

OVERVIEW

HISTORY

The Whitehorse Copper Belt consists of a string of over 30 copper occurrences roughly distributed parallel to the Alaska Highway. After the discovery of copper near Whitehorse in 1897 by prospectors on their way to the Klondike, the first claims were staked in 1898, and by 1899, most of the presently known deposits had been found.

Since then, mining has occurred in several episodes. High grade ore was extracted from nine underground mines between 1900 and 1920, and shipped by train to southern smelters. Mining ceased after the First World War and resumed in the early sixties. By then, modern exploration and mining methods, grouping of individual claims into large claim blocks by major mining companies, using copper prices and successful financing led to the outlining of new copper resources and the establishment of the infrastructure needed to mine them.



Yukon Archives, Hamacher Fonds, Houghton Collection
A team of 12 horses hauls a 20-ton boiler to the Pueblo mine (ca. 1910).

Six mineral deposits were mined in this second phase, mostly by open pit. The Little Chief mine was also mined by underground methods. All mining activity ceased when ore at the Little Chief mine was exhausted in 1982. Reserves of almost 3 million tonnes, distributed between five deposits, remained unmined.

The economic influence of the copper mines had a significant impact on transforming Whitehorse from a transportation hub to a stable community. The proximity of the town made this mining camp a very attractive one to work in. The Little Chief operation alone hired approximately 200 people for over 10 years. More than 10 million tonnes containing an average of 1.5% copper and significant values in gold and silver were mined between 1898 and 1982.

GENERAL GEOLOGY

The copper minerals of the Whitehorse Copper Belt occur in a very specific geological setting called a copper skarn deposit. Skarn deposits form deep in the earth's crust where hot, fluid-rich molten rock called magma cut through sedimentary rocks rich in lime, such as limestone. The interaction between the hot fluids in the magma and the limestone actually create a new rock type called skarn. Two types of skarns occur in the Copper Belt, each defined by its own set of characteristic minerals.

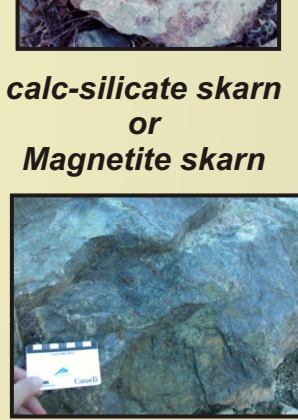
Iron skarn, also called magnetite-serpentine skarn, is dark grey to black and green, and contains mainly magnetite (a magnetic mineral) and serpentine. The other type, called calc-silicate skarn because the minerals are rich in calcium and silica, contains mainly brownish red garnet and light to dark green diopside, along with other minerals. Economic copper minerals, like bornite, chalcocopyrite and malachite, can occur in either one of the types of skarns but the magnetite skarns are mostly richer in copper. Gold, silver and other metals are also found with the copper minerals.



limestone



granodiorite magma



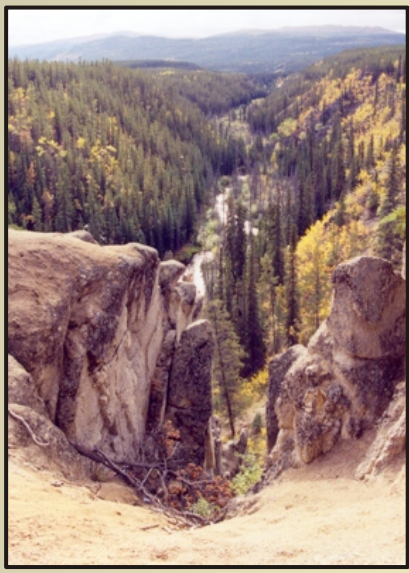
calco-silicate skarn or Magnetite skarn

Magmatic rocks can vary in composition. Here it is called a granodiorite. Once cooled, the rock shows a mixture of light and dark minerals. The limestone can vary in colour from white to grey to black, and it can be magmatic or banding. In the Copper Belt, the copper deposits are commonly located where specific lime-rich sedimentary layers occur near the granodiorite, and where the contact between the two rock types is wavy or irregular.

ACCESS VIA FISH LAKE ROAD

5- FISH LAKE ROAD LOOKOUT

491792 E, 6733207 N



This lookout offers a good exposure of the granodiorite and a great view of the McIntyre meltwater channel (see stop 9). Notice the steep banks and flat, narrow creek bed, distinctive features of a long-lived meltwater channel developed in bedrock.

Upstream, the channel is wider and shallower since it is eroding softer, less resistant glacial sediments. This stop is located on the Fish Lake Road, 1.5 km west of the Alaska Highway.

7- PUEBLO

490417 E, 6732051 N



Malachite (green) and azurite (blue)

The Pueblo was the largest of the early mines, but still a small deposit by modern standards. The old mine workings are now covered by the fish farm development. Outcrop at the southern end of the small lake consists of a bouldery till (see box 8) overlying oxidized (rusty) copper skarn, indicating that glaciers eroded the bedrock down to the level of mineralization before depositing the till.



Pueblo Mine, Yukon Archives, John Scott Fonds

The Pueblo was a "wet" mine in an area cut by many faults. A cave-in occurred in 1917 trapping nine miners. A diamond-drill crew established a speed record by pushing an 85-foot (25 m) drill in 72 hours, and in doing so rescued three survivors.

11- LIMESTONE HAUL ROAD

492725 E, 6726665 N



Banding between white and grey limestone is visible at the northern end of this large outcrop.

ACCESS THROUGH MUNICIPAL LANDFILL

1- WAR EAGLE

490443E, 6734173 N



War Eagle North: sedimentary beds dip towards the south at left; red iron oxide alteration at right.

This calc-silicate rock occurs totally within sedimentary rocks. The contact with the igneous granodiorite is not exposed in the pit; it is assumed to be located about 300 m east of the pit. The ore minerals are chalcocopyrite and bornite, with some molybdenite, a silvery molybdenum mineral. Some large, gold-coloured boulders in the bluish black rock waste dump, near the current tire dump, show nice examples of skarn.

The War Eagle North still shows evidence of copper mineralization at the bottom of the pit. It could not be mined economically due to the pit design. Since used as a land-fill site, the pit is now filled in with about a 30 m thickness of garbage.

The southern extension of the deposit, which proved to be small and shallow, is outlined by the War Eagle South excavation. The one wall is now revegetated with trees; scrap metal now outlines the eastern edge of the excavation.

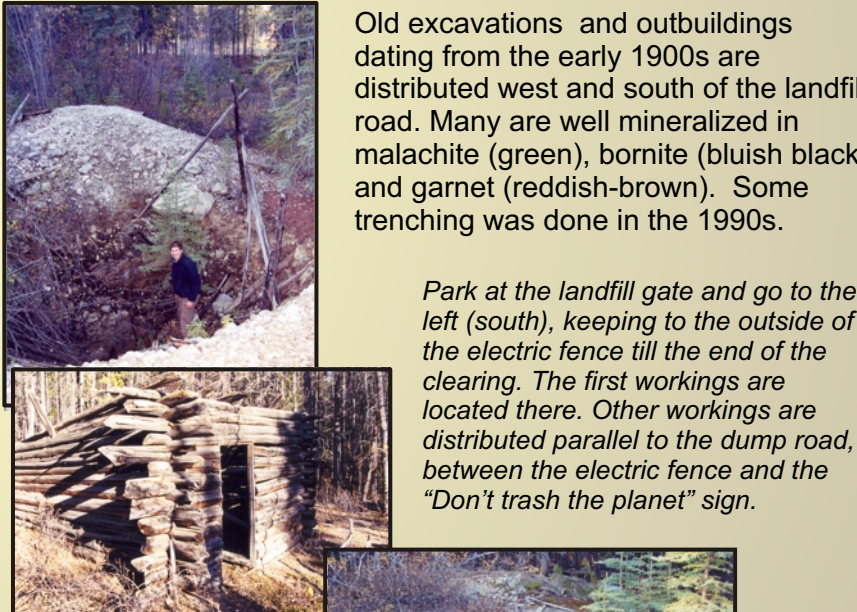
Malachite is visible on the west wall of Rabbitfoot Canyon, just north of the entrance to the landfill on the Alaska Highway. This limestone outcrop is near the contact with the granodiorite. Observe it while driving by; the high speed traffic make it a poor choice to stop.

2- ANACONDA/ COPPER QUEEN/ RABBITS FOOT

492063 E, 6734906 N 491951 E, 6734915 N

491876 E, 6734845 N 491839 E, 6734851 N

491907 E, 6735096 N



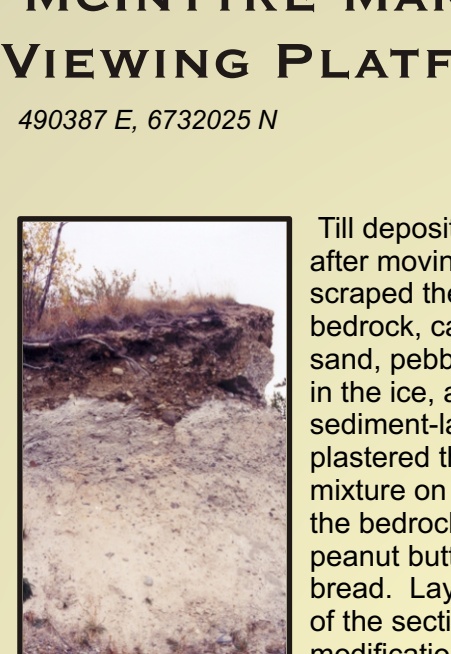
Old excavations and outbuildings dating from the early 1900s are distributed west and south of the landfill road. Many are well mineralized in malachite (green), bornite (bluish black) and garnet (reddish-brown). Some trenching was done in the 1990s.

Park at the landfill gate and go to the left (south), keeping to the outside of the electric fence till the end of the clearing. The first workings are located there. Other workings are distributed parallel to the dump road, between the electric fence and the "Don't trash the planet" sign.

ACCESS VIA COPPER HAUL ROAD / NORTH

8- TILL AT MCINTYRE MARSH VIEWING PLATFORM

490387 E, 6732025 N



Till deposits are left over after moving glaciers scraped the underlying bedrock, carrying clay, silt, sand, pebbles and boulders in the ice, and then the sediment-laden meltwater plastered the resulting mixture on the surface of the bedrock like smearing peanut butter on a piece of bread. Layering at the top of the section indicates later modification by streams.

The top brownish layer results from weathering of the till. White crumbly calcite (calcium carbonate), seen as horizontal or vertical layers and seams, formed from the evaporation of groundwater.

9- MCINTYRE CREEK MELTWATER CHANNEL

491806 E, 6728396 N



McIntyre meltwater channel, oblique air photo.

The meltwater carved through (or eroded) glacial sediments and bedrock and in doing so exposed some of the copper occurrences. Many of the early workings, such as the Pueblo, Copper King, Empress of India and Big Chief, are located in or adjacent to meltwater channels. Without this erosion, these deposits may have remained buried and left undiscovered.

Modern McIntyre Creek flows in a meltwater channel that can be observed from several vantage points on the haul road.

10- TILL- HAUL ROAD

492171 E, 6727809 N



Till (see stop 8), was transported by glaciers and deposited on top of the granodiorite. The dashed line marks the surface of the rock outcrop before it was covered by glacial deposits.

13- EMPRESS OF INDIA

Work on this skarn between 1900 and 1910 included trenches at the top of the bluff, and two adits in limestone at the base of it. This showing has never been drilled.

The trenches contain bornite, chalcocopyrite, malachite, azurite, epidote, garnet, actinolite and abundant quartz, at the skarn-limestone contact. The garnet here is unusual (photo top right); its amber colour is due to its lower iron content than that of the more common red variety.



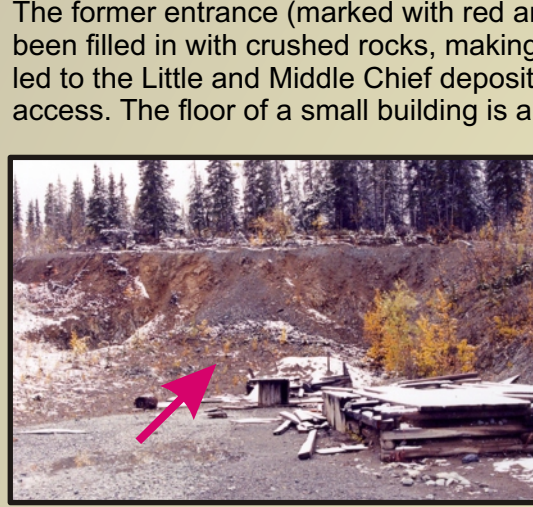
Another adit is located on the west bank of the creek, driven through barren (unmineralized) limestone.

Two excavations are located 100 m apart. One contains many colourful minerals such as epidote, actinolite, quartz, amber-coloured garnet, calcite, malachite and azurite. An impressive malachite-stained face is located a bit further to the south (photo above left).

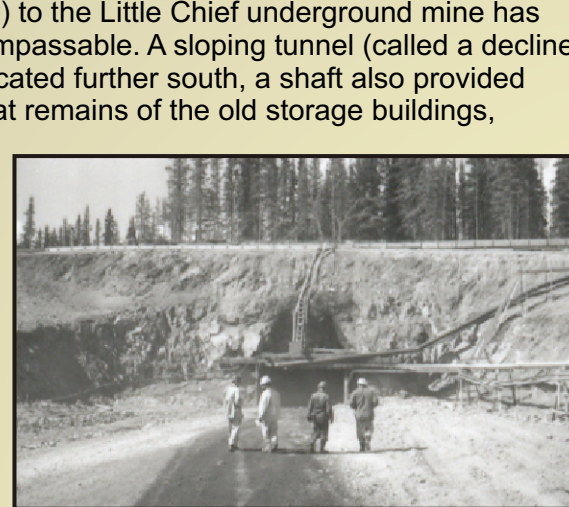
STOPS 20 TO 24- LITTLE CHIEF MINING OPERATIONS

20- LITTLE CHIEF PORTAL

495326 E, 6722824 N



View looking west

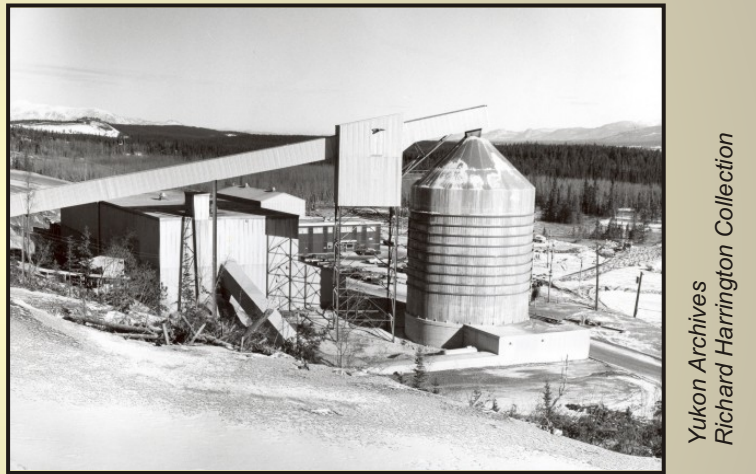


Miners at the portal, circa 1970.

21- MILL SITE

496724 E, 6722803 N

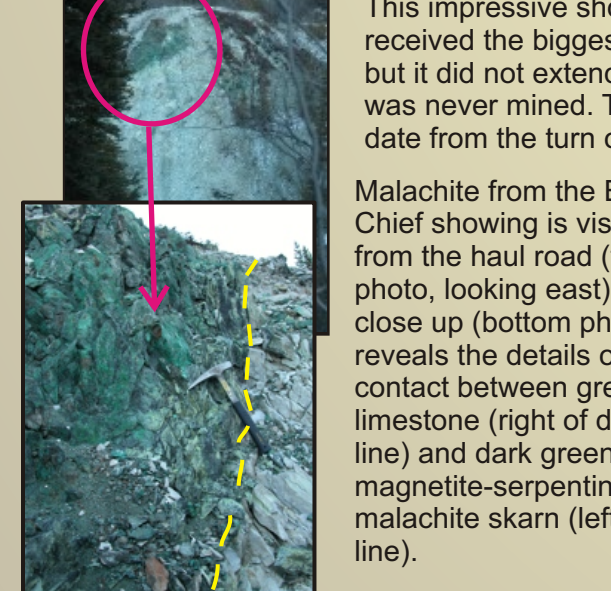
The former entrance (marked with red arrow) to the Little Chief underground mine has been filled in with crushed rocks, making it impassable. A sloping tunnel (called a decline) led to the Little and Middle Chief deposits located further south, a shaft also provided access. The floor of a small building is all that remains of the old storage buildings. The copper minerals were separated chemically by flotation and then dried. The resulting copper concentrate was shipped by truck to Skagway, and by container-ship to Japanese smelters via Vancouver. The waste material was stored in the tailings pond (see stop 23).



New Imperial Mines Ltd.: Surface buildings, circa 1970. The cylindrical tank was a storage bin for finely crushed ore.

22- BIG CHIEF

496485 E, 6724882 N



Malachite from the Big Chief showing is visible from the haul road (top photo, looking east). A close up (bottom photo) reveals the details of the contact between grey limestone (right of dashed line) and dark green magnetite-serpentine-malachite skarn (left of line).



Banded magnetite and yellow serpentine skarn

31- COWLEY PARK

505918 E, 6715477 N



Walk around the cleared area, you'll discover many signs of past exploration.



Malachite on pit wall (left) and on closely-spaced fractures (right).

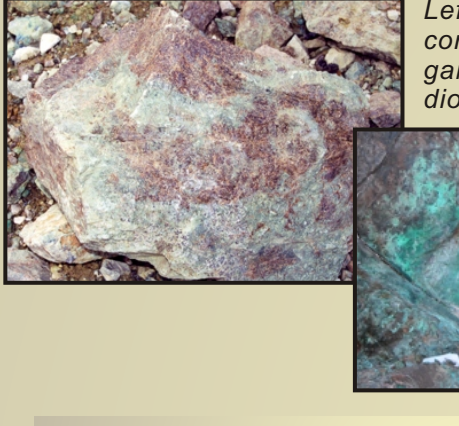
ACCESS VIA HAUL ROAD/ CENTRAL

14- GRAFTER

493222 E, 6726095 N



Yukon Archives, John Scott Fonds.



Left: classic calco-silicate skarn consisting of coarse reddish brown garnet with fine-grained light green diopside; right: malachite coating.

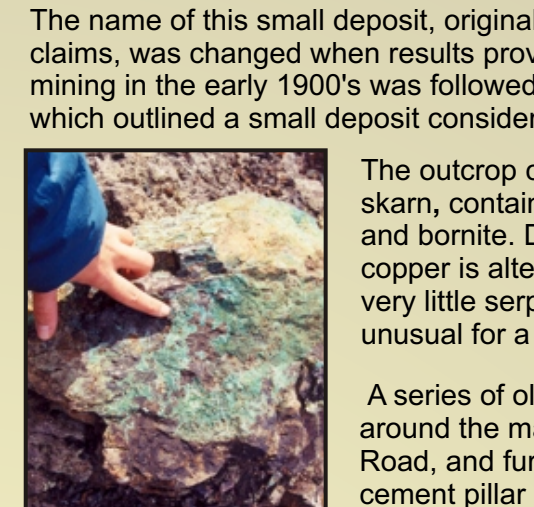
The deposit is a steep and pipe-shaped magnetite-serpentine skarn close to the diorite contact. Chalcocopyrite is the main ore mineral. Epidote, malachite and massive red garnet and fine-grained diopside can be found in the loose bulldozed material.



Ruins of a century-old tram, between the Grafter and the Copper Haul road.

15- BEST CHANCE

493414E, 6726350 N

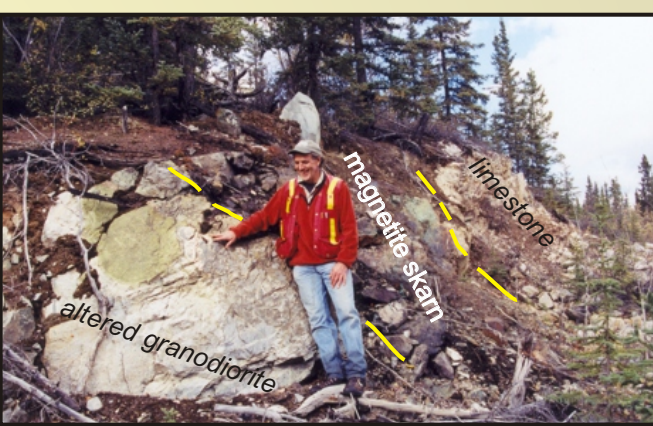


Robert Stroshain, former geologist for Hudson Bay Mining and Smelting Ltd., carefully inspects a century-old high-grade mine site. Note the malachite staining on the rock face.

16- GRAFTER EXTENSION

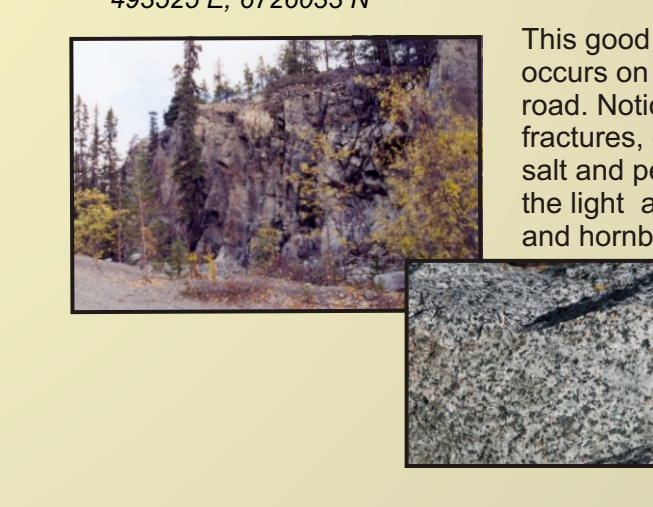
493383 E, 6726302 N

This outcrop, located across the haul road (west side) from the Best Chance, demonstrates the formation of a skarn at the contact between limestone and granodiorite.



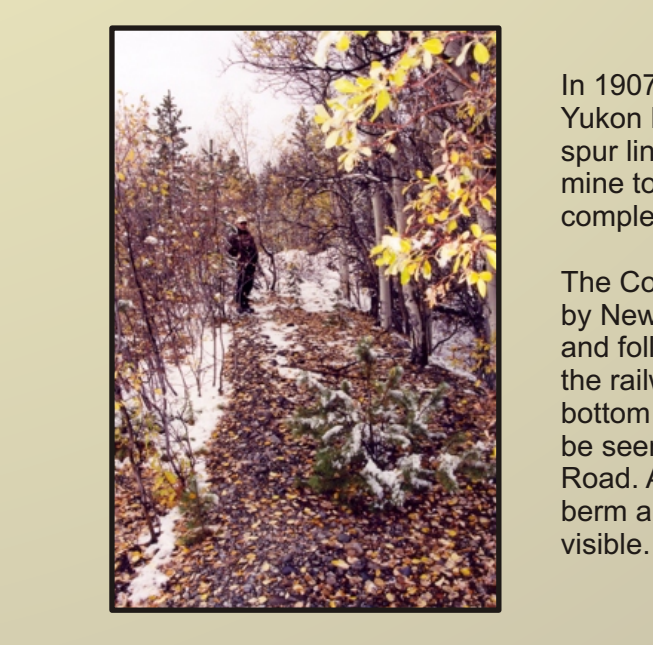
17- GRANODIORITE

493525 E, 6726033 N



19- WHITEPASS SPUR LINE

494766E, 6724182 N



In 1907, the White Pass and Yukon Railways started to build a spur line to connect the Pueblo mine to the main railway; it was completed in 1910.

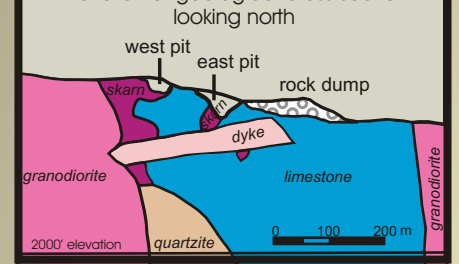
The Copper Haul Road was built by New Imperial Mines in 1969, and followed the same course as the railway. Where the valley bottom is flat, the rail bed can still be seen just east of the Haul Road. After almost 100 years, the berm and break in slope are still visible.



Counter clockwise: claim post on rock waste dump; open pit looking to northwest; limestone outcrop at the northern end of the waste dump.

18- ARCTIC CHIEF

Arctic Chief geological cross section looking north



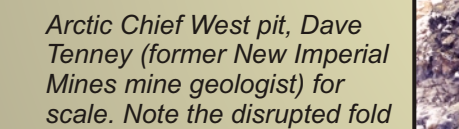
Two separate pods of dark magnetite-serpentine skarn with brown and green garnet-diopside skarn occur on the west flank of a pendant of sedimentary rock enclosed in granodiorite. The Arctic Chief West was mined underground in the early 1900's. Both deposits were later mined as two separate open pits in the late 1960's. These deposits were quite rich as they contained 1.5% copper with the highest silver and gold grades of the recent mines. A third zone, the Arctic Chief South, was not rich enough to be mined.

This is a popular area for mineral collecting; rock falls are common so use caution and stay away from the pit walls.

ARCTIC CHIEF WEST

493605 E, 6725078 N

Private, phone 633-3677 for permission to access



Arctic Chief West pit, Dave Tenney (former New Imperial Mines mine geologist) for scale. Note the disrupted fold in the banded limestone

The west pit contains a lens of magnetite skarn at the contact between limestone and granodiorite. The dark and rusty skarn lens stands in contrast with the light grey limestone. Folding is evident in the pit wall. Yellow serpentine is present. Note the timbers sticking out half-way up the north wall, marking the location of an old mining tunnel.

ARCTIC CHIEF EAST

493706 E, 6725162 N



Arctic Chief East pit (above); wedge of limestone totally surrounded by garnet-diopside skarn (right).

Patches of dark magnetite skarn occur on the pit walls (with spectacular azurite and malachite). A wide granitic dike cuts off the ore lens. Vertical drill holes, used to load explosives for blasting, are still visible on the north wall.

Large boulders at the entrance to the pit display very good examples of copper minerals (chalcocopyrite, bornite, malachite) and skarn minerals (garnet, serpentine, diopside).

ACCESS VIA FIREWEED DRIVE/ MARY LAKE SUBDIVISION

28- KEEWENAW

502145 E, 6715811 N

This is the only mine in the Copper Belt where the copper minerals are hosted in the granodiorite, rather than in the sedimentary rocks. This type of rock is called an endokam, as the skarn formed within the intrusive rock. Boulders at the base of the waste dump display complex alteration and intrusive textures.

Highly oxidized rocks near the surface contain green copper-oxide, silicate and carbonate minerals. Deeper, where surface waters have not oxidized the rocks, the copper is in sulphide minerals such as in bornite, chalcocopyrite, chalcocite and covellite. (see the spectacular boulder lining trail to Wolf Creek, photo lower far right); there is no magnetite. Other skarn minerals include epidote, thulite and potassium feldspar. Native gold was reported. Late stage dark basaltic dykes are visible in the far wall of the pit.

This was the last open pit mined by Whitehorse Copper Mines. It shut down in June of 1971 due to falling copper prices. The lower part of the pit remains unmined.



Variety of granodiorite textures (left and centre) with pink potassium alteration (left); mine waste dump (far right).



Chrysocolla, bornite, malachite (top left); Keewenaw pit looking north (top right); boulder of bornite, covellite, malachite (right).

29- GEM

502454 E, 6716089 N

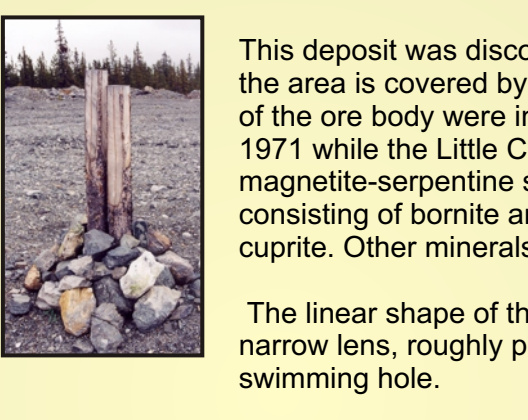


The ground surface, stripped of the overburden, shows the distribution of white limestone and dark grey and green magnetite skarn.

This large but low-grade magnetite skarn was stripped of the overlying glacial sediment in preparation for mining in 1970. Further study determined that the geometry of the deposit was more complicated than first thought and that the deposit would be uneconomic to mine, so development work on this zone was halted.

30- BLACK CUB SOUTH

502920 E, 6714905 N



This deposit was discovered by modern geophysical techniques as the bedrock in the area is covered by thick glacial sediments. The magnetic and electrical properties of the ore body were in sharp contrast with those of the surrounding rocks. Mined in 1971 while the Little Chief deposit was being readied for underground mining, this magnetite-serpentine skarn deposit produced 170,000 tonnes of copper ore consisting of bornite and chalcocopyrite, but also of chalcocite, native copper and cuprite. Other minerals present included diopside, actinolite, talc, chlorite and garnet.



The linear shape of the mined-out pit shows that the deposit was a steep and narrow lens, roughly parallel to bedding. It now provides a popular summer swimming hole.



Counter clockwise: claim post on rock waste dump; open pit looking to northwest; limestone outcrop at the northern end of the waste dump.

YGS Open File 2004-15

THE WHITEHORSE COPPER BELT, YUKON

An Annotated Geology Map

Sheet 2 of 2

Compiled by Danièle Héon

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with contributions by: Jeff Bond, George Gilbert, Dave Tenney, Forest Pearson, Robert Stroshain and Amy Stuart.

