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KRAIN

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ABSTRACT

The Krain porphyry copper prospect, located 10 km north of the Bethlehem mine, has been explored intensively over the past 20 years. Reserves of 14 million tonnes grading 0.56 percent copper are indicated, and little hope remains for discovery of additional tonnage.

Krain is unique in the district in that it is partly covered by post-mineral volcanic rocks beneath which an oxidized cap is preserved. Although primary sulfides are deeply and totally oxidized, very little chalcocite enrichment has resulted. Precipitation of copper appears to have been achieved primarily within the oxidizing zone, such that the cap is slightly enriched in copper. This is inferred to result from rapid neutralization of acid solutions by reaction with calcite, a common mineral of the hydrothermal alteration assemblage.

At Krain there are clear genetic and spatial ties between zonal patterns of mineralization, alteration, and fracturing, around a quartz diorite stock which resembles the Bethlehem phase of the Guichon Creek Batholith.

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Post-mineral faulting is significant.

LOCATION

The Krain property is located on the east flank of North Forge Mountain about 10 km north of the Bethlehem mine in Highland Valley district (Lat. 50° 35' N, Long. 120° 58' W, NTS 92I/10W, Elev. 1750 m).

HISTORY

The earliest history at Krain is unknown except that by 1907, a 5 m adit already existed on the property which was then called the Keystone Group. Little more was done until development of the Bethlehem mine commenced in 1955, and prospects in the district began to attract the attention of mineral exploration companies. Operators at Krain since 1955 have included Beaver Lodge Uranium, Far West Tungsten, Kennecott, North Pacific, Canex, Shulman, Noranda, Quintana and Getty; total exploration costs have exceeded one million dollars.

Several companies recognized that part of the mineralized area at Krain was deeply oxidized and lay beneath Tertiary volcanic cover where supergene enriched copper mineralization might exist. Determined efforts were made to explore this potential, as well as to develop tonnage in the primary sulfide zone. Regional and detailed geological mapping and sampling were supplemented by geochemical, magnetometer and induced polarization surveys, and considerable bulldozer trenching. Extensive diamond and percussion drilling have been done throughout the years.

The most recent operators, Quintana and Getty, in 1971-72 jointly explored extensions of mineralization beneath covered areas to the north and south. In 1973 Getty continued efforts to develop deeper extensions to the south and southwest, but since then the property has been idle.

In 1972 tonnage and grade estimates were made at Krain, including all areas of mineralization that could be recovered from a single open pit 250 m deep, using a 0.3 percent copper cutoff grade. The calculations indicated a total reserve of 14 million tonnes grading 0.56 percent copper. Of this total, about 9.1 million tonnes averaging 0.53 percent copper contain primary sulfides, and 4.9 million tonnes grading approximately 0.64 percent copper contain secondary copper carbonates and oxidation products.

Overall molybdenum content was estimated to average close to 0.01 percent molybdenum although short intercepts near the centre of the deposit contain as much as 0.03 percent molybdneum.

GEOLOGY

The Krain prospect lies on the southern boundary of an extensive area of post-mineral cover consisting of continental volcanic and interbedded sedimentary rocks of the Early Tertiary Kamloops Group. These rocks cover the northern half of the mineralized zone, and have protected an older oxidized cap as much as 100 m thick. Hypogene sulfides within this cap have been totally destroyed. In contrast, sulfides occur at surface within the southern part of the deposit where Pleistocene glaciation has removed most of the oxidized zone.

Mineralization at Krain occurs within quartz diorites of the Highland Valley phase (Guichon variety) of the Guichon Creek Batholith, as defined by Northcote (1969), and within younger anastomosing dykes and small stocks. These dykes and stocks exhibit textures ranging from porphyritic to hypidiomorphic-granular, more equigranular varieties closely resembling quartz diorites of the Bethlehem phase of the batholith (Northcote, 1969).

The mineralized porphyry system at Krain occurs within a broad northwesterly trending zone that also contains the Trojan (South Seas) prospect, a breccia-pipe 3 km south of Krain, and the Bethlehem deposits some 7 km further south. This broad zone is characterized by numerous sub-parallel northwest trending porphyry dykes, as well as by prominent fracture related but non-pervasive chlorite-epidote-chalcopyrite/±pyrite/ ±bornite hydrothermal vein and fracture selvage assemblages. Smaller zones of pervasive chlorite-clay alteration, some containing strong chalcopyrite mineralization, occur frequently at the margins of porphyry dykes. Extensive trenching and drilling were carried out by prospectors and exploration companies within and around many of these small showings.

At Krain mineralization and alteration are closely associated with an elongate 1000 m x 200 m dyke-like stock which is unroofed within a small area at the centre of the deposit (Figures 1 & 2). The unroofed portion appears to be an abrupt cupola-like projection which developed above the stock. To the northwest and southeast along strike the apex of the stock plunges gently away from the high point at Krain, and the lateral contacts dip about 70° southwestward (Figure 2).

Fracturing, brecciation, alteration and mineralization are all most strongly developed in and around the central cupola-like core, and along the upper surface of the stock.

PRIMARY MINERALIZATION AND ALTERATION

Well defined zonal patterns of primary sulfide mineralization and silicate alteration have been recognized around the core area. Within the core and near the contacts of the stock, chalcopyrite-bornite assemblages are found associated with molybdenite-bearing quartz veinlets. Peripheral to this mineralization, chalcopyrite-pyrite assemblages occur in fracture stockwork fillings in which pyrite becomes more abundant outwards, both within the wall rocks and the stock. Maximum total sulfide content is about 5 percent and this occurs in a zone approximately coincident with the outer limit of 0.1 percent copper grades.

Associated zoned silicate alteration is pervasive and diminishes outwards from sericite-clay-chlorite[1] assemblages in the core, through clay-chlorite, and chlorite assemblages in the chalcopyrite zone, to chlorite-epidote assemblages in the pyrite zone. Beyond the approximate outer limit of 0.05 percent copper, silicate alteration is no longer pervasive although chlorite-epidote assemblages form pronounced fracture selvage halos which gradually diminish to fracture coatings over transition zones as much as 1000 m wide.

1. Identification of sericite and clay-bearing mineral assemblages is based on physical properties and knowledge of x-ray determined mineralogy of similar rocks from the Bethlehem mine (McMillan, W. J., 1974, personal communication).

OXIDIZED ZONE

An oxidized cap as much as 100 m thick, has been preserved beneath Early Tertiary cover at Krain (Figure 2). The overall average oxide copper grade is about 20 percent higher than the overall average hypogene copper grade suggesting that copper enrichment has occurred within the cap. Malachite is the most abundant copper mineral but chrysocolla and a black waxy copper oxide of dendritic habit (neotocite? copper-manganese?) are common. These minerals form very prominent fracture coatings, some of which are botryoidal, and also fill cavities previously occupied by sulfides. Minor cuprite and disseminated native copper are found most commonly in the outer parts of the deposit.

Chalcocite occurs in minor amounts as thin coatings on corroded grains of sulfide within a narrow zone, extending through the lower metre of oxidized rock to the upper few metres of the primary sulfide zone. Chalcocite is not sufficiently abundant to contribute appreciably to the grade of the deposit, and does not account for the slight enrichment of the oxidized zone over primary grade.

Disseminated calcite forms as much as 5 percent of the more highly altered and better mineralized rocks at Krain, and is believed to have greatly influenced the migration of copper at the time of oxidation. The presence of calcite within the system likely resulted from the destruction of calcic plagioclase during the hydrothermal stage. Calcite under later oxidizing conditions probably reacted to neutralize cupriferous acid solutions formed from hypogene sulfides, precipitating copper before much vertical migration could take place. However some net downward migration of copper must have occurred as the processes of weathering, oxidation, and leaching progressed, if the apparent enrichment of the cap truly indicates secondary enrichment.

A possible alternate explanation for the higher oxide copper grade at Krain is second cycle oxidation of a pre-existing chalcocite blanket, but no substantiating textural relationships such as partially oxidized chalcocite relicts, or hematitic limonites were noted. Further, the chalcocite observed forms coatings on sulfide grains near the base of the oxidized zone, a site and mode of occurrence common in first cycle chalcocite blankets. It is interpreted therefore that at Krain, because of the retarding influence of carbonate mineralogy on downward migration of copper, only small amounts of copper reached the groundwater table where first cycle chalcocite could form.

STRUCTURE

Fractures and faults are prominent features at Krain, and the areas of highest fracture density which are adjacent to the stock, are also the zones of best mineralization.

Sets of steeply dipping northeasterly and northerly trending faults are shown on Figure 1. Pre-mineral existence of a few of these faults which contain sulfides is evident in the field, but a post-mineral age appears likely for most. Early Tertiary Kamloops Group rocks are restricted almost entirely to downfaulted blocks, where vertical offsets have been substantiated in several instances by drill data. It has not been possible to measure net movement on any of these faults, nor are the time relationships fully understood between mineralization, episodic minor faulting, and the development of the major regional Highland Valley and Lornex Faults.

SUMMARY

Krain is a well-explored porphyry copper deposit which forms part of a much larger hydrothermal sulfide system. Reserves of 14 million tonnes averaging 0.56 percent copper and 0.01 percent molybdenum are known, but potential is low for discovery of additional tonnage near surface.

Unlike most copper deposits within the Guichon Creek Batholith, Krain displays a strong genetic relationship with a small stock which in this instance intrudes Guichon quartz diorite. Texturally the stock resembles the Bethlehem phase of the batholith, and a cupola-like part of it forms a core about which are developed strong zonal patterns of fracture intensity, sulfide and hydrothermal silicate mineralogy, and copper grade.

Mineralized rocks at Krain were deeply oxidized prior to burial during Early Tertiary time. Despite total destruction of sulfides within a thick oxidized cap, very little secondary chalcocite enrichment resulted. Conversely, the oxidized cap itself appears to have become enriched in copper to the extent that oxide grade exceeds primary grade by about 20 percent. This enrichment is interpreted to result from the reaction of available hydrothermal calcite to precipitate copper from acid solutions produced during the oxidation process. Downward migration of copper was thereby retarded and, ultimately, with continued weathering and oxidation the oxidized zone became slightly enriched. Northern parts of the Krain deposit lie protected beneath Early Tertiary cover, but the oxidized cap within southern parts of the deposit, has all but been destroyed by Pleistocene glaciation.

The present distribution of Early Tertiary Kamloops Group is strongly influenced by faults, and at Krain most of these rocks occur in downthrown fault blocks.

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Northcote, K. E. (1969): Geology and Geochronology of the Guichon Creek Batholith, B. C. Dept. of Mines and Petroleum Resources, Bull. No. 56.

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Krain Deposit
Highland Valley

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EXPLORATION CASE HISTORY OF A DISSEMINATED COPPER DEPOSIT†

DON A. HANSEN* AND DAVID A. BARR**

The Krain disseminated sulfide deposit is in the Guichon batholith approximately 130 airline miles northeast of Vancouver, British Columbia.

Determinations of exchangeable copper content of stream sediments and of soils showed highest values near the deposit.

Ground magnetometer and self-potential surveys displayed no diagnostic variations over the deposit.

A variable frequency induced-polarization survey showed a response having excellent correlation with the known extent of the sulfide mineralization.

Location

The area under consideration is in interior British Columbia about 130 airline miles northeast of Vancouver.

Geologic Setting

The Krain Copper deposit occurs in the northern portion of the early Jurassic Guichon Creek batholith which lies in the eastern side of the Coast Intrusions. The batholith is composed mainly of quartz diorite and grades to augite diorite and gabbro near the periphery. The pluton has been intruded by a complex series of younger dioritic rocks. The Krain deposit and several other deposits of the area are associated spatially with the younger intrusive complex and its attendant zones of brecciation. Much of the northern portion of the batholith is covered by Miocene volcanics, and they reach a maximum estimated thickness of 800 ft in this area. The geologic map (Figure 1) is the result of interpolation between rock outcrops which represent less than 5 percent of the total area.

The geometry and mineralogy of the Krain Copper occurrence is determined by 25 drill holes. The deposit is ellipsoidal in plan and about 1,200 ft long. It strikes northwesterly and dips vertically to steeply southwest in conformity with the dominant joint pattern of the area.

The northwest portion of the deposit was leached during pre-Miocene times and contains copper carbonates, copper silicates, and very minor native copper. The southeast portion of the deposit contains disseminated sulphides, principally pyrite and chalcopyrite. The volume percentage of sulfide minerals reaches an estimated three percent near the axis of the deposit and diminishes away from this line.

Stream Sediment Survey

Stream sediment samples were collected at sites one-half mile apart in all active streams in the area. Near the Krain deposit the interval between sample sites was reduced to about 400 ft. Rate of stream flow and physical character of the sample were recorded at each site.

The samples were oven dried and screened to minus 80 mesh. A 250-milligram sample of the screened fraction was analyzed in a laboratory using the Holman copper test (Holman, 1956), which employs cold citrate extraction and dithizone titration. The results indicated on the geochemical map (Figure 2) are in parts per million of exchangeable copper. The width of the worm line is proportional to the copper value.

† Presented at the 29th Annual SEG meeting at Los Angeles, November 12, 1959.
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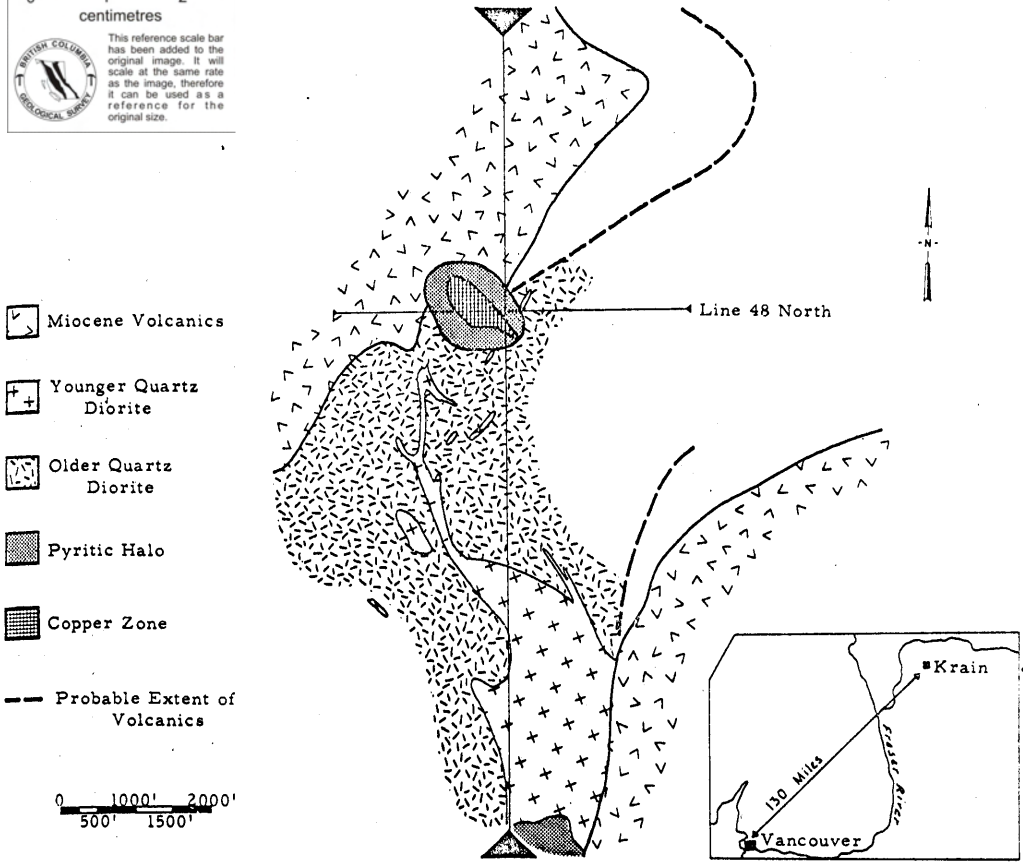


FIG. 1. Geologic map, Krain deposit, British Columbia, Canada.

The immediate area of the deposit does not have a strong superimposed drainage pattern. Nearby streams flowing to the northeast and south produce good downstream dispersion patterns. On the northeast drainage values fall from around 300 ppm near the mineralization to 5 ppm two miles downstream. The south drainage in part parallels the contact between the younger intrusive complex and the Guichon quartz diorite. Values in excess of 700 ppm were recorded immediately down drainage from a low grade mineralized zone. Five miles downstream the values had fallen to the background of less than 20 ppm.

The high copper values in the vicinity of the deposit serve to indicate a fairly restricted area of interest where more detailed methods of investigation have been applied.

Soil Geochemical Survey

Soil samples were collected at 100-ft intervals along grid lines 400 ft apart (Figure 2). Wherever an adequate soil profile was developed, the top of the B-1 horizon was sampled. The average depth to this zone was 6 to 9 inches. Exceptions were outcrop areas and topographic basins where a thick layer of loam was present.

Samples were dried, screened to minus 80 mesh and analyzed in a field laboratory. Anomalous areas were detailed in the field by the Holman test. Several of the larger anomalous areas were trenched by bulldozer. In each case evidence of copper mineralization was found.

The highest values of soil copper are in the immediate vicinity of the Krain deposit. The absence of additional high values over the

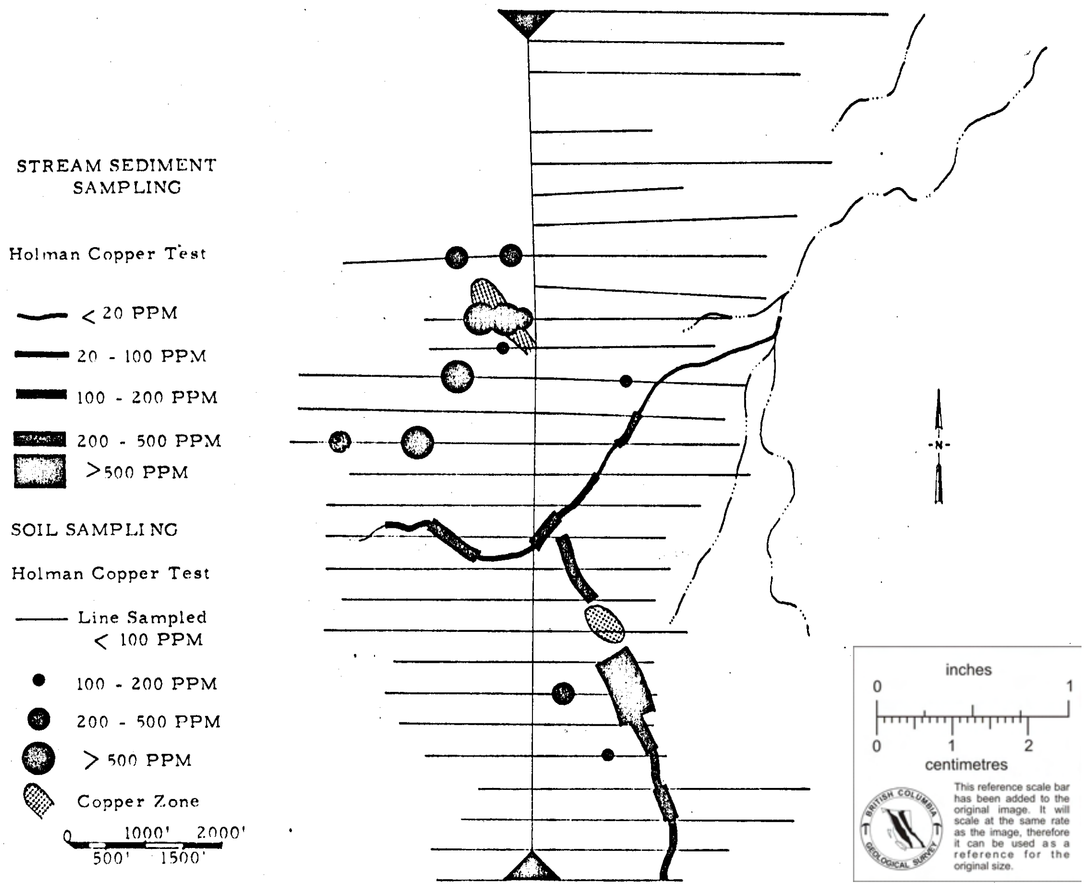


FIG. 2. Geochemical map, Krain deposit area, British Columbia.

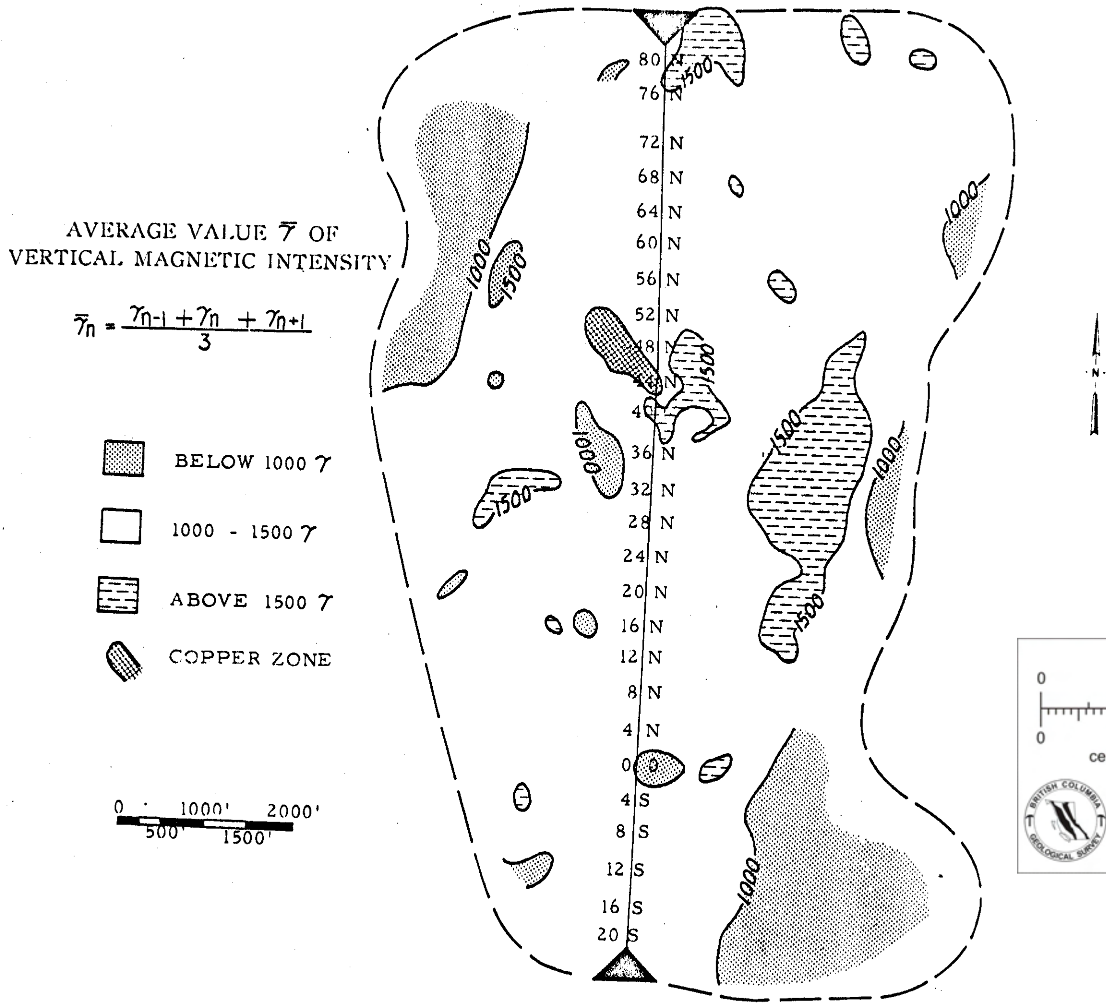
deposit is attributed to the limited ability of the copper ions to rise through thicknesses of glacial till which reached 70 ft.

Magnetometer Surveys

A regional air magnetic survey of the batholith was made at a nominal flight elevation of 500 ft with a line spacing of one-quarter mile. The results displayed no uniquely diagnostic response near the known major centers of mineralization. These centers are the Bethlehem disseminated copper deposit 10 miles south of the Krain occurrence and the Craigmont contact metamorphic copper deposit thirty miles south. Although the Craigmont property is known to have strong magnetic association the flight lines fell on either side of the deposit and it was not detected. The air magnetic data, however, did produce information of aid in determining the distribution of rock types within the pluton. The data also displayed linear elements which may be indicative of large-scale structural features of the region.

A ground magnetic survey was conducted using a Schmidt type balance. Station spacing was 100 ft on 400-ft grid lines. The purpose of the survey was twofold. First, it was hoped that any masses of younger intrusive complex and/or mineralized zones would be defined by magnetic lows. Secondly, it was anticipated that the magnetic data would be of aid in defining the areal extent of the Miocene volcanic cover.

It soon became evident that the magnetic variations incurred over very short distances



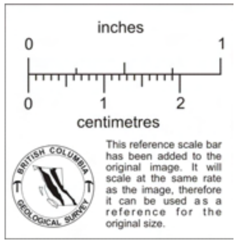


FIG. 3. Vertical magnetic intensity map, Krain deposit area, British Columbia.

were so great as to render contouring of the data impossible. In order to filter out the noise variations the field values were subjected to an averaging process. The value plotted at any station was the average of the values at that station and the stations on either side of it. A generalized contour map of the averaged data is presented as Figure 3. The strongest variations were the values below 1,000 gammas which occur in areas known to be volcanics. However, the low values are thought to characterize only certain members of the sequence since substantial volcanic outcrops occur away from these magnetic features.

The lower curve on Figure 4 is a plot of the observed magnetic values along line 48 North. It is clear that there is no diagnostic indication of the mineralized zone.

Self-Potential Survey

A portion of line 48 North was run using the standard SP procedure of measuring the potential difference between a fixed reference electrode and a second electrode which occupies successive stations along the profile.

As indicated in Figure 4 there are no diagnostic self-potential variations near the zone of mineralization. The absence of a self-potential anomaly is attributed to the present low rate of oxidation of the sulphide portion of the deposit.

Induced-Polarization Survey

Induced-polarization measurements were made using the dual-frequency method and an expanded Eltran electrode configuration. The dipole arrangement and the method of presenting the results are indicated in the upper left of Figure 5.

The current, I, is put into the ground through the dipole. The voltage, V, is measured on a dipole of equal length and at integral multiples of the dipole length away from the current dipole. The data obtained are plotted at the intersection of 45 degree diagonals drawn from the midpoint of the current and voltage dipoles.

The two basic pieces of information obtained are the direct current resistivity (ρ_{dc}) and the alternating current resistivity (ρ_{ac}). Two other factors are defined—the percent frequency effect and the metallic conduction factor. The percent frequency effect is the percentage change in ground impedance between the dc and ac measurements, i.e.,

$$\frac{\text{Percent frequency effect}}{100} = \frac{\rho_{dc}}{\rho_{ac}} - 1.$$

The metallic conduction factor is the percent frequency effect normalized by dividing by the dc resistivity.

While the percent frequency effect is most significant quantity, it is sometimes

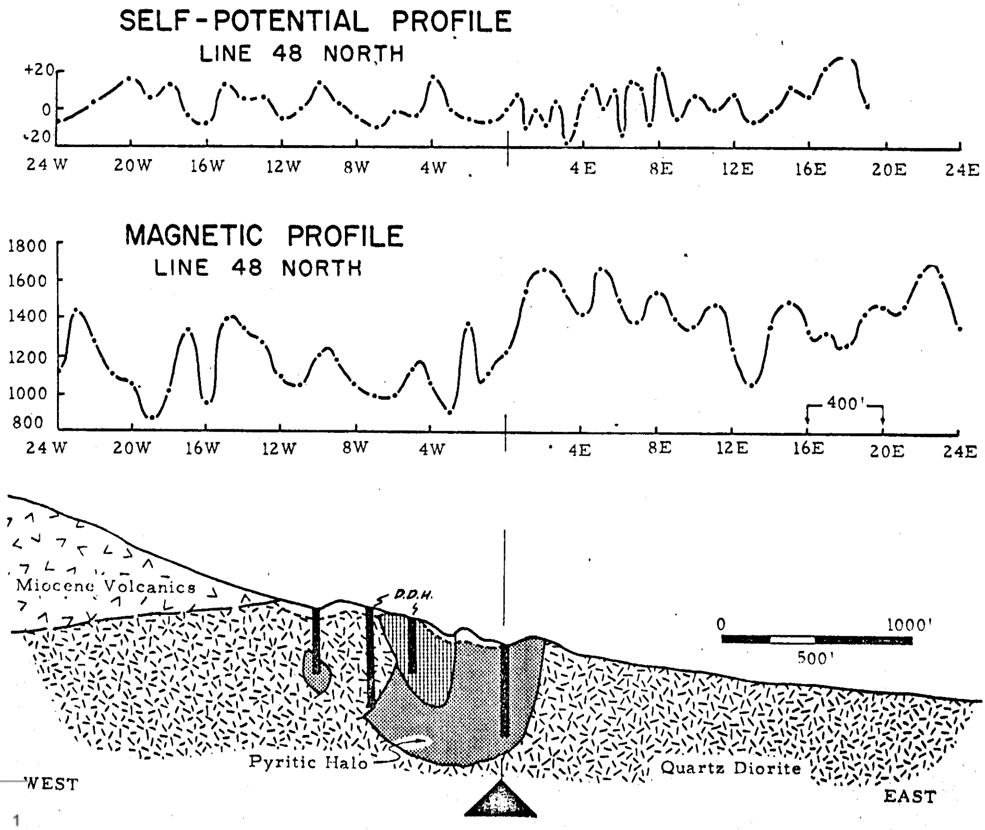
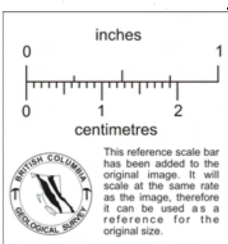


FIG. 4. Self-potential and magnetic profiles, Krain deposit, British Columbia.



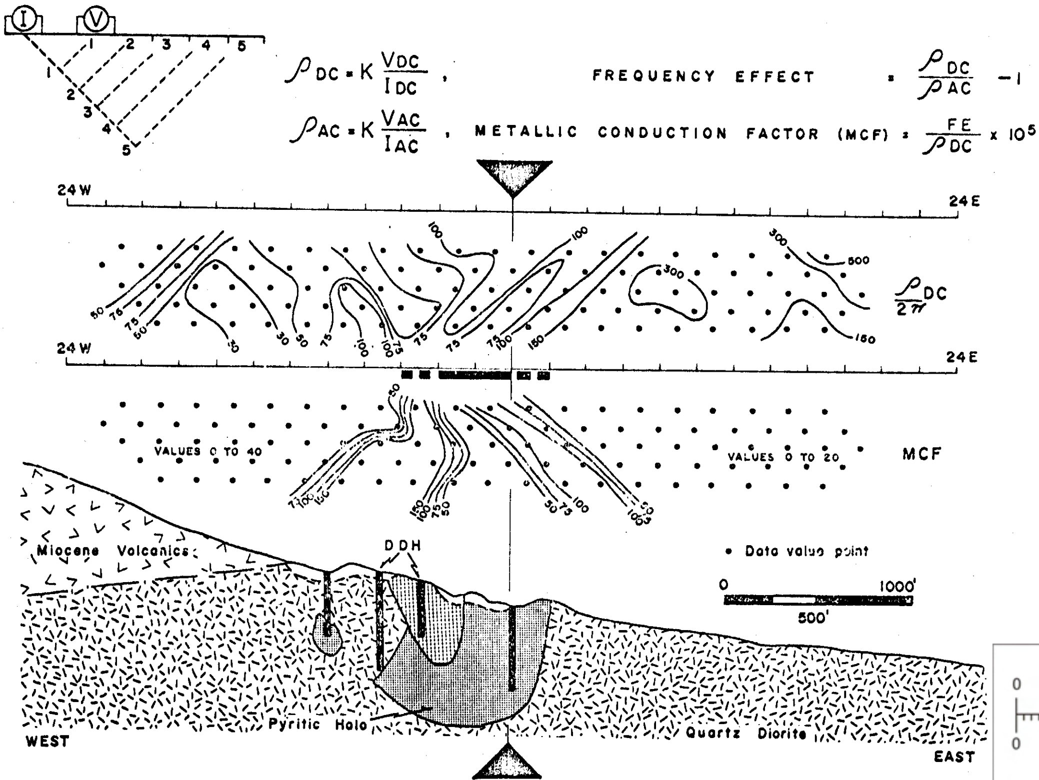
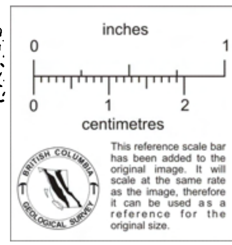


FIG. 5. Induced-polarization profile, line 48 north, Krain deposit, British Columbia.



found that the metallic conduction factor affords better correlation with the important geologic structures than do either the percent frequency effect or the dc resistivity.

The upper profile of Figure 5 is the dc resistivity pattern on line 48 North crossing the mineralized zone. It is seen by comparison with the geologic section that the lower resistivity values in general correlate well with the known extent of the Miocene volcanic cover and the higher values with the plutonic rocks. The dashed lines on the geologic map, Figure 1, indicate the extent of the volcanic cover as inferred from the resistivity data. The lower profile of Figure 5 is of the metallic conduction factor pattern along line 48 north. The interpreted horizontal extent of the source of strong polarization is indicated by the heavy line and the weaker polarization by the dashed line. By comparison with the geologic section, it is seen that the correlation between anomalous values and the known zone of mineralization is excellent.

Summary

In summary, then, the target sought is a zone of sulphide mineralization 1,200 ft long and 400 ft wide. The host rocks are plutonic with a partial cover of volcanic rocks. Pleistocene glacial debris covers most of the area, leaving less than five percent outcrop. The results of various geophysical and geochemical surveys are as follows:

1. A regional aerial magnetic survey provided no diagnostic response over known mineralization but was of use in interpreting the lithology and structure of the region.

2. A stream sediment survey using the Holman copper test indicated good dispersion pattern downstream from the centers of mineralization. Anomalous values in two

streams had fallen to the background two miles and five miles down drainage from the mineralization.

3. The highest values obtained in a soil copper survey were in the immediate vicinity of the Krain mineralization. The absence of additional high values is attributed to excessive overburden on the deposit—up to 70 ft.

4. A ground magnetometer survey produced no data diagnostic of the mineralized zone. The strongest magnetic features are thought to be related to certain members of the volcanic sequence. Other members produced a magnetic response similar to the quartz diorite.

5. A limited self-potential survey indicated no anomalous values near the Krain deposit. The lack of anomaly is attributed to the present low rate of oxidation of the sulphides in the deposit.

6. The dc resistivity portion of the induced-polarization data indicated the extent of the volcanic cover by virtue of the resistivity contrast between the volcanics and the plutonic rocks.

7. The polarization data defined very well the known extent of the sulfide mineralization.

Acknowledgments

The ground surveys described in this paper were carried out by Kennco Explorations (Western) Limited, a subsidiary of Kennecott Copper Corporation on a property currently owned by Western Beaver Lodge Mines Limited and Farwest Mining Limited. The authors wish to express their gratitude to the above companies for granting permission to publish this paper.

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Notes on the Krain Property (North Pacific Mines Ltd.)

Reports Available (from A. Allen)

1. Krain & DW Groups by G.E. Apps dated April/1957.
2. "I.P. Survey of the Krain Property" for NW Explorations (Kennco) by K. Vozoff (McPhar Geophysics) dated November 18/1957.
3. "Krain Property" by D. Barr for NW Explorations dated April 3/1958.
4. Letter from NW Explorations to Farwest Tungsten Copper Mines Ltd. April 18/1958.
5. Summary of Exploration on the Krain Property by D. Barr dated October 11/1958.
6. Report on Krain Property by D. Barr March/1959.

History

1955 - 1957 Farwest Tungsten Copper Mines & Beaverlodge Uranium Mines acquired the key claims and spent $200,000 on diamond drilling (28 holes, 10,194 feet) and bulldozing (2,000 feet), magnetometer survey and geochemistry.

1957 - 1958 NW Explorations (Kennco) spent $100,000 - relogged core, I.P. survey (27 miles), trenching (2,200 feet), linecutting (44 miles), diamond drilling (1 hole, 633 feet), magnetometer survey (23 miles), soil sampling (2,800 samples), silt sampling (170 samples), geological survey (6 square miles).

1965 - 1966 North Pacific acquired property and after some percussion drilling south of the known zone initiated a diamond drilling programme on the zone itself. Canex optioned the property and continued the detailed drilling of the known zone in the winter of 1965-66, giving up the property in June, 1966.

No work is in progress at the present time (Dec. 1966).

Summary of Kennco Work

The Krain copper deposit is controlled by faulting and is localized by differential shattering in and on the margins of felspar porphyry dykes related to the Younger Complex of quartz diorites. The deposit strikes northwest and dips steeply southwest with the best values lying in a lens shaped mass 1,200 feet long and containing:

5 million tons or 13,000 tons/vertical foot primary copper mineralization averaging 0.5% Cu.

5½ million tons of secondary copper mineralization averaging 0.5% Cu.

Primary sulphide minerals consist of chalcopyrite and pyrite with minor molybdenite and bornite. The secondary minerals are chrysocolla, malachite, native copper and cuprite. The NW portion of the deposit is partly overlain by Miocene volcanics which form remnants over the major part of the claim group.

In exploring the property Kennco were looking for a larger body of the same type of mineralization already known and placed much reliance on I.P. because the main deposit responded so well. The I.P. work yielded only weak responses in the claims surrounding the deposit. Several small geochemical (cold extractable copper) and magnetic anomalies were obtained which on trenching revealed minor copper mineralization.

The drilling prior to Kennco's work was orientated parallel and sub-parallel to the northwest strike of the main zone defined by Kennco after careful surface mapping and re-evaluation of the old work. Thus the previous drilling did not give a good cross-section of the zone and Kennco drilled hole #28 from the southwest side at 45° to intersect the best part at depths of 300-500 feet. The best grade obtained was 0.3%/100 feet. Pyrite was ubiquitous throughout averaging about 3% but exceeding this in some sections.

The I.P. coverage on the Krain property itself was pretty complete, and totalled 19½ line miles on lines 400 feet apart, extending places for 2,500 feet over the overlying volcanics. The survey was extended on to surrounding claims optioned for this purpose where a further 15 miles were completed. The I.P. unit used was one of the McPhar prototypes (variable frequency method) and much care was taken to standardize the instrument by making several traverses over the Bethlehem ore zones.

<u>Canex Drilling Results</u>

Canex concentrated solely on the known zone and drilled this on a regular grid pattern, a few holes penetrating to 1,500 feet below surface.

C.S.E. made a careful evaluation of the results, constructing contoured assay plans of levels at 50-foot intervals between the

5200 and 5500 levels. The maximum grade obtainable for this block between the 5200 and 5500 levels, which is essentially the upper 300 feet of the deposit, is 0.49% Cu. and 0.024% M_oS_2 with an average potential per level of 30,000 tons per vertical foot - i.e. the block referred to contains 9 million tons, including both primary and secondary sulphides. This calculation makes no allowance for dilution and the shape of the zone has been allowed to vary at each level - in practice it would not be mineable as defined.

The conclusion was reached that the potential of the main zone is not large enough to justify further drilling and the main hope lies in finding other zones along strike of greater size. The Kennco work seems to have eliminated this possibility, the only doubt now remaining being whether more up to date I.P. equipment would produce better results.

R. A. Dujardin

11th January, 1967
Toronto, Canada

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Primary sulphide minerals consist of chalcopyrite and pyrite with minor molybdenite and bornite. The secondary minerals are chrysocolla, malachite, native copper and cuprite. The NW portion of the deposit is partly overlain by Miocene volcanics which form remnants over the major part of the claim group.

In exploring the property Kennco were looking for a larger body of the same type of mineralization already known and placed much reliance on I.P. because the main deposit responded so well. The I.P. work yielded only weak responses in the claims surrounding the deposit. Several small geochemical (cold extractable copper) and magnetic anomalies were obtained which on trenching revealed minor copper mineralization.

The drilling prior to Kennco's work was orientated parallel and sub-parallel to the northwest strike of the main zone defined by Kennco after careful surface mapping and re-evaluation of the old work. Thus the previous drilling did not give a good cross-section of the zone and Kennco drilled hole #28 from the southwest side at 45^{o} to intersect the best part at depths of 300-500 feet. The best grade obtained was 0.3%/100 feet. Pyrite was ubiquitous throughout averaging about 3% but exceeding this in some sections.

The I.P. coverage on the Krain property itself was pretty complete, and totalled 19½ line miles on lines 400 feet apart, extending places for 2,500 feet over the overlying volcanics. The survey was extended on to surrounding claims optioned for this purpose where a further 15 miles were completed. The I.P. unit used was one of the McPhar prototypes (variable frequency method) and much care was taken to standardize the instrument by making several traverses over the Bethlehem ore zones.

<u>Canex Drilling Results</u>

Canex concentrated solely on the known zone and drilled this on a regular grid pattern, a few holes penetrating to 1,500 feet below surface.

C.S.E. made a careful evaluation of the results, constructing contoured assay plans of levels at 50-foot intervals between the

5200 and 5500 levels. The maximum grade obtainable for this block between the 5200 and 5500 levels, which is essentially the upper 300 feet of the deposit, is 0.49% Cu. and 0.024% M_oS_2 with an average potential per level of 30,000 tons per vertical foot - i.e. the block referred to contains 9 million tons, including both primary and secondary sulphides. This calculation makes no allowance for dilution and the shape of the zone has been allowed to vary at each level - in practice it would not be mineable as defined.

The conclusion was reached that the potential of the main zone is not large enough to justify further drilling and the main hope lies in finding other zones along strike of greater size. The Kennco work seems to have eliminated this possibility, the only doubt now remaining being whether more up to date I.P. equipment would produce better results.

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Toronto, Canada