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COPPER AND IRON RESOURCES, WHITEHORSE COPPER BELT, YUKON TERRITORY

(Report, 5 figures, Map 49-1962)

E. D. Kindle

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By

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COPPER AND IRON RESOURCES, WHITEHORSE COPPER BELT, YUKON TERRITORY

INTRODUCTION

This report describes both copper and copper-iron deposits in the Whitehorse Copper Belt. The writer commenced a study of copper occurrences throughout the Yukon and northern British Columbia in 1960 and the information in this paper is presented before preparation of the larger report in order to make it available sooner.

The Whitehorse Copper Belt (see GSC Map 49-1962) holds promise of being a future producer of both copper and iron. Copper is present in all of the 28 properties described, and iron, either as magnetite or specular hematite, occurs with the copper minerals in substantial amounts at the Arctic Chief, Best Chance, Big Chief, and Little Chief properties.

New discoveries are bound to be made soon. The known occurrences were all exposed by natural agencies along the west side of the copper belt, and an additional 10 miles of unexplored drift-covered favourable ground lies along this mineral belt. Another 15 miles of favourable contact-zone rocks, also drift covered, on the east side of the copper belt must also be considered as a future zone for through-the-drift exploration. Some of the magnetic anomalies that occur well within the Whitehorse granite stock may represent limestone blocks or horses caught up in the granite and converted in part to iron- and copper-enriched zones.

Both magnetite and specular hematite in this belt carry unusual amounts of gallium but an economical method for its recovery has not been worked out. Gallium is currently produced as a by product in the processing of bauxite. Electronic-grade gallium sells at $2.00 a gram (1 pound = 453.59 grams).

Historical Summary

The early history of copper mining in Yukon Territory is the history of the Whitehorse Copper Belt. According to McConnell (1909)[1] who visited the area in 1907 for the Geological Survey of

[1] Dates or names and dates in parentheses refer to publications listed in the Selected Bibliography.

Copper Production, Whitehorse Copper Belt

Mine	Years	Tons	Grade
Copper King	1900	9	46.4% copper
" "	1903	460	high-grade ore
" "	1907	100	" " "
" "	1915-1920	5,288	10% copper
Carlisle	1907	90	22% copper
"	1907-1917	910	25.5% copper
Pueblo	1906	700	5 1/2% copper
"	1912-1920	140,000	3.5% copper, 50% iron
Valerie	1903	40	18% copper, $5.00 a ton, gold
"	1907	? 100	"considerable high-grade ore"
Grafter	1907	2,000	6 to 8% copper, $3.00 a ton
"		11,450	6% copper; gold, and silver
Arctic Chief	1904	140	7.22% copper, 0.39 ounce gold a ton
" "	1907	83	5.37% copper, 49.5% iron, 0.18 ounce gold a ton
War Eagle	1907-1915	1,000	shipping grade
	Total	162,440	tons high-grade shipped

Canada the first copper discoveries were made there by miners on their way to Dawson in the summer of 1897. The first copper claim staked was the Copper King, by Jack McIntyre on July 6, 1898. The Anaconda, and Big Chief and Little Chief claims were staked later the same year and by late 1899 most of the other important claims, including the Pueblo, Best Chance, Arctic Chief, Grafter, Valerie, and War Eagle, had been discovered and staked. These properties are all on the west side of the northwesterly trending valley of Yukon River, in a zone 1 mile to 2 miles wide and 17 miles long. Most of them lie 1 mile to 3 miles west of the Alaska highway, but the most northerly prospect is on the south side of the highway 2 miles northwest of Whitehorse, at the north end of the belt.

In 1900 a shipment of 9 tons of rich bornite ore from the Copper King mine marked the first production from the district. Ore was mined at intervals over the next 15 years at seven different properties, but only high-grade copper ore was shipped; ore of milling grade was ignored. The table on page 2 presents a rough record of production during the active period of copper mining.

Aside from some drilling in 1927 by Richmond Yukon Company Limited at the Pueblo mine, little interest was shown in the copper mines during the period from 1920 to 1945. Noranda Mines Limited restaked some ground in 1946 and did a little drilling in 1947 and 1948. Imperial Mines and Metals Limited commenced exploration in 1956 with a drilling program at the Best Chance property. Early in 1961 this company held much of the favourable ground under a new name, New Imperial Mines, Limited. Diamond-drilling was begun at the Arctic Chief property early in 1963.

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GENERAL GEOLOGY

Triassic and Jurassic Strata

References: Wheeler (1961); McConnell(1909). (See Wheeler's report for a full account of the general geology of the Whitehorse District.)

Sedimentary rocks of Upper Triassic age, Lewes River Group, are the oldest rocks exposed along the copper belt. They consist largely of greywacke, arkose, limestone, quartzite, argillite, and slates. These rocks are all metamorphosed, the arkose has a granitic appearance, and massive beds of dark greywacke have the outward appearance of fine-grained diorite in some places. This dioritic aspect led McConnell(1909) to map these rocks under the name "porphyrites". Discontinuous beds of grey crystalline limestone occur at irregular intervals intercalated with the clastic sediments, and some thin beds of conglomerate are found. Beds of grey to white crystalline limestone that cap the succession range from 500 to 1,500 feet or more thick. One of the best exposures of this limestone member is in the mountain west of the North Star property where a thickness of about 1,400 feet is apparent. Two miles farther northwest the top beds of this Triassic limestone are overlain by thin-bedded quartzites of the overlying Laberge Group of Lower Jurassic age. The latter rocks south of the Copper Cliff property comprise conglomerates, quartzites, and slates. South of the Black and Brown Cub prospect the limestone passes into thinly laminated dark chert beds and quartzites, but the heavy drift cover conceals the greater part of the Jurassic succession.

Volcanic breccia and andesitic flows present in the lower part of the Lewes River Group in many parts of the Whitehorse district are apparently missing along the copper belt.

Intrusive Rocks

The Whitehorse Copper Belt granite stock is an oval-shaped northwesterly trending body, 20 miles long and up to 10 miles wide. It is an outlying mass of the Coast Range Intrusions from which it is separated by some 8 miles of intervening Jurassic and Triassic sedimentary and volcanic rocks. The dominant rock type is grey coarse-grained hornblende granite that ranges in composition through quartz monzonite to granodiorite and diorite. A few small bands of gabbro are caught up in the granite a mile southeast of the Copper Cliff prospect. The lower slopes of Golden Horn Mountain (east side) consist of a pink fresh-looking hornblende-biotite-oligoclase granodiorite.

Numerous dykes of porphyritic diorite, felsite, and aplite cut the hornblende granites near their contacts with older rocks.

Many of the ore deposits occur along the east side of a northwesterly trending belt of Triassic limestone and associated strata, 11 miles long and 1/2 mile wide (see GSC Map 49-1962) that are caught up as an elongated roof pendant in the granite. Metamorphism of the limestone in the vicinity of the granites varies. At irregular intervals the limestone was recrystallized and heavily charged with various contact-metamorphic minerals as well as copper sulphides and magnetite. The age of the granitic invasion is placed by Wheeler (1961) as between late Lower Cretaceous and early Upper Cretaceous.

Miles Canyon Basalt

The Miles Canyon basalts are the youngest rocks in the area. They are mostly thin vesicular flows, and individual flows are nearly all less than 150 feet thick. The total thickness of these rocks anywhere in the copper belt is probably not more than 400 feet. Much greater thicknesses are exhibited 20 miles southwest of MacCrea, north of Alligator Lake, where basaltic rocks outcrop between elevations of 5,000 and 6,300 feet.

Columnar jointing is the distinctive feature of the flows along Miles Canyon. The vertically radiating columnar joints in the upper flow below the footbridge suggests (Wheeler 1961, p. 86) that this part of the flow overlies a feeder. But the presence of granite outcroppings beneath the flows at the cauldron (granite seen by H.S. Bostock before the water level was raised by the Whitehorse Dam) discredits this theory. It seems probable that scattered masses of these lava flows originated from a number of different feeder vents throughout the district.

At the head of Miles Canyon, diamond-drilling has shown that the basaltic lavas are intercalated with sands, gravels, and peat layers, and the microfossils found indicate a Pleistocene age.

Folds and Faults

The Triassic and Jurassic sedimentary rocks are generally folded along northwesterly trending axes along the copper belt and the folds are invaded by granite and broken by faults (see GSC Map 49-1962). Most of the large faults strike northerly but a number of lesser faults have easterly strikes. Faulting has been a contributing factor in formation of skarn and mineral lodes at the Copper King, War Eagle, Pueblo, Valerie, Empress of India, and other mining properties.

The axial plane of the largest anticline along the belt runs northwesterly through a point 1/2 mile west of the Grafter mine, and the Spring Creek, Empress of India, Retribution, Best Chance, and Grafter mines occur on the easterly dipping limb of this anticline, at the contact of the limestone and granite. The limestone beds along this sector dip easterly at angles ranging from 20 to 60°. In many instances bedding in the limestone near the granite contact and in the skarn zones has been obliterated by recrystallization and flowage but this is not always the case. Recrystallization is most common in limestone horses completely surrounded by granite.

ECONOMIC GEOLOGY

Contact-Metamorphic Deposits

Most of the copper occurrences in the Whitehorse Copper Belt are classed as contact-metamorphic skarn deposits. They are found both in limestone of the Lewes River Group and in adjoining granitic rocks, mostly hornblende granites that invade the limestone. The contact zone between the limestone and granite is the favoured position. Skarn rock composed of lime silicates is prevalent in the contact zone and the copper sulphides occur in this altered rock which is enriched in silica, alumina, iron, and magnesium. Most of the skarn zones are characterized by an abundance of brown to red garnet, epidote, clinopyroxene, tremolite, wollastonite, magnetite, and specularite.

In some instances the skarn rock in the limestone is mineralized as much as 500 feet away from the contact, along fractured and faulted zones where mineral-bearing solutions from the granite had easy access to the host rock. Abrupt directional changes along limestone-granite contacts apparently favoured mineralization. An example is the right-angle bend in the contact at the north end of the Best Chance lode; or the presence of ore at the westerly extremity of a tongue of limestone on the Suburban claim. Two drift-covered lodes at the Arctic Chief are believed to lie in embayments in the limestone and the Big Chief lode is in an embayment in limestone.

Bornite and chalcopyrite are the principal economic copper minerals. Some chalcocite is found at the Best Chance and Spring Creek properties. The copper carbonates, malachite and azurite, occur in near-surface oxidized parts of most of the deposits. The copper silicate, chrysocolla, is found at the Keewenaw property. Minor native copper was encountered during early mining at the Pueblo mine.

There are two distinct classes of skarn orebodies as listed below and both classes are present at many of the mines.

1. Bornite and chalcopyrite associated with magnetite or magnetite and specular hematite. Large lenses of cupriferous magnetite occur at the Arctic Chief, Best Chance, Little Chief, and Big Chief mines. Cupriferous specular hematite is common at the Pueblo mine.

2. Bornite and chalcopyrite associated with silicate gangue minerals. These contact-metamorphic minerals include andradite (brown to red garnet), wollastonite, tremolite, actinolite, clinopyroxene, clinochlore, epidote, chlorite, serpentine, asbestos, calcite, and quartz. Small amounts of magnetite and in some cases specular hematite are also present in these deposits, and by either gradual or abrupt increase in the iron content, they grade into the magnetite-rich skarns of class 1. Some pyrite occurs with the copper sulphides, and pyrrhotite is found with pyrite at the Valerie mine.

The copper deposits contain only small amounts of gold, silver, and platinum, and preliminary tests show the presence of from 0.01 to 0.06 per cent gallium in the magnetite- and hematite-rich parts of the orebodies. Molybdenite and scheelite are present in small amounts of the deposits.

Chalcopyrite and bornite are commonly disseminated throughout both silicate- and iron-rich skarns. They are partly contemporaneous with the enclosing skarn but also occur as solid sulphide veins, veinlets, plums, lenses, and rich pockets that replace the skarn. The existence of these rich concentrations made it possible for the early miners to hand pick high-grade ore for direct shipment to the smelter. As these rich pockets of ore are of irregular outline and scattered there is a possibility that some orebodies may contain higher grade ore than is suggested by diamond-drill core sections.

Porphyry Copper Deposits

The term "porphyry copper deposits" is widely used in describing copper mineralization that is superimposed on any porphyritic intrusive rock such as quartz monzonite porphyry, granodiorite, or granite. In unglaciated areas these deposits normally have a near-surface enriched zone due to supergene enrichment, but glaciation in southern Yukon has in most cases scoured off enriched parts of all lode deposits.

In the Whitehorse Copper Belt only the Keewenaw and Reservoir Lake occurrences are classified as 'porphyry' type. In both places bornite and chalcopyrite occur in grey hornblende granite along poorly defined sheared zones or as disseminations in shattered

or fractured zones of irregular outline. This type of deposit is normally of low grade but is of interest in view of large tonnage possibilities.

In Arizona, porphyry-type ores grading 0.7 per cent copper are mined and rock running only 0.4 per cent copper is milled where its removal is required during mining operations.

Vein Deposits

Quartz veins containing copper sulphides are rare in the Whitehorse Copper Belt. A quartz-calcite vein containing pyrite and chalcopyrite occurs along a fault zone in the Empress of India mine. It ranges from 2 to 5 feet wide and cuts copper-bearing skarn rock. Another mineralized quartz vein, 3 feet wide, cuts skarn rock at the Copper King mine. Quartz veins containing bornite and chalcopyrite occur in hornblende granite north of the Pueblo mine and on the Scheelite claim. Some scheelite is present in the vein quartz at these properties.

A very strong quartz vein that outcrops a mile east of the granite stock, on the southwest flank of Canyon Mountain (see description of Golconda property) carries very little chalcopyrite but its existence is evidence that copper mineralization took place near the eastern contact zone.

McConnell (1909, p. 35) reported the presence of a silver-rich vein of tetrahedrite in a short drift from a winze, 50 feet below the main adit level in the Arctic Chief mine. He said: "The vein varies in width from a few inches, to a couple of feet, and had been followed 40 feet at the time of my visit. It does not appear on the surface and this mineral is not known elsewhere in the camp."

Sulphide veins of chalcopyrite and bornite that form rich ore shoots in the skarn rocks are the most important veins in the camp. They are described above under "Contact-metamorphic Deposits".

Geochemistry of Minor Elements

Gallium is concentrated in unusually large amounts in the magnetite- and hematite-rich parts of the Whitehorse Copper Belt deposits according to the evidence of tests made on representative samples. The analyses and assays listed below indicate a fairly constant gallium content of from 0.03 to 0.06 per cent. One sample from the Best Chance property showed no gallium but a check sample showed it to be present. An increase of gallium with increase of copper

content is not apparent, so that the gallium is probably locked in with the iron. In most of the samples tested for these elements, cobalt and nickel are present in about the same proportions as gallium. The magnetite and hematite also carry small amounts of vanadium, generally less than 0.009 per cent.

The gold content is low; highest assays of the samples tested are 0.135 ounce gold a ton on a sample from the north shaft, War Eagle property, and 0.065 ounce a ton on a typical ore specimen from the Arctic Chief. Silver is also present, generally a little more or less than an ounce a ton. Where copper is plentiful, silver values are always higher. The samples from the Best Chance, Arctic Chief, Valerie, Big Chief, and Little Chief properties all contained 0.002 ounce palladium and 0.004 ounce platinum per ton.

Assays of Iron-rich Samples, Whitehorse Copper Belt

Property	Iron (%)	Copper (%)	Gallium (%)	Gold (oz a ton)	Platinum and Palladium (oz a ton)
War Eagle	50.2	0.84	?	0.135	
Pueblo	52.1	0.41	0.04	0.005	
Best Chance	65.1	0.18	0.03	0.005	0.006
Arctic Chief	56.5	1.52	0.06	0.065	
Suburban	35.4	0.89	0.03	0.03	0.006
Verona	49.7	0.20	0.04	0.005	
Big Chief	55.4	0.56	0.03	0.001	0.006
Big Chief	58.1	0.17	0.04	0.005	0.006
Little Chief	59.1	2.38	0.06	0.025	0.006

(Assays by Mineral Sciences Division, Mines Branch, Ottawa.)

The spectrographic analyses listed below indicate the presence of between 0.1 and 1 per cent of manganese and equivalent amounts of titanium in some of the ore samples although some contain less. A sample of magnetite with minor hematite and chalcopyrite from the north War Eagle shaft held between 0.01 and 0.1 per cent of both yttrium and ytterbium. Copper ores associated with silicate gangue contain minor chromium, strontium, and zinc, and in two cases bismuth.

Spectrographic Analyses of Ores, Whitehorse Copper Belt

Property	Per cent Concentration of Elements				
	100-10%	10-1%	1-0.1%	0.1-.01%	0.01-0.001%
Copper King (garnet skarn)	Fe, Si, Ca	Al, Cu, Mg	Mn, Ti	Ag, Bi, Ga, V	Ba, Cr, Sr
War Eagle (magnetite-hematite-rich sample)	Fe	Ca, Mg, Si, Cu	Al, Ti	Ag, B?, Ba, Ga, Mn, V, Sr, Zn, Y, Yb	Co, Ni
Best Chance (magnetite sample)	Fe	Ca, Mg, Si	Al, Mn, Cu	Co, Ga, Ti	Ba, V, Ni
Pueblo (specular hematite)	Fe	Al, Mg, Si	Cu, Ti	Ca, Ga, Mn, V	Ag, Ba, Co?, Ni
Arctic Chief (magnetite-rich ore)	Fe, Mg	Ca, Si	Al, Mn	Ba, Co, Cu, Ga, Ni, Ti, V	Sr
Valerie (high pyrite, pyrrhotite)	Fe	Cu, Mg, Si	Al, Ca, Co, Ni	Ag, Mn, Ti, Zn?	Ba, Ga?, V
Little Chief (magnetite bornite)	Fe, Mg	Al, Cu, Si	Mn	Ba, Ca, Co, Ga, Ti, V, Zn?	Ag, Ni
Big Chief (magnetite-rich)	Fe	Ca, Mg, Si	Al, Cu, Mn, Ti	Co, Ga	Ba, Cr, Ni, V
Suburban (magnetite, garnet-rich)	Fe	Ca, Mg, Si	Al, Cu, Mn, V, Ni	Co, Ga, Ti, Zn?	Ag, Ba, Cr
Verona (magnetite-rich)	Fe	Al, Ca, Mg, Si	Mn, Ti	Co, Cu, Ga, Zn?	Ba, Cr, Ni, V
Zircon (garnet skarn)	Ca, Mg, Si	Cu, Al, Fe	Bi, Mn, Ti	Ag, Ba, Cr, Ni, Pb, Zn?	Co, V, Sr

(Semi-quantitative spectrographic analyses by Spectrographic Laboratory, Geological Survey of Canada.)

Molybdenite is present in some parts of the silicate-rich copper lodes and skarn samples holding more than 1 per cent molybdenite are present on the waste heaps at the Copper King, Grafter, and Cowley Creek mines. Scheelite occurs sparingly in a few places at these same mines and is generally associated with vein quartz. Scheelite and bornite occur together in a quartz vein in the granite (described under the "Pueblo Tungsten" and "Scheelite" properties).

Prospecting Possibilities

Many of the magnetic anomalies shown on Geophysics Maps 1413G and 1341G (released by Geological Survey of Canada, January 1963) may owe their presence to concentrations of magnetite in skarn deposits; this implies the possible presence of copper deposits, as magnetite and copper sulphides occur together in the Whitehorse Copper Belt.

The absence of magnetic anomalies along drift-covered contact zones does not imply absence of copper orebodies as most of the known deposits contain insufficient magnetite to produce magnetic anomalies.

All the ore shipped from the Whitehorse Copper Belt was mined from contact-metamorphic deposits, and new discoveries will probably be mostly of this class of deposit. Nevertheless some consideration should be given to the possible occurrence of porphyry-type copper deposits in the granitic rocks and possible copper-bearing vein deposits, either in the granite or in intruded Triassic and Jurassic sedimentary rocks.

Faulted ground in the vicinity of limestone and granite contacts is considered as particularly attractive for prospecting.

DESCRIPTIONS OF MINERAL DEPOSITS

Properties Described in this Report

(See Map 49-1962)

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Arctic Chief	33
Best Chance	29
Big Chief	36
Black and Brown Cub	45
Carlisle	23
Copper Cliff	42
Copper King	20
Cowley Creek	45
Empress of India	28
Golconda, Florence M., Concord, and Mohawk	38
Grafter mine	30
Keewenaw	42
Little Chief	36
North Star	41
Pass Lake	41
Polar	35
Pueblo mine	25
Pueblo Tungsten	27
Railway prospect	44
Rabbit-foot	15
Reservoir Lake	24
Retribution	29
Scheelite	24
Spring Creek	27
Suburban	34
Sue	45
Valerie	39
Verona	32
War Eagle	17

Anaconda (1)[1]

(Zircon)

(Lat. 60°45', Long. 135°09')

References: McConnell (1909, p. 50); MacLean (1914, p. 164).

The Anaconda property is on the west side of the Alaska Highway at mile 919.7, about 2 miles northwest of Whitehorse. It was first staked in 1898 by W.A. Puckett and was restaked recently under the name "Zircon Group".

The property is at the north end of the copper belt and the workings are in two northeasterly trending limestone and skarn bands that are invaded by hornblende granite (see Figure 1).

A garnet-rich skarn zone 6 feet wide is exposed 125 feet west of the Alaska Highway at mile 919.7, near the base of a limestone cliff at the site of the former adit (now caved). The zone strikes westerly and dips vertically. The skarn is stained with azurite and malachite. A channel sample 4 feet long, cut across the richest part of the skarn zone, assayed: gold, 0.01 ounce a ton; copper, 6.39 per cent; tungsten, none.

At the top of the limestone bluff 150 feet west of the caved adit, a skarn zone 3 feet wide is exposed in a small open-cut. It strikes northeasterly and is drift covered west of the pit. The skarn holds considerable bornite, and a 12-inch-wide zone on the north side of the cut is well mineralized. A typical sample of the best grade of ore from this cut assayed: gold, 0.04 ounce a ton; silver, 1.99 ounces a ton; copper, 7.05 per cent; nickel, 0.04 per cent; chromium, 0.01 per cent; bismuth, 0.08 per cent; manganese, 0.17 per cent.

A skarn band 12 feet wide, that lies 120 feet farther northwest, is bounded on the north by a rusty-weathering quartzite band 2 feet thick. The skarn and enclosing limestone strike northeast towards a granite dyke of similar orientation. The altered rock contains scattered grains of bornite over a width of 12 feet.

Another skarn zone is exposed 400 feet southwest of the caved adit, beside the old mine road. At a small open-cut 25 feet west of the road, a garnet-rich skarn zone contains 5 per cent or more of magnetite and a little bornite. In an 8-by-7-foot rock cut in a wide

---

[1] Number in parentheses appears on Map 49-1962 at the location of the property.

skarn zone 50 feet farther west, a wollastonite-rich section 2 feet wide carries from 1 to 2 per cent of bornite.

The Anaconda shafts, 900 feet northwest of the caved adit, are sunk on a wollastonite-rich skarn zone that is mineralized with bornite and lesser amounts of chalcopyrite. These sulphides are present for the most part as fine veinlets that lie parallel with the radiating crystal structure of the enclosing wollastonite crystals. The shafts are 100 feet apart and lie 50 feet southeast of a mass of hornblende granite. The No. 1 or more northeasterly shaft is probably 50 feet deep, judging from the waste heap, and the other is at least 30 feet deep. McConnell(1909, p. 51) described this orebody as 12 feet wide and stated that a shaft sunk on the lens to a depth of 30 feet followed copper ore to the bottom. A representative sample of ore from the dump assayed: gold, 0.005 ounce a ton; copper, 0.90 per cent; tungsten, none.

Some of the wollastonite is fluorescent under ultraviolet light and can be confused with scheelite, of which there is a small amount scattered over the dump.

Rabbit-foot (2)

(Lat. 60°45', Long. 135°09')

Reference: McConnell(1909, p. 52).

This claim was originally staked in July 1899 by Ole Dickson. It was recently held under the name "Bornite claim". The property is 2 miles northwest of Whitehorse and adjoins the Anaconda on the west. The workings are 1,200 feet west of the caved Anaconda adit.

A copper-bearing skarn zone, 100 feet long and up to 30 feet wide, occurs in limestone about 40 feet north of the granite contact (see Figure 1). The main Rabbit-foot shaft is down 50 feet on the skarn zone, and No. 2 shaft, 40 feet to the northeast, is 20 feet deep. Bornite is visible in the east wall of No. 2 shaft as plum-like masses 1 to 1 1/2 inches in diameter, connected by branching stringers and veinlets of bornite, across a width of 7 feet of skarn rock. The ore dump at No. 1 shaft is of silicate skarn rock, mostly well mineralized with bornite. The most prominent secondary minerals are wollastonite, epidote, garnet, and augite. Small grains of a fluorescent mineral are present in some of the rock and disseminated molybdenite was noted in some epidote-rich rock fragments. A specimen of the latter rock assayed: molybdenum, 1.04 per cent; tungsten, none; gold, 0.005 ounce

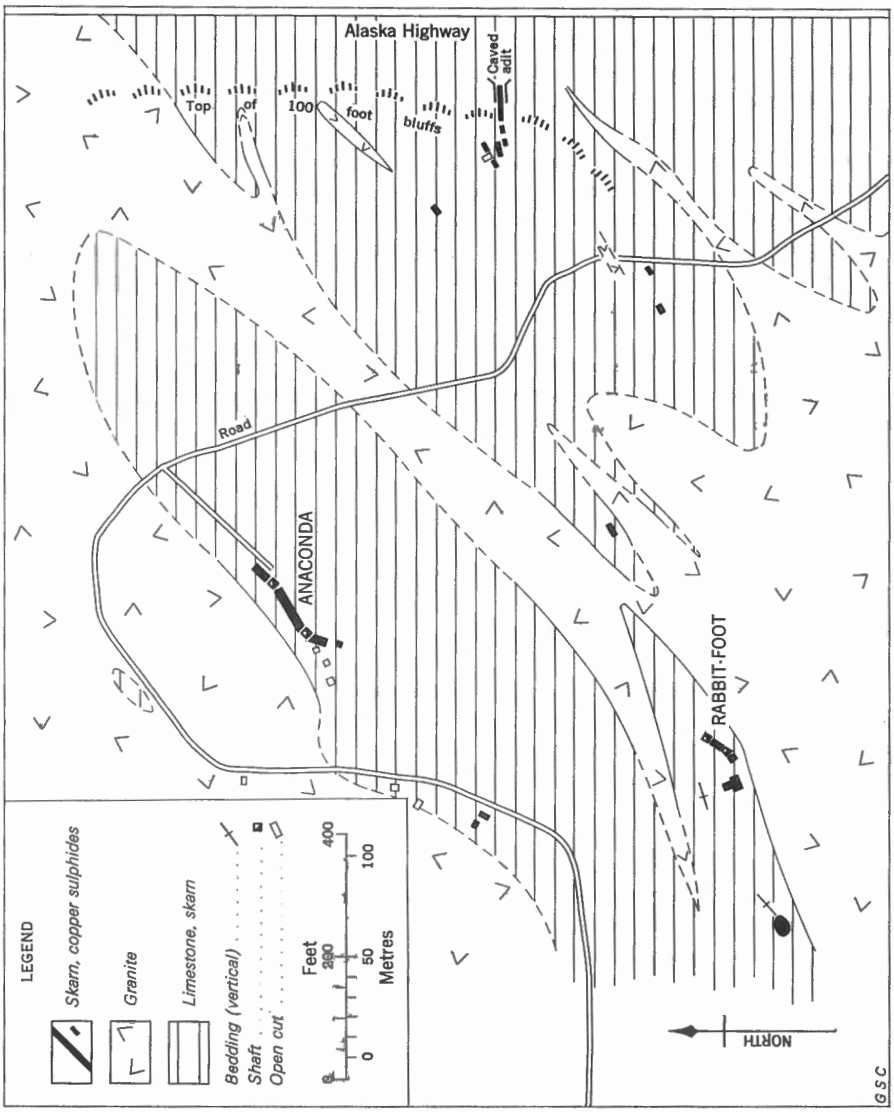

Figure 1. Plan of Anaconda and Rabbit-Foot properties

a ton. A typical sample of the rock from the dump assayed: copper, 0.70 per cent; tungsten, none; gold, 0.005 ounce a ton.

A skarn zone 30 feet wide exposed in a rock cut 50 feet west of No. 1 shaft, contains disseminated bornite throughout, probably a little more than 1 per cent. The rock exposures west of this open-cut are concealed by drift.

Both bornite and chalcopyrite impregnate skarn rock exposed for 30 feet in an area of low ground 400 feet northeast of No. 1 shaft. The exposed rock averages more than 1 per cent copper.

War Eagle (3)

(Lat. 60°44', Long. 135°10')

References: McConnell (1909, p. 52); Cockfield (1928, p. 17A); Wheeler (1961, p. 140).

The War Eagle is 3 miles northwest of Whitehorse, 1 mile west of the Copper King, and 1 mile north of the Pueblo mine. It was staked originally by S. McGee in July 1899. Messrs. Coldwell, Payntz, Lucas, and Kesler took over the property in 1907 and did considerable development work. Cockfield (1928) estimated that more than 1,000 tons of ore was shipped.

The mine workings are on the east slope of a northerly trending terrace 100 feet above the drift-filled valley bottom, at the head of the west fork of Porter Creek. The principal mineral showing is 150 feet long and 50 feet wide. It is a band of skarn and silicified limestone spotted with small brown garnets and with grains, bunches, and veinlets of bornite and lesser amounts of associated chalcopyrite. The skarn and limestone strike N 10° W and dip 70° SW. Numbers of small fractures that traverse the lode have a similar strike and dip. A general sample collected for 45 feet across the lode by McConnell (1909, p. 53) averaged 2.71 per cent copper. An adit driven west in 1907 to cut the lode at a depth of 23 feet is reported to have penetrated 76 feet of granite before reaching the orebody. The section along the drift showed two tremolite-garnet bands, one 14 feet and the other 10 feet wide, well mineralized with bornite and chalcopyrite, but separated by 20 feet of lower-grade material. Cockfield (1928, p. 17A) stated that the inclined shaft sunk on the east side of the lode is about 70 feet deep with levels at 13, 33, and 50 feet, and with a crosscut to the west at the bottom of the shaft. Cockfield saw ore streaks on the first level that were 18 and 25 feet wide, with a low-grade streak 12 feet wide. He found the eastern streak of ore south of the main shaft stoped out from the third level up, and north of the shaft both streaks were stoped to some extent on the first level but were untouched below.

An opening 40 feet long, 10 feet deep, and 5 feet wide is cut along another orebody in skarn rock between 300 and 340 feet south of the main shaft, on the southerly strike of the main orebody. In the north face of the cut there is a zone 2 to 3 feet wide of white bladed wollastonite crystals that occur along a bedding fault that strikes N 10°W and dips 70°W. The wollastonite is replaced by 2 to 3 per cent of bornite. The limestone on the foot-wall is silicified with a light development of brown garnets and is cut by veinlets of quartz, epidote, bornite, and chalcopyrite.

A cross-trench 200 feet farther south and 50 feet westerly exposes 15 feet of skarn rock, of which 3 feet carries between 0.5 and 1.0 per cent of bornite. This zone is localized by minor faults that strike northerly towards the orebody at the inclined shaft.

At a small outcrop 230 feet west of the main shaft, a bedded vein 8 inches wide holds more than 5 per cent of bornite with a little chalcopyrite. West of the outcrop there is heavy drift cover for 600 feet, then a ridge of quartzite, argillite, and greywacke with a few thin limestone beds.

The North shaft, 500 feet north of the inclined (main) shaft, is 70 feet deep. It was sunk in a drift-covered area and evidently penetrates granite, judging from the high percentage of granite blocks on the waste dump. Some copper-bearing magnetite ore is scattered about the collar of the shaft. The magnetite is coarsely crystalline and is replaced by from 1 to 3 per cent of chalcopyrite and bornite.

Small veinlets of chalcopyrite and bornite occur in limestone and skarn in an open-cut 200 feet southwest of the North shaft. The veinlets and seams are from 1 inch to 3 inches apart over a width of 5 feet. They are vertical and strike northeasterly towards the granite contact. Bornite and chalcopyrite were also seen in skarn rocks about 300 feet northwest of the North shaft.

The assays of samples 1, 2, and 3, shown in the table on page 19 are from Cockfield's report (1928, p. 17Â). Samples 4, 5, and 6 were collected by the writer, and sample 7 by McConnell (1909, p. 53).

Sample No.	Vein Width (feet)	War Eagle Mine, Locality	Au (oz/ton)	Ag (oz/ton)	Cu (%)	Fe (%)	Ga (%)
1	18	East streak, No. 2 level		1.31	1.53		
2	25	West streak, No. 2 level		2.95	9.34		
3	6	Cut along hanging wall, No. 2 level		2.40	1.65		
4	grab	Collar of North shaft	0.135	0.32	0.84	50.2	.01-.10
5	grab	Ore piled near main shaft	0.02	1.43	3.82		
6	grab	Ore piled at cut 340' south of shaft	0.025	3.39	8.05		
7	45	Surface cut across main lode			2.71		

A spectroscopic analysis of the iron-rich sample (No. 4) showed, in addition to gallium, the presence of (.01 to .10 per cent) yttrium, ytterbium, vanadium and strontium.

Copper King (4)

(Lat. 60°44', Long. 135°08')

Reference: McConnell(1909, p. 47).

The Copper King mine is 2 miles northwest of Whitehorse on the Fish Lake road. The property was staked by Jack McIntyre, July 6, 1898, and is credited as the first staking along the Whitehorse Copper Belt.

Nine tons of rich bornite ore shipped from this claim in 1900 was the first copper shipment from the district, and according to McConnellit yielded 46.4 per cent copper. A second shipment of 460 tons of high-grade ore was made in 1903. McConnell stated that a considerable tonnage was obtained during the season of 1907 and company records indicate that 5,288 tons of ore was shipped between 1915 and 1920. Total shipments were probably close to 6,000 tons.

An adit driven easterly from the valley of McIntyre Creek (see Figure 2) for a distance of 230 feet was the principal working at the time of McConnell's visit in 1907. There was also an inclined shaft 130 feet long with drifts at the 63-foot and 91-foot levels. The drift on the latter was 65 feet long in an easterly direction. The drift on the 63 level is 60 feet long and can still be reached via a 40-foot crosscut from the inclined shaft. The latter is at the south end of an open (at surface) stope that measures 45 feet long, 40 feet deep and up to 15 feet wide. Another shaft 65 feet deep is 230 feet northeast of the open stope and a third shaft 40 feet deep was sunk 200 feet south of the open stope.

The Copper King deposits are at the southwest end of a tongue-like body of Triassic limestone that is believed to extend south from the area of sedimentary rocks north of the Alaska Highway, into the copper belt hornblende granite stock. Some argillite and quartzite beds are interbedded with the limestone and, in the vicinity of the workings, these rocks strike easterly and dip from 45 to 75°N. Most exposures of the limestone are metamorphosed and altered in varying degrees to garnetiferous skarn rock and the copper deposits are in this altered rock.

According to McConnell, most of the ore mined consisted of bornite and chalcopyrite distributed through a gangue of secondary minerals consisting mainly of tremolite, augite, and garnet. Tremolite was the most important gangue mineral and the richest ore concentrations were in it; where the gangue was mostly garnet or augite and garnet, the copper sulphides were more scattered. Vein quartz, calcite, chalcedony veinlets, and epidote are also present in

the gangue. Molybdenite occurs sparingly and scheelite is present in small amounts associated with quartz stringers. Small amounts of magnetite are associated with red garnet rock on the dump at No. 2 shaft.

No. 2 shaft, 200 feet north of the open stope, is sunk on a red garnet skarn zone that ranges from 2 to 8 feet wide. It strikes west and dips 70°N. The zone lies parallel with the bedding of enclosing limestone and quartzite beds and is exposed for 175 feet west from the shaft. The garnetiferous rock is sparsely mineralized with bornite. Near the rock bluffs 150 feet west of the shaft, the foot-wall rocks are partly altered to skarn over a width of 30 feet south of the main vein and are spotted with small amounts of malachite. The red garnet zone lies along a fault zone that shows evidence of small post-ore movements.

The former No. 3 shaft is now marked by an open-pit 30 feet deep, 20 feet wide, and 30 feet long. The white limestone walls of the pit are marked by irregular green-stained skarn zones that contain from 1 to 3 per cent of bornite. The ore shoot had an easterly strike and its dip was 70°N parallel with the bedding of the limestone in the vicinity. A number of small intersecting fault zones that mark the walls of the pit may have been instrumental in localizing the mineralization.

Forty feet west of the open-pit, an open rock cut 25 feet long and 10 feet wide exposes a vein-lode that strikes northwest and dips 55°SW. The vein-lode consists of quartz veins, quartz stringers, and skarn, and carries disseminated bornite and a sprinkling of scheelite over a width of 3 feet. A parallel vein 4 inches wide is exposed on the cliff face 8 feet above and carries about 30 per cent bornite. It dips towards the granite which outcrops 25 feet southwest.

Irregular bornite replacements of skarn rock are exposed in a rock cut 125 feet southwest of the 30-foot-deep pit. Skarn, formed largely of brown garnet and epidote with some quartz stringers and chalcedony veinlets, carries a little bornite, molybdenite, and scheelite. This mineralized zone is 20 feet east of the granite contact which is believed to swing easterly less than 100 feet farther south in an area of heavy drift cover. A typical sample of the mineralized skarn from the rock cut assayed: gold, 0.005 ounce a ton; silver, 0.44 ounce a ton; copper, 1.47 per cent; molybdenum, 0.21 per cent.

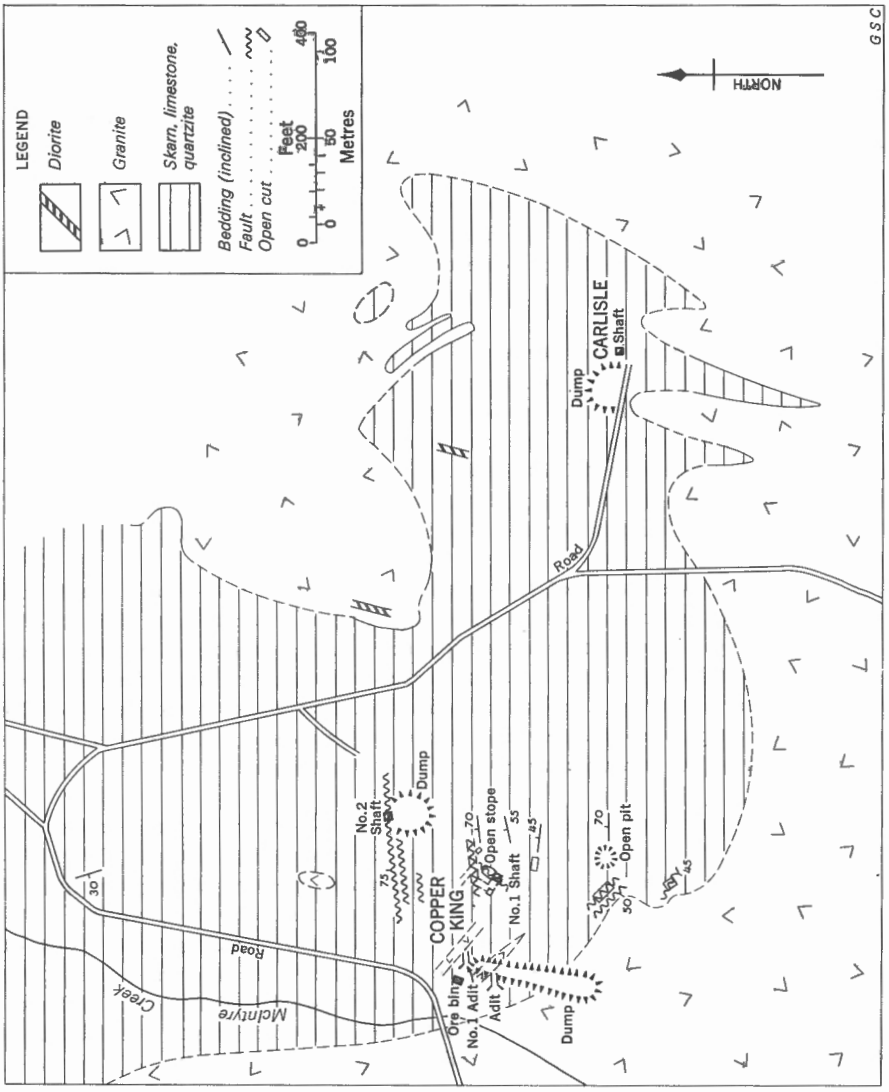

Figure 2. Plan of Copper King and Carlisle properties

Carlisle (5)

(Lat. 60°44', Long. 135°08')

References: McConnell (1909, p. 47); Cockfield (1928, p. 16A); McClelland (1951, p. 79).

The Carlisle mine is 2 miles northwest of Whitehorse and 1,000 feet east of the Copper King mine workings (see Figure 2). The property was originally owned by the Yukon Pueblo Mines Company which worked it in the 1901 to 1910 period. The Richmond Yukon Company held the ground in 1927.

The workings consist of a vertical shaft described by McConnell (1909) as 50 feet deep, from the bottom of which is an incline 87 feet long. At the 50-foot level a short crosscut 12 feet long to the north encountered a small lens of rich ore. This was drifted on for 50 feet, and 90 tons of ore, reported to average 22 per cent copper, was mined. The ore was principally bornite with some chalcopyrite in a tremolite-rich gangue. Cockfield (1928) stated that an orebody on the 134-foot level of the mine encountered an ore shoot 90 feet long and up to 20 feet wide. This shoot ended upwards on the second or 98-foot level and was pierced by diamond-drills below the 134 level. The east drift and south crosscut of the third level terminate in granite. McClelland (1951) stated that the mine produced 1,000 tons of ore with a grade of 25.5 per cent copper and 4.92 ounces of silver a ton.

The mine occurs in an irregularly shaped roof pendant of limestone and skarn, some 600 feet in diameter, enclosed on the north, east, and south by hornblende granite. On the west the roof pendant joins with the much larger limestone tongue that holds the Copper King deposits. The contact zones on this property are all marked by an intense alteration of the limestone to brown garnet and epidote. The depth of mineralization is probably dependent in large part on the depth to which the roof pendant penetrates down into the granite.

The writer tested the dump area with the ultraviolet lamp and found a little white scheelite present in quartz-rich ore specimens, in silicified granite, and in siliceous skarn. A quartz-rich specimen from the north side of the dump gave on assay of gold, 0.005 ounce a ton, and tungsten, 0.75 per cent WO_3. A typical sample of copper ore collected from the dump assayed gold, 0.01 ounce a ton, and copper, 3.58 per cent.

Scheelite (6)

(Lat. 60°44', Long. 135°10')

The Scheelite group is on the Fish Lake road 1.3 miles southwest of the Alaska Highway and 3 miles west of Whitehorse. Clem Eminger is owner and is the original discoverer of scheelite on this property and on the adjoining Pueblo 54 claim.

A pegmatitic quartz vein in hornblende granite carries a little copper, tungsten, and molybdenum. The vein is roughly 100 feet long, and 4 feet wide at a midway trench. It strikes a little south of east and the dip is vertical. On the east face of the trench, white scheelite forms more than 5 per cent of the vein matter in pockets up to a foot in diameter. In one pocket some scheelite is intergrown with inch-wide rosettes of molybdenum. This vein is drift covered a short way east of the trench and pinches out on the west, at a power line that runs north along the boundary between the Pueblo 54 claim and the Scheelite No. 2 claim.

Two other scheelite-bearing veins that occur on the Pueblo ground to the west are described under the heading "Pueblo Tungsten". The three pegmatitic veins together form part of an easterly trending arc 400 feet long.

On the west side of Fish Lake road, 300 feet east of the last-mentioned trench, is a granite boulder 10 feet long and 6 feet thick. A 4-inch-wide pegmatite vein that crosses the boulder holds considerable scheelite.

A chip sample collected across the vein in the trench, assayed: gold, 0.015 ounce a ton; copper, 1.70 per cent; tungsten, 0.38 per cent.

Reservoir Lake (7)

(Lat. 60°43', Long. 135°10')

Bornite occurs in hornblende granite on the hill 500 feet southeast of the outlet of Reservoir Lake, 1/2 mile east of the Pueblo mine. The bornite is in very thin veinlets along irregular cracks in the granite and is partly altered to malachite in the surface exposures. Except for some silicification and development of epidote along the fractures the granite looks generally fresh. Small scattered zones of the green-stained granite occur over an area about 150 feet in diameter. One of the mineralized zones contains about 1 per cent bornite and malachite over a width of 10 feet.

A pegmatite dyke 75 feet long and up to 2 feet wide dips southerly into the hillside just east of the copper-bearing granite. Geophysics Paper 1413 (Geol. Surv. Can., 1962b) shows a magnetic high along the east side of Reservoir Lake.

Pueblo Mine (8)

(Lat. 60°43', Long. 135°10')

References: McConnell(1909, p. 44); MacLean (1914, p. 160); Cockfield (1928, pp. 14-18); Wheeler (1961, p. 139).

The Pueblo mine is 3 miles west of Whitehorse and 2 miles southwest of the Alaska Highway, on the Fish Lake road. Porter Creek flows northeasterly across the Pueblo claim.

The property was staked in July 1899 by H.E. Porter, and soon passed into the hands of the Whitehorse Copper Company. The British America Corporation did some of the earliest work and in 1906 the Yukon Pueblo Mining Company of Spokane, Washington, took over and began exploration of the orebody. When visited by MacLean in 1912, the Atlas Mining Company of Chicago associated with Messrs. Close Brothers of London, England, were developing the property and had mined the main surface showing by open-cut to a depth of 20 to 30 feet. The shaft was reported to be down 200 feet and still in ore.

McConnell (1909) reported that smelter returns from a shipment of 700 tons of ore, taken from different parts of the lode in 1907, gave 5 1/2 per cent copper and 1 1/4 ounces silver per ton. Occasional assays for gold showed values of $1.00 to $2.00 per ton. During the season of 1912 and up to September 30 (MacLean, 1914), about 25,000 tons of ore had been shipped by Atlas Mining Company, and another 5,000 tons was to be shipped by the end of the year. Cockfield (1928) stated that the Pueblo mine produced 140,000 tons of ore before being shut down. The Richmond Yukon Company held the mine in 1927 and drilled some holes west of the old workings. These intersected some new ore at depths varying from 250 to 300 feet. North of the old workings, drilling indicated a northeasterly trending orebody that has a silicate gangue in contrast to the main hematite-rich lode.

The Pueblo orebodies occur in grey crystalline limestone intruded by grey hornblende granite, and are typical contact-metamorphic deposits. The limestone is a northerly trending unit that may be as much as 800 feet wide in the vicinity of the main workings, but 400 feet north from the main shaft the limestone narrows and changes to a northeasterly course along the narrow valley of Porter

Creek. Limestone is in contact with the granite at intervals along the steep walls of this narrow, drift-covered valley bottom and suggests the presence of a limestone band up to 200 feet wide. Drift covers the bedrock for more than 2 miles south from the mine.

A deep water-filled open pit 125 feet long from north to south and 75 feet wide marks the site of former mining. A band of cupriferous hematite 60 feet wide exposed at the south end of the pit is stripped of drift cover for 50 feet. This ore is a hematite replacement of limestone along a fault zone that strikes north through the open pit and strikes southeasterly from the south end of the pit. Another ore zone, 20 feet wide, strikes easterly in limestone from the east side of the open pit along an easterly striking fault zone. The main body of ore that occupied the open pit lay at the junction of these intersecting faults. The contact zones of limestone and granite in the vicinity of these faults to the east and southeast of the pit may have also been favourable places for ore deposition.

Discarded blocks and small heaps of hematite abound on the property. Most of the hematite is specular and grades in texture from a fine compact variety to coarsely crystalline bands of bladed, glistening specularite crystals, more than 1 inch long. Most of the fine hematite carries carbonates of copper, malachite and azurite. Chalcopyrite and bornite occur in hematite along the south rim of the open pit. McConnell (1909) found the silicate of copper, chrysocolla in silicified weathered parts of the ore outcrop, and cuprite, the red oxide, in veinlets and small masses through limited parts of the lode.

According to MacLean (1914) the values recovered from the top 20 to 30 feet of ore were from the carbonate ores or from oxides such as cuprite that replaced the original, primary sulphides throughout the oxidized zone.

Waste rock on the mine dump is mostly grey granite and limestone but some of the waste is skarn formed largely of tremolite, epidote, and garnet with small amounts of copper sulphides.

A vein of specular hematite, 5 feet wide, exposed on the roadside 500 feet north of the shaft, is localized in a small body of limestone adjoining a northerly-striking fault.

A 10-foot-long chip sample collected across the best part of the mineralized zone at the south end of the Pueblo open-pit, assayed: gold, .005 ounce a ton; copper, 4.90 per cent; iron, 52.1 per cent; gallium, 0.03 per cent. Another sample collected from the dump and consisting largely of specular hematite with minor magnetite, assayed: gold, 0.005 ounce a ton; copper, 0.41 per cent; iron, 62.6 per cent; gallium, 0.04 per cent.

Pueblo Tungsten (8)

(Lat. 60°44', Long. 135°10')

Scheelite occurs in a quartz vein in granite in the northeast part of the Pueblo 54 claim. The vein is lenticular, 110 feet long and 3 feet wide at its widest point in a 6-by-8-foot open-cut. It occurs along a small fault that strikes a little north of east and dips vertically. The quartz carries from 1 to 3 per cent bornite and 1 to 3 per cent scheelite. A second quartz lens lies 125 feet farther east in the granite, about 75 feet west of the power line that marks the east boundary of the claim. It is a pegmatitic quartz lens, 35 feet long and 5 feet wide at its centre. The quartz is copper stained and carries 1 to 2 per cent of scheelite in irregular streaks and concentrations a few inches wide and a foot or so long. (An additional tungsten-bearing quartz vein that occurs 100 feet farther east is described under "Scheelite" group.)

A 3-foot channel sample from the vein at the open-cut, assayed: gold, 0.0075 ounce a ton; copper, 2.04 per cent; tungsten, 2.96 per cent.

Spring Creek (9)

(Lat. 60°40', Long. 135°07')

Reference: McConnell(1909, p. 43).

This claim is 3 miles southwest of Whitehorse and adjoins the Empress of India on the north.

The main contact of the limestone and granite trends northwesterly across the property and is well exposed in rock bluffs on the east side of McIntyre Creek. The contact is marked by a skarn zone that in places is more than 100 feet wide. The skarn is spotted with azurite and malachite but contains for the most part less than 2 per cent of chalcopyrite and bornite. A small lens of rich ore was opened up by a shallow shaft, said by McConnell to be 43 feet deep, in 1907. This is now mostly filled by caving but pockets of ore are still visible in the walls. These carry chalcocite in addition to bornite and chalcopyrite. There is a strong development of tremolite in addition to garnet and epidote in the vicinity of the shaft.

The northerly striking granite contact lies 15 feet east of the shaft and both mineralized skarn and granite disappear beneath drift cover about 30 feet north of the shaft. The favourable contact zone is concealed by drift for 3 miles northwest of the Spring Creek shaft. A

magnetic high in the drift area just east of the abandoned railway line, 2 miles northwest of Spring Creek shaft, may indicate the presence of magnetite-rich skarn (Geophysics Paper 1413, Geol. Surv. Can., 1963b).

Empress of India (10)

(Lat. 60°40 1/2', Long. 135°07 1/2')

Reference: McConnell (1909, p. 42).

The property is on the north bank of McIntyre Creek 3 miles southwest of Whitehorse. An adit 130 feet long was driven in the north bank of the creek about 1910, but nothing has been done in recent years.

The main contact of the Triassic limestone and the copper belt granite stock crosses the property in a northwesterly direction. The adit is in a tongue of limestone 150 feet wide that extends north for 250 feet into the granite from the main body of limestone. The limestone is altered to white and grey marble and along the contacts is replaced by secondary minerals such as garnet, wollastonite, tremolite, actinolite, epidote, magnetite, quartz, and calcite. Bornite and chalcopyrite are disseminated in grains and bunches throughout the skarn rocks.

Along the east side of the limestone tongue the skarn is sliced by several northeasterly striking faults over a width of 15 feet. These strike N 10°E and dip 80°NW. The sheared skarn is mineralized with up to 1 per cent of copper sulphides, and oxidation of the sulphides has imparted a green hue to the steep rock wall on the north bank of the creek.

Two other parallel sheared zones—one 70 feet west, the other 90 feet west—are explored by short drifts from the adit. The principal opening runs N 10°E for 87 feet and follows the sheared zone for 45 feet. Towards the face of the drift the skarn is brecciated over a width of 5 feet. The gangue includes a large amount of quartz and calcite, and pyrite is present with minor copper sulphides. One pocket, about 2 feet long and 4 inches wide, carries nearly 1 per cent of scheelite, but this mineral was not seen elsewhere in the mine. No. 3 shear zone is exposed by 70 feet of drifting to the north from a short crosscut to the west, 45 feet from the portal. Brecciated skarn rock 2 to 3 feet wide is cemented by quartz and calcite and carries an erratic distribution of bornite and chalcopyrite. A 50-foot-deep winze is sunk on the mineralized skarn 20 feet from the face.

Retribution (11)

(Lat. 60°40', Long. 135°07')

Reference: McConnell (1909, p. 42).

The Retribution prospect is 3 miles southwest of Whitehorse and adjoins the Best Chance on the north.

A mineralized skarn zone, 20 feet in diameter, occurs in granite 400 feet south of McIntyre Creek and about the same distance northwest of the Best Chance lode. Masses of yellow garnet and greyish green, radiated actinolite are scattered about the collar of a 20-foot-deep shaft. Small amounts of quartz, calcite, and hematite are associated with the yellow garnet and plums of bornite and chalcopyrite form the cores of many of the radiated actinolite clusters. The main contact of the limestone and granite is in a drift-covered area about 100 feet west of the shaft.

Best Chance (12)

(Lat. 60°40', Long. 135°07')

References: McConnell (1909, p. 40); MacLean (1914, p. 163).

The Best Chance property, 3 miles southwest of Whitehorse, adjoins the Grafter mine on the north. A former railway spur line between the Pueblo mine and MacRae crosses the south end of the lode. Angus McKinnon discovered and staked the deposit in 1899. The Atlas Mining Company took it over for a short period beginning in 1912, and New Imperial Mines Limited have held the ground since 1954. There has been no production.

A large surface showing of copper ore associated with magnetite is exposed in an elongated mound-like mass on the north side of the old railway line (see Figure 3). The deposit is in a northerly striking skarn zone with hornblende granite on the east and white limestone on the west. The magnetite lens lies 10 to 50 feet west of the granite. It is 420 feet long, ranges from 10 to 40 feet wide and has an average width of about 20 feet. At its southern end the lode extends 70 feet south of the old railway line and terminates at a southwesterly striking tongue of granite. At the north end, the magnetite grades into skarn rock 15 feet south of the granite-skarn contact which swings sharply to the west. White limestone along the old railway bed, 75 feet west of the lode, strikes northerly and dips 45°W.

Waste from an old 26-foot-deep shaft 50 feet north of the railway bed, and waste from a 40-foot-deep shaft 270 feet north of the railway bed, is largely magnetite and garnet-epidote skarn rock with small amounts (1 to 3 per cent) of bornite and chalcopyrite and with some chalcocite. The copper minerals occur throughout the magnetite body and also in parts of the adjoining skarn zone on the east. Lenticular bands several feet across in the skarn are impregnated with chalcopyrite in grains and small masses. Diamond-drilling of the magnetite lode was conducted by New Imperial Mines Limited in 1957. This work indicated 100,000 tons of ore averaging 2 per cent copper.

Another cupriferous magnetite lens that is completely concealed by drift apparently lies along the course of the old railway bed between 120 and 320 feet southeast of the point where the lode described above intersects the railway line. High magnetic readings were recorded there with a dip needle during the 1961 season. This anomaly has not yet been tested by drilling (1962).

Grafter Mine (13)

(Lat. 60°40', Long. 135°07')

References: McConnell(1909, p. 38); MacLean (1914, p. 163); Wheeler (1961, p. 138).

The Grafter mine is 3 miles southwest of Whitehorse and 1,000 feet southwest of the former railway line between the Pueblo mine and MacRae. The deposit was discovered and staked in August 1899, by W. Woodney.

In 1901 and 1902 a shaft was sunk to a depth of 60 feet and a drift from the foot of the shaft was run 137 feet southwesterly in limestone and skarn rock (see Figure 3). Work was resumed by Robert Lowe in 1907 and 2,000 tons of ore was mined and shipped. This ore carried from 6 to 8 per cent copper, with gold and silver values averaging about $3.00 a ton. At the 50-foot level the orebody was found to follow a semicircular course about a core of white limestone 28 feet in diameter. It was followed along this course for 150 feet with stopes in places nearly to the surface. In general the lode ranged from 6 to 17 feet wide with some wider parts. The shaft was deepened to 100 feet late in 1907 and at the time of McConnell's visit preparations were being made for drifting on the ore at a depth of 90 feet. In 1912 the Atlas Mining Company held an option on the property and deepened the shaft to 150 feet. The Lowe Estate records show that 11,450 tons of ore averaging 6 per cent copper was shipped to Anyox from 1915 to 1917.

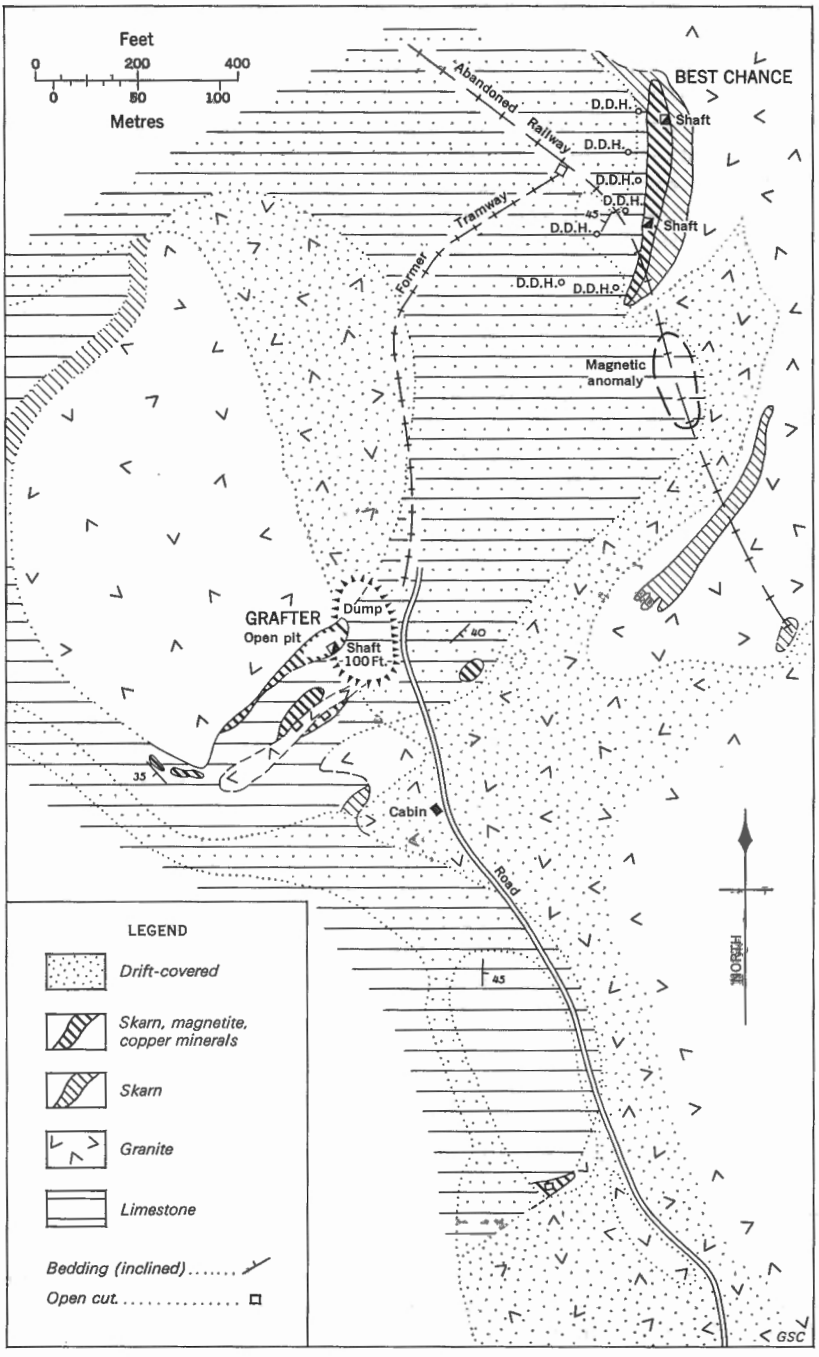

Figure 3. Plan of Grafter and Best Chance properties

The Grafter copper deposits are on the west side of the copper belt granite stock and are largely confined to a northeasterly trending limestone and marble band about 200 feet wide, bounded on the west by a granodiorite boss 700 feet in diameter. The latter is coarsely crystalline and more basic than the main granite stock. It ranges in colour from light to dark grey, the darker areas having a greater concentration of hornblende. A granitic dyke 350 feet long and more than 20 feet wide lies near the centre of the northeasterly trending limestone band, and the main ore deposit is in the skarn rock between the north end of this dyke and the Grafter boss.

The main surface working is a pit 50 feet in diameter and up to 30 feet deep with the main shaft at its southeast edge. According to McConnell the ore removed consisted essentially of bornite and chalcopyrite in varying quantities, disseminated through a hard garnet-augite-tremolite-epidote gangue. Malachite and azurite, cuprite and native copper occur in small quantities. Magnetite is common and both pyrite and molybdenite occur in small concentrations. A small veinlet of quartz containing specks of gold was cut in sinking the shaft. McConnell (1909, p. 32) stated that the wax yellow mineral cancrinite was observed in the mine in thin layers alternating with crystalline limestone. A large part of the 'waste' of a large dump area contains up to 1 per cent of chalcopyrite and bornite with chalcopyrite the more plentiful.

At 275 feet east of the main shaft is a trench 20 feet by 30 feet, floored with skarn consisting mostly of altered limestone replaced by brown garnets, epidote, and magnetite with a little chalcopyrite and bornite. A representative chip sample collected across the rock trench assayed iron, 56.46 per cent, and copper, 0.25 per cent. The favourable contact zone is concealed by drift for 1,000 feet south of the above open-cut and the Best Chance orebody outcrops 750 feet to the northwest. The extent and importance of a mineralized skarn zone exposed on the south edge of an outcrop area 1,150 feet southeast of the main shaft and 150 feet west of the mine road could best be determined by drilling.

Verona (14)

(Lat. 60°39', Long. 135°06')

Reference: McConnell (1909, p. 38).

The Verona claim is described briefly by McConnell as being underlain mostly by granite or diorite with limestone as occasional inclusions. He stated that a lens of magnetite, 30 feet in diameter,

with copper minerals, occurs on the claim, surrounded by epidotized and garnetized diorite.

The mineralized lens seen by the writer occurs in the granite 550 feet west of the abandoned railway bed at a point 600 feet south of the intersection of the railway bed and the old road to the Grafter mine. It is a limestone inclusion 60 feet long and 15 feet wide that is altered to epidote, garnet, and chlorite and is replaced by magnetite with small amounts of bornite. A typical sample of the ore collected by the writer, assayed: gold, 0.005 ounce per ton; copper, 0.20 per cent; iron, 49.7 per cent; cobalt, 0.03 per cent; gallium, 0.04 per cent; manganese, 0.12 per cent.

Arctic Chief (15)

(Lat. 60°40', Long. 135°07')

References: McConnell (1909, p. 33); Wheeler (1961, p. 138).

The Arctic Chief property is 4 miles southwest of Whitehorse. It was first discovered and staked in July 1899 by John Irving. Development work on a large copper-bearing magnetite body began in 1902. A select shipment of 140 tons of ore, made in 1904, gave returns of 0.39 ounce gold per ton, 2.5 ounces silver per ton and 7.22 per cent copper. In 1907, Arctic Chief Copper Mines Company of Spokane did further work and shipped 83 tons of ore that yielded 0.18 ounce gold per ton, 2.00 ounces silver a ton, and 5.37 per cent copper. New Imperial Mines Limited commenced a diamond-drilling program in 1963.

The magnetite lode occurs at the southwest end of a roof pendant of grey and white Triassic limestone enveloped in hornblende granite that grades locally into quartz diorite. The limestone mass trends northeasterly and is a little more than a mile long and about 1/2 mile wide. The orebody is exposed at the contact of the limestone and granite, or close to it, west of the portal of the main adit (elevation 3,012 feet). At the highest stripping, the magnetite is glacially polished and striated and is green speckled with malachite. Near the granite the limestones are converted to broad bands of brown garnet skarn with associated green epidote, augite, actinolite, some wollastonite and some pink epidote. The altered rocks are impregnated with various amounts of magnetite, bornite, and chalcopyrite.

The main adit follows and outlines a copper-bearing magnetite lens 200 feet long and from 25 to 40 feet wide. At 140 feet from the portal a winze sunk 50 feet follows ore for 25 feet and then enters altered diorite. According to McConnell, a short drift to the

north from the foot of the winze penetrates mixed ore and altered rock for a few feet and then enters limestone. A lens of well-mineralized magnetite was encountered in a short crosscut from this drift to the right, following the limestone-intrusive contact, but the work done was insufficient to show whether this was the downward continuation of the main orebody or the upper part of a new lens. A crosscut to the left, along the contact, led to the discovery of a vein of silver-bearing tetrahedrite that varied in width from a few inches to 24 inches. A 65-foot raise to the surface, from a point in the main adit 175 feet from the portal, follows skarn and ore and is in white limestone at the surface. The dump at the portal of the main adit is formed largely of cupriferous magnetite. Bornite and chalcopyrite are distributed as grains and small patches intimately intergrown with the magnetite. Serpentine and crystals of greenish white to pearly clinochlore are common in the magnetite. A typical sample of the magnetite gathered from the Arctic Chief dump assayed: copper, 1.52 per cent; iron, 56.5 per cent; gold, 0.065 ounce a ton; silver, 2.23 ounces a ton; cobalt, 0.05 per cent; nickel, 0.03 per cent; gallium, 0.06 per cent; vanadium, 0.007 per cent; palladium, 0.002 ounce a ton; platinum, 0.004 ounce a ton.

At a point 180 feet northeast of the main adit portal and 60 feet lower, a second adit driven to intersect the main orebody is caved at the portal.

The occurrence of three additional ore shoots is indicated in the drift-covered area east of the main adit by the presence of three magnetic anomalies. One anomaly as outlined by a dip-needle survey measures 300 feet long in an easterly direction and is 200 feet wide. Its centre is 325 feet east of the portal of the main adit. The second anomaly is 100 feet in diameter and its centre is 175 feet northeast of the centre of the main anomaly. The third anomaly is 400 feet southeast of the portal of the main adit. This one trends northerly and is 275 feet long and 125 feet wide. The Suburban anomaly 675 feet southeast of the main adit portal (see Suburban) is 90 feet in diameter.

Suburban (16)

(Lat. 60°39', Long. 135°07')

Reference: McConnell (1909, p. 37).

The Suburban property is southeast of the Arctic Chief and the workings are on both sides of a valley that branches off to the west at the head of McIntyre Creek. The development work was done between 1900 and 1907.

The Suburban shaft, 32 feet deep, is roughly 650 feet southeast of the Arctic Chief main adit. It is at the northwest corner of a wedge-shaped limestone body that protrudes westerly 100 feet from a larger limestone mass. From the shaft the contact runs south for 80 feet, then at S45°E for several hundred feet. This limestone roof pendant is apparently part of the larger mass in which the Arctic Chief orebodies are found, and the granite that lies between is a tongue-like invasion from the west, approximately 350 feet wide.

Waste rock and ore piled about the Suburban shaft include white and grey limestone and several tons of garnet-rich skarn. The latter carries about 25 per cent of magnetite and from 1 to 3 per cent of bornite and chalcopyrite. For 80 feet south from the shaft a well-defined magnetic high, recorded with a dip needle, indicates the presence of a concealed southerly striking skarn zone along the granite and limestone contact.

A sample of the mineralized skarn collected at the collar of the shaft, assayed: gold, 0.03 ounce per ton; copper, 0.89 per cent; iron, 35.4 per cent; nickel, 0.06 per cent; cobalt, 0.03 per cent; gallium, 0.03 per cent; manganese, 0.10 per cent.

A limestone contact with granite on the west is well exposed 300 feet south of the Suburban shaft on the south wall of a narrow valley. The contact is vertical and is marked by a skarn zone 3 to 4 feet wide. Garnet-rich and copper-stained bands lie parallel with the vertical bedding of the altered limestone, and a foot-wide limestone band 10 feet east of the contact is also mineralized with copper sulphides. A number of thin serpentine bands are present in the banded skarn, and some of these at the portal of a 20-foot-long adit hold fine veinlets of asbestos.

Polar (17)

(Lat. 60°39', Long. 135°07')

Reference: McConnell (1909, Map 1041).

The Polar prospect is 4 miles southwest of Whitehorse at the south end of a small lake known as Polar Lake. The property was staked about 1900. No work has been done since 1907.

Limestone outcrops on the west side of Polar Lake and granite on the east side. The contact runs southeasterly along a narrow drift-filled valley bottom and is exposed for a short distance along a 100-foot-high ridge 300 feet southeast of the lake. There the limestone is partly altered to serpentine and carries minor disseminated

chalcopyrite. The mineral zone is investigated by four short adits driven northeasterly into the hillside. At the face of the longest adit (50 feet) there is a fault contact of limestone and granite that strikes north and dips 60°W.

Little Chief and Big Chief (19, 18)

(Lat. 60°38', Long. 135°035')

Reference: McConnell (1909, p. 55).

The Little Chief prospect is 2 miles west of MacRae and 1/2 mile north of the Valerie mine; the Big Chief property adjoins the Little Chief on the north. The ground was first staked in 1898 by Andrew Oleson and William McTaggart. The workings consist of two short adits, pits and trenches and a few shallow drill-holes.

Copper-bearing magnetite-rich skarn zones outcrop at intervals for over 2,200 feet along or close to a northwesterly trending contact between hornblende granite on the west, and limestone and skarn rock on the east (see Figure 4). The limestone and skarn body is a tongue-like mass that reaches south into the granite from the main limestone body at Big Chief Lake. This sedimentary wedge is more than 3,000 feet long and ranges from 700 to 400 feet wide. Most of the contact zone is drift covered between Big and Little Chief Lakes and so is the main granite contact west of Robin Lake.

A magnetite-rich lode some 300 feet long and up to 150 feet wide, but with an average width of 50 feet, is exposed by stripping on the hillside 150 feet east of the north end of Little Chief Lake. Another magnetite-rich lode 70 feet farther north is 100 feet long and 30 feet wide, and this one forms the core of a larger malachite-stained skarn body. A third magnetite vein-lode,8 feet wide and more than 30 feet long lies 100 feet east of the main orebody. Bornite and chalcopyrite occur as small grains, blebs, and veinlets in the magnetite of each lode and bornite is the most prevalent sulphide. The largest lode is a replacement of a serpentine-rich zone that developed through alteration of the white crystalline dolomitic limestone. In several places the serpentine is traversed by asbestos veinlets 1/8 inch thick. Garnet-rich skarn is predominant south and east of these lodes, and for 800 feet in a northerly direction. It is characterized in places by the presence of pink epidote.

The Robin Lake ore zone is exposed in the valley bottom 600 feet northwest of Little Chief Lake or 300 feet southeast of Robin Lake. The ore outcrops consist of 15 feet of magnetite-rich, copper-stained, serpentinized limestone separated by 10 feet of pyritized quartzite

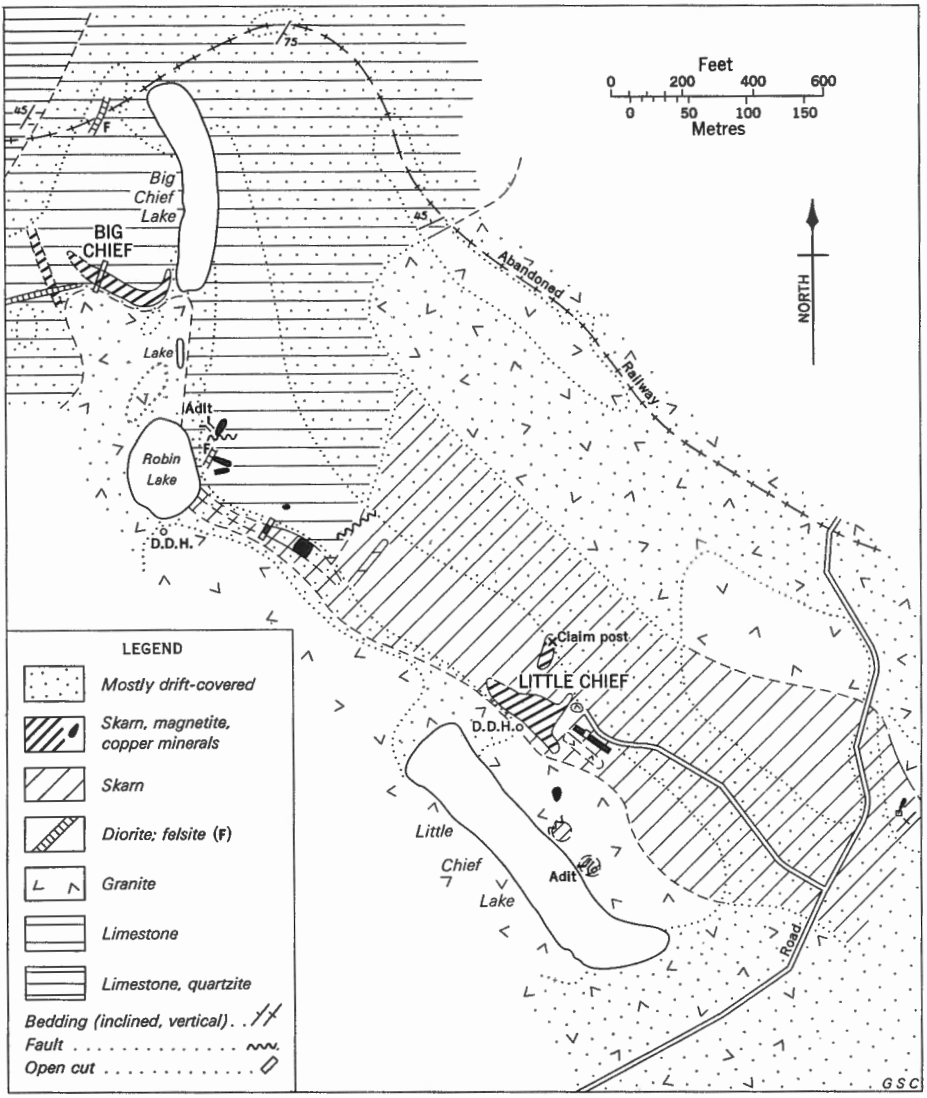

Figure 4. Plan of Little Chief and Big Chief properties

from another 10 feet of magnetite-rich, copper-stained serpentine. This mineralized zone is traced for 150 feet towards Robin Lake by trenches. Other copper-magnetite bodies occur on the hillside east of Robin Lake. The favourable contact zone is concealed by drift for 400 feet between Robin Lake and the south end of Big Chief Lake.

The Big Chief orebody is exposed on the west side at the south end of Big Chief Lake. It is a high-grade magnetite lens, some 15 feet thick, bounded by muskeg on the east and white limestone on the west. The lode strikes south for 100 feet, then turns west for 100 feet and then northwest for another 150 feet. The westerly and northwesterly striking parts of the lode range from 30 to 40 feet wide and follow the general line of contact of the granite and limestone. The granite on the south is exposed in only one trench. The westerly striking part carries less magnetite than the northerly striking part nearest the lake, but holds more disseminated bornite and malachite.

A serpentinized zone, 30 feet wide, trends northwesterly from a point 350 feet west of the south end of Big Chief Lake and carries disseminated magnetite and minor copper sulphides in its surface exposures. The contact of this serpentinized zone with the granite is drift covered to the south.

A typical sample of Little Chief ore collected from a 6-foot-deep cut at the south end of the property, assayed: gold, 0.025 ounce a ton; copper, 2.38 per cent; iron, 59.1 per cent; manganese, 0.60 per cent; cobalt, 0.07 per cent; gallium, 0.06 per cent. Another sample, collected from the magnetite-rich lens west of the south end of Big Chief Lake assayed: gold, 0.01 ounce a ton; copper, 0.56 per cent; iron, 59.1 per cent; cobalt, 0.02 per cent; manganese, 0.45 per cent; gallium, 0.03 per cent. Both samples carried 0.002 ounce palladium and 0.004 ounce platinum per ton.

Golconda, Florence M., Concord and Mohawk

(Lat. 60°39', Long. 134°53')

References: MacLean (1914, p. 165); Cairnes (1910, p. 55).

The Golconda and Florence M. claims were staked by Arthur Thompson in 1899 and the Concord and Mohawk claims were staked a few years later by P. Campbell of Whitehorse. The claims are situated on one of the most southerly of the limestone hills in the range facing the town of Whitehorse on the east. They are about 7 miles in a southeasterly direction from Whitehorse on the southwest corner of the range and a shaft on the Golconda claim is about 1,600 feet above Whitehorse. The claims were reached in early years by a good pack

trail, 7 miles long, that was built from Canyon City at the head of Miles Canyon.

The Golconda quartz vein-lode is reported by Cairnes (1910) as having been traced the entire length of four claims. He stated that the vein quartz occurs in a soft, friable, thinly bedded, somewhat iron-stained calcareous shale that has an average thickness of about 100 feet and is interbedded with typical heavily bedded Triassic limestone that strikes northwest and dips 40 to 50°NE. Veinlets of quartz traverse the shales in all directions, the majority following the bedding planes, and in places form considerable masses of quartz. The greatest amount of quartz occurs near the centre of the shale belt where for a width of from 6 to 26 feet it is almost free of rock, and for a few feet on each side consists to a great extent of interlacing quartz stringers. As the quartz is much harder than the shales it weathers less readily and stands out as a ridge from 4 to 12 feet high.

According to MacLean (1914), a shaft was sunk on the Golconda claim for 65 feet in quartz and then offset into the schist and sunk 35 feet farther to the 100-foot level for the purpose of crosscutting and drifting. And on the Conrad (former Concord) claim the Stevens shaft was sunk 12 feet on a 6-foot-wide outcrop of quartz.

Except close to the Golconda shaft, Cairnes (1910) found the quartz devoid of mineralization except for rarely seen particles of free gold and a slight amount of pyrite. Near the Golconda shaft the quartz contains in addition some disseminated chalcopyrite and some malachite. Quartz samples collected by MacLean (1914) assayed less than 20 cents a ton in gold.

Valerie (20)

(Lat. 60°38', Long. 135°3')

References: McConnell (1909, p. 53); MacLean (1914, p. 162); Wheeler (1961, p. 141).

The Valerie property was staked by Gustave Gervais in August 1899. The claim is 2 miles west of MacRae and is reached by an old truck road from MacRae.

The early development work consisted of sinking shallow shafts on the ore outcrops and from these 40 tons of high-grade chalcopyrite ore was shipped in 1904. McConnell (1909) stated that this ore averaged 18 per cent copper and more than $5.00 per ton in gold. A.B. Palmer of Whitehorse carried on additional exploratory work in

1907. A steep, inclined shaft was sunk to the 84-foot level, from where drifts totalling 270 feet in length were run in various directions. These workings were described by McConnell (1909) as follows:

"The upper part of the present working shaft is sunk in an outcrop of chalcopyrite ore, 10 to 15 feet in width. At a depth of 25 feet, the ore ceased, and the shaft was continued through barren rock, mostly altered diorite, down to the present 84-foot level. Short drifts to the north and northeast from the foot of the shaft, soon entered ore, and further exploratory work outlined a shoot of rich ore, approximately 50 feet in length, with a maximum width of 17 feet."

MacLean (1914) reported that the Atlas Mining Company held an option on the mine in 1912. The inclined shaft at that time was said to be 190 feet deep and some exploratory work was being done on the 84-foot level in the hope of finding other ore shoots.

The ore occurs along the northerly striking contact zone between Triassic limestone and grey granodiorite. Drift conceals these rocks north and east of the main shaft but limestone is exposed west of and for 150 feet south of the shaft, and granodiorite outcrops are numerous south of the contact which lies 150 feet south of the shaft. The limited exposures indicate a flexure in the granodiorite-limestone contact 150 feet southeast of the shaft, where a southerly trending contact swings west for 200 feet and then southwest. A brown-weathering diorite dyke, 20 feet wide, intrudes the limestone 150 feet west of the shaft.

At a 10-foot-deep shaft, 115 feet south of the main shaft, there is a lens of magnetite-rich skarn 2 to 3 feet wide. The magnetite holds bornite and is stained with azurite and malachite. The mineralization occurs along a narrow zone of faulting that strikes north towards the main shaft. Garnet and epidote are prominent in a skarn zone that extends 130 feet southwesterly from the 10-foot shaft, but the copper content is low.

According to McConnell (1909) the ore shoot penetrated in the mine on the 84 level is bordered on the south by a wide zone of altered and unaltered limestone, and altered diorite impregnated with arsenical pyrites in grains and bunches associated with small quantities of chalcopyrite, magnetite, augite, garnet, and calcite.

Several tons of sulphide ore that now lies on the dump east of the shaft, consists largely of pyrite, pyrrhotite, and chalcopyrite. A typical sample of this ore, collected by the writer, assayed: gold, 0.02 ounce per ton; copper, 1.65 per cent; cobalt, 0.12 per cent; nickel, 0.06 per cent; palladium, 0.002 ounce a ton; platinum, 0.004 ounce a ton. A spectroscopic analysis indicated less than 0.01 per cent gallium and vanadium.

Imperial Mines Limited made a magnetometer survey of the Valerie claim in 1956 and reported an anomaly 450 feet long, striking due north over the old mine, with four other anomalies at intervals to the northwest.

North Star (21)

(Lat. 60°37', Long. 135°03')

Reference: McConnell (1909, p. 57).

This prospect is 2,800 feet southeast of the Valerie mine and is reached by way of a wood road that extends southerly from the Valerie. A skarn zone 10 feet wide is exposed in an open-cut (No. 1) 100 feet east of the wood road. The skarn is sheared in an easterly direction and carries finely disseminated chalcopyrite and bornite. Skarn rock is also exposed in a trench 20 feet long, 150 feet farther northeast. The skarn is sheared along a strike of N 70°E and is impregnated with from 0.5 to 2 per cent chalcopyrite across a width of 10 feet. Several scattered outcrops of limestone are exposed for 300 feet south of the 20-foot cut. Small granite stocks up to 20 feet across intrude the limestone north and south of No. 1 cut, and pyritized greywacke outcrops along the wood road on the west. The main granite contact probably lies 100 to 200 feet north of No. 1 cut and may swing southerly 100 to 200 feet east of the 20-foot trench in a drift covered area.

A chip sample collected across 10 feet of ore in the 20-foot cut assayed: gold, 0.0025 ounce a ton; silver, 0.0015 ounce a ton; copper, 0.7 per cent. A sample of pyritized greywacke from the wood road assayed copper, 0.05 per cent.

Pass Lake (22)

(Lat. 60°37', Long. 135°03')

Pass Lake prospect is a little more than a mile slightly west of south from the Valerie mine, in the pass between two mountain ridges (elevation 3,225 feet). Hornblende granite, the dominant rock in the pass, holds as a roof pendant a wedge-shaped body of limestone whose southwest end lies 100 feet east of Pass Lake. A skarn zone, 2 to 5 feet wide and 100 feet long, composed largely of garnet, calcite, epidote, and magnetite, occurs along the southeast side of the wedge-shaped limestone body near the lake and holds a little chalcopyrite and bornite. It was prospected 50 years ago by two open-cuts and a 12-foot shaft.

A magnetite-rich sample collected at the most westerly pit, assayed: gold, a trace; copper, 0.4 per cent; iron, 56.65 per cent.

Copper Cliff (23)

(Lat. 60°35', Long. 135°01')

Reference: McConnell (1909, p. 57).

This prospect is 3 miles southwest of MacRae by a narrow lake at the head of a small stream that drains easterly. The lake is 600 feet long and 100 feet wide. White crystalline limestone bluffs 40 to 50 feet high enclose the west half of the lake and granite bluffs enclose the east half.

The principal showing is a mineralized garnet-rich skarn zone 10 feet wide and 20 feet long that outcrops on the bench 40 feet above the water on the north side of the lake. The mineral zone lies along the contact of the limestone with the granite stock to the northeast. The skarn rock contains bornite and chalcopyrite and some specular hematite. An adit driven 25 feet north into the mineralized zone at the water's edge exposes a 10-foot-thick porphyritic felsite dyke and mineralized skarn. The favourable contact zone both north and south of the lake is concealed by drift.

Keewenaw (24)

(Lat. 60°34', Long. 134°57')

Reference: McConnell (1909, p. 58).

The Keewenaw prospect is 4 miles south of MacRae and 1/2 mile west of the White Pass and Yukon Railway. It was restaked by P. Versluce and C. Gibbon of Whitehorse under the name "Cola Group" in 1960. Some trenching and diamond-drilling was done by Noranda Mines Limited about 10 years ago.

Bornite and malachite occur in hornblende granite on the east side of Wolfe Creek in an oval-shaped zone about 500 feet long and 250 feet wide. This zone trends southeasterly and the granite both within the zone and in its vicinity is cut by numbers of dark, fine-grained diorite dykes that also strike southeast. The diorite dykes are mostly less than 10 feet wide but some are 30 feet wide (see Figure 5). The granite is also cut by felsite dykes and by feldspar porphyry dykes that strike southeasterly. The latter are older than the diorite dykes. The granite of the oval zone is fine grained and altered, with a strong

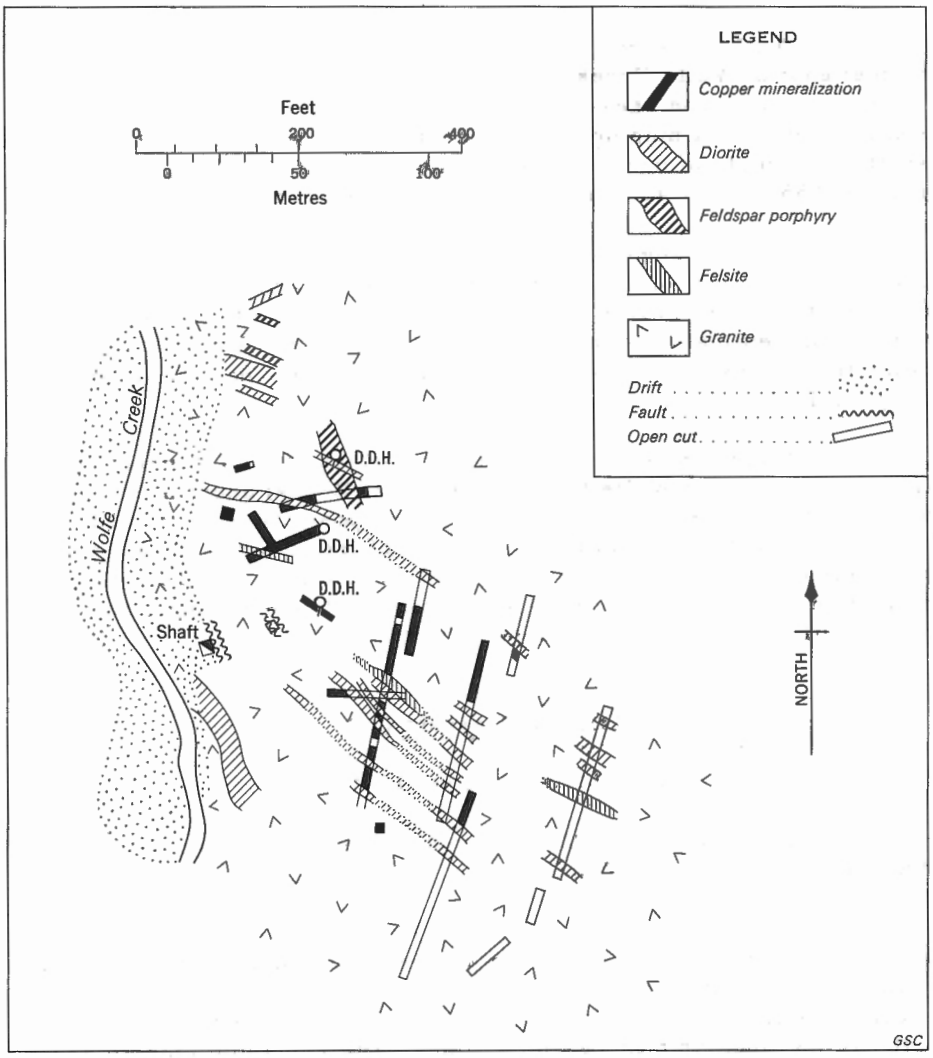

Figure 5. Plan of part of Kewenaw property

development of epidote and chlorite. Thin quartz veinlets and tiny fractures abound. Green copper stain is plentiful in the altered granite in the vicinity of the diorite dykes, but the total copper content is probably less than 1 per cent. The copper silicate chrysocolla is present in several of the most easterly rock cuts.

A 20-foot-deep shaft is sunk on an 8-foot-wide sheared zone 60 feet east of Wolfe Creek. The shearing strikes S 30° E and is about vertical. The sheared granite is mineralized with bornite and some shoots containing up to 5 per cent bornite were encountered in the shaft. A sample of ore collected at the collar of the shaft, assayed gold, 0.055 ounce a ton, and copper, 3.16 per cent.

Another shear zone, 8 feet wide and striking southeasterly, outcrops in an open-cut 90 feet east of the shaft and 50 feet higher, near the top of the canyon wall. The fractured granite in the shear carries disseminated bornite and some malachite. A chip sample collected across the open-cut assayed gold, 0.05 ounce a ton, and copper, 1.37 per cent.

Limestone outcrops along both banks of a northwesterly flowing tributary of Wolfe Creek (Keewenaw Brook) about 600 feet south of the most southerly trenches that expose the mineralized granite. A 20-foot adit in the north bank of the brook is driven easterly along the contact. Mineralized rock on the dump is stained with malachite and holds some bornite. A sample from the dump assayed gold, 0.01 ounce a ton, and copper, 0.50 per cent.

Railway Prospect (25)

(Lat. 60°34', Long. 134°55')

The prospect is 825 feet south of Mission Lake, east of the White Pass and Yukon Railway track.

A partly caved shallow shaft 40 feet east of the track was sunk more than 50 years ago along a limestone contact with hornblende granite. The contact zone is marked by irregular zones of coarsely crystalline black actinolite and grey clinopyroxene, and crystals of both are as much as 6 inches long. Magnetite and some epidote are associated with these minerals and small amounts of chalcopyrite are present. A representative sample from the dump assayed copper, 0.15 per cent, and iron, 49.86 per cent.

Black and Brown Cub (26)

(Lat. 60°34', Long. 134°55')

Reference: McConnell (1909, p. 58).

This property is 5 miles southeast of MacRae, and 1/4 mile east of the White Pass and Yukon Railway. The old workings lie on each side of a former Carcross to Whitehorse road at a rocky promontory.

Granite and limestone are in exposed contact on the west side of the road, and both are cut by dykes of felsite and diorite. Between 2 and 3 feet of garnet-rich skarn exposed in an open-cut contains a little bornite and malachite. A caved-in shaft that was sunk on the east side of the road in an area of drift, is reported by McConnell as being 62 feet deep. He stated that the shaft was sunk through a garnet-augite-tremolite rock, carrying some rich bornite ore.

Sue (27)

(Lat. 60°37', Long. 134°54')

A skarn zone in silicified limestone carries chalcopyrite, bornite and some molybdenite in an open-cut on the Sue claim, 1,500 feet west of the Cowley Creek mine shaft.

Most of the mineralization is on the southeast side of a small fault that strikes N50°E. A 4-foot-long channel sample collected across the bottom of the pit assayed: gold, a trace; copper, 1.55 per cent; molybdenum, 0.74 per cent. A sample of ore selected from the dump, consisting of chalcopyrite, garnet, epidote, calcite and some molybdenite, assayed: gold, a trace; copper, 5.30 per cent; molybdenum, 0.56 per cent.

In a trench 175 feet farther west, limestone is cut by a granite dyke. Mineralization is lacking, aside from a little pyrite.

Cowley Creek (28)

(Lat. 60°34', Long. 134°53')

The Cowley Creek property is on the west side of Cowley Creek, 2 miles southwest of the junction of the Alaska Highway and the Carcross road.

Copper minerals occur in skarn zones in an easterly trending band of limestone surrounded by hornblende granite. The limestone mass is roughly 3,000 feet long, 200 feet wide at Cowley Creek, and 1,200 feet wide at a point 1,000 feet west of the creek.

In a copper-stained skarn zone exposed in a 10-by-20-foot rock cut 100 feet west of Cowley Creek, bornite and chalcopyrite are present as small veinlets and impregnations. Brown garnet is abundant with lesser amounts of green epidote, calcite, quartz, and some magnetite.

The principal opening is a shaft 55 feet deep that was sunk 50 years ago about 1,400 feet west of Cowley Creek. An ore dump near the collar of the shaft is composed largely of brown garnet (andradite), wollastonite, and crystalline limestone. Bornite and chalcopyrite are most plentiful where there is an abundance of wollastonite. At a shaft 25 feet deep, 200 feet farther north, the excavated skarn rock is well mineralized with bornite and chalcopyrite and some of the skarn holds 1 to 2 per cent of molybdenite that is associated with brown garnet and epidote-rich gangue. Small pockets of magnetite occur with the silicate minerals.

An open-cut that lies 70 feet northeast of the 25-foot-deep shaft exposes more mineralized skarn, and most of the intervening ground carries more than 1 per cent copper. A lens of solid chalcopyrite up to 20 inches wide is exposed for 4 feet on the wall of the open-cut and occurs at the junction of two small vertical faults, one striking north and the other northeasterly.