indicates a moderately large area of high chargeability at the western ends of lines 64N and 72N. Part of this area was covered by a geochemical soil survey (Trobuttle), results of which indicate background copper values of 30 p.p.m. copper and less.

Diamond drilling results on the Wolf claims have shown that the Kerr Addison electromagnetic anomalies were caused by graphitic siltstones. A small magnetic high was caused by andesitic flows rich in magnetite.

2. Recommendations

A drilling programme should be implemented to determine the cause of the geochemical and chargeability anomalies in the area southwest of Hearne Hill. Locations of proposed drill holes will not be determined until all available data has been thoroughly studied. Initial percussion drilling would be satisfactory to test for mineralization and rock type.

In conjunction with the drilling programme, prospecting as well as further geological, geochemical and geophysical work should be conducted over the rest of the large Kofit claim group. Follow-up of other I.P. and geochemical anomalies found during the present programme on both the Wolf and Kofit groups could be included in this programme and a bulldozer might be useful for this purpose.

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12th December, 1968

APPENDIX I

CLAIM SCHEDULE
(Omineca Mining Division)

Claim Name	Record No.	Next Due Date
Kofit 1	55306	Oct. 13/73
Kofit 2	07	"
Kofit 3	08	"
Kofit 4	09	"
Kofit 5	10	"
Kofit 6	11	"
Kofit 7	12	"
Kofit 8	13	"
Kofit 9	14	"
Kofit 10	15	"
Kofit 11	16	"
Kofit 12	17	"
Kofit 13	18	"
Kofit 14	19	"
Kofit 15	20	"
Kofit 16	21	"
Kofit 17	22	"
Kofit 18 Fr.	23	"
Kofit 19 Fr.	24	"
Kofit 20 Fr.	25	"
Kofit 21	26	"
Kofit 22	27	Oct. 13/72
Kofit 23	28	"
Kofit 24	29	"
Kofit 25	30	"
Kofit 26	31	"
Kofit 27	32	"
Kofit 28	33	"
Kofit 29	34	"
Kofit 30	35	"
Kofit 31	36	Oct. 13/73
Kofit 32	37	"
Kofit 33	38	"
Kofit 34	39	"
Kofit 35	40	"
Kofit 36	41	"
Kofit 37	42	"
Kofit 38	43	"
Kofit 39	44	Oct. 13/72
Kofit 40	45	"
Kofit 41	46	Oct. 13/73
Kofit 42	47	"
Kofit 43	48	"

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Claim Name	Record No.	Next Due Date
Kofit 44	55349	Oct. 13/73
Kofit 45	50	"
Kofit 46	51	"
Kofit 47	52	"
Kofit 48	53	"
Kofit 49	54	"
Kofit 50	55	"
Kofit 51	56	"
Kofit 52	57	"
Kofit 53	58	"
Kofit 54	59	"
Kofit 55	60	"
Kofit 56	61	"
Kofit 57	62	"
Kofit 58	63	"
Kofit 59	64	"
Kofit 60	65	"
Kofit 61	66	"
Kofit 62	67	"
Kofit 63	68	"
Kofit 64	69	"
Kofit 65	70	"
Kofit 66	71	"
Kofit 67	72	"
Kofit 68	73	"
Kofit 69	74	"
Kofit 70	75	"
Kofit 71	76	"
Kofit 72	77	"
Kofit 73	78	Oct. 13/74
Kofit 74	79	Oct. 13/73
Kofit 75	80	Oct. 13/74
Kofit 76	81	Oct. 13/73
Kofit 77	82	Oct. 13/74
Kofit 78	83	Oct. 13/73
Kofit 79	84	Oct. 13/75
Kofit 80	85	Oct. 13/73
Kofit 81	86	Oct. 13/75
Kofit 82	87	Oct. 13/73
Kofit 83	88	"
Kofit 84	89	"
Kofit 85	90	"
Kofit 86	91	"
Kofit 87	92	"
Kofit 88	93	"
Kofit 89	94	"

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Claim Name	Record No.	Next Due Date
Kofit 90	55395	Oct. 13/73
Kofit 91	96	"
Kofit 92	97	"
Kofit 93	98	"
Kofit 94	99	"
Kofit 95	55400	"
Kofit 96	01	"
Kofit 97	02	"
Kofit 98	03	"
Kofit 99	04	"
Kofit 100	05	"
Kofit 101	06	"
Kofit 102	07	"
Kofit 103	08	"
Kofit 104	09	"
Kofit 105	10	"
Kofit 106	11	"
Kofit 107	12	"
Kofit 108	13	"
Kofit 109	14	"
Kofit 110	15	"
Kofit 111	16	"
Kofit 112	17	"
Kofit 113	18	"
Kofit 114	19	"
Kofit 115	20	"
Kofit 116	21	"
Kofit 117	22	"
Kofit 118	23	"
Kofit 119	24	"
Kofit 120	25	"
Kofit 121	26	"
Kofit 122	27	"
Kofit 123	28	"
Kofit 124	29	"
Kofit 125	30	"
Kofit 126	31	"
Kofit 127	32	"
Kofit 128	33	"
Kofit 129	34	Oct. 13/75
Kofit 130	35	"
Kofit 131	36	"
Kofit 132	37	"
Kofit 133	38	"
Kofit 134	39	"
Kofit 135	40	"
Kofit 136	41	"

Claim Name	Record No.	Next Due Date
Kofit 137	55442	Oct. 13/75
Kofit 138	43	"
Kofit 139	44	"
Kofit 140	45	"
Kofit 141	46	"
Kofit 142	47	"
Kofit 143	48	"
Kofit 144	49	"
Kofit 145	50	Oct. 13/73
Kofit 146	51	"
Kofit 147	52	"
Kofit 148	53	"
Kofit 149	54	"
Kofit 150	55	"
Kofit 151	56	"
Kofit 152	57	"
Kofit 153	58	"
Kofit 154	59	"
Kofit 155	60	"
Kofit 156	61	"
Kofit 157	62	"
Kofit 158	63	"
Kofit 159	64	"
Kofit 160	65	"
Kofit 161	66	Oct. 13/75
Kofit 162	67	"
Kofit 163	68	"
Kofit 164	69	"
Kofit 165	70	"
Kofit 166	71	"
Kofit 167	72	"
Kofit 168	73	"
Kofit 169	74	"
Kofit 170	75	"
Kofit 171	76	"
Kofit 172	77	"
Kofit 173	78	"
Kofit 174	79	"
Kofit 175	80	Oct. 13/73
Kofit 176	81	"
Kofit 177	82	"
Kofit 178	83	"
Kofit 179	84	"
Kofit 180	85	"
Kofit 181	86	"
Kofit 182	87	"

Claim Name	Record No.	Next Due Date
Kofit 183	55488	Oct. 13/73
Kofit 184	89	"
Kofit 185	90	"
Kofit 186 Fr.	91	"
Kofit 187 Fr.	92	"
Kofit 188 Fr.	93	"
Wolf 1 Fr.	55109	Oct. 16/69
Wolf 1	49119	May 1/71
Wolf 2	20	"
Wolf 3	21	May 1/70
Wolf 4	22	"
Wolf 5	23	"
Wolf 6	24	"
Wolf 7	25	May 1/69
Wolf 8	26	May 1/70
Wolf 9	27	"
Wolf 10	28	"
Wolf 11	29	"
Wolf 12	30	"
Wolf 13	31	"
Wolf 14	32	"
Wolf 15	33	"
Wolf 16	34	"
Wolf 17	50230	June 5/70
Wolf 18	31	"
Wolf 19	32	"
Wolf 20	33	"
Wolf 21	34	"
Wolf 22	35	"
Wolf 23	36	"
Wolf 24	37	"
Wolf 25	38	"
Wolf 26	39	"
Wolf 27	40	"
Wolf 28	41	"
Wolf 29	42	"
Wolf 30	43	"
Wolf 31	44	"
Wolf 32	45	"
Wolf 33	54044	Aug. 18/70
Wolf 34	45	Aug. 18/69
Wolf 35	46	Aug. 18/70
Wolf 36	47	"
Wolf 37	48	"
Wolf 38	49	"

A P P E N D I X II

DESCRIPTION OF ROCK TYPES

1. Hearne Hill Area

(a) Andesite

Andesite occurs as massive flows in the Hearne Hill area, which are often prominent as resistant bluffs. The rock is generally dark green in colour, and is very fine grained. Occasionally it may be tinged red from hematite; also, phenocrysts are occasionally noted. Chloritic alteration is usually present, when strong it is accompanied by carbonate-filled fractures.

(b) Sediments

As sedimentary sequences are few, no differentiation was made on mapping. Argillite, greywacke and conglomerate were encountered. All types are dark green-gray in colour. The conglomerate is composed of small, sub-rounded pebbles cemented by a dark argillaceous matrix. A fossil shell of the Pecten (?) type was found in the conglomerate on line 276E, 368N.

(c) Bedded Tuffs with Minor Lenses of Andesite and Sediments

These tuffs occur at the northeast edge of the claims and were not seen due to early snowfall. They are described as thinly-bedded, andesitic pyroclastic andesites intercalated with the flow rocks by J.M. Newell, T.G.S. geologist, in his 1967 report.

(d) Diorite

A small stock of complex diorite underlies much of the western slope of Hearne Ridge. The rock has been divided into two units:

(i) Quartz Diorite

Medium to fine grained plutonic rocks,occur mainly north of the North Fault. The fine grained phase has been included in this unit as it is merely a textural change resulting from differential cooling, mainly near contact. The fine grained phase grades imperceptively into andesite.

(ii) Hybrid Diorite

This dark, dense, fine grained diorite occurs mainly in the Discovery showing area. It is given separate status because its strong silicification and fracturing is found solely in proximity to the porphyry plug. The alteration of the diorite is probably due to hydrothermal fluids related in time to the porphyry intrusive.

(e) Feldspar Porphyry

Both biotite feldspar porphyry and minor hornblende feldspar porphyry are included under this description. When fresh, the rock is blue-gray and contains abundant feldspar and mafic phenocrysts in a fine grained groundmass. Near surface, oxidation stains the rock deep orange, which is a feature noted also at Granisle, Newman Peninsula and Poison Mountain (near Lillooet).

(f) Tectonic Breccia

The unit consists of coarse, sub-angular fragments cemented by a light, fine grained matrix. Coarse crystalline pyrite and chalcopyrite blebs are scattered through the matrix.

2. Wolf Claims

(a) Andesite

Occurs just west of Morrison Lake to the major northwest fault, exposed in several outcrops as massive flows. It is mainly a dark, fine grained rock, sometimes containing feldspar phenocrysts. It often carries abundant magnetite. Minor rhyolite flows, of unknown extent, are included in this unit.

(b) Siltstone

Occurs over most of the property west of the major fault. A very soft rock, it rarely outcrops. In drill core, it is a massive, fine grained, dark gray-to-black rock. Graphite may make up to 15% or more of the rock. It is usually cut by irregular quartz-carbonate stringers.

At the western contact of the granodiorite plug, siltstones and argillite have been hornfelsed. The hornfels is more resistant to erosion and is exposed at higher elevations. It carries minor pyrite near the intrusive contact.

(c) Granodiorite

This rock is very blocky and resistant to weathering. It forms abundant outcrops on the steeper slopes. It is generally medium grained, light gray and unaltered. Scattered quartz blowouts in this unit contain minor chalcopyrite and molybdenite.

(d) Feldspar Porphyry

Occurs mainly as dykes and sills intruding the siltstones and andesites. It is generally a light gray colour with white feldspar phenocrysts set in a fine matrix. No sulphides were visible in this unit on the Wolf claims.

CANADIAN SUPERIOR EXPLORATION LIMITED

DIAMOND DRILL RECORD

APPENDIX III

HOLE Nº: A

LOCATION: 73N, 1+00W A.B.L.

AZIMUTH:

PROPERTY: Trobuttle - Wolf

DIP: -90° **LENGTH:** 177' **ELEVATION:** 2430 **CLAIM Nº:** Wolf #1

STARTED: Oct. 5/68 **CORE SIZE:** AXK **DATE LOGGED:** Oct.10, 12/68 **SECTION:**

COMPLETED: Oct.12/68 **DIP TESTS:** **LOGGED BY:** B.H. Kahlert

PURPOSE: test Trobuttle mag anomaly

FOOTAGE from	FOOTAGE to	DESCRIPTION	SAMPLE Nº	FOOTAGE from	FOOTAGE to	LENGTH						
0	32	Unconsolidated overburden.										
32	62	Feldspar porphyry, light gray when fresh, rusty along fracture zones, medium grained; section is blocky, contains very minor pyrite, minor bleaching.										
62	65	Fault zone, mainly clay & fault gauge.										
65	177	Andesite, dark green, very fine grained; section is blocky, with chlorite on shears. Minor quartz-carbonate vein-lets cut core at random. Very strongly magnetic 70-100', weak to 140', strong to 177'.										
177		END OF HOLE										
		No sections were sent to assay. The magnetite in the andesite is sufficient to explain the anomaly.										

CANADIAN SUPERIOR EXPLORATION LIMITED
DIAMOND DRILL RECORD

LOCATION: 79+50N, 21+00W A-B.L.

HOLE NO: B

AZIMUTH:

PROPERTY: Trobuttle - Wolf

DIP: -90°　LENGTH: 150'　ELEVATION: 2500　CLAIM NO: Wolf #4

STARTED: Oct. 14/68　CORE SIZE: AXK　DATE LOGGED: Oct.17,18/68　SECTION:

COMPLETED: Oct. 18/68　DIP TESTS:　LOGGED BY: B.H. Kahlert

PURPOSE: test EM anomaly, Kerr Addison

FOOTAGE from	FOOTAGE to	DESCRIPTION	SAMPLE NO.	FOOTAGE from	FOOTAGE to	LENGTH						
0	48	Unconsolidated overburden.										
48	81	Shale and mudstone, black, very broken and strongly fractured with thick graphite along shears. Minor pyrite with graphite, massive pyrite 78'6" - 79'.										
81	90	Light gray feldspar porphyry, barren, minor quartz-carbonate veinlets.										
90	94	Siltstone, dark gray, barren.										
94	123	Light gray feldspar porphyry, barren, minor bleaching, occasional quartz-carbonate veinlets.										
127	129.6	Siltstone, abundant hair-width quartz veinlets, minor pyrite; lower contact brecciated.										
129.6	150	Porphyry, similar to section 94-123'.										
150		END OF HOLE.										
		No samples sent to assay. High graphite content - up to 10% in several 5' sections.										

CANADIAN SUPERIOR EXPLORATION LIMITED

DIAMOND DRILL RECORD

HOLE Nº: C

LOCATION: 21+00N, 0+00 Z B.L.

AZIMUTH:

PROPERTY: Trobuttle - Wolf

DIP: -90°

LENGTH: 82'

ELEVATION: 2430

CLAIM Nº: Wolf #19

STARTED: Oct.22/68

CORE SIZE: AXK

DATE LOGGED: Oct.26,28/68

SECTION:

COMPLETED: Oct.28/68

DIP TESTS:

LOGGED BY: B.H. Kahlert, D.J. Whalen

PURPOSE: test Kerr Addison EM anomaly

FOOTAGE from	FOOTAGE to	DESCRIPTION	SAMPLE Nº	FOOTAGE from	FOOTAGE to	LENGTH						
0	22	Unconsolidated overburden.										
22	82	Siltstone, black, blocky, cut by numerous quartz-carbonate veinlets. Graphite accompanies fractures, strong faults with heavy graphite 63-66', 74-80'. Minor pyrite on some fractures. Very little veining below 55'.										
82		END OF HOLE - hole lost, could not penetrate open mud seam.										
		No samples sent to assay. High graphite content is probably cause of EM anomaly.										

CANADIAN SUPERIOR EXPLORATION LIMITED

DIAMOND DRILL RECORD

HOLE NO: C-1

LOCATION: 21+00N, 0+00 Z B.L.

AZIMUTH: 140

PROPERTY: Trobuttle - Wolf

DIP: -55^{o} LENGTH: 136' ELEVATION: 2430 CLAIM NO: Wolf #19

STARTED: Oct. 29/68 CORE SIZE: AXK DATE LOGGED: Nov.1/68 SECTION:

COMPLETED: Oct. 31/68 DIP TESTS: LOGGED BY: B.H. Kahlert

PURPOSE: test Kerr Addison EM anomaly

FOOTAGE from	FOOTAGE to	DESCRIPTION	SAMPLE NO.	FOOTAGE from	FOOTAGE to	LENGTH						
0	12	Unconsolidated overburden.										
12	136	Siltstone, black, carbonaceous, strong shearing throughout accompanied by graphite. Quartz-carbonate-gypsum veinlets to ¼" wide abundant to 70', decrease below. Pyrite is in fractures up to 1/8" wide, never more 2-3% over 5' sections, decreases below 70'. Shearing and faulting stronger below 70', some black fault gauge. Several siliceous dykes 2-8" between 70-100'.										
136		END OF HOLE										
		No samples sent to assay. Graphite is sufficient to cause EM anomaly.										

CANADIAN SUPERIOR EXPLORATION LIMITED

DIAMOND DRILL RECORD

LOCATION:	30+00N, 1+00E, Y B.L.					HOLE Nº:	D
AZIMUTH:						PROPERTY:	Trobuttle - Wolf
DIP:	-90°	LENGTH:	57'	ELEVATION:	2420	CLAIM Nº:	Wolf #20
STARTED:	Oct. 19/68	CORE SIZE:	AXK	DATE LOGGED:	Oct. 23/68	SECTION:	
COMPLETED:	Oct. 22/68	DIP TESTS:				LOGGED BY:	B.H. Kahlert, D.J. Whalen
PURPOSE:	test Kerr Addison EM anomaly						

FOOTAGE from	FOOTAGE to	DESCRIPTION	SAMPLE Nº	FOOTAGE from	FOOTAGE to	LENGTH						
0	48	Unconsolidated overburden.										
48	50	Siliceous dyke (?) light gray, fine grained, minor siltstone inclusions.										
50	57	Siltstone, black, strongly fractured, very heavy graphite.										
57		END OF HOLE - hole lost, could not penetrate caving mud-seam.										
		No samples sent to assay. Strong graphite is sufficient to explain EM anomaly.										

APPENDIX IV

DOMINION OF CANADA: PROVINCE OF BRITISH COLUMBIA. TO WIT:	**In the Matter of**	Geological, Geophysical and Geochemical surveys performed by and on behalf of Canadian Superior Exploration Limited on the property of Tro-Buttle Exploration Limited

I, BERNARD H. KAHLERT
2356 West 8th Ave,
VANCOUVER 9, B.C.

of

in the Province of British Columbia, do solemnly declare that geological, geophysical, and geochemical surveys were executed on the Kofit group of claims of Tro-Buttle Exploration Limited in the Morrison Lake area, Ominica District, between October 14, 1968 and November 4, 1968. Expenses incurred are detailed as follows:

1.	Geological Surveys (Including Map Preparation) B.H. Kahlert, Geologist, Oct 14th to December 14th, 1968 2 months @ $700/Month	$1,400.00
2.	Induced Polarization Survey by Seigel Associates Limited. Contractors charges from October 14th to October 27, 1968 This sum is a pro rata portion of the total cost of the survey calculated on the ratio of days in the current assessment year to the total time spent on the survey as reported in the affidavit signed by Seigel Associates Limited (see next page)	5,202.75
3.	Magnetometer Survey Rental of Magnetometer from Warnock-Hersey International Ltd.	236.25
	D.J. Whalen, October 28 - November 4, 1968, 7 days @ 21.67/day	151.69
		387.94
4.	Geochemical Survey D.J. Whalen, October 14 - October 27, 1968, 14 days @ 21.67/day	303.38
	Geochemical Analysis by Barringer Research Ltd.	3,155.70
		3,459.08
5.	Transportation in Survey Area	1,222.75
6.	Camp, Living Expenses, and Minor Miscellaneous	3,527.83
	TOTAL	$15,200.35

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 11 day of April, 1969, A.D.

Bernard H. Kahlert

L. Geavotte

~~A Commissioner for taking Affidavits for British Columbia or~~
~~A Notary Public in and for the Province of British Columbia.~~
Sub-mining Recorder

★ o

In the Matter of

Statutory Declaration

(CANADA EVIDENCE ACT)

APPENDIX V

GROUPING OF CLAIMS AND ALLOTMENT OF COSTS AS REPORTED UNDER APPENDIX IV

KOFIT A GROUP

CLAIM NAME	NO. OF CLAIMS	RECORD NUMBER	PRESENT DUE DATE	TOTAL WORK TO BE APPLIED	ASSESSMENT YEARS/CL.
KOFIT 1 - 10	10	55306 - 15	Oct. 13/73	$1000	1
19 - 20	2	24 - 25	Oct. 13/73	200	1
27 - 28	2	32 - 33	Oct. 13/72	200	1
30	1	35	Oct. 13/72	200	2
41 - 54	14	46 - 59	Oct. 13/73	1400	1
65	1	70	Oct. 13/73	100	1
67 - 72	6	72 - 77	Oct. 13/73	600	1
73	1	78	Oct. 13/74	100	1
74	1	79	Oct. 13/73	100	1
75	1	80	Oct. 13/74	nil	nil
76	1	81	Oct. 13/73	100	1

KOFIT B GROUP

CLAIM NAME		NO. OF CLAIMS	RECORD NUMBER	PRESENT DUE DATE	TOTAL WORK TO BE APPLIED	ASSESSMENT YEARS/CL
Kofit	77	1	55382	Oct. 13/74	$ 200	2
	78	1	83	Oct. 13/73	200	2
	79	1	84	Oct. 13/75	100	1
	80	1	85	Oct. 13/73	300	3
	81	1	86	Oct. 13/75	100	1
	82	1	87	Oct. 13/73	100	1
	127-128	2	55432-33	Oct. 13/73	400	2
	129-138	10	34-43	Oct. 13/75	1000	1
	143-144	2	48-49	Oct. 13/75	200	1
	145-146	2	50-51	Oct. 13/73	400	2
	161-174	14	66-79	Oct. 13/75	1400	1
	175-178	4	80-83	Oct. 13/73	800	2

KOFIT C GROUP

CLAIM NAME		NO. OF CLAIMS	RECORD NUMBER	PRESENT DUE DATE	TOTAL WORK TO BE APPLIED	ASSESSMENT YEARS/CL.
KOFIT	18 Fr	1	55323	Oct. 13/73	nil	nil
	83 - 86	4	88 - 91	Oct. 13/73	400	1
	111 -126	16	55416 - 31	Oct. 13/73	1600	1
	139 -142	4	44 - 47	Oct. 13/75	nil	nil
	147 -153	7	52 - 58	Oct. 13/73	700	1
	179 -184	~~5~~ 6	84 - 89	Oct. 13/73	~~600~~ 500	1, except for Kofit # 183
	186 Fr	1	91	Oct. 13/73	nil	nil
	188 Fr	1	93	Oct. 13/73	nil	nil

KOFIT D GROUP

CLAIM NAME	NO. OF CLAIMS	RECORD NUMBER	PRESENT DUE DATE	TOTAL WORK TO BE APPLIED	ASSESSMENT YEARS/CL.
KOFIT 11 - 14	4	55316 - 19	Oct. 13/73	nil	nil
21	1	26	Oct. 13/73	$100	1
22 - 26	5	27 - 31	Oct. 13/72	500	1
31 - 34	4	36 - 39	Oct. 13/73	nil	nil
35 - 36	2	40 - 41	Oct. 13/73	200	1
55	1	60	Oct. 13/73	nil	nil
56 - 64	9	61 - 69	Oct. 13/73	900	1
66	1	71	Oct. 13/73	100	1
87 - 94	8	55392 - 99	Oct. 13/73	800	1
95 - 98	4	55400 - 03	Oct. 13/73	nil	nil
187 Fr	1	92	Oct. 13/73	nil	nil

KOFIT E GROUP

CLAIM NAME	NO. OF CLAIMS	RECORD NUMBER	PRESENT DUE DATE	TOTAL WORK TO BE APPLIED	ASSESSMENT YEARS/CL.
KOFIT 15 - 17	3	55320 - 22	Oct. 13/73	nil	nil
29	1	34	Oct. 13/72	nil	nil
37 - 38	2	42 - 43	Oct. 13/73	nil	nil
39 - 40	2	44 - 45	Oct. 13/72	nil	nil
99	1	55404	Oct. 13/73	nil	nil
100 -110	11	05 - 15	Oct. 13/73	nil	nil
154 -160	7	59 - 65	Oct. 13/73	nil	nil
185	1	90	Oct. 13/73	nil	nil

APPENDIX VI

QUALIFICATIONS OF PERSONNEL

BERNARD H. KAHLERT

Mr. Kahlert is Geologist with Canadian Superior Exploration Limited and has held this position since 1966.

He graduated in 1966 from the University of British Columbia, Vancouver, B.C., with the degree of B. Sc. (Single Major) in Geology. He has been with Canadian Superior since graduating.

In the work described in this report, he initiated the programme on the property, supervised most of the work and carried out the geological mapping personally.

APPENDIX VII

REPORT ON INDUCED POLARIZATION SURVEY ON SOME KOFIT CLAIMS MORRISON LAKE AREA, BRITISH COLUMBIA ON BEHALF OF CANADIAN SUPERIOR EXPLORATION LTD.

by

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

January 15, 1969

CLAIMS:

Name	Record Number
KOFIT 65 to 93	55370 - 55398
KOFIT 123 to 132	55428 - 55437
KOFIT 138 and 140	55443 and 55445

LOCATION:

Near Morrison Lake
Approximately 45 miles east of
Smithers, British Columbia
Omineca Mining Division
55° 126° SE

DATES:

September 26 to October 27, 1968

TABLE OF CONTENTS

SUMMARY

An induced polarization survey on this property has revealed several areas underlain by moderate to high chargeability material. The observed order of I.P. responses could be caused by disseminations of from 2% to 8% by volume of metallically conducting material such as sulphide mineralization, carbonaceous material or magnetite in unknown relative proportions.

Attention is directed to two areas where high chargeability responses coincide with favorable geochemical results. One of these areas may represent an extension of a known zone which contains low grade copper mineralization. Additional areas of high chargeability response may be considered of interest after further geological interpretation.

At some further stage of exploration additional induced polarization surveying may be warranted.

REPORT ON INDUCED POLARIZATION SURVEY ON SOME KOFIT CLAIMS MORRISON LAKE AREA BRITISH COLUMBIA ON BEHALF OF CANADIAN SUPERIOR EXPLORATION LTD.

INTRODUCTION

During the period from September 26 to October 27, 1968, a geophysical field party under the direction of Mr. Phil Nielson executed an induced polarization survey in the Morrison Lake area, British Columbia on behalf of Canadian Superior Exploration Ltd.

As shown on Plate 1, the survey area lies about 45 air miles northeast of Smithers, British Columbia and is accessable by float plane based near Smithers. It is also possible to travel to the property using truck, boat and tracked vehicle transportation.

The topography of the survey area varies from hilly to rugged. The mean elevation is about 3,500' above sea level. Most of the area is heavily timbered and low bushes make passage difficult. The surface of the claims is overburden covered.

The KOFIT claims are held jointly by Buttle Lake Mines Limited and Trojan Mines Limited and at the time of the survey were under option to Canadian Superior Exploration Limited. The claims covered in whole or part by the present survey are listed on the title page of this report.

A seigel Mk VB time-domain (pulse-type) induced polarization unit was employed. The Mk VB unit has a current on time of 1.5 seconds and an integrating time of 0.5 seconds. The reader is referred to the accompanying paper by H. O. Seigel "Three Recent Irish Discovery Case

Histories Using Pulse Type Induced Polarization" which describes the phenomena involved in this type of survey, the equipment employed, field procedures and the nature of results obtained over base metal mineral occurrences.

Approximately 21 miles of a previously cut survey grid with lines oriented north-south were used for the I.P. survey. For the reconnaissance survey, the three electrode array was employed using an electrode spacing of 400' and station intervals of 200'. Most of the grid lines were spaced 800' apart although intermediate lines spaced 400' apart were covered in areas of specific interest. In addition, one traverse was executed along a road running parallel to three diamond drill holes. On this traverse the three array with 400' and 200' electrode spacings and station intervals of 100' was used.

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

GEOLOGY

The geology of the KOFIT claims was studied by Texas Gulf Sulphur Limited in the summer of 1967 and the resulting map on the scale of 1" = 400' has been made available to the writer. In addition, more detailed mapping has been carried out by Canadian Superior Exploration who have also completed magnetometer and geochemical surveys.

Most of the survey area is underlain by intrusive rocks ranging from diorite, quartz diorite, and granodiorite to gabbro. This intrusive unit is bounded by andesitic volcanic rocks and intruded in the central part by a complex system of feldspar porphyry dikes which contain disseminated copper mineralization. Pyrite is found mainly as a fracture filling.

DISCUSSION OF RESULTS

Plate 2, on the scale of 1" = 400' shows the contoured reconnaissance chargeability and resistivity data for the entire survey area. A 5.0 millisecond contour interval has been shown chosen for the chargeability plan. The resistivity contour interval is as fine as 100 ohm-metres in areas of low resistivity and as coarse as 2000 ohm-metres in areas of very high resistivity. Areas exhibiting chargeabilities in excess of 20.0 milliseconds and resistivities in excess of 1000 ohm-metres have been shaded on the plans. The location of the road traverse is indicated as "Special Line" on the plans.

Plate 3, also on the scale of 1" = 400', shows the survey results in profile form. The profile scales are 1" = 20.0 milliseconds for chargeability and 2" = 1 logarithmic cycle with the line trace as 500 ohm-metres for resistivity.

Plate 4 is a compilation map showing the survey grid, claim locations and a schematic representation of the geology. Areas of high soil geochemical values in copper and molybdenum are indicated. The plan scale is 1" = 400'.

The observed chargeability values range from a low of 0.7 milliseconds to a maximum observed value of 48.1 milliseconds.

Chargeability responses in the southwest part of the grid covering approximately 25% of the survey area are below 5.0 milliseconds. Approximately 50% of the survey area exhibits chargeabilities between 5.0 and 20.0 milliseconds and the remaining 25% shows resistivities in excess of 20.0 milliseconds. Chargeabilities ranging from 20.0 milliseconds to 50.0 milliseconds could be caused by a uniform sub-surface distribution of from 4% to 8% by volume of metallically conducting mineralization.

Since the present survey has been executed using an asymmetrical electrode array, contours (particularly as drawn for survey lines as widely spaced as 800') may not provide a precise picture of the distribution of the physical characteristics of the subsurface. The present contour pattern is a random one and does not bear any close relation to the geological trends. While most of the high chargeability values appear to coincide with the intrusive rock unit in the central part of the grid, some high values are observed over areas mapped as underlain by greywacke or andesite.

An 1800' section of L 304 and the "Special Line" have been covered using 200' electrode spacings as well as the 400' reconnaissance electrode spacings. On L 304 the 200' electrode spacing chargeability results are somewhat higher than the reconnaissance results while on the Special Line the chargeability amplitudes are quite comparable for the two electrode spacings. In both places the apparent resistivity values are similar for both electrode spacings. These results indicate that in the above areas the high chargeability material comes to within 100' and perhaps closer to the ground surface and is contained in a large volume of rock.

As shown on the resistivity contour plan of Plate 2, the apparent resistivities vary from below 100 ohm-metres to a maximum value of 14,500 ohm-metres and about 2/3 of the area surveyed exhibits resistivities of less than 1000 ohm-metres. The overall resistivity pattern does not appear to correspond to either the chargeability or geology trends. It is noted that changes in resistivity may be caused as much by changes in the type or depth of overburden as by changes in the character of the bedrock.

CONCLUSIONS AND RECOMMENDATIONS

The present induced polarization survey has revealed several areas exibiting moderate to high chargeability responses. The nature of the causative metallically conducting mineralization is not as yet known however in the present geological environment it could consist of sulphide mineralization some of which would hopefully contain commercial values in copper or molybdenum.

Since many anomalous zones have been revealed by the present survey it is difficult to recommend an optimum area for further exploration on the basis of the geo-electrical results alone. Geological, geochemical and magnetometer surveys have been carried out on the present grid and these data should be closely correlated with the present induced polarization and resistivity results.

The wide area of high chargeability and high geochemical responses centred about L 300 just south of the 300 N base line would appear to be the most favourable area for further exploration. Showings and drill holes containing chalcopyrite occur in this area. A second target might be the high chargeability zone centered about station 320 N on L 300 which occurs near copper and molybdenum geochemical anomalies.

If the presently available data are sufficient to limit further exploration to a particular part of the grid, detailed induced polarization surveying may be warranted to allow quantitative interpretations of the location, depth below surface, attitudes and possible metallically conducting content of the anomalous bodies.

Respectfully submitted,

SEIGEL ASSOCIATES LIMITED

Jon G. Baird

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

Vancouver, B.C.
January 15, 1969

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

In the Matter of a geophysical survey on behalf of Canadian Superior Exploration Ltd.

I, E. M. Flett for Seigel Associates Limited

of 750 - 890 West Pender St., Vancouver

in the Province of British Columbia, do solemnly declare that an induced polarization survey has been executed on some KOFIT claims in the Smithers area, British Columbia between September 26 to October 27, 1968.
The following expenses were incurred:

(1)	Wages:			
	P. Nielsen	45 days @ $35/day	$1,575.00	
	A. Albrecht	16 days		
	T. Lauffs	46		
	G. Budgell	10		
	A. Scott	23		
	W. Whalen	23		
	R. Albert	15		
	G. Potvin	15		
	R. Lebrun	15		
		163 days @ $27.50/day	$4,482.50	$6,057.50
(2)	Transportation & Shipping			607.90
(3)	Food & Living Expenses			161.55
(4)	Consulting Fees:			
	19 days @ $150/day		$2,850.00	
	26 days @ $82.78/day		2,152.28	5,002.28
				$11,892.23

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 6th day of March, 1969, A.D.

E M Flett

Jill Turner

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

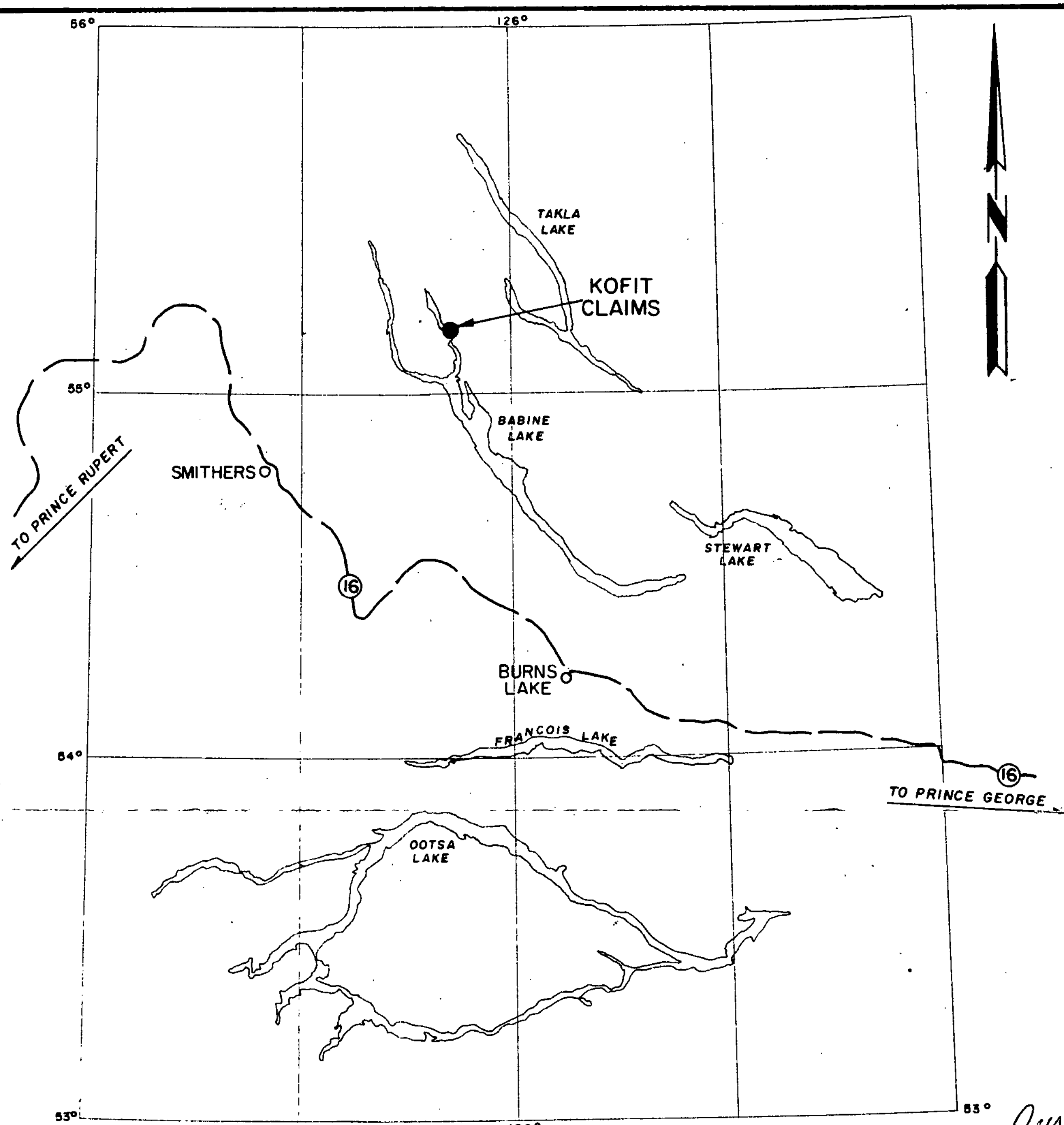
★o

SUB - MINING RECORDER

In the Matter of

Statutory Declaration

(CANADA EVIDENCE ACT)



Allan Fawley P.Eng.

PLATE I

CANADIAN SUPERIOR EXPLORATION LTD

SMITHERS AREA BRITISH COLUMBIA

LOCATION PLAN

KOFIT CLAIMS

SCALE: 1 INCH = 30 MILES (APPROX.)

REGISTERED PROFESSIONAL ENGINEER J. G. BAIRD PROVINCE OF ONTARIO

SURVEY BY SEIGEL ASSOCIATES LIMITED

SEPT. - OCT. 1968

Department of

Mines and Petroleum Resources

ASSESSMENT REPORT

NO. 1854 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.

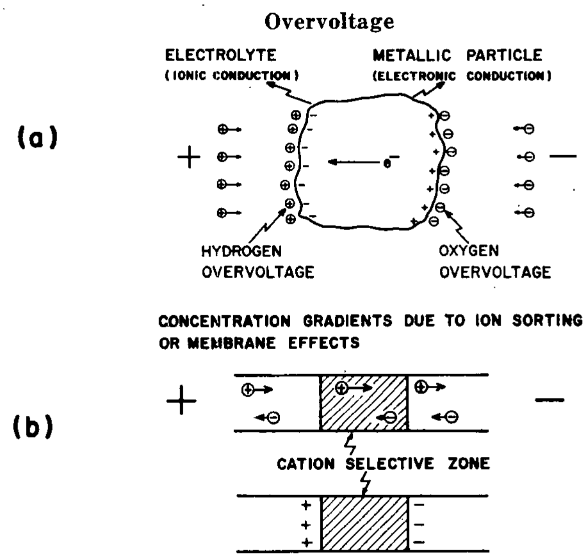


Figure 1.—Induced Polarization Agents.

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.

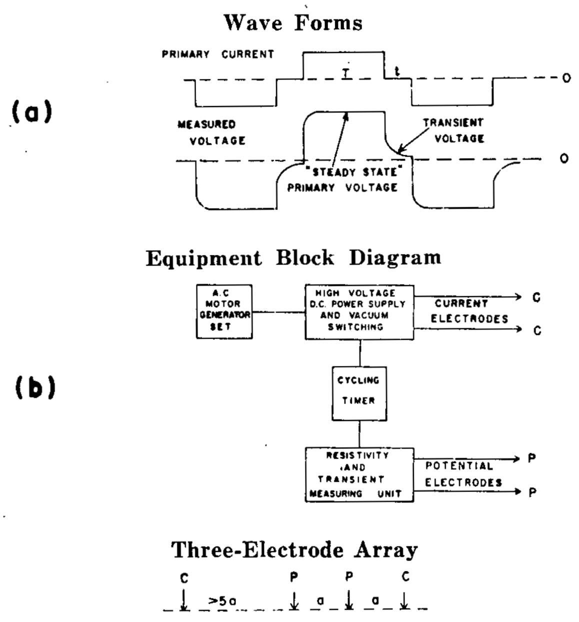


Figure 2.—The Pulse System.

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.

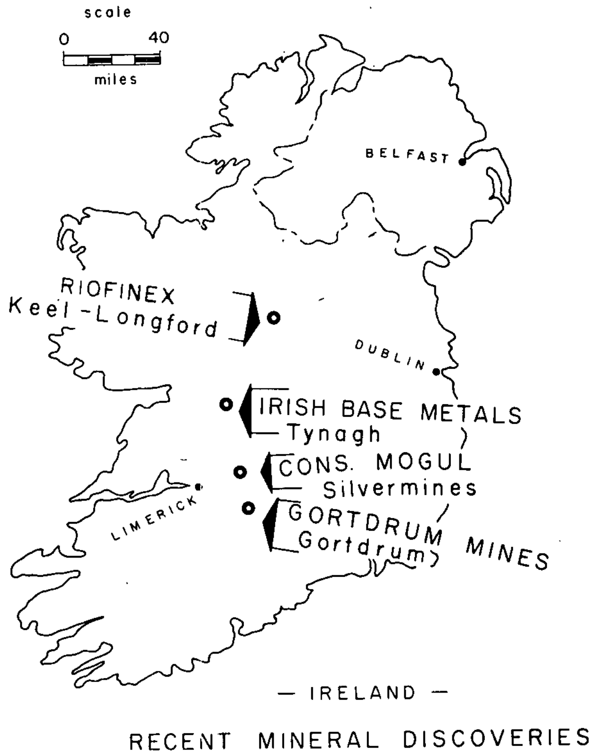


Figure 5.—Location Plan of Recent Mineral Discoveries in Ireland.

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.

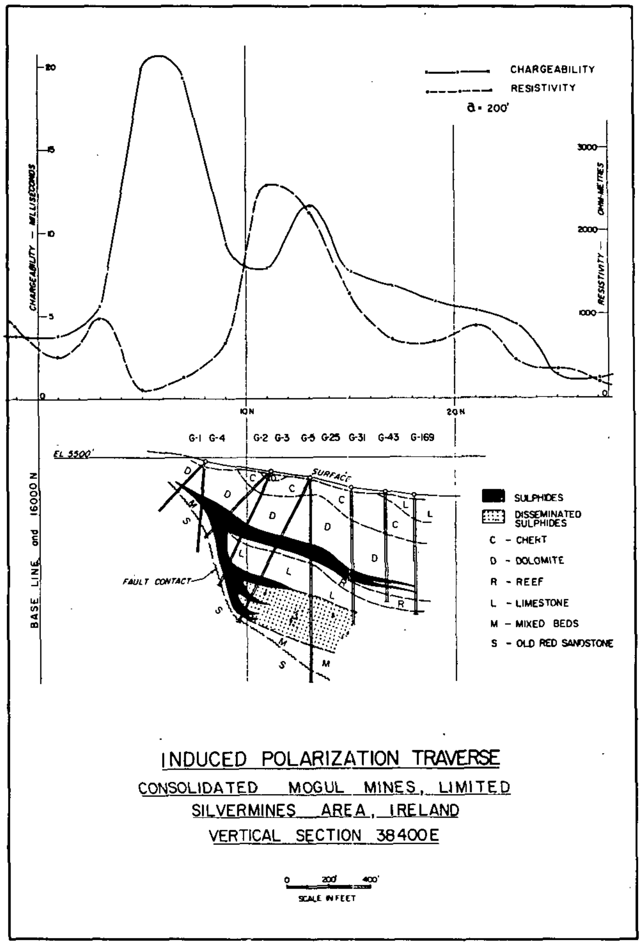


Figure 6.—Typical Discovery Traverse, Silvermines Deposit.

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.

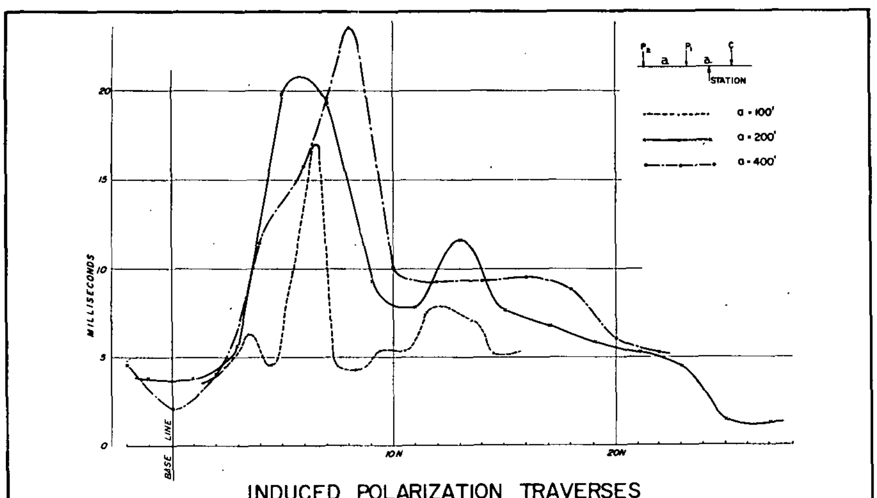


Figure 7.—Multiple Spacing Results, Silvermines Deposit.

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

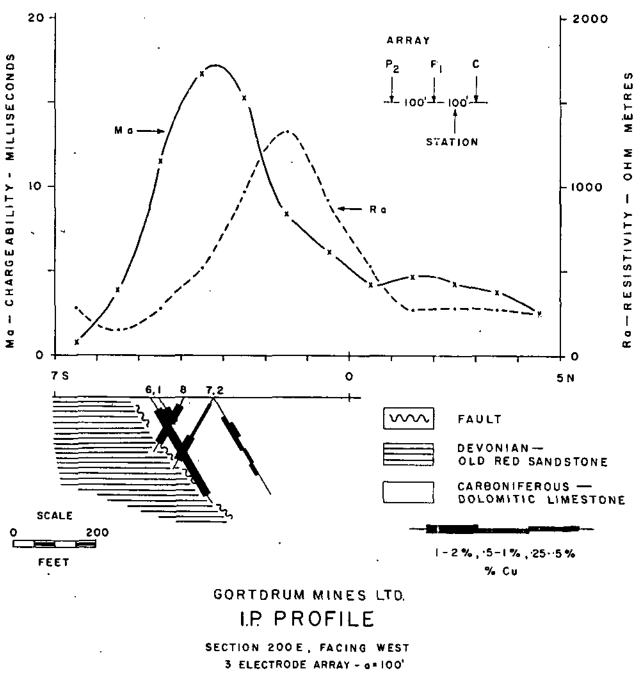


Figure 8.—Typical Discovery Traverse, Gortdrum Deposit.

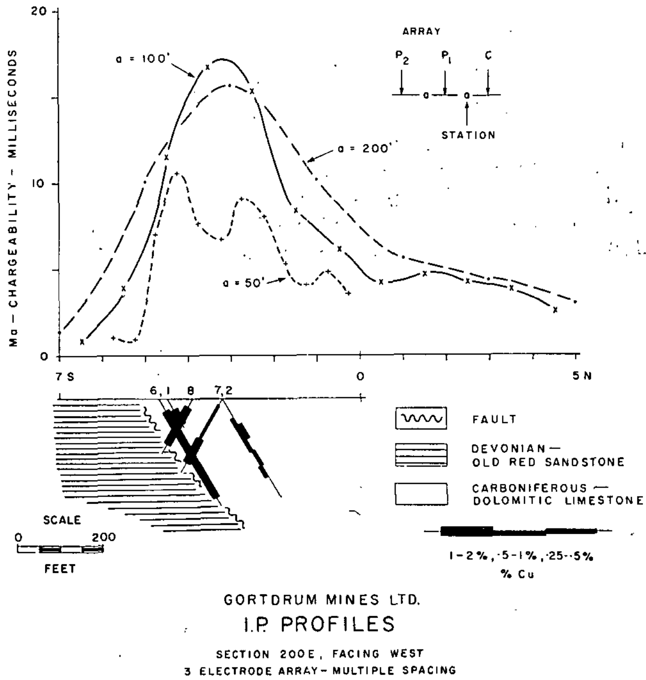


Figure 9.—Multiple Spacing Results, Gortdrum Deposit.

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.

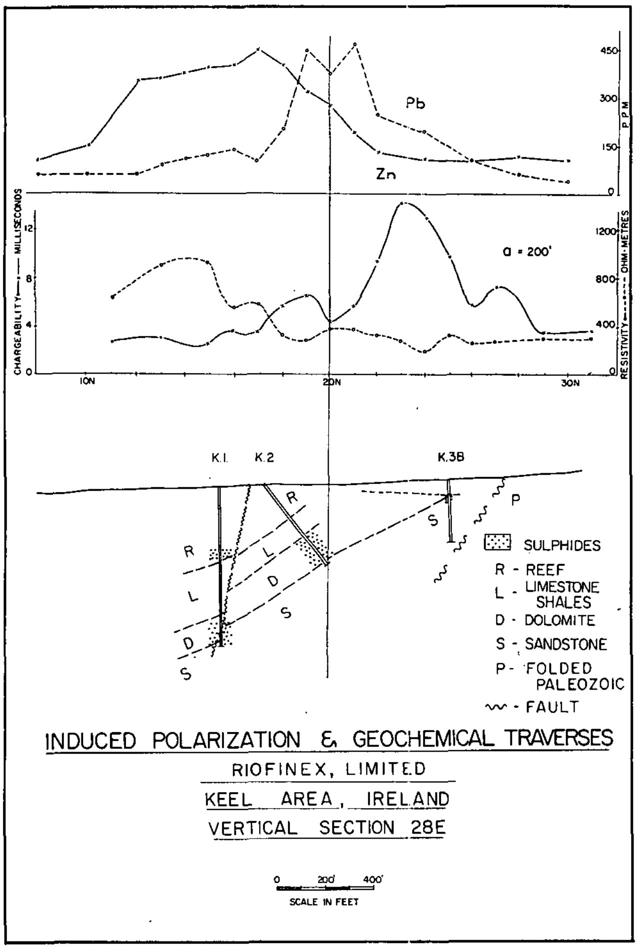


Figure 10.—Typical Discovery Traverse, Keel Deposit.

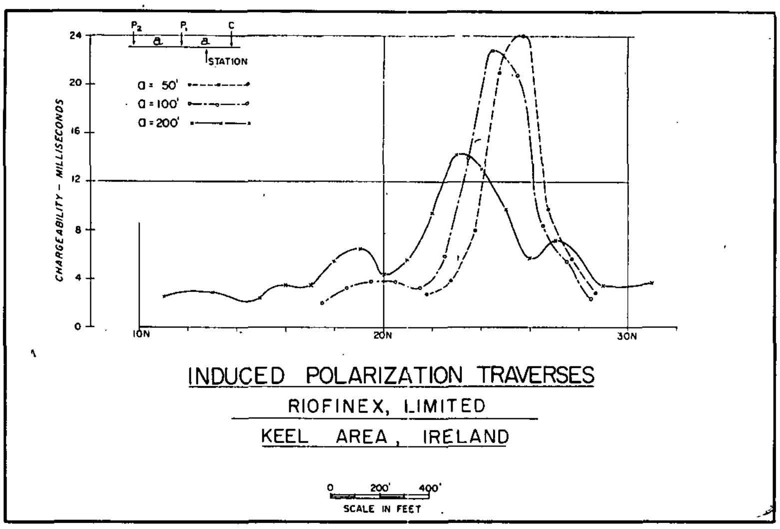


Figure 11.—Multiple Spacing Results, Keel Deposit.

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.

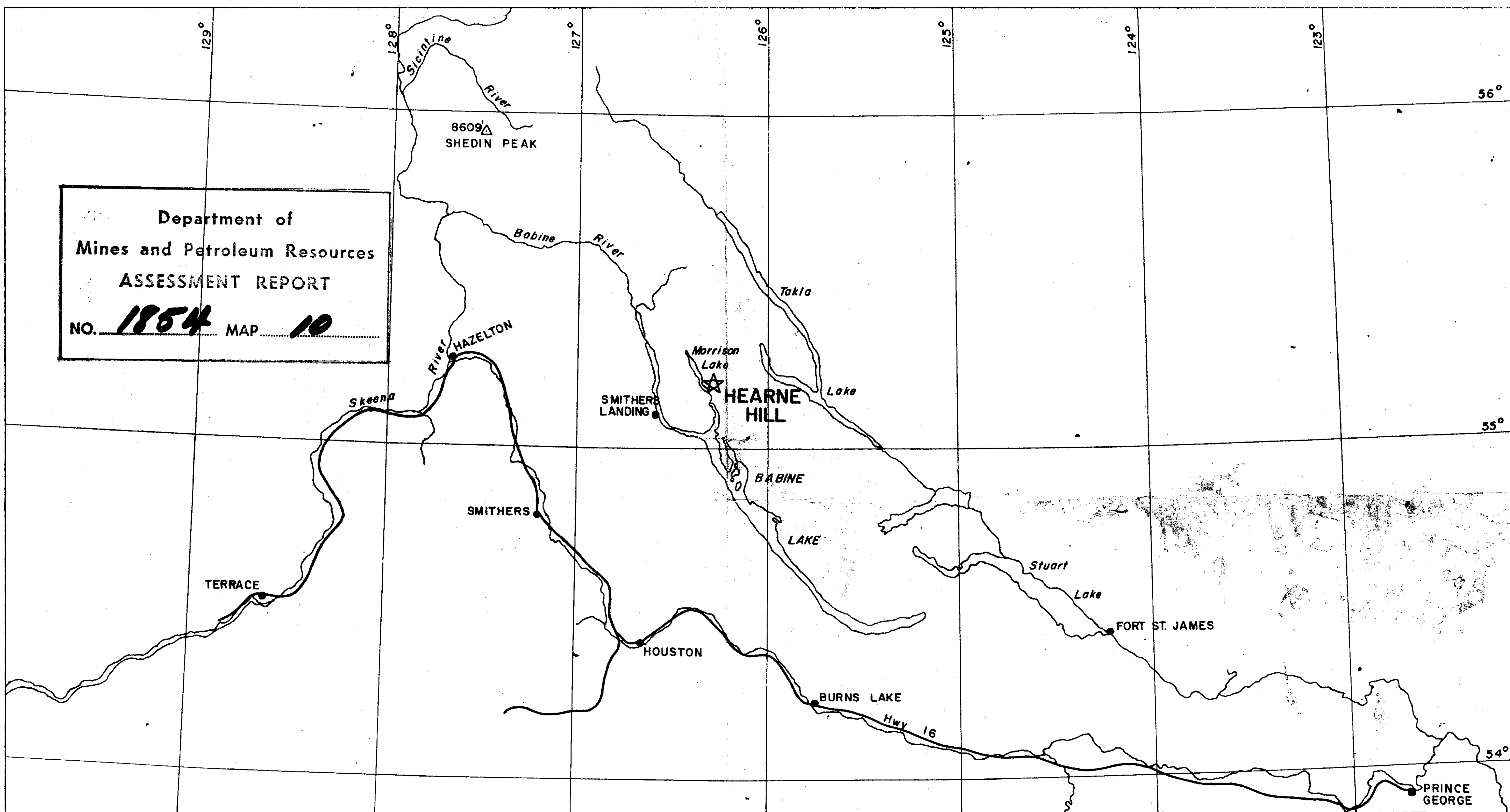
Figure 11 shows the chargeability results of the multiple spacing profiles on this section. Spacings of 50, 100 and 200 ft. were used. The progressive stepout of the peak values to the south with the increase in electrode spacing indicates the effect of the relatively flat dip to the south of the mineralization. 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



To Accompany Report by B.H. Kahlert, B.Sc., and A.P. Fawley, Ph.D., P.Eng., on Kofit Claims, ~~Omineca~~ Morrison Lake, Omineca M.D.

N.T.S.

1854

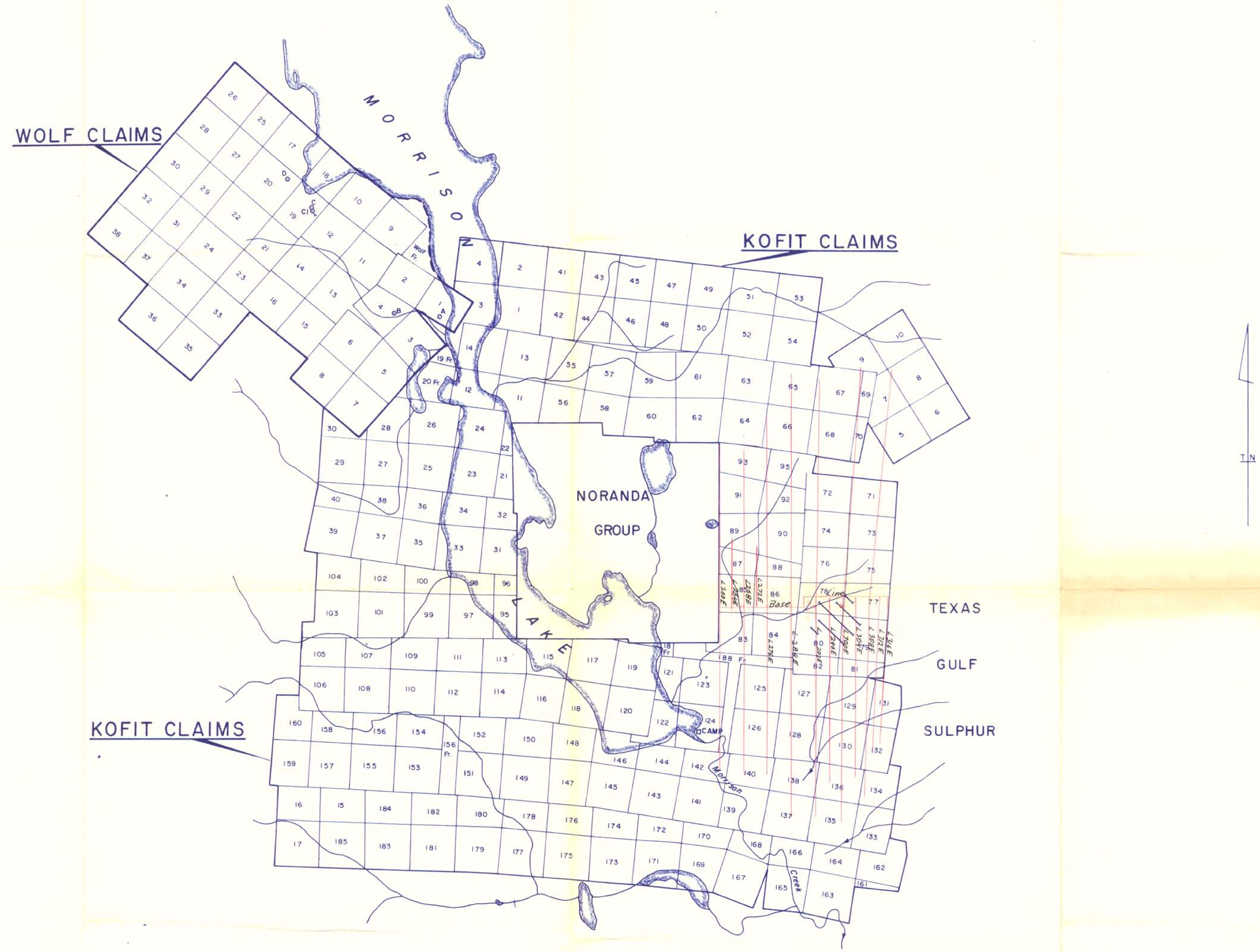
Allan Fawley P. Eng.

SCALE

20 0 20 40 60

Miles Miles

CANADIAN SUPERIOR EXPLORATION LIMITED		
TRO— BUTTLE OPTION		
LOCATION MAP #10		
Nov., 1968	B.H.K.	DWG. I



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1854 MAP 5

1854

To Accompany Report by B.H. Kahlert, B.Sc., and A.P. Fawley, PhD, P.Eng., on Kofit Claims, Morrison Lake, Omineca M.D.

LEGEND

CREEK

D.D.H., CANADIAN SUPERIOR

D.D.H., TEXAS GULF SULPHUR

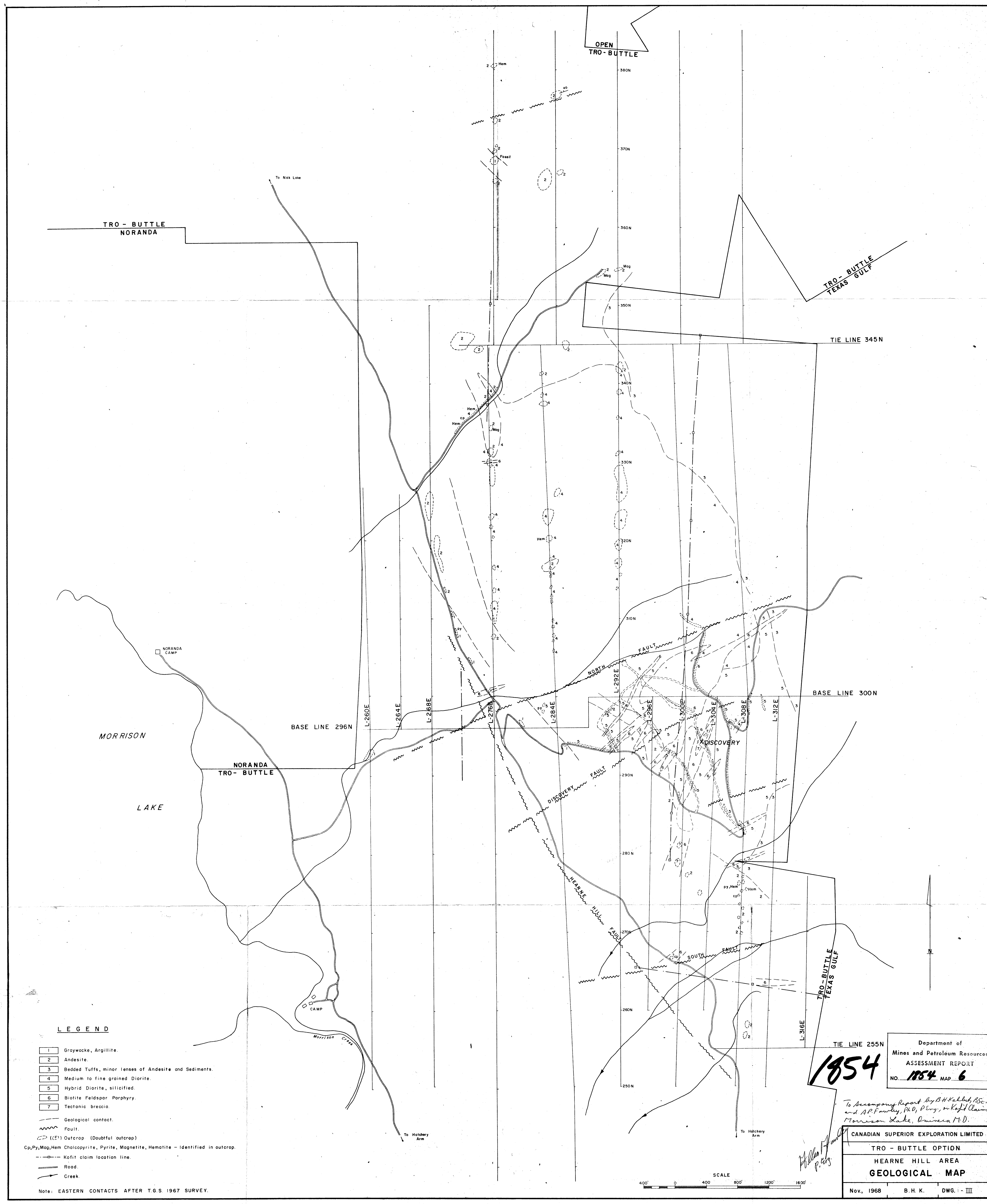
N.T.S.

SCALE

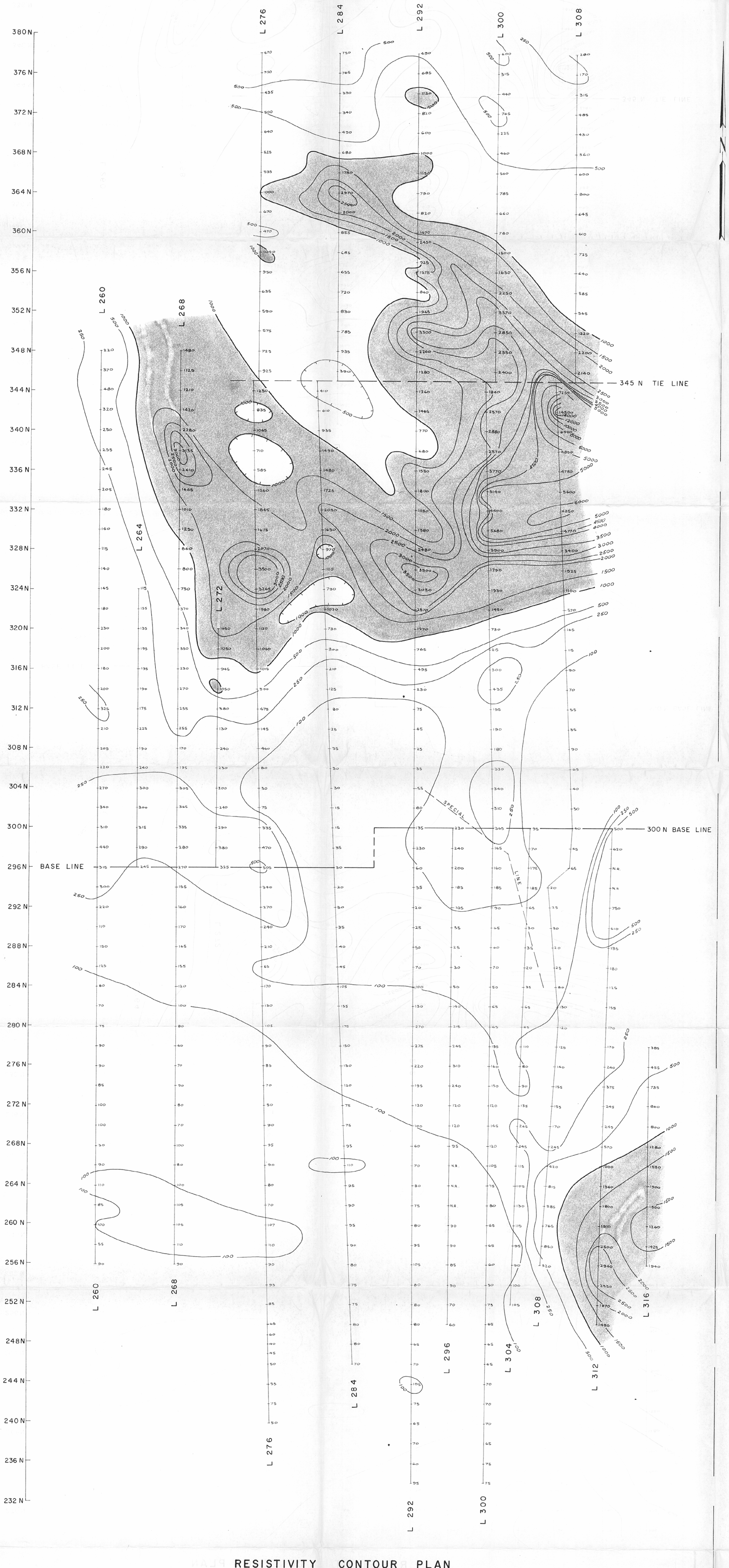
2000' 0 2000' 4000' 6000' 8000'

FEET FEET

CANADIAN SUPERIOR EXPLORATION LIMITED		
TRO - BUTTLE OPTION		
HEARNE HILL AREA		
CLAIM MAP & GRID		
Nov., 1968	B. H. K.	DWG. II



OPEN
TRO-BUTTLE
TRO - BUTTLE
NORANDA
TRO - BUTTLE
TEXAS GULF
To Nok Lake
TIE LINE 345N
BASE LINE 300N
BASE LINE 296N
NORTH FAULT
DISCOVERY
DISCOVERY FAULT
HEARNE HILL FAULT
SOUTH FAULT
MORRISON
LAKE
NORANDA CAMP
NORANDA
TRO - BUTTLE
CAMP
Morrison Creek
To Hatchery Arm
To Hatchery Arm
L-260E
L-264E
L-268E
L-276E
L-284E
L-292E
L-296E
L-300E
L-304E
L-308E
L-312E
L-316E
380N
370N
360N
350N
340N
330N
320N
310N
290N
280N
270N
260N
250N
TIE LINE 255N
N
SCALE
400' 0 400 800' 1200' 1600'
LEGEND
1 Graywacke, Argillite.
2 Andesite.
3 Bedded Tuffs, minor lenses of Andesite and Sediments.
4 Medium to fine grained Diorite.
5 Hybrid Diorite, silicified.
6 Biotite Feldspar Porphyry.
7 Tectonic breccia.
Geological contact.
Fault.
Outcrop (Doubtful outcrop)
Cp;Py;Mag;Hem Chalcopyrite, Pyrite, Magnetite, Hematite – Identified in outcrop.
Kofit claim location line.
Road.
Creek.
Note: EASTERN CONTACTS AFTER T.G.S. 1967 SURVEY.
1854
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1854 MAP 6
To Accompany Report by B.H. Kahlert, B.Sc., and A.P. Fawley, Ph.D, P.Eng., on Kofit Claims, Morrison Lake, Omineca M.D.
CANADIAN SUPERIOR EXPLORATION LIMITED
TRO - BUTTLE OPTION
HEARNE HILL AREA
GEOLOGICAL MAP
Nov., 1968
B.H.K.
DWG.: - III



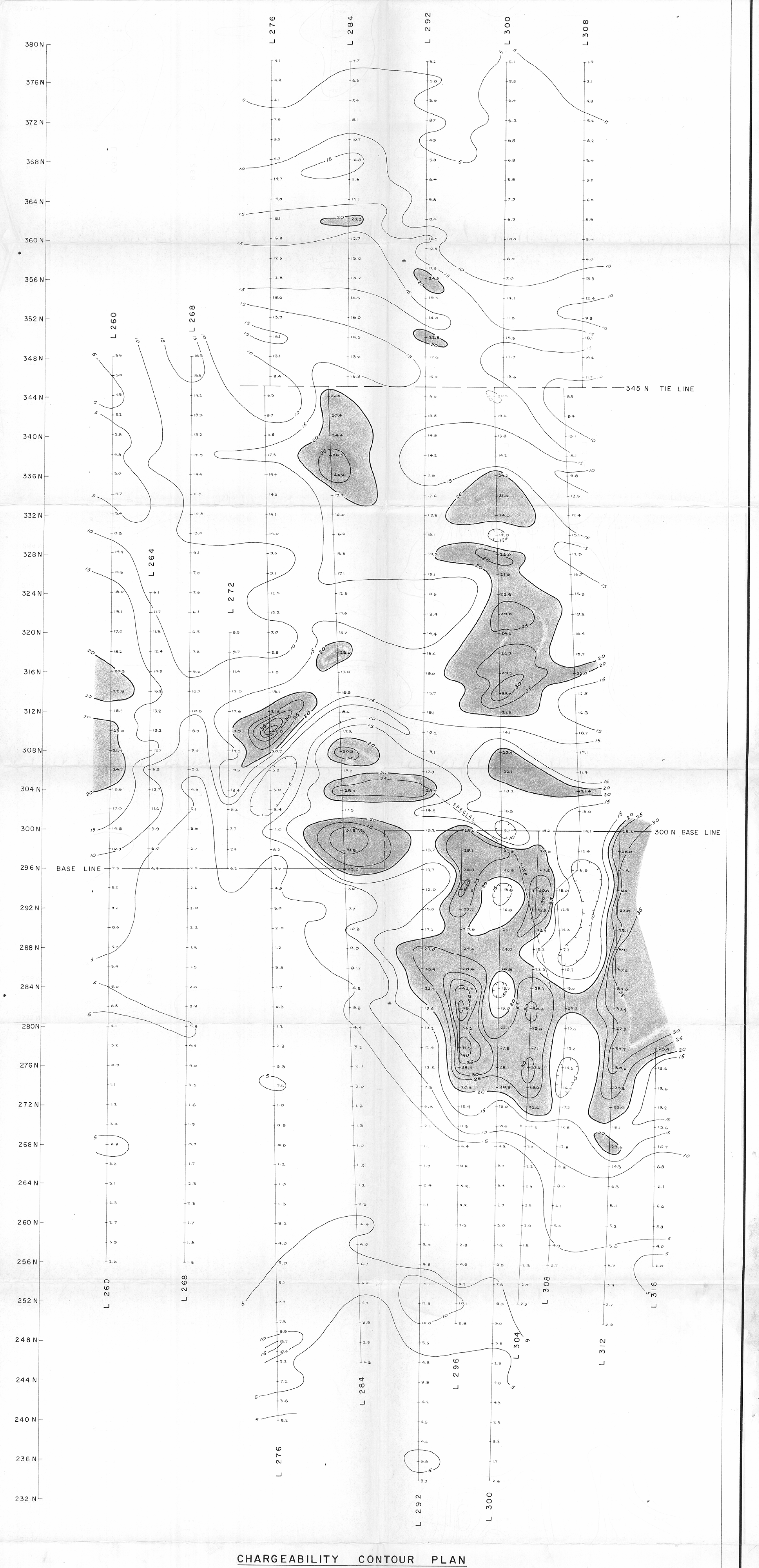
RESISTIVITY CONTOUR PLAN

LEGEND:

570 — LINE TRACE WITH RESISTIVITY VALUE IN OHM-METRES

100 — RESISTIVITY CONTOURS 100, 250 AND 500 OHM-METRE CONTOURS
500 OHM-METRE INTERVAL FROM 500 TO 5000
2000 OHM-METRE INTERVAL FROM 6000 TO 14,000

NOTES: THREE ELECTRODE ARRAY
ELECTRODE SPACING a = 400'



CHARGEABILITY CONTOUR PLAN

LEGEND:

2.3 — LINE TRACE WITH CHARGEABILITY VALUE IN MILLISECONDS

15 — CHARGEABILITY CONTOURS, 5 MILLISECOND CONTOUR INTERVAL

NOTES:
THREE ELECTRODE ARRAY
ELECTRODE SPACING a = 400'

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1854 M.P. 2

PLATE 2

CANADIAN SUPERIOR EXPLORATION LTD.

SMITHERS AREA, BRITISH COLUMBIA

KOFIT CLAIM GROUP

INDUCED POLARIZATION SURVEY

CHARGEABILITY AND RESISTIVITY CONTOUR PLANS

SCALE: 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
SEPT.-OCT., 1968

1854

Allan Hawley P.Eng.

248N
252N
256N
260N
264N
268N
272N
276N
280N
284N
288N
292N
296N
BASE LINE
300N
304N
308N
312N
316N
320N
324N
328N
332N
336N
340N
344N
348N
352N
356N
360N
364N
368N
372N
376N
380N
L 260
L 264
L 268
L 272
296
L 304
L 308
312
L 316
OHM - METRES
RESISTIVITY SCALE
OHM - METRES
312N
30N
308N
306N
304N
302N
300N
298N
296N
294N
292N
290N
288N
286N
284N
SPECIAL LINE
OHM - METRES
RESISTIVITY SCALE
OHM - METRES
BASE LINE 300 N

LEGEND:

CHARGEABILITY: SCALE: 1" = 20 MILLISECONDS
ELECTRODE SPACING: a = 200' x——x——x
a = 400' ·——·——·

RESISTIVITY: SCALE LOGARITHMIC (SEE ABOVE)
ELECTRODE SPACING: a = 200' x- - -x- - -x
a = 400' · - - - · - - - ·

NOTES:
THREE ELECTRODE ARRAY
ELECTRODE SPACING AS INDICATED
INTERLINE SPACING NOT TO SCALE

#3

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
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#3

PLATE 3

CANADIAN SUPERIOR EXPLORATION LTD.

SMITHERS AREA, BRITISH COLUMBIA

KOFIT CLAIM GROUP

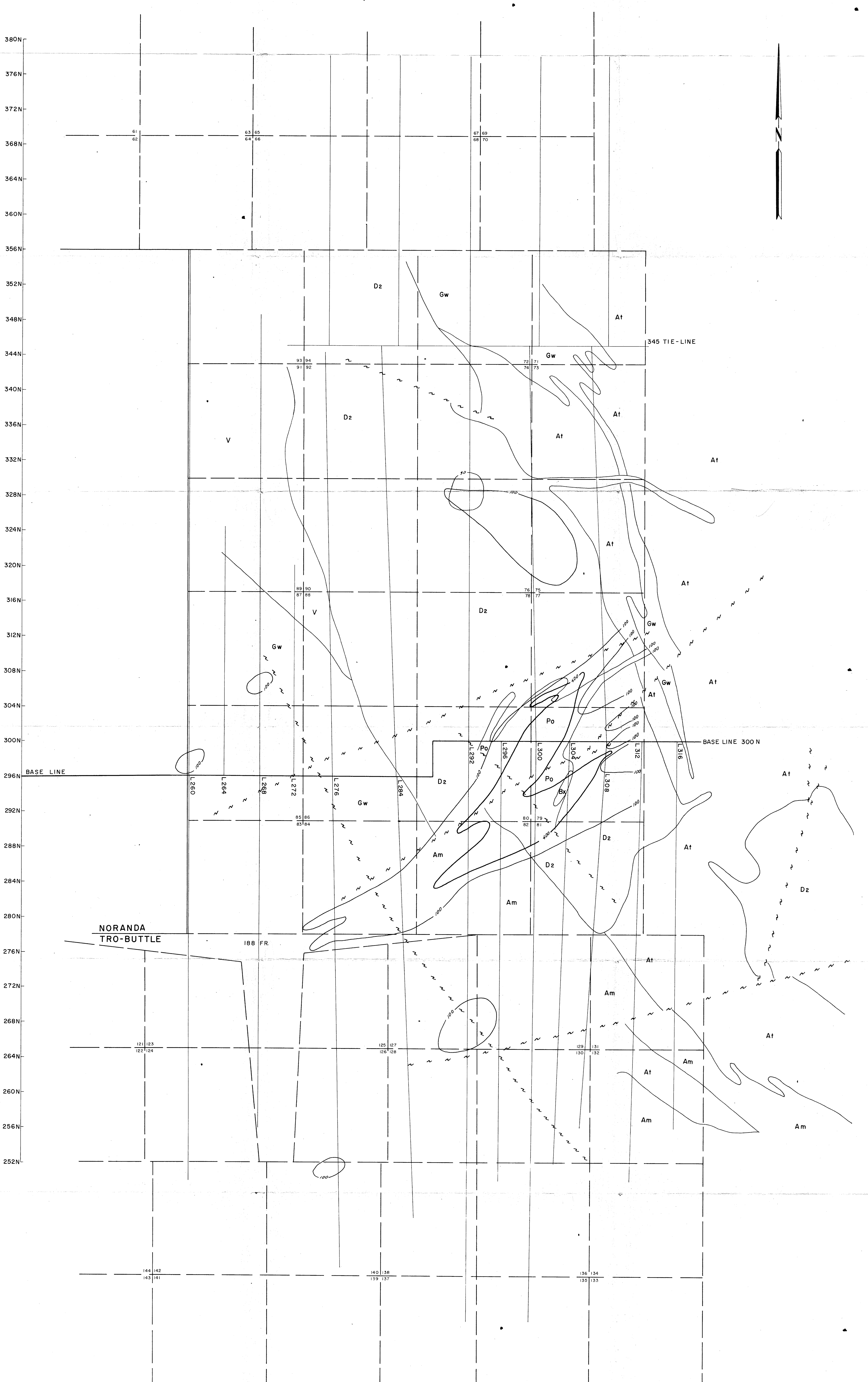
INDUCED POLARIZATION SURVEY

CHARGEABILITY AND RESISTIVITY PROFILES

SCALE: 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
SEPT.-OCT., 1968

1854 H. Allan Hawley P. Eng.



LEGEND

V	RED VOLCANIC FLOWS
Po	BIOTITE FELDSPAR PORPHYRY
Bx	CARBONATE CEMENTED TECTONIC BRECCIA
D2	QUARTZ DIORITE , IN PART FINE GRAINED HYBRID DIORITE + CONTACT + DYKE PHASE
Gw	ARKOSE , GREYWACKE
At	GREY ANDESITIC TUFFS
Am	MASSIVE CHLORITIC ANDESITE IN PART PORPHYRITIC
~ ~ ~	INFERRED FAULT
———	GEOLOGICAL CONTACT MAPPED OR INFERRED
—100—	100 p.p.m. COPPER CONTOUR
—400—	400 p.p.m. COPPER CONTOUR
—30—	30 p.p.m. MOLYBDENUM
144/142 143/141	CLAIM POST

NOTE : GEOLOGY AS SUPPLIED BY CANADIAN SUPERIOR EXPLORATION LTD.

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PLATE 4

CANADIAN SUPERIOR EXPLORATION LTD.

SMITHERS AREA, BRITISH COLUMBIA

KOFIT CLAIM GROUP

COMPILATION MAP

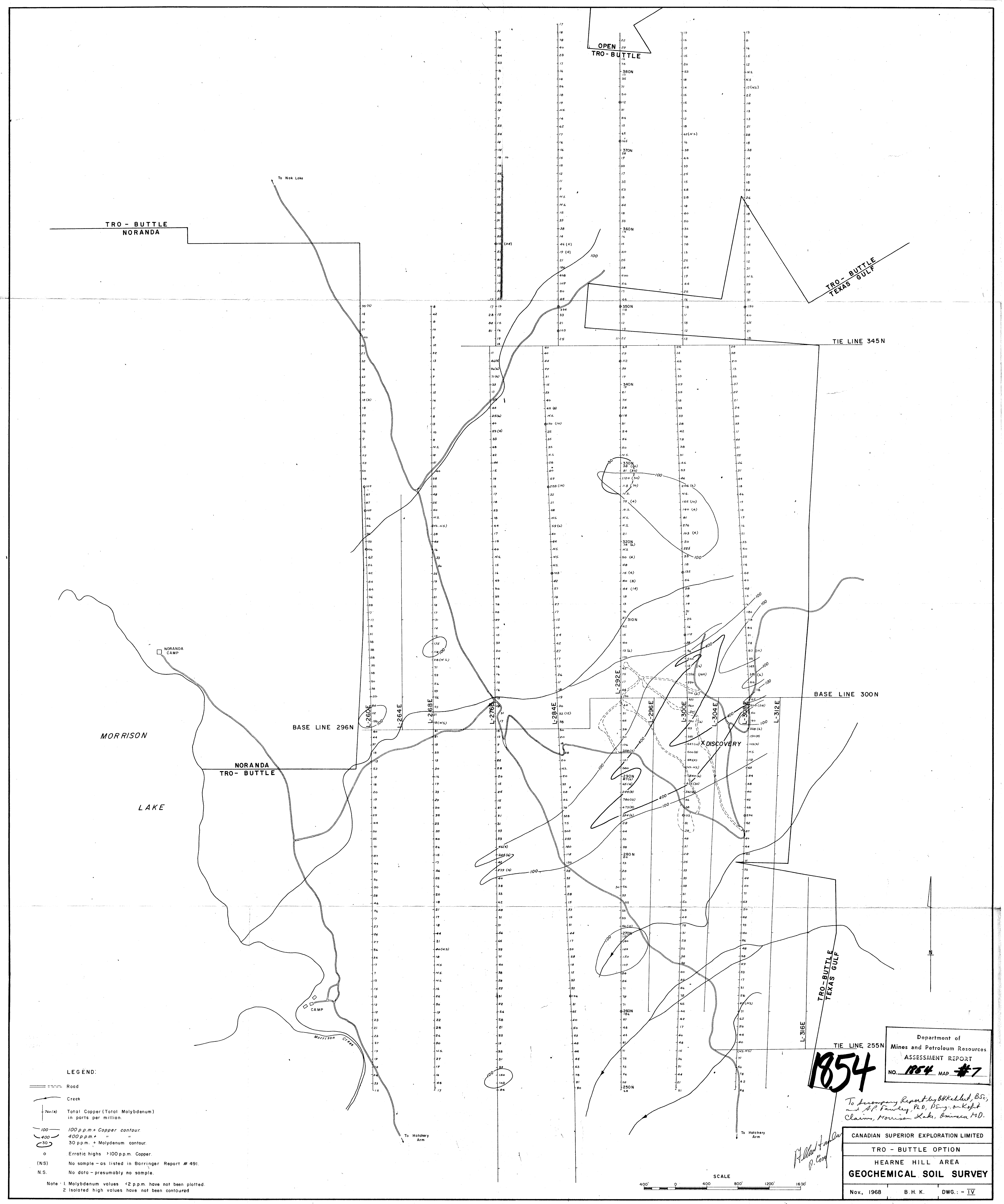
GEOLOGY, GEOCHEMISTRY, SURVEY GRID AND CLAIMS

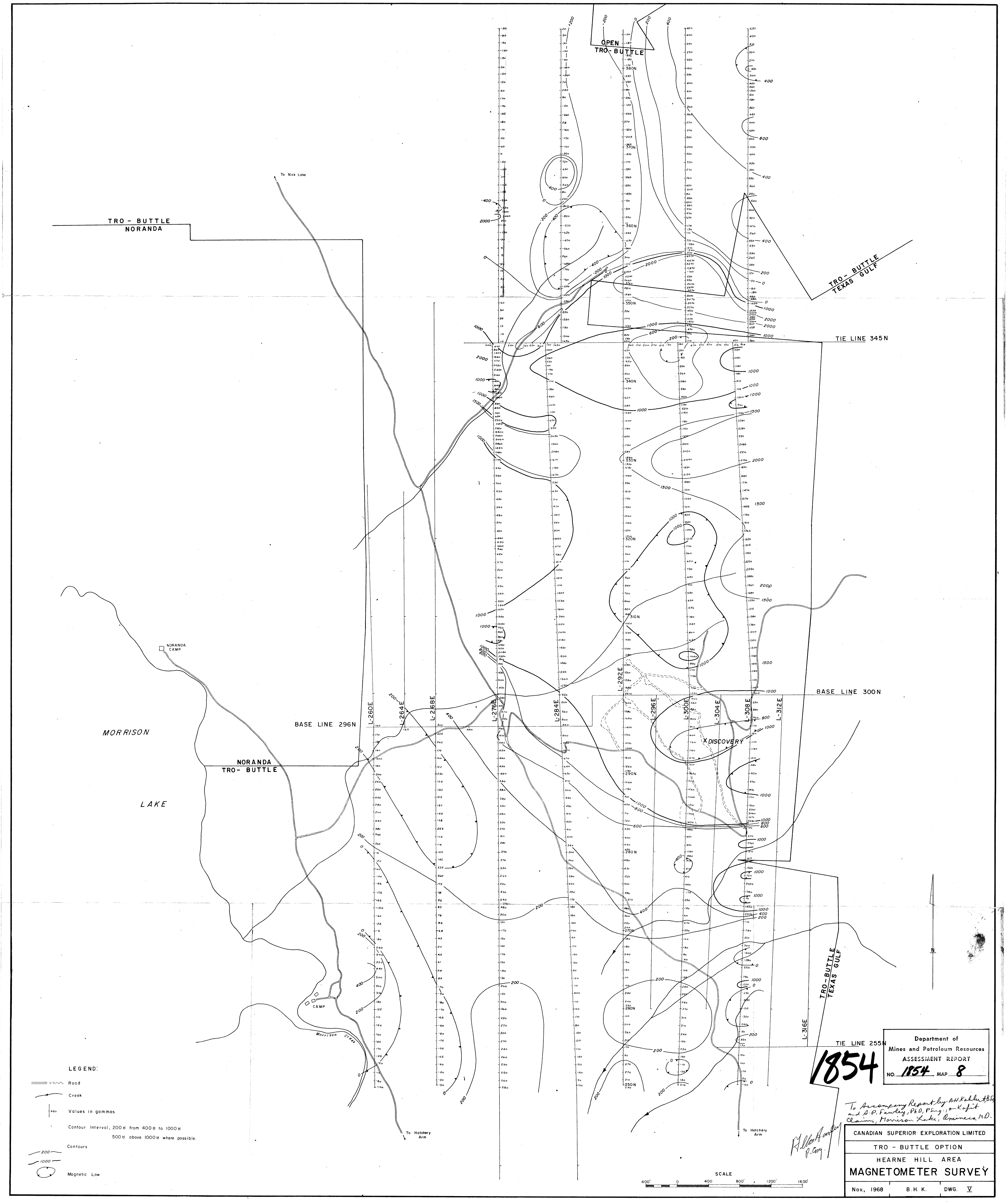
SCALE : 1" = 400'

SURVEY BY SEIGEL ASSOCIATES LIMITED
SEPT.-OCT., 1968

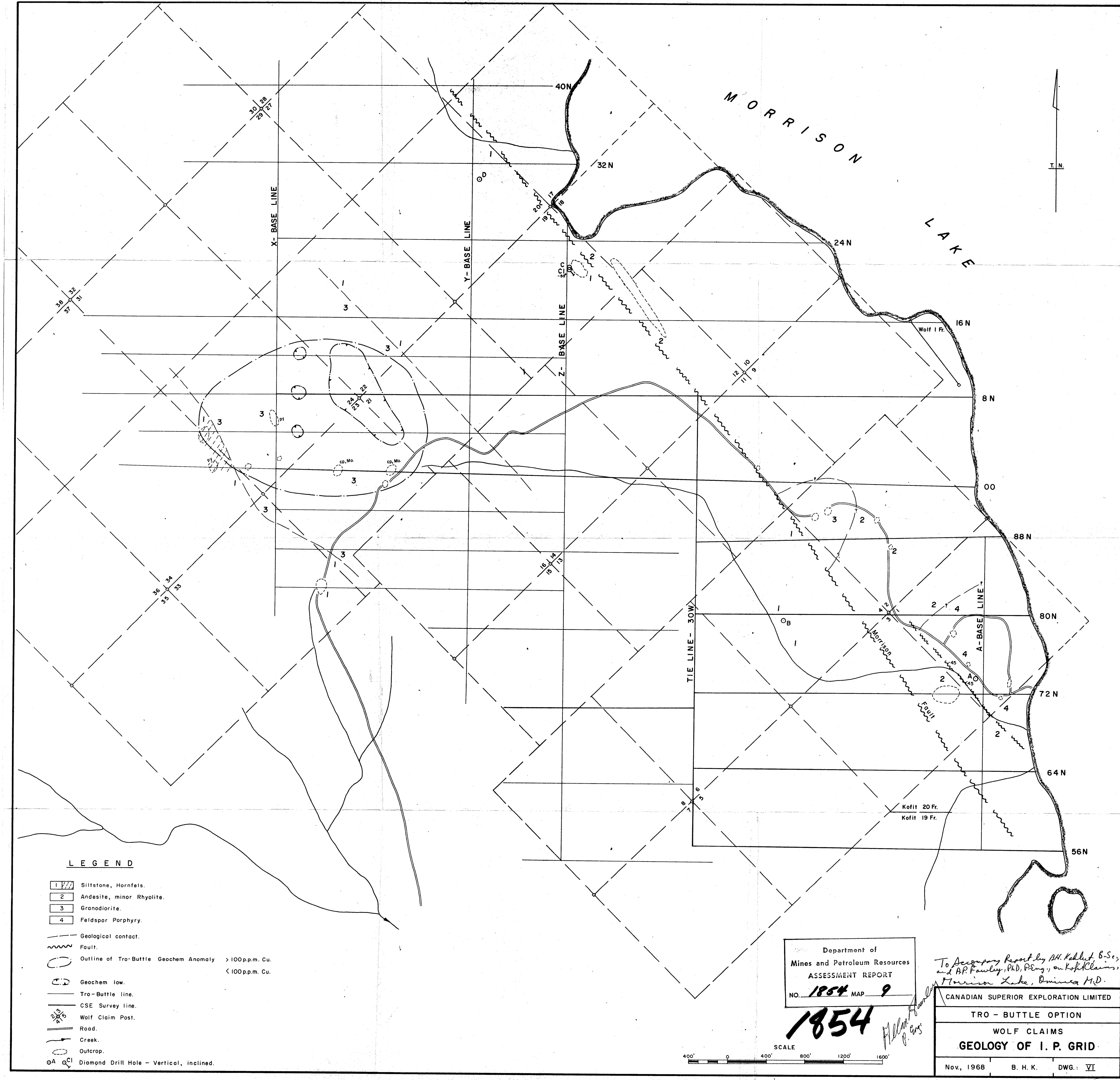
Allan Hamley
P. Eng.

1854


OPEN
TRO-BUTTLE
TRO-BUTTLE
NORANDA
To Nak Lake
TRO-BUTTLE
TEXAS GULF
TIE LINE 345N
380N
370N
360N
350N
340N
330N
320N
310N
BASE LINE 300N
BASE LINE 296N
L-260E
L-264E
L-268E
L-276E
L-284E
L-292E
L-296E
L-300E
L-304E
L-308E
L-312E
L-316E
DISCOVERY
290N
280N
270N
260N
250N
NORANDA CAMP
MORRISON
LAKE
NORANDA
TRO-BUTTLE
CAMP
Morrison Creek
TRO-BUTTLE
TEXAS GULF
TIE LINE 255N
N
To Hatchery Arm
To Hatchery Arm
LEGEND:
Road
Creek
Total Copper (Total Molybdenum) in parts per million.
100 p.p.m.+ Copper contour.
400 p.p.m.+ " "
30 p.p.m. + Molydenum contour.
Erratic highs >100 p.p.m. Copper.
(NS) No sample - as listed in Barringer Report # 491.
N.S. No data - presumably no sample.
Note · 1. Molybdenum values <2 p.p.m. have not been plotted.
2 Isolated high values have not been contoured
SCALE
400' 0 400 800' 1200' 1600'
1854
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1854 MAP #7
To Accompany Report by B.H. Kahlert, B.Sc., and A.P. Fawley, PhD, P.Eng., on Kofit Claims, Morrison Lake, Omineca M.D.
CANADIAN SUPERIOR EXPLORATION LIMITED
TRO - BUTTLE OPTION
HEARNE HILL AREA
GEOCHEMICAL SOIL SURVEY
Nov., 1968
B.H.K.
DWG.: - IV



OPEN
TRO-BUTTLE
TRO-BUTTLE
NORANDA
To Nak Lake
TRO-BUTTLE
TEXAS GULF
TIE LINE 345N
BASE LINE 300N
BASE LINE 296N
NORANDA CAMP
MORRISON
LAKE
NORANDA
TRO-BUTTLE
L-260E
L-264E
L-268E
L-276E
L-284E
L-292E
L-296E
L-300E
L-304E
L-308E
L-312E
L-316E
X DISCOVERY
CAMP
Morrison Creek
TIE LINE 255N
To Hatchery Arm
To Hatchery Arm
LEGEND:
Road
Creek
Values in gammas
Contour Interval; 200 ɣ from 400 ɣ to 1000 ɣ
500 ɣ above 1000 ɣ where possible.
Contours
Magnetic Low
SCALE
400' 0 400 800' 1200' 1600'
N
1854
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1854 MAP 8
To Accompany Report by B.H. Kahlert, B.Sc. and A.P. Fawley, PhD, P.Eng., on Kofit Claims, Morrison Lake, Omineca M.D.
CANADIAN SUPERIOR EXPLORATION LIMITED
TRO - BUTTLE OPTION
HEARNE HILL AREA
MAGNETOMETER SURVEY
Nov., 1968
B.H.K.
DWG. V


MORRISON LAKE
40N
32N
24N
16N
8N
00
88N
80N
72N
64N
56N
X- BASE LINE
Y- BASE LINE
Z- BASE LINE
TIE LINE- 30W
A- BASE LINE
Morrison Fault
Wolf I Fr.
Kofit 20 Fr.
Kofit 19 Fr.
T.N.
LEGEND
1 Siltstone, Hornfels.
2 Andesite, minor Rhyolite.
3 Granodiorite.
4 Feldspar Porphyry.
Geological contact.
Fault.
Outline of Tro-Buttle Geochem Anomaly
> 100 p.p.m. Cu.
< 100 p.p.m. Cu.
Geochem low.
Tro-Buttle line.
CSE Survey line.
Wolf Claim Post.
Road.
Creek.
Outcrop.
Diamond Drill Hole - Vertical, inclined.
SCALE
400' 0 400' 800' 1200' 1600'
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1854 MAP 9
1854
To Accompany Report by B.H. Kahlert B.Sc., and A.P. Fawley, PhD, P.Eng., on Kofit Claims, Morrison Lake, Omineca M.D.
CANADIAN SUPERIOR EXPLORATION LIMITED
TRO - BUTTLE OPTION
WOLF CLAIMS
GEOLOGY OF I. P. GRID
Nov., 1968
B. H. K.
DWG.: VI