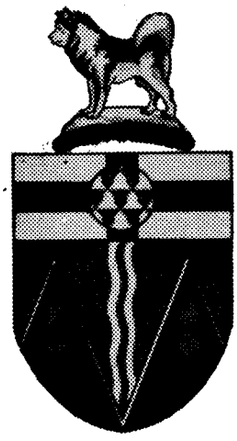
"COPPER MINING ON THE WHITEHORSE COPPERBELT - YUKON TERRITORY"



by

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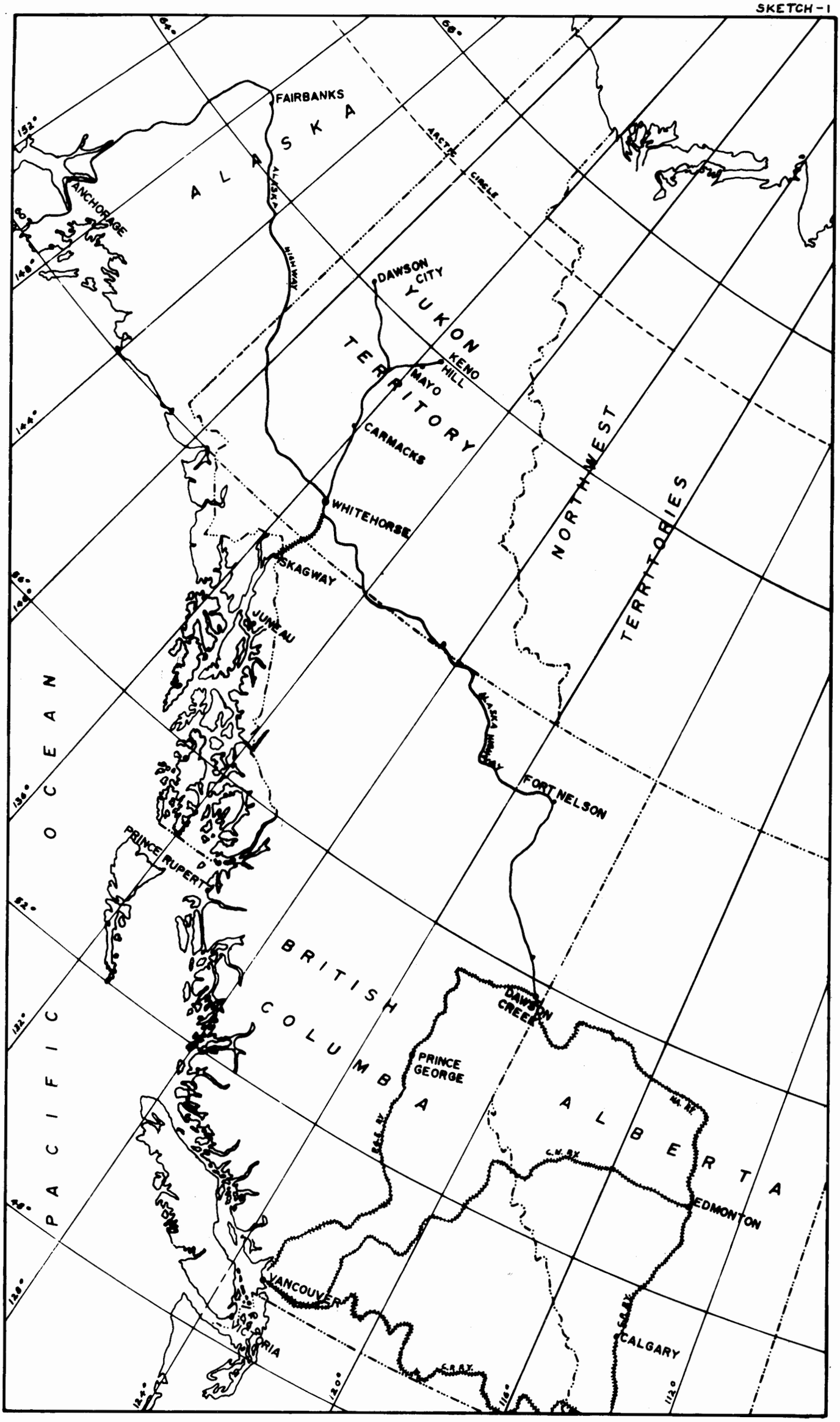
1. ABSTRACT

The Whitehorse Copperbelt lies on the West side of the Whitehorse trough in the southwest Yukon at about north 60½ degrees latitude and west 135 degrees longitude. Copper mineralization, consisting mainly of bornite and chalcopyrite, along an 18 mile belt was discovered in 1897 by miners travelling north to Dawson, during the start of the Klondike Gold Rush. The Lewes River Group - Upper Triassic in age, was intruded by a large igneous batholith of the Coastal Intrusive - Cretaceous in age. The sedimentary rocks were changed to calcium - magnesium - silicate skarn and calcium - magnesium - iron skarns with copper mineralization, near the intrusive contacts. The deposits are considered to be contact metasomatic in origin with siliceous minerals and copper - iron mineralization introduced. Proven ore reserves in five deposits consist of about 5½ million tons of copper grading 1.25 percent, in parts molybdenite and an average of $1.13 gold/silver values. In addition to these reserves 3½ million tons grading 2.14% have been outlined at depth on the Little Chief Deposit. Open pit mining is to be used to exploit the five deposits on a year round basis of mining, with a possibility of an underground operation at the Little Chief deposit. Under an agreement with a Japanese metal mining company and a Canadian Bank, 7.45 Million dollars were provided for mine and milling facilities. The agreement with the Japanese firm provides for a ten year contract for the sale of all concentrates produced from the property. The mill will produce about 29,000 tons of 35 percent copper concentrate each year. The concentrate will be shipped in containers by narrow gauge railway from Whitehorse, Y. T., to Skagway, Alaska, by boat to Vancouver, B. C. and then to Japan.

2. INTRODUCTION

The Yukon Territory is located in the northwestern section of North America and extends to the Arctic Ocean. It is bordered on the east by the Northwest Territories, on the south by British Columbia and on the

SKETCH - 1



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west by Alaska (location sketch - 1). The total area of the Yukon is 207,076 square miles and with a population of 16,000 in 1966. The capital city is Whitehorse, located in the southwestern corner of the Territory.

The principal settlements are Watson Lake, Teslin, Whitehorse, Carmacks, Haines Junction, Carcross, Mayo, Elsa, Calumet and Dawson City.

Access to the Yukon is by road, railroad and airlines. The Alaska Highway runs from the British Columbia border at mile 620 to mile 1247 on the Alaska Border. There are a total of 1479.9 miles of Territorial roads that connect with the Alaska Highway. The White Pass and Yukon Route, a narrow gauge railway, links the seaport of Skagway, Alaska, with Whitehorse, a total distance of 110 miles. Whitehorse, Dawson City and Mayo are serviced daily by Canadian Pacific Airlines flying DC-6s and a DC-3 from southern points. Wein Alaska flies daily service between Whitehorse and Juneau, Alaska with connecting flights to southern localities. Bus service on the highway is run daily during the summer and weekly in the winter, by Canadian Coachways between Dawson Creek, B. C. and settlements in the Yukon. Several trucking firms run scheduled hauls into the Territory from southern points and maintain distribution terminals in Whitehorse. The greatest percentage of petroleum products is transported into the Yukon by the White Pass and Yukon Route using a pipeline from Skagway, Alaska and tanker cars. The exception is the petroleum products trucked to Whitehorse from Haines, Alaska (254 miles) by the British American Company.

Hydro electrical power is supplied to the Whitehorse Area by the government owned Northern Canada Power Commission, that operates a 11,500 kilowatt plant. The power is distributed by the privately owned firm of Yukon Electrical Company, which also maintains a plant with a 1500 kilowatt capacity. Other Yukon communities are supplied with electrical power by the two forementioned companies, using diesel plants.

Climatic conditions in the Whitehorse area are relatively pleasant for the northerly latitude. The yearly mean temperature is 31 degrees F. with an average percipitation of 10 inches. The long and pleasant daylight hours in the summer offset the short cold days in the winter months.

The Whitehorse Copperbelt lies on the west side of the Whitehorse Trough (Wheeler, 1961, p. 109) at about north 60½ degrees latitude and west 135 degrees longitude. There are 28 copper showings distributed along the northwesterly bearing belt, that is 18 miles long and 3 miles wide.

Whitehorse is located two miles from the northern end of the Copperbelt (location sketch - 2).

Whitehorse is a city of 6000 population with a good assortment of business establishments and living facilities necessary for a mining community.

3. PHYSIOGRAPHY AND GLACIATION

The Whitehorse Trough, between the Teslin and Lewes plateau (Bostock, 1948, p. 65), is drained by the Yukon River. The broad Yukon River valley has an elevation of 2,000 to 2,500 feet above sea level. Mountains rise on either side to an approximate elevation of 5,000 feet and are within the northern extension of the Coast Mountains Range. The Copperbelt is located on the west side of the valley from the Yukon River.

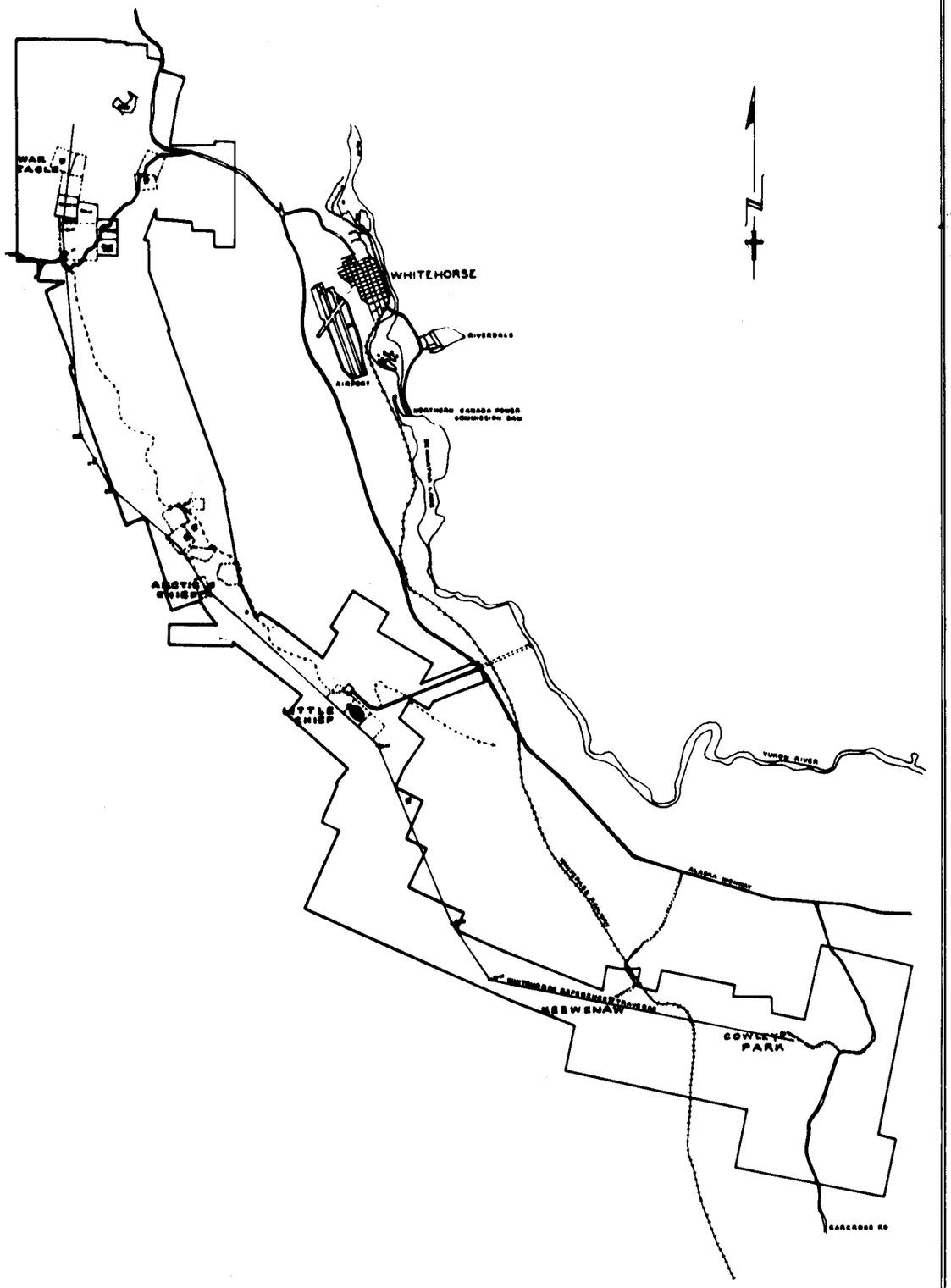
The area was once covered by the Cordilleran ice-sheet and the latest valley glaciation is Pleistocene in age. Thick glacial debris deposits are scattered along the east side of Yukon River valley opposite Whitehorse. The west side of the valley has about 75 percent glacial cover but with lesser thickness of glacial debris than on the eastern side of the Yukon River.

4. HISTORY

Discoveries of copper outcrops in the Whitehorse area were first reported by miners on their way to Dawson in 1897. The first claims were staked by Jack McIntyre who located the Copper King on July 6, 1898. The Big Chief and Little Chief claims were staked by Wm. McTaggart and Andrew Oleson in the later part of 1898. By 1899 most of the Copperbelt was prospected and staked, the more important discoveries were the Anaconda, Pueblo, Best Chance, Arctic Chief, Grafter, Valerie, War Eagle and others. During 1900 McIntyre and Granager, the owners of the Copper King, made a shipment of 9 tons of rich bornite ore stated to have yeilded 46.40% copper. Small shipments of selected hand picked ore were made from several of the previous mentioned properties up to 1909. The most interestingm mineral claims on the Copperbelt were given title to Crown Grant Mineral Claims up to the year 1909 on the Whitehorse Copperbelt.

In 1907, transportation of the ore between the properties and Whitehorse, on the 4 - 7 miles of Territorial wagon road, cost between $3.00

SKETCH - 2



NEW IMPERIAL MINES LTD.
WHITEHORSE Y.T.
N.M CLAIMS LOCATION PLAN

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- $4.00 per ton. By rail from Whitehorse and steamer to the various west coast smelters the cost was $6.00 per ton.

Between 1915 and 1920 development was done on the Copper King, Carlisle, Pueblo and War Eagle properties. In March of 1917 a disastrous mine cave at the Pueblo killed several miners and forced the closure of the largest producer on the Copperbelt. Mining ceased on the Copperbelt in 1920 due to the end of World War I and a drop in the price of copper.

In 1927 the Richmond Yukon Company Ltd. drilled at the Pueblo mine and other properties between 1926 and 1929. Once again a drop in the price of copper from 18¢ to 8¢ caused activity in the area to be abandoned during the 1930 depression years.

Noranda Mines Ltd. acquired claims and conducted geophysical surveys, geological mapping, trenching and diamond drilling in 1946 through to 1948 on the Copperbelt and in particular the Little Chief, Big Chief and Valerie areas. The company gave up the search due to the low grade of copper ore outlined by the drill program.

Under the direction of Mr. Aubrey Simmons, Imperial Mines and Metals Ltd. was formed in September of 1954 and acquired by staking, purchase or option numerous claims on the Copperbelt in 1955. In 1956 the company conducted magnetometer surveys and diamond drilling on the Arctic Chief and Best Chance claims. In March of 1957 the name of the Company was changed to New Imperial Mines Ltd.

New Imperial Mines Ltd. was reorganized by Mr. Arnold Pitt and exploration drilling for copper ore was begun in June of 1963 on the Whitehorse Copperbelt. By the end of 1964 the Company held 348 mineral and Crown Grant claims and had delineated 2.1 million tons of ore grading 1.20% copper. In June of 1964 the first feasibility report proved possible an open pit mining operation with a 1000 tons per day mill that could be increased to 2000 tons per day. In November of 1965 a second feasibility report was favourable for a 2000 ton per day mill, based on ore reserves of 5½ million tons of ore grading 1.20% copper to be open pit mined.

In December of 1965 an agreement for senior financing for the development of the property was signed with the Sumitomo Metal Mining Company of Japan. On July 1st, 1966, construction commenced on the mill site, near the Little Chief deposit, located in the central part of the Whitehorse Copperbelt. Mining started at the Little Chief Open Pit in the summer of

1966. The New Imperial Mines Ltd. mill began treating ore from the Little Chief deposit at the end of March 1967. (Claim and Property Sketch - 2).

Financing exploration of the property is as follows:

(a) Imperial Mines and Metals was incorporated in September 1954 with an authorized capital of 5 million shares.

(b) Sumitomo Metal Mining Company of Japan was given an exclusive option to purchase all future mill concentrates and to supply capital for mill financing in August 1964. A condition of the Agreement was their purchase of 200,000 shares of New Imperial Mines Ltd. stock for $150,000.

(c) Increased authorized capital to 5½ million shares on September 10, 1964.

(d) The Company optioned six separate agreements to purchase 90 mineral claims for $522,500 cash between 1963 and 1971.

(e) During 1964, 1.4 million shares were issued for $890,000 cash.

(f) In February, 1965, an agreement was made with Sumitomo Metal Mining Company of Japan, who advanced the Company $175,000 for exploration. New Imperial Mines Ltd. agreed not to enter into any agreements for sale or ore or concentrates, for financing further exploration or development costs, or sell any property without the approval of Sumitomo until December 31, 1965. The Company further granted Sumitomo an option to convert $90,750 of the $175,000 loan into 55,000 shares at $1.65 per share and the remaining $84,250 into 64,808 shares at $1.30 per share. These shares were issued in March of 1966.

(g) In September of 1965 Sumitomo agreed to advance $100,000 to the Company for option payments on claims and for a feasibility study. The advance was repaid on March 30, 1966.

(h) The authorized capital stock of New Imperial Mines Ltd. was increased to 7½ million shares on December 13, 1965.

5. GEOLOGY

Local Geology

The original rocks on the Whitehorse Copperbelt, were the Lewes River Group - Upper Triassic in age. The formation consists of:

(a) quartzite, arkose, greywacke and argillite

(b) limestone and dolomite

On parts of the Copperbelt the Laberge Group, Lower Jurassic in age, overlays the Lewes River Group. The two groups of rocks were upheaved and intruded by the Cretaceous Coastal Intrusive batholith. The igneous intrusive sequence consists of granite, granodionite to dioritic rocks. In very recent times the Miles Canyon extrusive basalt has covered parts of the forementioned rock groups.

Metamorphism

The Lewes River limestone and dolormite were the most predominate original rock types before being metamorphosed by the large igneous intrusive. The metamorphosed limestone and dolomite, with quartzite beds, were changed to a skarn rock type with various secondary siliceous minerals introduced. The skarns were developed due to an addition of silicate between the hot igneous intrusive and the sedimentary rock types. In places along the contacts between the Lewes River Group and the Coastal Intrusive copper ores were deposited in mineable sized deposits. The deposits are considered to be contact metasomatic in origin with two types of ore and mineral assemblages occuring. In parts the original rock types have only been affected by heat and pressure that recrystalized the limestone and dolomite. The present deposits can be considered as metamorphosed roof pennants and huge remnants of sedimentary rock trapped in the igneous intrusive.

TABLE FORMATIONS (Table 1)

Lithology of Skarns

The two skarn types that have developed are composed of one or more of the following minerals:

(a) Calcium - magnesium - silicate skarn made up of; actinolite, tremolite, diopside, wollastonite, epidote, garnet, chlorite, feldspar and alteration minerals.

(b) Calcium - magnesium - iron skarn consisting of; sepentine, diopside magnetite and specular hematite.

The skarns are usually light in color and very fine grained, but occasionaly with good crystals of all the forementioned minerals. The contact between the skarn and unaltered but recrystallized limestone is sharp and abrupt.

WHITEHORSE COPPERBELT

TABLE OF FORMATIONS

CENOZOIC

Quaternary

Pleistocene & Recent

Q	Alluvium, Glacial Drift
10	Miles Canyon Basalt

Post Cretaceous

Intrusive Dykes or Sills

9	9 A	Acidic	Granitic, Aplite, Felsite, 9 A May Predate Skarn
	9 B	Basic	Andesite, Diorite, Post-Ore

MESOZOIC

Cretaceous

Coast Intrusives

8	Diorite	8a	Altered
		8b	Unaltered
7	Granite, Granodiorite, Quartz Monzonite		

Lower Jurassic & Later

6	Laberge Group

Upper Triassic

Lewes River Group (Metamorphosed)

5	Limestone and or Dolomite 5 B Carb Limestone
4	Quartzite, Greywacke, Argillite, Arkose 4 q Quartzite, 4 g Greywacke
3	Skarn - 3a Actinolite, 3c Chlorite, 3d Diopside, 3e Epidote 3g Garnet, 3s Serpentine, 3t Tremolite, 3f Feldspar
2	Skarn - Bornite, Chalcopyrite, Coppe Oxides with; 2a Actionolite 2c Chlorite, 2d Diopside, 2e Epidote, 2g Garnet, 2s Serpentine
1	Magnetite Skarn - 10 - 80% Magnetite, Bornite, Cpy, Valeriite, Cu Oxides is - Serpentine, 1D-Diopside, 1C-Chlorite

The diorite grades from a fresh black and white colored variety to an altered greyish diorite and then into a "dioritic" skarn. The contact between the skarn and the dioritic skarn, or diorite, is often marked by abundant pink epidote or zoisite.

Economic Geology

The host rock for the mineral deposits consists of three types, (Table 1), (a) iron-copper serpentine or diopside skarn, (b) copper sulphide skarn, (c) barren skarn. In some parts of the Copperbelt the mineralized skarns are dioritized and in places interbedded with mineralized quartzite. The wall rocks contacting the skarn and ore deposits, are recrystallized limestone or a fresh to altered diorite. The diorite appears to halo the ore deposits and grade into granodiorite and granites.

The predominant copper mineralization consists of the sulphides bornite and chalcopyrite. On the north and south ends of the Copperbelt molybdenum occures with copper sulphides. In the central part of the Copperbelt copper sulphides are associated with magnetite and lesser quantities of hematite. Gold and silver are associated with chalcopyrite mineralization in all ore deposits. From the mineralization observed on the central ore deposits it is possible that two stages of primary mineralization occured. The first copper mineralization deposited was mainly bornite with the magnetite and the second stage consisted of chalcopyrite and quartz replacement. It is likely that chalcopyrite and quartz replacement has occured in the ore deposits on the north and south ends of the Copperbelt.

The copper minerals that occur in the ore deposits are: bornite, chalcopyrite, valeriite, chalcocite, tetrahedrite, covellite, cuprite, malachite, azurite, chrysocolla and minor native copper. The iron minerals are magnetite, specular and micaceous hematite, goethite, limonite, pyrite and pyrrhotite. Magnetite is the main iron mineral. The molybdenum minerals are molybdenite, powellite and scheelite. Other rare minerals are gallium, vanadium, cobalt, nickel, palladium, platinum and manganese.

The ore deposits are highly jointed, faulted and with very irregular shaped hanging and foot walls. Large and small folds are evident in surface outcrops with faulting due to folding of the rocks. Slickensides and shears are present in the diamond drill core and on surface outcrops.

Both pre-ore and post-ore felsic and mafic dikes have cut the Lewes River group of metamorphic rocks.

The presently delineated ore deposits on the Whitehorse Copperbelt (sketch - 2), are as follows:

(1) War Eagle - The ore deposit contains copper mineralization in a garnet - diopside - tremolite - epidote skarn. There is 1,230,000 tons of 1.29% copper delineated at the War Eagle deposit.

(2) Arctic Chief - The deposit contains 400,000 tons of 1.32% copper contained in a magnetite serpentine skarn.

(3) Little Chief - (Sketch - 3, L.C. Section). The Little Chief deposits contains 1,910,000 tons grading 1.41% copper ore in the area to be open pit mined. Recent drilling has indicated an additional 3½ million tons of ore grading 2.14% copper. The feasibility of an underground mining operation is presently being considered on the Little Chief Deposit. The host rock for mineralization, is a calcium - magnesium - iron skarn.

(4) Keewenaw - The Keewenaw deposit is a highly dioritized skarn with 380,000 tons grading 1.10% copper mineralization.

(5) Cowley Park - The host rock at the Cowley Park deposit is a calcium - magnesium skarn, and contains 1,370,000 tons of ore grading 0.87% copper and 0.091% MoS_2.

(6) Best Chance - The ore reserves are 200,000 tons grading 1.00% copper.

6. MINING

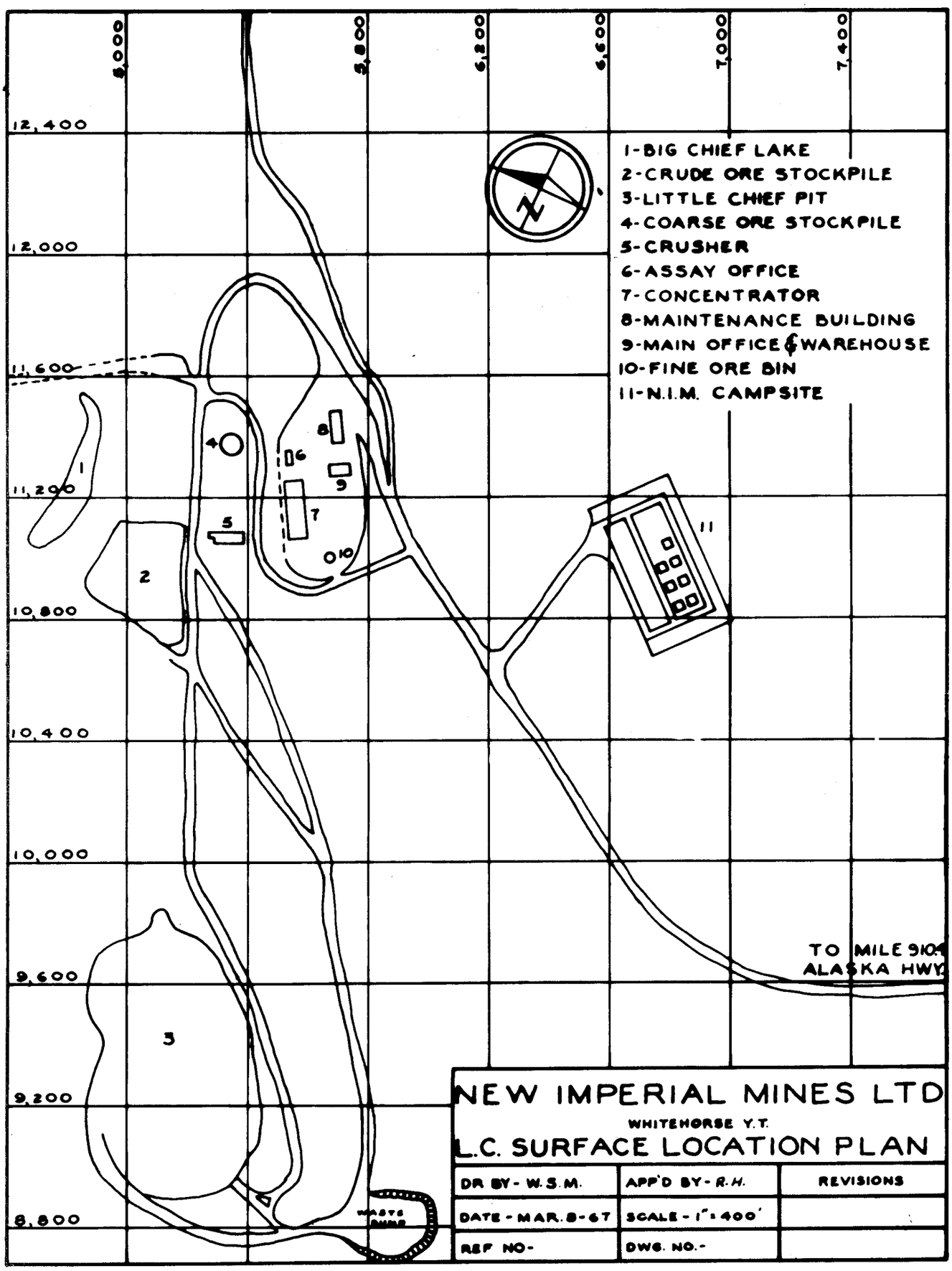
Method

Mining on the War Eagle, Arctic Chief, Little Chief, Keewenaw and Cowley Park (Sketch - 2), is to be done by open pit. The first pit to be developed is the Little Chief which is located in the central part of the Copperbelt near the mill site (Sketch - 4).

The Little Chief Pit (Sketch - 5, Little Chief Pit Plan), will reach a total depth of 350 feet from surface. The pit walls slope 62 degrees between the 20 foot safety berms. The safety berms are to be placed after each third 25 foot bench. The pit road has a constant 8% grade and is 40 feet wide.

Below the Little Chief open pit floor is 3½ million tons of ore

SKETCH - 4



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WHITEHORSE Y.T.

L.C. SURFACE LOCATION PLAN

DR BY - W.S.M.	APP'D BY - R.H.	REVISIONS
DATE - MAR. 8-67	SCALE - 1" = 400'	
REF NO-	DWG. NO.-	

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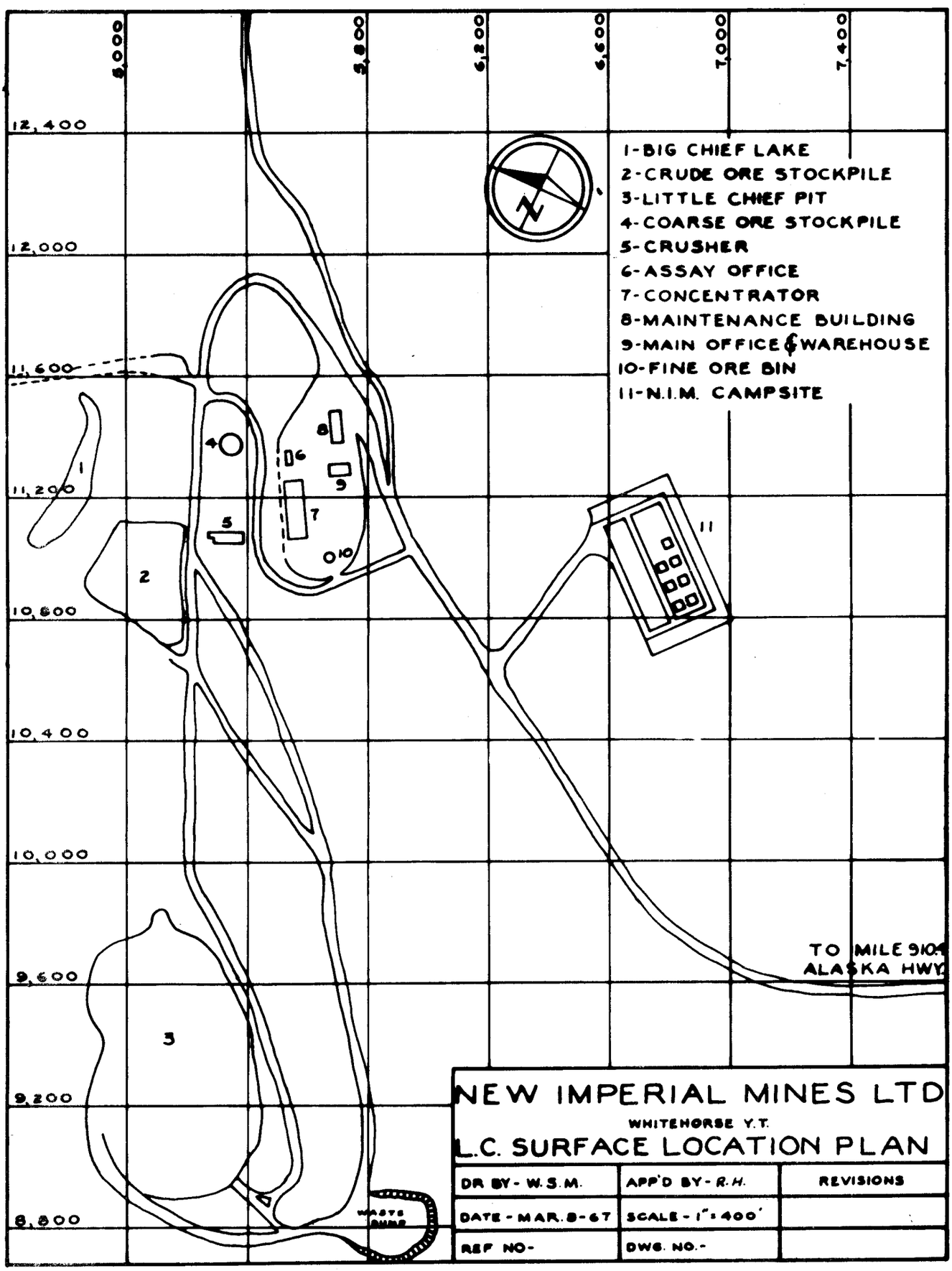
SKETCH - 4



NEW IMPERIAL MINES LTD

WHITEHORSE Y.T.

L.C. SURFACE LOCATION PLAN

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DATE - MAR. 8-67	SCALE - 1" = 400'	
REF NO-	DWG. NO.-	

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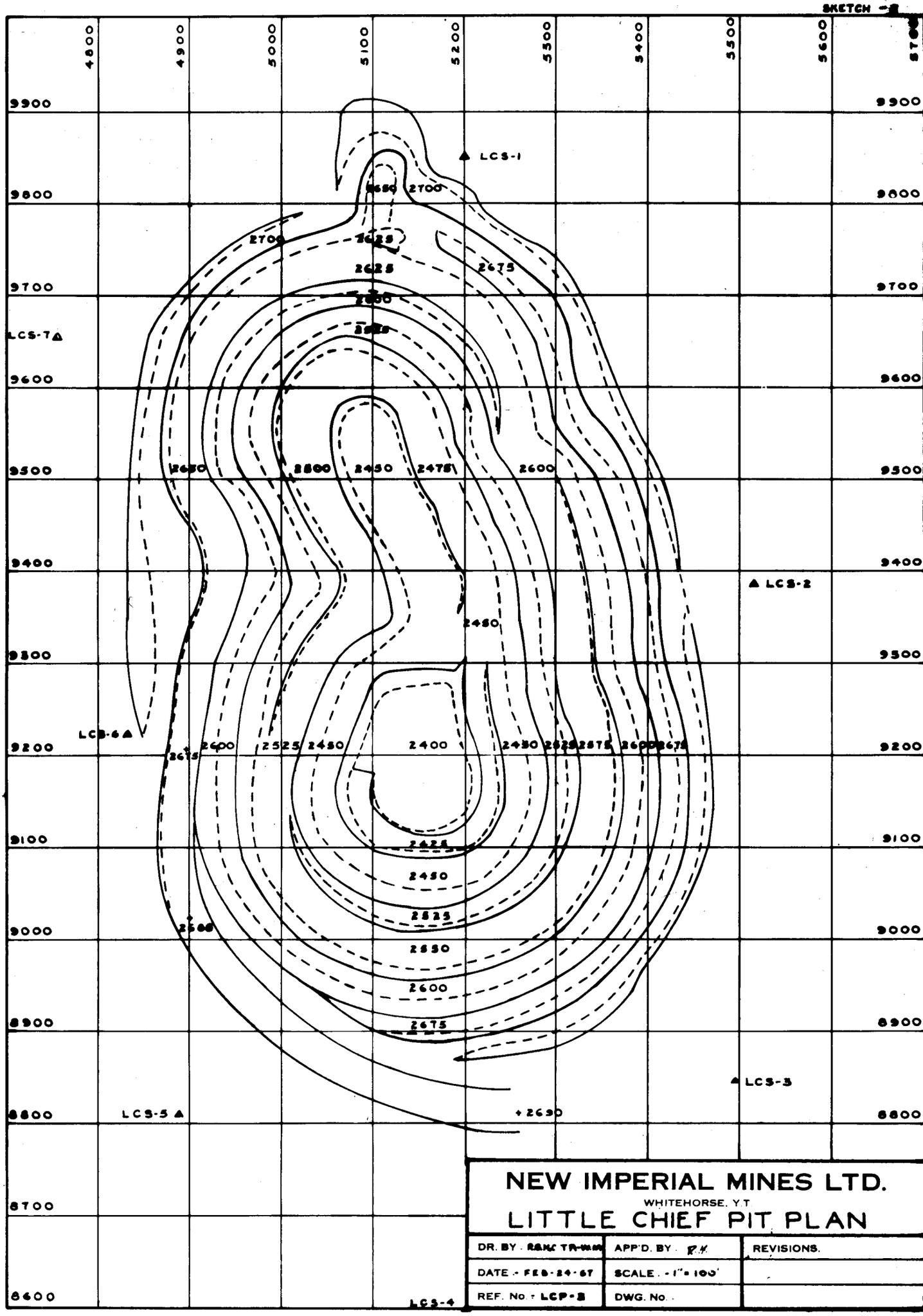
SKETCH -2



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WHITEHORSE, Y.T.

LITTLE CHIEF PIT PLAN

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DATE - FEB-24-67	SCALE - 1" = 100'	
REF. No. - LCP-2	DWG. No. -	

grading 2.14% copper. An underground back fill mining operation is presently being considered for the deep ore.

Production

The daily production is based on 2,500 tons of ore per day. The Little Chief Pit stripping ration is 1.12:1 and the daily mine requirements are 11,675 tons per day with 327,000 tons per month ore and waste.

The equipment to remove the ore and waste consists of five 35 ton trucks, one 5½ yard front end loader, two 2½ yard diesel shovels, one D8 Crawler Tractor, one grader, one 600 cubic foot air compressor, two jackhammers and one crawler drill.

Blasting the ore and waste has been found satisfactory using a 16 foot triangular hole pattern and 6 inch diameter blast holes. The blasting agent used is ammonia nitrate, prima-cord and some hydromex, when necessary. Most of the blasts vary from 40 - 60,000 tons in size.

The ore sorting is done by the geology department using one sampler and one pit sorter. Ore is blocked off in a blast, from information on the ore grading level plans and by visual examination of the drill cuttings. The drill cuttings, in an ore zone, are sampled and assayed for copper content. The results of several drill hole assays determine where the final blocked off limits of the blasted ore will be located. Good ore recovery has been experienced to date between calculated ore in place and actual pit sorted and hauled ore. Until more mill heads are available, it is difficult to know what ore dilution is taking place in the present methods of blasting and ore sorting.

7 MILLING

The New Imperial Mines Limited Mill Site is located in the central part of the Whitehorse Copperbelt (Sketch - 2 and 4), near the Little Chief Pit. When the mill is running at capacity it is expected to treat 2,500 tons of ore per day. The ore is treated by flotation for the recovery of the copper content.

The crude ore enters the crusher from an outside hopper, into a reciprocating pan feeder, through a grizzly feeder and into the 48 x 42 inch jaw crusher. The ore, minus 6 inch particle size, passes to the course ore stockpile by conveyor. A draw off conveyor beneath the course ore stockpile returns the ore to the secondary Symons cone crusher and then to the similiar

tertiary Symons cone crusher. The ore is passed through a primary screen, at a particle size of minus 5/8 of an inch, onto a conveyor to the fine ore bin. The ore is then transported to the mill by four conveyors. In the mill grinding is started in a 9 x 13 foot size Rod Mill and one 10 x 16 foot size Ball Mill. Classification of the ore is through two 24 inch cyclones. The pulp, 65% minus 200 mesh, is then treated with xanthate, pine oil and Quartec reagents in a conditioner and passes into the rougher flotation cells. The rougher flotation cell concentrate goes to a cyclone and underflow to a regrind 6 x 7 foot size Ball Mill. Following rougher flotation a scavenger concentrate is returned to the conditioner. The final product is thickened, stored in an agitator, filtered and dried to 8% moisture content. The concentrate is stored in the Mill Building in 25 ton containers for shipment. The mill is expected to produce a 35% copper concentrate with an average 85% recovery, and ore mill feed to be greater than 0.45% copper content.

Containers are placed on low bed trailers and trucked to Whitehorse and off loaded onto flat cars. The White Pass and Yukon Route transport the bulk concentrate 110 miles to Skagway, Alaska, by narrow gauge railway. The 25 ton concentrate containers are off loaded from the rail cars onto the White Pass ship at Skagway for shipment to Vancouver, British Columbia. In Vancouver, the concentrate is stored in bulk until 3,000 tons have accumulated for shipment to Sumitomo Metal Mining Company of Japan.

8. MARKETING

Financing

In December, 1965, a Letter of Intent was signed between Sumitomo Metal Mining Company of Japan and New Imperial Mines Limited. As a feasibility study completed the month previous has estimated a total cost of $7,253,900. to bring the property to production, Sumitomo agreed to supply two-thirds of this amount with New Imperial supplying the remaining one-third.

By June, 1966, this had been formalized in a firm agreement, duly ratified by the Japanese Government. New Imperial had arranged its participation amount through a loan from the Toronto-Dominion Bank.

Sale of Concentrate

By the terms of their agreement, New Imperial is required to sell exclusively to Sumitomo all the copper concentrates produced in the Whitehorse Copperbelt property for a period of ten years. The price of copper concentrate is to be the sum of the payments for gold, silver and copper. Copper prices are based on the average export refinery price for electrolytic copper wire bar as published in the Engineering and Mining Journal. There are minimum values set for the content of gold and silver included in the copper concentrate.

ON ITS WAY: Boxed pliofilmed containers carry the first shipment of ore from New Imperial to White Pass and Yukon Route for the beginning of it voyage to Japan.